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Perspectives

Recovery Strategies from the OR to Home

In This Issue

In the past decade, bariatric weight loss surgery has increased significantly from approximately 486% from 1998 to 2002. At this rate of increase, by 2007, the number of bariatric surgeries will exceed 300,000 per year. Reasons for the dramatic increase are varied: increased awareness of mortality and morbidity related to obesity, failure of the diet and exercise programs and improvements in the surgical procedures. In this article, Daniel Drake, Maura McAuliffe and their colleagues describe the physiologic and psychosocial challenges of obese patients and essential nursing skills for proper care of these patients in the immediate postoperative period.

Tracheomalacia (TM) in an infant occurs when the cartilage in the trachea fails to develop properly. This causes the wall of the trachea to be flaccid, rather than relatively rigid, leading to airway obstruction. The incidence of TM remains unknown, although this condition is more common than previously thought. Congenital TM is estimated to affect approximately 1 in 1,445 infants. Acquired TM is caused by degeneration of the normal cartilaginous support of the trachea. It occurs for a number of reasons: preterm neonates' chronic ventilatory needs and traumatized airways due to endotracheal intubation. In her article, Dr. Verklan reviews the incidence, pathophysiology, and presenting symptoms of TM, along with management strategies and their outcomes.

Postoperative Nursing Care of Patients after Bariatric Surgery

CONTINUING EDUCATION FOR NURSING

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The number of bariatric surgeries in this country is increasing, and nurses require new knowledge and skills to care for the unique needs of morbidly obese patients after surgery. Nurses who provide care to bariatric-surgery patients must demonstrate clinical skills for safe, efficient, and quality care during the perioperative period. The purpose of this article is to describe the physiologic and psychosocial challenges of obese patients and essential nursing skills for proper care of these patients in the immediate postoperative period.

The highly publicized obesity epidemic among children and adults has raised public awareness and concern about the health of our nation. Body mass index (BMI) is a measure often used to stratify patients based on their height and weight. BMI is calculated by using the following formula: BMI=kg/m^2. A normal BMI is between 19 and 26. From 1986 to 2000, the number of obese Americans (BMI of 30-39) increased two-fold, and those considered morbidly obese (BMI ≥40) increased more than four-fold.[1]

This continued increase in obesity comes with a growing demand for bariatric or weight-reduction surgery. In 2002, Nationwide Inpatient Sample (NIS) estimated that 71,733 bariatric surgeries were performed in the United States.[2] This statistic represents a 436% rise from 13,386 surgeries in 1998. If this rate of increase is maintained, by 2007, the number of bariatric surgeries will exceed 300,000 per year.

Bariatric surgeries

All bariatric surgeries are conducted in one of two ways: non-laparoscopic (open) method or laparoscopic (closed) method. The main difference between the two is the method of gaining access to the abdomen. The laparoscopic technique is becoming popular, but variables in higher risk patients may lead surgeons to select the more traditional open technique.[3] This approach is performed by making one long (8- to 12-inch) abdominal incision, so surgeons can access the stomach and intestines. The surgeon completes the procedure by closing the wound with sutures and staple closures.

The laparoscopic or minimally invasive approach consists of making 5 to 6 small (1/4- to ½-inch) incisions in the abdomen, through which the laparoscope and other instruments are inserted to carry out the operation. The laparoscopic procedure is performed inside the body after gas has been inserted to expand the abdomen. The incisions are closed with dissolvable internal stitches and sterile strips on the skin.[4] The ability to perform surgery through the laparoscopic approach is a major contributing factor to the increase in bariatric surgery.

Obesity pathophysiology

Bariatric surgery is performed on obese patients who usually have obesity-related comorbidities, such as diabetes, hypertension, and sleep apnea. These patients are at higher risk for perioperative complications. Bariatric surgeons effectively minimize risks through surgical expertise, appropriate preoperative patient selection, and identification and management of preoperative conditions that might otherwise contribute to poor outcomes.

Knowledge of the surgical procedure

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Supported by an educational grant from Dale Medical Products Inc.

Tracheomalacia: *Please fix it, so my baby can breathe!*

M. Terese Verklan, PhD, CCNS, RNC

Due to the physical immaturity of their lungs, the predominant diagnoses in preterm newborns are pulmonary disorders. They became the impetus for developing a variety of mechanical ventilators to provide oxygenation and ventilation through very small airways. Consequently, the aggressive management of pulmonary disorders in the neonate has become commonplace and neonatal intensive care units (NICU) have exploded to meet the needs of a growing preterm population.

Unfortunately, iatrogenic airway injury complicates the recovery of a significant portion of neonates who require ventilatory management. A smaller group of neonates presents with tracheomalacia (TM) as part of a primary disease process, such as tracheoesophageal fistula. This article will review the incidence, pathophysiology, and presenting symptoms of TM, along with management strategies and their outcomes.

Definition

TM is a condition in which the increased flaccidity of tracheal walls leads to anterior-posterior airway collapse and airflow obstruction.[1,2] This weakness may be isolated to a small area or involve the entire trachea.

During normal respirations, the trachea slightly dilates on inspiration and narrows with expiration due to differences between intrathoracic and intraluminal pressures.[3] Fluctuations in the widening and narrowing of the tracheal diameter that occur during normal respirations are amplified in patients with TM. In the most severe cases, the end result is tracheal collapse and airway obstruction.

Incidence

The incidence of TM remains unknown, although it is generally believed that this condition is more common than previously thought.[4,5] Data are difficult to gather, because an objective definition or classification of airway malacia (abnormal softening or sponginess) has not been thoroughly developed, nor are there standardized techniques to confirm the diagnosis, or noninvasive diagnostic tests available to facilitate widespread screening.[3,5]

Congenital TM, estimated to affect approximately 1 in 1,445 infants, is an isolated finding in a healthy neonate that typically resolves by the second year of life.[2] Acquired TM is caused by degeneration of the normal cartilaginous support of the trachea. It occurs for a number of reasons. In the NICU, the preterm neonates' chronic ventilatory needs and the need for endotracheal intubation often traumatize the airway.

Acquired or secondary TM is associated with chronic disorders due to prematurity. Bronchopulmonary dysplasia, a major morbidity associated with chronic ventilation in premature newborns, has been diagnosed in 52% of neonates bronchoscoped for airway difficulties later diagnosed as TM.[3] Other conditions linked to TM are congenital heart defects, gastroesophageal reflux severe enough to require fundoplication, and poor neurological outcome.[6-8] With the advent of very small, flexible bronchoscopes, which can evaluate the airways of very-low-birth-weight infants at bedside in the NICU, detection of TM will likely increase.

Pathophysiology and presentation

Whether primary or secondary, symptoms tend to appear after the first weeks or months of life. Non-specific signs, usually pulmonary in nature, are noted first. The most common signs are expiratory stridor and a cough.[3] The cough results from the changed orientation of anterior and posterior tracheal walls, which predispose recurrent vibrations to irritate the airway.[3]

Clinical presentation of the neonate who is receiving mechanical ventilation varies, depending on the location of damage. If TM is distal to the endotracheal tube, the infant needs to work harder to breathe when weaned from the mechanical ventilator. During weaning, decreasing airway pressures no longer function as a splint to maintain a patent airway. With spontaneous respiration, the airway begins to collapse. Any increase in the work of breathing and greater need for supplemental oxygen in premature infants with compromised pulmonary function may lead healthcare providers to consider a diagnosis of sepsis and begin emergency treatment. Thus, the diagnosis of TM may be delayed for some time.

If TM is proximal to the end of the endotracheal tube, the infant will be able to tolerate the weaning of mean airway pressures with little difficulty. However, once extubated, signs of respiratory distress may require immediate re-intubation. Mild TM may present with increasing work of breathing that may respond to continuous positive-airway pressure delivered nasally. The healthcare team may assume that the neonate was not yet ready for extubation, which can also delay the diagnosis of TM. It is not uncommon to have a delay in correct diagnosis of TM of 6 months after symptom onset.[9]

Infants often present with feeding difficulties, when an abnormal vessel compresses the airway and restricts cartilage growth. Dysphagia, regurgitation, coughing, and colour changes may be evident.[3] Respiratory obstruction may occur when a full esophagus squeezes the trachea. The resultant hypoxemia interferes with feeding and contributes to poor weight gain.

Management

TM is typically diagnosed after other disorders, such as sepsis, bronchopulmonary disease, and intraluminal obstructions, are ruled out. As with any disorder, obtaining the patient's history and performing a physical examination are important. In particular, difficulties in weaning from mechanical ventilation/positive-distending pressure should be noted. Dynamic imaging, such as spirometry or pulmonary function testing, would seem to be the methodology of choice to confirm a diagnosis, as the symptoms of TM change with air flow. A scale has been proposed to grade the severity of TM (Table 1).

Latest-generation mechanical ventilators offer continuous graphic displays of pressure-volume and flow-volume loops that highlight the resistance of the infant's airways. Although flow-volume loops really examine function as opposed to structure, they demonstrate where resistance to airflow occurs. Typically, in infants with TM, there is a flow limitation on the expiratory component due to airway collapse. Additionally, the flow-volume loops are noninvasive, repeatable, and permit a quick evaluation of the infant's response to interventions.[10] Numerical values can also be calculated to follow trends in the infant's pathology.

Radiographs have poor sensitivity in diagnosing TM.[10] Fluoroscopy with or without contrast may be a non-invasive alternative to bronchoscopy. Burden et al developed a predictor of mortality in the

Table 1. Clinical severity rating scale for TM[1,3]

Classification	Symptoms
Mild	Coughing
	Mild respiratory distress
Moderate	Stridor
	Wheezing
	Recurrent respiratory infections
	Colour changes
Severe	Stridor
	Symptoms of upper airway obstruction
	Difficulties in clearing secretions
	Reflex apnea
	Cardiac arrest

NICU by combining days requiring mechanical ventilation and fluoroscopy.[11] Infants requiring ventilation for greater than 21 days who had evidence of malacia of any severity in the trachea on bronchogram had a higher risk of fatal outcome ($p<.00001$).[11] Although these techniques provide information related to airway collapse, they are not able to ascertain with certainty the cause of airway collapse.

CT-scanning with multidetector scanners image the central airway in a matter of seconds.[12] Because the procedure can be completed very quickly, sedation of the infant is not usually required. Information obtained from the air-filled trachea and adjacent soft-tissue structures can be reconstructed into two- and three-dimensional images, including virtual bronchoscopy.[3] The biggest disadvantage of CT is that it exposes the infant to ionizing radiation, albeit low levels. For this reason, MRI has become the preferred diagnostic methodology for the evaluation of extrinsic airway abnormalities.[13]

Diagnostic endoscopy is the intervention of choice for inspecting the airway. Endoscopes have become progressively smaller, allowing the trachea and mainstem bronchi of low-birth-weight infants to be visualized. Because of their small airways, it is difficult to image the pulmonary structures of infants, especially during dynamic maneuvers, since infants are not able to follow instructions regarding breathing.[3] The scope is lubricated and passed through the endotracheal tube into the airway after administration of a local anesthetic. The vocal cords are inspected, followed by evaluation of the trachea and bronchi. Particular consideration is given to the shape, appearance, and contour of the trachea and bronchi as well as airway dynamics. The examination is videotaped for comparison with future assessments. An airway lumen collapse of greater than 50%, as measured by endoscopy, is considered abnormal.[3] Infants diagnosed with TM tend to have a greater than 75% collapse. As many as one-third of this percentage demonstrate a total collapse of trachea.[3]

Treatment with tracheostomy

The infant who displays mild to moderate symptoms of TM will often self-resolve in the first year or so of life, as the tracheal cartilage grows and stiffens. Infants with severe disease will require treatment.

A tracheostomy is an airway or stoma that is surgically created to bypass the upper airway structures. Under general anesthesia, an incision is made between the thyroid isthmus and sternal notch. A vertical incision is made in the trachea at the level of the second to fifth tracheal rings, which may be extended through one to three rings. It is important to note that no tracheal tissue is removed. The tracheostomy tube is inserted into the stoma under direct visualization, adjusted so that the distal end is approximately 2 cm above the carina, and held in place by stay sutures

Figure 1. Neonatal and pediatric tracheostomy tube holder (Dale Medical)

and/or a tracheostomy tie. The tracheostomy is sutured to the neck skin to prevent accidental dislodgement before formation of a tract.[14] The tracheostomy serves to maintain patency of the stoma as well as to serve as the device to which ventilator equipment may be attached.[15]

Tracheostomy complications can be categorized as either stoma or cannulation issues. The most common stomal complication is the development of granulation tissue that is fragile and highly vascular.[15] Infection and bleeding of the tracheal mucosa, both at the level of the stoma and at the distal tip of the tracheostomy tube, are not unusual occurrences.[14,16] Bleeding may be minimized by appropriate humidification and prevention of trauma during tracheal suctioning.

Cannulation complications include tube blockage with secretions and accidental decannulation. Thick secretions can narrow the tracheostomy tube lumen or completely obstruct the airway. Because the lumen of a neonatal tube is extremely small, even a slight compromise in diameter may have profound effects. Poiseulle's law states that the volume of air moving through a tube per unit of time depends on pressure, length, and radius ($v = r^4/ 8L \times (P_1 - P_2) \times t$). Thus, airflow depends on the 4th power of the radius exponentially.[17]

Tracheostomy tubes

Several types of neonatal tracheostomy tubes are available. They are generally composed of silicone or polyvinyl chloride (PVC). PVC tubes tend to be more rigid than silicone tubes, with a higher potential to cause tracheal tissue injury. Additionally, PVC tubes contain di-2-ethylexyl- phthalate (DEHP), a chemical that slowly leaches out of the tube and enters tissues as a toxic metabolite. Deposition of these metabolites has been associated with a number of adverse effects on body systems, especially the male reproductive system.[18]

Neonatal tracheostomy tubes are single lumen and do not require a cuff, since the airway normally narrows at the level of the cricoid, which acts as a functional cuff.

To prevent irritation and tissue damage to the airway, and decrease airflow resistance, the proper size tracheostomy tube needs to be in place. It is important for the clinician to realize that the outer diameter and tube length are not standard and can vary widely between manufacturers.[19] Three measurements are key to determining the best fit for the neonate. The inner diameter is the actual airway diameter. It is found on the neck plate of the tracheostomy tube. The tube that has the largest inner diameter possible without damaging the surrounding tracheal tissue is optimal. A large diameter will minimize airflow resistance in the case of mechanical ventilation as well as allow the tracheal suctioning of secretions. The outer diameter reflects the tube thickness. To ensure the optimal fit, the tube length must be a reflection of the neonate's own airway length. The term neonate has an airway length of only 5 to 6 cm, while the preterm neonate's airway is much shorter and based on decreasing gestational age. If the airway is shorter than 3 cm, a custom tracheostomy tube will have to be manufactured. Bronchospasms tend to occur when a long tube irritates the carina.

Once the tracheostomy tube is in place, it needs to be secured to minimize movement inside the airway and to prevent accidental dislodgement. Ties composed of materials that will not fray or irritate the skin, preferably with Velcro® at the ends, are threaded through the neck plate holes and securely fastened. The Dale Tracheostomy Tube Holder is one example of a holder with Velcro™ fasteners that is available in pediatric and neonate/infant sizes to fit very small necks. This holder can engage and disengage the tracheostomy plate for quicker tube stabilization and a moisture repellent lining may help prevent skin excoriation on the neck. (See Figure 1). After fastening the tracheostomy tube securely to the neonate, the healthcare provider must insert one finger between the ties and neonate's neck to ensure that the ties are sufficiently tight but not tight enough to become a ligature.

The lumen of the tracheostomy will need to be kept clear of secretions. Tracheal suctioning must be individualized for each patient, by determining the optimal depth for the suction catheter to be inserted. Non-traumatic suctioning will prevent bleeding, tissue trauma, and the development of more secretions. The nurse can add 0.5 cm to the length of the tube plus connector for a safe distance. This measurement should be written on the patient's information card along with the size of the suction catheter, tracheostomy tube size and manufacturer, and the time of tracheostomy care. The indications for suctioning are the same as for endotracheal tube suctioning, i.e., increasing work of breathing, desaturation episodes, audible secretions in airway, agitation, etc. The suction pressure should not exceed 60 mm Hg – 80 mm Hg (preterm) and 100 mm Hg (full term).[20]

Stoma care should be done at least twice a day to prevent infection and permit the assessment of skin integrity. A cotton-tipped applicator moistened with water or products recommended by the physician/advanced practice nurse, should be used to remove secretions. The caregiver should be-

gin at the stoma and roll the applicator outward and away from the stoma to prevent any dried secretions/crusting from entering the stoma. The area under the neck plate should be cleansed and thoroughly dried. The integrity of the skin should be visually assessed at any place where the ties/neck plate contact the skin. Areas of breakdown require immediate attention.

The surgeon usually performs the initial tracheostomy tube change about one week after the tracheostomy. The obturator will first be placed into the new or clean tube to maintain the correct curvature for insertion as well as to provide a rounded distal end to the tracheostomy tube to minimize tissue damage on insertion. It saves time and is less stressful for the neonate if the tracheostomy tapes are already threaded on one side of the neck plate. The end of the tracheostomy tube is lubricated with sterile water/normal saline or a water-based lubricant. Using a smooth motion, the old tube is gently pulled out and the new one is inserted. It is customary for two people to perform the procedure; one may be responsible for tube removal, while the other handles tube insertion. As a best practice, it is optimal to have two people in case untoward events occur.

Advances in neonatal care have changed the management of neonatal airway disease. Most often, preterm survivors with chronic lung disease who have failed endotracheal tube extubation on three occurrences and are anticipated to require more than 8 weeks of ventilatory support are candidates for tracheostomy. Thus, the common indication for a tracheostomy today has shifted away from upper airway obstruction to prolonged ventilatory dependence.[14]

Other treatments

Aortopexy has become the treatment of choice for severe TM.[3] During the procedure, the aorta is sutured anteriorly to the inner surface of the sternum, even when it is not the cause of airway collapse.[10] The ascending aorta is approached via a right anterior thoracotomy from which the anterior wall of the trachea is pulled forward as the aorta is fixed to the sternum.[16,21] Tracheal collapse depends on positive intrathoracic pressure (mediastinal); lifting of the aorta anteriorly prevents most of the pressure from being transmitted to the trachea[10,22] and widens the anterior-posterior tracheal diameter to prevent collapse.[16,21] There have not been any negative reports of aortopexy obstructing normal growth of the trachea.[10,22]

External splinting has been used to reinforce the TM. Controversial in the past, due to inconsistent results, the introduction of new materials has made this option more attractive. Bronchoscopically positioned silicone and metal stents can be placed non-invasively, avoiding complications associated with surgery.[3,10] The modern stent is expandable with fenestrations that allow ventilation of branching airways and assist in the re-establishment of ciliary function by permitting epithelial overgrowth.[10] Some stents can be expanded to allow for growth. Metal stents are associated with granulation tissue formation and migration; they need to be replaced as the infant grows.[3] The limitations of current stents continue to be studied, while the feasibility of resorbable biopolymer stents are being investigated.[23]

Special considerations for anesthesia

The anesthesiologist has two main goals when working with a patient being treated for TM. The first is to use continuous airway distending pressure to prevent airway collapse and air trapping; the second is to minimize coughing.[10] For the use of diagnostic bronchoscopy or radiology, the patient must be spontaneously breathing. This leaves the anesthesiologist with three anesthetic options[10]:

1. Sedation with topical anesthesia provides the best diagnostic results when using flexible bronchoscopy, because the airway dynamics are not attenuated. Excellent topical anesthesia with sedation is key to decreasing coughing and minimizing discomfort. Use of midazolam for comfort and an opioid premedication to provide sedation and suppress the cough reflex is recommended.

2. For general anesthesia with inhalational maintenance, the anesthetic circuit is attached to the side port of a rigid bronchoscopy and gas induction is entrained to induce anesthesia while supporting spontaneous breathing. Use of topical anesthesia with sedation is needed to decrease coughing and laryngeal spasm. A disadvantage of this technique is that general anesthesia may mask the severity of airway collapse.

3. General anesthesia with intravenous maintenance is rarely used in neonates but may be the optimal method in the older pediatric patient. Titrating the anesthetic given intravenously allows the child to breathe spontaneously and keeps the airway available for evaluation.

Outcome

Because of the difficulty in diagnosing TM, it complicates and adds to the morbidity of concomitant chronic illnesses in neonates recovering from chronic ventilation. Mortality rates remain as high as 80% among infants who suffer from severe TM.

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and pathophysiology of obesity will help nurses in understanding the postoperative course and how patient comorbidities need to be managed. Morbidly obese patients need nurses who have specialized physical assessment skills. When assessing these patients, there are differences in the ways to auscultate heart and lung sounds, measure blood pressure (BP), examine the abdomen, and provide nutritional assessment and skin care.[5] Nurses must be proficient at using the nursing process to appropriately assess and manage bariatric patients throughout their inpatient course. They must also be aware of other pathophysiological changes related to obesity, including potential differences in elimination, sleep, body temperature regulation, hygiene, mobilization, and psychosocial needs.[6]

Differences in drug pharmacokinetics are associated with bariatric patients due to their body fat composition, subcutaneous tissue vascularity, and effects of altered gastric pH – specifically changes that occur in drug distribution and absorption.[5,7] Modifications to drug dosages are often required. Obese patients may have a greater volume of distribution with highly lipophilic drugs, such as narcotics, which in turn, could lead to longer elimination half-lives. With hydrophilic drugs, such as neuromuscular blockers, there is a tendency to have a limited volume of distribution, thus dosing should be based on ideal body weight (IBW), which is calculated using the following formula: Men IBW (10 kg) = 50 + 2.5 kg/inch over 5 feet and Women IBW = 45.5 + 2.3 kg/inch over 5 feet.

Cardiovascular assessment and management

Obesity causes a proportional increase in circulating blood volume, plasma volume, and cardiac output. The latter increases linearly with weight (by 0.1 L/min for each kilogram of adipose tissue perfused). With increasing cardiac output, the patient's stroke volume rises. The result is that obese patients often have hypertension and cardiomegaly due to increased afterload. The higher circulating volume leads to an increase in preload, which in turn, elevates right ventricular dysfunction, as characterized by higher right atrial pressure, pulmonary artery pressure (PAP), and pulmonary capillary wedge pressure (PCWP).

Respiratory assessment and management

Patients who have bariatric surgery often have significantly altered physiologic and anatomical pulmonary characteristics, when compared to non-obese patients. They tend to have decreased lung expansion due to an elevated diaphragm as well as less compliant lungs and chest walls. These changes often result in hypoventilation and harder work for breathing. Typical structural changes (thoracic kyphosis and lumbar lordosis) are related to the duration of obesity. They may cause obese patients to have a fixed thorax with decreased rib movement. In addition, layers of fat on the chest wall and abdomen along with an elevated diaphragm increase the work of breathing for obese patients. The reduced functional residual capacity (FRC) predisposes obese patients to the development of hypoxia, closure of small airways (atelectasis), and V/Q mismatch during normal breathing. Coexisting bronchitis, asthma, and other respiratory problems contribute to decreased lung compliance. Respiratory difficulties are often worsened in the supine and Trendelenburg position (which patients are in perioperatively), as both of these positions cause further decreases in FRC. Obese patients often have prolonged and difficult respiratory management requiring mechanical ventilation,[8] which may be more difficult and often requires very high peak pressures, which can lead to barotrauma (pneumothorax).

Patients who present for bariatric surgery have a high incidence of sleep apnea. They often rely on continuous positive airway pressure (CPAP) machines at home to adequately ventilate, especially at night while sleeping. CPAP should be used when physician-ordered; however, nurses should be alert for potential undiagnosed sleep apnea in all patients undergoing bariatric surgery.[7]

Oropharyngeal changes associated with obesity can make intubation of the trachea very difficult. This problem should be anticipated in any patient who reports using CPAP at home. In some patients, the combination of anatomic and physiologic pulmonary changes necessitate securing of the airway surgically with a tracheotomy.

Super-obese patients (BMI >50) may present with even more respiratory difficulties. Some have obesity hypoventilation syndrome (OHS), also known as Pickwickian Syndrome, which consists of a triad of respiratory acidosis, hypoxemia, and polycythemia. These symptoms are associated with pulmonary vascular changes, such as pulmonary hypertension, right ventricular hypertrophy, a tendency toward pneumonia, and increased risk of pulmonary emboli. Some patients may require a tracheostomy to secure the airway necessitating special tracheostomy tube care and discharge instructions.5

The loss of an established airway is a serious matter, necessitating rapid attention and, possibly, rescue measures. Patients should be closely monitored for adequate inspiratory volume during the immediate postoperative course to avoid hypoxia, hypercapnia, and apnea during sleep. Pulse oximetry should be used for at least the first 24 to 48 hours, and physicians should be informed if patients are unable to maintain adequate oxygen saturations or need increases in supplemental oxygen. Emergency intubation equipment, extra tracheostomy tubes, and tracheostomy surgical kits should be kept at all intubated patients' bedsides at all times. Positioning patients in the upright position, encouraging early ambu-

Equipment Needs Unique to Patients Who Have Bariatric Surgery

***By Susan Gallagher** RN, PhD, CWOCN*

Experts suggest that 300,000 people will have bariatric weight loss surgery in 2007. It is in the best interest of patients for caregivers to fully understand the patients' unique needs and to have planning, equipment, and education in place to meet those needs. Equipment presents the first defense against caregiver injury and strategically protects patients against the hazards of immobility, threats to dignity, and other preventable, predictable, and common emotional and physical complications of acute care. The challenge in caring for the larger, heavier patient is accommodating to both size and clinical need.

Equipment such as beds, wheelchairs, binders, tracheostomy tube holders, drain tube holders, gowns, walkers, and more serve to improve the care of bariatric patients. Bed frames need to be wide enough for patients to turn and reposition themselves. Wider wheelchairs provide a means of mobility, without the threat of pressure to the soft tissue. An adequately sized abdominal binder can comfortably accommodate a wider postoperative patient for purposes of providing support (see Figure 1). Patients report they are more comfortable and willing to ambulate when a binder is in place. Narrow cloth tracheostomy tube ties can burrow into the neck skin folds among patients with thicker necks causing pressure-related skin injury. Tracheostomy tube holders that are wider and longer than standard tracheostomy ties are available for use when indicated (Dale Medical Products, Inc.). Tube holders keep tubes from burrowing into soft tissue that can lead to pressure-related skin injury. Gowns that sufficiently cover the patient ensure personal privacy and promote dignity and safety.

Clinicians are in a key role to discuss equipment needs with vendors. Clinicians must challenge themselves to think about whicht equipment is essential to patient care and demand that manufacturers begin to more fully address the special needs of this underserved patient population.

*For more information on the caring for the bariatric patient, Dr. Gallagher has written a book entitled,*The Challenges of Caring for the Obese Patient, *published by Matrix Medical Communications, Edgemont, PA.*

Figure 1. Abdominal Binder (Dale Medical)

lation, and frequently reinforcing incentive spirometry, coughing, and deep breathing will help to mitigate postoperative respiratory complications.

Other comorbidities

Morbidly obese patients presenting for bariatric surgery often have other comorbidities that may need treatment. They often have insulin requirements due to adult-onset diabetes. Electrolyte imbalances may be present due to severe dieting or overeating.

Obese patients are predisposed to venous thromboembolism (VTE) and must be assessed to determine the need to institute VTE prophylaxis. They are also at risk for developing perioperative renal insufficiency. In these patients, the glomerular filtration rate (GFR) may be elevated. Higher GFRs have been linked to glomerular sclerosis, proteinuria, and declining renal function. Postoperative assessment of urine output is essential.

Most morbidly obese patients are at risk for Mendelson syndrome, as they may aspirate gastric contents. Most have higher volumes of gastric acid and acid of lower pH levels. Therefore, patients who have bariatric surgery require preoperative aspiration precautions, which may include the administration of nonparticulate antacids, histamine-2 blockers, or metoclopramide.

Early detection of postoperative complications

Bariatric-surgery patients are at risk for developing complications related to surgery and preoperative comorbidities. Some of the most serious complications include gastric leaks, wound infections, hernias, ulcers, thrombosis, pulmonary embolisms, bleeding, infection, and vitamin and nutrient deficiencies.[8,9,10] Nurses should be alert in order to provide early detection of these complications (Table 1). Any of these findings should be reported to the physician for appropriate medical intervention. These patients have a higher risk of the following postoperative morbidities: atelectasis, pneumonia, thrombophlebitis, pulmonary embolism, wound infection, and dehiscence.

Table 1: Symptoms of postoperative complications

- Heart rate: sustained, unexplained heart rate above 120 bpm
- Hypotension
- Oliguria
- Patient experiences anxiety or feelings of doom
- Hypoxia, decreased oxygen saturation, signs of air hunger
- Fever >102° F
- Abnormal changes in appearance or volume of gastric or percutaneous drains
- Signs or symptoms of wound infections
- Presence of hematemesis or melena
- Persistent cough

Gastric leak is one of the most serious postoperative complications. Symptoms of a possible gastric leak include fever above 39° Celsius, sustained pulse rate above 120 bpm, and patient perceptions of impending doom or unreasonable anxiety. These symptoms should be reported immediately to the physician team, as early detection and reporting could lead to life-saving surgical intervention.

Postoperative insulin needs

Patients presenting for bariatric surgery often need daily subcutaneous insulin and/or oral antidiabetic medication. The fact that they will not be eating or drinking in the immediate perioperative period requires that nurses be attentive to their patients' glucose levels and insulin requirements, which can be altered due to changes in the postoperative diet. Interestingly, the bypass surgery itself may cause a change in patients' responses to their own insulin or a change in their glycemic responses. Over the past 10 years, several studies have demonstrated a dramatic resolution of diabetes mellitus after gastric bypass surgery – sometimes within a few days. Pories and others have reported that, with appropriate postoperative follow-up, 83% of non-insulin-dependent patients with diabetes experience a return of normal blood suger.[11] Others have confirmed that almost all patients with type 2 diabetes mellitus, even those with insulin dependence, will have either resolution or improvement in their disease status.[12]

Barriers to postoperative care

Typically, during the postoperative period, patients who have bariatric surgery follow a plan of care that is based on evidenced-based practice and their physician's orders and preferences. Clinical pathways have been shown to improve quality, reduce length of stay, and reduce cost in this patient population.[13] Within these plans are key interventions for optimal quality outcomes and the appropriate course of hospital stay. They include early patient ambulation, thromboembolic prophylaxis, appropriate airway and pulmonary management, accurate measurement of vital signs and intake and output, appropriate pain management, and appropriate discharge planning and instruction.

The Association of Perioperative Registered Nurses (AORN) has identified 10 diagnoses that may be associated with bariatric surgery. All nurses who care for these patients should be familiar with these conditions (Table 2).[9] Nurses should also recognize potentially difficult aspects of caring for obese patients. For example, they may require more time for dependent-care requisites, have increased difficulty in urinary catheter and intravenous access placement, and have altered emotional, social, or psychological needs.[6,9]

Table 2: Nursing diagnoses for bariatric surgery (AORN)[9]

- Knowledge deficit
- Activity intolerance
- Impaired physical mobility
- Anxiety
- Nutritional imbalance (more than body requirements)
- Risk for infection
- Ineffective breathing pattern, related to morbid obesity and/or comorbidities
- Risk of imbalance in fluid volume
- Hypothermia
- Ineffective therapeutic regime management

Postoperative diet recommendations

Patients who have bariatric surgery are typically prescribed a strict diet postoperatively that regulates the consistency, volume, nutritional, and chemical makeup of foods. After surgery, food is gradually re-introduced by type and consistency. Postoperative diets are designed to promote weight loss but, more importantly in the immediate postoperative period, to protect the integrity of the very small stomach pouch, gastrojejunal anastomosis, and other surgical sites within the gastrointestinal system. Patient adherence to diet is essential, initially for safety, then for successful weight loss.

Nurses must understand diet recommendations for the immediate postoperative period and assist the patient in understanding the importance of adherence. Nurses must report to physicians any patient complaints of nausea and diarrhea as well as any patient's inadequate knowledge of diet and postoperative plans.

Unique skin, wound, and drain care

Because bariatric surgery is performed by either laparoscopic or open techniques, there will be postoperative differences in surgical access incisions and in placement of abdominal drainage devices. Drainage devices may include Jackson-Pratt bulb suction drains and nasogastric tubes. Nasogastric tubes should not be manipulated postoperatively, nor should they be inserted postoperatively, as they may damage the surgical site.

Obese patients have very unique skin care needs. They are often at higher risk of skin pressure ulcers and have skin folds that may present sites of breakdown, chronic dermatitis, and fungal infection. Nurses should aggressively assess and perform skin care management postoperatively, with special attention to the incision and areas of excess skin folds.[11] This care includes the appropriate application of pressure-reducing sleep surfaces and consultation with wound, ostomy, and continence nurse experts, when needed.[14,15]

Postoperative pulmonary care of patients who have bariatric surgery includes the possible need for postoperative me-

chanical ventilation and positive end expiratory pressure (PEEP), if the patient is on a ventilator, or CPAP, if the patient is not mechanically ventilated, to maximize oxygen delivery. Due to the ventilation/perfusion mismatches, these patients oxygenate better in the semi-recumbent position. Early ambulation, vigorous pulmonary toilet, and the provision of adequate postoperative analgesia will contribute to better postoperative pulmonary performance.

Holistic nursing care

Obese patients may be self-conscious about their weight or appearance. They may feel that they are a burden to health-care delivery systems or caregivers. Nursing-care activities should be performed in a manner consistent with promotion of patient dignity and respect. Nurses should be aware of and attempt to prevent obesity discrimination in the hospital.[7,9,14] Bariatric surgery should be viewed by health-care providers as a positive, health-promoting, and often life-sustaining intervention. Nurses should view themselves as an important members of the bariatric team, who are crucial to a quality outcome in the client's life.

Post-discharge needs

Bariatric surgery creates a lifelong change in patients' anatomy, physiology, and overall health status. Postoperatively, patients commit to lifestyle changes that include physician follow-up and study.[16] The hospital-based perioperative phase of their care is the shortest of all, but it provides the opportunity for early educational interventions that stress the importance of compliance to physicians orders and follow-up care. In the postoperative phase of hospital care, nurses should be able to perform and reinforce discharge teaching congruent with the physician's plans.

Conclusion

The number of patients who have bariatric surgery is expected to continue to increase over the next few years, making this operation one of the most frequently performed procedures in general surgery. Skilled nurses who accurately detect postoperative complications can improve patient outcomes.

Despite the growing trend of obesity and its impact on nursing care, there is a paucity of nursing research to guide the nursing care of obese patients. Future nursing research is needed to validate best nursing practices in the care of obese patients who have bariatric surgery.

The National Association of Bariatric Nurses (NABN) is an organization that seeks to improve the nursing care of morbidly obese patients and their families through education, research, and professional networking. They conduct educational meetings that focus on the nursing care of these patients. For more information, visit their Web site at www.bariatricnurses.org.

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Provider approved by the California Board of Registered Nursing. Provider #CEP1447

After reading this article, the learner should be able to:

1. Expalin why tracheomalacia is difficult to recognize in the chronically ventilated neonate.
2. Discuss the treatment options for severe tracheomalacia. Identify two goals of anesthesia during bronchoscopy.
3. Identify the most vital nursing skills for appropriate care of bariatric-surgery patients in the immediate postoperative period.
4. Identify the unique and challenging risks of bariatric surgery.
5. List symptoms of postoperative complications in bariatric-surgery patients.

Instructions

1. Read both articles.
2. Complete the post-test on page 8. (You may make copies of the answer form).
3. Complete the participant evaluation.
4. Mail or fax the complete answer and evaluation forms to address on back page.
5. To earn 1.9 contact hours of continuing education, you must achieve a score of 70% or more. If you do not pass the test you may take it one more time.
6. Your results will be sent within four weeks after form is received.
7. The fee has been waived through an educational grant from Dale Medical Products Inc.
8. Answer forms must be postmarked by April 15, 2008.

Perspectives, a quarterly newsletter focusing on postoperative recovery strategies, is distributed free-of-charge to health professionals. *Perspectives* is published by Saxe Healthcare Communications and is funded through an educational grant from Dale Medical Products Inc. The newsletter's objective is to provide nurses and other health professionals with timely and relevant information on postoperative recovery strategies, focusing on the continuum of care from operating room to recovery room, ward, or home.

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1. **Tracheomalacia is a disease that:**
   a) causes the trachea to stiffen and prevent air flow
   b) increases lung compliance and decreases airway resistance
   c) softens the tracheal cartilage, causing airway collapse
   d) decreases lung compliance and increases airway resistance

2. **A 40-day-old, ex-28-week gestational age neonate with moderate to severe bronchopulmonary dysplasia developed sudden respiratory failure and required re-intubation almost immediately after being extubated. A diagnosis of TM proximal to the end of the endotracheal tube is made:**
   a) true
   b) false

3. **Flow-volume loops displayed on mechanical ventilators can be used to:**
   a) highlight the compliance of the pulmonary parenchyma
   b) examine the structure of the trachea, larynx, and mainstem bronchi
   c) demonstrate where resistance to airflow occurs on expirations
   d) deliver bronchodilators to the alveolar spaces

4. **MRI is the preferred technology to evaluate extrinsic airway abnormalities because:**
   a) CT has too many multidetector scanners that blur the image
   b) CT utilizes ionizing radiation in low levels to penetrate the tissues
   c) MRI uses ionizing radiation in high levels to obtain clear images
   d) MRI can be used to scan the entire body, not just the trachea

5. **The intervention of choice for inspecting the airways is:**
   a) CT scanning
   b) MRI
   c) fluoroscopy
   d) endoscopy

6. **The goals of anesthesia in airway management are:**
   a) prevent airway collapse and minimize coughing
   b) encourage airway collapse and coughing to evaluate airway dynamics
   c) paralyze the vocal cords and minimize tracheal closing
   d) prevent airway collapse and encourage coughing to evaluate airway dynamics

7. **All of the following are symptoms of possible postoperative complications of bariatric surgery, except:**
   a. hypotension
   b. fever of >102° f
   c. hematemesis or melena
   d. hypertension

8. **All of the following are obese-related comorbidities, except:**
   a. angina
   b. diabetes
   c. hypertension
   d. sleep apnea

9. **It is estimated that, by 2007, the number of bariatric surgeries will exceed _____ per year.**
   a. 100,000
   b. 200,000
   c. 300,000
   d. none of the above

10. **Obesity causes a proportional increase in all of the following, except:**
    a. blood volume circulation
    b. factor VIII
    c. plasma volume
    d. cardiac output

11. **Anatomical pulmonary differences exist between obese patients and non-obese patients. Typical structural changes include which of the following?**
    a. thoracic kyphosis and lumbar lordosis
    b. anterior larynx
    c. tmj stiffness
    d. reactive airway disease

12. **Most morbidly obese patients have increased _____, putting them at higher risk of Mendelson syndrome.**
    a. food requirements
    b. abdominal girth
    c. sleep apnea
    d. gastric volumes of acid of a lower pH

13. **Some of the most serious postoperative complications of bariatric surgery include:**
    a. gastric leaks
    b. wound infections
    c. vitamin and nutrient deficiencies
    d. all of the above

Participant's Evaluation

What is the highest degree you have earned (circle one) ? 1. Diploma 2. Associate 3. Bachelor's 4. Master's 5. Doctorate

Indicate to what degree you met the objectives for this program: Using 1 = Strongly disagree to 6 = strongly agree rating scale, please circle the number that best reflects the extent of your agreement to each statement.

	Strongly Disagree					Strongly Agree
1. Explain why tracheomalacia is difficult to recognize in the chronically ventilated neonate.	1	2	3	4	5	6
2. Discuss the treatment options for severe tracheomalacia. Identify two goals of anesthesia during bronchoscopy.	1	2	3	4	5	6
3. Identify the most vital nursing skills for appropriate care of bariatric-surgery patients in the immediate postoperative period.	1	2	3	4	5	6
4. Identify the unique and challenging risks of bariatric surgery.	1	2	3	4	5	6
5. List symptoms of postoperative complications in bariatric-surgery patients.	1	2	3	4	5	6

Name & Credentials _____
Position/Title _____
Address _____
City _____ State _____ Zip _____
Phone _____ Fax _____
email address _____

Mark your answers with an X in the box next to the correct answer

	A	B	C	D		A	B	C	D
1	☐	☐	☐	☐	9	☐	☐	☐	☐
2	☐	☐	☐	☐	10	☐	☐	☐	☐
3	☐	☐	☐	☐	11	☐	☐	☐	☐
4	☐	☐	☐	☐	12	☐	☐	☐	☐
5	☐	☐	☐	☐	13	☐	☐	☐	☐
6	☐	☐	☐	☐	14	☐	☐	☐	☐
7	☐	☐	☐	☐	15	☐	☐	☐	☐
8	☐	☐	☐	☐	16	☐	☐	☐	☐

How long did it take you to complete this home-study program? _____

What other areas would you like to cover through home study?

_____

_____

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