Anaesthetic management of laparoscopic pyloromyotomy for infantile hypertrophic pyloric stenosis: A retrospective study of 109 cases

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Abstract

Anaesthesia for laparoscopic pyloromyotomy poses multiple challenges. We have analysed our experience of anaesthetizing these infants by describing the perioperative events statistically in order to improve our anaesthetic technique.

Pre-operative records, demographic details, intraoperative and post operative records of all cases of laparoscopic pyloromyotomy performed over a period of 5 years in a tertiary care unit were collected and reviewed. A statistical analysis of demographic details, preoperative clinical features with emphasis on metabolic derangements, adverse events during surgery and in the post operative period was done. We observed a combined intraoperative and post operative complication rate of 20% with no occurrence of mortality. Maximum morbidity post operatively was due to the development of emesis seen in 8 children (7.3%).

Key words: Laparoscopy, Pyloromyotomy, Pyloric stenosis.

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Introduction

Infantile hypertrophic pyloric stenosis is a common pathological condition of early infancy with incidence ranging from 1.4-8.8 per 1000 live births. It is a medical emergency requiring immediate correction of fluid and electrolyte imbalance. Surgical intervention by pyloromyotomy is undertaken as an elective procedure. It presents important anaesthetic implications unique to infancy. The infants should be considered as full stomach with risk of regurgitation and pulmonary aspiration. Residual dehydration and acid base imbalance may coexist (1,2). With the advent of minimal invasive techniques, laparoscopic pyloromyotomy has become popular and widely accepted(3,4,5). Advantages of the laparoscopic technique include faster feeding times, reduced post operative hospital stay, less post operative complications, emesis and analgesic requirement with improved cosmesis (3,4,5,6). Pneumoperitoneum, hypercarbia and positioning in an infant undergoing laparoscopy add to the anaesthetic risk(1,2).

We undertook this study to critically evaluate our anaesthetic experience in the management of laparoscopic pyloromyotomy and compare our results with similar observational studies.

Methods

Hospital ethics committee approval was taken to review the anaesthesia records of infants who had underwent laparoscopic pyloromyotomy in a tertiary care institute from April 2007 to July 2013. Demographic data of 109 patients was collected along with details of symptomatology including non bilious projectile vomiting, sunken frontanelle, dry mucous membranes, reduced skin turgor suggestive of dehydration and constipation. Investigations at the time of admission including arterial blood PH, serum electrolytes were collected. Intraoperative records of difficult airway (3 or more attempts of laryngoscopy before securing airway by senior anesthesia consultants), desaturation (fall in SpO2 to <85%), arrhythmias on a 5 lead ECG, haemodynamic instability (fall in mean arterial pressure by >10% of baseline values), bradycardia (heart rate <80bpm), delayed recovery, hypothermia (core body temperature< 35◦ C measured at nasopharynx), laryngospasm were noted. Arrhythmias, vomiting and other significant post operative events were noted along with time to first feed and discharge.

The hospital anaesthesia protocol in infantile hypertrophic pyloric stenosis was fluid resuscitation and to ensure the following values before acceptance of a case: serum potassium > 3.2meq/L, serum chloride >105meq/L, serum bicarbonate<30 mmol/L, Urine chloride>20meq/L, urine output> 1ml/kg (7,8).

The review of anaesthesia records revealed induction of general anaesthesia with injection Fentanyl 2 microgram/kg and Injection Thiopentone 5 mg/kg and Atracurium 0.6mg/kg administered intravenously and airway secured with appropriate size endotracheal tube. Maintenance of anaesthesia was done with isoflurane 0.7-1.5%, oxygen 50% in air, pressure controlled

ventilation. Intermittent bolus of Atracurium 0.3mg/kg was administered every half hour. Warming mattress was placed. Calculated administration of balanced salt solution. Continuous monitoring of ECG, heart rate, blood pressure, SpO2 and nasopharyngeal temperature was done intraoperatively. Analgesia was achieved with per rectal acetaminophen and local anesthetic infiltration at incision site.

At the end of surgery, gastric mucosal integrity was confirmed by saline insufflation. Neuromuscular block was reversed with administration of injection neostigmine(0.05mg/kg) with injection glycopyrolate (0.01mg/kg) and extubated when spontaneous breathing was adequate and placed in lateral position and shifted to PACU. After around 2 hours, the infant was shifted to ward and feeding initiated after standard NPO hours. Demand feeds were gradually increased as tolerated by the child. The child was discharged once a full feed was achieved.

Results

Data of 109 children all of whom underwent elective laparoscopic pyloromyotomy was observed. Demographic data is represented in Table 1 and per operative observations in Table 2 and 3. Male infants were 95 (88%) and female 13(12%). The clinical symptoms ranged over an average duration of 13 days (3-45 days). All the infants were born at term gestation.

Table 1: Demographic data of subjects included in the study

PARAMETER	MIN VALUE	MAX VALUE	MEAN+/-SD
AGE (DAYS)	12	120	42.8+/-20.45
WEIGHT (KG)	1.8	5.25	3.18+/-0.7

Table 2: Parameters at time of admission

PARAMETER	MIN VALUE	MAX VALUE	MEAN+/-SD
PH	7.374	7.828	7.53+/-0.1
Bicarbonate	10	39	26.23+/-6.72
Sodium	117	142	132.38+/-6
Potassium	2.2	5.7	4.26+/-0.9
Chloride	71	108	93.44+/-9.8

Table 3: Peri operative observations

PARAMETER	MIN VALUE	MAX VALUE	MEAN+/-SD
Operative time(min)	15	125	47.6+/-20.33
First feed(hours)	8	120	23.32+/-18.7
Post op hospital stay (days)	1	15	2.76+/-2.66

Perioperatively incidence of complications was 20%. There were 4 (3%) cases of difficult airway, delayed recovery 3 (2.75%) cases, bradycardia 2 (1.83%) cases and 1(0.9%) case each of laryngospasm, apnea at reversal, bleeding requiring post operative blood transfusion. Post operatively 8 (7.3%) infants had vomiting and 2 (1.83%) infants developed sepsis (positive blood culture with persistent hypotension, feeble peripheral pulses).

Discussion

Laparoscopic pyloromyotomy has been performed in our institute, a tertiary referral centre as the principal method of management of infantile hypertrophic pyloric stenosis since 2007.Data of 109 children were analysed. Demographic details were comparable with reported studies (4,9,10,11,12,13) .

Infants present with projectile, non bilious vomiting during first one week to 10 days of age associated with constipation. Persistent vomiting leads to dehydration, acid base imbalance and weight loss (11,12,14). In the present study, all infants had projectile non bilious vomiting with constipation, onset varied from 3-45 days of life. Details of severity of vomiting in terms of number of episodes of vomiting, volume and characteristics of the vomitus is not available. 102 infants presented with signs of dehydration, either dry mucous membranes, depressed frontanelle, and/or reduced skin turgor.

Infants develop hypokalemic, hypochloremic metabolic alkalosis due to persistent vomiting (8,11,12). A rise in bicarbonate levels with increasing severity of physiological derangements has been observed (11, 14). In the present study we observed an alkaline PH of 7.53 with a mean bicarbonate 26meq/l which constitutes mild illness. Maximum bicarbonate levels observed was 39 meq/l which constitutes moderate dehydration. Hypokalemia observed in our study was also mild with the lowest value recorded as 2.2meq/l. Mild hyponatremia and hypochloremia was

observed. Classical alkalosis with severe dehydration was not observed probably due to increasing awareness by the parents and also faster diagnosis and treatment (7, 15). Mean operative time was 47 min. Low pulmonary reserve with high inclination for airway collapse in infants combined with increased oxygen demand make them prone for rapid desaturation and bradycardia. Hence rapid sequence induction and intubation was practiced with gentle face mask ventilation (low volume and high rate) after induction and prior to intubation (17, 18). Cricoid pressure was not applied routinely as it leads to alteration in airway anatomy causing difficulty in laryngoscopic visualization of the airway and intubation. (19)

Time to first feed and post operative duration of hospital stay has been considered by many authors to grade post operative recovery (3, 20) and these parameters have been found to be in acceptable limits in the present study. On discussing with the surgeons, it was found that demand feeding was started with milk after standard NPO hours if there was no abdominal distension and no ryles tube aspiration. Feeding was delayed if vomiting was present. But details of whether this schedule was followed in each case, quantity of feed is not available. Causes for delay in first feed (> 24 hrs) include occurrence of emesis, presence of ryles tube aspiration, abdominal distension, sepsis and occurrence of surgical complications (mucosal perforation: 4 cases, inadequate pyloromyotomy:5 cases, omental prolapse through port site:1 case). The post operative hospital stay was prolonged in the children who developed sepsis requiring icu care. One infant was admitted for upto 15 days and another infant for 10 days and both infants had developed sepsis and emesis. In 3 infants, post operative stay was extended to one week due to emesis. AA shah (9) reported feeding by 6 hours and mean post operative hospital stay of 3.4 days. Ostlie et al (16) report faster time to first feed of 3.8 hours and a total mean duration of hospital stay of 53 hours. Several studies have observed significantly faster time to full feed and shorter duration of post operative hospital stay in infants who underwent laproscopic pyloromyotomy as compared to the open procedure.(4, 6, 13, 21)

We observed a combined intraoperative and post operative complication rate of 20% with no occurrence of mortality which is higher as compared to other reported studies. There were 4 cases of difficult airway where intubation was done on the third attempt by senior anesthesia consultants. No specific association of difficult airway and pyloric stenois was found and the cause could be attributed to the inherent difficult pediatric airway. There were 3 cases of delayed recovery and one child developed apnea, both managed by positive pressure breaths and warming the child. In 2 infants bradycardia was observed during recovery requiring treatment with glycopyrolate. One instance of bleeding intraoperatively was observed requiring blood transfusion. One child developed laryngospasm immediately after extubation but recovered after administering positive pressure breaths via face mask. Sapkota et al (22) observed an intraoperative complication rate of 15% including occurrence of delayed recovery (9%), difficult airway (4%) and perforation (2%). Delayed recovery, repiratory depression and apnoea, in our study where all infants are full term could be attributed to residual CSF alkalosis (23) causing increased sensitivity to opiods. Hence we now administer fentanyl in a reduced dose of 1ug/kg .(7,23,24)

Maximum morbidity post operatively in infants undergoing laparoscopic pyloromyotomy was due to the development of emesis seen in 8 children (7.3%) of which 3 infants had inadequate pyloromyotomy. This being a retrospective study details of post operative feeding schedule in each case, quantity and quality of feed, number of attempts of feeding, number of episodes of emesis, etc is not available. Hence cause of emesis can only be contemplated to be due to multiple factors like inadequate aspiration of saline via the Ryles tube, laparoscopic intervention under general anesthesia with mean operative time lasting >30 minutes, fluid and electrolyte imbalance and also side effects of various anesthetic drugs including fentanyl, volatile anesthetics (25). They were treated by administration of intravenous fluids and antiemetics including ondansetron. Fujimoto et al (6) observed a 3% incidence and Obinna et al (26) 1.8% frequency of post operative emesis with laparoscopic pyloromyotomy. A similar complication rate of post operative emesis and intraoperative and post operative complications was observed by Nigel Hall et al (3), Sola et al (4) between open and laparoscopic pyloromyotomy. The high incidence of post operative emesis mandates a more aggressive multimodal protocol for its prevention and treatment. Insisting on complete suctioning of CO2 from the abdomen by the surgeons at end of surgery, complete aspiration of saline via the Ryles tube in supine and then in lateral positions before extubation, emphasis on adequate intraoperative fluid management, use of propofol for induction, avoidance of opiods with alternative analgesic modalities are some preventive strategies which we have adopted in our practice. Use of combination antiemetic therapy with ondansetron and dexamethasone 0.05mg/kg iv may also prove to be effective (25). Efficacy of other 5HT3 receptor antagonists like dolasetron, granisetron, tropisetron as compared to ondansetron need to be evaluated in further studies in such infants.

This being a retrospective study, the data collected is not complete and various aspects of symptomatology and complications cannot be concluded. However, it can be safely said that laparoscopic pyloromyotomy is a feasible surgical procedure with acceptable post operative recovery indices. Occurrence of complications though higher as compared to other

studies have not resulted in significant post operative morbidity and prolongation of hospital stay. Preventive multimodal approach to decrease incidence of post operative emesis has been incorporated in our anesthetic protocol.

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