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Mr. Speice

Independent Study and Mentorship- 3A

26 October 2016

Research Assessment 6

Subject: Congenital Heart Surgery and Recovery in Pediatric Surgery

MLA Citation:

Works Cited

"Commitment and Compassion: Inside Congenital Heart Surgery at Texas Children's Hospital," director. Texas Children's Hospital, 8 July 2011, https://www.youtube.com/watch?v=d3nh1-tvqsk.

Mohamed, Saleh. "Implementation of Enhanced Recovery after Surgery in Pediatric Cardiac Practice: a Synopsis." *Ainh- Shams Journal of Anaesthesiology*, vol. 8, Oct. 2015, p. 464. *Health and Wellness Resource Center [Gale]*, doi:10.4103/1687-7934.172664.

Assessment:

For this research assessment I was first looking to learn something different about my topic of study, and while looking for articles I came across a video about the congenital heart surgery field. Although this is an even more specific field, this video taught me a lot about pediatric cardiac surgery. It has shown me the commitments and sacrifices medical professionals make to become part of the team involved in congenital heart surgeries.

The video spoke about the challenging aspects of this career through the point of views of medical professionals part of this dedicated team. An author who has studied pediatric surgery spoke on several challenges and requirements, for example, dexterity of hands and actual physical ability to do work. This requires the stitching of extraordinary fine small vessels that have to be uniformly places. The surgeon also comes into a surgery not one hundred percent know what they will be encountering. There is a need for speed, precision, and intellectual smarts is higher than in any other specialty. This author said he is convinced that congenital heart surgery is the most difficult specialty in medicine. A nurse spoke on the emotional stresses of this career, and the loss of young lives. Another doctor spoke on how each patient has numerous operations and when a surgeon is thinking about the operation he/she is doing at the moment, he/she also has to think of the operation that is happening two or three years from that moment, The surgeon also has to fix the heart in a way that allows for it to grow with a child. These specific challenges were all new to me and allow me to further understand the career of a pediatric cardiac surgeons. It has made this career a lot more realistic in my mind and a lot more achievable. Although all these challenges were stated sound quite impossible, the video shows an example of someone who has achieved all these challenges and does a job they love. This shows me in a bigger picture what I am studying in Independent Study and Mentorship and teaches me that this career can be realistic. With past research assessments and now this one I am able to learn about real life examples of people with this career and I can combine all of this information to gain a bigger picture on what this career truly entails. I know of challenges, what pediatric cardiac surgery is, I know about the commitment of this career, the rewards, the common conditions and diseases involved with this career, the need for this career, and the lack of cardiac care in low income countries. With all of this information I see that I take great interest in the lack of cardiac care in low income countries and that this could possibly be a path I could be taking with my original work proposal. I hope to further research solutions to this problem, to assist in the development of my original work.

The article I researched spoke of the recovery of pediatric cardiac surgeons, it spoke of an ERAS approach to pediatric cardiac patient recovery something, before reading this article, I had a very limited knowledge on. I knew that with cardiac surgery comes a long and painful recovery, but this article shows me an improvement for this long and painful recovery. This process includes and earlier admission to hospital, reduced postoperative ventilation time, same-day discharge from ICU to high dependency unit, optimal analgesia, early liberation from fluids and early mobilization, and an earlier discharge from hospital. Overall this process improves a patient's recovery experience and leads to a shorter hospital stay. The ERAS process also lowers medical costs and better utilizes hospital resources. The article also spoke on patient selection for ERAS. This article taught me of a possible solution to patient recovery and gave me a different point of view to pediatric cardiac surgery.

Video: Commitment and Compassion: Inside Congenital Heart Surgery at Texas Children's Hospital Notes

Dr. Fraser (congenital heart surgeon): Patients viewed as commonplace today never survived when I was in medical school

- We are able to do very highly and expensive therapy for children with serious problems

Anesthesiologist: I don't think there is any job more stressful than dealing with children who are born with heart defects. You have to deal with both the baby and the family.

Ruhlman: There are vast options for families with any quality

- Sometimes people don't demand the best for their child because they don't know better
- more heart surgeries the better, hospital-wise

Dr. Fraser: these were units are very rare, highly complicated,very delicate symbiotic propositions

- Not for people that want a side job doing it. Very specialized field. Only specialized trained dedicated team should be even thinking of doing this

Ruhlman: What a job? I'm convinced congenital heart surgery is the most difficult specialty in medicine

- dexterity of hands, actual physical ability to do work
    - Stitch extraordinary find small vessels together
    - PAs is described it as stitching together wet tissue
    - uniformly placed
    - you don't know what you are going to encounter
        - sometimes surgeries are only half hour,
        - Need for speed, precision, and intellectual smarts is higher than any other specialty

Fraser: this type of work attracts certain type of individuals

- incredibly committed
- days are extremely long and difficult
- emotions are always on edge

Blocker RN: emotional stresses, sometimes beautiful lives are lost

Heinle: extremely complicated patients and good message is that 98% of the time, in this institut, patient survive

Morales: 2- 4 operations

- Have to think about the operation you are doing now, but also the operation that is happening in 2 years
- Danger to patient because if you reenter the sternum if the heart is stuck up to the sternum and you can injure the heart
- it is very noticeable with children come from outside institutes, bad craftsmanship doesn't heal very well and when it does not heal very well you need to go back and fix it

Anesthesiologist: There is no when surgery is done

- You need to perfect what you are doing and put into it everything you have and all you want and all what you are and finish your day and still come back again tomorrow and do it again

When someone entrust their child on to you it is a daunting responsibility and that is what drives the team to give those children care

Implementation of enhanced recovery after

Comment [1]: I found this article and was curious to what it is about

surgery in pediatric cardiac practice: a synopsis.

Mohamed Saleh. *Ain-Shams Journal of Anaesthesiology*. Oct-Dec 2015 v8 i4 p463.

Byline: Mohamed. Saleh

Enhanced recovery after **surgery** is a multimodal, multidisciplinary, evidence-based approach, aiming to control postoperative pathophysiology and rehabilitation. The aim of this article is to review current literature in **pediatric cardiac** practice, implementing the ERAS approach, to identify peri-operative strategies that are associated with enhanced recovery after **pediatriccardiac surgery**.

Introduction

Enhanced recovery after **surgery** (ERAS) was introduced in 1997 by Henrik Kehlet, a gastrointestinal surgeon from Denmark. It is a multimodal, multidisciplinary, evidence-based approach, which aims to control postoperative pathophysiology and rehabilitation. It provides perioperative care that minimizes stress/surgical trauma reaction, aiming to reduce postoperative morbidity, and improves and accelerates recovery, leading to a shorter length of hospital stay. All of these factors have an economic advantage in terms of better utilization of resources and cost-benefit ratio. ERAS was originally described in colorectal **surgery**, but it has expanded to include other surgical specialties [sup][1],[2] .

Comment [2]: I know nothing about this

Comment [3]: Important!!!

The aim of this article was to review current literature in **pediatric cardiac** practice, implement the ERAS approach, and identify perioperative strategies that are associated with enhanced recovery after **pediatric cardiac surgery**.

Enhanced recovery after **surgery** in **pediatric cardiac** practice

Early tracheal extubation after **pediatric cardiac surgery** is not a new concept, but has received renewed attention with the evolution of ERAS. Early extubation after **pediatriccardiac surgery** was first proposed by Barash et al . [sup][3] in 1980. In 1984, Schuller et al . [sup][4] reported that early extubation after **pediatric cardiac surgery** has minimal risk in carefully selected patients. However, early extubation and ERAS are not synonymous. Early extubation is an element component of ERAS program.

Comment [4]: Also know very little about this

In 2010, a protocol was published from Great Ormond Street Hospital that describes a clinical perioperative pathway in which **pediatric cardiac** patients rapidly progress from preoperative preparation, through **cardiac surgery** and postoperative care. The protocol includes admission to hospital on the morning of **surgery**, reduced postoperative ventilation time, same-day discharge from ICU to high dependency unit in the ward, optimal analgesia, early liberalization from fluids and early mobilization, and earlier discharge from hospital. Greater experience with this type of protocol leads to reduction in the length of hospital stay [sup][5] .

Comment [5]: This protocol is essential to a patients survival

The benefit of implementation of ERAS in **pediatric cardiac** practice is decreased hospital stay, decreased overall medical costs, and better utilization of resources without affecting patient safety [sup][6] . In the current era of limited resources and cost-benefit consideration, such protocol would be appreciated.

In this article, we have reviewed current literature in **pediatric cardiac** practice, implemented the ERAS approach, and identified the following perioperative strategies that are associated with enhanced recovery after **pediatric cardiac surgery** [Figure 1].{Figure 1}

Preoperative strategies

Patient selection Appropriate patient selection is important for successful ERAS program [sup][7],[8] . Patient selection criteria included the following:

Comment [6]: also have never thought about it

*Age more than 6 months and weight more than 10 kg, as many studies demonstrated that there is an increased rate of reintubation in younger infants. *Presence of simple **cardiac**lesion, including atrial septal defect (ASD), ventricular septal defect (VSD), patent ductus arteriosus (PDA), and coarctation of the aorta, in addition to having undergone certain **pediatric cardiac** procedure, including Glenn and Fontan shunt. Children with **cardiac** lesions, including large left-to-right shunts and moderate-to-severe pulmonary hypertension, and those with complicated **cardiac** lesions, including atrioventricular canal, truncus arteriosus, D-transposition of the great vessels, total anomalous pulmonary venous return, and hypoplastic left heart syndrome, were excluded.

Comment [7]: I could possibly research cardiac procedures

Comment [8]: why?

*Completely healthy preoperative condition: Patients with preoperative comorbidities, including preoperative respiratory compromise, preoperative congestive heart failure, and failure to thrive, were excluded. Preadmission counseling

Adoption of specialized preanesthesia evaluation for **pediatric** patients scheduled for **cardiacsurgery** allows admission to hospital on the day of **surgery** with significant reduction in surgical cancellation or delay from abnormal laboratory tests, upper respiratory infections, or other intervening events, as well as significant reduction in the length of admission [sup][9],[10],[11] .

Optimization of patient's condition

All medications should be continued up to the time of **surgery**, except diuretics and digoxin, which should be stopped 24 h before **surgery**. Treatment of anemia and optimization of chest condition are of paramount importance [sup][7],[8] .

Shortened preanesthetic fasting interval

Children scheduled for **cardiac surgery** may be allowed to drink clear liquids up to 2 h before induction of anesthesia without adversely affecting residual gastric fluid volume and gastric fluid pH. The aim of shortening preanesthetic fasting interval is to avoid preoperative dehydration and hypoglycemia, and to maximize patient and parent satisfaction. Avoiding preoperative dehydration and preserving intravascular volume improve hemodynamic response during inhalation induction of anesthesia and facilitate vascular access. Avoiding preoperative hypoglycemia through ingestion of dextrose-containing fluids maintain plasma glucose levels, especially in infants and young children with limited glycogen stores [sup][12],[13] .

Premedication

Clinically significant decrease in SpO [sub]2 and rise in PaCO [sub]2 were observed in children with congenital heart disease following standardized intramuscular premedication with morphine, scopolamine, and secobarbital. Hypoxia and hypercarbia are detrimental in these patients, as they cause acute increase in pulmonary artery pressure and pulmonary vascular resistance. Oral midazolam was demonstrated to be a safe alternative for such protocol [sup][14],[15],[16] .

Intraoperative strategies

Short-acting anesthetic agents

For many years, a high-dose opioid technique was considered to be beneficial in improving outcome in complex **surgery** for congenital heart disease (CHD). It was shown that a high-opioid technique can blunt the stress response to **surgery** and cardiopulmonary bypass and was thought to provide superior hemodynamic stability [sup][17],[18],[19] .

However, ERAS program requires an anesthetic technique that allows safe early extubation within a few hours in the ICU. Therefore, a high-dose opioid technique is typically not suitable for this approach [sup][7],[8],[20] . It has been demonstrated that the use of moderate doses of short-acting or intermediate-acting opioid supplemented with inhalational anesthetic can reduce the duration of mechanical ventilation and intensive care stay [sup][21],[22] .

Neuraxial blockade

Neuraxial blockade might be useful in minimizing intravenous opioid administration. Caudal or intrathecal opioid has been shown to blunt the stress response to **surgery** and cardiopulmonary bypass and improve postoperative analgesia in **pediatric cardiac** patients [sup][23],[24],[25] . Although there is no doubt that neuraxial blockade provides long-lasting analgesia with significant opioid-sparing effect, there is controversy as regards the safety and benefits of such technique [sup][26],[27],[28] .

Minimally invasive surgical approach

Minimally invasive surgical approaches facilitate ERAS program. Limited skin incisions with median sternotomy, limited sternotomy, right anterior minithoracotomy, and video-assisted endoscopic technique have superior cosmetic results without affecting morbidity and offer more psychological and social satisfaction for the patients [sup][29],[30],[31],[32],[33],[34],[35] .

Normothermia

The recent change to normothermic cardiopulmonary bypass and normothermic cardioplegia is gaining popularity in **pediatric cardiac** practice. Normothermic cardiopulmonary bypass and intermittent normothermic blood cardioplegia are associated with higher spontaneous resumption of sinus rhythm, smaller increase in troponin I, improved hemodynamic stability, allowing early extubation of patients, and shorter duration of ICU stay [sup][36],[37],[38],[39] .

Ultrafiltration

The systemic inflammatory response resulting from extracorporeal circulation, surgical trauma, protamine, and ischemia-reperfusion injury causes humoral and cellular responses, leading to increased interstitial fluid and generalized capillary leak, and has a potential for multiple organ dysfunction syndrome [sup][40],[41],[42] .

During **pediatric cardiac** operations, using either conventional or modified ultrafiltration removes excess fluid and inflammatory mediators. Several studies demonstrated that ultrafiltration increased arterial oxygen tension and lowered carbon dioxide tension after bypass, shortened intubation and mechanical ventilation times, and improved postoperative pulmonary compliance [sup][43],[44],[45],[46] .

Steroids

Perioperative steroid administration is a common practice in **pediatric cardiac surgery** to modulate the inflammatory response associated with cardiopulmonary bypass [sup][47] . Intraoperative steroid administration was associated with a significant decrease in postoperative **cardiac** troponin levels and shorter durations of stay in intensive care and hospital [sup][48],[49],[50] . The use of an additional preoperative dose resulted in further modulation of inflammatory response, with improvement in oxygen delivery, and reduction in duration of mechanical ventilation [sup][48],[51],[52] .

Postoperative strategies

Systemic nonopioid analgesic

Effective pain management and sedation without respiratory depression is a crucial issue during the postoperative period. Narcotic administration may cause respiratory depression as well as nausea, vomiting, and delayed alimentation [sup][53],[54] . The use of nonopioid analgesic ketorolac in the postoperative period for pain control has been reported to be effective and safe in several studies [sup][55],[56],[57],[58],[59] .

Parasternal intercostal nerve block

Parasternal intercostal block is a simple, safe, and effective technique for postoperative analgesia in **pediatric** patients undergoing **cardiac surgery** through median sternotomy. It resulted in less postoperative pain, reduced the requirement for postoperative opioids, and allowed early tracheal extubation [sup][60] .

Continuous incisional infusion of local anesthetics

Continuous incisional infusion of local anesthetics is another simple, safe, and effective technique for postoperative analgesia in **pediatric** patients undergoing **cardiac surgery**through median sternotomy. It reduced postoperative analgesic requirement and sedative administration [sup][61] .

Dexomedetomidine

Dexmedetomidine is a selective a-2 adrenergic receptor agonist with sedative, analgesic, and anxiolytic properties [sup][62],[63] . The use of dexmedetomidine in **pediatric** patients after **cardiac surgery** has been demonstrated to be well tolerated in intubated and nonintubated children. Favorable effects of dexmedetomidine include blunting sympathetic stress response through reduction of endogenous catecholamine release and decrease in intraoperative anesthetic, as well as postoperative analgesic requirements [sup][64],[65],[66],[67] . However, dexmedetomidine did not significantly affect the postoperative course of children as measured by success of early extubation, duration of mechanical ventilation, and length of ICU stay [sup][68] .

Avoid fluid overload

Fluid overload in **pediatric** patients after **cardiac surgery** may lead to multiple organ dysfunction syndrome [sup][69] . Moreover, **pediatric** patients undergoing **cardiac surgery**are at risk for acute kidney injury. Chan et al. [sup][70] demonstrated that the risk was associated with long cardiopulmonary bypass duration, low **cardiac** output syndrome, and total circulatory arrest. The cause-effect relationship between acute kidney injury and fluid overload has been demonstrated in either directions [sup][71] . Several studies showed that fluid overload was associated with impaired oxygenation and poor outcomes [sup][72],[73],[74],[75] .

Blood transfusion

It has been demonstrated that greater intraoperative and early postoperative blood transfusion emerged as a risk factor for longer duration of mechanical ventilation and prolonged hospitalization and was associated with increased incidence of infections in children after **cardiac surgery** [sup][76],[77],[78] .

Glycemic control

Hyperglycemia is common among **pediatric** patients after **cardiac surgery**. Severe hyperglycemia has been associated with increased morbidity and mortality rates [sup][79],[80],[81],[82] . A conventional management (no insulin, no glucose) is satisfactory in most patients. However, insulin may be considered for small neonates with complex congenital heart **surgery** [sup][83] .

Nutrition support

Several studies have demonstrated that early enteral feeding decreases postoperative complications, accelerates wound healing process, decreases the cost of hospitalization, and improves quality of life [sup][84],[85],[86],[87] . However, feeding difficulties are common following **pediatric cardiac surgery**. Risk factors for feeding difficulties include increased risk adjustment for congenital heart **surgery** score (RACHS score) and prolonged postoperative intubation [sup][88],[89] . The use of a standardized enteral feeding protocol reduced the incidence of necrotizing enterocolitis, enabled high-risk infants to achieve recommended daily calories earlier in their postoperative course, and also decreased the duration of total parenteral nutrition use [sup][90],[91] .

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Nil.

Conflicts of interest

There are no conflicts of interest.

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