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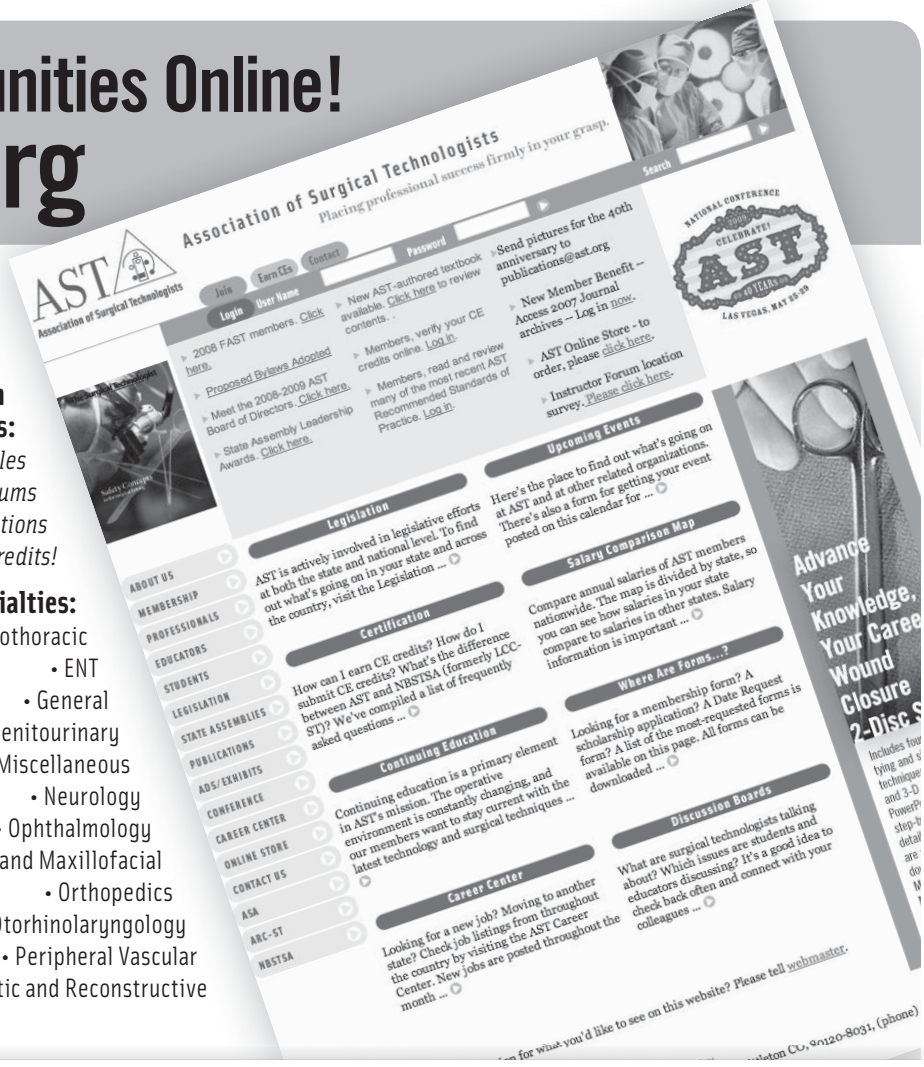

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A Teamwork Approach to Quality Patient Care in the Operating Room

ANN MARIE MCGUINESS, CST, CNOR, MEd, TERI JUNGE, CST, CFA, FAST

LEARNING OBJECTIVES:

- Compare and contrast the roles of the surgical team members
- Understand the history of critical thinking care models
- Define collaborative patient care
- Recognize the critical importance of Recommended Standards of Practice
- Understand how to apply the collaborative case model to surgical patient care

Editor's Note: During a previous AST national conference in New Orleans, Betty Schultz, RN, who was then president of AORN, discussed patient safety and how collaboration between professionals in the circulating and scrub roles have the potential to enhance the goal of quality patient care.

This led to the idea of an article co-authored by a CNOR and a CST that would demonstrate how the two surgical team members perform independently, but interact mutually to ensure a safe patient outcome.

The resulting article focuses on collaboration. Much of the introductory information may appear as a review for many practitioners, but it is included to address the distinct perspectives of the two professions.

Both authors believed that the case-study format would most effectively illustrate the roles of the CNOR and CST within the context of patient safety. The reference material was selected from multiple sites that are relevant to both professions.

This article also serves to introduce a new patient care model called CARE, which melds the A-PIE model familiar to nurses and the A POSitive Care approach familiar to surgical technologists and published in the AST-written textbook, Surgical Technology for the Surgical Technologist.

Introduction

In today's operating room, the surgical team, composed of both professional and paraprofessional members, plays a vital role in the successful outcome of any surgical intervention. The teamwork model of integrated function and interaction is the foundational basis that fosters a blending of the strengths of the various team members as they come together and work as a unit in the operative setting.

It is the synergy of this team—each with their own professional knowledge, skills and behaviors—that provides the structure and environment that assure the delivery of safe patient care and enable the patient's return to an optimum level of wellness.

The Registered Nurse and the Certified Surgical Technologist function as a subunit within this team, interacting through the utilization of a unique, dynamic relationship—that of four hands and two minds, one sterile role and one nonsterile role, working in interdependent collaboration, cooperation, and mutual support to manage the complexities of the highly technical, specialized operating room environment and to deliver safe patient care.

Using the context of the patient undergoing vaginal hysterectomy, this article will highlight the roles and interactions of these two members of the surgical team—the circulator and tech.

Roles of the surgical team members

The circulator role is primarily filled by the Registered Nurse (RN). Certification by the Competency and Credentialing Institute (CCI) as a Certified Nurse Operating Room (CNOR) is the preferred credential for those individuals practicing in the capacity of circulator.

The focus of the circulating role is one of patient assessment, safety and advocacy, as well as the technical skills of operating room management. In many facilities, the circulator is assisted by the Certified Surgical Technologist in delivering safe patient care outside the sterile field and in performing the technical skills of the operating room that fall within their scope of practice.

The tech's role is primarily filled by the Certified Surgical Technologist (CST). National certification by the National Board of Surgical Technology and Surgical Assisting (NBSTSA) as a Certified Surgical Technologist is the preferred credential for individuals practicing in this role. The focus of the tech's role is one of management of the sterile field.

The roles of both the circulator and the tech are complex and involve an interdisciplinary approach toward:

- Care of the patient and surgical team members
- Application of the principles of asepsis and implementation of the practice of sterile technique
- Awareness of the environment
- Knowledge of normal regional anatomy and physiology
- An understanding of the pathophysiology related to the planned surgical intervention
- Knowledge of the operative procedure and its variations
- Identification and management of variations that may be specific to the patient (eg, size or comorbid conditions) or surgeon

Critical thinking models in the operative setting

The day-to-day delivery of quality patient care is one of the most important responsibilities and duties of the surgical team members. It is important that this patient care be delivered based on a collaborative utilization of critical thinking models.

One model—the A-PIE model, derived from the work of Ida Jean Orlando—is a nursing-process model based on the concepts of Assessment, Planning, Intervention, and Evaluation.

A second model, utilized by the surgical technologist—the A POSitive CARE model, derived from the work of Bob Caruthers, CST, PhD—focuses on the technical aspects of patient care. The acronym A POSitive CARE represents knowledge of Anatomy, Pathology, the Operative procedure and its Specific variations, while keeping in mind the Care directed toward the patient and/or team, Aseptic principles and sterile technique, the Role of the team members, and Environmental awareness and concern.

A third model, the CARE model, was developed by the authors of this article. The CARE model embraces the essence of both the A-PIE and A POSitive CARE models and provides a common pathway for interaction among surgical team members.

The CARE model of collaborative surgical patient care

The CARE model is an integrated model of patient care practice that includes active participation and collaboration by all members of the surgical team. It integrates and shows the primary relationship between the roles of tech and circulator in the provision of patient-focused care throughout the intraoperative period.

It includes the concepts of Communication, Assessment, Recommended standards and guidelines, and the Execution of policies and procedures. This model is simple to remember, demonstrates an interdependent relationship among the various practitioners as they perform their duties and execute their responsibilities, and can easily be utilized by any member of the surgical team to prepare for and carry out the various components involved in the delivery of quality patient care.

Communication

During a surgical intervention, the circulator and tech must work together as a unit, in a manner that emulates the true meaning of the word "team." This intraoperative team carries out the myriad tasks and activities that assure the most positive patient outcome possible.

Interaction occurs before, during, and after patient contact to assure that the instrumentation, supplies, equipment and specialty items are gathered, prepared and delivered to the surgeon and assistant in a timely and efficient manner—minimizing the patient's exposure to anesthesia and surgical trauma. Effective teamwork requires planning and utilization of strategies that allow smooth, uninterrupted performance of each individual's tasks and responsibilities.

One key to the success of any team is the use of positive communication. In light of the fact that this intimate subunit must rely upon each other for follow-through of many aspects of a related task, positive communication becomes the linchpin that binds the team into a single functioning unit.

A close-knit intraoperative team communicates on many levels, both verbally and, more often, nonverbally. The circulator assesses the patient's unique needs and develops an individualized plan of care. This care plan is shared with the tech, including patient allergies, patient limitations and any additional information, such as patient size, that may affect procedural activities.

The circulator performs ongoing patient and sterile field monitoring, anticipating and delivering needed items in a manner that permits the procedure to flow smoothly and without interruption. The tech monitors the sterile field, the surgical team and the unfolding events of the surgical intervention—sharing observations and special requests with the circulator in a timely manner, which enables them to work together in meeting the surgeon's and patient's needs.

Communication not only occurs between the tech and circulator, it also involves sharing information among other team members, the patient and any other caregivers who are able to provide additional information and input needed to develop a clear picture of the many patient variables that may influence their intraoperative care.

Admitting personnel and staff gather knowledge and assess the patient, documenting information that plays a vital role in addressing the unique needs of each and every patient.

The surgeon is an integral part of this communication team. He or she best knows the patient's chief complaint and has had the opportunity to discuss individual patient concerns relevant to their biopsychosocial needs. By communicating this information to the intraoperative team, the surgeon can be assured that both the routine and specialty items required for the procedure are prepared in a timely and professional manner.

Communication with the anesthesia provider allows for a smooth and seamless anesthesia induction, maintenance and recovery, along with maintenance of physiological homeostasis.

Assessment

Assessment, the art of gathering information used to develop a plan of action, is the second key to a successful patient outcome and begins at the time the procedure is scheduled.

Many operating rooms now have the ability to utilize and access computerized patient information. This enhanced technology allows the surgeon to forward procedural and patient-specific information and requests directly to the intraoperative team. This information may include the later-

ality of the procedure, the use of a trial supply or piece of equipment, patient allergies, such as latex sensitivity, or the need for ancillary personnel not commonly utilized.

Knowing this information in advance of the patient's arrival in the operating suite permits the team to optimize preparation, resulting in optimal levels of preparedness and remediation of any situation that may lead to or result in a disruption or delay in the surgical intervention.

Assessment is divided into two areas: procedure-specific information and patient-specific information:

Procedure-specific information

The surgeon's preference card is a valuable tool when gathering data related to a specific procedure and surgeon. It contains listings of routine instruments, supplies, wound closure materials, and equipment commonly used by a particular surgeon during a particular procedure. Patient position and positioning aides, skin preparation materials and techniques, surgeon's glove size and other details are contained on a well-developed and maintained card. It is important for the intraoperative team to assure that the surgeon's preference card is current and accurate, allowing all members of the surgical staff to correctly prepare for each procedure.

Procedure-specific preparation also involves assuring that specialty items, such as mesh for herniorrhaphy, prostheses for orthopedic procedures, and limited-inventory equipment, such as a microscope or stirrups for lithotomy positioning, are available. Emergency cases, unanticipated equipment failures and back-ordered inventory can lead to the staff's inability to provided necessary equipment for patient use.

Once the patient is anesthetized, discovering that needed equipment or items are not available is unproductive, inappropriate and unprofessional. Prospective management of these types of situations through anticipation, planning and effective communication can prevent the need to delay or cancel a surgical intervention—a situation that can be stressful to both the surgeon and patient.

Assessment also involves procedure-specific operating room preparation. During the initial daily room preparation, it is important that equipment, such as lights, suction and the electrosurgical generator, be checked to assure that they are in proper working order.

The same is true for any specialty equipment brought into the room for use on a specific case. It is the responsibility of the intraoperative team to review the case cart and compare it to the patient's record and surgeon's preference card to determine that all requested items are present or immediately available.

Patient-specific information

Every patient who comes to the operating room brings with him or her unique needs and requirements. The operative experience may become routine for operating room practitioners, but it is important that the patient not be defined merely as a room number, diagnosis or procedure. When we refer to patients by their intended procedure, it diminishes the value of each life that is entrusted into our care during this most critical time.

The biopsychosocial needs of each patient play an important role in their overall successful return to their optimum level of wellness. Information that has the potential to impact patient care, such as coexisting medical conditions and patient allergies, should be shared with all individuals caring for this patient.

Patient-specific information may be gathered from other members of the care team (such as the physician and personnel in the admissions or preoperative holding areas), family members or life partners, the patient's medical records, and of course, directly from the patient.

As the circulator and anesthesia provider assess the patient's individual needs, it is important that any information that affects surgical intervention be shared among all members. Patient anxiety level, allergy status, fear of certain items or noises, the need for the presence of a family member or partner for psychological support, the request for omission of a certain aspect of care, such as blood transfusions, are all issues that should be monitored and maintained by all members of the intraoperative team.

Patient anxiety affects their care by releasing cortisol and stimulating the "fight or flight" reaction. This leaves a patient less able to fight infection and may negatively impact postoperative wound healing.

Developing a trusting and supportive relationship between patients and their caregivers should include anxiety-reducing practices, such as introducing all members of the surgical team to the patient, focusing on the patient and the patient's needs, assuring patient safety and well-being by providing physical and verbal comfort, applying warm blankets, and using patient safety devices, such as safety straps.

If possible, the tech should refrain from making loud or unnecessary noise, requesting supplies, or performing surgical counts in the presence of the awake patient. These activities distract the circulator from providing direct patient care and tend to create an environment that generally increases patient anxiety levels.

Information pertaining to the patient's height or weight is also important. It may be necessary to modify the type, length or size of the instruments and/or the suture routine, based on this information.

Recommended standards and guidelines

A third key to a successful patient outcome is recognizing and following recommended standards of practice and guidelines. Several important groups provide input and maintain standards of practice that affect operating room practice, including the Association of periOperative Nurses (AORN), the Association of Surgical Technologists (AST), the American College of Surgeons (ACS), the American Hospital Associa-

tion (AHA), the Association for the Advancement of Medical Instrumentation (AAMI), and the Joint Commission.

The standards of practice and guidelines of these groups, along with several others, provide insight into, and serve as a framework for, the delivery of quality, safe patient care. These documents provide a foundation upon which quality surgical patient care is based. The topics covered represent literally every aspect of operating room practice, from attire to sterilization, disinfection and standards of care.

While recommended standards serve as a guide for practice, they are developed and based on research, input and data collected from across the country. They are the standards to which the community holds the intraoperative team responsible.

When in clinical practice, the intraoperative team utilizes the principles of these standards, recommended practices and guidelines to aid in decision-making and the implementation of care. Use of these principles assures the practitioner that their decisions are professional, sound, research-based and designed to provide the surgical patient with an optimal outcome.

Execution of policies and procedures

Execution of the patient's care plan, based on the recommended standards and guidelines, represents the fourth key to the CARE model for successful patient outcome. As the operative procedure is carried out, each team member is responsible for assuring that the needs of the patient and the team are met in a timely and thorough manner and with quality and integrity. Each member, while assessing their own domain of function and contributing their ideas and thoughts, needs to work collaboratively to prevent redundancy and to promote successful, competent and professional care delivery.

Delivering quality patient care

Easy to remember and use, the CARE model can serve as a reference point to ensuring that quality patient care is delivered each and every time. Application of this model, supported by examples referencing the standards of practice from a variety of professional organizations and industry leaders related to operating room practice, is exemplified using the following scenario.

Case study

A 32-year-old female, gravida 5, para 5, is scheduled to undergo vaginal hysterectomy due to second-degree uterine prolapse. Her medical history is unremarkable, with the exception of morbid obesity. Her social history includes the statement that both parents are deceased; her mother from a cerebrovascular accident at the age of 54 and her father from lung cancer at the age of 59.

She is married, with five children, ranging in age from four to 16. She works in a manufacturing plant on the assembly line. She smokes two packs of cigarettes per day and consumes one to two cans of beer daily. Her current medications include oral contraceptives, and she has no known drug allergies. Her admission data includes the following statistics:

- Height—5'3"
- Weight—354 pounds

Admission vital signs

- Blood pressure—146/85
- Pulse—88 bpm
- Respirations—20/min
- Temperature—97.6° F

Anatomy, physiology, and pathophysiology of the female reproductive system

The internal reproductive organs of the female include the uterus, ovaries, and fallopian tubes. The ovaries are both exocrine and endocrine glands, producing the hormones estrogen and progesterone, inhibitin, and relaxin, as well as storing and releasing mature ova during the course of the reproductive

TABLE 1A OVERVIEW OF AORN RECOMMENDED PRACTICES FOR POSITIONING THE PATIENT IN THE PERIOPERATIVE PRACTICE SETTING

- Preoperative assessment for positioning needs should be made before transferring the patient to the procedure bed.
- Positioning devices should be readily available, clean, and in proper working order before placing the patient on the procedure bed.
- The number of personnel and/or devices should be adequate to safely transfer and/or position the patient.
- Maintaining the patient's correct body alignment and supporting extremities and joints decreases the potential for injury during transfer and positioning.
- After repositioning or any movement of the patient, bed, or devices that attach to the procedure bed, the patient should be reassessed for body alignment.

TABLE 1B INJURY RISKS AND SAFETY CONSIDERATIONS WHEN POSITIONING PATIENTS—LITHOTOMY

- Hip and knee joint injury
- Lumbar and sacral pressure
- Vascular congestion
- Neuropathy of obturator nerves, saphenous nerves, femoral nerves, common peroneal nerves and ulnar nerves
- Restricted diaphragmatic movement - pulmonary region
- Place stirrups at even height
- Elevate and lower legs slowly and simultaneously from stirrups
- Maintain minimal external rotation of hips
- Pad lateral or posterior knees and ankles to prevent pressure and contact with metal surface
- Keep arms away from chest to facilitate respiration
- Arms on armboards at less than 90-degree angle or over abdomen

TABLE 2 THE JOINT COMMISSION 2005 CRITICAL ACCESS HOSPITAL STANDARDS—MEDICATION MANAGEMENT

COP Standard MM.-4.30 (TX3.2)

- Standard: Medications are appropriately labeled.
- Rationale: A standardized method for labeling all medications will minimize errors.
- Elements:
  - Medications are labeled in a standardized manner according to critical access hospital policy, applicable law and regulation, and standards of practice.
  - At a minimum, all medications are labeled with the following:
    - Drug name, strength, amount (if not apparent from the container)
    - Expiration date when not used within 24 hours
    - Expiration time when expiration occurs in less than 24 hours
    - For all compounded IV admixtures and parenteral nutrition solutions, the date prepared and the diluent

years. The fallopian tubes serve as a conduit for the capture and transportation of ova from the ovary to the uterus.

The uterus is a pear-shaped organ, located between the bladder and the rectum in the pelvic cavity, consisting of three layers—the endometrium, or lining; the myometrium, or muscle layer; and the perimetrium, which is part of the visceral peritoneum. The uterus is divided into several sections: the dome-shaped portion located above the fallopian tubes, referred to as the dome or fundus; the central section, called the body or corpus; and the inferior, narrow portion that controls entrance into the uterine cavity from the vagina, the cervix.

The uterus receives an ample blood supply from the uterine arteries, which are branches of the internal iliac arteries. Blood leaving the uterus returns to the internal iliac veins via the uterine veins. The uterus is the site of menstruation, implantation and development of a fertilized ovum, and labor.

The uterus is suspended in the pelvic cavity by a series of paired ligaments. The broad ligaments are double-folds of peritoneum that attach the superior segment of the uterus to the sidewalls of the pelvis. The uterosacral ligaments connect the posterior neck of the uterus to the sacrum. The cardinal ligaments extend from the broad ligaments and connect the cervix and vagina to the pelvic wall. The round ligaments extend from the uterus to the labia majora via the inguinal canal.

Uterine prolapse, or descensus, is a condition of laxity of the uterine suspensory ligaments. In first-degree prolapse, this laxity permits the cervix to be displaced downward into the vagina to the level of the vaginal introitus.

In second-degree prolapse, the cervix is displaced downward to a point where the cervix passes through the introitus and is exposed to the outside environment. In third-degree prolapse, the uterine body is displaced downward to a point where it can be seen outside the introitus.

Exposure of the vaginal mucosa to the outside environment can lead to erosion of the vaginal mucosa, ulceration and infection. In its displacement, the uterus may also pull on the posterior wall of the bladder, resulting in a bladder neck malposition that can result in urinary incontinence and chronic urinary tract infection.

Procedural overview

Vaginal hysterectomy involves the removal of the entire uterus, including fundus, corpus and cervix via a vaginal approach. Following injection of a hemostatic agent, such as vasopressin or epinephrine, into the vaginal cuff, an incision is made around the periphery of the cervix.

Uterine clamps, such as Kocher, Phaneuf, or Heaney clamps are used to secure the uterine body pedicles during division and ligation of the uterine ligaments and vessels with size zero absorbable suture material. The ovaries and fallopian tubes also may be removed via this approach, but are commonly left in place so that the ovaries may continue providing adequate levels of estrogen and progesterone throughout the patient's life cycle. The vaginal cuff is then closed with absorbable suture material to prevent intestinal prolapse.

Working through the restricted space of the vagina can be challenging. Vaginal hysterectomy is the procedure of choice for the diagnosis of uterine prolapse, or descensus, since the supporting ligaments of the pelvic floor are sufficiently relaxed to permit manipulation of the reproductive tissues using this approach. In addition, the patient's return to wellness is usually hastened by not having to address the issues and concerns that can accompany an abdominal incision.

Positioning

Vaginal hysterectomy involves placement of the patient in the lithotomy position, a position associated with inherent dangers and risks. The circulator and tech must be familiar with these risks and must plan appropriate interventions based on both knowledge of the position and intervening patient factors.

Lithotomy position

The lithotomy position permits access to the perineum and rectum by stabilizing the patient's legs away from the surgical site. A modification of the dorsal recumbent position, the lithotomy position uses stirrups for positioning of the lower extremities. Three types of stirrups are available: knee-crutch stirrups, candy cane or string stirrups, and boot-type stirrups.

For long procedures, such as a vaginal hysterectomy, the boot-type stirrup is the preferred positioning aid for the lower extremities. This stirrup is designed to support the lower extremity by placing the foot and calf into a boot device. The boot is attached to an arm that can be repositioned intraoperatively by the surgeon, providing support with a minimum

TABLE 3 OVERVIEW OF OR SAFETY PRECAUTIONS RELATED TO ELECTROSURGERY–VALLEY LAB, INC

- The ESU should not be used in the presence of flammable agents (ie, alcohol and/or tincture-based agents)
- Avoid oxygen-enriched environments
- Use of a nonconductive holster is recommended by ECRI, Los Angeles Fire Marshall, AORN
- Do NOT use red rubber catheters or other materials as a sheath on active electrodes.
- Radiofrequency is not always confined by insulation. Current leakage does occur. It is recommended that cords not be wrapped around metal instruments or bundled together.

TABLE 4 OVERVIEW OF AORN RECOMMENDED PRACTICES FOR SPONGE, SHARP, AND INSTRUMENT COUNTS

- Sponges should be counted on all procedures in which the possibility exists that a sponge could be retained.
- Sharps and miscellaneous items should be counted on all procedures.
- Instruments should be counted on all procedures in which the likelihood exists that an instrument could be retained.
- Sponge, sharp, and instrument counts should be documented on the patient's intraoperative record.

of circulatory and vascular compromise of the extremity. The stirrup arms are attached to the siderails of the operating table using universal socket adaptors, and preliminary height and length adjustments are made.

Prior to placement of the patient on the operating table, the table is prepared in the following manner. The head segment is removed from its normal location at the head of the table, placed onto the foot section, and secured. If necessary, the Bakelite cassettes (X-ray boards) of the table are removed.

The sheet and draw sheet are placed, and an absorbent pad may be added over the perineal cutout of the table's buttocks section. To expedite the positioning process, all necessary positioning devices and padding should be assembled prior to the patient's entry into the operating room.

The patient is initially placed in the supine position, so that the sacral area of the pelvis is positioned over the perineal cutout on the operating table. Care is taken that the patient is positioned correctly, allowing self-retaining vaginal retractors to be utilized, while preventing sacral strain from hyperextension and over-rotation of the hip joint. A patient safety strap is applied over the thigh area during anesthesia induction and emergence.

The hands and arms should be positioned on bilateral armboards to prevent accidental entrapment of fingers in the foot section of the operating table as this section is raised or lowered. The armboards are positioned at an angle less than 90° to prevent brachial plexus injury. The elbows are padded, and the arms are placed with the palms facing upward to prevent ulnar nerve injury. Alternatively, the hands and arms may be placed over the patient's abdominal area, if they do not interfere with respiratory effort.

To prevent electrical injury, the patient's body should not be permitted to contact any metal portion of the operating room table. The patient is anesthetized, and the eyes are lubricated and secured in the closed position to prevent corneal drying and abrasion. Antiembolic devices, such as antiembolitic stockings or sequential compression devices, are commonly applied to the lower extremities to prevent venous stasis that could lead to deep vein thrombosis.

Once permission to move the patient is obtained from the anesthesia provider, the safety strap is removed, and the legs are manipulated slowly and simultaneously by two nonsterile surgical team members to prevent hyperextension of one leg, which could result in sacral nerve damage. While supporting the foot in one hand and the calf with the other, the legs are positioned in the boot with the hips flexed and the legs abducted and externally rotated, exposing the perineum and vaginal introitus.

The boots must be properly positioned and well padded to prevent peroneal nerve damage, due to pressure on the peroneal nerve in the popliteal space. Any final height and length adjustments are made to the stirrups. The head segment is removed from the foot of the table, and the leg section of the table is lowered as far as possible.

Trendelenburg's position

Trendelenburg's position may accompany the lithotomy position to displace the abdominopelvic organs away from the operative site to allow better visualization, reduce blood flow to the pelvis, and promote venous drainage. Cardiovascular and respiratory compromise, blood pressure changes, and patient movement toward the head of the operating table are potential hazards to the patient in this position. Precautionary and interventive measures to prevent patient movement include decreasing the angle of the operating table, utilizing padded shoulder braces, moving the operating table slowly, and returning the patient to the level position as soon as possible.

At the end of the surgical intervention, the leg section of the table is raised, and the head segment is reattached to the foot of the table. Permission to move the patient is obtained before both legs are returned to the dorsal recumbent position simultaneously and slowly, permitting the patient's hemodynamic status to remain within normal limits. A rapid lowering of the legs may induce a hypotensive episode, especially in the hemodynamically challenged patient. (See Tables 1A and 1B.)

Medications

The female reproductive organs and associated structures have an ample blood supply. The uterine arteries arise directly off the internal iliac arteries, resulting in the potential for

TABLE 5 THE JOINT COMMISSION UNIVERSAL PROTOCOL FOR PREVENTING WRONG SITE, WRONG PROCEDURE, WRONG PERSON SURGERY

Preoperative Verification Process
Purpose: To ensure that all of the relevant documents and studies are available prior to the start of the procedure and that they have been reviewed and are consistent with each other and with the patient's expectations and with the team's understanding of the intended patient, procedure, site and, as applicable, any implants. Missing information or discrepancies must be addressed before starting the procedure.
Process: An ongoing process of information gathering and verification, beginning with the determination to do the procedure, continuing through all settings and interventions involved in the preoperative preparation of the patient, up to and including the "time-out" just before the start of the procedure.
Marking the Operative Site
Purpose: To identify unambiguously the intended site of incision and insertion
Process: For procedures involving right/left distinctions, multiple structures (such as fingers and toes), or multiple levels (as in spinal procedures), the intended site must be marked such that the mark will be visible after the patient has been prepped and draped.
"Time Out" Immediately Before Starting the Procedure
Purpose: To conduct a final verification of the correct patient, procedure, site, and as applicable, implants.
Process: Active communication among all members of the surgical/procedure team consistently initiated by a designated member of the team, conducted in a "fail-safe" mode, ie, the procedure is not started until any questions or concerns are resolved.

brisk, intraoperative bleeding. The vagina provides limited access to the pelvic tissues, and any bleeding that occurs can impair visualization of important structures.

Chemical hemostasis is the method of choice to both minimize blood loss and permit optimal visualization in the surgical field. This becomes even more critical when dealing with the morbidly obese patient, where visualization may already be compromised due to limited exposure of the perineum obtained from positioning.

Vasopressin, a vasoconstricting agent commonly used in a 0.67-units/ml solution, is injected into the vaginal cuff at the level of the cervix prior to the incision. When vasopressin is injected into tissues, a rise in systemic blood pressure is commonly observed. If vasopressin is injected systemically, via direct delivery into a blood vessel, systemic hypertension or hypertensive crisis can result, placing the patient at risk for cerebrovascular accident (CVA).

When using any medication in the operating room setting, safety guidelines for the handling of medications should be followed. Both the tech and the circulator should verify the medication's name, expiration date, and strength or concentration. Once the medication is transferred to the sterile field, all containers that the medication is placed into must be appropriately labeled with the medication's name and concentration.

When the medication is handed to the surgeon, the name and concentration should be stated, even if this is the only medication on the sterile field. Just prior to injection and again once the injection is completed, the overall dosage delivered should be shared with the anesthesia provider, so that he or she may adjust the levels of anesthetics and monitor the patient closely for adverse medication effects.

The dosage should be reported to the circulator, too, so that accurate and thorough documentation of medication usage may be completed. These safeguards permit the safe and accurate delivery of medication to the patient. (See Table 2.)

Hazardous equipment

ESU

Technology in the operating room lets us "live better electrically" with the electrosurgical unit (ESU) having become a standard part of most surgical interventions. The ability to easily control superficial bleeding intraoperatively, though, does not come without hazards, particularly fire and electrical injury.

The activated electrosurgical pencil adds one of the three principal components of fire—that of ignition or a heat source. Combined with flammable, disposable drapes, gauze sponges and preparation solutions, and fueled by the oxygen-rich environment of the surgical suite, ESU use can instantaneously change from the role of lifesaver to that of dangerous foe.

Many safeguards have been added to the use of electrosurgical technique to safeguard the patient from inadvertent injury, but many of these safeguards depend on human intervention to assure their ability to prevent injury. These interventions include the proper use and placement of the patient-return electrode and the use of the safety holster to prevent inadvertent activation of the hand-switching active electrode.

Methane gas

A hazard commonly overlooked when performing rectovaginal surgery is the potential for the ignition of methane gas, a flammable gas produced during the digestive process and stored in the large intestine. Should this gas be expelled during ESU activation, ignition can cause a burn to the perineum, especially in the presence of pubic hair and flammable (alcohol-based) prep solutions. Care should be taken to prevent gas evacuation by using a moistened gauze sponge to pack the rectum intraoperatively and limiting use of the ESU active electrode during periods when the patient is coughing or "bucking."

Patient-return electrode

The manufacturer's recommended guidelines for use should always be followed when selecting a proper site for return electrode (pad) placement. An area that contains a large underlying muscle mass provides an optimal site for pad placement. Conditions such as excessive underlying scar or thick adipose tissue, underlying metal implants or bony prominences make alternative site selection a must.

Excessive hair requires removal prior to pad placement in order to assure good contact between the skin and the electrode. A site close to the surgical incision and one closer to the incision than other potential alternative sites for ground should be selected for optimum pad placement.

Preventing alternative pathways to ground is equally important. No part of the patient, especially hands and fingers, should be in direct contact with the metal surfaces of the operating table.

Safety holster

Each disposable, hand-activated electrosurgical pencil comes with a disposable holster in which to store the active electrode when not in contact with the patient. Like any new behavioral pattern, holster use requires diligent monitoring and promotion of its use.

Positioning of the holster in such a manner that is conducive for the surgeon to secure the pencil will encourage routine usage and, perhaps, prevent an iatrogenic patient injury. Positive communication skills among team members will aid in developing and reinforcing this skill pattern. (See Table 3.)

Retained foreign items

Gone are the days of "The Captain of the Ship," when the surgeon was totally and solely responsible for the actions of himself and the operative team providing patient care. Today, nurses and surgical technologists are formally educated, not only in the skills, knowledge, and behaviors of their professions, but also in patient safety and risk management.

Under the doctrine of Res ipsa loquitor ("The thing speaks for itself"), leaving an unintended foreign item inside a patient body cavity can have life-impacting consequences, not only for the patient, but for the members of the operating team as well.

The physical and physiological pain of undergoing additional surgery, as well as the potential injury to tissues and organs, compel the operating room team to assure that all unintended foreign items are removed from body cavities prior to closure of those cavities. While the likelihood of misplacing a surgical instrument in the pelvic cavity during vaginal hysterectomy is not as likely as it would be for open abdominal procedures, the potential still exists, in addition to the risk of bending or breaking surgical needles and unintentionally failing to remove a bloodied packing sponge.

As professionals, we have an obligation to our patients to account for all items prior to the final closure of a body cavity. Performing audible counts with both members of the intraoperative team—visualizing and recording each item as it is counted—provides the best assurance that these items will not become a problematic issue for the patient or the surgical team.

A retained foreign item left in a patient can be devastating for the operating room professional. The idea that a patient was directly harmed by one's actions can leave staff members with a sense of failure and low self-esteem. The trauma of defending one's professional knowledge and skills in a court of law can result in individuals leaving the profession for less demanding and less stressful careers. (See Table 4.)

Wrong site surgery

In response to the public outcry related to report after report of incorrect surgical interventions performed on healthy tissues, The Joint Commission published the Universal Protocol for Preventing Wrong Site, Wrong Procedure, Wrong Person Surgery.

This protocol mandates that policies and procedures be implemented to avoid the incidence of surgical procedures performed on the wrong patient or wrong tissue. (See Table 5.) All Joint Commission-accredited institutions are required to comply with this protocol as a means of providing safe patient care.

One aspect of the protocol requires that a "time-out" be performed just before the beginning of the procedure or the skin incision. The protocol requires that active communication take place among all members of the surgical team.

In light of the nature of hysterectomy, where the final determination as to approach is sometimes made following a bimanual examination by the physician while the patient is under anesthesia and unable to mark the appropriate incision site, it is important that clear communication regarding the patient's desires and anticipated outcomes be made known prior to anesthesia induction.

Conclusion

The intraoperative team, composed of formally educated and credentialed CNORs and CSTs working together to deliver quality patient care, is a concept that needs to be adopted and implemented with the sole focus of making a positive impact on patient care and operative outcome.

The results of the actions, collaboration, and synergy of this team of experienced and knowledgeable experts, along with surgeons, anesthesia providers and other support staff, set the stage for a positive, safe and successful patient outcome in today's challenging O.R. environment.

About the authors

Teri Junge, CST, CFA, FAST, is currently program director of the surgical technology program at San Joaquin Valley College in Fresno, California. She is also the medical reviewer for *The Surgical Technologist.*

Ann Marie McGuiness, CST, CNOR, MEd, is currently the ARC-ST director of accreditation services. Formerly, she was program director of the surgical technology program at Lock Haven University—Clearfield Campus in Clearfield, Pennsylvania. She has been a Certified Surgical Technologist since 1977 and has served on numerous committees for AST, ARC-ST, and NBSTSA.

References

1. Accreditation Review Committee on Education in Surgical Technology (ARC-ST). Available at: http://www.arcst.org. Accessed June 2006.
2. Association of periOperative Registered Nurses. Available at: http://www.aorn.org. Accessed June 2006.
3. AST Field Guide to Member Benefits. Association of Surgical Technologists; Centennial, Co; 2005.
4. Caruthers B, Price P, Junge T, eds. Surgical Technology for the Surgical Technologist: A Positive Care Approach. Albany, New York: Thomson Delmar; 2001.
5. Conner R, ed. Standards, Recommended Practices and Guidelines. Denver, Co: Association of periOperative Registered Nurses; 2006.
6. Fuller J. Surgical Technology: Principles and Practice, 4th ed. Philadelphia, Pa: Elsevier; 2005.
7. JCAHO 2005 Critical Access Hospitals Standards—Medication Management. Joint Commission on Accreditation of Healthcare Organizations. Available at: http://www.JointCommission.org/accredited+organizations/critical+access+hospitals/standards/prepublication+standards/cah_mm_05stds.pdf. Accessed June 2006.
8. Merriam-Webster Dictionary. Available at: http://www.m-w.com/cgi-bin/ dictionary?book=Dictionary&va=profession. Accessed June 2006.
9. Miller B. Encyclopedia and Dictionary of Medicine, Nursing, and Allied Health, 6th ed. Philadelphia, Pa: WB Saunders;1997.
10. OR Safety Precautions. Valleylab. Available at: http://www.valleylab.com/education/poes/poes_35.html. Accessed June 2006.
11. Price P, ed. Surgical Technology for the Surgical Technologist: A Positive Care Approach, 2nd ed. Albany, NY: Thomson Delmar; 2004.
12. Rothrock JC, ed. Alexander's Care of the Patient in Surgery, 12th ed. St Louis, Mo: Mosby; 2003.
13. Tortora G, Derrickson B. Principles of Anatomy and Physiology, 11th ed. Hoboken, NJ: Wiley; 2006.
14. The Nursing Process. Available at: http://nursing.about.com/od/nursesgeneralinfo/a/nursingprocess.htm. Accessed September 2006.
15. Universal Protocol for Preventing Wrong Site, Wrong Procedure, Wrong Person Surgery. Available at: http://www.jointcommission.org/PatientSafety/UniversalProtocol/. Accessed June 2006.

Note: The *AST Standards of Practice* are accessible online at www.ast.org.

We anticipate adding more of the Board-approved standards this summer.

DNR: the Ethics of Resuscitation

REBECCA PIEKNIK, CST, CSA, MS, FAST

LEARNING OBJECTIVES:

- Summarize the history of DNR orders.
- Understand the Patient Self-Determination Act.
- Identify the three levels of patient preference for resuscitation.
- Define Living Wills and their related terms.
- Learn the guidelines for perioperative DNR policies.

Many of us view hope as a magic wand—with a wave of that wand we can fix anything. Yet, "hope is viewed through clear eyes and has a profound effect on the chemistry of the brain and workings of the body."[15] When a terminally ill patient goes to the doctor, he or she is looking for hope. Even in dire circumstances, these patients hope for a chance to be cured. With hope, these patients turn to the medical community for guidance to ease their suffering. With hope, these patients trust their physicians to treat them with the dignity and respect every person deserves, even at their time of death.

"A Do Not Resuscitate (DNR) order is written for patients for whom cardiopulmonary resuscitation would be considered futile."[5] The DNR order was developed in the late 1970s, and since its inception, protocols have been written for clearer understanding of its implementation.

"At Columbia HCA Healthcare Corporation, a 22-week-old fetus was delivered by induced labor. Before delivery, the parents had decided, based on the uncertain prognosis for such a premature infant, that they did not want the baby resuscitated, although it is unclear whether this decision was documented. The baby was resuscitated because, in the caregivers' judgments, the baby's condition was adequate for survival. The baby survived but required total care. The district court awarded the parents a substantial financial award based on the fact that the hospital and its staff did not follow their directive."[11]

The Court of Appeals in Texas overturned this decision and ruled in favor of the hospital, even though the Texas Natural Death Act, amended as the Advance Directives Act, clearly states parents may withhold life-sustaining treatment from their child, if the child has been certified as terminally ill.[11]

In another case, an 82-year-old man was resuscitated after initiating a DNR order. Shortly after, he suffered a stroke and became partially paralyzed. He was discharged to the care of his daughter and admitted to a nursing home. Even though the court ruled that treatment without consent was a breach of duty, the court also declared that continued living was not a compensable injury.[11]

When a patient unmistakably limits the medical measures he or she is willing to endure, and a health care provider disregards such instructions, consequences could include the damages arising from any battery inflicted on the patient, as well as licensing sanctions against the health care professional and the medical profession.[11] Even with the incorporation of comprehensive standards of care in practice, controversy and ambiguity remain in the execution of the DNR in the perioperative setting.

Many hospitals have a policy that states DNR orders are automatically suspended during surgery.[5] Acknowledging a patient's right to self-determination by being placed on DNR status in the operating room creates considerable ethical and professional trepidation. On one hand, the patient has the right to refuse treatment. This refusal may sometimes be in conflict with the unwritten perception of saving a life by the surgeons and anesthesia providers who are caring for the patient. The Patient Self-Determination Act (PSDA) was passed in 1990 to allow all patients to make choices and decisions about the type and extent of medical care they receive. The PSDA ensures that hospitals, long-term care facilities and home health agencies receiving Medicare and Medicaid reimbursement recognize living wills and power of attorney for health care as advance directives. This is the right of self-determination guaranteed by the Fourteenth Amendment.[9] (See sidebar.)

Many professionals consider execution of the DNR in the OR as malpractice rather than ethical practice.[2] This stems from the fear of legal liability for correctable incidents and the fact that the deaths would be reviewed by hospital morbidity and mortality committees.[2] This could be paramount to negative influence on their professional reputation. The American Society of Anesthesiologists (ASA) has published guidelines suggesting the re-evaluation of DNR orders prior to the patient coming to the OR.[1] The ASA's documented guidelines include a goal-directed approach to perioperative DNR orders. Caregivers should discuss with the patient his or her preference for resuscitation on three levels:

1) Quantitative and qualitative outcomes. This involves the qualitative characteristics of those outcomes and their meaning to the patient and the burden of reaching the various patient-desired outcomes. The patient needs to be given realistic expectations for any out-

come, and the caregiver needs to be honest as to what quality of life the patient can expect postoperatively. If a patient does not want to be on a ventilator long term, is his or her physician aware of this?

2) Operating room caregivers. This includes the surgeon and anesthesiologist who should act as fiduciary representatives with expert knowledge to determine if any continued therapy would be consistent with the patient's wishes.
3) Evidence-based practice. Patients who wish to retain their DNR orders may choose to request "resuscitative efforts during surgery and in the postoperative care unit only if the adverse events are believed to be both temporary and reversible in the clinical judgment of the attending anesthesiologists and surgeons."[1]

The ASA Guidelines limit possible discrepancies that sometimes arise with procedure directed orders. This approach allows for care of the patient to be more idiosyncratic to the patient's wishes, because the success of the therapies can be tested and not predicted. This also allows for the option of withdrawing care in the postoperative setting, if continued care is unlikely to achieve an expected beneficial result.[1]

Rescinding the DNR in the OR is an ill-defined area of patient care in which there fails to be continuity in the scope of practice. One would presuppose that with education, improved policies and the creation of perioperative DNR forms, greater overall acceptance and documented use of perioperative DNR orders would exist.[1] However, resistance to the perioperative re-evaluation of DNR orders remains for several reasons. Foremost, many anesthesiologists and surgeons have personal beliefs that bind them to continue a treatment once it has begun. Anesthesia involves the deliberate depression of vital systems, followed by their resuscitation that may include the need for mechanical ventilation.[5] Also, general internists and geriatricians who practice in tertiary care settings are more familiar with life-sustaining treatment than palliative medicine.[7] To discontinue treatment would be a breach of an implied contract or a conviction that they have personally failed in their fiduciary responsibilities to a patient.

These views are substantial when considered with the idea that anesthesiologists are still likely to be sued if they permit a patient with a well-documented perioperative DNR order to die.[1] There are more perceived reasons than not to suspend DNR orders in the OR. It is critical that the patient understand the implications of both. Respect for patient autonomy is the most important reason to ensure the patient has a full understanding of rescinding the DNR.[5]

The ASA suggests that anesthesiologists may agree in theory with perioperative re-evaluation of the DNR, but find it very difficult to put into practice. First, hospital policies may not clarify the patient's right to refuse treatment, nor do they provide a practical apparatus for re-evaluation and proper documentation. Secondly, as DNR occurrence is not a daily event, the anesthesiologist may lack expertise in this area of care. Novice anesthesia providers may find it difficult to think past the concept that anesthesia causes physiological instabilities that are routinely corrected to the point that anesthesia care stops and resuscitation begins.[1] Physiologically maintaining a patient during a procedure is often necessary, as anesthesia changes a patient's blood pressure, circulation and level of consciousness.[8] The point when resuscitation becomes extraordinary care is never clear, because events that lead to an intraoperative arrest often resemble actions that occur in the course of routine anesthesia.[4] The burden of this decision rests on the anesthesiologist, who may not have established a relationship with the patient due to constraints. Lastly, the pressures of production, decreased turnover time, and lack of time to hold necessary discussions with the patient or surrogate may also lend itself to rendering well-written policies ineffective in everyday practice.

One way to address this ethical dilemma, suggestive of compromise, is to provide resuscitation in the operating room for cardiopulmonary arrests due to anesthesia, but not those for the underlying disease. When the caregiver must begin chest compressions or defibrillate a patient, it is tacit that care has moved from reversing the complications of an intervention to performing cardiopulmonary resuscitation (CPR).

Cardiopulmonary resuscitation was instituted in the 1960s and quickly disseminated through cardiac arrest teams and coronary care units. CPR was initially developed to reverse sudden death in otherwise healthy individuals; however, it became more widely used in chronically ill hospitalized patients. CPR has become the standard of care, unless the patient or surrogate explicitly refuses it.[7] In 1986, the National Academy of Science (NAS) endorsed "respect for patient authority" in decisions regarding CPR and the initiation of a DNR status. According to the American Society of PeriAnesthesia Nurses (ASPAN), an "estimated 15% of surgical patients have an active do-not-resuscitate or do-not-intubate clause that reflects the elderly or chronically ill patient's preference for a 'dignified death' without artificial life support."[10]

Although great disagreement remains over the ethical answer for patients with DNR orders in the operating room, little information is available on the outcomes of patients with DNR orders who undergo surgeries, especially those who require perioperative resuscitation.[12] To evaluate whether patients with DNR orders were less likely to undergo operations, and to illustrate the characteristics, preferences and outcomes of patients with DNR orders who underwent surgery, a study was conducted on seriously ill patients at five hospitals.[12] The study involved adult patients admitted to five acute care hospitals who agreed to participate in Phase I of the Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatments (SUPPORT) between June 1989 and June 1991.[12]

Patients who met the predetermined criteria had the following diagnoses: acute respiratory failure, exacerbation

of chronic obstructive pulmonary disease, exacerbation of congestive heart failure, end-stage liver disease, nontraumatic coma, nonsmall cell lung carcinoma stage III or IV, metastatic colon carcinoma, or multiple organ system failure with sepsis or malignancy.[12] The expected six month mortality for the patient group at the beginning of the study was 50%.[12] Patients were excluded: if they died or were discharged within 48 hours of admission, were expected to have a hospital stay of three days or less, had AIDS, head trauma, were pregnant, or did not speak English.[12]

The intention of the study was to predict patients' outcomes and to illustrate their decision-making abilities.[12] Patients and surrogate decision makers were interviewed after enrollment in the study concerning the patient's functional status and their general preference regarding aggressiveness of care. Patients were asked, "If you had to make a choice at this time, would you prefer a course of treatment that focuses on extending life as much as possible, even if it means having more pain and discomfort, or would you want a plan of care that focuses on relieving pain and discomfort as much as possible, even if that means not living as long?"[12]

As stated in the study:

"The results concluded that of the 4,301 patients enrolled in the study, 1,251 were considered for surgery and 745 (60%) had surgery performed. Of the patients undergoing surgery, 10% had DNR orders recorded on their chart. Of those patients considered for surgery who had DNR orders, 48% received surgery (57 patients).[12] The 57 patients who had a

The Patient Self-Determination Act

The Patient Self-Determination Act (PSDA), passed in 1990, requires medical care facilities that receive Medicare and Medicaid payments to inform patients of their right to choose the type and extent of their medical care and to provide patients with information about living wills and power of attorney. Specifically, the PSDA requires the following from heath care facilities (including hospitals, nursing homes, home health agencies, hospice programs, and HMOs):

- Provide written information to patients about their rights to make decisions about their treatment through advance directives. A representative from the health care facility should also explain its own policy regarding advance directives. If a portion of the patient's advance directives violate the policies of the facility, the patient must be advised of which of their directives will not be followed.[9,16]
- Ensure compliance with state law. The information offered to patients and written policies and procedures should take into account the laws and court decisions of the state.[9,16]
- Maintain written policies and procedures regarding advance directives. And educate employees and the local communities about laws in the state governing advance directives. Effective implementation of advance directives will be easier for all parties involved if personnel are trained in advance and familiar with hospital policies.[16]
- Document the existence of or lack of an advance directive in the patient's medical record.[9,16]
- Do not discriminate in the type or quality of care provided based on whether or not the individual has executed an advance directive.[9,16]

Advance directives

An advance directive is a general term that refers to one of two legal documents used to speak for the patient in the event that they cannot make decisions for themselves. Those two legal documents are 1) a living will or 2) the durable power of attorney.

A living will must be properly witnessed by a notary, and allows the patient to state, in writing, that they do not wish to be kept alive by artificial means or heroic measures. Patients should discuss their living wills with their doctors and legal counsel to identify and understand the terms—such as code status, artificial means, and heroic measures—used in their living wills.

Creating durable power of attorney is a legal way to appoint a health care proxy who will make medical decisions for the patient in the event that he or she cannot do so. This person should be aware of the patient's specific wishes for treatment and be familiar with any religious considerations that the patient wants to have taken into account.[9,16]

Each state has its own laws concerning advance directives, which can vary widely. A living will or durable power of attorney signed in one state may not be recognized in another. Traveling technologists should be aware of the specifics of the state law in which they're practicing. State specific documents can be obtained through the state's health department. Advance directive documents are also available at no charge through the Partnership for Caring, 800-989-9455, or www.partnershipforcaring.org/Advance/documents_set.html.

Additional information

- A Patient's Bill of Rights is available on the American Hospital Association web site: www.hospitalconnect.com/aha/about/pbillofrights.html
- The Partnership for Caring, a nonprofit educational organization, provides a wealth of information on setting up and following advance directives. Visit their web site at www.partnershipforcaring.org or call 1-800-989-WILL for information.

DNR order prior to surgery had a mean age of 66 (range of 19 to 86 years) and 54% were male. These patients had the following diagnoses: acute respiratory failure (32%), exacerbation of chronic obstructive pulmonary disease (9%), exacerbation of congestive heart failure (4%), end stage liver disease (2%), non-traumatic coma (8%), non-small cell lung carcinoma stage III or IV (9%), metastatic colon carcinoma (12%), multiple organ system failure with sepsis (7%) or multiple organ system failure with malignancy (21%).[12] A wide variety of procedures was performed, with tracheostomies being the most common."[12]

"Of the 57 patients who had DNR orders prior to surgery, 10 had documentation in the medical chart that the orders were to be disregarded (18%): nine had the DNR order reversed preoperatively, and one had a note indicating that resuscitation was to be used, but the order was not reversed. Three patients experienced an intraoperative cardiopulmonary arrest (5%); two received resuscitation (one had a note and the other an order to reverse the DNR preoperatively), and one patient whose DNR order was not reversed, died without resuscitation. Two other patients received resuscitation during their hospitalization: one patient was resuscitated seven days after surgery, the second 70 days after surgery. The DNR order was never reinstated for these two patients."[12]

"Of the 57 patients, 13 died within one week of the surgery (23%). Two of these patients received intraoperative resuscitation; death occurred one day post-op, the second death happened on the fifth day after surgery. Of the 11 patients who died without resuscitation, one patient died intraoperatively, and nine patients had died by postoperative day seven. One patient was discharged and died within one week of the surgery. Nine patients died between one and two weeks postoperatively (6%), and eight between two and four weeks postoperatively (14%)."[12]

"Of the 57 patients who had DNR orders prior to surgery, 31 survived to leave the hospital (54%). None of the four patients resuscitated intra- or postoperatively survived to leave the hospital; 44% of the patients survived two months or more postoperatively, and 30% survived at least four months."[12]

The authors of the study identified five harms as a consequence of resuscitation.[13] The first harm is unnecessary resuscitation when the patient's condition does not justify it. This harm could include ineffective actions. The second harm is when the patient's condition is too far advanced, and resuscitation is unsuccessful. The patient may be too ill for the resuscitation to have the desired effect. If this ensues, the harm to the patient might include physical discomfort, loss of dignity, delayed death and survival with an unacceptable quality of life. Harm to the family might include unfulfilled hope, loss of control of a loved one's destiny, a cost of lost earnings while at the bedside and the cost of supporting a disabled survivor.[13] The third harm of resuscitation is if it provides no beneficence because it prolongs a poor quality of life. If the quality of life is unacceptable to the patient or family, then an apparent and appalling harm has ensued. The fourth harm of resuscitation is the redirection of resources from alternative health care activities that may bring greater benefit to other patients. Resuscitation is a significant use of scarce resources.[13] The fifth harm is if it is unwelcome by the patient. A valid DNR order written by the patient must be considered in keeping with the principle of respect for patients' rights. To resuscitate without regard for the patient's explicit wish is a harmful disrespect for the patient's autonomy.[13]

A hospital-wide policy that automatically suspends all DNR orders in the OR does not address a patient's right to self determination.[13] Surgeons should include patients and surrogates in the decision-making process when there is reconsideration of the DNR order in the OR. The American Medical Association (AMA) has established principles of medical ethical standards that advise physicians to "provide complete medical service with compassion and respect for human dignity."[13]

The American College of Surgeons (ACS) issued a statement in 1994 stating that surgeons must take the lead role in guiding patients and the surgical team through this preoperative aspect of care. It is essential for patients to understand that surgery and anesthesia management may create the potential for correctable cardiac arrest.

Patients should also be aware that many actions associated with resuscitation (eg intubations, ventilation, medication) are a routine component of anesthesia care. The DNR order must be reevaluated before surgery to allow patients to reconsider the parameters of their advance directive and make an informed decision based on their values.

An AORN position statement from 1995 supports the ACS recommendation. AORN notes that "a patient's rights do not stop at the entrance to the operating room. Automatically suspending a DNR order during surgery undermines a patient's right to self determination."[13]

Conclusion

Ethicists have well-versed suggestions for policy development in hospitals regarding CPR that include shared decision making, respect for patient autonomy and contemplation of proportionate benefits and burdens.[7] [Table 1]. If the risks and benefits of surgical procedures and anesthesia are fully explained to the patient, as they should be, then there is a moral obligation to respect the decision for a patient to be DNR in the OR if they so choose. The role of every health care provider is "First Do No Harm." According to the Hippocratic Oath, health care providers should help the sick; not necessarily cure them.[5] Helping the sick may entail allowing death to occur naturally. "Death is the outcome of every life, therefore, death should not be considered a failure."[5]

About the author

Rebecca Pieknik, CST, CSA, MS, FAST, earned a bachelor of health service administration from Baker College in 2002

TABLE 1 GUIDELINES FOR PERIOPERATIVE DO-NOT-RESUSCITATE (DNR) POLICIES

Reevaluation requirements	Patients with DNR orders may be appropriate candidates for anesthesia and surgery, especially for procedures intended to facilitate care or relieve pain. The etiologies and outcomes of cardiac arrest during anesthesia are sufficiently different from those in nonsurgical settings that reevaluation of the DNR is necessary.
Delineating responsibilities for reevaluating the DNR order	The anesthesia provider, in conjunction with the patient's other physicians, is responsible for discussing these issues with the patient and/or family in reassessing the patients DNR status, and for communicating the decision to those who will be involved with the patient's care during the intraoperative and immediate postoperative period.
Provision of options Agreement with the patient and/or family on one of the following options may meet the needs of most patients with DNR status who require anesthesia and surgery.	• Full Resuscitation. The patient desires that full resuscitation measures be employed during surgery and in the PACU, regardless of clinical situation. • Goal Directed. The patient desires resuscitative efforts during surgery and in the PACU only if the adverse clinical events are believed to be both temporary and reversible, in the clinical judgment of the attending anesthesiologists and surgeons. This option requires the patient and/or surrogate to trust the judgment of the anesthesia provider and other care givers to use resuscitative interventions judiciously, based on their understanding of the patient's values and goals of treatment. • Procedure Directed. The patient desires that full resuscitative measures be employed, with the exception of certain specific procedures, such as chest compressions or electrical cardio version. However, certain procedures are essential to providing the anesthetic care (such as airway management and intravenous fluids). Refusal of these procedures would not be consistent with a request in the progress notes. • Additional options. One of the options outlined above, or any other if appropriate, should be documented in the progress notes.
Documentation requirements	Documentation must include both an entry in the progress notes as well as an order in the physician's orders. An attending physician, whether utilizing the standardized form or a narrative format, must sign the physician's orders. Documentation in the progress notes should include the following and be written or cosigned by the attending physician: • The decision-making process which has been and will be followed • The role of professional staff involvement • Role of patient, family, and other decision makers • Data on which the decision is to be based
Time limitations for DNR orders	The original DNR order should be reinstituted at the time the patient leaves the care of the anesthesia provider (on transfer out of the OR or PACU) unless documented otherwise.
Special considerations	• Caregivers right to withdraw from the patient's care. If the patient elects to have the DNR order remain in effect during anesthesia and surgery, physicians and other caregivers have the option of declining to participate in the surgery. • Role of iatrogenic disease. Iatrogenic causes of arrest do not deserve any special consideration. Caregivers should not override patients' decisions about resuscitation, unless they have specifically addressed these issues with the patient and the patient authorizes such interventions. • Pediatric perioperative DNR orders. Pediatric patients should have their DNR orders reevaluated for the perioperative period. Decision making for pediatric patients is a complex area that is beyond the scope of this document. Caregivers should seek guidance from more knowledgeable clinicians, ethical and legal consultants or other policies.
Resources available for assistance	Caregivers may believe that ethical or legal consultation may be necessary or might prove helpful, particularly when there is a lack of consensus about whether to resuscitate. The following resources are available: • Ethics Consultations (provide mechanism of contact) • Hospital Office of General Counsel (provide mechanism of contact)

and a masters of science in bioethics from Albany Medical College, Graduate College of Union University in May 2005.

She is currently working as the manager of Central and Sterile Supply at Pontiac Osteopathic Regional Medical Center in Pontiac, Michigan.

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References

1. Waisel DB. Perioperative DNR Orders. *American Society of Anesthesiologists Newsletter.* 2002;66(10). www.asahq.org/Newsletters/2002/10_02/whatsnew_1002.htm, assessed 3/11/04
2. Curtin L. DNR in the OR: Ethical Concerns and Hospitals Policies. *Nursing Management.* 1994;25(2):29-31.
3. Coopmans VC and Gries CA, Awareness and experience with perioperative DNR orders. *AANA Journal.* June 2000; 68(3):247-256.
4. Couper C, et al. DNR in the OR. *JAMA.* March 18, 1992;267(11):1465.
5. McGraw KS. Should Do-Not-Resuscitate Orders Be Suspended During Surgical Procedures? *AORN Journal.* April 1998;67(4):794-6,799.
6. The Patient Bill of Rights. American Hospital Association. www.hospitalconnect.com/aha/about/pbillofrights.html, assessed 3/11/04
7. Pearlman RA, Miles SH, and Arnold RN. Contributions of Empirical Research to Medical Ethics. *Theoretical Medicine.* 1993;14:197-210.
8. Roberts M. Do-Not-Resuscitate orders in the OR—Do they work for the patient? *AORN Journal.* August 2002;76(2):242-244.
9. The Patient Self-Determination Act. American Cancer Society. www.cancer.org/docroot/MIT/content/MIT_3_2X_The_Patient_Self-Determination_Act.asp?sitearea=MIT, assessed 3/11/04
10. *Standards of Perianesthesia Nursing Practice 2002.* Cherry Hill, NJ: The American Society of Perianesthesia Nurses; 2002.
11. Waisel DB, et al. Guidelines for Perioperative Do-Not-Resuscitate Policies. *Journal of Clinical Anesthesia.* 2002;14:467-473.
12. Wenger NS, et al. Patients with DNR orders in the operating room: surgery, resuscitation, and outcomes. SUPPORT Investigators. Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatments. *J Clin Ethics.* Fall 1997;8(3):250-7.
13. Ardagh M. Futility has no utility in resuscitation medicine. *J Med Ethics.* 2000 Oct;26(5):396-9.
14. Goldberg S. Do-Not-Resuscitate Orders in the OR—Suspend or Enforce? *AORN Journal.* August 2002;76(2):296-299.
15. Seigel, Robert. Personal interview with Jerome Groopman. Anatomy of Hope. www.npr.org/features/feature.php?wfId=1618292, assessed 3/8/04
16. Facts about the Patient Self-Determination Act. Partnership for Caring. www.partnership forcaring.org/Resources/psda02.html, assessed 3/10/04

Gynecologic Surgery: Problems and Complications

BOB L CARUTHERS, CST, PhD

LEARNING OBJECTIVES:

- Demonstrate an understanding of the steps for handling major pelvic bleeding
- Identify the pelvic structures that may require special consideration
- Recognize the symptoms of various postoperative complications
- Indicate the condition and associated symptom of related pelvic infections
- Define and understand the various signs and symptoms of hypovolemic shock

Except for a few procedures in gynecologic surgery, pelvic anatomy determines the difficulties encountered during the procedure and the most likely complications of pelvic surgery. Pelvic anatomy also provides the surgical responses available, especially during an instance of critical hemorrhage. Most bleeding can be handled in routine fashion with pressure, ligation, or electrocauterization. This article will focus on more specific and critical instances of hemorrhage.

Principles of securing pelvic hemostasis

The standard rules for handling major bleeding can be stated simply and clearly:

- Lacerations to large abdominal and pelvic arteries should be repaired.
- Small openings in large abdominal and pelvic veins should be repaired.
- Large veins with lacerations that are not amenable to suturing should be tied off.
- Of the veins, only the portal can not be tied off. (Tying the vena cava is acceptable under difficult conditions. Bilateral lower-extremity edema will result until collateral return develops to the required sufficiency.)

Common abdominal and pelvic structures that may require special consideration or techniques include the vena cava, internal iliac vein, and common iliac artery. Pregnancy creates special conditions for the gynecologic surgeon to consider. Obstetric DIC, a paradoxical coagulopathy, may require both surgical and medical intervention. An important anatomical reminder for the surgeon and the first assistant is that most potential problems are lateral to the uterus. Specific problems will be considered below.

Puncture to the vena cava

The most common defect in the wall of the vena cava is circular, found above the bifurcation, and caused by evulsion of a perforator vein.[1] The standard procedure follows:

- Apply digital pressure to control hemorrhage.
- Gain exposure.
- Secure vascular instruments.
- Grasp the puncture point with vascular tissue forceps.
- Lift gently and "tent" the vena cava.
- Apply a hemoclip parallel to the normal course of the vena cava.[1]

Laceration to the internal iliac vein

Iliac injuries are more common on the right side. This significant clinical finding is typically the result of trocar insertion with the right hand.[1] The standard procedure is:

- Apply digital pressure to control hemorrhage.
- Use sponge sticks proximally and distally to the bleeding site to occlude the vessel. ("Sponge-on-a-stick" used to press down on the vessel.)
- Stop bleeding at site and gain exposure.
- Place DeBakey vascular clamps proximally and distally to the laceration.
- Use synthetic absorbable suture to tie off the vessel proximally and distally to the laceration site.[1]
- Special care must be taken to avoid injury to the right ureter, which is close to both the artery and vein.[1]

Laceration to the common iliac artery

The iliac injuries are more common on the right side. This significant clinical finding is most commonly the result of trocar insertion with the right hand.[1] The standard procedure follows:

- Apply digital pressure to control hemorrhage.
- Use sponge sticks proximally and distally to the bleeding site to occlude the vessel ("Sponge-on-a-stick" used to press down on the vessel.) Note: Do not apply non-vascular clamps to the artery.
- Stop bleeding at site and gain exposure.
- Place DeBakey vascular clamps proximally and distally to the laceration.
- Use 5-0 synthetic monofilament suture on a vascular needle to close the laceration.[1]
- Special care must be taken to avoid injury to the right ureter, which is close to both the artery and vein.[1]

Damage to internal iliac branches in sacrospinous ligament

This situation may develop from dissection anterior to the iliac spine that enters the lateral extension of the cardinal ligament.[1] The standard procedure follows:

- Place packs into the pararectal space.
- Control gross bleeding with pressure.
- When bleeding is controlled, "roll" packs laterally and inferiorly.
- Use a long clamp to clamp branches that can be identified individually.
- Use a synthetic absorbable suture on a needle to suture-ligate the plexus.
- Continue rolling the pack laterally and inferiorly and identify the next plexus.
- After each venous plexus has been sutured, continue to roll the pack laterally and inferiorly and identify and clamp the branches of the hypogastric vein.
- Suture-ligate with a fine synthetic absorbable suture.[1]

Damage to the ureter or bladder

The intimate position of the bladder in relation to the uterus and other female pelvic structures places it at a higher risk for injury, as does the long course of the ureter. Its relation to the distal portion of the uterus, for instance, places it in the position of high-risk for traumatic injury. A look at surgical trauma to the urinary tract is found in a reflective study by Raut et al.[2] in which 1,188 cases were reviewed. Of that number, 892 of the procedures were gynecologic and 296 obstetric. The total number of injuries found was 15 (12 were gynecologic and three obstetric). Of the complications, 13 were related to bladder injuries, with only two related to damage to the ureter. Contributing conditions were studied and primary risk factors determined to be: infiltrated carcinoma of the cervix, pelvic adhesions, adhesions secondary to prior surgery, and distorted anatomy.[2]

The CST and CFA should know the normal course of the ureter and its relation to gynecologic structures, as well as common variants. For effective assisting, the CST and CFA must be able to describe the course of the ureter and to visualize it in their minds. This tactic of visualization permits one to constantly compare what one is actually seeing with the expected. A simple comment such as, "Does that ureter seem to be moving more medially than usual?" may alert the surgeon who is focused elsewhere to a potential problem.

If concern exists about damage to the ureter, the following approach is advised:

- Two options exist: (a) remove the ligatures until the ureter is identified and place a stent, or (b) open the abdomen and dissect out the ureter, then remove the sutures.
- The anesthesia provider should administer one ampule of indigo carmine dye IV.
- A water cystoscope should be inserted into the bladder, and blue colored urine should be verified flowing from the ureteral orifice.
- If no dye is noted after 10 minutes, a ureteral catheter will need to be placed.
- Re-ligate the veins.

Postoperative complications—overview

All surgical procedures run the risk of complications. These may be minor or life-threatening, and a speedy and sure diagnosis with proper intervention is required. Typically, certain complications are more likely to occur within a given time frame. Immediate complications occur during surgery, and the vast majority of these are traumatic injury to a structure (eg bowel or ureter) or the need to control hemorrhage. These complications require immediate surgical response. Cardiac arrest requires a team approach to resuscitation and may require termination of the procedure.

Early complications occur within 48 hours following surgery. These are usually hemorrhagic, cardiac or pulmonary complications. During the first postoperative week, watch for paralytic ileus (third day), wound dehiscence, pelvic hematoma, secondary bleeding (as late as 14 days), and urinary tract fistula. Complications that may occur long after the operative date include adhesion formation, incisional hernia, prolapse and urinary incontinence, and uterine scarring. A sense of these postoperative complications can be found in the study by Sotto, which followed 627 cases of radical hysterectomy and documented complications.[3]

Overall:

- Surgical deaths: six (causes: hemorrhage, sepsis, atelectasis, blood transfusion reaction).
- 23.8% infections in the unirradiated group: urinary track 13.6%; incisional 5.5%; pelvic 4.7%.
- Fistulas in unirradiated group: ureterovaginal 1.3%, vesicovaginal 0.5%.
- 48.4% infections in the irradiated group (twice the incidence of the other group).
- Fistulas in the irradiated group: six rectovaginal 9.7% (did not occur in other group); one ureterovaginal; two vesicovaginal.[3]

Circulatory and cardiac concerns

Postoperative hemorrhage is always a worry. Bleeding may be quickly identified and corrected if the site is apparent. Intra-abdominal bleeding is not easy to identify. It requires vigilant monitoring of vital signs. One should maintain a high level of suspicion during the postoperative phase. The objective is to identify intra-abdominal bleeding quickly, before the patient is in the initial stages of shock. One should never delay because of the potential of compromise of renal circulation, followed by cardiac and cerebral impairment.

Slow bleeding, while not life threatening, may result in anemia if allowed to continue over a prolonged period of time. Slow bleeding can also delay recovery. It can lead to the formation of a pelvic hematoma. This can cause increased pain and serve as a site for infection.

Once established, thrombosis can be a potentially life-threatening condition. Thrombosis and subsequent embolism are relatively rare and may be avoided with the use of low-dose subcutaneous heparin. Should thrombosis be iden-

TABLE 1 ILEUS VS OBSTRUCTION[5]

Postoperative ileus	Sign/symptom	Obstruction
Distension discomfort, but not cramping pain	Abdominal pain	Cramping becoming progressively severe
48-72 hrs postoperative	Relation prior to surgery	Usually delayed: 5-6 days for remote onset
Present	Nausea and vomiting	Present
Present	Distension	Present
Absent or reduced	Bowel sounds	Borborygmi with peristolic rushes and high pitched tinkles
Only if there is an associated peritonitis	Fever	Rare; if present may suggest a gangrenous bowel
Gas in colon; distended loops of small and large bowel	Radiographs	Single or multiple loops of distended bowel (small more common) with air/fluid levels
Conservative Nasogastric suction; enemas; cholinergic stimulation	Treatment	Conservative: nasogastric decompression Surgical intervention

TABLE 2 BASIC CLASSIFICATION OF SHOCK STATES[6]

Type	Definition
Hypovolemic	An inadequate circulating blood volume results from hemorrhage or acute volume depletion
Distributive	Total body water is normal or slightly decreased but is pulled into the interstitial fluid compartment, resulting in an intravascular volume depletion
Cardiogenic	Intrinsic pump failure exists
Extracardiac obstructive	The heart is intrinsically normal and total blood volume is adequate, but mechanical factors interfere with performance

tified, the patient will need prompt treatment with intravenous heparin as indicated.[4]

As previously noted, most postoperative complications are usually medical in nature and not surgical. Myocardial infarction is a severe medical complication and requires a team approach for management.

Respiratory concerns

Pulmonary complications are generally related to the length of time the patient is under anesthesia. Atelectasis is a common finding after general anesthesia. Atelectasis is often accompanied by a transient pyrexia, dry cough, chest pains and mild shortness of breath.[5]

If the portion of collapsed lung is small, the condition will usually resolve without any further complication. However patients with preexisting pulmonary disease, a history of smoking, and/or increased age are at high risk for infection. Careful monitoring of fluid intake and output is necessary, since pulmonary edema secondary to fluid overload dramatically exacerbates the condition. This is true of all surgical patients, but increased vigilance is necessary with patients who were pre-eclamptic. There may be dramatic shifts between fluid compartments in the postoperative period.

Adult respiratory distress syndrome is infrequent in gynecologic patients. When it occurs, it presents a serious problem that requires aggressive intervention, including positive pressure ventilation.[5]

Gastrointestinal concerns

Traumatic injury to the bowel must be addressed immediately. If necessary, assistance from a general surgeon may be required. These injuries are rather infrequent, but management of the gastrointestinal tract is required for every patient and may include nutritional therapy. In cases where the bowel is manipulated, the return to function is normally delayed. It is necessary, however, to distinguish between postoperative ileus and bowel obstruction (Table 1).[5]

Shock in the gynecologic patient

Shock, secondary to any of its several causes, presents a major problem for the physician. In the United States, septic shock alone is believed to affect 100,000 to 300,000 patients. Of those affected, 40-60% will die. In obstetrics, hemorrhagic complications and sepsis continue to be two of the three major causes of obstetric mortality.[6]

TABLE 3 SIGNS AND SYMPTOMS OF THE EARLY STAGE OF HYPOVOLEMIC SHOCK6

System	Symptom/sign	Cause
CNS	Mental status changes	Decreased cerebral profusion
Cardiac circulatory	Tachycardia	
Rapid and thready pulse	Adrenergic stimulation increases contractility, increasing both cardiac output and resistance in the vascular system	
Systemic circulatory	Normotensive or hypotensive; jugular vein distention decreased; narrow pulse pressure	Vascular system resistance decreased; venous return decreased secondary to volume loss; sympathetic nervous system increases vascular tone
Renal	Oliguria	Perfusion decreased secondary to decreased circulating blood volume
Respiratory	Normal or tachypneic	Sympathetic stimulation; acidosis
Skin	Cold, clammy	Vasoconstriction; sympathetic stimulation

TABLE 4 CLASSIFICATION OF HYPOVOLEMIC SHOCK[6]

Sign	Class 1	Class 2	Class 3	Class 4
Blood loss (mL)	Less than 750	750-1500	1500-2000	Greater than 2000
Blood volume (%)	Less than or equal to 15	15-30	30-40	Greater than 30
Heart rate (beats/min)	< 100	> 100	> 120	> 140
Blood pressure	Normal or increased	Normal	Decreased (mean arterial <60 mmHg)	Decreased
Pulse pressure	Normal	Decreased	Decreased	Decreased
Capillary refill	Normal	May be delayed	Usually delayed	Always delayed
Respirations (per min)	Normal	Mildly increased	Moderate to marked tachypnea	Marked tachypnea; respiratory collapse
Urinary output (mL/hr)	> 30	20-30	5-15	Essentially anuric
Mental status	Normal or anxious	Anxious	Confused	Lethargic or obtunded

Shock is an acute clinical syndrome characterized by hypoperfusion and severe dysfunction of the organs that are vital for survival. This condition results from an acute and systematic loss of cardiovascular function. The result is a reduction in cardiac output and/or circulatory blood volume. Shock may be subdivided into several classifications on the basis of its underlying cause. One scheme used is presented in Table 2.[6]

Shock presents a very complicated medical picture and the clinical presentation may vary considerably. Primary factors affecting the clinical picture are:

- The severity of the profusion defect
- The type and severity of the underlying etiology
- The type and degree of any pre-existing organ dysfunction.[6]

Hypovolemic shock

Hypovolemic shock refers to a condition in which the circulating blood volume is inadequate. This inadequacy may result from hemorrhage or acute volume depletion. The clinical features of early hypovolemic shock are presented in Table 3.[6]

Hemorrhagic shock

Hemorrhagic hypovolemic shock is the most common form of shock seen in the operating room. A useful classification system is presented in Table 4. Be aware, however, that estimating intravascular volume can be difficult clinically. Clinical manifestations of hemorrhagic shock may vary considerably. In part, the variation will depend on the rate at which blood is being lost and the total volume of blood loss at a given time.[6]

Septic shock

Septic shock presents on a continuum from an early-shock or early hyperdynamic phase to the late-shock phase. Historically, a variety of terms with inconsistent definitions were used to describe early shock. In 1992, the American College of Chest Physicians/Society of Critical Care Medicine Consensus Conference developed a set of clinical definitions to define the subsets of serious clinical infection (Table 5). Septic shock was defined as sepsis with hypertension that persists despite adequate fluid resuscitation, leading to derangements in cellular and organ system function force.[6]

Sepsis is the precursor to septic shock and multiple organ failure. Sepsis represents a major medical problem in the United States today. In spite of all advances in medicine, the number cases of sepsis reported each year continues to grow. Most of the infections (over 50%) are caused by gram negative organisms. Nosocomial infections have increased likewise. To some extent, this is reflective of the current patient population. Increased risk factors include advanced age, underlying systemic disease, frequent use of indwelling catheters and other mechanical devices, burns, prolonged or indiscriminate use of broad spectrum antibiotics, aggressive

TABLE 5 CLINICAL DEFINITIONS OF INFECTION SYNDROMES[6]

Condition	Definition
Infection	Microbial phenomena characterized by an inflammatory response to the presence of microorganisms or the invasion of normally sterile host tissue by these organisms.
Bacteremia	Presence of a of viable bacteria in the blood.
Systemic inflammatory response syndrome	Systemic response to infection manifested by two or more of the following conditions as a result of infection: temperature > 38 degrees Celsius or < 36 degrees Celsius; heart rate > 90 beats per minute; respiratory rate > 20 breaths per minute or PaCO2 of less than 30 mmHg, or WBC > 12,000 µL or < 4000 µL.
Sepsis	Systemic response to infection manifested by two or more of the following conditions as a result of infection: temperature > 38 degrees Celsius or < 36 degrees Celsius; heart rate > 90 beats per minute; respiratory rate > 20 breaths per minute, or PaCO2 of less than 30 mmHg, or WBC > 12,000 µL or < 4000 µL.
Severe sepsis	Sepsis associated with organ dysfunction, hypoperfusion, or hypotension. Anomalies can include, but are not limited to do, lactic acidosis or acute alteration in mental status.
Septic shock	Sepsis with hypotension, despite adequate fluid resuscitation along with profusion. Anomalies can include, but are not limited to, acidosis or oliguria.
Hypotension	A systolic blood pressure of less than 19 mmHg, or a reduction of > 40 mmHg from baseline in the absence of other causes of hypotension.
Multiple organ dysfunction syndrome	Presence of altered organ function in acutely ill patients. Homeostasis cannot be maintained without intervention.

TABLE 6 EARLY SIGNS AND SYMPTOMS OF SEPTIC SHOCK[6]

System	Symptom/sign	Cause
CNS	Subtle mental status changes, septic encephalopathy	Decreased cerebral profusion; cytokine-related endothelial cell damage creates a leaky blood brain barrier
Cardiac circulatory	Tachycardia; bounding pulse	Myocardial ischemia; depressed cardiac function; decreased or increased cardiac output; decreased systemic vascular resistance
Systemic circulatory	Normotensive or hypotensive; widened pulse pressure	Decreased systemic vascular resistance; decreased circulatory volume
Renal	Oliguria	Afferent arteriolar vasoconstriction
Respiratory	Normal or tachypneic	Pulmonary edema; acidosis; muscle fatigue
Skin	Warm	Peripheral vasodilation; sympathetic stimulation; febrile response
Other	Fever or hyperthermia	Infection; endotoxins; cytokines

cytotoxic chemotherapy, and the use of cortical steroids or other immunosuppressive agents. The surgical team must be aware that sepsis often causes hemostatic defect, adding to the risk factors to be considered.[6]

Early recognition and response to septic shock is important. The signs and symptoms of early septic shock are presented in Table 6.[6]

Signs and symptoms—late stage of shock

The signs and symptoms associated with the late stage of shock are the same for both hypovolemic and septic shock. (Table 7.)[6]

Management of shock

Shock requires clear and decisive management. The management of shock is clearly outside the role and responsibility of the surgical technologist. As always, it is helpful to know basic priorities and intentions in order to be an effective assistant. One way to remember the priorities for the treatment of shock is to restore ORDER.[6]

O Provide adequate oxygen delivery.
R Restore volume with crystalloid and/or blood products.
D Drug therapy (blood pressure support, antibiotics, and other agents as needed).
E Evaluate the response to therapy.
R Remedy the underlying cause.[6]

Postoperative infections

Determining precisely the cause of postoperative infections is a difficult task. Different definitions and criteria have been used in studies to establish the causes of infection, which is compounded by the fact that the population studies also vary considerably. Hager reviewed the literature and reported the following:[7]

- Pelvic infection following abdominal hysterectomy—3.9% to 50%
- Pelvic infection following vaginal hysterectomy—1.7% to 64%
- Septic pelvic thrombophlebitis after gynecologic procedures—0.1% to 0.5%.[7]

While the incidence range is too great to answer many specific questions, it does point out that there is a significant problem to be faced by the gynecologic surgeon to prevent and treat postoperative infection.[7] The risk factors for postoperative infection are as follows:

TABLE 7 SIGNS AND SYMPTOMS OF THE LATE STAGE OF HYPOVOLEMIC AND SEPTIC SHOCK[6]

System	Symptom/sign	Cause
CNS	Disorientation; obtundation	Hypoxia; increased cerebral edema
Cardiac circulatory	Cardiac dysfunction; tachycardia; other dysrhythmia	Irreversible ischemia; decreased cardiac index; decreased ejection fraction
Systemic circulatory	Right heart failure; extra vascular pooling	Right heart failure; extra-vascularizing
Renal	Oliguria progressing to anuria	Acute renal failure
Respiratory	Tachypneic	Adult respiratory distress syndrome
Skin	Cold, clammy	Vasoconstriction; sympathetic stimulation
Other	Lactic acidosis; coagulopathy; thrombocytopenia; depressed platelet function	Anaerobic metabolism; hepatic dysfunction; endothelial cell injury; platelet deposition; vascular thrombosis

TABLE 8 BACTERIA COMPOSING NORMAL VAGINAL FLORA[7]

Aerobes	Anaerobes
Staphylococcus aureus	*Peptostreptococcus sp*
Staphylococcus epidermidis	*Bacteroides sp*
Group B streptococcus	*Fusobacterium sp*
Streptococcus sp	*Prevotella biviua*
Enterococcus faecalis	*Prevotella disiens*
Lactobacilli	*Bacteroides fragilis group*
Corynebacterium sp	
Escherichia coli	
Klebsiella sp	
Gardnerella vaginalis	
Peptococcus sp	

- Altered immunocompetence
- Surgery in an infected operative site
- Failure to use prophylactic antibiotics
- Altered immunocompetence
- Diabetes mellitus
- Premenopausal age
- Obesity
- Prolonged preoperative hospitalization
- Excessive intraoperative blood loss
- Operative inexperience
- Lower socioeconomic status
- Prolonged operative time
- Excessive devitalized tissue[7]

Of all the risk factors, the single most important is immunocompromise, a lowering of the patient's normal ability to defend herself against certain potentially dangerous organisms.[7]

Vaginal flora and infection types

Pelvic infections are, for the most part, the result of the endogenous sources of bacteria. The vagina is a rich source of bacteria and the most frequent source of the bacteria that cause postoperative infections. The bacteria composing normal vaginal flora are listed in Table 8.[7]

Because of the rich quantity of bacteria, pelvic infections are almost always polymicrobial. The following types of infection occur: cuff cellulitis, cuff abscess, ovarian abscess, septic pelvic thrombophlebitis, osteomyelitis pubis, wound infection, urinary tract infection, and bacteremia.[7]

The surgeon must respond to a febrile state with a set treatment regimen. A battery of diagnostic tests may be used to determine the location and type of infection. This is then treated with the appropriate regimen.[7]

Routine postoperative care

The first 72 hours are critical in the postoperative period. The patient is admitted to the postanesthesia care unit (PACU) and their cardiovascular, respiratory and renal status is carefully monitored. The preoperative evaluation (discussed above) and intraoperative findings or complications will determine specific diagnostic and treatment needs. The patient will be discharged from PACU to a surgical unit or other intensive care unit.[8]

Routine postoperative orders must account for the following:

- Diagnosis following surgery
- Vital signs every 15 minutes until stable
- Vital signs every two hours for 24 hours (then switch to every eight hours if stable)
- Intake and output monitoring
- What conditions constitute a call to the surgeon or specified intervention
- Activity level
- Diet
- Intravenous fluids
- Inspirometer use or other respiratory aids
- Type and care of drains
- Pain medications
- Antiemetic
- Antibiotics
- Any other medications
- Bladder catheterization orders[8]

About the author

Bob Caruthers, CST, PhD, served as former AST deputy director and director of professional development. He received his BA from the University of Texas, Austin, in 1972 and his PhD in 1995. He started his medical career as an emergency room orderly and was subsequently employed as a certified operating room technician. He later specialized in neurosurgery and developed a consuming interest in the human brain and its study.

He joined the faculty at Austin Community College and later moved to Colorado to work for AST. He was responsible for leading many significant efforts and was executive editor of the first edition of Surgical Technology for the *Surgical Technologist: A Positive Care Approach,* launched a program of educational CD-ROMs, was instrumental in the success of the AST National Conference and initiated the development of advance practice forums.

In January 2000, Bob was diagnosed with glioblastoma multiforme and faced his illness with strength and determination. In 2002, he lost the battle—and is still missed. This article was excerpted from his manuscript that was related to an OB/GYN advanced practice manual.

References

1. Wheeles Jr CR. *Atlas of Pelvic Surgery, 3rd ed.* Baltimore: Williams and Wilkins; 1997: 492-7.
2. Raut V. Shrivastava A, Nandanwar S, Bhattacharya M. Urological injuries during obstetric and gynaecological surgical procedures. *J Postgrad Med.* 1991 Jan; 37(1):21-23.
3. Sotto LS. Radical hysterectomy with bilateral pelvic node dissection. Our experience at the Philippine General Hospital. *Eur J Gynaecol Oncol.* 1990; 11(6):447-52.
4. Thompson JD, Rock WA. Control of Pelvic Hemorrhage. In: *Te Linde's Operative Gynecology, 8th ed.* Rock JA, Thompson JD, eds. Philadelphia: Lippincott-Raven Publishers;1997: 219-226.
5. Horowitz IR. Postanesthesia and postoperative care. In: *Te Linde's Operative Gynecology, 8th ed.* Rock JA, Thompson JD, eds. Philadelphia: Lippincott-Raven Publishers;1997: 140-142.
6. Smith HO. Shock in the gynecological patient. *In: Te Linde's Operative Gynecology, 8th ed.* Rock JA, Thompson JD, eds. Philadelphia: Lippincott-Raven Publishers;1997: 245-255.
7. Hager WD. Postoperative infections: prevention and management. In: *Te Linde's Operative Gynecology, 8th ed.* Rock JA, Thompson JD, eds. Philadelphia: Lippincott-Raven Publishers;1997: 233-238.
8. *Surgical Technology for the Surgical Technologist: A Positive Care Approach.* Caruthers BL, et al, eds. Albany, NY: Delmar Thomson Learning; 2001.

Improving Access to Health Care for Children

SHAWN P HUELSMAN, CST; CHARLES S MODLIN, JR, MD, FACS; SHANNON PHILLIPS, MD; AND LATEEF SAFORE, MS

LEARNING OBJECTIVES:

- Assess the US Department of Health and Human Services Poverty Guidelines
- Identify the causes leading to uninsured children
- Contrast the costs of government vs private HMOs
- Determine what other issues affect access to health care
- Summarize ways to increase access to health care

Author's Foreword

In surgery, many surgical technologists assist on surgical procedures performed on pediatric patients. From ear tubes to transplant, children of all demographics require procedures to correct a deformity or condition. Unfortunately, many of these children do not have health care insurance, or they depend on state and federally funded Medicaid and State Children's Health Insurance Programs (SCHIP). What does the future hold for these programs, and how does it affect the access to health care for the pediatric population that depends on extensive medical and surgical services? While reading this article, please take time to consider the following questions and access the surgical technology forum area at http://www.ast.org/forum/ to further discuss these with fellow students and seasoned professionals.

1. Do hospitals have the right to decide who does and doesn't receive surgical care?
2. Are there systems that affect decisions about surgical care?
3. Do geographical and economic demographics influence how and where children will have access to care, and which surgical care will be provided (ie emergency versus elective surgery)?
4. Are surgeons restricted from using expensive instruments or discouraged from opening packs of non-vitally-necessary equipment, if the hospital knows it won't be reimbursed by Medicare?
5. Would a more cost-effective physician assistant, resident, or CFA be called in to assist, instead of having a second surgeon scrubbed in?
6. Is there a difference in the degree or amount of postoperative follow-up care given to a surgical patient who is under- or uninsured?
7. Do hospitals frown on lengthy procedures for under- or un-insured patients, because they're more costly?
8. Are there moral/ethical principles involved? Are any of them being violated?

Introduction

Currently in the United States, nearly 18 million children live in poverty; half of them are not medically insured.[14] This statistic mirrors the findings in Ohio, where there are 600,000 poor children, and 235,000 are without any health care insurance.[14] Although 43% of uninsured children come from poor or near-poor families, 73% of these children come from low-income families that are considered 200% above the poverty level ($40,000 for a family of four).[13] (The current poverty level for a family of four is $20,650.)[23]

Though federal and state governments have developed programs to help children regarding their access to health care through Medicaid and the State Children's Health Insurance Programs (SCHIP), one in five poor children, and 17% of near-poor children, remain uninsured.[13] Along with children being uninsured medically, they are also uninsured in the areas of dental and mental health care. More than 25 million children lack dental care benefits, though it is a service provided by Medicaid.[27]

Can the federal and state governments provide health and dental care for the millions of children who are poor or near poor in the country? If so, will there be enough providers to offer the access to care that is needed? In addition, what socioeconomic barriers prevent access to care, even if a public program insures children? This article will examine all the methodologies, regarding access to care and suggests improvements to the current system.

Access to Health/Dental Care Through the Use of Public Insurance Programs

One of the biggest problems related to access to health care services is insurance. Through the creation of Medicaid and the recently created SCHIP program in 1997, more children are able to receive health insurance benefits than ever before. In Ohio, 65% of poor children and 38% of near-poor children participate in these health care programs.[14] Though Medicaid and the SCHIP programs are available through the state, 12% of the entire child population under the age of 19 and 300% of the poverty level remain uninsured.[14]

Causes Leading to Uninsured Children

In a 2003 study, nearly 30% of low-income parents knew what the SCHIP program was, and 40% did not know that their children were even eligible for health coverage.[10] Another study showed that if a parent (or another member of the family) had a negative experience with the process of applying for these programs, then the parent probably would not enroll the children.[10]

During an analysis of Medicaid/SCHIP eligible children in Ohio, lower household income, parental unemployment, parental health insurance coverage, and lower child age were associated with greater child participation in Medicaid and SCHIP.[18] What causes the decrease in enrollment? Parents participating in a 13-city focus group study reported frustration over answering numerous questions on the application; enduring long waiting periods in county offices; long, complicated and degrading applications, and finally, "rude" and "disorganized" social service workers.[10] Many parents reject the challenges associated with enrolling children, especially in a single-parent situation. Another frustration is an application form published in English and the absence of an interpreter for non-English speaking clients. Consequently, many communication problems occur, and the time for children to gain coverage may be prolonged.

The Bureaucracy of Government Run Insurance Programs and the Cost Savings of Private HMOs

Child health care issues, such as the reauthorization of the SCHIP program, have recently become lost among other questions. The SCHIP program was originally created to offer assistance to children from working families that made too much money to be covered under Medicaid, but earned less than twice the federal poverty level. It is a genuine concern that the amount of money appropriated for the SCHIP program may remain the same as its creation in 1997 ($40 billion) or even decrease.[1] How will this affect a child's access to health care? With the decrease in funds, fewer children will be able to apply to the program, or coverage for mental health services, speech and physical therapy, or dental care may become more limited.[1] For example, if SCHIP is eliminated, children who need therapy services that cost $25,000 will not receive it.[32] In some states such as Georgia, SCHIP had to close out enrollment due to a lack of money at the state level.[32]

Some members of Congress are using SCHIP as a tool to try to achieve universal health care coverage for all children, or to include other individuals besides children. Seven states (Hawaii, Illinois, Maine, Massachusetts, Pennsylvania, Vermont, and Washington) have enacted universal coverage.[13] The majority of these states have used the SCHIP program as a tool to accomplish this goal. In Ohio, House Bill 119 was passed in the 2008-2009 state budget.[11] It included an expansion of SCHIP eligibility for children with family incomes up to 300% of the federal poverty level and represented a 100% increase from the current level. In dollar amounts, a family that now earns approximately $60,000 annually will qualify for state SCHIP benefits, which include a Medicaid Expansion Package (Individuals will receive all of the benefits as Medicaid recipients.).

Unfortunately, SCHIP will not guarantee universal coverage for children, or at least a free universal health care structure. SCHIP does not grant an entitlement to care as reflected in Georgia. With the number of children applying for this program and Medicaid, a sliding scale based on income is under discussion. Therefore, a family earning $60,000 annually will be charged higher co-payments and deductibles than a family earning $40,000 a year.[1]

The growing problem with SCHIP is that it was developed for uninsured children from low-income families. Over its 10-year lifespan, SCHIP has included children from middle-income families earning more than 300% above the federal poverty level, the child's family, or even single adults without children.[15] Consequently, individuals who may be able to purchase private health insurance will enroll under SCHIP and squeeze out those that cannot afford private insurance. As more beneficiaries are added, needier children may lose coverage.

In order to control the costs of SCHIP, state governments have looked for alternative ways of managing their Medicaid programs as well. In Georgia, SCHIP had to limit enrollment due to a lack of money at the state level.[32] At the same time, the state turned over responsibility for the Medicaid system to private health maintenance organizations (HMOs). In addition to Georgia, 32 other states turned their Medicaid systems into HMOs in "hopes of cutting through red tape, providing better care to needy patients and saving taxpayers money."[33] The result of this shift has been a decrease in

2007 U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES POVERTY GUIDELINES

Persons in Family or Household	48 Contiguous States and D.C.	Alaska	Hawaii
1	$10,210	$12,770	$11,750
2	$13,690	$17,120	$15,750
3	$17,170	$21,470	$19,750
4	$20,650	$25,820	$23,750
5	$24,130	$30,170	$27,750
6	$27,610	$34,520	$31,750
7	$31,090	$38,870	$35,750
8	$34,570	$43,220	$39,750
For each additional person, add	$ 3,480	$ 4,350	$ 4,000

needed covered therapy and specialty care, longer wait times to see physicians, and the elimination of some services.[33] In a "Good Morning America" report, the major HMO corporations that have assumed responsibility for state-run Medicaid programs have experienced billion dollar profits and higher stock prices.[33]

What's in your wallet?

In the United States, 20 million children use Medicaid as their primary insurance; 700,000 of them live in Ohio.[14] Of the two public programs, Medicaid continues to be the primary public insurance resource for the poor and near poor of individuals living at 150% above the federal poverty level. Parents who spend time to apply for these benefits feel that their children have coverage for any medical, specialty, mental health or dental care issue. Unfortunately this is not the case. While children have the necessary insurance, there is a lack of qualified providers to furnish services to clients with Medicaid as their primary insurance. In numerous reports it has been stated, "Children who lack health insurance have worse access to care than those with either public or private health insurance."[4]

Poor kids need more protection against unforeseen health effects. Early and periodic screening, diagnosis, and treatment, while perhaps unnecessary in middle-class contexts, address the real moral-hazard problem of capitated insurers' incentive to "not discover" all present and latent conditions.[21]

Medicaid and how it relates to more protection against unforeseen effects

According to the Center for Medicare and Medicaid Services (CMS), dental care for children with Medicaid insurance is covered. A poignant example is the case of 12-year old Deamonte Driver who was covered for dental care as part of his Medicaid benefits.[27] One day, Deamonte complained of a toothache, and his mother Alyce phoned local dental clinics and dentists for an appointment. While she struggled to find a dentist who accepted Medicaid insurance, Deamonte's toothache developed into an abscess. The infection from the tooth spread into his brain requiring two major surgeries. Unfortunately, the surgeons were too late, and Deamonte died.

A study published by the American Academy of Pediatrics reports this example represents a problem within the Medicaid system. This survey found that physician participation in public programs was approximately 89%. Unfortunately only two-thirds of these providers accepted all Medicaid/SCHIP patients.[4] In Ohio, SCHIP is based on the Medicaid expansion and therefore has the same fees for reimbursement as Medicaid. Other forms of SCHIP lead to a lower reimbursement than Medicaid.

Access to Health Care versus Quality of Health Care

The Medicaid and SCHIP programs have reduced the number of uninsured, low-income children by one-third.[4] The problem with these programs along with private insurance companies is the failure to provide reports that show how the differences between public and private insurance affect overall quality of care for the pediatric patient. In addition, how is the quality of care affected by the access to care? In the Medicaid and SCHIP populations, it is often difficult to perform long-term studies on access versus quality of care. The main cause for this is the lack of a primary care provider (either by families opting to use a multi-practice clinic or the emergency department). Children without any form of insurance have adverse effects on medical care use and health,[9] and children living in poverty have more health problems and poorer utilization of preventative health.[26] This is due to a lack of a "medical home," and the fact that many parents do not believe that their children are eligible for medical benefits.

With the current reduction of private providers accepting Medicaid payments, many individuals with Medicaid or SCHIP insurance are forced to utilize the emergency department (ED) as their resource for primary care. ED care is meant to be expedient in order to assist individuals undergoing genuine medical emergencies. A more common sight in today's ED is the "Fast Track," a section that cares for patients needing treatment for non-emergency medical conditions. This gives the opportunity for uninsured individuals or those who have Medicaid to receive medications and treatments usually performed by a primary care provider. The result is a decreased ED work force and the inability of physicians to see patients with medical emergencies. A study by Hadley regarding health care changes among uninsured individuals concluded that, "An uninsured person who experiences an unintentional injury or a new chronic condition has greater difficulty obtaining recommended medical care and takes longer to return to full health, if at all."[9] Hadley also states that uninsured individuals receive significantly less care and have poorer health outcomes than those with insurance; in addition, they depend more on EDs for their care, which will eventually become "episodic and lack continuity."[9] This lack of continuity in care can also be applied to those with Medicaid insurance. As previously noted in Georgia, if the physician or dentist does not accept Medicaid insurance, then the access to care is no longer available.

Not only do the participants in these plans suffer. Those communities that have a network of primary care physicians that do accept Medicaid payments become frustrated with the inability of their patients to access specialty services and medications along with the lack of continuing patient relationships.[3] This is especially important for those children who are medically fragile.

Medically fragile children present lifelong illnesses or conditions that leave them "technology-dependent." Causative factors commonly include the increase in extremely preterm or very low birth weight infants.[19] In 1990, the US Supreme Court ruled in the case of Sullivan versus Zebley that, "Childhood disability should be determined by indi-

vidualized functional assessments of children ineligible for Supplemental Security Income (SSI) on the basis of medical standards alone."[19] The court's decision allowed medically fragile children to receive SSI benefits, and subsequently receive coverage under the state Medicaid system. The rationale for enabling medically fragile children to enter the Medicaid system was attributed to the children's increased chances of having "extensive, chronic health care needs," and that "these children would need frequent use of long-term and acute care facilities."[19] This rationale adds additional support to the argument for a consistent relationship with a primary care physician and access to the appropriate specialists who will work together in the child's long-term care.

Families with these children have major concerns, when publicly administered programs convert to privately operated agencies. First, the child's primary care may be turned over to a general practitioner who lacks experience with the child's condition and medical history. Second, many managed care plans limit the amount and type of pediatric specialists, which also may reduce specialty care in the form of family support groups, and counseling.

Other Areas that Affect Access to Care

Public insurance and the medical community are not the only culprits responsible for the lack of access to care. Two other barriers that hinder access to care include the location of the service provider and a means of transportation.

In the urban sector, missing appointments due to a lack of transportation commonly occur.[25] Low-income parents and single parents often cannot afford a reliable automobile or other mode of transportation, as well as the costs of maintenance, fuel and parking.

Children in rural areas are limited to the primary providers in their community, and therefore are geographically disadvantaged. When these children are hospitalized, they are admitted to non-rural hospitals due to the lack of local specialty or subspecialty resources in their community (ie mental health and high–risk newborn care).[5] Governmental policy has focused on ways to bring health care providers to rural patients by providing physicians with complete tuition reimbursement in exchange for serving three to four years in a rural area. This philosophy is now changing, because specialty care in rural areas may affect quality and safety of care due to the relatively small number of cases performed in the rural setting.

The trend is for mobile health clinics or other forms of outreach, including telemedicine. The Cleveland Clinic has launched a new initiative for expanding health care access to rural areas. Understanding that individuals throughout Northeast Ohio need access to the best quality care, the Cleveland Clinic created 15 Family Health Centers; six of them are located in rural areas. These Family Health Centers offer primary care services in family medicine, pediatrics, and internal medicine, while also providing experts in specialty care, radiology and lab services; and some centers also have an attached surgery center. Now individuals living miles away from Cleveland Clinic's main campus can receive the same level of care. Through the clinic's E-Chart system, if an individual is referred to the main campus, the physician on the other end has total access to the patient's chart, X-rays, lab results and other information required to maintain continuity of care.

Analysis of the *Invest in Children* Program

How does a community change an ailing system in order to increase access to health care? One community has successfully reached out through collaboration. The Invest in Children program was created in 1999 to:

Mobilize resources and energy to ensure the well-being of all young children in Cuyahoga County, provide supportive services to parents and caregivers, and

build awareness, momentum, and advocacy in the community around children and family issues.

The vision of this organization is to see that all children in Cuyahoga County (the county that includes Cleveland, Ohio, currently ranked as the fourth poorest city in America)[34] reach their full potential and are supported by a community committed to their success. This program is led by a partnership committee with representation from local and state government, philanthropic organizations, religious agencies, business owners, corporations and the three major health systems in Cleveland. This program combines agencies within Cuyahoga County, (Cuyahoga County Employment and Family Services, Cleveland Department of Public Health, Cuyahoga County Board of Health, Cuyahoga County Community Mental Health Board, Help Me Grow, and Starting Point) in a creative collaboration to provide quality services to all children within the county.

Through the contributions of the members of this collaborative, the Invest in Children program has made substantial impact on families and children within Cuyahoga County. Achievements include:

- Approximately 86% of all parents up to age 25 and first time parents of any age receive a newborn home visit from an RN. One percent of infants being served had contact with at least one Invest in Children service before six months of age.
- Approximately 89% of eligible children under age six living in poor and low-income families receive free insurance from Healthy Start, and 96% of all children in the county have some form of health insurance. The estimated percent of uninsured children under age six fell from 10.5% to 4.4 %.
- 2,924 prenatal home visits were conducted in 2006.
- 7,317 newborn home visits were conducted in 2006, for a total of 34,279 visits during the duration of the program.

- 6,525 ongoing home visits and service coordination were conducted, for a total of 19,799 visits during the duration of the program.
- 344 early childhood mental health visits were made.
- The percentage of women with adequate prenatal care rose to approximately 80%.
- 131,342 children have accessed Invest in Children services (107,965 from Medicaid recipients).

According to Shannon Phillips, md, who sits on the Partnership Committee, Invest in Children has increased child health and early developmental services, but as with any complex initiative, there is still room for improvement. Phillips comments that dental and mental health services are inadequate largely due to the lack of qualified providers that offer services. Although 80% of women in Cuyahoga County receive adequate prenatal care, the low birth weight rate (9.0%) continues to increase. Current initiatives are focused on getting information about the program out to the community. Recently, a mass media campaign was launched in the county market. Commercials, billboards, and radio ads informed the public about the services Invest in Children provides the children of Cuyahoga County. This program is one of the most comprehensive of its kind in the United States, seeking to link access and education to optimal health and developmental outcomes.

How do we increase the access to care?

From government-administered Medicaid and SCHIP programs to community-based programs described in the Invest in Children program, great steps have been made by programs across the country to increase the access to care for children. Is universal health care the answer? According to a CNN/Opinion Research Corporation Poll, 73% of Americans feel that there should be a national health insurance program for all children under the age of 18, even if this would require higher taxes.

Although Medicaid and SCHIP programs are operating effectively on behalf of poor and low-income children, the methods of provider reimbursement for services need to be re-examined so children will have continuity and quality of care.

Outpatient clinics (based on the Cleveland Clinic Family Health Center model) staffed by primary care providers could be established in other states. Operating hours could be extended to accommodate working parents and facilitate families with limited transportation options. Once established, these clinics would be available to provide a continuity of care while potentially reducing the number of non-emergency ED visits, thereby allowing the EDs to return to focusing on urgent medical care.

Ideally, these clinics would be networked within an affiliated health system in order to provide continuity of care for children with long-term medical needs, including access to highly trained specialists. To address the question of transportation, community hospitals could be enlisted to provide resources for appointments and by limiting the distance between rural children and major medical centers.

In Ohio and Cuyahoga County, there are excellent hospitals to provide medical care to children. Unfortunately, in the shadows of these great medical centers, over 26,000 children remain uninsured within Cuyahoga County, and over 212,000 are uninsured in the state.

With the rising population of uninsured children and the decreasing number of children having access to care, the community, medical centers, and health care providers have an opportunity to increase public awareness of programs and how to enroll in these programs, while also providing public health services, including education and screening.

The Cleveland Clinic Men's Minority Health Center and the Health Equity Initiative have proven that public health programs and community involvement lead to positive outcomes in health care disparities. The Men's Minority Health Center, chaired by Charles Modlin, MD, FACS, is the first in the country to address the challenges of health care disparities among minority men. Utilizing a multidisciplinary approach to clinical care research and screening, minority men who do not have access to these services are treated, utilizing a world-class care approach to medicine. During the yearly health fair, minority men are able to participate in free screenings, such as prostate cancer, blood pressure, diabetes and cholesterol. The event represents an opportunity to provide information about diseases and other public health issues, including smoking cessation and nutritional health.

With the expansion of the Men's Minority Health Center with the Health Equity Initiative, children in Cleveland will receive the same opportunities. The initiative hopes to create a children's health fair that will provide screenings for children, and also offer information to parents, including tips on keeping their children healthy, resources and assistance available for parents and children of need, and parenting information.

In Phillips's opinion, "Health care is a right, not a privilege." While an important part of the issue, insurance alone does not provide a direct access to health care. Society must join together in order to encourage individuals to apply for eligible benefits, while giving assistance to families unable to obtain necessary treatment, so all children can become the leaders of tomorrow.

About the Authors

Shawn Huelsman, CST, BSHM, is the program manager for Organ Transplant and an organ preservation specialist at the Cleveland Clinic in Cleveland, Ohio..

Charles S Modlin, Jr, MD, FACS, is a renal transplant surgeon and department head for the Men's Minority Health Clinic in the Glickman Urological Institute at Cleveland Clinic.He is an associate professor of surgery at the Lerner College of Medicine, Case Western Reserve University.

Shannon Phillips, MD, MPH, FAAP, is a staff physician and patient safety officer for Pediatric Hospital Medicine in the Department of General Pediatrics at the Cleveland Clinic. She is a member of the partnership committee for the Invest in Children Program in Cuyahoga County, Ohio.

Lateef Safore, MS, currently works in the Department of Laboratory Pathology and is Director of Health Policy for the Minority Men's Health Clinic at the Cleveland Clinic. He is a doctoral candidate in health policy at the University of Akron.

References

1. Berman S. State Children's Health Insurance Program (SCHIP) reauthorization: will it get us closer to universal coverage for America's children? Pediatrics. 2007; 119: 823-825.
2. Bronstein JM, Adams EK, Florence CS. SCHIP structure and children's use of care. Health Care Financing Review. 2006; 27 (4): 41-51.
3. Chamberlain LJ, Hughes DC, Bishop JS, Matsuda DH, Sassoubre L. Universal health care coverage for children: Impact on pediatric health care providers. Journal of Health Care for the Poor and Underserved. 2005; 16: 622-633.
4. Cuttler L, Kenney GM. State Children's Health Insurance Program (SCHIP) and pediatrics: background, policy challenges, and role in child health care delivery. Archives of Pediatric and Adolescent Medicine. 2007; 161(7): 630-633.
5. Dougherty D, Simpson LA, McCormick MC. Rural areas and children's health care coverage, use, expenditures, and quality: policy implications. Ambulatory Pediatrics. 2006; 6: 265-267.
6. Dubay L, Guyer J, Mann C, Odeh M. Medicaid at the ten-year anniversary of SCHIP: looking back and moving forward. Health Affairs. 2007; 26(2): 370-381.
7. Duderstadt KG, Hughes DC, Soobader MJ, Newacheck PW. The impact of public insurance expansion on children's access and use of care. Pediatrics. 2006; 118: 1676-1682.
8. Goepp JG, Chin NP, Massad J, Edwards LA. Pediatric emergency department outreach: solving medical problems or revealing community solutions. Journal of Health Care for the Poor and Underserved. 2004; 15: 522-529.
9. Hadley J. Insurance coverage, medical care use, and short–term health changes following an unintentional injury or the onset of a chronic condition. JAMA. 2007; 297(10): 1073-1084.
10. Hill I, Stockdale H, Evert M, Gifford K. Do access experiences affect parents' decis ions to enroll their children in Medicaid and SCHIP? Maternal and Child Health Journal. 2006; 10: 517-525.
11. Legislative Service Commission. (State of Ohio). Medicaid and CHIP eligibility for persons under age 19. 2007; HB 119. 170-178.
12. Office of Early Childhood, Cuyahoga County. Invest in Children. 2006 annual report: Big things are happening.
13. Kaiser Commission on Medicaid and the Uninsured. Available at: http://www.kff.org/. Accessed August 15, 2007.
14. Kaiser Family Foundation (2006). Statistics comparing United States to Ohio. Available at: http://www.statehealthfacts.org/chfs.jsp?rgn=37&rgn=1. Accessed August 15, 2007.
15. Leavitt M. Return SCHIP to its roots. A program for low-income children should not replace private insurance. Modern Healthcare. 2007; 37(17): 24-25. [MEDLINE]. http://search.ebscohost.com/login.aspx?direct=true&db=mnh&AN=17477200&SITE=ehost-live. Accessed July 6, 2007.
16. Lichtenstein R, Banaszak-holl J, Calloway, J Allen R, Lopez E, Ross R, Johnson P, Riley S. Training welfare caseworkers in service excellence: increasing children's Medicaid coverage. Journal of Health Care for the Poor and Underserved. 2006; 17: 486-492.
17. Mangione-Smith R, McGlynn E. Assessing the quality of healthcare provided to children. HSR: Health Services Research. 1998; 33(4): 1059-1088.
18. McAlearney JS. Opportunities for outreach: Medicaid participation among children in Ohio. Journal of Health Care for the Poor and Underserved. 2004; 15: 357-374.
19. Mentro AM. Health care policy for medically fragile children. Journal of Pediatric Nursing. 2003; 18(4): 225-232.
20. Mitchell JB, Haber SG, Hoover S. What happens to children who lose public health insurance coverage? Medical Care Research and Review. 2006; (63) 5: 623-635.
21. Nichols LM. Thee moral case for covering children (and everyone else): policy analysis and evaluation cannot rest until there is real health care justice throughout the entire land. Health Affairs. 2007; 405-407.
22. Sommers BD. Insuring children or insuring families: do parental and sibling coverage lead to improved retention of children in Medicaid and SCHIP? Journal of Health Economics. 2006; 25: 1154-1169.
23. 2007 HHS Poverty Guidelines. US Department of Health and Human Services. Washington, DC. Available at: http://aspec.hhs.gov/poverty/07poverty.shtml. Accessed November 8, 2007.
24. US Bureau of the Census. Cuyahoga County Data: 2004. Available at: www.census.gov/cgi-bin/saipe/saipe.cgi. Accessed July 12, 2007.
25. Yang S, Zarr RL, Kass-Hout TA, Kourosh A, Kelly NR. Transportation barriers to accessing health care for urban children. Journal of Health Care for the Poor and Underserved. 2006; 7: 928-943.
26. Zlotnick C. Community- versus individual-level indicators to identify pediatric health care need. Journal of Urban Health: Bulletin of the New York Academy of Medicine. 2006; 84(1): 45-59

Media Resources

27. Poor kids without dental insurance can suffer deadly consequences: Dentists often won't accept Medicaid because of low reimbursement rates. Available at: http://abcnews.go.com/print?id=3120743. Accessed June 26, 2007.
28. CNN/Opinion Research Corporation Poll. Available at: www.pollingrwport.com/health3.htm. Accessed July 12, 2007.
29. Freking K. Officials split on kids' health insurance: state officials at odds with Bush administration over health program's future. Available at: http://abcnews.go.com/print?id=3288633. Accessed on June 26, 2007.
30. Harris D. Kids face life and death without a net: nine million children in America are uninsured, and the results can be fatal. Available at: http://abcnews.go.com/print?id=3240851. Accessed June 26, 2007.
31. Harris D. Health insurance crisis for children: bureaucracy and red tape blamed for millions of uncovered children. Available at: http://abcnews.go.com/print?id=3288383. Accessed June 26, 2007.
32. Kongshaug N, Harris D. (June 17, 2007). Kids' health at risk as politicians argue; thousands of Georgia families are locked out of a successful insurance program. Available at: http://abcnews.go.com/print?id=3311252. Accessed June 26, 2007.
33. Shaylor J, Cuomo C, Hawkins S. Rocky transition from public Medicaid to private HMOs: some say they struggle to get care with Medicaid HMOs. Available at: http://abcnews.go.com/print?id=3314626. Accessed June 27, 2007.
34. Cleveland still poor, but not the poorest big city in the US. Available at:http://blog.clevland.com/metro/2007/08/cleveland_still_poor_but_not_p.html. Accessed November 8, 2007.

Palliative Care Education in the Acute-care Setting

REBECCA PIEKNIK, CST, CSA, MS, FAST

LEARNING OBJECTIVES:

- Demonstrate an understanding of the meaning of palliative care
- Develop an understanding of the important issues related to palliative care
- Distinguish the types of education related to palliative care and the different staff levels
- Summarize the findings of the palliative care survey
- Demonstrate an understanding of a patient's prognosis and ways to coordinate communication between a patient and family.

The end-of-life phase is gaining recognition as an important aspect of life that is ignored until it is too late. This is a period in which individuals have the right to expect quality of life, pain and symptom control, and support for decisions about death and the effect it has on family members. Recommendations by the Institute of Medicine emphasize the need for action by clinicians, educators, researchers, policy makers and the public to strengthen the knowledge base for palliative care and treatment of symptoms common during the end of life.[15]

Background

An exploratory study was done to assess the knowledge level of nursing staff and medical residents regarding palliative care. A questionnaire was developed that was distributed to several units within the acute-care hospital. These units included oncology, SICU and MICU, as well as pulmonary, patient safety and from the director of the palliative-care consultation service.

The major observation by the researcher was that 72% of the respondents felt there was not any formal or written material for staff regarding palliative care; although 24% of the staff acknowledged written material concerning hospice care. Over 83% of those surveyed identified a lack of education regarding pain management; however, 43% affirmed the acute-care hospital offered a half hour to one hour in-service concerning pain management. When queried, staff stated they were very comfortable in consulting residents and attending staff for pain management.

The study revealed several important factors that should be considered as planning for palliative-care services begins. The implementation of palliative care should include a core disciplinary team that consists of a physician, nurse, social worker, pharmacy and pastoral care. Consultations among these team members should focus on current and future treatment of patients identified for palliative care. This would aid patients in being transitioned to appropriate levels of care, thereby reducing lengths of stay, especially in ICU. According to the data collected, pain management should be an essential component of any form of palliative care. It would be essential for the physician to work with pharmacy and nursing education to develop pain management protocol for writing orders. Through joint efforts between the physician, pharmacy and nursing education, pain relief can be addressed.

Through the choice of descriptors and qualitative data, respondents identified there was continuity in the use of bereavement support in every unit of patient care. Although staff could not identify any specific guidelines in the policy manuals, a referral to pastoral care by staff was commonplace to aid the patient in spiritual counseling or provide their family with bereavement support.

Significance was noted in the respondents' views on whether communication was appropriate between all disciplines that are involved in a patient's goals for care. Although nursing staff felt communication was appropriate, the director of patient safety felt attending physicians did not do as good of a job as the house staff in communication across the different disciplines. The findings of this study can be used to explore ways to improve the education process of palliative care and ways to implement outcomes for education regarding palliative care in the acute-care setting.

Methodology

Scope and limitations

This study was limited to the following units: staff from oncology (ONC), the medical intensive care unit (MICU), the surgical intensive care unit (SICU), the director of the palliative-care consultation service, medical director of patient safety and head of pulmonary medicine. Staff was randomly selected to answer the questionnaire. To facilitate the questionnaire's response, only those who expressed an interest or willingness to answer the questions were approached. Participants were assured they would be anonymous and that no specific patient information would be collected. It was assumed the questionnaire was completed honestly and accurately, and the participants did not feel intimidated, since their job performances were not being evaluated.

Selection of the survey tool

As with any new procedure or drug used in medicine, education is the key factor in successfully implementing proper

protocol. The knowledge base of staff nurses, residents, as well as attending physicians would need to be identified in order to develop educational outcomes for the incorporation of palliative care to the acute-care hospital in the study. This data could provide valuable information regarding the knowledge level of staff in the different units who provide direct patient care in the hospital.

Development of the questionnaire

The survey selected was an open-ended questionnaire written by the researcher. It was chosen because of its straightforward method to obtain data. A 10-question survey was designed and used to collect data. (See sidebar.) As most patient-care providers are familiar with hospice care, a brief explanation of the difference between palliative and hospice care was provided. Staff nurses were asked to answer the questions as they related to their area of patient care. Physicians were asked to answer the questions as they related to the residents on their rotation.

Selection of the sample

This study is based on a selected representative sample of hospital employees who provide care to patients with progressive illnesses. They were selected on the following bases:

1. Five staff nurses were selected from the MICU.
2. Five staff nurses were selected from the SICU.
3. The medical director for the palliative-care consultation service was selected due to her contact with a variety of patients that request palliative as well as hospice care.
4. Seven staff nurses in the ONC unit were selected based on their knowledge regarding patients being supported with end-of-life care.
5. The medical director of patient safety works with house residents and fellows that oversee patient care in the hospital.
6. The medical director of pulmonary care oversees a patient base with respiratory problems.
7. The medical director for the palliative-care consultation service is spearheading the initiative to incorporate palliative care at the study hospital.

Distribution of the questionnaire

The questionnaire utilized in this research dictated the use of a combination of personal interview and respondent anonymity. Research approval for the questionnaire was obtained by the Human Investigation Committee (HIC) and approved by Nursing Development and Educational Resources

Palliative Care Questionnaire

Palliative care concentrates on the quality of life for the patient and that of the family. It is planned treatment to relieve, rather than cure, symptoms caused by cancer or other terminal illnesses.

Palliative care is a comprehensive approach to treating serious illnesses that focuses on the physical, psychological, and spiritual needs of the patient. Its goal is to achieve the best quality of life available to the patient by relieving suffering, controlling pain and symptoms, and enabling the patient to achieve maximum functional capacity. Respect for the patient's culture, beliefs, and values are an essential component. Palliative care is sometimes called comfort care or hospice-type care.

Hospice care is an individualized program of support for people within the final stages of a terminal illness and their families. Hospice care may take place in the patient's home or in a hospice facility. The emotional, psychological, and spiritual care also includes the family, who continues to receive ongoing support even after the patient dies.

Hospice care is defined as a coordinated program for meeting the special physical, emotional, social and spiritual needs of dying individuals, by providing palliative and supportive services during the illness and bereavement to and on behalf of individuals who have no reasonable prospect of cure and, as estimated by a doctor, have a life expectancy of less than six months.

What type of education is available at various staff levels regarding palliative care?

1. How many hours of education are given to address pain management for patients?
2. What topics are covered during grand rounds or in-services regarding alternative therapies?
3. Is there training/guidelines established to assist staff in recognizing the patient's need for psychosocial counseling?
4. Is there an in-service or guidelines in place to assist staff in offering respite care? Does your staff know the difference in respite or palliative care?
5. What criteria/guidelines have been established to assist staff in writing orders for pain management? With whom would the staff confer if they have questions? Is your staff comfortable in writing orders for pain management?
6. What information is given to staff to assist in offering spiritual counseling and support in the hospital? Is your staff aware of spiritual counseling that is offered in the hospital?
7. How does the staff handle cultural sensitivity training when dealing with terminal and end-of-life patient issues?
8. What guidelines have been established to assist staff in offering bereavement support? Does your staff follow through with ways to offer bereavement support?
9. What means have been established to facilitate communication between the different disciplines with a patient's treatment goals? Does your staff aid in facilitation of communication regarding treatment goals?
10. What criteria/guidelines are available to assist staff in facilitating the transfer to hospice or palliative care? Is your staff comfortable in facilitating the transfer to hospice or palliative care?

Table 1: Palliative-care questionnaire data, summarized by department

Questions	MICU Nurses	SICU Nurses
What type of education is available at various staff levels regarding palliative care?		
No formal education for staff regarding palliative care	Two nurses stated there was none, only written info for hospice	One nurse identified an in-service
How many hours of education are given to address pain management?		
30 minute in-service for pain management	0 nurses recalled any in-service	Four nurses recalled a 30 minute session
Ongoing in-service for pain management	Four nurses agreed there was ongoing education	One nurse identified education in pain control
What topics are covered during in-services regarding alternative therapies?	Only three nurses knew of alternative therapy	Four nurses felt informed on alternative therapy
Healing touch therapy or massage therapy	One nurse had knowledge of touch therapy	
Is your staff comfortable in writing orders for pain management?		
Comfortable consulting residents and attending physicians for pain management		All surveyed were at ease in consults
Refer pain management to physicians	Staff preferred to refer to physicians	
Is there training established to assist staff in recognizing a patient's needs for psychosocial counseling?		
No specific training to recognize a patient's need for psychosocial counseling	Three nurses did not know of any training	All five nurses felt untrained
Patients were assessed upon admission to the unit on needs for psychological counseling	One nurse assessed patients upon admission	This unit did not assess patients
Are there guidelines in place to assist staff in offering respite care? Is it available?		
Are not aware of any respite care or guidelines	Only one nurse knew of respite guidelines	Four nurses were not aware of guidelines
What information is given to staff to assist in offering spiritual counseling and support? Are you aware of counseling offered in the hospital?		
Aware of pastoral care services and were comfortable referring patients to pastoral care.	Three nurses aware of services	Only two nurses referred patients to pastoral care
What guidelines have been established to assist in offering bereavement support? Does staff follow through with bereavement support?	All four knew established guidelines	All five nurses knew guidelines
No specific guidelines for bereavement except to contact pastoral care.		
What means have been established to facilitate communication between the different disciplines with a patient's treatment goals? Does your staff aid with facilitation of communication regarding treatment goals?	All four nurses aid in patient's goals	All five nurses aid in patient's goals
Nursing staff felt that communication was appropriate between all involved in a patient's care.		
What criteria /guidelines are available to assist staff in facilitating the transfer to hospice or palliative care? Is your staff comfortable in facilitating the transfer to hospice or palliative care?		
Hospital needs to offer more in house service and promoting the policies and procedures when it comes to hospice and palliative care. Staff is not comfortable.		One nurse felt there should be more education
Staff is comfortable in referring patients to hospice. The hospice representatives facilitate the transfer.	All four nurses knew guidelines in the transfer of care	All five nurses knew of guidelines for the transfer of care

	ONC Nurses	Director of Pulmonary	Director of Patient Safety	Director of Palliative Care
		Not available for residents	Not sure	Not available for residents
	One nurse identified an in-service			
		Rounds once a year	Informal verbal education	None regularly
	Five nurses recalled a 30 minute in-service			
	Two staff stated there was a pain control in-service			
	Three nurses felt informed on alternative therapy	No alternative therapies discussed	Informal discussion held on options	No alternative therapies discussed
	Four nurses knew of touch therapy			
		Comfortable using individual formulary	Residents use published algorithms	Residents use individual formulary
	Only two nurses felt at ease to consult			
	Five nurses referred patients to physicians			
		Residents not familiar with any training	Staff used some guidelines	None known
	Four nurses did not recognize any training			
	Four nurses used admission for assessing patient			
		Not aware of any	Staff refers patient to hospice	Residents call care counselor
	Five nurses did not know of any respite care			
		Works closely with pastoral care	Residents offer pastoral care	Works with pastoral care
	Six nurses referred patients to pastoral care			
	All seven nurses knew of guidelines			
		Residents follow through by contacting pastoral care	Staff follows through by contacting pastoral care	Works closely with pastoral care
	All seven nurses aid in patient's goals			
		There are no set standards for communication	House staff communicates better than attending physicians	
		Physicians do not discuss with patients. Usually a nurse handles the discussion	Consult director of palliative care/ lack of continuity of care for patient	Staff is aware of guidelines and work with director to transfer patients
	One nurse felt there should be more education			
	All seven nurses knew of guidelines for the transfer of care			

(NDER). As time was a factor, the survey was hand delivered to staff in the patient care units on March 31, 2005. Nurses were randomly selected by management to complete the survey. Surveys were mailed back through interdepartmental mail. There was an 80% return rate on surveys that were distributed in SICU and a 100% return rate from MICU and ONC patient care units. The questionnaire was presented to physicians who oversee residents that offer patient care. This allowed the opportunity for more detailed verbal feedback on the questions. Primary data was collected through the questionnaire.

Analysis of data

The researcher summarized the data by utilizing a table for easy visualization of the information for comparison across the units (See Table 1).

Summary

The findings of this study can and should be used to determine what kind of education is necessary for initiating palliative care as part of standard care within the study hospital and the value of that education in ensuring patient-care continuity across the different units at that hospital. The nature of the interviews varied. Face-to-face interviews were held with the physicians who supervise staff residents in these areas. The remaining questionnaires were answered and returned through interdepartmental mail.

Findings

Nineteen percent acknowledged a one-hour workshop regarding the palliative-care concept, yet no indication of how it would or could impact their patients. This corresponds with findings of the 1995 Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatment (SUPPORT), which concluded that the utilization of specially trained nurse clinicians to facilitate communication with patients produced no statistical change in the patient's pattern of care.[15]

The nursing staff, as well as residents, could not identify any formal education in the hospital regarding palliative care. A general lack of knowledge about palliative care is hindering communication and discussion about care preferences for patients with progressive illnesses.

Palliative care is event and patient driven. It can be initiated at the time of diagnosis of a life threatening or debilitating condition, yet without staff being adequately informed about palliative care, initiation of palliative care is a challenge. Eighty percent of the staff in MICU could not identify any education regarding pain management, while 80% in SICU recalled a 30 minute in-service. Seventy two percent of the ONC unit that provides end-of-life care stated they had a 30 minute in-service and 28% felt there was on-going education regarding pain management.

The staff in MICU, SICU and oncology that answered the survey all stated they often referred the patient for pain management, although residents only received education during grand rounds once a year. MICU preferred to refer patients to physicians for pain management. Coincidentally, the SUPPORT study findings stated that 50% of hospitalized dying patients experienced moderate to severe unrelieved pain up to their deaths.[15] If nurses and physicians are to be advocates for their patients, failure to aid in pain and symptom control can be seen as failure to meet a patient's physiological needs.

Palliative care includes addressing a patient's psychosocial needs as it supports patients and families through a life-threatening illness. The statistics acknowledge that one out of every eight patients is identified for psychosocial counseling. This ratio falls far below expected rates for patient satisfaction. Forty-three percent of staff surveyed in MICU felt they had training in recognizing a patient's need for psychosocial counseling and only one nurse stated an assessment was done upon admission to the unit. Although 100% of the staff surveyed in SICU recognized a patient's need for counseling, only half of the ONC unit felt they could recognize the need for psychosocial counseling.

The Palliative Task Force at the acute-care hospital identified that pastoral care would be an important entity to any palliative-care service that might be offered. It has been recognized that "keystone rounds," which involve the residents, attending physicians and nursing staff, offer the opportunity for communication between the different disciplines regarding a patient's goals for care.

The ability to communicate between the different disciplines and family members ensures there is a commonality for each patient regarding treatment goals. This is accomplished through keystone rounds that take place daily on the units. However, the medical director of pulmonary care felt there was lack of communication in regard to the patient's goals of treatment. Residents and attending physicians are uncomfortable discussing end-of-life issues. According to the Reuters study, family end-of-life orders often exist for hospice patients, and feedback from the questionnaire supports that nursing staff is very comfortable calling for referrals to the hospice unit.[3]

The initial phase of palliative care for the study hospital will be based on a consultation service headed by the director of the palliative-care consultation service. According to a study done in 2002, the hospital would best be supported by an educational model of palliative care. This would include residents and fellows who would be supervised by the palliative-care physician. Currently, physicians are not adequately trained to handle the complexities of end-of-life care and pain management. The education model for palliative care should be multifaceted and include physicians, nurses, medical and nursing students, pastoral care and social workers.

Resources for education can be obtained from Education for Physicians in End of Life Care (EPEC) and include fundamental skills in communicating, ethical decision making, palliative care, psychosocial considerations, and pain and symptom management.[11] By identifying specific objectives, essential skills to palliative care can be learned. Core curricula should be established with ethical conferences that include end-of-life care, advance directives, limitation of treatment, futility, quality of life, as well as assisted suicide/euthanasia.

According to the National Institutes of Health, patients with progressive illness experience many symptoms and syndromes, such as difficulty breathing (dyspnea), and transient episodes of confusion and loss of concentration, nausea, fatigue, and depression.[16] These symptoms add considerably to the suffering of patients and their families, and to the cost and burden of medical care. Studies from the Center to Advance Palliative Care have documented patient demands regarding palliative care:

- Patients want vigorous treatment of their pain and symptoms.
- Patients want relief from worry, anxiety and depression.
- Patients want communication about their care over time.
- Patients want coordinated care throughout the multiple-year course of an illness.

The cornerstone of palliative care is to ensure that patients do not suffer from uncontrolled symptoms. Hospitals accredited by the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) are required to meet national standards for effective pain treatment. By instituting palliative care in the acute-care setting, the study hospital will be successful in meeting pain management and other quality standards set by JCAHO.[16]

Today's health care system can be very fragmented and complex as it attempts to meet the needs of the chronically ill, while at the same time strives to offer sophisticated care that requires tremendous coordination of time and staff. Palliative-care programs allow for staff to provide high-quality coordinated care to their patients.

Recommendations

Based on the study the following recommendations can be made:

1. The director of the palliative-care consultation service will take calls for palliative-care consultations and bring in other team members as necessary. The core disciplinary team should consist of a physician, nurse, social worker, pharmacy and pastoral care. Consultations among these team members will focus on current and future treatment of patients identified for palliative care. Patients would be transitioned to appropriate levels of care. This will translate to reduced lengths of stay, especially in the ICU units. The consultation will serve

Palliative care plan checklist

Address short term medical progress and goals.

- ☑ Assess whether specific criteria toward progress have been met (eg mental status or ventilator needs). Has there been improvement, stability, or worsening in the past 24 hours?
- ☑ Are there clinical changes (eg new gastrointestinal bleeding) that will impact the patient's ability to meet desired clinical goals?
- ☑ Review interventions that may be needed in the next 48 hours and set overt criteria to measure progress (eg objective indicators of progress toward ventilator weaning).
- ☑ Use this information to review goals and determine whether changes in the prognosis can guide you, the patient, or the family in decision making.

Address patient symptoms and psychosocial needs.

- ☑ Review progress in managing the current symptoms and psychosocial needs (patient and family).
- ☑ Identify existing or new physical symptoms and psychosocial needs (eg patient depression, family stress) and discuss among team members.
- ☑ Develop a treatment plan for each symptom/need for the next 24 hours.
- ☑ Identify both ICU and non-ICU resources (eg palliative care nurse, clinical psychologist, etc) to assist in the care plan and clarify roles for members of the interdisciplinary team.

Clarify understanding of prognosis and coordinate patient/family communication.

- ☑ Review patient/family understanding and concerns about diagnosis, prognosis, possible outcomes, and details of the above items.
  - Inquire if the patient or significant others have new information or new perspectives that can help clarify the understanding of the patient's goals and preferences.
  - Decide if the goals of care need to be refined or changed.
  - Agree on specific criteria for the reassessment of clinical responses and goals.
- ☑ Determine what new information needs to be communicated within the next 24 hours.
- ☑ Agree on who and how the team will communicate with the family/patient today (eg the attending physician will meet with family at 3 pm; the resident will attend, then call out-of-town relative after meeting).

Document care plan and coordinate the follow-up and the next day's assessment.

- ☑ Document the clinical status, symptoms, and daily goals of care with the details of the decision-making process.
- ☑ Change orders as necessary (eg new do-not-resuscitate order).
- ☑ Schedule next meeting for interdisciplinary team that includes the patient (if able) and family to update the goals, medical evaluation, responses to current therapy, and future plans.

as a forum to educate medical and nursing staff about palliative care and decision making for individual patients. Creating a pathway for care would be the next step to palliative care that meets the patient's needs.

- Phase I: Patient with terminal diagnosis. The attending physician discusses treatment options with the patient and family.
- Phase II: The care coordinator contacts palliative care. The RN consults the social work and pastoral care departments. The patient makes a decision on care based on his or her own value system.
- Phase III: Continue treatment.

2. Pain management is an essential component of palliative care. The physician will work with the pharmacy and the nursing education department to develop pain management protocol for writing orders. Through joint efforts between the physician, pharmacy and nursing education, pain relief can be addressed. Analgesia includes not only drug therapy, but also non-pharmacological interventions such as imagery, massage, therapeutic touch, music therapy and meditation. The goal of therapy is to keep the patient comfortable, without clouding mental or cognitive functions. Teaching pain management to the nursing staff can alleviate many fears they have (eg causing respiratory depression in patients in order to address their pain symptoms or creating narcotic addictions in tenuous patients).

3. From the results of the study, it would be beneficial to develop a bereavement care flow plan with pastoral care. This will aid in the coordination of treatment for patients within the palliative-care service leading to improved patient and family satisfaction. Spiritual needs should be addressed on a broad scale. A patient or family member may experience any or all of these convictions:
   - the need for meaning and purpose
   - the need for love and relatedness
   - the need for forgiveness[18]

   Protocol for referring patients to respite care should be incorporated into the care plan. This will facilitate help for family members if it becomes necessary.

4. The needs of seriously ill patients and their families are typically complex and multidimensional. Staff skills should include: medical evaluation and decision making, pain and symptom management, patient and family communications, a capability to address difficult decisions about the goals of care, sophisticated discharge planning, and the ability to deliver continuity of care.[7] Support services to the core team include: patient advocates, anesthesia pain experts, rehabilitation therapists, and psychiatry consultants. The interdisciplinary team should have special training and/or work experience in palliative medicine, hospice or nursing home settings. There should be an understanding of the standards of the acute-care setting as well.[7]

5. Psychosocial counseling was identified through the study to be an inconsistent or unrecognizable component of needed care. A standardized approach to psychosocial counseling can be obtained through a suggested practice guideline. In addition to the various symptoms associated with a disease process, common problems may include: anxiety, depression, insomnia and financial difficulties. Improved communication and decision making can help alleviate some of the psychosocial stress that occurs for many patients and family members.[2]

6. Through the questionnaire, staff acknowledged that a protocol should be developed along with educational in-services to address criteria for staff in order to facilitate the transfer to hospice. The information should be recorded on video or DVD for training of new personnel to the unit. This protocol would be implemented by both hospice and palliative-care services, working together to ensure a smooth transition.

Clinical assessments

Ongoing clinical assessments are important when planning care for chronically ill patients. When developing a care plan, it is essential to evaluate functional ability in daily activities and correlate the physical signs and symptoms.6 Creating prognostication tools will help health care professionals determine when functional and physical decline occurs and a patient has entered the terminal phase.[21] This would have been especially helpful in the care plan for Mrs G.

When Mrs G's condition deteriorated after her abdominal surgery, her son and daughter began to wonder if consenting to surgery was a wise decision. It was suggested the family consider hospice and a do-not-resuscitate (DNR) order. Pain and symptom management were addressed in the care plan. The family was asked to switch from curative treatment to hospice and end-of-life care.[6] Those who cared for Mrs G grieved over the loss of their patient of the last seven years. If upon admission, goals were identified with the patient and family, a care plan based on palliative care may have created the understanding and communication to allow staff as well as the patient and family transition to hospice care. If palliative care been part of the care plan, the family, patient and staff may have had more time to accept the prognosis and emotionally prepare for the ultimate outcome.

Palliative care plan checklist

A care plan checklist should be utilized at admission to begin communication between staff, family and the patient about

care and goals. A daily care plan checklist can also be used to facilitate palliative care, simultaneously with curative or life-prolonging therapies if so desired. A user-friendly algorithm aids in identifying goals of care to ensure the patient's needs are being met (see sidebar). This daily care plan can be initiated in general units as well as units that may not be familiar with end-of-life care. This checklist can help clarify the goals of care for the staff, ICU team, consultants, patients, and family, as well as provide a medium for quality improvement.[10]

As a patient is admitted to the hospital, it is important to determine patient-centered goals of care and then decide if ICU care or palliative care will help support these goals or distract from them. With a documented strategy upon admission, the patient can benefit from a care plan that integrates palliation into the daily agenda.[10] Different models of care should not exclude any of the others; each may be useful at different stages of the disease process.[11]

Patient centered and family centered care

"Respect for persons is an ethical ideal that states it is wrong to use people as a means to an end. People should be treated as an end to themselves."[12] For example, the health care clinician should reflect on whether there is benefit to that particular intervention.[12]

Potential benefits of hospital-based palliative care include:

- Reduction in symptom burden
- Care concordant with patient-family preferences
- Patient-family/professional consensus on the goals of medical care
- Improved patient and family satisfaction
- Improved (or no adverse) utilization outcomes (length of stay, ICU days, readmission rate, rate of hospice use, emergency department use).

Conclusion

Since completing the study, a number of advancements have occurred at the acute-care hospital. The findings of the study validated the algorithm that had been presented to the End of Life Steering Committee at the hospital. A core disciplinary team that consists of a physician, nurse, social worker, pharmacy and pastoral care was put in place. The hospital received approval for an in-house palliative care unit, which will be designed with the idea of meeting the individual needs of each patient. The End of Life Steering Committee is working directly with pharmacy to update policies to ensure proper pain management. Bereavement cards have been integrated as part of the protocol for a patient that does expire. Every staff member who was directly involved with the patient's care during his or her stay in the hospital signs each card.

The study raised awareness as to what patient needs the hospital is not meeting. To close this gap, it will be necessary to educate staff and furnish resources that can be utilized when caring for the critically ill patient. The End of Life Steering Committee formed an education subcommittee that will initiate a step plan to educate those who are or who may be involved with chronically ill patients. The importance of education in any care flow plan can not be stressed enough. Although this program is in its infancy, it illustrates that the hospital does respect patient autonomy and the importance of quality patient care.

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About the Author

Rebecca Pieknik, CST, CSA, MS, FAST, earned a bachelor of health service administration from Baker College in 2002 and a masters of science in bioethics from Albany Medical College, Graduate College of Union University in May 2005. She is currently working as the manager of Central and Sterile Supply at Pontiac Osteopathic Regional Medical Center in Pontiac, Michigan.

Bibliography

1. Kellar N, Martinez J, Finis N, Bolger A, von Gunten CF. Characterization of an acute inpatient hospice palliative care unit in a teaching hospital. *Journal of Nursing Administration*. 26 (3):16-20, 1996 Mar. (10 ref).
2. Pioneer Programs in Palliative Care: Nine Case Studies. October 2000. Millbank Memorial Fund. www.milbank.org/pppc/0011pppc.html. Accessed 12/9/05.
3. Study: End-of-life Often Begun Too Late. Reuters. February 24, 2005. www.reuters.com/printerFriendlyPopup.jhtml?type=healthNews&storyID=771130. Accessed 2/24/05.
4. Neigh J. HAA update: Hospice Forum: Hospice Survey Shows Widespread Interest in Working with Hospitals to Provide Palliative Care. *Caring*. February 2003;22:24, 26.
5. Scala-Foley MA, Caruso JT, Archer D, and Reinhard SC. Medicare's Hospice Benefits. *American Journal of Nursing*. September 2004;104.
6. Matzo ML. Palliative Care: Prognostication and the Chronically Ill: methods you need to know as chronic disease progresses in older adults. *American Journal of Nursing*. September 2004;104:40-49, quiz 50.
7. Center to Advance Palliative Care. Planning a Hospital-Based Palliative Care Program. Technical Assistance Series. November 2000. www.capc.org/building-a-hospital-based-palliative-care-program/ Accessed 12/12/05.
8. Policy Report. Palliative Care Academic Career Awards—A Public-Private Partnership to Improve Care for the Most Vulnerable. New York:

International Longevity Center—USA. www.ilcusa.org/_lib/pdf/palliativecare.pdf. Accessed 12/12/05.
9. Mason D, Coyle N and Ferrell BR. Why Isn't All Care "Palliative Care"? *American Journal of Nursing.* November 2004;104.
10. Mularski RA, Osborne ML. American Academy of Hospice and Palliative Medicine. *Palliative Care and ICU Care—Daily ICU Care Plan Checklist.* www.eperc.mcw.edu/FFforPDA/548.htm. Accessed 12/12/05.
11. Emanuel LL, von Gunten CF and Ferris FD, eds. Plenary 1. Gaps in End-of-Life Care. *The Education for Physicians on End-of-Life Care (EPEC) Participant's Handbook.* EPEC Project, The Robert Wood Johnson Foundation, 1999: 1-10.
12. Hayes C. Ethics in End-of-Life Care. *Journal of Hospice and Palliative Nursing.* January-March 2004;6: 41-42.
13. Kristjanson LJ, Toye C and Dawson S. *New dimensions in palliative care: a palliative approach to neurodegenerative diseases and final illness in older people.* MJA2003: 179 (6 Suppl):S41-S43. www.mja.com/au/public/issues. Accessed 4/2005.
14. Dunne K and Sullivan K. Family experiences of palliative care in the acute hospital setting. *International Journal of Palliative Nursing.* April 2000;6: 170-4, 176-8.
15. *Symptoms in Terminal Illness: A Research Workshop.* Meeting Report. National Institute of Nursing Research. National Institutes of Health. September 22-23, 1997. http://ninr.nih.gov/ninr/wnew/symptoms_in_terminal_illness.html. Accessed 12/12/05.
16. Hospital Based Palliative Care. 2004; *Center to Advance Palliative Care: Providing Program Assistance Hospital-Based Palliation.* www.capc.org/site_root/Documents/document_177160828.html. Accessed 4/2005.
17. Herper M. *Can We Afford to Die?* Forbes.com, Inc. 8-18-2004. www.forbes.com/healthcare/2004/08/18/cx_mh_0818howdie.html. Accessed 12/12/05.
18. Edmonds PM, Stuttaford JM, Penny J, Lynch AM, Chamberlain J. Do Hospital palliative care teams improve symptom control? Use of a modified STAS as an evaluation tool. *Palliative Medicine.* September 1998. 12(5):345-51 (19 ref).

Additional resources

- American Medical Association (AMA), www.ama-assn.org/
- American Nurses Association (ANA), http://nursingworld.org/
- Education for Physicians on End of Life Care (EPEC), www.epec.net
- Hospice Association of America (HAA), www.hospice-america.org/
- Human Investigation Committee (HIC) Yale University School of Medicine, http://info.med.yale.edu/hic/
- National Hospice and Palliative Care Organization (NHPCO), www.nhpco.org
- Patient Self Determination Act (PSDA), www.dgcenter.org/acp/pdf/psda.pdf#search='Patient%20Self%20Determination%20Act
- The Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatments (SUPPORT), http://jama.ama-assn.org/cgi/content/abstract/274/20/1591

Surgery of the Head and Neck: Anatomy, Instrumentation and Dissection

MARY SUTTON, CST, CFA, FAST

LEARNING OBJECTIVES:

- Understand the anatomy of the head and neck.
- Recognize the three classes of tumor staging.
- Summarize the steps of a radical neck dissection.
- Summarize the steps of a modified radical neck dissection.
- Summarize the steps of a selective neck dissection.

This article is one of a series that will discuss head and neck surgeries from an otolaryngology perspective. Most of these surgeries involve cancer, and often involve portions of the alimentary or respiratory tracts that must not be compromised. The desired outcome is excision of the tumor, which may present some cosmetic problems for the patient. If excision is not feasible, then any palliative procedure may include bypassing the tumor to allow the patient to get nourishment or a proper route of respiration.

Surgeons in other specialties may assist the otolaryngologist with these procedures, such as a total laryngopharyngectomy with a gastric pull-up or repair of a defect with a pedicle or free flap, such as a mandibulectomy with a fibular free flap.

Part one examines the anatomy of the head and neck, various types of dissection and the related instrumentation.

Neck anatomy

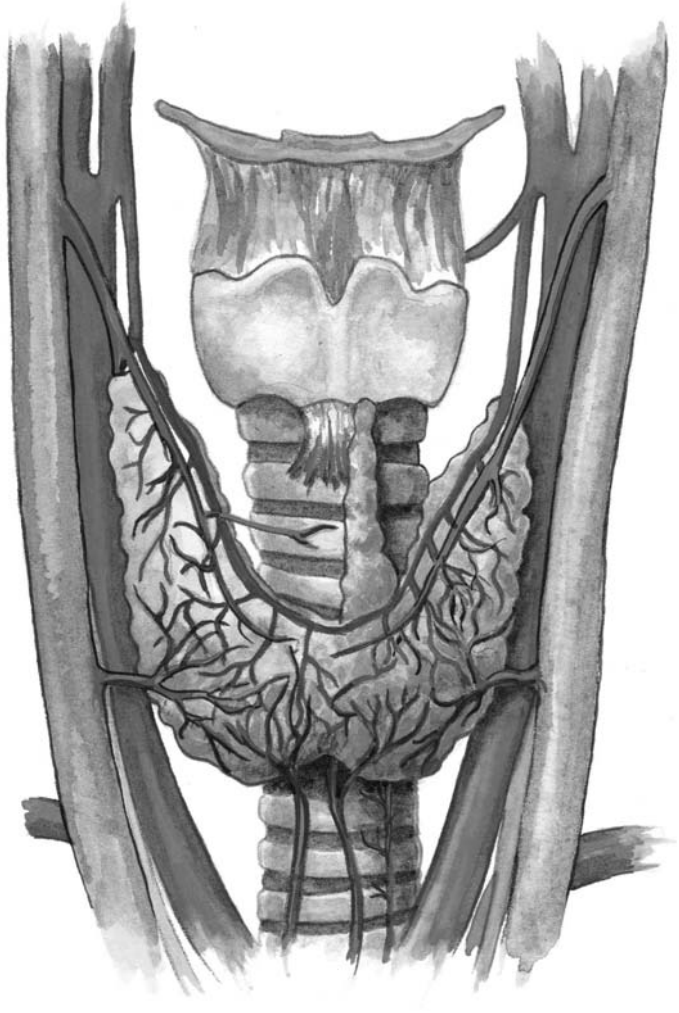
The neck contains major communication routes from the head to the rest of the body. It holds the spinal cord, the air and food passages, major nerve pathways that include several cranial nerves and their branches, and the major blood vessels that flow between the head and the heart.

Musculature

The strap muscles of the neck connect the larynx and associated structures, such as the hyoid bone, with the sternum anteriorly. There are also muscles that connect the hyoid bone with the base of the tongue, mandible, and the styloid process of the temporal bone.

The strap muscles of the neck connect the larynx and associated structures, such as the hyoid bone, with the sternum anteriorly. There are also muscles that connect the hyoid bone with the base of tongue, mandible, and the styloid process of the temporal bone. The digastric muscle has one belly, which extends from the mastoid to the hyoid and then ascends to the anterior mandible about at the midline. The sternocleidomastoid muscle divides the neck into anterior and posterior triangles. The posterior triangle is mostly the musculature of the spinal cord; whereas, the anterior triangle is composed of most of the major vessels and structures of the neck. The anterior neck may be divided into smaller triangles for dissection purposes.

The anterior and posterior bellies of the digastric muscle form the submandibular triangle. Both anterior bellies of the digastrics form the submental triangle, which is the midline of the neck. The vascular or carotid triangle is inferior to the digastric and hyoid. The omohyoid muscle, which is important in dissection landmarks, runs from the hyoid to the scapula, almost perpendicular to the sternocleidomastoid muscle (SCM). The platysma muscle extends from the clavicle to the



acromion process of the scapula, the deltoid fascia, and the pectoralis major to the lower border of the mandible.

Innervation

Several major nervous structures course throughout the neck. Knowledge of the course of these nerves is important in any dissection of the neck or neck structures. The marginal mandibular branch of the facial nerve (VIIth cranial) dips below the mandible into the fascia above the submandibular gland, before ascending upward to innervate the corner of the mouth. The cervical branch of the facial nerve innervates the platysma, the stylohyoid muscle, and the posterior belly of the digastric.

The vagus nerve travels inferior to the carotid within the carotid sheath. In the chest, the vagus sends a branch back to the larynx. This branch, the recurrent laryngeal nerve, ascends along the tracheoesophageal (TE) groove and enters the larynx to innervate the true vocal cords. Great care is taken to identify and preserve this nerve in head and neck surgeries, especially thyroidectomy and parathyroidectomy, as damage to this nerve will cause vocal cord paralysis with its associated pathology.

The spinal accessory nerve (XIth cranial) travels from the skull base to innervate the SCM and the trapezius muscle, usually above the level of the carotid bifurcation below the digastric muscle. The hypoglossal nerve (XIIth cranial) travels from the skull base to cross the carotid artery, usually above the bifurcation, and then ascends to innervate the tongue. Often during neck dissections, there are two areas where knowledge of the course of the hypoglossal nerve is important—the carotid bifurcation and the area where the nerve ascends through tissue inferior to the submandibular gland. When performing a laryngectomy, care is taken not to injure the hypoglossal nerve, as it passes close to the lateral horn of the hyoid bone.

The lingual nerve is identified in submandibular gland excision as it travels superior and deep to the gland. The phrenic nerve travels in the posterior neck to the diaphragm from cervical roots 3-5. The brachial plexus also starts in the posterior neck, running from C5 to T1. There is also a cervical sympathetic chain, which travels in the carotid sheath.

Vascularity

The major artery to the head is the carotid, which branches in the neck to the external and internal carotid arteries. The internal carotid has no branches in the neck. The branches of the external carotid artery in the neck include: the superior thyroid, ascending pharyngeal, facial, lingual, occipital, post-auricular, and the internal maxillary arteries.

The carotid artery courses through the neck within its own carotid sheath. Also contained within the sheath are the vagus nerve and the internal jugular vein. The external

Tumor staging (TNM)

In head and neck cancer, as well with other cancers, there is a tumor staging system that identifies the size of the tumor, lymph node involvement, and metastasis. The tumor is identified in three ways: a "T" class, which represents the size and depth of the tumor; an "N" class, which represents the site of nodal metastasis, if any, the number of nodes involved, and the size of these nodes; and an "M" class, which represents metastasis to distant tissues.

The "T" class is as follows:		*The "N" class is as follows:*		*The "M" class is as follows:*	
T0	Unknown primary tumor	**N0**	No lymph node metastasis	**M0**	No distant metastasis (cancer has not spread to distant body structures)
T1	0 cm to 2 cm	**N1**	Single lymph node, less than 3 cm on the same side as the tumor	**M1**	Distant metastasis (cancer has spread to distant body structures)
T2	2 cm to 4 cm	**N2a**	Single lymph node, 3-6 cm on the same side as the tumor	**MX**	Distant metastasis cannot be assessed
T3	4 cm to 6 cm	**N2b**	Multiple nodes, none greater than 6 cm, same side		
T4	Greater than 6 cm	**N2c**	Bilateral or opposite nodes, none greater than 6 cm		
Tx	Primary tumor cannot be assessed	**N3**	Metastasis in a node greater than 6 cm		
		NX	Nodes cannot be assessed (usually due to a node biopsy)		

Tumor staging is usually done from the patient's CT scan, but the surgeon may perform whatever appropriate surgical procedure is needed to view the primary tumor. The surgeon will also palpate the neck to feel for enlarged lymph nodes. When staging laryngeal tumors, since the vocal cord isn't 6 cm or greater, the tumor would be staged according to the surface area of the vocal cord consumed by tumor, whether it crosses over the midline and how far onto the opposite cord.

jugular vein is more lateral in the neck. There are also anterior jugular veins, which run along the midline of the neck along the strap muscles.

Pharynx, larynx, esophagus, and trachea

The pharynx, larynx, esophagus, and trachea also are major structures of the neck. The pharynx and larynx are closely associated in the anatomy of the neck until they separate, approximately at the level of the cricoid cartilage, to become the esophagus and trachea.

The thyroid gland resides anterior and lateral to the trachea, below the strap muscles. Blood supply to the thyroid is from both superior and inferior poles, but care is taken to identify the recurrent laryngeal nerve before sacrificing any structures around the thyroid. Paired parathyroid glands are usually found on the posterior aspect of the thyroid gland, but may be found as inferiorly as the mediastinum.

Lymphatics

Cervical lymph nodes are divided into several levels for dissection. These levels are determined by the anatomic structures of the tissue in which they reside. The importance of levels for neck dissections is due to the recent studies of the lymphatic metastasis from different head and neck tumors. It has been found that, based on the location of the tumor, there is a specific lymphatic flow and, therefore, a greater propensity for the lymph nodes in that flow zone to become metastatic.

Level I lymph nodes are the nodes within the submental triangle (level Ia), and those found within the submandibular triangle (level Ib). Obviously, since the submental triangle is midline, there would be only one specimen for level Ib for both sides of the neck (eg if performing a bilateral neck dissection).

Level II lymph nodes are the upper jugular nodes. The anatomical boundaries are the upper third of the jugular vein and adjacent spinal accessory nerve, from the carotid bifurcation inferiorly to the skull base superiorly. Laterally, the border is the sternocleidomastoid muscle, and the medial border is the lateral border of the stylohyoid muscle.

Level III lymph nodes are the middle jugular nodes. These lymph nodes reside in the middle third of the jugular vein from the carotid bifurcation superiorly to the junction of the omohyoid muscle, with the jugular vein inferiorly. The lateral boundary is the posterior border of the sternocleidomastoid muscle. The medial boundary is the lateral border of the sternohyoid muscle.

Level IV lymph nodes are the lower jugular nodes. Boundaries of level IV are the lower third of the jugular vein from the omohyoid muscle superiorly to the clavicle inferiorly. The lateral boundary is the posterior border of the sternocleidomastoid muscle, and medially the lateral border of the sternohyoid muscle.

Level V lymph nodes are the posterior triangle nodes. Boundaries of level V are the anterior border of the trapezius muscle laterally, the posterior border of the sternocleidomastoid muscle medially, and the clavicle inferiorly.

Level VI lymph nodes are the anterior cervical nodes. These lymph nodes are usually taken when removing the specimen, usually the larynx. Level VI comprises the lymph nodes surrounding the midline structures of the neck, from the hyoid bone superiorly to the suprasternal notch inferiorly. The lateral border of level VI is the carotid sheath on each side of the neck.

Instrumentation, supplies, and equipment

Various types of neck dissection will be discussed after a general overview of the instrumentation, supplies, and equipment needed.

Instrumentation

Most hospitals have some type of neck dissection tray for head and neck cases. It is important that these trays contain several fine-tip tonsil clamps or Scanlon clamps (which are sometimes called baby Burlisher clamps). Green thyroid retractors are important retractors for neck trays as well as US Army (Army/Navy), baby Richardson, double skin hooks, vein retractors, nerve hooks, and rakes. A bipolar cord and tips, which is usually the bayonet type, are essential. Extra Allis clamps, Lahey clamps, and fine mosquitoes are usually included in the typical neck set. Many surgeons utilize a baby Yankauer suction tip; however, it is advisable to include a larger Yankauer tip and assorted Frazier tips as well.

(Tech tip: It is always a good habit to have a tracheotomy set in the room when doing any kind of major neck dissection, especially with removal of a tumor.)

Supplies

Supplies needed for a neck dissection depend on whether the dissection is performed independently or if it is performed in conjunction with the removal of a tumor. It is important to have several packs of X-ray detectable 4″ x 4″ sponges opened on the field as they are used during the dissection. Normal supplies, such as laps, electrosurgical pencil and suction tubing, should be opened. Suture is surgeon specific but the following are recommended as routine.

- Large silk on a cutting needle to retract the neck flaps and secure the drains
- Various sizes of silk ties and stick ties
- Absorbable suture to close the incision
- Staples to close the skin

A drain should be available; most surgeons use a 10 mm flat drain with a bulb. This is the surgeon's preference, but he or she may use two drains, one on each side of the neck, so be prepared. Some surgeons like a nerve stimulator to ensure they have located major nerves within the neck. If a radical neck dissection is being performed, the surgeon may take a dermal graft to protect the carotid artery. Skin graft supplies should be available in this situation.

Equipment

Normal operating room equipment, with the addition of headlights, is needed for neck dissections. There should be a minimum of two headlights, one for the surgeon and one for the assistant. A bipolar machine, if not part of the electrosurgical unit, must be present.

Dissection types

Neck dissections are performed either in conjunction with the removal of a head and neck tumor, or after radiation therapy to shrink the size of a neck tumor. There are several types of neck dissections: radical, modified radical, and selective. For many years, radical neck dissection was the only surgery performed for head and neck cancer patients with nodal metastasis. It has only been within the last 20 years that the modified radical neck dissection was performed to protect the patient from the morbidity involved with radical neck dissection. Now, studies have shown that certain patients may only need a selective neck dissection.

Radical

Radical neck dissection involves the removal of all cervical lymph node groups, extending from the body of the mandible to the clavicle, the lateral border of the sternohyoid muscle, the contralateral anterior belly of the digastric muscle, and the anterior border of the trapezius muscle. All levels of lymph nodes are excised, as well as the spinal accessory nerve, the internal jugular vein, and the sternocleidomastoid muscle.

Indications for radical neck dissection are extensive lymph node metastases and/or extension beyond the capsule of the lymph node(s) to involve the spinal accessory nerve and the internal jugular vein.

A high morbidity results from a radical neck dissection. Morbid outcomes include:

- Cosmetic deformity due to loss of normal neck contour
- Major functional impairment of the neck due to the loss of the sternocleidomastoid muscle
- Increased risk of scar band formation and resultant neck contracture
- Shoulder drop with decreased abduction, and external rotation of the shoulder due to the loss of the spinal accessory nerve

Major morbidity is rare. However in the unfortunate situation of having bilateral radical neck dissections performed at the same time, the sacrifice of both jugular veins leads to cerebral edema and bilateral blindness immediately. The long-term morbidity is persistent facial and laryngeal swelling. If bilateral radical neck dissections must be performed, the surgeon usually operates about six weeks apart to reduce the risk of blindness and cerebral edema. The long-term morbidity would still exist.

There are two basic types of incisions for neck dissections, including radical neck dissections. The type of incision chosen is based upon what other surgery might be performed along with the neck dissection. If no other surgery is scheduled or if the other procedure is done in the mouth with no outside incision, the apron flap incision would be used.

The apron flap incision consists of an incision, usually from mastoid tip to mastoid tip, passing about two finger widths above the sternal notch. If only one side of the neck is to be dissected, the surgeon may modify the apron flap incision by ending the incision slightly past the midline of the neck.

The other incision is the Schobinger incision. This incision would be used for cases where the surgeon was splitting the lip to allow access into the mouth for better exposure, or if the mandible was being transected or split. The Schobinger incision follows the line of the mandible about two finger widths below the mandible, going up the chin to split the lip (if necessary). A second limb of the incision is made following the line of the sternocleidomastoid muscle to just above the clavicle.

For neck dissections, the patient is placed in the supine position on the operating table with the neck extended. The affected side is turned away from the anesthesia provider, or if bilateral neck dissections are being performed, the table is usually turned so the right side is away from the anesthesia provider. The patient is prepped and draped.

The appropriate incision is made, and the skin flap is developed. Care is taken to leave the platysma muscle with the flap, as it promotes healing. The submandibular gland is identified and dissected out. The XIIth cranial nerve and the lingual nerve are identified below the gland and preserved. The duct of the submandibular gland is identified and transected.

The digastric muscle is followed to the midline of the neck, and the fatty tissue at the midline is dissected from the two bellies of the digastric. The posterior belly of the digastric is followed, and tissue is dissected out along the way. The sternocleidomastoid muscle is released from its superior attachment, and the tissue is dissected away from the floor of the neck along the sympathetic chain. Care is taken to identify the phrenic nerve and the superior portion of the brachial plexus and leave them intact. The inferior attachments of the sternocleidomastoid muscle are released.

The inferior aspect of the internal jugular vein is identified and dissected. Several heavy clamps, like Crile or Mixter, are used to transect the jugular vein. Heavy silk stick ties are used along with heavy silk ties to make sure that the vein is properly ligated. The vein is dissected away from the carotid sheath superiorly and then ligated. The rest of the neck tissue is dissected to the midline of the neck and the specimen is removed en bloc.

Some surgeons will use a dermal graft to cover the carotid artery for protection. The graft is most often taken from the thigh. The wound is irrigated and hemostasis is achieved. Bleeding vessels are coagulated, and one or two Jackson-Pratt drains are used to drain the wound. The wound is closed and dressed appropriately. Care is taken postoperatively not to overextend the neck, as the carotid artery is not well protected.

Modified radical

Modified radical neck dissection is the en bloc removal of the lymph node-bearing tissue from one side of the neck, including levels I through V. The dissection extends from the mandible to the clavicle, the lateral border of the sternohyoid muscle to the anterior border of the trapezius. There is preservation of one or more of the following: internal jugular vein, spinal accessory nerve, and sternocleidomastoid muscle. (In the discussion of the selective technique later, all structures will be preserved.)

Indications for modified radical neck dissections are probable or grossly visible lymph node disease that is not directly infiltrating or fixed to the jugular vein, spinal accessory nerve, or sternocleidomastoid muscle. If there is infiltration of one of these structures, the structure would be removed and the others preserved. This would prevent some of the morbidity of a radical neck dissection.

The morbidity of the modified radical neck dissection is dependent on the structures removed. Most patients experience the loss of the submandibular gland on the operative side. Some patients may have a paresthesia of the spinal accessory nerve, which leads to weakness in the shoulder and is often temporary. This is often due to retracting the nerve.

In the case of the modified radical neck dissection, the patient is supine with neck extended. The affected side is turned away from the anesthesia provider. The patient is prepped and draped. The same surgical procedure as the radical neck dissection is followed up to transecting the sternocleidomastoid muscle. In the modified radical neck dissection, the sternocleidomastoid muscle is dissected away from the tissue, which runs between it and the carotid sheath. The muscle is then retracted laterally and the spinal accessory nerve is identified superiorly.

The nerve is freed from the surrounding tissue and is gently retracted away in order to dissect out the tissue running between the sternocleidomastoid muscle and the superior internal jugular vein. This area is often referred to as the "bloody triangle," because it is a very small area in which blood vessels are hard to locate and coagulate.

After the tissue in this area is dissected, it is brought under the nerve and is kept attached to the rest of the tissue as the dissection continues. The branch of the spinal accessory nerve, which innervates the trapezius muscle, is identified in order to be preserved. The tissue is dissected to the anterior border of the trapezius then followed upward along the carotid sheath. The carotid artery and vagus nerve are identified, and the tissue is dissected upward toward the internal jugular vein.

The tissue is dissected off the internal jugular vein sharply with a #15 blade. Care is taken to identify the branches of the vein, which will be ligated as the dissection continues along the vein. The XIIth cranial nerve is also identified as it crosses over the bifurcation of the carotid artery and makes its turn upward into tissue to be dissected free. There are some facial veins, which run along this area as well, so this tissue is clamped, cut, and ligated with free ties. After freeing the tissue along the vein and the nerve, the tissue is dissected to the midline of the neck and transected. The wound is irrigated, and hemostasis is achieved.

When doing a left neck dissection, the integrity of the thoracic duct should be verified by having the anesthesia provider perform a Valsalva maneuver. (See History of Surgery, April 2005.) If chyle is detected, the duct must be identified and ligated. Any bleeding is stopped and one or two Jackson-Pratt drains should be used to drain the wound. The wound is closed and dressed appropriately.

Selective

Selective neck dissections are defined as the en bloc removal of one or more lymph node groups at risk for harboring metastatic cancer. These dissections are performed on patients who have no lymph node metastasis (N0), but who are at risk for early lymph node metastasis. The levels removed depend on the location of the primary lesion and its known pattern of spread. The types of selective neck dissections are: supraomohyoid, lateral, posterolateral, and anterior compartment. Although a discussion of types follows, the author will not discuss the operative procedures, since they are nearly identical to that of a modified radical neck dissection—the only difference being the anatomy.

Supraomohyoid neck dissection is the removal of levels I, II, and III. If the nodes in level IV are removed, it is referred to as an extended supraomohyoid neck dissection. Indications for a supraomohyoid neck dissection include patients with an oral cavity cancer who are at risk for nodal disease. These tumors, especially from the tongue or the floor of the mouth, have a higher metastasis rate, regardless of the size of the tumor. If the patient has tongue cancer, the level IV lymph nodes are removed.

Elective supraomohyoid neck dissections may be done on the contralateral neck for patients with tumors of the floor of the mouth, ventral surface or midline of the tongue, where there are no indications for postoperative radiation therapy.

Lateral neck dissection is the en bloc removal of levels II, III, and IV. Nodal disease associated with cancers of the oropharynx, hypopharynx, and larynx is an indication for lateral neck dissections. Because most of the primary tumors in these areas are midline in the neck and have bilateral nodal drainage, bilateral lateral neck dissections are performed.

A posterolateral neck dissection is defined as the en bloc removal of levels II, III, IV, and V. This neck dissection also includes the removal of the suboccipital and postauricular nodes, and is usually associated with skin cancer and soft tissue carcinomas. The location of the primary disease is usually in the posterior scalp, nuchal ridge, occiput, or posterior upper neck. With these cancers, it is important to remove the subdermal fat and fascia between the lymph nodes and the primary disease to prevent metastasis arising in the cutaneous soft tissue.

The final selective neck dissection is the anterior compartment dissection, which is the en bloc removal of level VI lymph nodes. Indications for this dissection are for cancers arising in the thyroid, hypopharynx, cervical trachea, cervical esophagus, and laryngeal tumors that extend below the glottis. The boundaries of this dissection bilaterally are the carotid sheaths, the hyoid bone, and the sternal notch. If parathyroid glands are identified, they must be reimplanted. Often this dissection is done when taking out the primary tumor, as with a laryngectomy.

Conclusion

The anatomy of the neck, the types of dissection and the related instrumentation are all important background information for understanding head and neck surgeries from an otolaryngology perspective. A review of the various stages of cancer helps the surgical technologist relate the seriousness of the disease with the related procedure. The upcoming articles in this series will discuss specific procedures, including thyroidectomy and parathyroidectomy and surgeries of the larynx.

About the author

Mary Sutton, CST, CFA, FAST, is currently an instructor at Concorde Career Institute in Jacksonville, Florida, and was recently a speaker at AST's 36th Annual National Conference in Orlando. She has been active in the Florida State Assembly, the AST national Board of Directors, and continues to serve the profession on the NBSTSA Board of Directors.

References

1. *An Atlas of Head and Neck Surgery, 3rd ed.* Lore JM, ed. Philadelphia: WB Saunders; 1988.
2. Chaffee EE and Lytle IM. *Basic Physiology and Anatomy, 4th ed.* Philadelphia: Lippincott; 1980.
3. Gray H. *Gray's Anatomy, 15th ed.* Chancellor Press; 1994.
4. Martini R. Chapter 11: *The Muscular System. In: Fundamentals of Anatomy and Physiology [online].* Prentice Hall; 2000. cwx.prenhall.com/bookbind/pubbooks/martinidemo/chapter11/medialib/CH11/html/ch11_4_1.html (accessed 5/16/05)
5. *Taber's Online 3.0.* [registration required] www.tabers.com (accessed 5/7/05)
6. *Cancer Facts. Staging: Questions and Answers.* National Cancer Institute. cis.nih.gov/fact/5-32.htm
7. Association of Surgical Technologists. *Study Guide to Accompany Surgical Technology for the Surgical Technologist: A Positive Care Approach, 2nd ed.* Junge T, ed. Clifton Park, NY: Thompson Delmar Learning; 2004.

Surgery of the Head and Neck: Oral Surgery and Fracture Management

MARY SUTTON, CST, CFA, FAST

LEARNING OBJECTIVES:

- Summarize the steps of a glossectomy
- Demonstrate an understanding of a resection of the floor of the mouth
- Define a mandibular resection
- Contrast the three different types of LeFort fractures
- Compare the treatments for facial fractures

Many of the surgeries in the oral cavity deal with the excision of cancerous lesions on structures within the cavity. There are also surgeries dealing with the fixation of fractures and helping a patient overcome sleep apnea. Some of the surgeries dealing with the excision of cancerous lesions may require major reconstruction and will be described when discussing that surgery. Any specific anatomy or instrumentation will be discussed with each surgery.

Oral Anatomy

The oral cavity functions in the articulation of speech, mastication of food, and as an alternate airway. The boundaries of the oral cavity are the lips, the anterior tonsillar pillars, the hard and soft palate, and the buccal mucosa. The floor of the mouth is made up of the mucosa overlying the sublingual and submandibular glands. Contents of the oral cavity are the teeth and gums, the tongue, and the orifices of the ducts of the salivary glands.

Instrumentation and supplies

When preparing for oral surgeries that deal with excision of cancerous lesions, the surgical technologist should start with the standard neck set. Some neck sets also contain instrumentation to deal with the oral cavity structure; however, an oral, dental, and facial set may be warranted according to the situation. Retractors, such as a Jennings mouth gag or a dental mouth prop, may be needed to hold the mouth open. Anthony suction tips may be useful within the mouth.

If working on the mandible, bone instruments are needed. These instruments should include a Freer elevator, small key elevators (usually ¼″ and ½″), Lewin bone clamps, and osteotomes and a mallet. When splitting the mandible to access a lesion, a mandibular reconstruction set with plates and screws is warranted. A sagittal saw is also necessary to split the mandible or to cut out any bone involved with a cancerous lesion. Tooth extraction instruments may also be required for patients with lesions involving the gums, mandible or maxilla.

Supplies needed for oral surgeries include: X-ray detectable 4″ x 4″ sponges; a suction apparatus; monopolar and bipolar electrosurgical supplies, including a Teflon® tip for the electrosurgical pencil (to prevent the pencil tip from sticking to the mucosa of the oral cavity); 2-0 silk suture for tongue retraction; and absorbable suture for repairing the defect. If major reconstruction is required to repair the defect, additional supplies must be brought into the room.

It is a good habit to have a tracheotomy set and tracheotomy tubes available. Prophylactic tracheotomy may be performed preoperatively, if significant swelling of the tongue (to the point of airway obstruction) is expected.

Glossectomy

Glossectomy is removal of all or part of the tongue to remove cancerous lesions. Tongue cancer is typically a disease of the middle-aged and elderly. It most commonly affects men. Most patients with tongue cancer have a history of long-term tobacco and/or alcohol use. Depending on the staging and type of the cancer, a neck dissection may also be performed.

The patient is placed under general anesthesia. A direct laryngoscopy and esophagoscopy may be performed to check for spread of the disease. If only working within the mouth, a skin prep may not be necessary. Often, though, a skin graft is used to repair the defect. In these cases, the skin graft site is prepped and draped separately. Some surgeons will reprep and drape when performing a neck dissection or perform the neck dissection first. Others will prep and drape for the neck dissection along with the draping for the glossectomy and skin graft. They will cover the neck during the glossectomy, then change gloves before proceeding to the neck dissection.

A mouth prop or gag is used to open the mouth, and a 2-0 silk suture is placed through the tip of the tongue for retraction. With the silk suture, the tongue can be pulled upward for easier visualization. The lesion is identified and excised, taking a margin of normal tissue with the lesion. The tumor should be sent for margins before closing the defect. The defect may be repaired simply by closing it upon itself.

If the defect is too large, a skin graft is used for repair. A split-thickness skin graft is taken with a dermatome, usually from the thigh on the affected side. The skin-graft site is treated for bleeding and dressed appropriately. The skin graft is sewn to the sides of the defect with an absorbable suture.

A bolster may be used as a pressure dressing on the defect. When using a bolster, the suture lengths are kept long to tie the bolster down to the repaired defect. The bolster is made up of some type of antibiotic gauze (eg Xeroform™ gauze) surrounding cotton balls that are coated with an antibiotic ointment. The suture lengths are tied over the bolster to hold the skin graft down and allow better healing with no dead spaces.

When a bolster is used, a tracheotomy may be necessary due to the bulk of the dressing in the mouth. Prior to emergence from anesthesia, the tongue is checked for swelling and, if necessary, a tracheotomy is performed. Often, a nasal airway can be placed to maintain patency of the airway after removal of the endotracheal tube. The throat is cleared of debris and, if a throat pack was used, it must be removed prior to extubation. The traction suture and oral retractor are removed. A nasogastric tube may be placed before the patient is awakened.

Postoperatively, the patient may be given prophylactic antibiotics for 24 hours. The patient is fed through the nasogastric tube. If there is no skin graft, the nasogastric tube can be removed when the swelling has reduced and the patient can tolerate fluids. If the patient has a skin graft and bolster, the nasogastric tube is maintained until the bolster is removed and the tongue is able to move, which generally occurs on the fifth postoperative day.

Complications of glossectomy include edema and resultant airway obstruction, hematoma, and loss of the skin graft. Also, the lesion can recur if inadequate margins are taken.

Resection of the floor of the mouth

The floor of the mouth is a common site for carcinoma in the oral cavity. As with glossectomy, the patients are often middle aged or elderly and have a history of long-term use of alcohol and tobacco.

Floor-of-mouth lesions may be small, needing a simple excision procedure with a skin graft. Other floor-of-mouth lesions are extensive and may involve the alveolar ridge (gums) and the mandible. Often, these extensive lesions are repaired with some type of flap, usually from the pectoralis major.

Neck dissection is performed on the same side as the lesion, except when the lesion is in the midline, indicating bilateral neck dissections. When removing a small lesion, the surgical team must be prepared to do the more extensive surgery, if the margins continue to come back positive. Sometimes, it is difficult to access a floor-of-mouth lesion. If so, a mandibular split or mandibulotomy is performed to reach the lesion. Tracheotomy may be performed, especially when a flap is used to repair the defect.

The patient is placed on the operating table in the supine position and undergoes general anesthesia. The patient's neck is extended, and the patient is prepped and draped, including an area for a skin graft. The mouth is propped open with a mouth prop or gag, and a 2-0 silk suture is placed through the tip of the tongue for retraction. The lesion is identified, and proper exposure is achieved. The lesion is excised, taking a margin of normal tissue. The margins of the tumor are verified by frozen section to be free of tumor and, if clear, the defect is repaired with a skin graft. A nasogastric tube may be placed. The tongue retraction suture and mouth retractor are removed.

If the lesion is extensive, the surgery is more extensive as well. If the mandible needs to be split to get to the lesion, then the lip may also have to be split, and the tissue taken off the mandible to a point past where the area is to be split.

To split the lip, the incision is started in the midline of the lip. Some doctors mark the vermilion of the lip for easier closure. The incision is carried downward, and a small 'V' is made in the incision halfway to the chin to prevent strictures after closing. The rest of the incision is made to the chin and slightly under the chin. The inner lip and buccal mucosa is incised away from the mandible to a point past where the mandible is to be split. The alveolar tissue is excised in the area, and the periosteum of the mandible is elevated away with a key elevator. A sagittal saw is used to split the mandible. The mucosa of the floor of the mouth is dissected from the mandible. The lesion is excised and repaired. The mandible is repaired by plating, and the alveolar ridge is closed. The buccal and inner lip mucosa is sewn back to the tissue around the mandible. The incision is closed.

If the mandible is involved in the tumor, a piece of the mandible is taken with the lesion. The same lip-split incision is made, and a portion of the mandible is resected with the tumor. This is usually for the extensive tumor surgery, where a flap is needed for repair of the defect. Depending on the amount removed, the mandible can be repaired by plating across the deformity or with a fibular or radial forearm free flap. For these extensive lesions or when the mandible is split, a tracheostomy is performed to protect the patient's airway.

Complications of simple resection of a floor-of-mouth tumor are loss of the skin graft and necrosis of the tip of the tongue due to loss of vascularity, which may have been involved in the tumor. Complications of the major resection of a floor-of-mouth tumor include loss of the flap, osteomyelitis of the mandible, and the same complications as the simple resection.

Mandibular resection

Resection of a portion of the mandible can be used to obtain adequate exposure for resection of lesions of the floor of the mouth, as well as to obtain negative margins of resection that may not be achieved without removing the bone. If the tumor has invaded the bone, a more extensive resection of the mandible is needed. The advantage of removing a smaller portion of the mandible is dental rehabilitation. The patient can be easily fitted with dentures. When taking a larger portion of the mandible, the surgeon could decide not to repair the

mandible based on the tumor and the postoperative course in treating it.

When removing any part of the mandible, some teeth may be removed in order to perform a resection. The surgeon must take care not to disturb the roots of the teeth that will not be involved in the resection. A tracheotomy is performed to protect the patient's airway.

The patient undergoes general anesthesia and is placed in the supine position on the operating table with the neck extended. Before prepping and draping, a direct laryngoscopy and esophagoscopy may be performed to check for the spread of the disease. The patient is prepped and draped. The tracheotomy may be performed at the beginning or the end of the procedure, depending on the surgeon's preference. A mouth gag or prop is used to keep the mouth open, and a 2-0 silk suture is placed on the tongue tip for retraction.

The lesion is identified, and the amount of the mandible to be resected is decided. A lip split incision may also be performed to provide better exposure. If the patient has teeth, one tooth on either side of the resection must be removed. The alveolar ridge is cut and elevated away on either side of the resection. A sagittal saw is used to cut the mandible, and the remainder of the lesion is excised. The mandible is repaired, usually by a mandibular reconstruction plate and screws. A skin graft is placed over the defect. If the defect is extensive, a flap may be used. The lip split incision is closed, and a nasogastric tube is placed.

The major complication of mandibular reconstruction is a fracture of the mandible. This occurs most frequently in a mandible that is edentulous (toothless), because bone loss is common after tooth loss. Care should be taken to prevent fracture.

Uvulopalatopharyngoplasty (UPPP or UP3)

Uvulopalatopharyngoplasty (UPPP) is the surgical technique of choice for management of obstructive sleep apnea (OSA). Symptoms of OSA include snoring, history of restless sleep, and daytime sleepiness. Before performing surgery, the patient would undergo a sleep study where the patient would be given nasal oxygen by positive pressure. Patients who cannot tolerate the nasal oxygen become candidates for UPPP.

Often a concurrent septoplasty and/or tonsillectomy will also be performed. The septoplasty is performed if the patient has a history of nasal obstruction, usually from a deviated septum. Large tonsils are another cause of OSA.

UPPP is not always successful in correcting OSA and, if it fails, the patient would have to use the nasal oxygen with positive pressure. Some surgeons perform a UPPP using a laser (ie LAUP or laser-assisted UPPP). The surgical technique, postoperative treatment, and risk of complications for both procedures are the same.

Instrumentation needed for an UPPP include a tonsillectomy set, as well as a needle holder and suture scissors, if those are not included in the set. An absorbable suture will be used to close the soft palate. Supplies needed are the same as that of a tonsillectomy, with the addition of an extension tip for the electrosurgical pencil.

Patients undergoing UPPP will be given general anesthesia. They will be positioned on the operating table the same as for a tonsillectomy. The tonsillectomy mouth gag is placed, and the tonsils are removed. The soft palate is incised, and the incision is carried through to the nasopharynx. The uvula and a small portion of the soft palate are resected. Hemostasis is achieved with the use of the electrosurgical pencil, and the wound is closed with absorbable sutures (eg 3-0 or 4-0 chromic).

Postoperatively, the patient is observed overnight to ensure that adequate oxygen saturation is maintained. The patient will have pain and discomfort due to the soft palate wound; however, the amount of narcotics given must be limited due to the respiratory depression they cause. A soft or liquid diet is ordered, similar to tonsillectomy patients.

Complications of UPPP include some swallowing difficulty, which is usually temporary. The patient is asked to drink slowly. A rare complication is nasopharyngeal stenosis due to a tight closure of the palate wound. UPPP may not work to correct OSA in some patients.

Facial fracture management

Facial fractures are most often associated with trauma. The location and severity of the fracture is related to the position and intensity of applied force and the amount of energy transferred. For example, a fist or a fall has low energy, which would mean less comminution of the bone. Higher levels of force, such as automobile accidents, cause greater comminution of the bone.

Facial fractures have predictable patterns described by Renee LeFort (see sidebar). The fractures don't always follow the patterns, but it is a good rule of thumb. If a high level

LeFort fractures

In the late 1800s, Renee LeFort took a bowling ball and swung it at different skulls at various speeds to see how the bones fractured. He described different facial fractures according to the type of injury and the energy used to produce them. These LeFort fractures are taught to medical students and residents, but most often facial fractures do not follow LeFort's classifications. They are still used to describe certain craniofacial procedures for patients with craniofacial and upper jaw deformities.

LeFort I: a transverse fracture through the floor of the maxillary sinuses where only the palate moves.

LeFort II: a fracture through the maxillary sinuses, the nasal bones, and the nasoethmoidal complex. It is often called a pyramidal fracture.

LeFort III: a major fracture pattern that goes through the orbits and creates complete or partial craniofacial disjunction.

of force comes straight at the face, the nasal bones, frontal sinus, and nasoethmoidal complex are most commonly fractured. If there is an isolated trauma to the orbit, such as a fist, the resultant fracture is likely to be an orbital blowout. A tripod fracture is a zygomatic fracture, which also involves fractures at the lateral and infraorbital rims, the orbital floor, the zygomatic arch, and the lateral maxilla.

In the repair of any facial fracture, the surgeon must reposition and fixate the bones to prevent malocclusion and shortening of the midface. Also, the surgeon must restore the functional properties of structures in the area of the fracture.

Instruments needed for the repair of facial fractures may vary based on the area fractured and the planned repair. For instance, if the fracture is around the eye or zygoma, an eye plastic set is used. One instrument used often for a depressed zygoma fracture, especially in a tripod fracture, is a urethral sound. The sound can be used through a brow incision and inserted under the depressed area of the zygoma to elevate the bone.

If repairing maxillary or mandibular fractures, a Caldwell Luc set is often used with an arch bar set. An arch bar set contains a Brophy retractor, two wire needle holders, wire cutters, wire pushers, a couple of hemostats, and arch bars. To secure the arch bars, usually 24- and/or 26-gauge wire is needed. When fixating fractures, use sets with plates and screws comparable for the type of bone—smaller plates and screws for smaller or thinner bones; larger plates and screws for larger bones. A drill is necessary to size the screw holes and to place the screws.

Supplies needed for repairing facial fractures are X-ray detectable 4″ x 4″ sponges, a suction apparatus, an electrosurgical unit, a control syringe, and a 25-gauge needle. Local injection is usually preferred and often consists of 1% lidocaine with epinephrine. The suture used is determined by the location of the incision and the type of tissue to be approximated.

Zygomatic fracture management

Zygomatic fractures are most often caused by motor vehicle accidents and physical altercations. These fractures also are associated with fractures around the eye, so the vision of the patient must be checked due to swelling in the area. Not all zygomatic and associated orbital fractures need to be corrected surgically. In the case of tripod fractures, if the zygoma is depressed, the bone may be lifted up by a urethral sound without the need for further intervention. If internal fixation is needed, then the surgery is more extensive.

The patient usually undergoes general anesthesia. He or she is placed on the operating table in the supine position, and after intubation, the table is turned with the affected side away from the anesthesia provider and equipment. The patient is prepped and draped. Lidocaine with epinephrine is injected along the lateral brow.

The incision is centered over the fracture but is started on the lateral aspect of the eyebrow and follows the orbital rim. Double skin hooks are placed to retract soft tissue, which is dissected away to expose the fracture. A periosteal elevator, such as a Freer, is used to elevate the periosteum off the bone to be plated. A urethral sound may be used to push up the zygoma for proper fixation.

A plate is chosen and fitted for the bone to achieve proper anatomy. Screws are placed in the plate, and the fixation is checked for approximation of the bone—intraoperative X-rays may be needed. The wound is closed, usually with an absorbable suture.

Maxillary fracture management

Maxillary fractures are uncommon but are most often caused by motor vehicle accidents. All of the LeFort fractures have a maxillary fracture component, but repair of these will not be discussed. Often, the only treatment for a maxillary fracture is arch bars. The arch bars ensure that the teeth are set in their proper position, and keeping the patient in arch bars can result in fracture healing by rest. If a maxillary fracture needs internal fixation, the fracture is commonly fixed through a Caldwell Luc incision. Care is taken to identify and not to injure the infraorbital nerve. Small plates and screws are placed, and the wound is closed with an absorbable suture.

Arch bar application

Arch bars are used to keep the teeth and jaws in their proper position by wiring them together following a fracture. This prevents malocclusion after the fracture has healed. If the patient is to have arch bars placed, the anesthesia provider will insert a nasotracheal tube. Because the jaws will be wired shut, it would be impossible to remove an orotracheal tube. If a nasotracheal tube cannot be placed, it is necessary to perform a tracheotomy. The surgical team should be ready at all times to perform a tracheostomy when placing arch bars.

Placement of arch bars is a clean procedure and may be done separately or in conjunction with reduction and fixation of a fracture. A Brophy retractor is placed to allow access to the teeth. The arch bar is measured for both jaws and cut to the appropriate length.

Prestretched 24- or 26-gauge wire, which is cut in half and loaded onto a wire twister or heavy needle holder, is used to secure the wires. The wire is passed between two teeth around the back of one tooth and brought out between that tooth and the next tooth. The wire is wrapped around an arch bar and tightened by twisting it. The wire is cut above the twisted end, and the cut end is pushed under the arch bar to protect the lips and buccal mucosa. The wire placement process is repeated until both arch bars are placed. Loops of wire, called "Ivy" loops, are created to wire the two arch bars together. Several loops are used. The patient either has their fractures fixed or is awakened.

Tech hint: It is very important to make sure that the patient is sent to the post anesthesia care unit with a wire cutter. Postoperatively, the patient should keep the wire cutter with them at all times while the arch bars are in place. If there is a problem with the airway, the wires may have to be cut to help correct the problem.

Mandibular fractures

Mandibular fractures can occur anywhere on the body of the mandible. The type of repair is usually selected according to the type of trauma, the location of the fracture, and the extent of the damage. Mandibular fractures can be open into the oral cavity, and should be repaired as soon as possible. Timing of the repair also depends on other trauma to the body and the stability of the patient.

Because the pull of the masseter muscle, which is attached to the mandible, is so great, arch bars are almost always placed for mandibular fractures. An exception would be when there is a mandibular split for the resection of a tumor. The surgeon makes the fracture and, therefore, the occlusion of the jaw would be approximated before plating the split.

The choice of plates and screws varies depending on the part of the mandible that is fractured. The bone above the angle of the mandible is very thin and could use the same plates as utilized on the maxilla. The body of the mandible is thick and would require a larger plate or possibly a compression plate. It is important to find out what type of plates and screws the surgeon plans to use prior to the start of the procedure.

The patient is placed in the supine position on the operating table and placed under general anesthetic with a nasotracheal tube. The table may be turned so the affected side is away from the anesthesia provider and equipment.

Arch bars are placed before or after draping, depending on the surgeon's wishes. Most often, mandibular fractures are repaired orally, so little or no prep may be required. The oral mucosa is incised over the fracture site, and the tissue is elevated and dissected away to expose the fracture. The appropriate plate is selected and fitted to the bone. Screws are placed in the plate to fixate the fracture. The wound is closed with an absorbable suture (eg 3-0 or 4-0 chromic).

Postoperatively, the patient's airway is monitored for patency, especially for patients with large fractures or those who are very edematous. Prophylactic antibiotics are given for about 48 hours. If there is swelling around the eye from any trauma, the vision is checked. Complications of mandibular fracture fixation include infection, hematoma, and nonunion of the fracture.

Conclusion

Being part of a head and neck surgery team can be a very difficult task. One must realize that the surgery being performed on a cancer patient is the best possible way to treat that cancer no matter how bad the results appear. A thorough knowledge of the anatomy, tumor staging, the surgical procedures being performed, and the surgeon's preferences makes the surgical technologist a viable team member.

About the author

Mary Sutton, CST, CFA, FAST, is currently an instructor at Concorde Career Institute in Jacksonville, Florida, and was recently a speaker at AST's 36th Annual National Conference in Orlando. She has been active in the Florida State Assembly, the AST national Board of Directors, and continues to serve the profession on the NBSTSA Board of Directors.

References

1. Breau RL and Suen JY. Management of the N0 Neck. Management of the Neck in Head and Neck Cancer, Part 1. Otolaryngology Clinics of North America. Vol. 31. No. 4; 1998.
2. Chaffee EE and Lytle IM. Basic Physiology and Anatomy, 4th ed. Philadelphia: Lippincott; 1980.
3. Cummings C, ed. Otolaryngology-Head and Neck Surgery. Vol. 1-3. 2nd ed. St Louis: Mosby;1993.
4. Gray H. Gray's Anatomy, 15th ed. London:Chancellor Press; 1994.
5. Kennedy (Sutton) M. Superficial Parotidectomy for Parotid Gland Tumors. Englewood, CO: Association of Surgical Technologists; 1997.
6. Lore JM, ed. An Atlas of Head and Neck Surgery, 3rd ed. Philadelphia: WB Saunders; 1988.
7. Myers EN, ed. Operative Laryngology. Vol. 1-2. Philadelphia: WB Saunders; 1997.
8. Robbins KT. Classification of neck dissection: current concepts and future considerations in management of the neck in head and neck cancer. Management of the Neck in Head and Neck Cancer, Part 1. Otolaryngology Clinics of North America. Vol. 31. No. 4; 1998.
9. Bobby R Alford Department of Otolaryngology and Communicative Sciences, Baylor College of Medicine. www.bcm.tmc.edu/oto (accessed 4/1998)
10. www.vesalius.com (accessed 4/1998)

Total Knee Arthroplasty

JEFFREY BIDWELL, CST, CFA, CSA, MA

LEARNING OBJECTIVES:

- Summarize the history of arthroplasty techniques
- Define the categories of total knee implants
- Understand the biomechanics of arthroplasty
- Distinguish the anatomy of the knee
- Summarize the steps in an arthroplasty

Introduction

The purpose of this article is to present a brief overview of the various aspects of a total knee arthroplasty. For surgical technology students and CSTs with limited orthopedic experience, this article provides an insight into the complexity of the procedure from the surgeon's perspective.

Arthroplasty is an operation to restore motion to a joint and function to the muscles, ligaments and other soft tissue structures that control the joint.[2] Total knee arthroplasty is indicated for patients who demonstrate radiographic intraarticular disease and severe knee pain or other symptoms that cannot be controlled with nonoperative methods. For individuals with mild pain, over-the-counter medications such as acetaminophen (eg, Tylenol®) and topical pain relievers (eg, Aspercreme®, Icy Hot®) might be sufficient to provide relief. Nonsteroidal antiinflammatory drugs (NSAIDs), such as ibuprofen, are used to relieve pain and inflammation, but are known to have side effects. More moderate pain is treated with stronger NSAIDs and COX-2 inhibitors. Cortisone injections are also given to the joint to relieve inflammation, but this type of relief is usually only short-term.

When pain, limping, and joint dysfunction become so severe that none of these treatments provide adequate relief, surgery may be the next option. There are several surgical alternatives to knee replacement, such as arthroscopy, osteotomy, and synovectomy. These may be able to delay the necessity of a replacement, but when pain reaches the point that it becomes controlling, a knee replacement is usually recommended.[11]

History

Early arthroplasty techniques initially utilized the patient's own tissues (skin, muscle, fascia) in the joint, which improved ankylosed joints but did little to help arthritic joints. Surgeons also experimented with glass, Bakelite and cellulose as interpositional material, but they also produced poor results for the arthritic knee.[2]

Modern approaches to today's total joints began in the 1960s when Sir John Charnley designed a stainless steel femoral head to articulate with a polyethylene acetabular implant. Both were secured by polymethylmethacrylate to the surrounding bone. Guston developed a similar system for the knee following Charnley's design. Other applications including arthroplasty of the elbow, ankle and wrist were attempted, but poor results have limited their use. However, arthroplasties of the knee and hip continue to improve and increase based on Charnley's design of metal on polyethylene and improved technology. In most cases, stainless steel implants have been replaced with stronger metals, such as cobalt and titanium, but research has yet to find a better alternative for polyethylene.[2]

Total knee implants

Knee implants can be divided into three different categories, based on the section of the knee to be replaced: unicompartmental, bicompartmental and tricompartmental. Unicompartmental implants are used to replace either the medial or lateral side of the corresponding articular surface of the femur and tibia. Bicompartmental implants replace medial and lateral surfaces of the femur and tibia. Tricompartmental implants replace the medial and lateral surfaces of the femur and tibia, plus the patella.

Tricompartmental implants are further subdivided into categories, depending on the stability of the patient's knee. Unconstrained implants require minimal resurfacing of the tibia and femur, and good collateral and posterior cruciate ligaments. Semiconstrained implants are used when there is a problem with ligament balancing. Fully constrained implants, which are joined together by hinges and only allow motion in a sagittal plane, are used when there is a severe deformity with the ligaments, or during revisions.[2]

Basic biomechanics

Motion occurs during the normal movement (gait cycle) of the knee in three planes: flexion and extension, abduction and adduction, and rotation.

Longitudinal and rotational alignment

Studies have demonstrated a direct correlation between long-term success of a total knee procedure to the restoration of normal limb alignment. Malalignment of the prostheses can lead to long-term problems such as: patellofemoral and femorotibial instability, accelerated polyethylene wear and implant loosening. The mechanical axis line should project through the center of the knee joint. During a normal gait, the mechanical axis is inclined three degrees from the vertical axis. If the mechanical axis is nearer to the lateral side of the knee

center, the knee is in valgus alignment. In varus alignment, the opposite is true. Valgus or varus deformity can be determined by an anteroposterior roentgenogram.[2]

Patellofemoral joint

The patella increases the lever-arm action of the extensor mechanism of the knee. The quadriceps and patellar tendons insert on the patella anteriorly. In this way, the patella lengthens the extensor lever by displacing the forces of the quadriceps and patella tendons away from the center of rotation. The length of the extensor lever arm

varies during knee flexion.[4] The Q-angle, as described by Hvid, is the angle between the extended anatomical axis of the femur and the line between the center of the patella and the tibial tubercle. The quadriceps acts primarily in line with the anatomical axis of the femur, with the exception of the vastus medialis obliquus, which acts to medialize the patella in terminal extension. In other words the Q-angle at the top of the thigh is shaped like the letter V. It starts at the anterosuperior iliac spine, continues to the middle of the femur, and then follows a straight line down the center of the patella to the tibial tuberosity. If the tibial component is internally rotated, it will increase the Q-angle and lead to lateral subluxation of the patella. Tibial components should be centered on the medial border of the tibial tubercle, slight external rotation. Similarly, internal rotation of the femoral component can increase lateral patellar subluxation.[2] A lateral retinacular release can help correct lateral patellar subluxation. This is performed by cutting the synovium and retinaculum longitudinally to the muscle fibers of the vastus lateralis. If a full release is performed, the superior lateral geniculate artery should be identified to avoid possible devascularization of the patella.[2]

Anatomy

The knee joint is formed by the tibiofemoral and patellofemoral articulations. There is not a single unified capsule in the knee. The cruciate and collateral ligaments are the two main sets of ligaments for the knee joint. The cruciates are located within the joint capsule "intracapsular ligaments." The anterior cruciate ligament (ACL) attaches to the anterior surface of the tibia in the intercondylar area, just medial to the medial meniscus. The posterior cruciate ligament (PCL) attaches to the posterior tibia in the intercondylar area and runs in a superior and anterior direction on the medial side of the anterior cruciate ligament. It attaches to the anterior femur on the medial condyle. The ACL tightens during extension, preventing hyperextension of the knee. When the knee is flexed, the ACL keeps the tibia from being moved anteriorly. The posterior cruciate ligament keeps the femur from being displaced anteriorly on the tibia or the tibia from being displaced posteriorly on the femur.[7]

The medial collateral, or tibial collateral, ligament is a flat, broad ligament, attaching to the medial condyles of the femur and tibia. Fibers of the medial meniscus are attached to this ligament. On the lateral side is the lateral collateral, or fibular collateral, ligament. It is a round, cordlike ligament that attaches to the lateral condyle of the femur and runs down to the head of the fibula. It does not attach to the lateral meniscus. The collateral ligaments provide stability in the frontal plane. The medial and lateral menisci are two wedge-shaped fibrocartilage disks, located on the superior surface of the tibia and are designed to absorb shock. The medial meniscus, due to its attachment to the medial collateral ligament, is more frequently torn.[7]

Muscles of the knee

The pes anserine muscle group is made up of the sartorius, gracilis, and the semitendinosus. Each proximal attachment has a different source; the sartorius muscle from the iliac spine, the gracilis from the pubis, and the semitendionosus muscle from the ischial tuberosity. They all join together to have a common distal attachment on the anteromedial surface of the proximal tibia.[4] The quadriceps muscles are comprised of four muscles: rectus femoris muscle, vastus lateralis, vastus medialis and vastus inter medialis. All four attach to the base of the patella and to the tibial tuberosity through the patellar tendon. The popliteus muscle originates on the lateral condyle of the femur and crosses the joint posteriorly to insert medially on the posterior proximal tibia. The gastrocnemius muscle attaches by two heads to the posterior surface of the medial and lateral condyles of the femur. After descending the posterior calf superficially, it forms a common tendon with the soleus muscle and attaches to the posterior surface of the calcaneus. The gracilis, sartorius, and tensor fascia latae muscles span the knee joint posteriorly and provide stability to the joint.[6]

MIS surgical approach

Many surgeons today are using the mini-incision (MIS) approach. Ideally, this approach does not evert the patella or resect the quadriceps muscle or tendon. It does not necessarily involve a smaller four- to six-inch skin incision. The idea behind the MIS is that if the knee's extensor mechanism is not disturbed, the patient should experience a faster recovery and less postoperative pain.[11]

The surgeon can choose from three different approaches:

The subvastus approach provides exposure, while preserving the quadriceps attachments to the patella. This approach will not require the patella to be everted. The subcutaneous tissue is divided down to the fascia of the vastus medialis. The inferior border of the muscle is identified and cut usually 4 to 9 cm medial to the edge of the patella in order for the surgeon to slide a finger under the muscle obliquus, while staying on top of the synovial lining of the joint. The vastus medialis is pulled superiorly. The vastus medialis is then released from the medial retinaculum, while leaving a portion attached to the inferior border of the vastus medialis.

Key Terms[2,7,9]

Pes anserinus is the combined insertion of sartorius, gracilis and semitendinosus.

Ligament of Wrisberg is a band that leaves the posterior horn of the menisci, passes along side of the PCL and attaches to the medial condyle of the femur.

Transverse ligament stretches across the anterior part of the knee and connects one meniscus to the other.

Coronary ligaments are the deeper portions of the capsule that unites the menisci to the tibia and femur.

Ligamentum mucosum is often the first structure seen when entering the joint through a scope; it is a triangular fold of synovial membrane.

Genicular arteries: superior, middle, inferior = collateral circulation around the knee. The greatest risk in a lateral retinacular release is devascularization of the patella caused by interruption of the superior lateral geniculate artery. This artery is located at the musculotendinous junction of the vastus lateralis.

Popliteus bursa lies between the popliteus tendon and the lateral condyle of the femur. It separates the popliteus tendon from the lateral menisci.

"The unhappy triad of O' Donoghue," or called (terrible triad) includes the tibial collateral ligaments, ACL and medial meniscus when torn.

Chondromalacia consists of softening, discoloration, fraying and degeneration of the articular surface of the kneecap. This is seen in women ages 14– 28 usually.

Osteochondritis dissecans; distal femur, portion of it loses blood supply, usually lateral surface medial condyle.

Baker's cyst occurs at the back of the knee, (popliteal cyst) and can result from an enlargement of the semi-membranous bursa or bursa beneath the medial head of the gastrocnemius. It seems to be associated with a meniscal tear.

Joint mice is any loose body in the knee joint.

The incision is then made through medial retinaculum and synovium along the medial border of the patella, then inferiorly following the medial border of the patellar tendon to the proximal portion of the tibia. The medial soft tissue sleeve is elevated along the tibia. The patella and extensor mechanism are retracted into the lateral gutter. The knee is flexed, and the patella should stay retracted in the lateral gutter behind the Hohmann retractor. The quadriceps tendon and vastus medialis will lie over the distal anterior portion of the femur. The knee is flexed in various degrees of extension during the different procedural steps to improve visualization along with retracting the extensor mechanism. The medial and lateral menisci and any osteophytes are removed, along with soft tissue releases.[12]

Standard total knee incision

Anterior midline is the most common skin incision; it is made with the knee in flexion, which allows for better exposure. The skin incision should be long enough to avoid excessive tension during retraction. The standard retinacular incision is a medial parapatellar approach. It is extended proximally the length of the quadriceps tendon, leaving a 3 to 4 mm cuff of tendon on the vastus medialis for later closure.[2] The incision is continued around the medial aspect of the patella, extending 3 to 4 cm onto the anteromedial surface of the tibia, along the border of the patellar tendon. The medial side of the knee is exposed by subperiosteally stripping the anteromedial capsule and deep medial collateral ligaments off the tibia. Special attention must be paid to the patellar tendon attachment to the tibial tubercle; avulsion is very difficult to repair. The knee is extended and the patella is everted along with the release of lateral patellofemoral plicae and adhesions. In obese patients, a lateral release may be necessary to allow eversion of the patella. The knee is again flexed, and the remaining meniscus and ACL are removed. If a PCL-substituting technique is being used, the PCL will also be removed at this time.[2]

Wright Advance Knee System

Femoral preparation

An opening in the femoral canal is initiated with a 3/8" drill bit. The opening is placed medial and anterior to the anteromedial corner of the intercondylar notch. The fluted intramedullary (IM) reamer/rod is inserted into the femoral canal, while irrigating and aspirating several times to reduce the risk of fat embolism.

Femoral alignment

The valgus angle is set prior to attaching the valgus angle alignment guide to the IM reamer/rod. A small screw is tightened to lock the valgus angle. The femoral valgus alignment guide slides over the IM reamer/rod, until the paddle rests against the distal condyle. The guide is locked in place by tightening the large screw. The distal resection crosshead may be locked onto the valgus alignment guide by tightening the locking screw with a hexagonal head screwdriver. The alignment is checked by referencing the femoral head with the external alignment guide and rod. The crosshead is fixed to the anterior femur by placing 1/8" headless pins or drill bits into the zero-holes.

Femoral resection

The distal femoral resection is performed with or without the IM rod and alignment guide in place. The valgus angle alignment guide and IM reamer/rod are removed with the T-handle. It is removed as one unit, therefore the large screw need not be loosened. The distal femur is resected using a 0.050 thickness saw blade. Either the standard resection slot

or the +4 mm resection slot may be used, as necessary. The crosshead may be adjusted proximally or distally as needed and stabilized with an additional headless pin through the divergent pin hole to provide additional stability.

Femoral sizing

The anterior-posterior (A-P) femoral sizer is placed flush against the resected distal femur and adjusted so that the feet rest against the posterior condyles, and the stylus touches the most prominent aspect of the anterior cortex just proximal to the anterior condyles. The estimated size is indicated on the distal surface of the sizing caliper. The markings on the stylus correspond to the length of the anterior flange of the femoral component and can be used to locate the exit point of the sawblade. The sizer is pinned to the distal femur using 1/8" diameter-headed pins. After determining the appropriate size, the holes in the distal femur for the fixation pegs on the femoral resection block are prepared with a 3/16" drill bit and the 0˚ or 3˚ drill guide. The position of the holes determines external rotation relative to the posterior condyles. The surface marked "left" should face the surgeon for a left knee and "right" should be facing the surgeon for a right knee.

Anterior and posterior resections

The femoral resection block corresponding to the size indicated by the caliper is selected. The femoral resection block is placed into the prepared holes and flush to the distal femur. The block is stabilized medially and laterally using 1/8" diameter-headed pins. The posterior cut is carried out first using a 0.050 thickness saw blade, followed by the anterior.

Trochlear groove resection

The final femoral resection of the trochlear groove is performed. The guide is attached to the femur using fixation pins and the resection is carried out.

Tibial preparation

The ankle yoke is positioned against the lower leg proximal to the malleoli, and the spring is wrapped around the leg. The bar holding the appropriate resection crosshead is raised, and the bar is pinned to the upper tibia once the crosshead is centered on the proximal tibia.

Extramedullary tibial resection

The resection slot is located a few millimeters below the lowest articular surface. The medial/lateral adjustment screw at the ankle is used to align the resection guide parallel to the tibia. The stylus is attached to the crosshead, and the crosshead adjustment knob is turned to raise or lower the crosshead until the level of the resection is indicated by the stylus. The crosshead is pinned to the proximal tibia using headless pins to allow detachment of the crosshead from the guide to allow proximal or distal movement. An alignment guide and rod may be used to check alignment to the ankle. The crosshead may be pinned to the tibia through the divergent pin holes for added stability. The resection is carried out using a 0.050 thickness saw blade. If necessary, the 3˚ varus/valgus resection block is used to re-cut the tibia in correct alignment.

Tibial sizing

The tibial trial base equal in size to the femoral implant is assembled with the trial base handle and placed against the proximal tibial surface. Alignment may be checked by inserting an alignment rod through the handle to check alignment to the ankle. The keel punch guide is attached to the keel punch handle and is secured to the trial base by turning the knurled handle. The entry hole for the tibial stem is prepared using the 1/2" drill guide and reamer. The hole is reamed to the necessary depth. The appropriate keel punch on the threaded punch handle is slid through the guide until the punch is fully seated. Once the punch is seated, the handle is removed by turning counter-clock-wise until it is disengaged from the punch leaving the tibial trial base and stem in place for trial reduction.

Patellar preparation

The patellar reamer guide is attached to the parallel patellar clamp and is centered over the apex of the patellar articular surface and clamped. The thumbscrews are loosened on the depth regulator until it rests at the bottom of the patellar reamer guide. The appropriate patellar reamer is inserted into the guide until it rests on the apex of the patellar articular surface. Reference the scale on the side of the reamer guide to note the depth of the reamer. The top edge of the depth regulator is set to 14 mm below the reamer collar. The depth regulator stops the reamer at the appropriate level. The appropriate drill guide is used to size the patella and prepare holes in the bone for the implant peg(s).

Trial reduction

The knee is flexed, and the appropriate size femoral trial is placed on the distal femur using the femoral impactor or holder/driver. The appropriate tibial trial insert is placed onto the trial base, and the trial reduction is completed. When satisfied with the fit, the trials are extracted using the appropriate tools.

Implant insertion

The femoral implant is inserted with the femoral impactor or folder/driver. The metal tibial base is inserted with the tibial base impactor. The trial tibial insert may be reinserted to check ligament and soft tissue balancing for stability. The trial tibial insert is removed. The patellar implant is secured with bone cement and held in place with the parallel patellar recessing clamp. Once the cement has cured, the appropriate tibial insert is seated and locked into place.

Ligament balancing

Soft tissue and ligament releases are performed during exposure and bone resurfacing. Three common problems may occur during total joint reconstruction: varus deformity, osteophytes and valgus deformity.

Varus deformity is a common problem in the osteoarthritic knee. The surgeon will usually release the deep medial collateral ligament off the tibia and the attachment of the semimembranosis aponeurosis.[2]

Osteophytes, on both tibia and femur should be removed because they can raise the medial soft tissue sleeve which will shorten the MCL. For severe deformities, the PCL and posterior medial capsule can also be released. Too much of a release can lead to valgus instability.[2]

Valgus deformities often occur in patients with rheumatoid arthritis and osteoarthritis, usually associated with hypoplasia of the lateral femoral condyle and flexion contracture of the knee. For correction, the lateral capsule is released from the tibia. In lesser degrees of deformity, balance can be obtained by release of the iliotibial band at the level of the joint line. For severe deformities, the LCL can be stripped off the lateral condyle and the popliteus tendon can be incised.[2]

In a fixed flexion contracture, posterior soft tissues block full extension of the knee. The first step is to strip the adherent posterior capsule proximally off the femur, a short distance above the femoral condyles posteriorly. Additional bone from the distal femur will also help correct the contracture by enlarging the narrowed extension gap.[2]

Wound closure

The wound is irrigated, hemostasis is achieved, and a drain is placed, if necessary. Closure occurs with the knee in approximately 35° of flexion in layers with suture according to the surgeon's preference. A bulky dressing is applied.

Postoperative care, complications and prognosis

Continuous passive motion may be implemented to maintain range of motion. The patient typically remains hospitalized for three to four days postoperatively. A rigorous physical therapy program may be ordered to assist the patient in gaining strength and maintaining balance. Assistive devices, such as a walker or cane, may be needed initially.

Potential postoperative complications may include infection. Infection in a total joint is catastrophic for the patient. Infection control begins with the operating room team that must observe and practice strict aseptic technique. The following recommended methods are just some of the ways to reduce the risk of surgical site infection:

- Minimize the number of personnel in the room
- Eliminate unnecessary conversation in the room
- Use ultra-clean air operating rooms (laminar flow-vertical and horizontal)
- Use ultraviolet light
- Use body exhaust systems (low levels of bacterial shedding)
- Use prophylactic antibiotics
- Use double gloving

Other complications may include:

- Hemorrhage
- DVT- deep venous thrombosis
- Restricted range of motion
- Neurovascular complications related to tourniquet inflation
- Uneven leg length

The patient is expected to return to normal activities within four to six weeks postoperatively.

About the author

Jeff Bidwell, CST, CSA, CFA, MA, graduated from Madisonville Community College Surgical Technology Program in 1991, earned his bachelor's degree from the University of Southern Indiana in 1997, and a master's degree from Murray State University in 1999.

Currently, he is the director of the surgical technology and surgical first assisting programs at Madisonville Community College. He also is serving as secretary/treasurer for the Accreditation Review Committee on Education in Surgical Technology (ARC-ST).

References

1. Becker, J. Stucchi A, ed. Essentials of Surgery. Philadelphia: WB Saunders; 2005.
2. Canale T. Campbell's Operative Orthopaedics. St Louis: Mosby; 1998.
3. Price P, ed. Surgical Technology for the Surgical Technologist: A Positive Care Approach. 2nd ed. Albany, NY: Thomson Delmar Learning; 2004.
4. Wheeless' Textbook of Orthopaedics, http://www.wheeless online.com/ortho/2136. Accessed 3/9/2006.
5. Gray, H et al. Anatomy of the Human Body. Philadelphia: Lea & Febiger; 1985.
6. Moore K, Dalley A. Clinically Oriented Anatomy. 4th ed. Philadelphia: JB Lippincott; 1999.
7. Martini, F. Human Anatomy. 3rd ed. Upper Saddle River, NJ: Prentice Hall; 2000.
8. Niederhuber J. Fundamentals of Surgery. New York: Appleton & Lange; 1998.
9. Thorek, P. Anatomy in Surgery. Philadelphia: JB Lippincott; 1951.
10. Townsend C. Sabiston Textbook of Surgery. 17th ed. Philadelphia: JB Lippincott; 2004.
11. Wright Medical Technology. www.wmt.com. Accessed 3/8.2006.
12. Zimmer Orthopedic Products.