Original Article

Fast Tract Extubation in Paediatric Cardiac Surgery: National Institute of Cardiovascular Diseases (NICVD) Experience Karachi

Extubation in Paediatric Cardiac Surgery

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ABSTRACT

Objective: There are limited cardiac centers dealing with paediatric cardiac surgery with enormous patient burden resulting long waiting lists due to manpower as well logistic issue . Therefore the concept of fast tracking is very attractive to overcome logistic issue. We describe our experience of postoperative fast-track extubation of children undergoing cardiac surgery.

Study Design: Observational / descriptive study.

Place and Duration of Study: This study was conducted at the National Institute of Cardiovascular Diseases, Karachi from July 2015 to December 2015.

Materials and Methods: Total 244 pediatric patients of less than 16 years of age were underwent definitive as well as palliative surgical intervention for congenital heart defects at National institute of cardiovascular diseases Karachi. Both male and female patients aged less than 15 years undergoing elective surgical procedures for Congenital heart defects or acquired heart effects on cardiopulmonary bypass (CPB) or off pump were included in the study. Patients with missing data like extubation time and whose were planned for overnight ventilation due to preoperative diagnosis or delayed due to surgical causes like mediastinal bleed were excluded from study

Results: Among these patients fast tract extubation was observed in170(70%) and 74(30%) patients were extubated beyond 6 hours . While patient operated with the support of heart lung machine had higher number of delayed extubation rate that is 58(78.%) than off pump patients 16 (22%) $p<.05$. Extubation failure was observed in 9 patients with 5 patient who were extubated on table (fast tract group) and four patients extubated beyond six hours .(delayed extubation group).

Conclusion: Fast tract extubation is successful in majority of patients operated for congenital heart defects. Early extubation is safe and is associated with reduction in length of ICU stay and better PCICU bed management without any effects on mortality or morbidity of patients after paeditaric cardiac surgery. It requires only desire for proactive management and team work without any specific protocol or algorithm to achieve early extubation.

Key Words: Paediatric Cardiac Surgery , Fast Tract Extubation , Congenital Heart Defects , Paediatrics , Fast Tract Cardiac Surgery.

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INTRODUCTION

Fast tract cardiac surgery has a broader scope with multidisciplinary involvement to address perioperative course to minimize over all duration of stay in hospital and return to regular social life at most earliest. Thus fast tracking in cardiac surgery involve preoperative preparation of patients as outpatient, fast tract extubation, mobilization and hospital discharge in an effort to reduce costs and perioperative morbidity[1] both physical and psychological. Despite a number of articles published in recent years advocating various weaning strategies or algorithms, appropriate rapidity of weaning from mechanical ventilation and timing of extubation is a topic of debate in pediatric cardiac critical care. Early return of child to home made the idea of fast-tracking attractive for the medical team involved in the care of children as well as for parents. Tracheal extubation is a first step towards fast tract protocol in pediatric cardiac surgery. Generally, the term 'early extubation' is used when the endotracheal tube is removed within six hours after the surgery or ultrafast tract when patient extubated in operation room[2,3]. Concept of early extubation after pediatric cardiac surgery is not a new one . It was first published by Barash in 1980 involving 197 pediatric cardiac patients with age less than three years including neonates with 61% were successfully extubated in the operation room[4] . Early extubation has many proven

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advantages like avoidance of accidental extubation, pulmonary hypertensive crisis from endotracheal suctioning associated irritation, laryngotracheal trauma , ventilator associated pneumonia , mucous blocking of endotracheal tube , and lung collapse ,reduced requirements of sedatives ,early mobilization , earlier ICU discharge , minimizing overall length of hospital stay , reduced costs (ventilator associated, as well as length of ICU/hospital stay) and reduced parental stress by establishing verbal communication between the child and parents [5] . Delayed extubation is most distressing experiences for the parents[6] as most common question asked by parents regarding extubation of child as they believe it is a sign of successful intervention.

In our study we had retrospective analysis our six month record to see the trend of tracheal extubation in our pediatric population underwent palliative as well as definitive intervention for cardiac defects.

MATERIALS AND METHODS

We had performed a Observational / descriptive study of record from July 2015 to December 2015. Total 244 pediatric patients of less than 16 years of age were underwent definitive as well as palliative surgical intervention for congenital heart defects at National institute of cardiovascular diseases Karachi tertiary care hospital dedicated to cardiac patients only. Both male and female patients aged less than 15 years undergoing elective surgical procedures for Congenital heart defects or acquired heart effects on cardiopulmonary bypass (CPB) or off pump were included in the study. Patients with missing data like extubation time and whose were planned for overnight ventilation due to preoperative diagnosis or delayed due to surgical causes like mediastinal bleed were excluded from study.

Perioperative course: All the patients operated for intra cardiac defect requiring cardiopulmonary bypass shifted to ICU on mechanical ventilation planned for fast tract extubation ; extubation within six hours or delayed either due to failure to achieve extubation criteria or planned over night ventilation based on team decision . While rest off patients always planned for ultrafast extubation; on table extubation . Extubation criteria we are following is mentioned in table 2 .All patients were premedicated with syrup chloral hydrate . In the operation room induction was done with injection dormicum .1mg/kg, injection morphine .1mg/kg, atracurium .5mg/kg and propofol 2mg/kg . Maintainace was done with Inhalational sevoflurane 2.5% and morphine infusion or nalbuphin. On cardiopulmonary bypass maintain ace was done with isoflurane 1.15%. American Society of Anesthesiologists(ASA) ecommended monitoring was (pulse rate, electrocardiogram, noninvasive and invasive blood pressure, SO2%, ETCO2, oesophageat temperature(on pump patients) and urine output) conducted in all patients specially those operated on cardiopulmonary bypass .Arterial blood gases with Hemoglobin, electrolytes (baseline,after CPB and preextubation), blood sugar and activated clotting time (ACT){haprinised} were also monitored.Neostigmine (40 µg/kg) and pyroglycopyrolate (10 µg/kg) was administered as a reversal after full filling extubation criteria.

RESULTS

In our final analysis we had included 244 patients. There were 130 male and 114 females. Demographic characters are showing table 1. There was fast tract extubation was observed in 170(70%) patients with on table extubation of 52(30%) of fast tract group and delayed extubation 74(30%).

Table No.1: Demographic Variable of patients N=244

Variable	No. Patients	Percentage
Gender		
• Male	130	53.27%
• Female	114	46.72%
Age		
• Neonate	15	6.1%
• Infant	39	15.9%
• Children	190	77.86%
Diagnosis		
• Tetralogy Of Fallot (TOF)	84	34.42%
• Ventricular Septal Defect (VSD)	22	9.01%
• Ventricular Septal Defect(VSD)+ Pulmonary Hypertension(PAH)	54	22.13%
• Atrial Septal Defect(ASD)	24	9.83%
• Miscellaneous	60	24.59%
Pump		
• On Pump	148	60.65%
• Off pump	96	39.34%
Palliative intervention		
• Pulmonary Artery Banding (PA Band)	33	13.52%
• Modified Balolock Tussing Shunt(MBT)	12	4.91%
• Glenn	9	
Off pump definitive		
• Patent Dutus Arteriousis(PDA) ligation	13	3.68%
• Miscelanous	7	2.86%

Extubation failure was observed in 9(4%) patients, reintubated within 24 hours of extubation with 5patients from fast tract group with on table extubation and 4 patients from delayed extubation group. However patients reintubated for surgical reason like tamponade or bleed were considered in groups of fast tract or delayed extubation as per there first extubation time . Association of extubation time with other variable are shown in table 3 . Out of 244 patients 19 (8%) patients were expired . Apparently it looks very high mortality but unfortunately we had very high risk patient population presented with advance stage of morbidity as well as in malnourished status . As shown in our mortality out come with 5(13.5%) mortality in ultrafast tract extubated child four operated for PA band and one after MBT shunt while 14(19.7%) mortality of delayed extubation group among these also included those failed to extubated . These include two case of senning for dTAGA, four cases of TOF, two cases of VSD with sever pulmonary hypertension and one case of total anomalous pulmonary venous connection (mixed type) with pulmonary hypertension.

Table No.2: Extubation criteria followed in our study

General Assessment	Neurological Status	Acceptable Respiratory Mechanics	Acceptable Arterial Blood Gases (Abgs) On 5cm Or Less Of Cpap Or Psv
Awake without stimulation	Awake without stimulation	Negative inspiratory force >25cm H2O	. PaO2>70 torr on FIO2 of 0.5 or less
Chest tube drainage<50 mL/h	Moving limbs	Tidal volume >5 mL/kg	PCO2<48 torr
Adequate reversal of neuromuscular blockade	Obeying command	Vital capacity >10–15 mL/kg	pH 7.32–7.45
Core temperature>35.5 _		Spontaneous respiratory rate as per desired based on age	
There is consenus between surgical and critical care team for extubation		Air leak	

Table No.3: Relation of different variable with extubation pattern

Variable	Fast tract extubation	Delayed extubation
Age(n=244)		
• Neonate	10(67%)	5(37%)
• Infant	32(82%)	7(18%)
• Children	129 (68%)	61(32%)
Pump (n=244)		
• On Pump	90(62%)	58 (38%)
• Off pump	80(84.4%)	16 (15.6%)
Iontrope Support		
• Single Iontrope (n=135)	92(68%)	43(32%)
• Double Iontrope (n=12)	3(25%)	9(75%)
Tetralogy Of Fallot (TOF) (n=73)	42(57.5%)	31(42.5%)
Venntricular Septal Deffect (closure) (n=35)	21(60%)	14(40%)
Atrial Septal Defect (closure) (n=23)	21(91.3%)	2(8.7%)

DISCUSSION

Desire to reduce the cost of cardiac surgery without compromising the patient safety resulted in the development of fast tract protocol in adult cardiac surgery . However there are variable personnel and group policies regarding the application of fast tract protocol in patients with congenital heart defects . While many centers feels comfortable with fast-tracking concept others still routinely follow time based protocol with continue invasive ventilation and deep sedation postoperatively for a day or two in the intensive care depending on the type of intervention and risk factors . There have been a many reports and articles that evaluate the practice of fast tract extubation after pediatric cardiac surgery . Most reports suggesting early extubation can safely be achieved, mostly having carefully selected patient population. Most of these publications include carefully selected patients with uncomplicated repairs and excluded young patients requiring complex repair or deep hypothermic circulatory arrest[7,8,9]. Prospective study conduct by Mohammad Irfan Akhtar[1] on fast tract extubation and reported Bleeding, low cardiac output, respiratory complication, while another study conducted by Kloth et al.[10] and reported risk factors on Younger age, lowboy weight .

Even though more often patients selected for early extubation based on institutional inclusion/exclusion criteria , nevertheless surgeon and anesthesiologist at the end of the procedure made the final decision to extubate in the OR or select for early extubation. Successful weaning from mechanical ventilation requires the presence of satisfactory cardiovascular function, satisfactory ventilatory reserves and optimal pulmonary mechanics. Proper timing of tracheal extubation in these children depends on clinical evaluation of the patient's ability to sustain spontaneous breathing without eliciting significant sympathetic response. Prior to tracheal extubation the patient should be assessed to rule out presence of low cardiac output syndrome using clinical markers such as trends in vital signs and physical examination, derangement of blood acid base balance, serum lactate levels, and invasive monitoring of arterial blood and central venous pressures along with AV difference. The decision of not to proceed with fast tract extubation is often based on multiple factors like pulmonary hypertension , prolong pump time, high ionotrop support at the end of procedure and consequently it can be difficult to point out the exact reason(s) of delayed extubation in a retrospective manner. However, factors found to independently predict failure of early extubation, such as long CPB time, interact with many of the criteria used to evaluate the potential for safe extubation (e.g., myocardial function, hemostasis, airway edema). In our study we have patients with pulmonary artery hypertension those excluded by fast tract extubation because of anesthetic preference . Nevertheless few were also extubated early again by anesthetic team headed by different in charge . Currently there are reports favoring even on table extubation of patients with pulmonary hypertension[11] . However in our study none of the patient operated on pump underwent ultra fast tract extubation , while it is our routine practice for off pump patient on table extubation. However patients underwent fast tract protocol or those extubated after 6 hours ;differences in morbidity and mortality are difficult to predict [12] same as reintubation rate [13]. William T. Mahle et al[14] reported a multicentre review of fast tract extubation in patient underwent total correction for Tetralogy Of Fallot and Fonton circulation , they found 31.5% patients of Tetralogy Of Fallot and 69.8% of Fontan achieve successful early extubation with decrease length of hospital stay . While in our study we have observed successful fast tract extubation after total correction of TOF in 42(57.5%) out of 73. Though there was no complete total cavopulmonary connection was done but nine patients underwent bidirectional Glenn shunt with all patient were extubated within six hours of shifting to PICU. Same trend was observed after VSD closure with 21(60%) out of 35 patient achieved extubation in 6 hours . Patients with atrial septal defect closure have fast tract extubation in 22(91.3%) out of 24 patients while remaining two patients had sinus venous defect with sever pah and other had single atrium with severe mitral regurgitation underwent atrial septation and mitral valve repair. While patient with delayed extubation has strong association of extubation failure[15,16] . Same trend was observed in our study with 4 patients from delayed extubation group and 5 from fast tract group with four patients of PA banding with sever pulmonary artery hypertension and one underwent MBT shunt for pulmonary atresia developed pulmonary flooding requiring reintubation.

CONCLUSION

This study found that we do not uses any specific protocol for fast tract extubation, it is our determination and team work that make us possible to achieve fast tract extubation and desired operative list management. Nevertheless still there is a lot of to do to achieve more to improve patient care and patient number management.

Conflict of Interest: The study has no conflict of interest to declare by any author.

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