Infantile hypertrophic pyloric stenosis - does optimal pre-operative stabilisation enhance recovery: a retrospective study

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Abstract

Introduction: Infantile hypertrophic pyloric stenosis is a pathological condition of early infancy which poses many challenges to both treating surgeons and anaesthesiologists. Correction of acid base imbalance and dyselectrolytemia is mandatory before considering the infant for surgery to prevent peri-operative complications.

Aim: To evaluate the relation between duration of history, time taken for stabilisation and post-operative recovery time. To evaluate the post-operative complications and need for post-operative ventilator and ICU care Methods: We conducted a systemic review of documents of 42 infants who underwent surgery for IHPS. Age, sex, weight, duration of history, time required for stabilisation, post-operative recovery time, need for ICU care and complications were noted and evaluated.

Results: Analysis revealed that, as the duration of history increases, time required for stabilisation will be prolonged. But if we consider infants for surgery after proper correction of acid base and electrolyte abnormalities, the recovery time will not be affected much. No infant required post-operative ventilator support or ICU care.

Conclusion: Preoperative optimal stabilisation of fluid, acid base and electrolyte disturbances reduces the peri operative morbidity and improves the post-operative recovery. Thus, if efficient anaesthesiologist and surgeons are available, the IHPS infants can be treated in peripheral set ups with limited facilities of ICU and mechanical ventilators.

Keywords: IHPS, Stabilisation, Recovery, Optimal, Infants

Introduction

Infantile hypertrophic pyloric stenosis (IHPS) is a pathological condition of early infancy characterised by hypertrophy of the pylorus along with elongation and thickening which eventually progress to near complete obstruction of the gastric outlet. The incidence ranges from 2-3.5 in 1000 live births, although the rates and trends vary markedly from region to region.[1-4] It is more common in males than females (4:1-6:1).[5,6,7] More common in first born male child compared to others.[9,10,11] Symptoms most commonly occur before first two months of life.

The symptoms associated with IHPS include immediate post prandial, non-bilious, often projectile vomiting and demands to be refed soon afterwards.[12] Some infants may present with poor feeding and weight loss.[8]

IHPS is a medical emergency requiring immediate correction of fluid and electrolytes imbalance.[8,9,10] The correction of alkalosis is mandatory prior to surgery because alkalosis has been associated with an increased risk of post-operative apnea.[13,15,16] The timing of surgery depends upon clinical status of the infant.. Surgery should be delayed if there is dehydration and/or electrolytes derangements.[12]

An anaesthesiologist faces problem with this conditions because of the physiological features of the infant an unstable cardiovascular system, immature thermoregulatory mechanism of the infant, high bowel obstruction with its danger of regurgitation and aspiration, fluid and electrolyte imbalances.[11]

We undertook this retrospective study to evaluate the relation between duration of history, time taken for pre-operative stabilisation and post-operative recovery and to know whether children need post-operative ICU care in Bapuji Child Health Institute (BCHI), Davangere, Karnataka.

Methods

Hospital ethical committee approval was taken to review the anaesthesia records of infants who underwent pyloromyotomy in BCHI, a tertiary paediatric centre from 2012-2015. All surgical cases files of the infants who had undergone surgery for pyloric stenosis were analysed. Age, sex, weight, duration of history, time taken for stabilisation, time taken for recovery, pre-operative ABG, serum electrolytes, mode of anaesthesia and analgesia were analysed. Vomiting and significant post-operative events were noted along with time for first feed and discharge. The relation between duration of history, time required for stabilisation and post-operative recovery time was calculated with Pearson correlation coefficient.

The study included 42 infants who had undergone surgery for pyloric stenosis. Detailed evaluation of case sheets revealed that, after admission the infants underwent detailed clinical examinations and investigated for complete blood analysis with serum electrolyte, arterial blood gas analysis and ultrasonography. After the confirmation of the diagnosis of IHPS, the surgical and anaesthesia team

were collectively involved in pre-operative stabilisation which included resuscitation with iv fluids and electrolytes namely ½ DNS with/without KCl according to electrolyte status, at a rate of 4ml/kg/hr. When the hydration status improved clinically and repeat ABG was normalised, the infant was posted for pyloromyotomy and informed written consent from parents/guardian was taken and surgery was scheduled on next day.

All infants were shifted to OT with nasogastric tube in situ. Nasogastric tube suctioning was done before induction. OT table was covered with warming mattress to prevent hypothermia. Intra operative monitoring was done with pulse oximetry, ECG, NIBP, Nasopharyngeal temperature and precordial stethoscope.

The review of anaesthesia records revealed that infants were induced with Propofol (2mg/kg)/Thiopentone (5mg/kg)/Sevoflurane (4%), analgesia was given with Fentanyl (1.5micro gm/kg), relaxation was attained by Scoline (1.5mg/kg) and airway secured with appropriate sized un-cuffed ET tubes. Maintainance of anaesthesia was done with isoflurane+N2O+O2+intermittent doses of Atracurium (0.5mg/kg). Calculated doses of IVF were infused intra operatively. After the surgical procedure Neuromuscular block was reversed with administration of Neostigmine (0.05mg/kg) and Glycopyrolate (0.01mg/kg) and extubated when spontaneous breathing was adequate and shifted to post-operative recovery room. Time taken for complete recovery from anaesthesia was noted

Results

A total number of 3500 Surgeries were undertaken during study period in the institute. Out of 3500 surgeries, 72 (2%) were surgeries for pyloric stenosis. Out of 72 pyloric stenosis cases only 42 cases could be reviewed retrospectively.

Incidence of pyloric stenosis was 34 (80%) in males and 8 (20%) in females out of 42 cases. The sex ratio was 4:1 (Fig. 1).
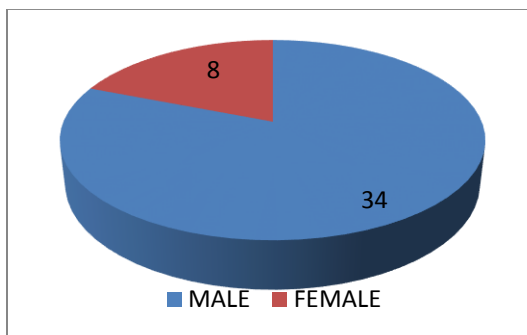

Fig. 1: Showing sex ratio in the incidence of pyloric stenosis

Table 1: Showing demographic data observed in the study

Parameter	Min Value	Max Value	Mean +/- SD
Age (days)	15	120	40.5+/-22.7
Weight (kg)	2	5	3.1+/-0.7
Duration of Symptoms(days)	2	120	13.6+/-8.7

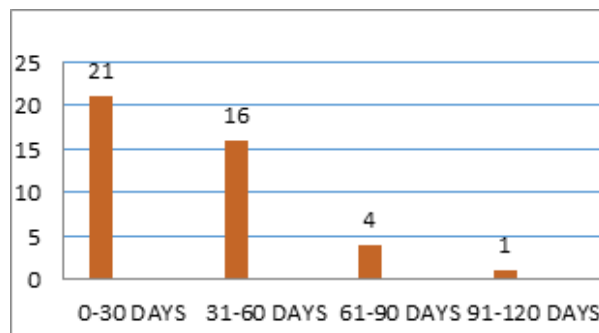The demographic details are as shown in the Table 1 and Fig. 2, 3.

Fig. 2: Showing age group distribution of infants with pyloric stenosis
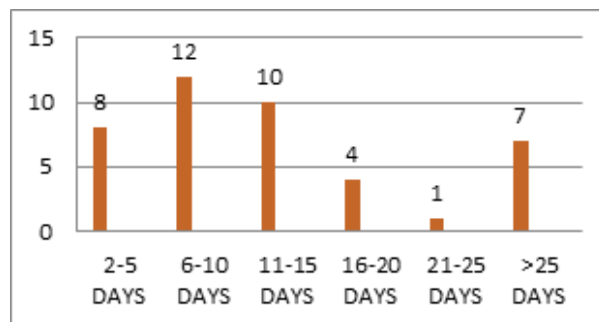

Fig. 3: Showing duration of symptoms in infants with pyloric stenosis

Out of the 42 cases of IHPS, we reviewed 12 infants presented with 6-10 days of symptoms of vomiting and 10 infants with 11-15 days of symptoms of vomiting. Maximum infants reported to the hospital within 6-15 days of onset of symptoms.

On examination, out of 42 infants, 12 infants were dehydrated. Out of 12 infants, 7 were mildly dehydrated, 4 were moderately dehydrated and one was severely dehydrated.

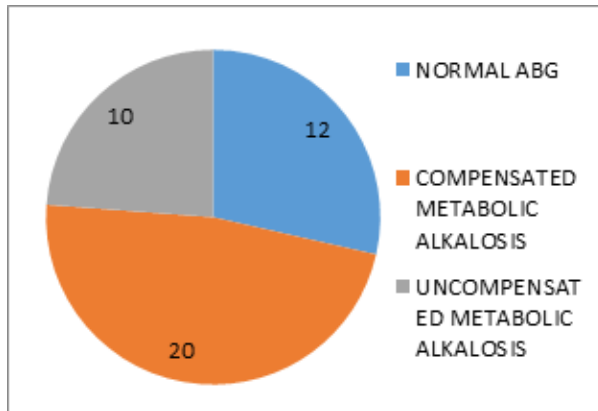Pre-operative ABG findings were as shown in Fig. 4 and Table 2.

Fig. 4: Showing ABG in patients with pyloric stenosis

Table 2: Showing ABG values in infants with pyloric stenosis

Parameter	Min Value	Max Value	Mean +/- SD
P^H	7.38	7.69	7.55 +/- 0.95
Bicarbonates	17	36.3	29.4 +/- 5.6
PCO_2	19.2	46	30.7 +/- 5

Electrolytes of the infants were as shown in the Table 3.

Table 3: Showing electrolytes values in pyloric stenosis

Parameter	Min Value	Max Value	Mean+/- SD
Sodium	116	145	134 +/- 8.3
Potassium	2.8	6	3.2 +/- 1
Chloride	73	110	92 +/- 10

The time required for stabilisation and the recovery of all the infants are as shown in the Table 4.

Table 4: Showing duration of history, stabilisation and recovery in infants with pyloric stenosis

Parameter	Min Value	Max Value	Mean +/- SD
Duration of Symptoms(days)	2	120	13.6+/-8.7
Duration of Stabilisation (days)	1	10	2.6 +/- 1.6
Duration of Recovery (days)	2	15	5 +/- 2.4

As per Pearsons correlation, the association between *duration of symptoms and duration of stabilisation* showed R value as 0.703 with 'p' value <0.001 (Fig. 5), which implies there is positive correlation between the above two variables, the relationship is strongly associated.
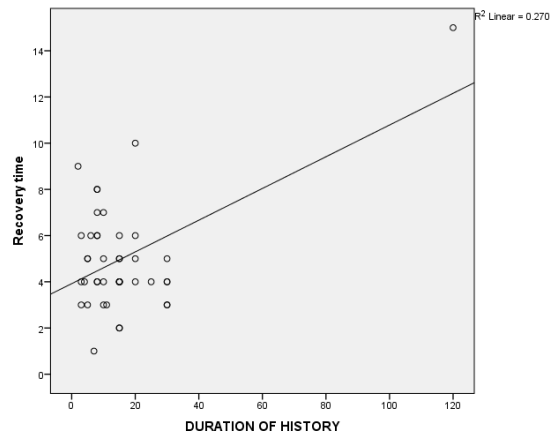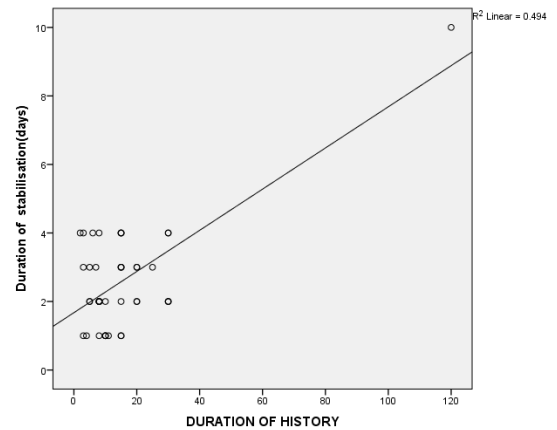

Fig. 5: Graph showing association between duration of history and duration for stabilization and recovery time

As per Pearsons correlation, the association between *duration of symptoms and duration for recovery* showed 'r' value as 0.519 with 'p' value <0.001 (Fig. 5), which implies there is positive correlation between the above two variables.

As per Pearsons correlation, the association between *duration of stabilisation and duration for recovery* showed 'r' value as 0.533 with 'p' value <0.001 (Fig. 6), which implies there is positive correlation between the above two variables.
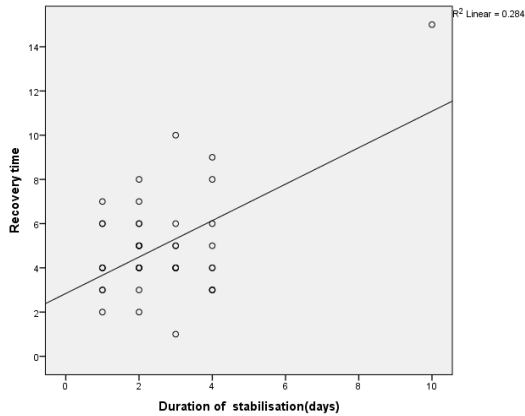
Fig. 6: Graph showing association between duration of stabilisation and recovery time

No Infant developed any post-operative complications including emesis. No infants were shifted to PICU for ventilatory support. All infants were monitored in post-operative ward. One Infant was started on feeding same day of surgery, 39 infants on next day of surgery and 4 infants on 2nd post-operative day.

Discussion

Infantile hypertrophic pyloric stenosis (IHPS) is believed to be a congenital problem, however evidences suggests that it develops postnatally.[13] Surgical correction of the condition by splitting the pyloric muscle without disturbing the mucosa and leaving it to heal secondarily is the definitive mode of management.

In our study, of the total surgical cases of 3500 during our study period, 72 cases, 2% were of the pyloric stenosis. Due to some technical reasons in Medical Record section, only 42 cases could be reviewed for the study. Out of 42 case records, 34 infants were male and 8 infants were female with sex ratio of 4:1 and this figure is comparable with global incidence of IHPS.[14] In our study demographic data such as age and weight are comparable with reported studies.[15,16,17]

Infants with IHPS present with projectile non bilious vomiting. Persisting vomiting leads to dehydration, acid base imbalance and weight loss.[11,18] The incidences of dehydration in our study are less compared to the reported studies.[9] Less numbers of dehydration cases may be because of increasing awareness among the parents and faster diagnosis.

Infants develop hypokalemic, hypochloremic metabolic alkalosis due to persisting vomiting. Progressive vomiting results in the loss of H+, Cl-, Na+ and K+ ions leading to metabolic alkalosis. Measurement of serum electrolytes, arterial blood gas analysis and pH will help in quantitating the degree of infant's metabolic abnormality.[18,19] In the present study, we observed 12 infants with normal ABG, 20 infants with compensated metabolic alkalosis and 10 with uncompensated metabolic alkalosis.

Vomiting will also cause electrolyte imbalance due to continuous loss of K+ and Cl- ions. Maximum number of infants had potassium and chloride abnormalities compared to sodium. Mild hypokalemia was observed in our study with minimum value of 2.8 mEq/l. but hypochloremia was severe with lowest value recorded as 73 mEq/l. classical hypokalemic, hypochloremic metabolic alkalosis with severe dehydration was not observed in our study probably because of increased awareness and health education among the community.

Stabilisation consists of making infants fit for surgery. It can be done by correcting electrolytes and acid base imbalance. Treating alkalosis is mandatory as it can cause prolonged recovery or post-operative apnoea. The degree of dehydration may be estimated by physical examination, haematocrit and history of weight loss. Therapy consists chiefly of restricting oral intake in vomiting patients and of replacing chloride loss with saline solution. Potassium depletion should be calculated; not more than 3 mEq/kg/day should be given and replaced only after urination has provided evidences of initiation of rehydration. Glucose 5g/kg/day not only meets the infants metabolic need but also reduces further potassium losses from its neoglycogenic and protein sparing effects. Alkalosis will remain until sodium and potassium equilibrium is re-established.[20]

Day of admission to day of surgery was considered as the time required for stabilisation in our study. 9 infants were stabilised in one day, one infant was stabilised for 10 days and mean value of stabilisation was 2.6 days with standard deviation of 1.6. Infants were stabilised with iv fluids- ½ DNS with/without KCl according to electrolyte status,at a rate of 4ml/kg/hr.

Duration of post-operative hospital stay was considered by many authors to grade post-operative recovery.[21] Post-operative recovery duration is within the acceptable range. The maximum post-operative morbidity in IHPS infants will be because of vomiting. In our study no cases developed vomiting or any post-operative complications.

As the duration of symptoms increases, time required for pre-operative stabilisation will also increases. It is due to severe derangements in fluid and electrolytes. In our study results showed, there is strong positive association between duration of symptoms and time required for stabilisation. Pearson's correlation-'r' value of 0.703, which implies that there is a strong positive association.

Duration of symptoms is directly proportional to the recovery time if the pre-operative stabilisation is not done properly for infants with IHPS. If the cases are considered for surgery after complete stabilisation of ABG and electrolytes imbalance, recovery time/time to discharge will be unaffected. In our present study

Pearson's correlation-'r' is 0.519 implies, there is a positive association between duration of symptoms and recovery time but the relationship is not stronger. In our study the association between time required for stabilisation and time required for recovery showed 'r' value of 0.533 implying the relation between the above two variables is directly proportional but not stronger. In all the above comparison, the 'p' is significant with its value <0.001.

There were no intra operative or post-operative complications. No infant required post-operative ventilatory support.

Limitations

- Small sample size
- This being a retrospective study, the data collected is not complete and various aspects of symptomatology and complications could not be concluded.
- Comparison of open pyloromyotomy with laparoscopic pyloromyotomy not done
- Maintenance doses of Isoflurane and ETCO2 measurements were not properly documented. Hence their influence on recovery could not be ascertained.

Conclusion

IHPS being a medical emergency, poses a challenge to the anaesthesiologist in view of gross fluid and electrolyte derangements. Optimal stabilisation of these derangements not only reduces the intra operative morbidity but also improves the post-operative recovery from anaesthesia. This facilitates early feeding and discharge from the hospital. Thus if an efficient Anaesthesiologist and Surgeons are available, the pyloric stenosis infants can be treated in peripheral set ups with limited facilities of ICU and ventilator care.

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