

The Efficiency of CPAP in Reducing Invasive Ventilation in Post-Surgical Cardiac Pediatric Patients

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ABSTRACT

Introduction: The use of mechanical ventilation in the postoperative period is associated with longer PICU and increased length of stay in hospital. There are few studies that analyze any association between NIV specially CPAP and the duration of invasive mechanical ventilation (IMV) regarding PICU and length of stay. In this study, our main goal was to evaluate efficiency of the CPAP in reducing invasive ventilation in post-surgical cardiac pediatric patients.

Objective: To evaluate efficiency of the CPAP in reducing invasive ventilation in post-surgical cardiac pediatric patients.

Method: This cross-sectional study was carried out at Bangladesh Shishu Hospital and Institute, Bangladesh. Data were collected from March 2018 to January 2020. A total of 40 pediatric patients requiring NIV after heart surgery were included in this study. Sample were collected through purposive sampling as per inclusion criteria.

Results: During the study, prophylactic NIV was the most common indication 28 (70%), followed by ARF 12 (30%). CPAP was the most common modality of NIV 36 (90%) and the "nasopharyngeal tube" was the most common interface 32 (80%), followed by face mask (3%) and nasal mask (8%). NIV failure according to IMV prior to NIV, indication and type of NIV where NIV failure was greater in patients that had not received IMV prior to NIV, in those intubated for ARF, in those with

BIPAP and in those requiring several inter-faces, nasal mask or full-face mask.

Conclusion: CPAP was the most common modality, and the "nasopharyngeal tube" was the most common interface in our study although. Prospective multicenter studies are needed to better assess the association of CPAP and the need for mechanical ventilation, PICU LOS and mortality.

Keywords: Continuous Positive Airway Pressure (CPAP), Heart Surgery, Invasive Mechanical Ventilation (IMV), Acute Respiratory Failure (ARF), Paediatric Intensive Care Unit (PICU), Length of Stay (LOS), Non-Invasive Ventilation (NIV).

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INTRODUCTION

Outcomes in children after heart surgery depend on the severity and complexity of the underlying heart disease, preexisting conditions, duration and complications during surgery and clinical evolution in the postoperative period.¹ The use of mechanical ventilation in the postoperative period has an important impact on hemodynamics and clinical evolution.²⁻³

Several studies have found an association between mechanical ventilation in children after heart surgery and an increased risk of mortality, longer pediatric intensive care unit (PICU) length of stay (LOS) and greater costs.⁴⁻⁵ For all these reasons, an early extubating is recommended if the hemodynamic situation after surgery is acceptable.⁶ Several studies have analyzed the factors

that are associated with a prolonged extubating after heart surgery in children⁷ but there are few studies that analyze whether there is an association between NIV specially Continuous positive airway pressure (CPAP) and the duration of invasive mechanical ventilation (IMV) regarding Paediatric Intensive Care Unit (PICU) and length of stay (LOS). In this study, our main goal was to evaluate efficiency of the CPAP in reducing invasive ventilation in post-surgical cardiac pediatric patients.

OBJECTIVE

To evaluate the efficiency of CPAP in reducing invasive ventilation in post-surgical cardiac pediatric patients.

METHODOLOGY

Type of study: It was a cross sectional type study.

Place and Period of the Study: The study was carried out at Bangladesh Shishu Hospital and Institute, Bangladesh where data were collected from March 2018 to January 2020.

Study Population: A total of 40 pediatric patients requiring NIV after heart surgery were included in this study. Sample were collected through purposive sampling as per inclusion criteria.

Data Analysis: All collected data were coded and input in SPSS-25 for further analysis. Both descriptive and inferential statistics done. Descriptive statistics included frequency distribution, percent, mean, standard deviation, graph, tables, figures and inferential statistics.

RESULTS

Table 1 shows age distribution of the patients where most of them belong to the 1 year- 5 years age group 16 (40%) followed by 12 (30%) in 6 months-1 year age group and same in 12 (30%) were 6-10 years age group.

Figure 1 shows gender distribution where majority of the patients were male 28 (70%).

Table 2 shows clinical status of patients where prophylactic NIV was the most common indication (70%), followed by ARF (30%). CPAP was the most common modality of NIV (90%) and the “nasopharyngeal tube” was the most common interface (88%), followed by face mask (3%) and nasal mask (8%).

Table 3 shows NIV failure according to IMV prior to NIV, indication and type of NIV where NIV failure was greater in patients that had not received IMV prior to NIV, in those intubated for ARF, in those with BIPAP and in those requiring several inter-faces, nasal mask or full face mask.

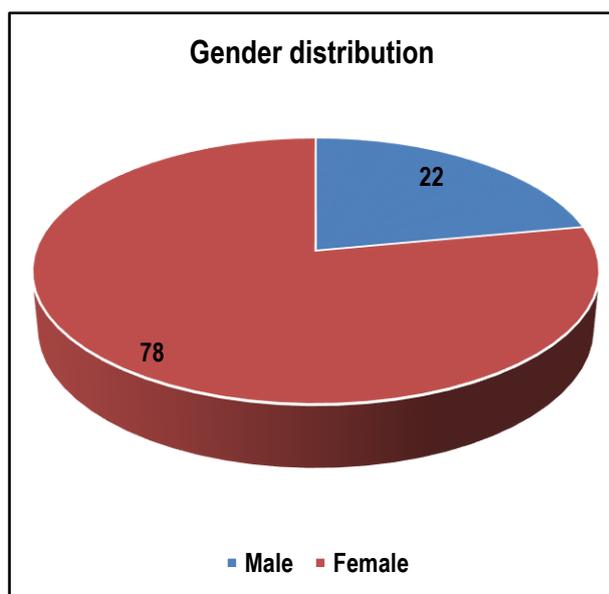


Figure 1: Gender distribution.

Table 1: Age distribution of the patients

Age group	%
6 months-1 year	30%
1 year - 5 years	40%
6 years -10 years	30%

Table 2: Clinical status of patients

Clinical status	%
IMV	12%
NIV	88%
NIV type	
CPAP	90%
BIPAP	10%
NIV Indication	
Prophylactic	60%
Respiratory failure	30%
NIV failure	10%
Interface	
Nasopharyngeal tube	88%
Nasal mask	8%
Face mask	3%
Nasal cannula	1%
Duration of IMV (days)	
	3.0
Duration of NIV (days)	
	2.0
PICU LOS All patients (days)	10.0 (3.0–16.0)
PICU LOS Patients NIV (days)	16 (9.0–31.0)

Table 3: NIV failure according to IMV prior to NIV, indication and type of NIV

	NIV failure (%)	P value
IMV prior to NIV		
Yes	20%	0.035
No	80%	
Indication		
Prophylactic	25%	0.04
Respiratory failure	75%	
Modality		
CPAP	10%	0.015
BIPAP	90%	

DISCUSSION

An early extubation reduces the incidence of mechanical ventilation-related complications and it minimizes the undesired effects on heart function.⁸

NIV decreases the risk of mechanical ventilation-related complications while maintaining the beneficial heart and lung effects of positive airway pressure, enabling an earlier extubation.⁹ Nevertheless, very few studies analyze the utility of NIV in the postoperative period of heart surgery in adults or children.²⁻³

Our study is the first one to analyze NIV after heart surgery in children over a long period. Our study shows that the use of IMV has decreased as the use of NIV has increased in our unit. This has not affected the incidence of NIV failure.

The use of BIPAP, which offers greater respiratory support, as well as the use of nasal cannula (which are comfortable and well tolerated) has increased throughout the study, while the use of nasal and full-face masks has been reserved for patients with a more severe ARF. Some of the most important factors for the success of NIV are the good tolerance and acceptance of the

technique on behalf of the patients as well as an increasing experience of the PICU team. Infants require longer mechanical ventilation and the need for NIV was greater than that of older children. This fact has been described in previous studies.^{6,7} It may be due to the greater complexity of the underlying heart disease and the surgery, to their greater metabolic requirements or to their greater dependence on diaphragmatic muscles (which can become impaired after heart surgery). The indication for NIV was prophylactic after extubation in most of our patients for having ARF or heart failure risk factors.⁵ It was not possible to analyze the efficacy of NIV in reducing the risk of failure and intubation due to the characteristics of our study. Our percentage of NIV failure is consistent with what has been published by other authors.^{3,6}

CONCLUSION

CPAP was the most common modality, and the nasopharyngeal tube was the most common interface in our study. Prospective multicenter studies are needed to better assess the association of CPAP and the need for mechanical ventilation, paediatric intensive care unit (PICU), length of stay (LOS) and mortality.

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