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Development, Implementation, and Evaluation of a Continuing Education Curriculum for Cardiac Intensive Care Nurses in Sulaymaniyah, Iraqi-Kurdistan: A Special Studies Project

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Abstract

Development, Implementation, and Evaluation of a Continuing Education Curriculum for Cardiac Intensive Care Nurses in Sulaymaniyah, Iraqi-Kurdistan: A Special Studies Project

By Molly King

Background: The estimated global incidence of congenital heart disease (CHD) is 8 per 1,000 live births. More than 1,000,000 children are born with CHD each year, and 90% are born in places with little to no access to adequate care. If left untreated, many children with CHD will have dramatically shortened lives. In the Iraqi-Kurdistan, 4000 children have been diagnosed with CHD. In April 2010, the Sulaymaniyah Center for Heart Disease (SCHD) opened providing cardiothoracic surgery to adults and children in need. The Ministry of Health of Kurdistan and the Medical Director of the SCHD requested a cardiac nurse to train the Kurdish nurses in the cardiac intensive care.

Purpose: The purpose was to develop a 10-week continuing education curriculum to be implemented with the heart center nurses. This curriculum was designed to address specific knowledge deficits of the nurses, areas with a demonstrated lack of competency. The overarching goal of this project was to enable the nurses in the Sulaymaniyah Center for Heart Disease (SCHD) to provide safe and appropriate care to patients recovering from cardiac surgery.

Methods: The content of the curriculum was based on a combination of prior experience teaching nurses in other countries with developing cardiac programs, observed knowledge deficits of the nursing, and requested content from the Kurdish nurses. Mandatory, weekly, 2-hour sessions were held in the SCHD conference room. Post-tests were administered to the nurses in attendance.

Results: The conferences were well attended by the staff. Staff were encouraged to work on the post-test in small groups to model teamwork and the scores overall were good. Over the course of ten weeks, small practice changes were observed, including the nurses recording a respiratory rate and patient getting more adequate analgesia and sedation in the post-operative period.

Discussion: The majority of the nurses (12 of 18) enjoyed the curriculum content, and actively engaged with me at the bedside. Nurses want to deliver good nursing care, but have limited access to current nursing literature. Clear role delineation and educator authority would facilitate a successful program to enhance the skills of the Kurdish nurses in the SCHD.

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INTRODUCTION

Congenital heart disease (CHD), the most common birth defect, results in significant morbidity and mortality in the first year of life. The estimated global incidence of CHD is 8 per 1,000 live births; however, this does not account for the regional variation that exists and, in many cases, is difficult to estimate (Bernier, Stefanescu, Samoukovic, & Tchervenkov, 2010). Yearly more than 1,000,000 children are born with CHD, and 90% are born in places with little to no access to adequate care (Tchervenkov, et al., 2008). In response to this, the World Society for Pediatric and Congenital Heart Surgery (WSPCHS) was formed in 2008 at an international conference in Montreal, Canada (Dearani, et al., 2010). The vision and mission of the WSPCHS follow:

> The Vision of the World Society is that every child born anywhere in the world with a congenital heart defect should have access to appropriate medical and surgical care.
>
> The Mission of the World Society is to promote the highest quality comprehensive care to all patients with pediatric and/or congenital heart disease, from the fetus to the adult, regardless of the patient's economic means, with emphasis on excellence in education, research, and community service (Tchervenkov C. I., et al., 2008).

Based on analysis of global and regional databases, the most common congenital heart defects are ventricular septal defects (VSD), atrial septal defects (ASD), and tetralogy of Fallot (TOF); however, the incidence of patent ductus arteriosus (PDA) was excluded from the analysis by the authors. VSD had the highest incidence, accounted for 30-50% of cardiac lesions (0.3-7.7 per 1,000 live births). ASD accounted for 0.3 to 4.2 per 1,000 live births (15-25%). TOF accounted for 5-10% of lesions (0.16-0.46 per 1,000 live births) (Bernier, Stefanescu, Samoukovic, & Tchervenkov, 2010). Because the presence of a PDA is often closely related to gestational age, it

was not included in the analyses; however this lesion accounts for a large amount of morbidity and mortality.

The natural history of congenital heart disease is often only seen in regions with suboptimal access to care. For example, a patient with PDA has an associated mortality risk of 30% in the first year of life and 42% mortality by 45 years old. A large ASD has a mortality risk of 5-15% prior to the age of 30. TOF with pulmonary stenosis is associated with 25% mortality before the age of 1, and 40%, 70%, and 90% mortality by the ages of 3, 10, and 40 years, respectively. These statistics are startling given that in resource rich environments mortality is quite low, 4% overall (Tchervenkov, et al., 2008). This 4% includes highly complex cyanotic lesions, most of which require palliation or repair within the first week of life.

Several limitations affect the ability of the global community to address CHD in a meaningful way. A true incidence of CHD is difficult to establish in countries with minimal access to cardiac services, due to selection bias associated with those seeking care. Additionally, newborns with cyanotic heart disease often do not survive the neonatal period, and therefore, may or may not be included in data. Second, utilization of diagnostic tools (i.e. echocardiography, electrocardiography, and chest radiographs), if available at all, often is not uniform amongst providers. The third factor limiting CHD concerns the complexity and expense of managing children with CHD. Due to the nature of cardiac interventions, the care required is highly complex, often technical, and resource intensive (Bernier, Stefanescu, Samoukovic, & Tchervenkov, 2010). The non-governmental organization For Hearts & Souls is working to address many of these deficiencies, which will be discussed in this section.

Currently over 4000 children with congenital heart disease live in the Kurdish Region of Northern Iraq and over 1000 of these children live in the city of Sulaymaniyah (Rasco, 2010). The

resources to manage children with these conditions are extremely limited. Prior to the summer of 2010, the only pediatric cardiac center in Iraq was in Erbil, the capital of the Kurdish region of Iraq. This is a private hospital; therefore, it is prohibitively expensive for most families. Other options include traveling to Turkey, Jordan, or Iran in search of costly diagnosis and treatment. A diagnostic cardiac catheterization in Turkey has an estimated cost of $10,000 USD (Courtney, 2010). To afford this, many families sell homes, cars, and anything else of value.

Image1. Map of Iraqi-Kurdistan (Kwek, 2010).

The Sulaymaniyah Center for Heart Disease (SCHD) was opened in late April 2010 on the initiative of the Kurdish Regional Government in conjunction with Kurdistan Save-the-Children. An Iraqi cardiothoracic surgeon was recruited from Perth, Australia to open and run the center. At the time of my arrival, five cardiac surgeries were being performed each week, including one to two pediatric procedures for CHD. Over the course of the summer, the surgeon selected both adults and children for surgeries. The adult surgeries included coronary artery bypass graft

(CABG) and mitral and aortic valve replacements. The pediatric selected cases were repairs of ASD, PDA, and coarctation of the aorta (CoA). Of the pediatric cases, the only type of surgery requiring cardiopulmonary bypass (bypass) was ASD closure. A patient requires bypass when the heart must be stopped to perform the repair. CoA and PDA repairs are considered extracardiac cases, because the heart continues to pump throughout the surgeries.

Several non-governmental organizations have promised to support the establishment and ongoing success of the SCHD. For Hearts and Souls (FHAS) [http://www.forheartsandsouls.org], a faith-based NGO with close ties to Samaritan's Purse [http://www.samaritanspurse.org], has committed to an ongoing partnership focused on addressing educational needs of the surgical staff, cardiac catheterization staff, and nursing staff. The primary clinical aims of FHAS include:

1. Advance recognition of congenital heart disease (CHD) in developing countries
2. Work with local physicians and nurses to increase capacity in managing children with CHD
3. Host lecture sessions designed to enhance the local staff's assessment skills.
4. Enable the local authorities and staff to develop or expand a pediatric cardiac center that provides successful procedures and contributes to the enhanced quality of life for families and children with CHD.

FHAS has used this model to implement programs in Mongolia, Kosovo, and Northern Iraq. I have been involved with the projects in each of these three countries. The FHAS team comprises two to three pediatric cardiologists, one pediatric cardiothoracic surgeon, one pediatric anesthesiologist, one pediatric intensivist, one perfusionist, three pediatric nurse practitioners, seven or more pediatric cardiac intensive care nurses, child life specialists, and a biomedical engineer.

The continuing education for nurses project in Sulaymaniyah began in response to a request from the Ministry of Health of Kurdistan and the Medical Director of the SCHD to train the Kurdish nurses in the cardiac intensive care. Most of the ICU nurses (8 of the 9) were new graduates and therefore had little to no experience. Based on this knowledge, a curriculum was designed to provide these novice nurses with the tools necessary to recognize changes in a patient's condition and to intervene appropriately and safely. Following cardiac surgery, the post-operative phase is the dangerous for children. Their vital signs can change very quickly. A keen eye is needed to recognize the subtle changes and intervene appropriately. Training the Kurdish nurses extends their knowledge and enables them to provide better care, care more in line with evidence-based practice.

Problem Statement

One specific problem in Iraqi-Kurdistan is the lack of consistent correct diagnosis and management of congenital heart disease. In countries with more advanced resources for caring for medical problems, many of these children would have surgery within the first year of life. However, due to limitations intrinsic to the Iraqi environment and limited access to care, surgery may not be an option. Compared with children without CHD, children with CHD often have a dramatically shortened life expectancy. With proper treatment or surgery, many of these children could have a life expectancy within the norms of their home countries (Tchervenkov C. I., et al., 2008).

Some of the previously mentioned limitations include: inconsistent funding from the central government of Iraq; insufficient equipment, supplies, and medications; a lack of properly trained physicians; a lack of professional nurses; a lack of continuing educational opportunities; and a

punitive work environment. Many of the physicians and nurses are working in an antiquated medical system, thus hindering the advancement of health care.

Purpose

The immediate purpose was to develop a continuing education curriculum to be implemented with the heart center nurses. This curriculum was designed to address specific knowledge deficits of the nurses, areas with a demonstrated lack of competency. The overarching goal of this project was to enable the nurses in the Sulaymaniyah Center for Heart Disease to provide safe and appropriate care to patients recovering from cardiac surgery.

Definition of Terms

Congenital Heart Disease (CHD): "a problem with the heart's structure and function due to abnormal heart development before birth. Congenital means present at birth" (Schumacher, 2009).

Atrial Septal Defect (ASD): "congenital heart defect in which the wall that separates the upper heart chambers (atria) does not close completely" (Mikati, 2010).

Coarctation of the Aorta (CoA): "narrowing of the aorta, the large blood vessel that branches off your heart and delivers oxygen-rich blood to your body. When this occurs, your heart must pump harder to force blood through the narrow part of your aorta" (Mayo Clinic Staff, 2010).

Patent Ductus Arteriosus (PDA): "a persistent opening between two major blood vessels leading from the heart. This heart defect present at birth (congenital) often closes on its own or is readily treatable. Left untreated, a patent ductus arteriosus can cause too much blood to flow through the heart, weakening the heart muscle and causing heart failure and other complications" (Mayo Clinic Staff, 2009).

Coronary Artery Bypass Graft (CABG): "procedure that restores blood flow to your heart muscle by diverting the flow of blood around a section of a blocked artery in your heart.

Coronary bypass surgery uses a healthy blood vessel taken from your leg, arm, chest or abdomen and connects it to the other arteries in your heart so that blood is bypassed around the diseased or blocked area. After a coronary bypass surgery, normal blood flow is restored" (Mayo Clinic Staff, 2010).

Cardiopulmonary Bypass Pump (bypass): "a procedure to circulate and oxygenate the blood during heart surgery involving the diversion of blood from the heart and lungs through a heart-lung machine and the return of oxygenated blood to the aorta" (American Heritage Medical Dictionary, 2010).

Extracardiac Surgery: a type of heart surgery where the heart continues beating throughout the surgery; the use of bypass is not required during the repair.

World Society for Pediatric and Congenital Heart Surgery (WSPCHS): "established in 2006 in order to bring together pediatric and congenital heart surgeons and their colleagues from around the world in a spirit of cooperation, friendship and mutual respect" (WSPCHS, 2010).

For Hearts and Souls (FHAS): a faith-based NGO dedicated to advancing pediatric cardiac care in Mongolia and Iraqi-Kurdistan, using a team-based approach.

Pediatric Cardiothoracic Surgeon: a physician whose surgical specialty is addressing pediatric heart disease

Pediatric Anesthesiologist: a physician with specialized training in anesthetizing children with CHD undergoing surgery

Pediatric Intensivist: a physician with focused training providing specialized care to critically ill children in an ICU (American Academy of Pediatrics, 2010).

Perfusionist: technician that sets up and operates the bypass pump; this individual is responsible for doing the work of the child's heart and lungs while the heart is stopped during open heart surgery machine allows the blood to flow to all other organs in the body. "Once the surgery is complete, the patient is taken off the machine and the blood is re-circulated through the heart"

(eHow, 2010).

Acute Care Pediatric Nurse Practitioners: "nurses in advanced nursing practice roles in caring for acutely, critically, and chronically ill children in a variety of health care settings," generally in an ICU of some kind that specializes in the unique needs of children (Emory University).

Pediatric Cardiac Intensive Care Nurses: nurses who have advanced training caring for the specific needs of critically ill children with heart disease, pre-operatively and post-operatively.

Child Life Specialists: "trained professionals with expertise in helping children and their families overcome life's most challenging events. Armed with a strong background in child development and family systems, child life specialists promote effective coping through play, preparation, education, and self-expression activities" (Child Life Council, Inc, 2010).

Biomedical Engineer: "a discipline that advances knowledge in engineering, biology and medicine, and improves human health through cross-disciplinary activities that integrate the engineering sciences with the biomedical sciences and clinical practice" (Imperial College).

LITERATURE REVIEW

Many factors affect the ability of staff of the Sulaymaniyah Center for Heart Disease (SCHD) to carry out necessary post-operative nursing functions. The three main identified factors include competency of the staff, motivation, and resources. Competency includes many features. The most apparent features include: the technical ability of the nurses to carry out their functions as well as the critical thinking and analytical skills necessary to identify and intervene in a timely and appropriate manner. Motivation includes the personal motivation of the individual staff members, political motivation, and specific motivations of the regional health system. Underscoring the other factors affecting the SCHD is the presence or absence of resources: fiscal resources, personnel resources, and technological resources.

Competency

'Competency' is a poorly defined term. The National Council for State Boards of Nursing (NCSBN) defined competency as, "the application of knowledge and the interpersonal, decision-making, and psychomotor skills expected for the practice role, within the context of public health" (Scott Tilley, 2008, p. 59). The concept of competency has grown in popularity in the United States since 1996 when the Joint Commission on Accreditation of Healthcare Organizations (JACHO) began requiring hospitals to demonstrate competence in their staff. JACHO's aim was to assure high patient standards and improve patient experiences (Axley, 2008). Frequently cited aspects of competency appearing in the literature include: knowledge, actions, professional standards, internal regulation, and dynamic state (Axley, 2008).

Increasing competency, as a construct, has been moderately tested both in the United States and other developed countries as well as in developing countries where the knowledge deficits may be more apparent; however, the majority of these programs were implemented with physician

groups, rather than with nurses. Changes in competency level have been mainly addressed through continuing education courses or programs (Forsetlund, et al., 2009).

One such implemented nursing program was an ongoing collaboration between the College of Nursing at Brigham Young University and an Ecuadorian hospital that focused on training nurses from different educational backgrounds. The content of the educational sessions focused on neonatal resuscitation, pediatric and adult advance life support, basic life support, and infection control measures. Palmer and Bracken demonstrated retention of some of the content from year to year. Retention was improved by strategically placing visual aids throughout the hospital (i.e. hand washing placards placed above sinks). Palmer and Bracken described five constructs to consider when working toward continued achievement through the partnership. The five R's include: realistic goals, repetition, reinforcement, reassessment, and remaining open to change (Palmer & Bracken, 2009).

Cruz et al. focused a continuing education course on the importance and use of nursing diagnosis (2009). "Nursing diagnoses communicate the professional judgments that nurses make every day to our patients, colleagues, members of other disciplines and the public," according to the North American Nursing Diagnosis Association International (NANDA-I) (NANDA International, 2010). A patient's nursing diagnoses are developed through a thorough evaluation of the clinical data (Cruz, Pimenta, & Lunney, 2009). Because nursing diagnoses direct patient care, it is imperative that nurses are able to accurately and consistently recognize aberrations of normal. At the University of Sao Paulo, Brazilian nurses participated in a course assessing the accuracy of nursing diagnosis. The authors used pretest and posttest data to determine the level of accuracy gained over 2 case studies. Overall, the level of accuracy of nurses improved but most did not achieve the highest accuracy scores (case study 1 = 64.1%; case study 2 = 71.8%). Accuracy was

positively correlated with educational level, use of teaching aids, and cognitive abilities and strategies (Cruz, Pimenta, & Lunney, 2009).

Given that the post-operative period following heart surgery is highly complex, there are significant consequences of low accuracy in care delivery. These consequences range from prolonged hospitalization to increases in morbidity to increased mortality. If the use of nursing diagnoses can increase the accuracy of care delivery, this can have a direct impact on patient safety and patient outcomes. For this reason, Cruz et al identifies that "continuing education courses are needed to assist nurses in attaining the associated knowledge and learning how to apply this knowledge to clinical cases" (Cruz, Pimenta, & Lunney, 2009, p. 126).

Different strategies have been attempted to improve nursing competency. As previously mentioned, they have ranged from theoretical constructs within the nursing science (nursing diagnosis) (Cruz, Pimenta, & Lunney, 2009) to practical skill introduction (infection control strategies) (Palmer & Bracken, 2009). Both have been shown to be effective, but, not without some limitations.

One of the limitations sited by Palmer and Bracken references gifts of equipment and supply. While these items meet valuable identified needs, a discrepancy remains when these items either fall into disrepair or the supplies run out. The authors noted, "… The receiving country is left with what they started with. Without knowledge, they will invariably go back to doing what they did before" (Palmer & Bracken, 2009, p. 474).

One of the limitations of the Cruz study was that the participants were mostly master's or doctoral prepared (n=23, 59%). The statistical significance that was achieved (p=0.008) may not be

representative of achievable results of bedside nurses with less education (Cruz, Pimenta, & Lunney, 2009).

To increase quality of nursing care delivery, other strategies have been to import nursing curricula from developed nations, such as the United States and England, and apply them in developing countries. In a comprehensive review of the literature, Jayasekara and Schultz analyzed the feasibility and appropriateness of using nursing curricula for developed nations to train nurses in less resource rich countries. Four studies met inclusion criteria. The designs of the studies were quite different, and therefore, the planned meta-analysis was not possible (Jayasekarea & Schultz, 2006). However, the review identified factors important for successful curriculum implementation. "Direct applicability of a curriculum model from another country is not appropriate for different cultural context without first assessing its cultural relevancy" (Jayasekarea & Schultz, 2006, p. 214).

One study included in the review, measured the perceived importance Chinese nursing educators placed on nursing constructs (i.e. technical skills, integrity, communication, autonomy, critical thinking, and global healthcare). The Chinese educators ranked "technical skills", "communication", "integrity", and "human dignity" highly; whereas, "autonomy", "global healthcare", "human diversity", and "healthcare systems and policy" were ranked lowest. The constructs deemed important to nursing, and therefore were priorities in education, by the Chinese educators align with many of the cultural beliefs and practices (Xu, Davis, Clements, & Xu, 2002). Some important concepts in nursing practice ranked poorly, due to incongruence with Chinese cultural norms. The authors suggest the curriculum's acceptability would be enhanced by first assessing the cultural relevancy of the curriculum and then adapting it to meet the cultural norms of the home country (Jayasekarea & Schultz, 2006).

A nursing curriculum for implementation in the United Arab Emirates (UAE) was successfully adapted from a Bahrain model of nursing curriculum (Jayasekarea & Schultz, 2006). Rather than transplant the curriculum from Bahrain to UAE, the Bahrain curriculum served as a useful framework when the American University of Beirut established a nursing program in Abu Dhabi. Although the developed curriculum included the rigors expected of an American liberal arts institution, it was practical and relevant to UAE society. Because the Bahrain curriculum was used as a framework, it was culturally relevant, and thus, acceptable (Kronfol & Athique, 1986).

In the book *Analyzing Performance Problems*, Mager and Pipe describe a method of strategically identifying and addressing performance issues. These issues are referred to as 'performance discrepancies' because they highlight the gap between actual performance and desired performance. Seven possible reasons for performance discrepancies are identified.

1. Unaware of expectations
2. Lack the tools, space, or authority
3. Lack of feedback concerning performance quality
4. Punished for right actions
5. Rewarded for incorrect actions
6. Ignored for right and wrong actions
7. Knowledge deficit related to task or job (Mager & Pipe, 1997, p. 3)

Motivation & Teamwork

Individual Motivation

Motivation encompasses several themes. Farmer developed a framework that describes the key factors affecting the career and achievement motivations of the individual (Farmer, 1985). A

sense of collective achievement is important to the daily functions carried out in an intensive care unit (ICU). External to the ICU staff are the motivating factors of the facility.

According to social learning theory, learning and related behaviors are influenced by an individual's background, personal self-concept, and environment or social origin (Farmer, 1985). Part of a person's background is their cultural identity. Triandis describes this as a "cultural syndrome," defined as ''a pattern of shared attitudes, beliefs, categorizations, self-definitions, norms, role definitions, and values that is organized around a theme that can be identified among those who speak a particular language, during a specific historic period, and in a definable geographic region''(Triandis, 1996, p. 408). These cultural syndromes have been used to describe culture-level constructs; they can, however, be identified in an individual of a given culture.

Individualistic and collectivist aspects have been described in cultures. "Individualism is a social pattern associated with people's perceived independence from collectives and with personal preferences, needs, and goals. In contrast, collectivism is associated with people's perceived interdependence with collectives and with the preferences, needs, and goals shared with others" (Vodosek, 2009, p. 122). However, to classify a culture as uniquely individualistic or collectivist is to minimize the human aspects of different cultures.

Triandis further differentiated culture into either horizontal or vertical orientation. Horizontal orientation is defined as "an emphasis on equality and people's similarity on individual attributes, especially status" (Vodosek, 2009, p. 122). Whereas vertical orientation placed "an emphasis on hierarchy, an acceptance of inequality, and the assumption that rank has its privileges" (Vodosek, 2009, p. 122). Within both the vertical and horizontal orientations, individualism and collectivism has been observed. Examples of all four characterizations can be found in a given

subgroup. Culture affects the way an individual interacts with coworkers, superiors, and subordinates.

Horizontal individualism was characterized by individuals being distinct from the group and exhibiting a sense of self-reliance. However, despite this self-reliance, the individual does not strive to achieve a higher status than the group. Vertical individualism described individuals who are in competition for success and status. Conversely, groups that emphasized social cohesion characterize horizontal collectivism. And finally, vertical collectivism was the concept of sacrificing oneself for the benefit of the group (see Table 2.1).

Cultural Characterization	**Manifestations in Group Functioning**
Horizontal Individualism	Individual distinction from group & self-reliance Lack of interest in achieving higher status
Vertical Individualism	Independent actors in competition for status
Horizontal Collectivism	Social cohesion of group
Vertical Collectivism	Individual sacrifice to benefit group

Table 2.1. Adapted from Vodosek, 2009.

The interdisciplinary team of an ICU is comprised of individual staff members. Motivating factors for individuals to perform well within a team construct include a strong support system, professional respect and relationships, rapport within the team, and a desire to "work together for the patient's sake" (Simmons & Sherwood, 2010, p. 256). Additionally, mutual respect and learning were described as positively influencing work motivation. Feelings of respect were associated with recognition of understanding the roles and responsibilities of each team member, including the individual (Simmons & Sherwood, 2010).

The findings of Simmons and Sherwood must be interpreted cautiously. While this qualitative study may be representative of Emergency and NICU nurses in Texas, it may not be appropriate

to generalize the findings. Most of the literature on teamwork and components of an effective team were done in the United States. No studies were found assessing individual professional motivators or team motivators in the Middle East. Therefore, it is difficult to ascertain how those factors ultimately affect patient care delivered in Iraqi-Kurdistan.

Team Motivation

The typical environment of an Intensive Care Unit (ICU) has characteristics of high stress, a fast pace, and is highly technical. Efficient and highly effective teams are characterized by an interdisciplinary group of professionals working toward a common goal for the patient. The Institute of Medicine report, "To Err is Human," challenged ICU providers to deliver better, safer care (Institute of Medicine, 2000). In a systematic review of the literature, Reader, Flin, Mearns, and Cuthbertson identified common themes of team performance found in ICUs, and identified factors contributing to improved team performance as well as factors that hinder performance. Four factors have been associated with shorter hospital stays, less medical errors, and increased patient satisfaction. These include: team communication, team leadership, team coordination, and team decision-making (Reader, Flin, Mearns, & Cuthbertson, 2009).

Environments in which nurses were reluctant to report errors, patient concerns, poor information dissemination on newly admitted patients, and a lack of communication between clinicians were associated with an increased number of critical incidences (Reader, Flin, Mearns, & Cuthbertson, 2009). These factors characterize poor team communication. Conversely, characteristics of strong team communication include making clear and direct requests, closed loop communications, clearly communicating of the urgency of the patient's condition, and sharing information among all members of the patient care team (Reader, Flin, Mearns, & Cuthbertson, 2009).

However, providers often are not taught communication strategies that facilitate effective interdisciplinary communication. The Institute of Medicine estimates that 70% of adverse events occurring in US hospitals is related to miscommunication and poor working relationships (Greuber & Knebel, 2003). Ineffective communication combined with increasingly complex patients creates potentially increased risk to patients (Page, 2004). Neonatal and Emergency Department nurses in a Texas hospital were asked to describe highly effective teams. The important features of teamwork were a clear understanding of personal role and responsibility identification as well as a clear delineation of the roles and strengths of the other team members. Some factors that were associated with poor team functioning included "hierarchical information sharing, frequent interruptions, multi-tasking, and work overload." These factors were also associated with work dissatisfaction, high burnout, and turnover (Simmons & Sherwood, 2010, p. 258). Simmons and Sherwood recommended developing a standardized communication format (Simmons & Sherwood, 2010). The SBAR tool (Situation-Background-Assessment-Recommendation) is one commonly used for standardized communication in US hospitals to assist in relaying pertinent patient information to assure quality care (Kaiser Permanente of Colorado).

Motivation for Health Policy

Priority setting for healthcare in resource scarce countries is highly complex and challenging. There has been recent interest to promote rational priority setting focusing on cost-effectiveness analysis and burden of disease. A literature review described the process of priority setting for health interventions. Effective decision-making in health policy included dialogue between policy-makers and other stakeholders, including the public, to best approximate fairness (Youngkong, Kapiriri, & Baltussen, 2009).

According to the World Society for Pediatric and Congenital Heart Surgery (WSPCHS), the burden of congenital heart disease is great. Untreated congenital heart disease (CHD) has high morbidity and mortality. The estimated incidence of CHD is 8 per 1,000 live births, and 90% of cases are born in areas of the world with little to no access to care, resulting in high mortality. The high mortality rate has been attributed to a variety of factors including problems in diagnosing CHD, delayed referral, lack of surgical centers, high cost, shortage of trained specialists, "brain drain" of staff, and inadequate investment in health (Saxena, 2009). CHD for several decades has not been a high priority in developing countries, arguably rightly so, with high neonatal, infant, and childhood mortality from diarrheal diseases, respiratory infections, malaria, and malnutrition. However, as many countries are gaining wealth, some are able to shift their priorities to address the leading birth defect, CHD (Bernier, Stefanescu, Samoukovic, & Tchervenkov, 2010).

Saxena, a cardiothoracic surgeon in New Delhi, advocated for minimizing costs using a variety of mechanisms, including: timely intervention, surgical audits, and prioritization of cardiac care. Intervening in a timely fashion reduced costs because older children with cyanotic CHD often have protracted post-operative courses, complicated by bleeding and ventricular dysfunction. Repairing these children during infancy or early childhood circumvents these complications. Surgical audits allow for ongoing assessment and evaluation of outcomes and highlight areas for process and quality improvement. Additional cost cutting measures can be identified through audits and process evaluation (Saxena, 2009).

Saxena's third suggestion was to prioritize care to children who will likely have the best outcomes, directing resources away from lesions requiring multistage surgeries (Saxena, 2009). Other centers have emphasized the role of palliation rather than a complicated complete repair, citing that "palliation remains a life-saving tool in developing nations, much as it did in the early

years in the developed world" (Hewitson, Brink, & Zilla, 2002, p. 344). Palliation is a general term in cardiac surgery that describes a few different surgeries, including pulmonary artery banding and Blalock-Taussig shunt placement. The goal of palliation is to provide symptom relief without correcting the underlying defect (Backer & Mavroudis, 2003). Hewitson, Brink, and Zilla further state that palliation, because of its relative ease and low cost, would keep patients alive while government and international leaders improve the healthcare standards so that more extensive cardiac services can be provided (Hewitson, Brink, & Zilla, 2002).

Alternatively, Leblanc advocated for creating a climate for pediatric cardiac care, using the "KISS" approach—keep it simple and safe. He advocated for maximized resources to reach the most children. One aspect of the strategy included training all staff (surgeons, anesthesia providers, and nurses) abroad for up to one year. Upon their return, these staff members were responsible for developing protocols and checking equipment and materials prior to starting surgical cases (Leblanc, 2009). Leblanc and Saxena both recommend judicial use of invasive diagnostics as most cardiac lesions can be diagnosed with a non-invasive echocardiogram (Leblanc, 2009) (Saxena, 2009).

The differing positions of Saxena, Hewitson, and LeBlanc highlight some of the debate surrounding delivery of cardiac care services.

Resources

Prior to the 1970s the health care system in Iraq was considered by many to be one of the most efficient and sophisticated in the region (Voelker, 2004). Some sources site a progressive health care system into the 1990s (Aziz, 2003). Prior to UN sanctions, the health system budget was $540 million US (Aziz, 2003). In the face of three wars (the Iraq-Iran War, the Gulf War, and

Operation Freedom), the Saddam Hussein Regime began placing increased emphasis on military spending while decreasing spending on health care, education, and other public services(Voelker, 2004). In a post-Operation Freedom environment, the pharmaceutical industry is disorganized; and therefore, no countrywide drug policy in place (Voelker, 2004). It is a commonly held belief among the physicians and nurses that some medications are made poorly and are ineffective.

"Nurses are a crucial part of the healthcare workforce in terms of caring for patients, preventing illnesses, and promoting the health status of the nation" (Jayasekarea & Schultz, 2006, p. 209). Unfortunately, the profession of nursing in many countries, particularly developing nations, has not attained the professional status within the regional or national health systems. In Iraq one obstacle to developing nursing as a profession is the lack of a certifying nursing board. Once nurses have completed the educational requirement, they are eligible to work. Additionally, nursing as a profession has been historically undervalued. Rasmye Abd Al Sala, an oncology nurse, describes the training that nurses receive: "We spend 3 years in nursing school, but that is the equivalent of high school, so most nurses begin work at only 15 or 16 years old. There is no possibility of specialist training in, for example, cancer nursing" (Sansom, 2004, p. 144).

METHODS

Setting

Sulaymaniyah is in the Kurdish Region of Northern Iraq, two hours west of the Iranian border and eight hours north of Baghdad (355 kilometers). The population is estimated to be 1 million people (Sulaymaniyah Governorate, 2008). The Sulaymaniyah Center for Heart Disease (SCHD) opened in April of 2010. The hospital aims to treat children and adults with heart disease using surgical intervention. As of August 2010, the waiting list for adults needing heart surgery was over 400 patients long (Shehatha, 2010). The pediatric waiting list is over 4000 (Rasco, 2010). Kurdish and Arabic physicians and Kurdish nurses staff the SCHD.

The SCHD has two Operative Theaters (OR) and two cardiopulmonary bypass pumps. Surgery is performed five to six days a week (Saturday through Thursday). On most days, Dr. J performs one case. Occasionally, two cases were done in a day. Anesthesia, anesthetic nurses, scrub nurses, perfusionists, and junior surgeons comprise the surgical staff. Twenty to thirty people were involved in most OR cases. Following completion of surgery, the patients were transferred down the short corridor to the Intensive Care Unit (ICU).

The ICU has the capacity for six patients, although realistically, three ICU patients stretch their human and technical resources. Each bedspace is equipped with a cardiac monitor capable of invasive monitoring of two pressure lines. The monitors are linked to a central monitor. Additionally, three ventilators are available, two of which are reliable. The ventilators are capable of pediatric settings. Each bedspace also had access to central oxygen; however, the oxygen would often malfunction, necessitating changing patients to oxygen cylinders. There are a number of intravenous infusion pumps and syringe pumps for continuous infusions.

The ICU staff consists of nine nurses. Eight of the nurses graduated from nursing school within the last academic year. No licensing boards exist for medical professionals (physicians or nurses) in Iraqi-Kurdistan. Once a student has graduated they are able to practice and are placed by appointment into their nursing role. The Head Nurse, K, worked for two years in a Respiratory ICU in Baghdad prior to coming to the SCHD ICU. During the day shift (8AM-4PM), two nurses were on duty with K. The night shift (4PM-8AM) had two nurses also. K would generally stay until the post-operative patient from the day was stable. The night shift nurses would take turns sleeping during the night for three-hour stretches.

The Cardiac Wards are downstairs. The male ward houses five, and the female ward also houses five. Male children under the age of twelve stay in the female ward with their mothers. Three transport monitors were available and shared among patients. These bedspaces also had taps for central oxygen, but large cylinders were often brought into the wards when the oxygen spontaneously turned off.

Nine nurses staffed the cardiac ward. Three nurses worked the day shift and two the night shift. Eight of the nurses are new graduates as well; one had prior experience as a paramedic.

Invitation

Since 2007 I have been volunteering with the faith-based non-governmental organization, For Hearts and Souls (FHAS). The Medical Director, Dr. Kirk Milhoan, completed two tours of duty as a trauma physician during Operation Freedom in Iraq. During that time, he was involved in several goodwill missions hosted by the United States military. As a pediatric cardiologist, he screened thousands of Iraqi and Kurdish children for congenital heart disease with the permission of the regional and local government.

The general director of health in Sulaymaniyah, Dr. Rekwait H. Rashid Karim discussed with Dr. Milhoan plans to create a cardiac surgery center in Sulaymaniyah. Dr. Karim noted the inexperience of nurses to be one of the biggest challenges. A request was made for someone to train the nurses. Given my previous history of training nurses in post-operative cardiac ICUs in Mongolia and Kosovo, Dr. Milhoan asked if I would fulfill their request. I left for Sulaymaniyah, Iraq on June 1, 2010 and began working in the SCHD on Sunday June 6, 2010. I worked with the SCHD nurses for nine weeks developing a curriculum, and during the tenth week a FHAS surgical and cardiac catheterization team arrived.

Curriculum Development

I had worked with nurses in developing pediatric cardiac programs in Mongolia and Kosovo prior to arriving in Iraq. The issues facing the nurses are surprising similar in both countries. The nurses wanted to give good care to the patients, but often they were limited in their ability to do so due to lack of supplies, lack of assessment skills, and lack of autonomy. Common areas of knowledge deficit included awareness of normal pediatric vital sign ranges, patient assessment, pain assessment and management, and understanding of congenital heart disease.

On the first Sunday morning in a meeting with Dr. J, he told me his greatest concerns. Most of his concerns centered on patient safety issues related to an inexperienced staff. I shared with him what had been identified as knowledge deficits in other countries, and asked if those would be appropriate topics to cover. The feedback I received confirmed my suspicions. We discussed the benefits of bedside teaching with adjunct nursing conferences designed to cover specific topics related to nursing care and cardiac disease. Weekly conferences were planned.

During the first weeks there, I observed the practices of the ICU nurses and physicians as they recovered post-operative patients. I asked questions about the standard practices and patient management; I also attempted to gauge the staff's understanding of cardiopulmonary anatomy and physiology. Originally, I was planning to focus the curriculum content on pediatric cardiac conditions and post-operative management. However, after seeing that 80% of the patients were adults, I opted to cover the life span in order to expand the utility of the content for the nurses.

The heart hospital administrator, D, and Head Nurse K informed me of what they considered to be the knowledge deficits of the staff. K was very concerned that the nurses did not know cardiopulmonary resuscitation (CPR). Other suggestions included teaching basic nursing skills (i.e. suctioning, placing a urinary catheter, and chest tube management). I also asked the nurses of the ICU and the Cardiac Ward what topics interested them. Some of the requested topics were electrocardiography and cardiac and respiratory assessments. Taking into account my observations and the goals of the parties involved, the planned topics were:

1. Vital Signs, including Pain
2. Electrocardiography Interpretation
3. Medication Safety
4. Cardiac Repairs
5. Input and Output Balance
6. Cardiopulmonary Resuscitation
7. Infection Control

Classroom Environment

The weekly lectures were given on the first floor of the SCHD in the conference room, just outside the men's ward. The room was equipped with a projector, screen, large table, and several chairs. The room was air conditioned and comfortable. Extra chairs were brought in to

accommodate the nurses. Six nurses could comfortably sit around the table, and the others sat in a second semi-circle behind the nurses at the table. The conference time was set to be on Thursdays at 4PM for two hours.

K instructed the nurses to bring notebooks and pens to each conference. Nurses were informed of the conference content at the end of the previous conference or during the week prior to meeting.

Process of Curriculum Development

I developed the content of the conferences using a composite of online resources, bound textbooks, and electronic textbooks accessed through Emory University's eTextbooks. Each lecture required fifteen to twenty hours to develop. Each conference included a ten to twenty question post-test. Some test questions were found in textbooks, and I wrote others.

Implementation

Weekly conference sessions were planned. The conferences started during the fourth week on July 1. The prepared lecture notes were given to a clinical pharmacist on the Tuesday before the session, and she translated them from English to Arabic. The hospital administrator then translated the notes from Arabic to Kurdish. The administrator, D, came to each of the conferences. Samaritan's Purse provided me with an interpreter for the lectures. Over the course of ten weeks, I had two different interpreters; the second was a recent medical school graduate. The conferences were interpreted from English into Kurdish.

The format was consistent for each session. During the first session, I used the first fifteen minutes to ascertain the expectations of the nursing staff as well as to collect their ideas on desired topics. Then, I described my expectations for them and explained some of the overall

objectives of the summer conference. Over the next hour, we went through the prepared materials, and the post-test was administered during the last half hour of the conference. In subsequent weeks, we reviewed the previous week's post-test, and I encouraged discussion of problem questions.

Evaluation

The nursing staff was allowed and encouraged to work in small groups on the post-tests. The rationale being that in bedside nursing rarely is a nurse working independently to solve a problem. This was designed to foster teamwork practices that could extend to the bedside. This was deemed appropriate as nursing education is done in English in Iraqi-Kurdistan. Additionally within the Iraqi academic system, the minimal passing score is 50% (Fritz D. , 2010).

The planned evaluation included keeping a register of nurses' attendance and their grades on the post-tests. I also sought feedback from the head nurse, the other nurses (ICU and cardiac ward nurses), the hospital administrator who attended the lectures, and the surgeon. I asked specifically about pertinence to patient care and understandability of the content. The surgeon was asked about specifically observed behavior changes in the nurses.

I kept a daily journal detailing activities and events. This tool aided in identifying practice changes that took place. During the first four weeks before the conferences began, I noted specific nursing practices that were either actually harmful or potentially harmful to the patients.

Plan for Education Retention and Sustainability

Three of the sources used to prepare the conferences and teach at the bedside were left with the nurses in the ICU. This included a comprehensive pediatric textbook, a handbook of pediatric cardiac surgery, and a nursing drug guide. Additionally, four spiral bound copies of the

curriculum were left in Sulaymaniyah. The spiral bound copies included the lecture notes, PowerPoint slides, and the post-tests. The ICU, cardiac ward, and cardiac catheterization recovery area received a bound copy, and the fourth copy was given to the Samaritan's Purse Office in Sulaymaniyah.

Future teams are planned to return to the SCHD to continue the staff development programs.

RESULTS

Curriculum Contents

The curriculum was developed through lesions learned on previous trips, inputs from the head nurse and director, and feedback from the participating nurses. Prior to leaving for Sulaymaniyah, I planned for six separate lectures based on knowledge gaps previously identified in other countries. These included:

1. Vital Signs
2. Basic Assessment, with special focus on cardiac and respiratory assessments
3. Intake & Output Balance
4. Post-operative Pain Management
5. Medication Safety
6. Infection Control

The conference contents were discussed with and approved by Dr. J, the cardiothoracic surgeon. Head Nurse K ranked the following in order of importance:

1. Cardiopulmonary Resuscitation (CPR)
2. Suctioning, oral and endotracheal tube suctioning
3. Urinary Catheterization
4. Chest Tubes
5. Blood Glucose Protocol Use

During the first conference the nurses requested information on electrocardiography and physical assessment.

Initially, the conferences were planned to be held at 10 am on Thursday mornings. The first conference was to be on the third Thursday; however, due to a complication with the previous day's patient, the first conference was postponed a week. The first conference was held the following week. Unforeseen holidays, critically ill patients, and a nurse's strike delayed

conference proceedings. The plan of facilitating six conferences proved to be an overestimation. Three topics were covered during four different sessions. They included:

1. Vital Signs & Pain Management
2. Basic Electrocardiography (2 parts—Normal Sinus Rhythm and Common Arrhythmias)
3. Medication Safety

I prepared a fourth topic; however, due to the nursing strike and time constraints, the lecture was never given. The fourth topic covered the surgical indications, repairs, and post-operative complications that were being seen in the SCHD. The fourth lecture and post-test was included in the gifted bound copies that were left at the hospital at the end of the ten weeks.

Conferences Proceedings

All of the conferences took place in the month of July. The second topic, basic electro-cardiography, required two sessions. One week covered normal sinus rhythm, and the next session we worked through commonly seen arrhythmias. Even though the fourth topic, cardiac repairs, was never covered, it was recognized as a vital component for the nursing staff. Many were unaware of the underlying defect in their pediatric patients or the implications for surgery in both adult patients and pediatric patients. Time was spent at the bedside reviewing normal cardiac anatomy and explaining the pre-surgical condition of the patients with the nurses once the patient was stable. In the middle of the summer, the female nurses began seeking me out to ask questions about the patients' conditions. They inquired about proper patient management and prognostic indicators for the pediatric patients. They would also ask me to help them interpret the arterial blood gas (ABG) results of the patients. ABG interpretation was not included in the curriculum.

Attendance

The ICU nurses and the ward nurses were required to attend the conferences. Other nurses from the heart hospital were invited but not required to attend. These included the anesthesia nurses, the perfusionist nurses, and the OR nurses. One of the anesthesia nurses came to the electrocardiography sessions. Unfortunately, the conferences could not be opened up to staff hospital-wide due to space constraints.

Of the 18 nurses of the heart hospital, 14 came to the first session, including Head Nurse K. Five of the nurses completed all post-tests, 80% of these were ICU nurses. The ICU nurses had more consistent attendance. This was perceived to be due to shorter ICU stay when compared to the ward stay of the patients. Because surgery was not performed on Thursdays, often the ICU was empty by Thursday afternoon. A patient often stayed in the cardiac ward for a week or more post-operatively; therefore, it was more difficult for the ward staff to consistently attend the sessions. Eleven nurses, including one anesthesia nurse, took the electrocardiography quiz. Ten nurses attended the final conference topic, medication safety, and took the post-test.

Post-Test Scores

Vital signs and pain management were discussed in the first conference topic. The average score on the 11-question post-test was 6.6 with median score of 6.75. The second topic, electrocardiography, was the most complicated topic; however, the nurses scored well overall with a median score of 18 out of a possible 23. The nurses performed well on the final post-test, medication safety, with one nurse receiving a perfect score. The mean and median scores were 6.9 and 7 out of a possible 10, respectively (see Table 4.1).

Nursing Topic	Mean (total possible)	Median	Range (max, min)	Total Attendance
Vital Signs & Pain	6.6 (11)	6.75	(8.5, 4)	14
Electrocardiography	16.3 (23)	18	(21, 0)	11
Medication Safety	6.9 (10)	7	(10, 4)	10

Table 4.1. Mean, median & ranges of the post-test scores administered during a continuing education conference that was held during the summer of 2010.

Changes in Bedside Practice

During the initial surveillance which included chart audits and nursing practice observation, I noticed that even though the flow sheets the nurses used were very basic, they often were not filled in appropriately. One glaring omission was a lack of a recording of respiratory rate, one of the six basic vital signs. When I inquired, I heard several reasons from the head nurse about why it was not documented, such as "I can see if the patient is in distress by looking at him" and "I don't worry about respiratory rate. Two main things for ICU nurse: blood pressure and heart rate. If patient is tachypnic, the nurse will know because the [oxygen saturation] will go down."

These comments from the head nurse confirmed that a lecture on vital signs would be an appropriate place to begin. At the end of the vital signs sessions, I stated explicitly my expectations for practice changes. After several days of reminders about recording the respiratory rate, it began to be done. When I returned the next week after a weekend off, the respiratory rates were not being recorded. I tried to use consistent verbiage when requesting this vital sign to be recorded, such as, "It is a *vital sign*. It is important for patient safety to follow this." Reminders were unnecessary after three weeks because they were consistently doing this.

A commonly mismanaged post-operative problem is pain recognition and management. This became apparent on the first day. The first patient was an 8-year-old female undergoing atrial septal defect (ASD) closure. Her baseline heart rate was 100. When the first incision was made,

her heart rate increased to the 150s and remained there until she went on bypass. During the immediate recovery phase of most patients, neuromuscular blocking agents were used to maintain "sedation"; however, often the patients did not receive analgesia or sedation.

Particularly when managing the pediatric patients, the staff (nursing and many physicians) appeared to be unsure of how to manage the patients. Trying to ascertain their knowledge of basic pediatric management, I asked the head nurse and the head anesthesiologist what a normal heart rate for an 8-year-old would be. I received no answer.

Before and after the first session I asked questions about pain assessment and management. Some of the novice nurses seemed to recognize that patients were in pain. After the session, some were able to verbalize that elevated heart rate and blood pressure were often signs of pain. I encouraged the staff to relay these findings to the anesthesiologist or Dr. J. After a couple of days I realized the prescribed hierarchy was for the nurses to tell the head nurse, who would then relay the message on to the doctors if he saw fit. Carrying out this chain of command often took 1-2 hours. However, after a week of asking for analgesia for every patient, the surgeon started ordering "paracetamol four times a day" for all patients. (Paracetamol is the same as acetaminophen.) Even though this is not considered an optimal post-operative pain management strategy, it was a move in the right direction. The pediatric patients received more analgesia and sedation than the adults.

Case Study

On my fifth day, a 3-year-old girl, F, had a repair of coarctation of the aorta (CoA) with patient ductus arteriosus (PDA) closure. The primary post-operative complication of CoA repair is hypertension (Eliot, 2005). In my seven years of ICU experience, every child has come out of the OR on a continuous infusion of antihypertensive medication with an arterial line in place. In the

OR F's blood pressure was 178/xxx by cuff pressure. Consistent with standards of practice, an arterial line was attempted but mistaken inserted in a vein; therefore, ineffective to monitor arterial blood pressure (Eliot, 2005).

On arrival to the ICU, her cuff pressure was 201/127 (with mean arterial pressures of 159). There was much discussion between the anesthesiologist, Dr. M, and the head nurse about why this blood pressure was not possible. They decided the monitor was malfunctioning. A manual blood pressure was taken, giving a similar result. At this point it was determined that her hypertension was related to the noxious stimuli caused by the endotracheal tube, and she was extubated. She had previously showed no signs of readiness to extubate. She had minimal spontaneous respiratory effort, no attempt to open her eyes, and no post-operative blood gas. Following extubation, she showed signs of shock (poor capillary refill, poor extremity perfusion, and stridor).

Dr. J came into the ICU and placed a femoral arterial line, the invasive blood pressure read 141/96 (116). Several doses of midazolam (Versed), a dose of furosemide (Lasix) was given (0.5 mg/kg IV), along with trial doses of nitroglycerin. Two hours after arterial line placement, she was started on a beta-blocker continuous infusion (Esmolol) due to persistent hypertension. Her hypertension would continue through post-operative day five (POD #5). Ultimately she went home on 2 antihypertensive agents and a diuretic. This maintained her blood pressures to just under normal adult pressures, still considered hypertensive for a 3 year-old child.

On POD #2, the two ICU nurses working during the daytime asked if I knew why she was so hypertensive. I walked through the defect (CoA) and the repair with them; I then explained why

hypertension is a very common post-operative problem. The nurses seemed to understand and appreciate my explanation.

The following week Dr. M asked if it was normal for hypertension to be as severe as hers was. I explained that I had not encountered this in my experience. I mentioned that every CoA repair I had recovered came out of the OR on a continuous infusion of antihypertensive medication, and it is often discontinued by the next morning. He then asked if I thought she would have gotten better quicker had that happened. I responded there is no way of knowing what would have happened, but it was worth trying with the next CoA repair.

This case study describes some of the challenges to advancing nursing care in the SCHD.

DISCUSSION

My last day of working with the nurses in the Sulaymaniyah Center for Heart Disease (SCHD) was a Friday, the weekly holy day. The hospital pace on Fridays is much slower; many services, such as laboratory and consulting services, are not available. One of the junior cardiothoracic surgeons asked the surgical group to assist him in draining a pericardial effusion that had presented in clinic the previous day. The For Hearts and Souls (FHAS) team agreed to assist with the anesthesia and surgical technique of the surgery, with the understanding that the Kurdish nurses would recover the patient after surgery. A discussion occurred between the leaders of the FHAS and the Kurdish junior surgeon and anesthesiologist. The Kurdish nurses did not appear to be involved in the discussion. During my time there, consistently the physicians made the decisions, and Head Nurse K occasionally told the other ICU nurses about the decisions that affected them. The post-operative plan as agreed upon by anesthesia, cardiothoracic surgery, and the American team was that the Kurdish nurses would recover the patient. However on this day, the Kurdish head nurse did not come in; and therefore, no one informed the nurses of the agreed upon plan. I assisted the two Kurdish nurses in admitting the patient to the ICU from the OR because it was apparent that no one had told them they were recovering this teenage patient. In my discussions with the surgeon I told him it seemed as though the nurses had no information about this patient. He told me I should tell them what kind of surgery he had done. I replied that as the surgeon he knew better what he had done than I did; therefore, he should tell them. He then did.

This exemplifies the decision-making and communication challenges within the SCHD. The hierarchical structure of the hospital is unidirectional. On the morning of June 27, when there were no patients in the ICU, one of the female nurses, H, explained the kinds of interactions she had had with the physicians. If she questions a medication dosage that the physician ordered,

some respond, “Are you the doctor? Or am I the doctor?” or “You don’t need to worry. It’s not your concern.” Nurses fear punitive consequences to questioning a physician’s orders. On more than one occasion a medication error was made. The most potentially serious medication error during my stay occurred on July 12 when a 4-year-old was given the anti-arrhythmic amiodarone to treat sinus tachycardia. This medication was given IV push by an anesthesiologist, an inappropriate administration method. Additionally, this dangerous medication is indicated only for life threatening recurrent ventricular arrhythmias(Wolters Kluwer Health, 2009). Fortunately, the patient was not harmed from receiving this medication. Prior to the administration I questioned the use of this medication, the administering physician told me, “It was out of my hands.” Prior to this event, the medication safety session had been planned, but this reinforced the necessity of it.

Patient safety diligence must always be paramount. Avoiding medication errors is just one way to protect patients from harm. This is highlighted in a paper written by Sachs. In the article, a series of errors in judgments were describes that ultimately resulted in a stillborn child and emergency hysterectomy in a low-risk patient. Multiple point-of-view were presented, including the patient and her husband. The narrative uniquely demonstrated the complexity of the circumstances and highlighted several points of communication breakdown (Sachs, 2005).

Curriculum Content

The presented topics were strategically selected. When attempting to advance a system with so many areas of need, I chose to focus on a few foundational topics. The post-test questions attempted to measure critical evaluation and integration of the content in the lectures, rather than asking the nurses to memorize the slide content. Because these nurses were all graduates of nursing school, I worked to balance the content so that they were not “insulted” by the simplicity, but were also adequately challenged. Some of the nurses that believed the content was too

elementary and continued using deficient nursing skills. Others, however, embraced the content and were eager for more knowledge and skills to improve their practice, and ultimately, deliver better patient care.

The lecture on vital signs may have seemed elementary to some of the nurses; however, after the conference the nurses were given the tools necessary to improve patient care delivery. During the discussion on normal temperature ranges, I explained why all the patients were coming out of the OR hypothermic, I then addressed re-warming strategies. The nurses began to be proactive about warming the patients post-operatively. This simple nursing intervention of using one or more blankets equipped the nurses to take initiative in patient care.

The nursing staff requested course content on electrocardiography. I was hesitant to include it in the lecture series because of its complexity. After much deliberation, I included it. I wanted to involve the staff in the content design. I designed the lecture originally to be delivered in one session, however it took two. Even though the staff seemed interested in this topic and did better on this post-test than the others, I question its inclusion in the curriculum. Because it took two sessions (3.5 hours) to cover, the time could have been spent more economically on a topic that was clinically relevant for the work they are expected to do, such as infection control practices.

After observing their clinical nursing practice and understanding the expectations of nurses in SCHD, I designed the curriculum to address the things they were doing every day. They were recording vital signs, administering medications, and recognizing abnormal rhythms. When Head Nurse K and I originally spoke, he thought cardiopulmonary resuscitation (CPR) was the most important topic to teach. I agree that while an understanding of CPR is crucial to an ICU, it should not be the most critical component. I wanted to teach assessment skills that would enable

the nurses to recognize danger signs and decompensation in patients prior to cardiac or respiratory arrest. When teaching CPR it is important for participants to be able to practice their skills (compressions and ventilation). We did not have access to manikins to facilitate such practice. I did observe a cardiopulmonary arrest during my time there. The unidirectional hierarchical structure of SCHD is conducive to a smooth resuscitation. For these reasons, a CPR conference seemed to be a fruitless venture, and therefore, was not done.

Negotiating the educational priorities was challenging. The newness of the specialty in Iraq combined with the novice nurses resulted in significant knowledge gaps that needed to be filled. Head Nurse K agreed that it was unlikely I could teach all the nurses everything they needed to know about cardiac surgery and recovery. Ultimately, K acquiesced to my planning strategy. I am unsure of his motivation to resign to my plan. Possibly, he was agreeing with my decision-making process. However, within this culture individuals are expected to defer to anyone with perceived authority over them without question. This could be his motivation. Alternatively, it also could have been a result of an unidentified language barrier.

Strengths

Introduction of an outsider with current knowledge of modern cardiac care demonstrate and teach more updated skills and critical thinking challenged the current practices and generated discussion of quality patient care. One of Saddam Hussein's early strategies to minimize the Kurds was to debilitate their educational structure. Books and publications were prevented from entering the country, and students and professional were not allowed to travel internationally for conferences, meeting, or postgraduate education (Husni, Taylor, & Koye, 2006). This lack of access to best practice research led to the continuation of out-dated practices.

An American nursing educator living in Iraqi Kurdistan stated, “often the Kurds will disagree with you at first, but a couple of weeks or months later, you’ll see them doing what you had originally suggested” (Fritz D. , 2010). This was demonstrated to me in late July. During rounds in the cardiac ward each patient had a paper posted with three hand-written columns: one for intakes, one for outputs, and a third for balances. This was a new addition to the charting that had been done up to this point. When I complimented the nurse responsible for making the sheets, he told me, “This was your idea.” I had mentioned it in June. I cite this as a strength because behavior change toward best practice was made.

Limitations

Several limitations of the curriculum specifically, and the program in general, made the achievement of the goals difficult to obtain. On my first day in the hospital, the surgeon expected me to start teaching right away. As a surgeon trained in Australia, he assumed that the staff would be open to my instruction. He did not introduce me or state why he had asked me to come or what his expectations were for what the staff would gain from my experience. Based on the hierarchical nature of the culture, I realized that having Dr. J validate my presence by clarifying his expectations for the nurses and describing my credentials would be integral to the success of the program. Two weeks after I had been there I discussed this with Dr. J. However, apparently he felt this was not a priority, so he never did this.

Twelve of the eighteen nurses (ICU and cardiac ward) valued my input and guidance, however, the head nurse believed much of it to be unnecessary. Another limitation is the inability to monitor and evaluate long-term retention and practice changes. The FHAS teams will return periodically, one to two times per year, to assist in expanding the surgical team’s ability to perform pediatric heart surgery and to recover them safely. This will address the question of

long-term retention of good nursing practices at least in part, although not perfectly. The ultimate nursing goal is that a nurse would change his or her practice and professional course based on differences they observed in my style of care delivery. I encouraged the nurses to seek out best practice information and question the physicians and surgeons for explanations of poorly understood concepts. I explained that in my nursing culture it was inappropriate for me to not ask questions if there was something I did not understand. I also took more time with patients and their families answering questions and addressing their concerns. Several nurses mentioned to me that they noticed that the patients really liked me and liked that I talked with them so much.

Due to the lack of complete buy-in of all partners (nurses and physicians), the sustainability of the initiatives is in question. To mitigate this, textbooks, handbooks, and curriculum were left with instruction that it would remain in the ICU where all staff could have access to it. Additionally, the cardiac ward staff was also given a spiral bound copy of the curriculum.

Recommendations

The vision of the World Society for Pediatric and Congenital Heart Surgery (WSPCHS) is that "every child born anywhere in the world with a congenital heart defect should have access to appropriate medical and surgical care" (Tchervenkov C. I., et al., 2008p. 64) . The WSPCHS supports models encouraging collaboration with national staff through training and education, stating, "The best models need to be supported, encouraged and expanded . . . . Global improvement of care for patients with pediatric and congenital disease will require the systematic mobilization of health care professionals in the spirit of cooperation and teamwork" (Tchervenkov C. I., et al., 2008p. 66).

The WSPCHS focuses much attention on improving accessibility of pediatric cardiac care, but their position paper only briefly mentions the need for adequate post-operative nursing care and

ancillary staff. In my experience there are often wide experience, educational, and status gaps between physicians and nursing staff. Advancing nursing practice needs to be a priority rather than an after-thought.

As different governmental and non-governmental organizations move to advance pediatric cardiac care around the world, a commonly identified obstacle is inadequate nursing care for the children. In Iraq the lack of a professional licensing exam and professional board of nursing leaves individual nurses, as well as nursing as a profession, with limited access to advancement and development of nursing practice. Of those I worked with, the majority of nurses verbalized interest in advancing their nursing practice. This can be achieved in a variety of ways. One is for other foreign nurses to come and teach the nurses at the bedside.

Reproducing the methods described here will help to sustain their knowledge retention and encourage better nursing practices at the bedside. Another option, which is being considered by the hospital administration, is selecting promising nurses and physicians and sending them out of Iraq for training in developed centers abroad. One identified limitation is that when nurses are trained outside of their institution, they are exposed to resources and technology that are not available in their home country; therefore, applicability is questioned. There is also the risk of attrition if nurses decide not to return home.

As the Sulaymaniyah Center for Heart Disease moves forward, teaching done in country and at the bedside should focus initially on the fundamentals of nursing practice. Practice changes were observed over the ten weeks, a short time to observe practice changes. The nurses of SCHD, led by Head Nurse K, want patients to receive appropriate care. Unfortunately, due to limited access to current literature, they do not know what appropriate care is. Future nursing educators looking

to advance nursing care in this context should be prepared to consistently model good nursing practice and defend best practice with a strong understanding of the nursing and medical literature. This understanding is important for educating the staff, but also for recognizing that in various situations best practice is not followed. The key is teasing out suboptimal practice from dangerous practice and addressing dangerous practices first.

Recommendations for receiving institutions include a clear delineation of expectations from the visiting educator as well as for the staff. As a result of this absence, the staff was unclear about my role and this may have led to unnecessary tensions between the staff and me. On a few occasions I was asked if I were going to change all 3000 nurses in Iraq. This seemingly rhetorical question demonstrated to me there was not a clear understanding of my role and what was expected of them. As previously mentioned, clear introductions and role identification by a key authority figure would help mitigate these tensions. Additionally, the receiving institution should consider giving the visiting nursing educator authority to direct practice changes.

Within SCHD, simple clinical changes could be made to move them closer to meeting best practice standards; however, the resistance I experienced made each practice change attained difficult. Recognizing that pediatric congenital heart disease and its management is an evolving science, SCHD would benefit from openness to change and adaptation of care practices.

"We have learned, as have others, that to develop a culture of safety, we must be open about our mistakes" (Sachs, 2005, p. 838). Several studies describe effective teamwork and communication as being instrumental to reducing medical errors and improving patient safety (Sachs, 2005)(Reader, Flin, Mearns, & Cuthbertson, 2009)(Simmons & Sherwood, 2010). Both Sachs and Reader et al. stress the importance of structured dialogue addressing patient care issues and

provider concerns (2009)(2005). In the SCHD for nurses to able to voice concerns, a condescending and punitive environment must be avoided.

Sachs also highlights the importance of case review. Cases are reviewed through the lens of identifying breakdowns in optimal care. The quality improvement committee then adapts these care breakdowns into "lessons learned." These are then modified into educational opportunities to improve the process of care, rather than be punitive (Sachs, 2005).

Personally, even though my ten weeks in Iraq were the most physically and emotionally challenging weeks of my life, my support system in Iraq as well as back home was immensely important. The country director of Samaritan's Purse (SP) Kurdistan office, with 40 years experience working in the Middle East, was an invaluable resource to me in understanding the culture. Initially there was concern that SP had not informed the SCHD administration of my presence in country. However, this was not the case. SP had ongoing dialogue prior to my arrival and during my stay with the administration and the surgeon. Details of these conversations were relayed to the staff. As previously mentioned, failure to communicate with the staff resulted in misunderstandings and confusion among the nursing and physician staff.

Additionally, having "easy" Internet access, via Skype, to my family at home and my thesis advisor helped me stay focused, thinking about the experience beyond my ten weeks in Iraqi-Kurdistan. Strategic analysis, ongoing flexibility, and feedback from my advisor allowed me to move forward in this project.

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APPENDIX A: CONTINUING EDUCATION CURRICULUM FOR CARDIAC INTESIVE CARE NURSES IN SULAYMANIYAH, IRAQI-KURDISTAN

Lesson 1: Taking and Interpreting Vital Signs (VS)

Lesson 2: Electrocardiogram (ECG) Interpretation

Lesson 3: Medication Safety

Lesson 4: Adult and Pediatric Cardiac Repairs

Lesson 1: Taking and Interpreting Vital Signs (VS)

Objectives

1. Identify acceptable age-appropriate VS.
2. Describe proper interval at which VS should be taken in the immediate post-operative setting, intensive care setting, and the ICU step-down setting.
3. Demonstrate ability to take a full set of VS, including heart rate (HR), blood pressure (BP), respiratory rate (RR), pulse oximeter (pulse ox), temperature, and pain score.
4. Begin to understand 3 of the pain scales that are available for use in different patient populations.
5. Interpret VS and recognize when outside of acceptable limits.

PART ONE: AGE-APPROPRIATE VITAL SIGNS

6 Components of a complete set of vital signs:

1. Heart Rate
2. Respiratory Rate
3. Blood Pressure (cuff & arterial, if available)
4. Pulse Oximeter

5. Temperature
6. Pain Score

Heart Rate, Respiratory Rate, & Blood Pressure by Age

Age	Heart Rate (beats/min) [average]*	Respiratory Rate (breaths/min)^	Blood Pressure (mmHg)#
Newborns	100-170 [120]	30-55	65-85/45-55
6-12 months	80-130 [110]	25-40	80-100/55-65
1-2 years	80-130 [110]	25-40	90-105/55-70
2-6 years	70-120 [100]	20-30	95-110/60-75
6-10 years	70-110 [90]	16-22	100-120/60-75
10-17 years	60-100 [85]	16-20	110-135/65-85
Adult	60-100 [85]	12-18	110-135/65-85

Helpful hint for remembering normal BP for child >1 year old: 70 + (2 x age in years) = acceptable low systolic limit.
Ex: 8 year old

Normal BP = 70 + (2 x 8) = 70 + 16 = 86 mmHg systolic

Temperature & Pulse Oximeter

Normal limits of temperature and pulse oximeter do not vary much across the life span. Therefore, for the purposes of the post-operative patients, the acceptable temperature range is between 36.0 and 37.9 °C. If the patient's temperature is greater than 38 °C, this patient is febrile. Commonly in the post-cardiopulmonary bypass state patients are mildly hypothermic (<36 °C). These patients should be warmed passively with blankets.

A healthy, non-smoker patient should have a pulse oximeter reading >98% regardless of the age of the patient. Many textbooks state that if the pulse oximeter reading is <96%, supplemental O_2 should be given. In the post-operative setting, common practice is to provide supplemental O_2 for oxygen saturations <93%.

Pain Score

Several pain scales exist for use in patients of all age groups from newborns to the elderly and all levels of communicativeness from fully awake and talking to non-verbal at baseline. We will cover many of these pain scales in a future lecture, but today I will present three of the most commonly used scales in the pediatric post-operative setting: FLACC scale, the CRIES scale, and the Faces scale. Even though these pain scales were developed for the pediatric population, they can still be used to assess pain in patients of all ages. This is especially true of the intubated patient. Additionally, it is important to note that the use of chemically paralyzing agents (i.e. vecuronium, pavulon, rocuronium, and cisatricurium) make the assessment of pain more difficult. The only tools available to the clinician are vital signs and presence of tears.

The FLACC scale

The FLACC scale is a five-part scoring tool with possible pain scores from 0-10. Zero indicating comfort and 10 indicating severe pain. Analgesia should be administer for scores >3.

Categories	Scoring		
	0	1	2
Face	No particular expression or smile	Occasional grimace or frown; withdrawn, disinterested	Frequent to constant frown, clenched jaw, quivering chin
Legs	Normal position or relaxed	Uneasy, restless, tense	Kicking or legs drawn up
Activity	Lying quietly, normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid, jerking
Cry	No cry (awake or asleep)	Moans or whimpers, occasional complaint	Crying steadily, screams or sobs; frequent complaints
Consolability	Content, relaxed	Reassured by occasional touching, hugging, or being talked to; distractible	Difficult to console or comfort

Interpreting the Behavioral Score:

0 = Relaxed and comfortable

1-3 = Mild discomfort

4-6 = Moderate pain

7-10 = Severe discomfort or pain or both

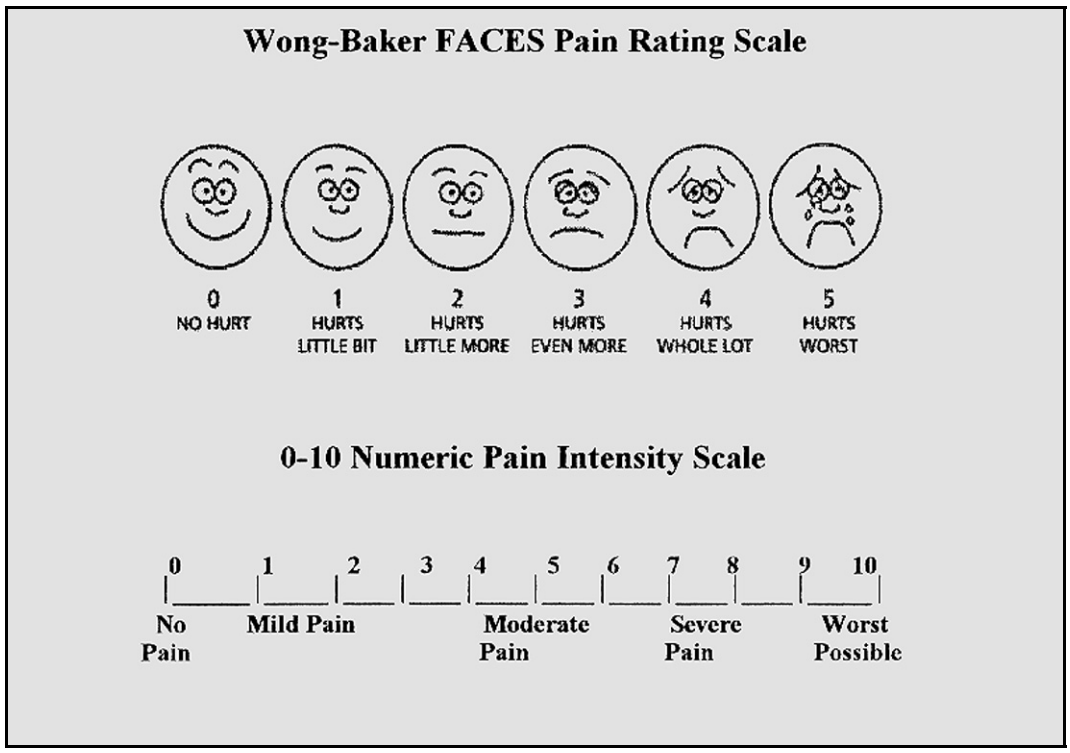
The CRIES scale

This scale was developed to evaluate neonatal postoperative pain; however, I like that it is concrete in its assessment of pain. I find it to be a useful tool for practitioners learning to assess and treat pain appropriately. Similar to the FLACC scale it consists of a 0-10 scoring system. Again, the patient should be treated for pain for scores >3.

Categories	Scoring		
	0	1	2
Crying	No	High-pitched	Inconsolable
Requires O_2 for saturation >95%	No	Less than 30%	Greater than 30%
Increased Vital Signs	HR & BP equal to or less than preoperative value	HR & BP increased less than 20% of preoperative value	HR & BP increase greater than 20% of preoperative value
Expression	None	Grimace	Grimace/grunt
Sleeplessness	No	Baby wakes at frequent intervals	Baby is awake continuously

The Faces scale

The Faces scale is useful for patients 3-years-old and older. Following a brief explanation of what each of the faces represent, ask the patient to point to the face that most closely describes their experience of pain. As with the other two scales, pain greater than 3 should be treated. Do not to compare the patient's facial expression to the Faces scale; this tool is to be used by the patient. If the patient cannot respond verbally to the nurse, do not use this pain scale.



Central Venous Pressure (CVP)

CVP is an indicator of the fluid status of patients by measuring the right atrial pressure and right ventricular preload. A normal range of CVP is between 0 and 8. It is often helpful to follow the trend of the CVP rather than look at one value. Low CVP is an indicator of inadequate filling of the right atrium. This can be caused by hypovolemia, vasodilation, or any other condition that decreases blood flow to the heart. High CVP is an indicator of inadequate ejection, or emptying. Common causes are hypervolemia, vasoconstriction, right-sided heart failure, or pulmonary hypertension.

PART TWO: INTERVAL FOR ASSESSING VITAL SIGNS

The desired interval for assessing vital signs is variable based on the preference of the physician and surgeon. Generally in an intensive care unit, postoperative vital signs are recorded every 15 minutes for the first hour, then every 30 minutes for the second hour, and hourly thereafter. The

frequency of recording vital signs can be increased if the patient's condition warrants it, but should never be recorded less frequently. All vital signs should be recorded every time, including pain score.

A common question asked is, "If I am looking at the patient and the monitor continuously, why do I need to record the numbers?" Recording the numbers allows other caregivers to understand the patient's postoperative course quickly, and it also allows all caregivers to opportunity to follow trends in the patient's condition.

PART THREE: TECHNIQUE & PRACTICE

The equipment needed to measure vital signs includes a watch with a second hand, a stethoscope, an appropriately sized blood pressure cuff, and a pulse ox.

Heart Rate

In the postoperative cardiac patient, monitoring the heart rate frequently is important. The heart rate is an indication of possible arrhythmia, shock, and pain. In adults counting a distal pulse for 15 seconds and multiplying by 4. If the pulse rate is irregular, count for a full one minute. In children, it is best to count the pulse rate at the apical impulse. Again, if the pulse is irregular, count for a full minute.

Infants and children's heart rate are more variable, this is normal. Adults are able to increase their cardiac output by both increasing their heart rate and also increasing contractility. Infants and children are only able to increase their heart rate.

Respiratory Rate

To measure the respiratory rate in adults, watch the chest rise and fall for 15 seconds, then multiply this by 4. This results in the number of breaths per minute. Or alternatively, for 30 seconds if the respiratory rate is not regular. Measuring the respiratory rate in a child requires a slightly different approach. Because of the infants and young children (<6 years) use the diaphragm as their primary breathing muscle, respirations are easiest to measure by watching the rise and fall of the abdomen. Additionally, because infants normally breathe irregularly, it is best to count respirations for one full minute. Another method for measuring respirations is to lightly rest one hand on the thorax of an infant or small child and count the feel of the rise and fall. Yet another method is to listen for inspiration with a stethoscope. All of these techniques are effective in measuring the respiratory rate in infants and small children. The different technique may work better in different patient situations, all are acceptable; and all should be done for a full minute.

Blood Pressure

One of the most commonly made errors in measuring blood pressure is choosing an inappropriately sized blood pressure cuff. If the cuff is too small, the blood pressure will read falsely high. And if the cuff is too large, it will read falsely low. The bladder of the cuff should cover about 40% of the upper arm. When the cuff is wrapped around the patient's arm, the bladder length covers 80-100% of the arm's circumference and 50-75% of the upper arm's length.

Later on in the summer we will talk more about what it could be an indication of when there is a discrepancy between an upper extremity blood pressure and a lower extremity blood pressure.

Lesson 2: Electrocardiogram (ECG) Interpretation

Objectives

1. Identify components of electrocardiogram (ECG).
2. Explain the relationship between mechanical and electrical events in the heart.
3. Interpret the basic arrhythmias generated from the sinoatrial node, atrioventricular node, atria, and ventricles.
4. Describe appropriate interventions for common arrhythmias.

Part One:

What does the ECG tell us?

Electrocardiogram (ECG) gives us a visual picture of the electrical conduction through the cells of the heart. The heart has the ability to generate its own electrical activity. This is called automaticity. The cardiac cycle is composed of both electrical and mechanical action. The electrical activity is divided into a depolarization and a repolarization phase. The mechanical response of the heart is divided into systole and diastole.

> Depolarization: "active phase of electrical activity, associated with systole."
>
> Repolarization: "resting phase, associate with diastole" (Woods, 1997, p. 38).

How are electrical impulses passed through the heart?

The normal conduction pattern starts in the top of the right atrium at the sinoatrial node (SA node). The current then travels down to the atrioventricular node (AV node) through the intermodal tracts. The impulse then travels down the Bundle of His. The Bundle of His is in the upper third of the ventricular septum of the heart. From there, the impulse splits between the right bundle branch and the left bundle branch. The impulse enters the left bundle branch first to allow more time for depolarization of the left ventricle. This is because the left ventricle is a

larger muscle than the right ventricle. From the bundle branches, the impulse is carried deep into the ventricles through the Purkinje fibers.

Each point along the pathway from the SA node to the Purkinje fibers is able to generate its own rhythm. In an adult, the intrinsic (natural) rate of the SA node is 60-100 beats per minute. The intrinsic rate of the AV node is 40-60 beats per minute. And the intrinsic rate of the Purkinje fibers is 15-40 beats per minute.

Image 1. Cardiac Conduction.

How does electrical activity relate to mechanical contraction?

The electrical activity of the heart precedes mechanical contraction of the heart. Following SA node firing, the right and left atria contract. While the atria are contracting the impulse is traveling down through the AV node, bundle branches, and Purkinje fibers. After the Purkinje fibers are triggered, the right and left ventricles contract.

It is important to note that the presence of electrical activity does not necessarily mean the heart is contracting. What are the signs of a pumping heart?

Part Two: ECG Basics

An ECG complex consists of 5 waveforms labeled P, Q, R, S, and T. The middle 3 letters are collectively called the QRS complex.

P Wave

The P wave represents atrial depolarization or conduction of the electric impulse through the atria. There are several characteristics of the P wave that should be noted.

1. Location: precedes the QRS complex
2. Amplitude: 2 to 3 mm high
3. Duration: 0.06 to 0.12 seconds
4. Configuration: usually rounded and upright

The PR Interval

The PR Interval is a tracing of the impulse from the atria through the AV node, bundle of His, and right and left bundle branches. The most important thing to note about the PR interval is the length. Measure from the beginning of the P wave to the beginning of the QRS complex. A normal PR interval is 0.12 to 0.2 seconds.

The QRS Complex

A QRS complex should follow every P wave and represents ventricular depolarization. The following are characteristics of the QRS complex:

1. Location: follows the PR interval
2. Amplitude: 5 to 30 mm but differs in depending on the lead chosen
3. Duration: 0.06 to 0.1 seconds (half of the PR interval). This is measured from the beginning of the Q wave to the end of the S wave.
4. Configuration: Q wave follows the P wave (the first negative wave following the P wave), R wave follows the Q wave (the first positive wave following the Q wave), the S wave follows the R wave (the first negative wave following the R wave). All 3 waves may not be seen all the time.

The ST Segment

This segment follows the QRS complex and represents the end of ventricular contraction and the beginning of ventricular repolarization or relaxation. ST segments have different characteristics than the other parts of the ECG.

1. Location: follows the S wave to the beginning of the T wave
2. Deflection (directionality): usually isoelectric (neither positive nor negative)—this line is not far from the baseline of the ECG.

The T Wave

The T wave represents ventricular recovery or repolarization and has the following characteristics:

1. Location: follows the S wave
2. Amplitude: 0.5 mm in leads I, II, and III and up to 10 mm in the precordial leads
3. Configuration: typically rounded and smooth
4. Deflection (directionality): upright in the leads I, II, and V_3 and V_6; inverted in lead aV_R

The QT Interval

This interval measures the time of ventricular depolarization and repolarization. The QT interval is variable depending on the heart rate of the patient. The following characteristics should be noted:

1. Location: from the beginning of the QRS to the end of the T wave
2. Duration: varies based on age, sex, heart rate; usually from 0.36 to 0.44 seconds and should not be greater than half of the distance between consecutive R waves when there is a regular rhythm

The U Wave

U waves are not seen in all ECGs, but when they are noted they have the following characteristics. The configuration is most important.

1. Location: follows the T wave
2. Configuration: typically upright and rounded
3. Deflection (directionality): upright

Part Three: ECG Interpretation 8-Step Method

1. Determine atrial and ventricular rhythm using a paper and pencil. The P-P intervals should be equal, and the R-R interval should be equal. Measure from the beginning of one P wave to the beginning of the next P wave. Determine whether the atrial rhythm is regular or irregular. Then repeat with the R-R interval.
2. Determine the rate. Using a 6-second strip (30 large boxes), count the number of P waves and multiply by 10. This gives you the heart rate.
3. Evaluate the P wave based on the above criteria.
4. Determine the duration of the PR interval as discussed above.
5. Determine the duration of the QRS complex.
6. Evaluate T waves.
7. Determine the duration of the QT interval.
8. Evaluate any other components. Look for beats of different shapes, ectopic beats. Also, evaluate the ST segment.

Using the above information, determine the rhythm. Some questions to ask include:

1. Where does the rhythm start from?
2. Is the rhythm regular or irregular?
3. Is the heart rate fast, slow, or normal?
4. Any rhythm abnormalities?

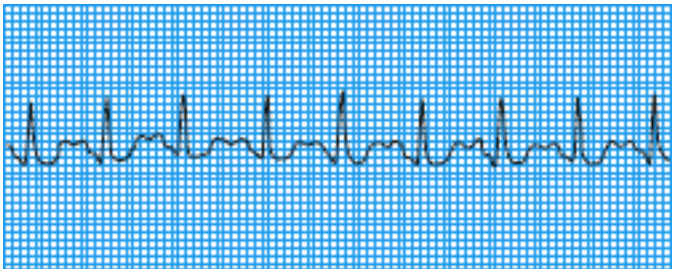
Normal Sinus Rhythm

1. Atrial rhythm:
2. Ventricular rhythm:
3. Atrial rate:
4. Ventricular rate:
5. P wave:
6. PR Interval:
7. QRS Complex:
8. T wave:
9. QT Interval:
10. Other:
11. **Interpretation:**

Part Four: Introduction to Arrhythmias

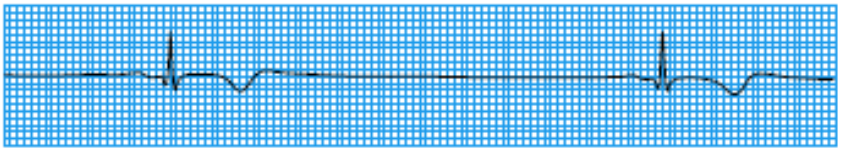
We will not be going over all of the arrhythmias that can be seen in the ICU today. There are many different rhythms and they can be very complex. Today we will talk about some of the easier to recognize arrhythmias. In my nursing practice, it is not uncommon for me to see a rhythm that I cannot completely interpret. In these times, I let the physician know that the patient is having an arrhythmia, but I am not sure what it is. Often I will describe it to the best of my ability and show them a print out of the rhythm.

Sinus Tachycardia



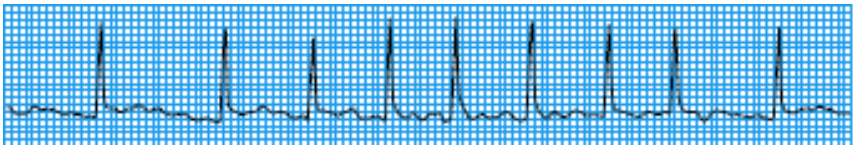
This rhythm is like normal sinus rhythm but faster. This results from an increase in the SA node. The intervals will all be appropriate lengths. There will be one P wave for each QRS complex and one QRS complex for each P wave. This is commonly seen in patients who have pain, are dehydrated, or have a fever.

Sinus Bradycardia



This rhythm is like normal sinus rhythm but slower. This results from a slowing of the SA node. The intervals will be appropriate lengths. There will be one P wave for each QRS complex and one QRS complex for each P wave. Sinus bradycardia is common in athletes and during sleep.

Atrial Fibrillation



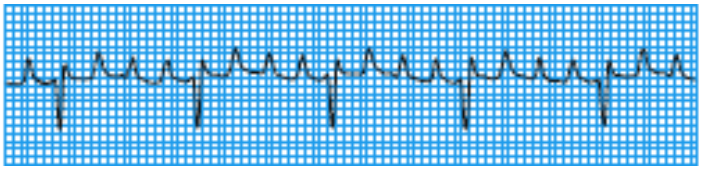
Atrial fibrillation is the most common fast arrhythmia in adults. In atrial fibrillation the rhythm is not regular. Atrial impulses are being generated from within the atria but outside the SA node. Because the impulse does not start in the SA node, there are no true P waves. The atrial rate is

very fast (250-300 per minute). The ventricular rate can be fast or slow, but the QRS complexes are often of normal length.

Treatment options:

1. Medications: Calcium channel blockers (diltiazem and verapamil)
2. Synchronized cardioversion 0.5 to 1 J/kg—in adults a common starting Joules levels is 100 Joules. Prior to cardioversion of atrial fibrillation, blood thinning agents should be given. This is because emboli can form in the atria during atrial fibrillation that can be sent to parts of the body following cardioversion.

Atrial Flutter

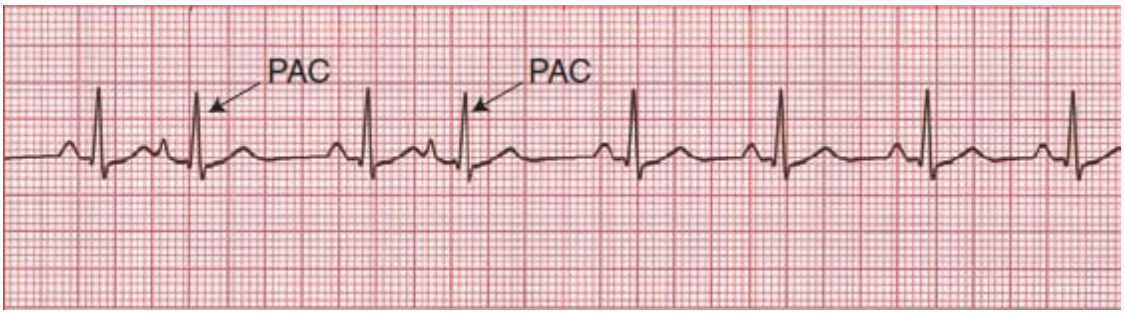


Atrial flutter is the second most common fast arrhythmia in adults. The AV node conducts the ventricles rhythm at different rates. There may be 2 flutter waves to each QRS complex or 4 flutter waves to each QRS complex. In this example, there are 3 flutter waves to each QRS. The atrial rate is often very fast (250-350 beats per minutes). The flutter waves have a saw-tooth appearance. Often the ventricular is regular, but it may be irregular. The QRS complexes are usually normal but may be wide is flutter waves are buried in them.

Treatment options:

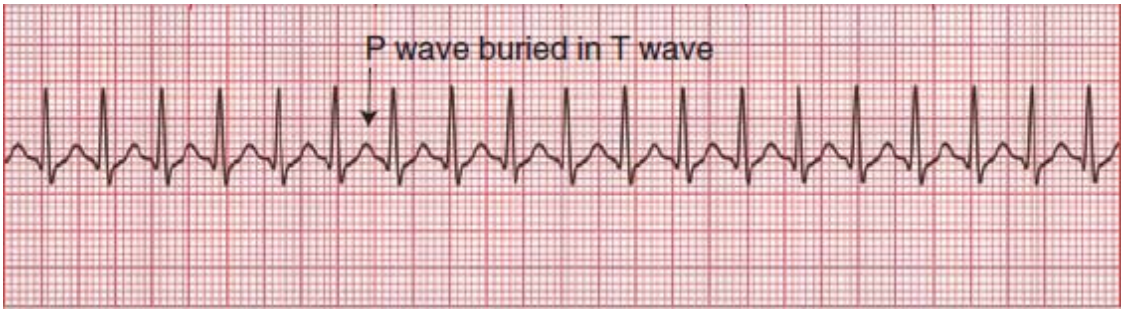
1. Medications to slow the SA node include calcium channel blockers or beta-adrenergic blockers
2. Rapid atrial pacing to end the flutter waves.
3. Synchronized cardioversion 0.5 to 1 J/kg—in adults a common starting Joules levels is 100 Joules.

Premature Atrial Contraction (PAC)



A single QRS complex occurs before expected in a PAC. Normally, following the PAC, normal sinus rhythm resumes. The rate depends on the underlying rhythm. PACs will have a P wave, but it may be a different shape than the other P wave. Most often no treatment is necessary if the electrolytes are normal.

Supraventricular Tachycardia (SVT)

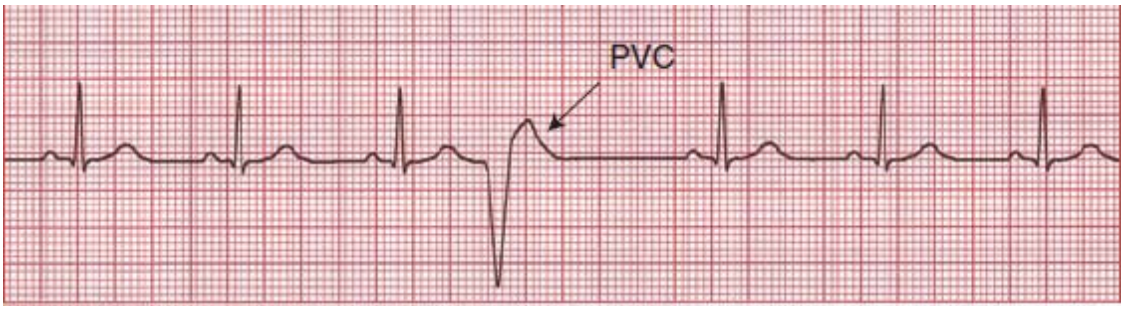


The rate in supraventricular tachycardia is very fast. This rhythm is regular and the P wave can be buried within the T waves making them difficult to see. Rates can be anywhere from 150-300 beats per minute. This rhythm is starts in the atria. This is not a ventricular rhythm.

Treatment options:

1. Vasovagal maneuvers: blowing in a straw or bearing down.
2. Medication: Adenosine rapid IV push using a 3-way with normal saline flush.
3. Synchronized cardioversion: 0.5 to 1 J/kg

Preventricular contraction (PVC)

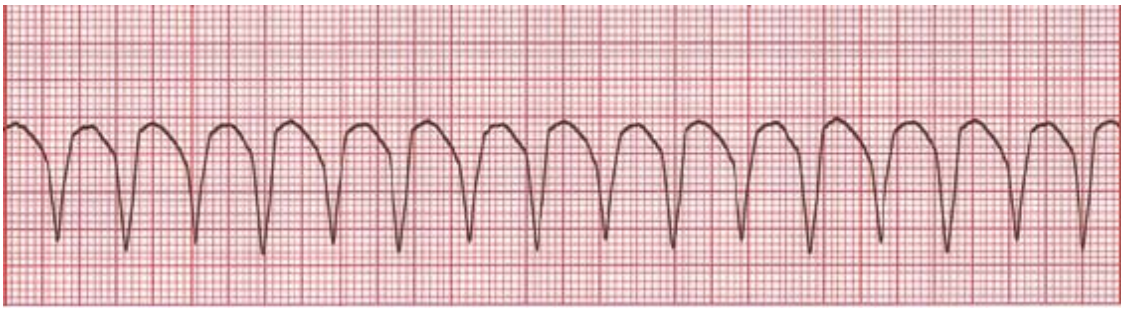


PVCs are triggered from within the ventricles. They do not have P waves, so there is no PR interval to measure either. PVCs are wide complex and have a strange appearance. Often because they occur before the ventricles are full, they do not generate a pulse. You can see this on both the arterial line and the pulse oximeter waves. There is a missing pulse. If the electrolytes are normal, they are often left untreated.

Special PVCs:

1. Bigeminy: a PVC every other normal beat
2. Trigeminy: a PVC every third normal beat
3. Couplet: 2 PVCs in row.
4. There is a special name for 3 or more PVCs in a row. What is this name? (Ventricular tachycardia)

Ventricular Tachycardia (VT)



Venticular tachycardia is a wide complex fast rhythm. The rate can be from 150-300. There are no P waves. Patients can be stable or unstable while in VT. When the patient is in VT it is important to assess a pulse, because whether a person has a pulse determines the treatment.

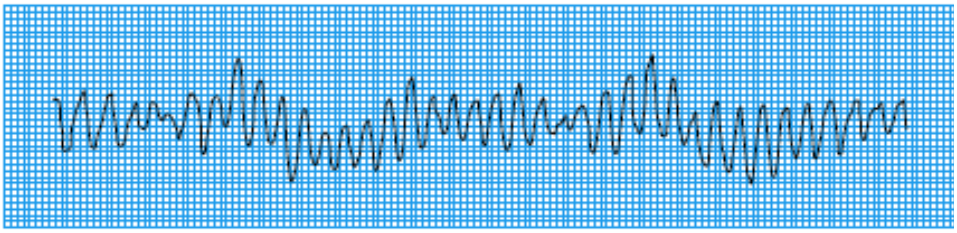
Treatment options:

VT with a pulse:

1. Medications: amiodarone or lidocaine IV
2. Synchronized cardioversion
3. If left untreated, VT with a pulse will go on to become pulseless VT, then ventricular fibrillation, then asystole.

Pulseless VT: Cardiopulmonary resuscitation with defibrillation.

Ventricular fibrillation (V-Fib)

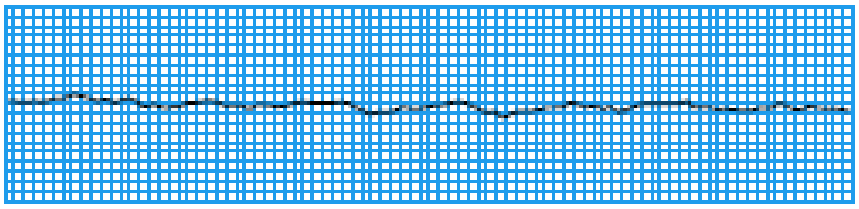


In ventricular fibrillation, depolarization and repolarization are not happening. The heart is basically quivering. There is no cardiac output associated with this rhythm. Rapid intervention is required to keep the patient alive. The fibrillation waves can be coarse, medium, or fine. All of these are shockable. Fine V-fib can look like asytole so it is important to look at the rhythm in multiple leads. If left untreated V-fib will quickly deteriorate to asystole.

Treatment options:

1. Immediate defibrillation and cardiopulmonary resuscitation
2. Followed by treating the underlying causes (myocardial ischemia, myocardial infarction, untreated VT, underlying heart disease, acid-base imbalance, electric shock, severe hypothermia, electrolyte imbalances—hyperkalemia, hypokalemia, and hypercalcemia).

Asystole



Note the lack of P waves and the lack of QRS complexes. There is no electrical activity going through the heart. This is not a shockable rhythm. The treatment for this is effective chest compressions. Also, giving IV adrenaline may stimulate some electrical impulses than can then be shocked.

Myocardial Infarction (MI)

A myocardial infarction or heart attack involves three stages of damage to the cells— ischemia, injury, and infarction. Symptoms are caused by a blockage in one or more coronary arteries which results in a lack of oxygen to the heart. Symptoms of MI include chest pain, shortness of breath, and tiredness. Pain in other areas of the upper body can also by caused by MI; these areas include arms, jaw, neck, or stomach. Other symptoms include nausea (sick to the stomach) or cold sweat.

One of the tests done to diagnose MI is a 12 lead ECG. On the ECG changes in the ST segment and T waves indicate MI. As discussed previously, the ST segments should be close to baseline, if it is more than 1 mm away from the baseline, or 1 small square. The T wave is usually goes up above the baseline; however, in MI the T wave may be inverted, or be rounded below the baseline. If these changes are seen in 2 or more leads (or views of the heart), myocardial infarction should be suspected. The more extensive the changes; the more the heart is damaged.

This results in a much sicker patient with a higher risk of suffering from irreversible effects or dying.

Lesson 3: Medication Safety

Objectives

1. Describe the five (5) rights.
2. Correctly identify the uses of the medications commonly used in the heart center.
3. Describe proper administration techniques.
4. Identify side effects of the medications and describe how to recognize them.

Part One: The Five (5) Rights

Nurses are responsible for administering the medications that are prescribed by the doctors. Nurses are also responsible for understanding what the medication is used for, proper dosage, proper administration, common side effects, and any interactions. Medication administration is a very big responsibility that can have serious effects on the patient. Our patients are on many different medications, it is important for us to be aware if any of the medications interact with each other.

While we cannot eliminate all the risks associated with giving medications to patients, there are many things we can do minimize the dangers associated with giving medications. I hope that many of you have noticed that before I do any treatment with a patient, I assess them. This includes doing a physical assessment and looking back at the previous charting on the patient. Doing this allows me understand better the patient's condition and informs me of any complication that patient has had since I last saw them. This is a significant part of nursing practice. You should all be doing this. If you are uncomfortable or unsure about how to do a physical assessment on a patient, please let me know and we will work on this together, one on

one. I know many of you were hoping there would be a lecture on physical assessment. But because my time is limited, I will be unable to meet that request.

At the bedside I have talked with many of you about looking at the doctor's order prior to giving a medication. This is just one step in safe medication administration. Verifying five (5) rights is a systematic approach designed to minimize risk. The five (5) rights are as follows:

1. Right drug
2. Right patient
3. Right dose
4. Right route
5. Right time

1. The Right Drug

Reading the medication label is very important, especially since the labels are in different languages. As the hospital gets contracts with different companies for supplies, the look of the medications may change; therefore, we cannot rely recognizing the packaging.

2. The Right Patient

As the number of patients we treat increases it is especially important that we correctly identify the patients prior to giving them any medications. Once the patients are extubated, we should ask them to say their name. In the US each patient has a special bracelet they are given when they are admitted to the hospital. This bracelet has their name, a special number, and their birthdate. I use this bracelet to ensure that I am giving the medication to the correct patient.

3. The Right Dose

Giving the right dose is more than giving the dose that is prescribed. There are many different medications that are used, and it can be difficult to keep all the dosages straight. This is why many of you have seen me looking things up frequently. I have many dosages memorized because I use these medications frequently. But rather than relying on memory, I look things up. It should be more important to be safe than to know everything.

Medications for children are based on the weight of the child. When you look up the dosage of almost every medication for children, they are all calculated "per kilogram." For example, the dose of paracetamol is 10 mg per kg per dose. In adults the dose is 500 mg per dose. See the difference?

4. The Right Route

As we know, medications can be given in a variety of routes (oral, intravenous, intraocular, subcutaneous, etc.). The order must specify the route of administration wanted by the physician. This happened a few weeks ago. Dr. Jaafar had written an order for Lasix, but forgot to write tab or IV. The nurse who was taking care of the patient saw this order and saw that the route was not specified. Before giving the lasix to the patient, this nurse asked Dr. Jaafar which route. Dr. Jaafar clarified that he meant to write "tab." The patient then received the lasix tablet as ordered. I can tell you that Dr. Jaafar was very pleased that the nurse clarified the order and not at all upset.

5. The Right Time

Medications are also ordered at different frequencies. It is important to know how frequent a medication should be given. Some medications, especially antibiotics, have different frequencies depending on what is being treated. For example, if a patient is receiving the antibiotic ceftriaxone for an ear infection it is dosed one time only. But if they are being treated for

meningitis it will be dosed every 12 hours. Just like with the "right dose," the proper timing, or frequency, of medications can be found in drug books.

Part Two: Medications

Now we will move on to talk specifically about the most common medications that are used in the heart center. I have grouped them together according to their use. For each medication, we will talk about dosage, route, effect, nursing administration guidelines, common side effects, and common interactions.

Respiratory Medications

Oxygen

This is the most commonly used medication in the ICU. Every patient is on oxygen for at least 24 hours after surgery. We should have a systematic approach to weaning oxygen.

Simple Face Mask:

If patients are extubated to a face mask, the flow should be greater than 5 liters per minute (LPM). If the face mask flow is less than 5 LPM, carbon dioxide may accumulate and cause CO_2 retention. Additionally flow higher than 8LPM does not significantly increase the amount of oxygen the patient is receiving (Wilson, Grande, & Hoyt, 2007) (Dillion, 2010).

Nasal Cannula (Nasal Mask):

A nasal cannula must be used to wean a patient from oxygen because the lowest flow usable on a face mask is 5 LPM. The flow given by a nasal cannula can be as small as 1/16 of a liter, but flow higher than 6 LPM does not significantly increase the amount of oxygen the patient is receiving (Wilson, Grande, & Hoyt, 2007) (Dillion, 2010). When weaning oxygen, it is safest to decrease the flow of oxygen by 1 LPM every 2 to 4 hours. Oxygen should never be weaned without the use of pulse oximetry.

Oxygen Toxicity:

Too much oxygen can actually cause damage to the cell of the lungs. The studies are still being done to determine at what level of oxygen usage oxygen toxicity begins. When the patient is on the ventilator, convention supports oxygen use at concentrations of 50% (FiO_2) or less (Wilson, Grande, & Hoyt, 2007). If the patient condition however, requires higher concentrations of FiO2, it must be provided. There is a fine balance between preventing hypoxia and oxygen toxicity.

Aminophylline

Use: to treat symptoms of asthma or emphysema. It is a bronchodilator; it works by relaxing the smooth muscles in the lung tissue.

Dosage: The dosing of aminophylline varies based on the age and smoking status of the patient. Look it up each time you administer it to ensure proper dosing.

Route: Oral or intravenous

Nursing Administration Considerations: IV administration should be given over 20 minutes. A smoker is unable to clear aminophylline at the same rate as a non-smoker. It will take the smoker longer to get aminophylline out of the system. Also, patient with heart failure will take longer to clear the medication as well.

Common Side Effects: Tachycardia, headaches, restlessness. Overdose can result in acute MI.

Drug Interactions: Interacts with propofol and neuromuscular blockers. Propofol and the neuromuscular blockers may be less effective.

(Wolters Kluwer Health, 2009) (Lee, Custer, & Rau, 2009)

Sedation & Analgesia

Fentanyl

Uses: Short-acting, rapid onset pain reliever used before and after surgery for pain treatment. Usually needs to be redosed every 1 to 2 hours.

Dosage: Children: 1 mcg/kg per dose or 1 mcg/kg/hr as continuous infusion

Adult: 50-100 mcg per dose or 1 mcg/kg/hr as continuous infusion

Route: IV

Nursing Administration Considerations: Give IV dose slowly over 1-2 minutes.

Side Effects: Chest wall rigidity, hypotension, hypoventilation

Drug Interactions: When given with amiodarone can cause severe bradycardia, sinus arrest, and hypotension.

(Lee, Custer, & Rau, 2009) (Gehlbach & Kress, 2005) (Wolters Kluwer Health, 2009)

Midazolam

Uses: Sedation and anxiolysis before and after surgery in the ICU. Rapid onset (0.5-5 minutes). Effects last 2 hours.

Dosage: Children: 0.05-0.1 mg/kg per dose intravenous or 0.05-0.1 mg/kg/hr as continuous infusion. Oral administration requires higher doses.

Adult: 1-2 mg per dose (up to 5 mg doses have been given) or 0.05-0.1 mg/kg/hr as continuous infusion.

Route: IV and oral

Nursing Administration Considerations: Give IV dose slowly over 2 minutes.

Common Side Effects: Bigeminy, PVC, tachycardia, bradycardia, headache, tremor, respiratory depression.

Drug Interactions: The effects of propofol may be increased.

(Gehlbach & Kress, 2005) (Lee, Custer, & Rau, 2009) (Wolters Kluwer Health, 2009)

Propofol

Uses: Induction and maintenance of anesthesia, sedation for intubated, mechanically-ventilated ICU patients. Rapid onset (less than 1 minute).

Dosage: Health adults <55 years old: 5-80 mcg/kg/min started slowly and titrated up to effect. In elderly and ill adults: 80% of dose given to healthy adults.

Route: IV

Nursing Administration Considerations: Bolusing propofol is not recommended for elderly or critically ill. IV administration is painful, so give in a large vein. Shake the vials prior to drawing them up. Because of the nature of the medication it is only stable for 6 hours after it is drawn up. After 6 hours, it should be discarded. Be very careful not to contaminate the syringe or tubing, but the lipid formulation is very susceptible to bacterial growth. Propofol must have a dedicated line (it cannot be mixed with anything else).

Common Side Effects: hypotension, bradycardia, decreased cardiac output, apnea, cough, respiratory acidosis during weaning.

Drug Interactions: When given with CNS depressants (barbiturates, benzodiazepines, and opiods), more CNS depression is seen (increased sleepiness).

(Wolters Kluwer Health, 2009) (Gehlbach & Kress, 2005)

Paracetamol

Uses: Fever reducer and treatment of mild to moderate pain.

Dosage: Children: 10 mg/kg/dose every 4-6 hours, not to exceed 4 doses daily.

Adults: 500-1000 mg per dose every 4-6 hours, not to exceed 4 g per day.

Route: IV, oral, and rectal

Nursing Administration Considerations: Give slowly over 15 minutes.

Side Effects: Jaundice, leukopenia, signs of overdose are signs of liver failure.

Drug Interactions: Increased bleeding time for patients on warfarin.

(National Health Service, 2007) (Wolters Kluwer Health, 2009)

Diuretic

Furosemide

Uses: Diuretic agent used to decrease edema and decrease the fluid volume of patients. Decreasing circulating fluid volume decreases the work load of the heart.

Dosage: Children: 1 mg/kg

Adults: 20-80 mg daily

Route: IV and oral

Nursing Administration Considerations: Intravenous infusion should be given slowly (over 10-30 minutes), rapid injection can cause hearing loss and tinnitus.

Side Effects: hypokalemia, hyponatremia, mild GI upset, hypotension, hyperglycemia, metabolic alkalosis, vertigo

Drug Interactions: Use furosemide with caution in patients also on antihypertensives. Deafness may be worse if furosemide is given with aminogylcosides (Gentamicin).

(National Health Service, 2007) (Wolters Kluwer Health, 2009)

Proton Pump Inhibitor

Omeprazole

Uses: Prophylaxis of acid aspiration, treatment of gastroesphogeal reflux disease (GERD), and part of the treatment regimen for Helicobacter pylori (H. pylori)

Dosage: Children: 1 mg/kg in 24 hours given once daily or twice a day.

Adult: 20 or 40 mg daily

Route: IV or oral

Nursing Administration Considerations: Intravenous infusion should be given over 5 minutes.

Side Effects: Headache, diarrhea, nausea, vomiting, and dizziness; fever in children (33%)

Drug Interactions: Omeprazole increases the effectiveness of warfarin.

(National Health Service, 2007) (Wolters Kluwer Health, 2009) (Lee, Custer, & Rau, 2009)

Antiarrhythmics

Amiodarone

Uses: Class III antiarrythmic, used to treat ventricular tachycardia and ventricular fibrillation, has also been used to treat supraventricular tachycardia that does not respond to adenosine.

Dosage: Children: Load 5 mg/kg over 30 minutes, then follow with a continuous infusion at 5 mcg/kg/min up to 15 mcg/kg/min

Adults: Load 150 mg over 10 minutes (15 mg/min) followed by 360 mg over 6 hours (1 mg/min) followed by a maintenance dose of 0.5 mcg/kg/min. Supplemental boluses of 150 mg given over 10 minutes may be given for breakthrough VF or VT.

Route: IV and oral

Nursing Administration Considerations: The continuous infusion must be diluted in D5W to a concentration of 2 mg/ml.

Side Effects: Hypotension, sinus arrest, cardiac arrhythmias, photosensitivity.

Drug Interactions: Increased risk of cardiac toxicity if hypokalemia occurs when given with furosemide. Increased effect of warfarin.

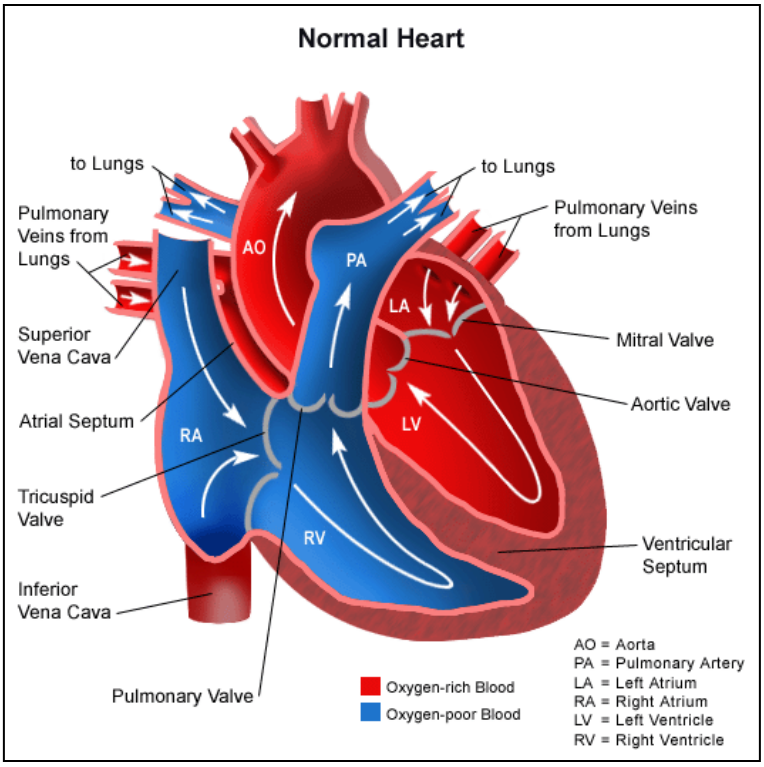
Lesson 4: Adult and Pediatric Cardiac Repairs

Objectives

1. Describe and identify the parts of normal cardiac anatomy.
2. Describe the components of common cardiac repairs, pediatric and adult.

3. Describe post-operative complications for each repair (ASD, PDA ligation, Coarctation of the Aorta, CABG, MV replacement, and AV replacement).

Part One: Normal Cardiac Anatomy

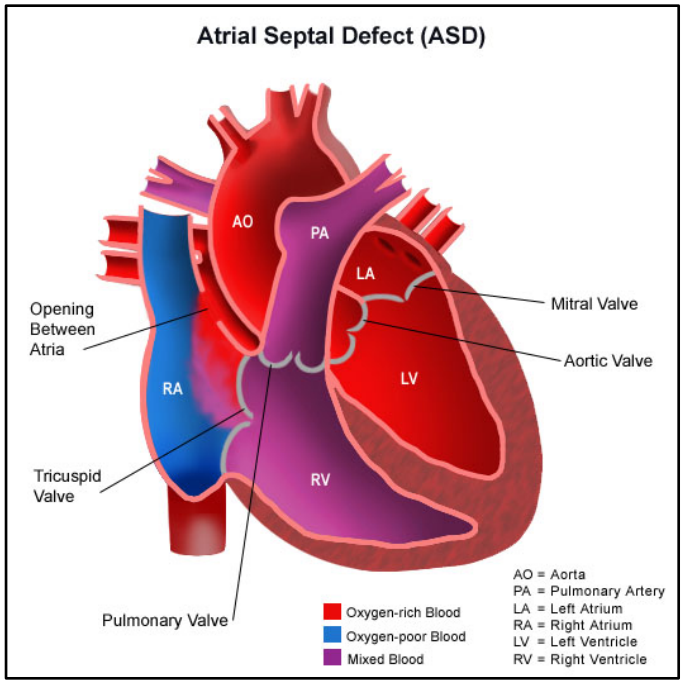


Blood enters the right atrium (RA) from the body via the Superior Vena Cava (SVC) and the Inferior Vena Cava (IVC). The blood goes through the tricuspid valve into the Right Ventricle (RV). Blood then goes out the RV through the Pulmonary Valve (PV) into the Pulmonary Artery (PA) to the lungs where it is oxygenated.

After being oxygenated, the blood travels to the left side of the heart through the Pulmonary Veins. The Pulmonary Veins empty into the Left Atrium (LA). From the LA the blood goes through the Mitral Valve (MV) into the Left Ventricle (LV). The blood leaves the LV passing through the Aortic Valve (AV) into the Aorta where the oxygen-rich blood travels to the rest of the body. After delivering blood to all the tissues of the body, the de-oxygenated blood returns to the right side of the heart through the IVC and the SVC.

Part Two: Cardiac Repairs

Atrial Septal Defects (ASD)



An Atrial Septal Defect, or ASD, is a hole between in the septum between the right and left atria. This is the second most common congenital heart defect; ventricular septal defects (VSD) are the most common.

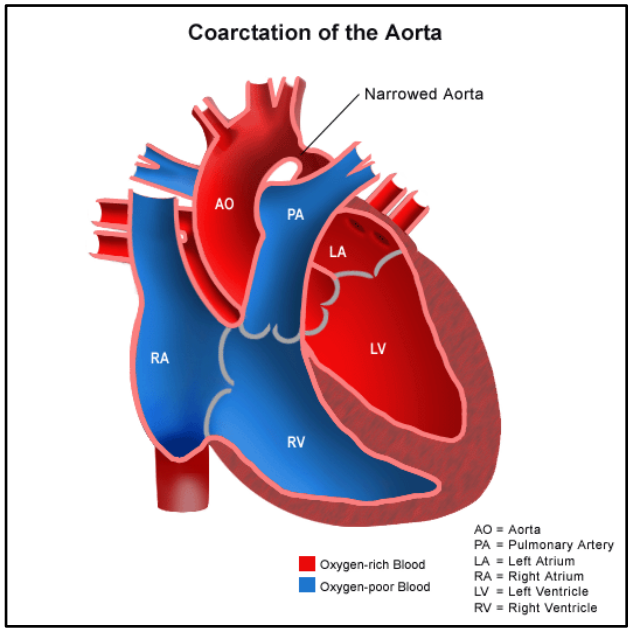
The Repair

The heart rests inside a sac, called the pericardial sac. A piece of the pericardium is removed and used to patch the hole or holes. This repair requires cardiopulmonary bypass.

Post-Operative Complications

Invasive monitoring usually includes arterial access and central venous pressure (CVP) monitoring. Most patients have a benign post-operative course, transient hypotension occurs occasionally. A very rare post-operative complication is heart block; this may be temporary or permanent.

Coarctation of the Aorta (CoA)



Coarctation of the Aorta is a condition in which a part of the aorta is narrowed. This narrowing causes decreased blood flow to the parts of the body beyond the coarctation. Often the coarctation is beyond where the left subclavian artery branches. The symptoms of CoA include unequal 4-quadrant blood pressures, weak femoral pulses, and cool feet. Four-quadrant blood pressures are useful in diagnosing CoA. Blood pressures are taken in all 4 extremities. If the systolic of the right arm blood pressure is more than 20 mmHg above the other extremities, CoA should be suspected.

The Repair

Often this repair is done through a left thoracotomy. Once the coarctation is visualized by the surgeon, clamps are placed above and below the site. The CoA is removed and the 2 ends are sutured together. This repair does not require bypass.

Post-Operative Complications

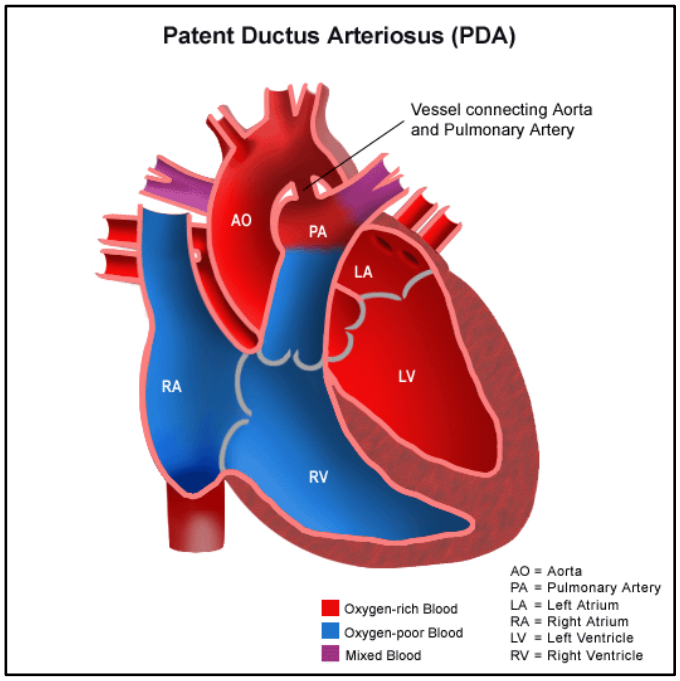
As soon as possible in the post-operative period it is important to check the patient's blood pressure in all four extremities.

Invasive monitoring includes arterial lines and central venous catheters. Systemic hypertension is the most common post-operative complication. This is often controlled with continuous infusion of antihypertensive medications like esmolol or nitroprusside. If the hypertension is uncontrolled,

it can result in a bowel ileus or bowel necrosis. The continuous infusion of antihypertensive medication is often changed to an oral antihypertensive like captopril or enalapril.

Paraplegia (paralysis of the legs) is an extremely rare complication. This complication is caused by the spinal cord ischemia that occurs while the aorta is clamped. Even though this complication is rare, it should be noted when the patient moves his or her legs after surgery.

Patent Ductus of Arteriosus Ligation (PDA Ligation)



During fetal development, the lungs need only a small amount of oxygen. This oxygen is used for lung development, not for breathing. The lungs receive about 20% of the total blood flow during development. The Patent Ductus of Arteriosus (PDA) allows the lungs to be bypassed so that the baby can grow. Most of the time when the newborn takes its first breath (or shortly thereafter), the PDA closes. Occasionally, the PDA fails to close. This can be closed either surgically or in the cardiac catheterization laboratory with and device occluder.

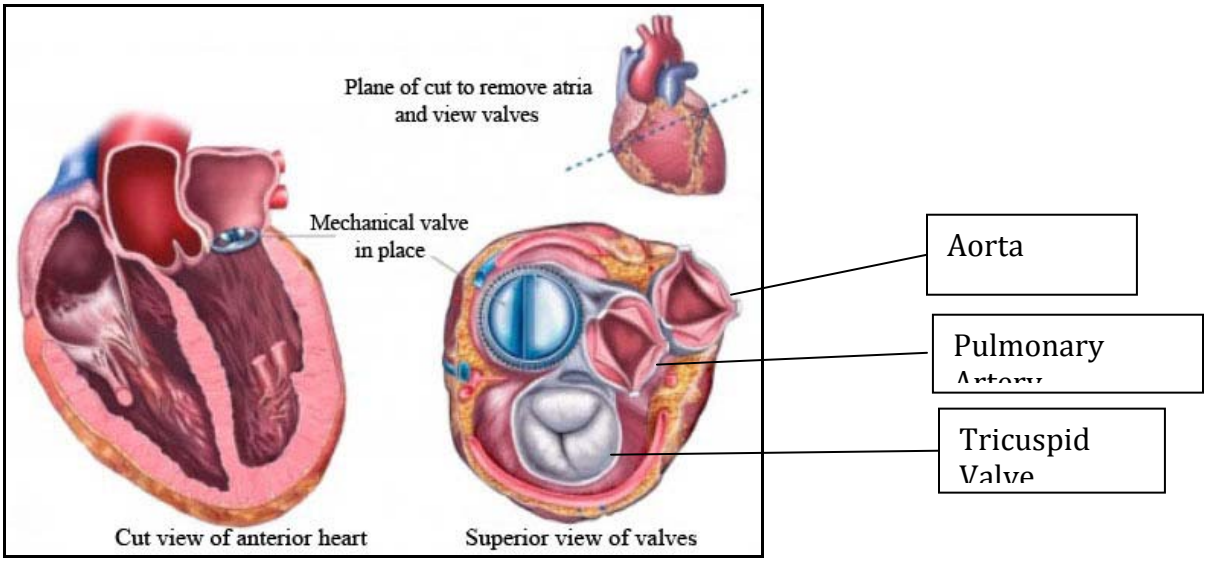
The Repair

Often this repair is done through a left thoracotomy. The PDA is either surgically ligated (or tied) and divided into two, or a PDA clip may be placed, occluding blood flow through the PDA.

Post-Operative Complications

The post-operative course for these patients is generally benign, assuming that close monitoring is occurring. Invasive monitoring (such as arterial lines or CVP) is not usually required. The length of stay is generally two (2) to three (3) days. If the patient was in significant congestive heart failure preoperatively, the hospital stay may be longer.

Mitral Valve Replacement (MVR)



The Mitral Valve is the valve between the Left Atrium (LA) and the Left Ventricle (LV). Of the patients that have had MVR here, most of them have a history of rheumatic fever. Rheumatic fever is a complication of a streptococcal infection (strep throat). Rheumatic fever can develop if a strep infection is not treated or is treated inappropriately. Rheumatic disease damages the connective tissues of the body; valves are connective tissue. The valves become very leaky and work inefficiently. When patients have rheumatic heart disease for a long time, the valves become stenosed and leaky. Patient can also have dilated atria, arrhythmias, and ventricular dysfunction. Many of our patients have a long history of atrial flutter(Chin & Chin, 2008).

The Repair

This repair involves removal of the diseased valve and a new valve is put in its place. This valve may be either a tissue valve or a mechanical valve. Tissue valves are either bovine valves or porcine valves. St. Jude valve is the mechanical valve used here. This repair requires bypass.

Post-Operative Complications

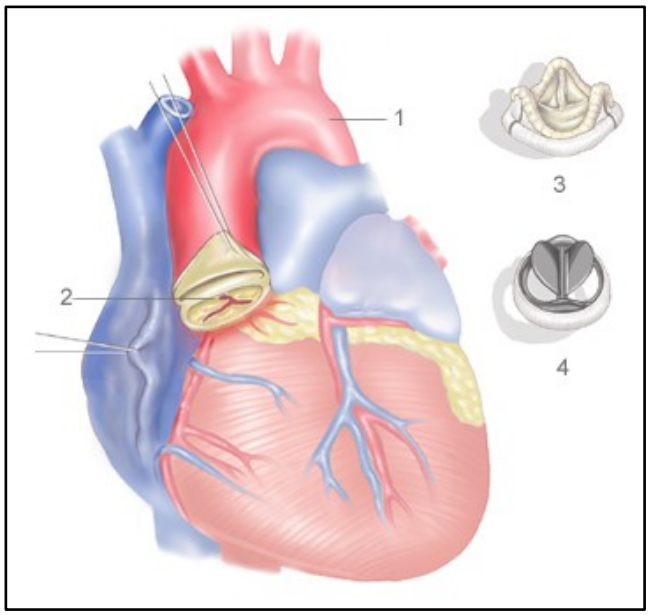
Three common post-operative complications following cardiopulmonary bypass include low cardiac output state, bleeding, and heart block or other arrhythmias. The most common and most significant post-operative complication is a low cardiac output state. Low cardiac output state signs and symptoms are consistent with organ hypoperfusion and shock. This should be recognized as cold and clammy skin, decreased pulses, and decreased urine output. Management of this situation is centered on correcting either the heart rate, preload, or afterload of the heart.

Bleeding is another complication that may occur. If a patient has more than 200 ml of blood over an hour, the physician should be notified. This may indicate active internal bleeding, which increases the risk of the patient developing cardiac tamponade.

Another complication that the patient should be monitored for is the occurrence of heart block or other arrhythmias. Patients with valvular heart disease may often have chronic atrial flutter. These patients should be monitored closely for hemodynamic instability related to their arrhythmia. Patients should come to the ICU with pacer wires either secured to the chest or attached to the pacer if they are requiring pacing.

Patients having mechanical valve replacement will need lifelong anticoagulation. Warfarin is the medication of choice for these patients. Warfarin is a highly effective medication, but can be dangerous if not monitored properly. Patient education is very important to improve patient safety and compliance. (See Patient Education Booklet provided by the Clinical Pharmacist.)

Aortic Valve Replacement (AVR)



The aortic valve is a three leaflet valve between the left ventricle and the aorta. Valve replacement may be indicated in cases of severe aortic valve stenosis or regurgitation. Three common causes of arotic stenosis, or stiffness, exist. Calcified aortic stenosis with a congenitally bicuspid aortic valve is the most common cause of aortic stenosis. Nearly as common is calcified aortic stenosis with severe calcification that occurs as patient age. The third cause of aortic stenosis is rheumatic fever, similar to mitral valve disease. If a patient shows symptoms of syncope (fainting), angina, or heart failure, aortic valve replacement may be indicated.

The Repair

This repair involves removal of the diseased valve and a new valve is put in its place. This valve may be either a tissue valve or a mechanical valve. St. Jude valve is the most commonly used mechanical valve. This repair requires cardiopulmonary bypass.

Post-Operative Complications

Three common post-operative complications following cardiopulmonary bypass include low cardiac output state, bleeding, and heart block or other arrhythmias. The most common and most significant post-operative complication is a low cardiac output state. Low cardiac output state signs and symptoms are consistent with organ hypoperfusion and shock. This should be

recognized as cold and clammy skin, decreased pulses, and decreased urine output. Management of this situation is centered on correcting either the heart rate, preload, or afterload of the heart.

Bleeding is another complication that may occur. If a patient has more than 200 ml of blood over an hour, the physician should be notified. This may indicate active internal bleeding, which increases the risk of the patient developing cardiac tamponade.

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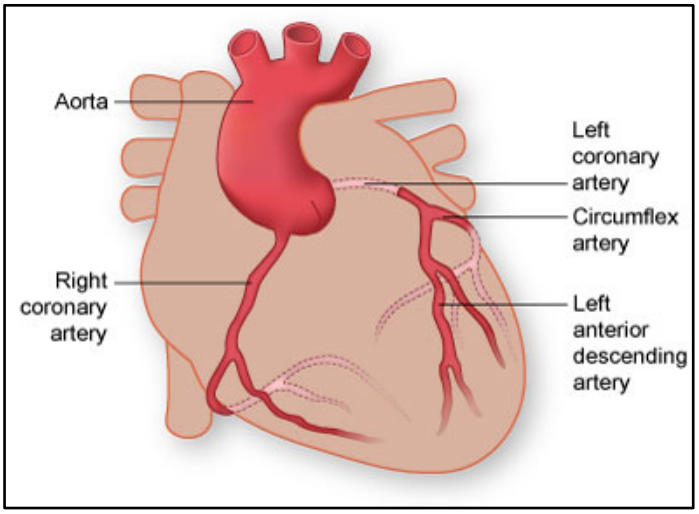
Patients having mechanical valve replacement will need lifelong anticoagulation. Warfarin is the medication of choice for these patients. Warfarin is a highly effective medication, but can be dangerous if not monitored properly. Patient education is very important to improve patient safety and compliance. (See Patient Education Booklet provided by the Clinical Pharmacist.)

Coronary Artery Bypass Graph (CABG)



Coronary Artery Bypass Graph (CABG) is performed when a patient has occluded or blocked coronary arteries. These blockages are the result of an accumulation of plaque inside the vessels. When the coronaries are blocked or partially blocked, blood flow is limited to the

tissues distal to, or beyond, the site of occlusion. This results in angina and possibly myocardial infarction. Conditions such as uncontrolled hypertension and uncontrolled diabetes mellitus, combined with unhealthy diets that are high in saturated fats and calories, lead to development of these plaques.

The Repair

For this repair, vessels (veins and arteries) are taken from other areas of the body and attached to the outside of the heart. Often the vessels chosen are the saphenous vein and the internal mammary artery. One end of the vessel is attached near the coronary sinus, and the other end (distal end) is attached to the disease vessel after (distal) to the site of occlusion. Generally, the risks of the surgery are not outweighed by the benefits of the repair until a 3 vessel repair is required, such as the left anterior descending, right circumflex, and right coronary artery. This repair requires cardiopulmonary bypass.

Post-Operative Complications

Three common post-operative complications following CABG include low cardiac output state, bleeding, and heart block or other arrhythmias. The most common and most significant post-operative complication is a low cardiac output state. Low cardiac output state signs and symptoms are consistent with organ hypoperfusion and shock. This should be recognized as cold and clammy skin, decreased pulses, and decreased urine output. Management of this situation is centered on correcting either the heart rate, preload, or afterload of the heart.

Bleeding is another complication that may occur. If a patient has more than 200 ml of blood over an hour, the physician should be notified. This may indicate active internal bleeding, which increases the risk of the patient developing cardiac tamponade.

Another complication that the patient should be monitored for is the occurrence of heart block or other arrhythmias. Patients should come to the ICU with pacer wires either secured to the chest or attached to the pacer if they are requiring pacing.

Other nursing care points to consider include elevating the extremity from which the saphenous graft was taken. Elevating the extremity limits swelling, promotes healing, and decreases the risk for clot formation in the distal leg (near the foot).

APPENDIX B: LESSON POST-TESTS

LESSON 1: VITAL SIGNS & PAIN MANAGEMENT

A nurse is assessing a 2-year-old girl with the following vital signs: temperature 36.6 C axillary, apical pulse 100, respirations 28 breaths per minute, blood pressure 125/80. Which action by the nurse would be most appropriate?

1. Reevaluate the child's temperature in 1 hour.
2. Report the blood pressure to the physician.
3. Assess for additional signs of respiratory distress in the child.
4. Determine why the child has tachycardia.

A nurse is measuring the blood pressure of a thin, small-statured man. The blood pressure cuff covers his upper arm completely. The nurse would expect the blood pressure too be what? And what action should be taken?

1. Too low, obtain smaller cuff
2. Too high, obtain larger cuff
3. Accurate, no action is needed
4. Too low, obtain larger cuff
5. Too high, obtain smaller cuff

A 54-year-old man is one day postoperative and has the following vital signs: temperature 37 C axillary, apical pulse 120, respiratory rate 25, blood pressure 180/110, O_2 saturation 94%. Which of the following is the most likely cause?

1. Pain
2. Hypovolemic shock
3. Surgical failure

What is the normal breathing rate of an adult?

_____breaths/minute

True/ False: Recording frequent vital signs aids in the recognition of trends or slight changes in the status of the patient allowing the provider to make changes in the plan of care before it becomes critical.

Which of the following describes the appropriate interval for measuring vital signs in the immediate postoperative period?

1. Every 5 minutes for 1 hour, then every 30 minutes for 2 hours, then hourly thereafter.
2. Every 10 minutes for 30 minutes, then hourly thereafter.
3. Every 15 minutes for 1 hour, then every 30 minutes for 1 hour, then hourly thereafter.
4. On admission and then hourly thereafter.

Name one way measuring the respiratory rate of a child differs from that of an adult.

What are the six vital signs?

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

Which of the following is a normal set of vital signs for a 6-year-old?

1. Pulse rate 55, respirations 16 breaths per minute, blood pressure 110/65.
2. Pulse rate 135, respirations 22 breaths per minute, blood pressure 85/40.
3. Pulse rate 80, respirations 40 breaths per minute, blood pressure 130/80.
4. Pulse rate 80, respirations 22 breaths per minute, blood pressure 110/65.

A 15-year-old male has just arrived at to the ICU postoperative from an ASD closure. He has the following vital signs: temperature 36 C axillary, apical pulse 130, arterial blood pressure 88/50 (64), respirations vented at 16 breaths per min, pulse oximeter 97% on 0.50 FiO_2. You have checked all of the equipment, and the vital signs persist as previously stated. What do you, the nurse, expect Dr. Jaafar to order, and why?

1. NS; because hypotension with tachycardia is evidence of hypovolemia.
2. Fentanyl; the tachycardia is caused by pain.
3. Nothing; these vital signs are within normal limits for a 15-year-old male.
4. Extubation; the patient is stable and ready for extubation because the pulse oximeter is 97%.

Your patient is a 3-year-old post-operative day 1 from an ASD closure & PDA ligation. Based on the following description, determine her pain score using the FLACC scale. She is lying very still & refuses to move or be moved. Her legs are straight out & stiff. She is withdrawn and refuses to play with you. When you attempt to help her move up in bed, she whimpers and cries. She calms down when her mother speaks to her and hugs her.

FLACC score:

Your Intervention:

LESSON 2: ELECTROCARDIOGRAPHY (ECG) INTERPRETATION

The normal pacemaker of the heart is the:

1. SA node
2. AV node
3. Bundle of His
4. Purkinje fibers

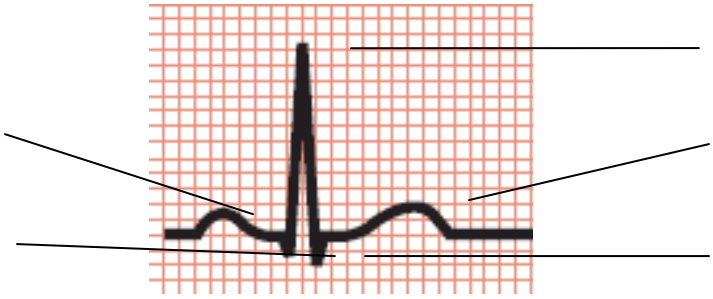
The normal duration of the QRS complex is:

1. 0.06 to 0.1 seconds
2. 0.12 to 0.20 seconds
3. 0.36 to 0.44 seconds

Atrial and ventricular rate can be determined by counting the number of small boxes between:

1. The end of one P wave and the beginning of another.
2. Two P or R wave in a row.
3. The middle of two consecutive T waves.

Label the parts of the following electrical complex:



Three or more premature ventricular contractions (PVC) in a row is called_____

A patient admitted with an acute MI complains of chest pain. When you look at his ECG monitor you note a heart rate of 35 beats per minute. Which area of his heart has taken over as the heart's pacemaker?

1. SA node
2. AV node
3. Purkinje Fibers

Interpret the following strip of a 56-year-old female.

Atrial rhythm:

Ventricular rhythm:

Atrial rate:

Ventricular rate:

P wave:

PR Interval:

QRS Complex:

T wave:

QT Interval:

Other:

Interpretation:

Interpret the following strip of a 9-year-old male.

Atrial rhythm:	QRS Complex:
Ventricular rhythm:	T wave:
Atrial rate:	QT Interval:
Ventricular rate:	Other:
P wave:	**Interpretation:**
PR Interval:	

A 65 year old patient diagnosed with angina is admitted to the ICU. You begin cardiac monitoring and record a rhythm strip. Using the 8-step method of rhythm strip interpretation, which of the following would you do first?

1. Calculate the heart rate
2. Evaluate the P wave
3. Check the rhythm
4. Measure the QT interval

A patient develops sinus bradycardia. Which symptoms indicate that his cardiac output is falling?

1. Hypertension and further drop in heart rate.
2. Hypotension and dizziness.

3. Increased urine output and syncope.

Following cardiac surgery cardiac monitor displays the following rhythm. Use the 8-step method to interpret this rhythm.

Atrial rhythm:	QRS Complex:
Ventricular rhythm:	T wave:
Atrial rate:	QT Interval:
Ventricular rate:	Other:
P wave:	**Interpretation:**
PR Interval:	

What labs should be drawn? _____

LESSON 3: MEDICATION SAFETY

List the five (5) rights

1. _____
2. _____
3. _____
4. _____
5. _____

When there are a large number of medications to be given to a patient, does the nurse need to know about all of them?

Yes

No

Rapid administration of this medication can cause hearing loss.

1. Paracetamol
2. Furosemide
3. Ceftriaxone
4. Omeprazole

What is the minimal amount of oxygen flow that can be given by simple face mask?

_____

Your patient is a 13-year-old male (30 kg) who had ASD closure done 2 days ago by Dr. Jaafar. He is complaining of pain at the site of the incision. What is the appropriate dose of paracetamol for this patient? Show your calculation.

Which of the following is a sign of readiness to wean the nasal cannula of a 63 year old male with a 40 year history of smoking?

1. Productive cough
2. Respiratory rate of 35
3. Easy respirations
4. Flaring of the nostrils when he breaths (nasal flaring)

Of the following which should ***not*** be used to treat sinus tachycardia?

1. Amiodarone
2. Fentanyl
3. Normal saline
4. Midazolam

Omeprazole has a potential drug interaction with warfarin. What is the interaction?

1. More prolonged bleeding time
2. Decreases the effectiveness of warfarin
3. Makes hypotension worse
4. Causes deafness

Which of the following is not a side effect of furosemide?

1. Hypokalemia
2. Hyponatremia
3. Hypotension
4. Hypoglycemia

A 7 year old female weighing 22 kg is post-op from a coarctation of the aorta repair. She is tachycardic and hypertensive. You recognize this as symptoms of pain. A dose of fentanyl is ordered. What dose of fentanyl should be ordered? Show your work.