Bag Valve Mask Ventilation Versus Controlled Ventilation for Minor Pediatric Surgery.

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ABSTRACT

Introduction: Paediatric anaesthesia deals with Examination under anaesthesia to complicated surgical interventions. Most of the minor surgeries can be performed with Bag Valve Mask Ventilation which avoids complications of endotracheal intubation .

Methods: A retrospective randomized control study was undertaken in 654 paediatric surgeries performed at Shree Birendra Hospital, Chhauni (April 2005-March 2010). The children underwent minor general, Ear nose throat and orthopaedic surgery to compare spontaneous Bag Valve Mask ventilation in 503 patients (BVM Group) and controlled ventilation in 151 patients (CV Group). The BVM group was done under spontaneous mask ventilation and CV group under endotracheal intubation. Anaesthesia was induced and maintained with oxygen and halothane, using a Mapleson F system with spontaneous ventilation and a Rendell-Baker face mask. The duration of anaesthesia was less than one hour.

Results: In this study we noted the complications like trauma to face and lips, dental trauma, laryngospasm, perforation of tracheaor esophagus, pulmonary aspiration of gastric contents or foreign bodies and post extubation complications.

Conclusions: It is concluded that the need of controlled ventilation with endotracheal tube is limited to only a few procedures and many of the paediatric surgeries can be performed with spontaneous mask ventilation. Therefore anaesthesia with oxygen and halothane with spontaneous mask ventilation is a satisfactory method for minor procedures in children .

Keywords: BVM, controlled ventillation, paediatric surgery.

INTRODUCTION

Paediatric anaesthesia embraces patients from the premature, naeonate to the adolescent. Children require anesthesia for a variety of procedures from minor to major surgeries. There remains a debate whether to go for spontaneous mask ventilation or controlled tube ventilation. Tracheal intubation requires expertise and has more consequences in children.

Minor surgeries can be carried out under spontaneous mask ventilation which reduce opioid requirements, opioid related side effects and recovery time thus enabling patient to early discharge.

Although both these techniques are in practice for a long time there are only a limited studies comparing these techniques. Since most of the paediatric procedures can be undertaken on mask ventilation we chose to take

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up this study to evaluate the efficacy of spontaneous mask ventilation and the rate of complications in minor paediatric surgeries.

The aim of this study was to to determine whether Bag mask Valve ventilation is as efficacious as endotracheal intubation to provide anaesthesia for minor paediatric surgery and to compare the complications in abovementioned methods.

METHODS

This was a retrospective randomized control study in 654 paediatric surgery in Shree Birendra Hospital, Chhauni (April 2005-March 2010).

The study groups were divided into two Groups namely, Bag Mask Valve (BVM) Ventilation Group and Controlled ventilation (CV) Group. All Minor Paediatric General, ENT and Orthopaedic surgeries were included. Patient older than16 years, belonging to ASA III and ASA IV physical status and surgery lasting more than 60 minutes were excluded from the study. Results were analyzed using Microsoft Excel. Pre anaesthetic assessment of the children was done. The parents or guardians were well explained about the procedure and written informed consent was taken. Patients were kept nil per oral four hours prior to surgery. On arrival in Operation Theater intravenous cannula was inserted in the waiting room in laps of parents. They were premedicated with oral midazolam 0.5 mg. After taking them to the operation theater the children were injected with Pethidine 0.5 mg/kg, induced with Propofol 2mg/kg. Suitable sized Rendall Baker face mask was applied and ventilated with the Mapleson F circuit.

The spontaneous mask group was thereafter maintained with Halothane 1-2%. The controlled ventilation group was injected with Inj. Vecuronium 0.1 mg/kg and after 3 minutes intubated with suitable sized tube. Inj. Vecuronium was topped up as per requirement and they were reversed at the end of surgery with Inj. Neostigmine 50 mcg/kg and Atropine 20 mcg/kg.

We also noted the complications like trauma to face and lips, dental trauma, laryngospasm, perforation of tracheaor oesophagus, pulmonary aspiration of gastric contents or foreign bodies and post extubation complications.

After completion of procedure, patients were transferred to recovery room.In recovery room patients vitals are monitored and any other complications like nausea, vomiting, were noted. When patient was fully conscious and well oriented they were shifted to postoperative wards.

RESULTS

The children ranged between 4 months to 15 years for BVM group and 1 year to 14 years for CV group. Regarding Sex distribution, In BVM group out of 503 patients 318 (63%) were male and 185 (36%) were female, where as in CV Group out of 151 patients, 71 were male(47%) and 80 were female (52 %) and $_{p}$ Value is 0.35 which is not significant.

Mostly the general, orthopaedic and ear and throat surgeries were included in the study. Surgeries requiring muscle relaxation and prolonged duration were taken into CV group and most of the implant removals and examinations were carried out in BVM due to the paediatric age group.

The comparision between the complications among these two procedures were the crux of this study. The complications noted were bradycardia, dental trauma, hypoxemia, laryngospasm and soft tissue injury.

Bradycardia was noted in both BVM and CV groups. But in BVM group the incidence of bradycardia was less than CV group. In CV group 21 (13.90%) among 151 patients developed bradycardia whereas in BVM group the value was 7 (1.39 %).

Dental trauma was inflicted on 5 patients (3.31%) in the CV group whereas it was none in the BVM group.

Hypoxemia was noticed in both the groups but the incidence was higher in the CV group. In CV group 7 children (4.63%) developed hypoxemia and in BVM group the number was 8 (1.59%).

The second most important complication was laryngospasm which was very high in the CV group, 15 in number (9.93%) as compared to 4 in the BVM group which is (2.98%).

Finally soft tissue injury was noted among 8 (5.29%) of the patients in the CV group whereas the value was 5 (0.99%) in BVM group.

Table 1. Types of Operations

Operation	GA Count	IVA Count
Appendectomy	51	1
Circumcision	4	83
Debridement	4	8
EUA	0	5
Excision	18	16
Exploration	4	1
Herniotomy	8	125
Incision and Drainage	2	27

K - Wire Fixation	7	16
Laparotomy	10	0
MUA	7	39
Myringoplasty	11	1
OR&IF	72	9
Orchidopexy	2	4
Others	33	20
Removal of Implant	13	20
Tonsillectomy	19	14

Table 2. Complications

Complications	CV	BVM	P value
Bradycardia	21	7	0.043
Dental Trauma	5	0	
Hypoxemia	7	8	
Laryngospasm	15	4	
Soft Tissue Injury	8	5	

DISCUSSION

In 1854, a singing teacher named Manuel Garcia (1805–1906) became the first man to view the functioning glottis in its entirety[1]. After World War I, further advances were made in the field of intratrachealanesthesia by Sir Ivan Whiteside Magill[2,3]. Sir Robert Reynolds Macintosh (1897–1989) also achieved significant advances in techniques for tracheal intubation when he introduced his new curved laryngoscope blade in 1943[4].The most widely used curved laryngoscope blade is named after Macintosh[5-7].

Tracheal intubation (orotracheal, nasotracheal, cricothyrotomy, or tracheotomy) is indicated under any circumstances where the airway is unprotected[8]. Bag-valve-mask (BVM) ventilation is an essential emergency skill. This basic airway management technique allows for oxygenation and ventilation of patients. BVM ventilation is also appropriate for elective ventilation in the operating room when intubation is not required. In our study 503 patients were operated under spontaneous bag mask ventilation and only 151 patients needed endotrachael intubation .This explains that most of the paediatric minor surgeries can be carried out with BVM method.

BVM ventilation requires a good seal and a patent airway. Practice with this important skill increases the clinician's ability to provide effective ventilation. Adjuncts such as oral and nasal airways can aid with ventilation by relieving physiologic obstruction and by opening up the hypopharynx. The masks come in many sizes, including newborn, infant, child, and adult. Choosing the appropriate size helps to create a good seal and, therefore, aids effective ventilation. Bags for BVM ventilation also come in different types. Newer bags are equipped with pressure valve. Some bags have one-way expiratory valves to prevent the entry of room air; these allow for delivery of greater than 90% oxygen to ventilated and spontaneously breathing patients.

There are significant differences in airway anatomy and respiratory physiology between children and adults. After about 8 years, airway difference between adults and children mainly reflect size difference. These anatomical and physiological differences gradually become less significant as the human body approaches a mature age and body mass index[9].

Several anatomic differences make respiration less efficient for infants. The smaller diameter of the airways,high compliance and poor support by sorrounding structures lead to functional airway closure[10]. Also the high oxygen consumption and increased work of breathing explain the high respiratory rate and the rapid oxygen desaturation[11]. In our study hypoxemia was noticed in both the groups but the incidence was higher in the CV group. In CV group 7 children (4.63%) developed hypoxemia and in BVM group the number was 8 (1.59%).

Endotracheal intubation being an invasive procedure, there may be problems if the airway is difficult. There are a number of devices specially designed for assistance with difficult tracheal intubation in pediatric patients[12]. Many a times injuries may occur while attempting intubation. Soft tissue injury was noted among 8 (5.29%) of the patients in the CV group whereas in the BVM group the value was 5 (0.99%). Dental trauma was inflicted on 5 patients (3.31%) in the CV group whereas it was none in the BVM group.

The duration of endotracheal intubation attempts is also important as the paediatric patients tend to develop bradycardia along with hypoxemia. Although bradycardia was noted in both BVM and CV group in our study the incidence was lower in BVM than CV group. In CV group 21 (13.90%) among 151 patients developed bradycardia whereas in BVM group the value was 7 (1.39 %).

Because the airway of a child is narrow, a small amount of edema can produce severe obstruction. Edema can easily be caused by forcing in a tracheal tube that is too large relative to the diameter of the trachea. Conversely, an excessive leak can sometimes be corrected through the placement of a larger (0.5 mm larger in internal diameter) tracheal tube, and in difficult-to-ventilate pediatric patients children it is often necessary to use cuffed tubes to allow for high pressure ventilation if the leak is too great to overcome with the ventilator. In our study the second most important complication was laryngospasm which was very high in the CV group, 15 in number (9.93%) as compared to 4 in the BVM group which is (2.98%). That explains the higher risk of airway manipulations as opposed to simple bag mask ventilation.

CONCLUSIONS

Bag valve mask ventilation is an effective method of anaesthesia. With this technique endotracheal intubation related complications like laryngospasm, bronchospasm, reintubation and residual effect of paralyzing agents can be avoided. There is an added advantage of minimal drug use as less depth of anaesthesia is needed and the recovery is faster.

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