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RESEARCH ARTICLE

DEMOGRAPHY AND ULTRASOUND MEASURES IN INFANTILE HYPERTROPHIC PYLORIC STENOSIS - OUR INSTITUTIONAL EXPERIENCE

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Abstract

Introduction: Infantile hypertrophic pyloric stenosis (IHPS) is most common surgical cause of non-bilious vomiting in infants. This study describes the clinical presentation, diagnosis, management and outcome of management of infants with IHPS and identifies the factors responsible for poor outcome in these patients.

Methods and Materials: This is a prospective study. It was conducted between September 2018 to April 2020 at J. K. Lone Hospital, SMS Medical College Jaipur, and Rajasthan, India.

Results: A total 80 patients (M: F=4.7:1) were studied with male predominance. Mean age of presentation was 6.26 weeks. Maximum 47.5% (38) patients present in age group of >4-8 weeks. Clinical presentation with a triad of non-bilious projectile vomiting, visible gastric peristalsis and palpable Olive tumor was present in 62.5 % (50) patients. Non bilious vomiting was the most common presenting symptom, present in 100% (80) patients. Mean hospital stay was 4.23 days. Serum electrolytes disturbance was present in 61.5% (49) patients. The surgery was Ramstedt's pyloromyotomy done in all cases. Mortality rate was 3.75%.Thickness of pyloric muscles was increasing in proportional ratio with age.

Conclusion: In this study delayed presentation and Serum electrolytes imbalance are most common causes of poor outcome. USG abdomen is best imaging modality for confirmation of diagnosis. Pyloric muscle wall thickness showed relation with age in proportional increasing pattern.

Introduction:-

Infantile hypertrophic pyloric stenosis (IHPS) is a disorder of pyloric region of stomach in infants characterized by hyperplasia of smooth muscle fibers of the pylorus, that cause increase in thickness of pyloric wall and length of pyloric canal. This cause narrowing of pyloric canal and leads to gastric outlet obstruction [1].

There are variable incidences of IHPS among different ethnic groups and races around the world [2]. The Incidence of IHPS is about 1–4per 1000 live births. It is more common in male infants. The male to female sex ratio is 4–6:1[3,4]. It is more common in preterm infants than term infants [5,6]. Male predominance and a positive family

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history of IHPS are risk factors for infants. Etiology of IHPS is multifactorial including environmental factors, genetic factors and others [7,8,9].

Historically, IHPS was first described as a disease entity in 1888 by Harald Hirschsprung [2].Clinical presentation of IHPS is progressive projectile non-bilious vomiting. Infants brought by parents to hospital with this symptom mostly between 2nd and 8th weeks of age [10,11]. Some patients may present with emaciated and severely dehydrated condition. There is visible peristalsis in upper abdomen of infant progressing from left to right side. An "olive-like" tumor may be palpable at the lateral edge of the rectus abdominus muscle in the epigastrium or right upper quadrant of the abdomen. Olive like tumor becomes palpable in calm and sleeping infants when abdominal muscles are relaxed [11].

The diagnosis of IHPS is confirmed by ultrasound of abdomen. In IHPS, ultrasonography abdomen showed increased pyloric muscle thickness and length of pyloric canal [12, 13].Ultrasonographic diagnostic criteria for IHPS are pyloric muscle thickness of 3.5 - 4 mm or more and pyloric canal length of 16 mm or greater. Infants with IHPS showed hypokalemia, hyponatrimia, hypochloremia, and metabolic alkalosis with paradoxical aciduria. This occurs due to loss of large amounts of gastric hydrochloric acid with recurrent vomiting. The severity of electrolyte imbalance and metabolic alkalosis depends upon the duration of symptoms (vomiting) prior to hospital admission [14].

The study was conducted to describe our experience for IHPS about age of presentation, male female sex ratio, clinical presentation, laboratory findings, USG findings, management and outcome, and identify factors responsible for poor outcome of these patients. We postulated in this study that preoperative pyloric muscle wall thickness and pyloric canal length has correlation with weight and age of patients with surgically proven IHPS.

Methods and Material:-

Study design-

This is a prospective study, conducted in 80 infants (66 male,14 female) at J. K. Lone Hospital, SMS Medical College Jaipur, Rajasthan, India. This study conducted from September 2018 to April 2020 over period of 20 months. We describe the experience in the management of patients with IHPS admitted to our Department of pediatric surgery.

The data collection included age, sex, weight at admission, clinical presentation, serum electrolytes, signs of dehydration, USG abdomen findings, treatment and outcomes, duration of hospital stay and mortality.

Inclusion criterias –

This study included all infants who were admitted with following features:

1. Recurrent non bilious projectile vomiting
2. Palpable olive like tumor
3. Epigastric fullness with visible peristalsis
4. USG proved IHPS

Exclusion criterias–

1. Recurrent bilious vomiting
2. Whole abdominal distension

Operative procedure

Planning of surgery for IHPS depends upon the clinical condition of the infants. If serum electrolytes are normal and no sign of dehydration then the surgery can do on the day of diagnosis [15].

Surgery should be delayed if there are signs of dehydration and/or electrolyte derangements [16]. A nasogastric tube should not be placed routinely because it removes additional fluid and hydrochloric acid from the stomach, which precipitate the electrolyte and acid-base imbalance. Intravenous administration of 5% dextrose in normal saline (1:1 ratio of both) containing 20 mEq/L of potassium chloride is the optimal resuscitation regimen for fluid and electrolyte replacement.

Ramstedt pyloromyotomy is the procedure of choice [17]. We did this procedure in our all cases. Operation was done by right upper quadrant transverse incision. After opening of peritoneum, pyloric tumor delivered out and hold between index finger and thumb. Longitudinal incision was given at anterosuperior avascular surface of pylorus with back of knife handle. Widening of incision was done with pyloromyotomy forcep up to visibility of pouting mucosa. Completion of procedure confirm by freely side to side movement of both margins. Finally pylorus replaced in abdominal cavity and wound closed in layers.

Picture 1:- Showed right upper quadrant transverse incision.

Picture 2:- Showed intra operative holding of pyloric tumor.

Picture 3:- Ramstedt pyloromyotomy showing protruding mucosa after myotomy.

Results:-

Total 80 patients of IHPS were included in this study. Out of them 66 were males and 14 females. The male female ratio was 4.7:1. The mean age of presentation was 6.26 weeks. The Age of younger most infant was16 days and the oldest was of 15.28 weeks (107 days).

Table 1:- Sex distribution.

Sex	Frequency	% (n=80)
Male	66	82.5
Female	14	17.5

Table 2:- Age distribution.

Age Group	Frequency	% (n=80)
1-4 week	29	36.25
>4-8 week	38	47.5
>8-12 week	11	13.75
>12 week	2	2.5

Infants were divided in four groups according to their age of presentation. Maximum 47.5% (38) patients present in age group of >4-8 weeks. Infants presenting in age group 0-4 week were 36.25% (29), in 8-12 weeks 13.75% (11), and above 12 weeks 2.5% (2).Weight of infants at the time of admission was recorded. The mean weight of infants was 3.32kg. Weight of infants ranges between 1.7 kg to 5.5 kg.

Table 3:- Clinical presentation.

Clinical feature	Frequency	% (n=80)
Projectile Non bilious Vomiting	80	100
Visible Peristalsis	69	86.25
Palpable Olive Tumor	50	62.5
Epigastric Fullness	80	100
Sign of Dehydration	32	40

Clinical Presentation

The provisional diagnosis of patients was made clinically in whom triad of non-bilious projectile vomiting, visible gastric peristalsis and palpable Olive tumor was present. Non bilious projectile vomiting was present in 100% (80) patients. Visible gastric peristalsis was present in 86.25% (69) and a palpable olive tumor in 62.5% (50) (Table 3).This triad was present in 62.5% (50) in the study population.

Picture 4:- Showing epigastric fullness.

Hospitals stay of patients range from 2 to 8 days. Mean hospital stay in this study was 4.23 days. But in patients who were present with dehydration and electrolytes imbalance or had post-operative complication like vomiting, wound infection, stay for long time.

Table 4:- Serum Electrolytes.

Electrolytes	numbers	%(n=80**)**
Hyponatrimia	39	48.75
Hypokalemia	35	43.75%
Hypochloremia	27	33.75
Normal S.E.	31	38.75

In this study 61.25% (49) of patients had serum electrolytes disturbance. 48.75% (39) patients had hyponatrimia. 43.75% (35) patients had hypokalemia and 33.75% (27) had hypochloremia. 38.75% (31) patients had normal electrolytes.

Correlation of USG findings with age and weight of patients - We studied here relation of pyloric muscle wall thickness and length of pyloric canal in USG with age and weight of patients at time of presentation. Results are following:

Table 5:- Correlation of age with muscle Thickness and Length of pyloric canal.

Age groups (Weeks)	Muscle Thickness(mm) (Mean)	Canal Length(mm) (Mean)
0-4	4.818 ± 1.0448	18.273 ± 2.9014
>4-8	5.276 ± 1.1781	20.596 ± 3.4060
>8-12	5.473 ± 1.0593	21.240 ± 4.2443
>12	6.800 ± 1.0583	21.000 ± 2.6458

As shown in Table 5, pyloric muscle wall thickness showed relation with age in proportional increasing pattern.

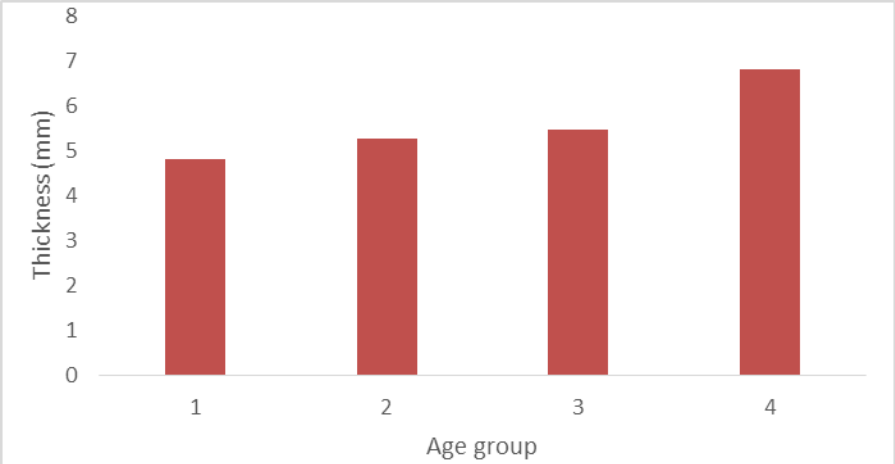

Fig. 1 pyloric thickness of different age groups

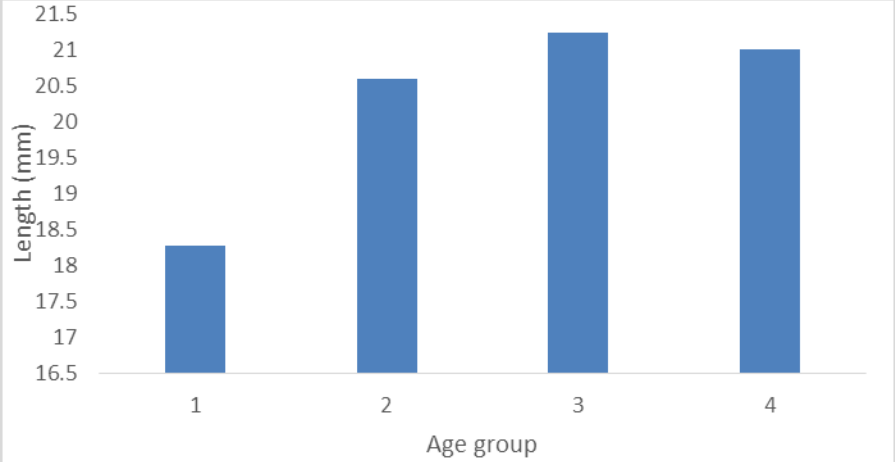

Fig. 2 pyloric canal Length of different age groups

Table 6:- Correlation of weight with muscle thickness and length of pyloric canal.

Weight (kg)	Muscle Thickness(mm) (Mean)	Canal Length(mm) (Mean)
1.5-2.5	4.833 ± 0.5228	21.683 ± 4.8424
2.6-3.5	5.521 ± 1.3023	20.609 ± 3.6770
3.6-4.5	5.232 ± 1.1931	19.974 ± 2.0715
>4.5	4.967 ± 0.7367	17.850 ± 2.3098

As shown in table 6, muscle thickness and pyloric canal length both had no proportional increasing pattern relation with weight of patient.

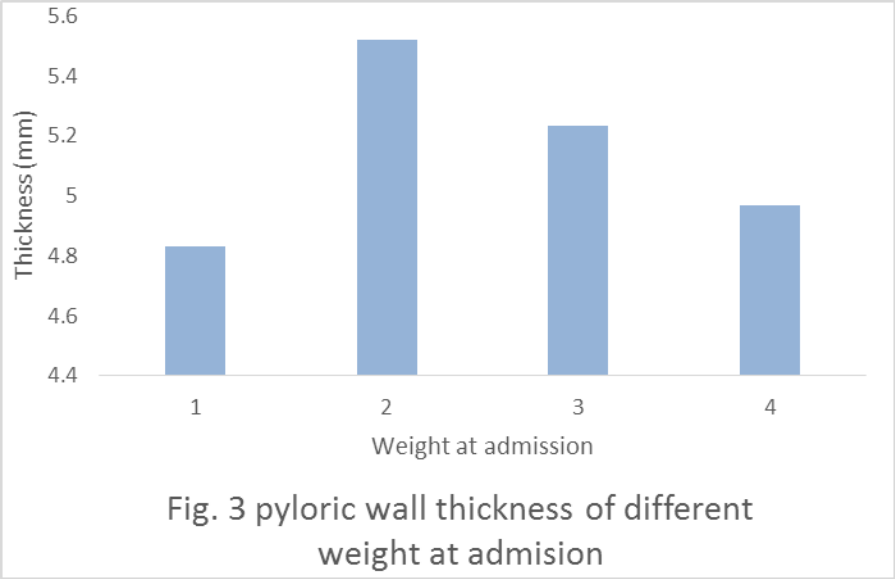

Fig. 3 pyloric wall thickness of different weight at admision

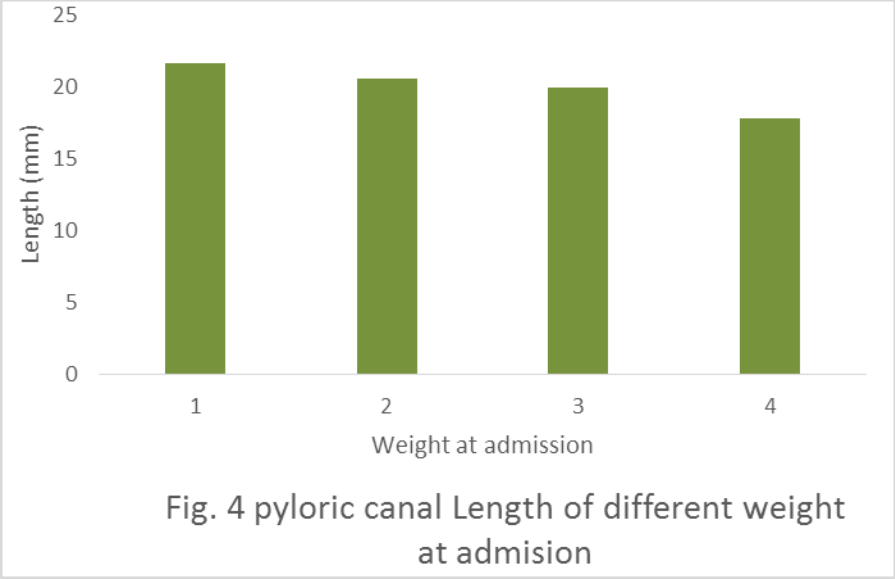

Fig. 4 pyloric canal Length of different weight at admision

Three patients were expired 3 (3.75%) in this study.

Discussion:-

Infantile hypertrophic pyloric stenosis (IHPS) was first described by Harald Hirschsprung in 1888 [18]. IHPS is the most common cause of gastric outlet obstruction and most common surgical cause of vomiting in infants [19].

Diagnosis of IHPS is done by clinical features like non bilious projectile vomiting, palpable olive tumor, and visible peristalsis. Upper GI dye study is also helpful to diagnose the IHPS. Ultrasonographic findings like pyloric wall thickness and canal length confirm the clinical diagnosis. Lowe et al gives a new USG based diagnostic criteria named pyloric ratio. Pyloric ratio is the ratio of pyloric wall thickness and diameter. A ratio 0.27 or more is diagnostic for pyloric stenosis. Sensitivity and specificity of pyloric ratio is 96% and 94% respectively [20,21].

Incidence of IHPS is more common in male. A study done by N dongo et al in 2018 showed sex ratio 4.25:1. In our study sex ratio is comparable with this study. In our study sex ratio was 4.7:1 **[22].** Mean age of IHPS patients at the time of admission was 6.26 weeks in this study. Range of admission age was 16 days to 6.7 weeks. Most commonly (47.5%) patients were present between 4 to 8 weeks of age. Study by Ndongo et al mean age of presentation was 5.2

± 1.2 weeks with a range of 8 days to 12 weeks and most of neonates were present within 2–6 weeks (76.2%) of life. In our study maximum patients of IHPS admitted within 4-8 weeks [19].

Hospital stays in this study range between 2 days to 8 days, with mean of 4.3 days. In Study of Chalya et al 2015, length of hospital stay ranged from 1–14 days witha median of 12 days. In Chalya et al study, prolonged preoperative length of hospital stay was reason of prolonged overall length of hospital stay **[23].**

Clinical presentation in our study was represented by triad of non-bilious vomiting, visible peristalsis, and palpable olive tumor. It was present in 62.5% (80) cases. Epigastric fullness was present in all patients. Dehydration was present in 40% cases.

Serum electrolytes imbalance in our study was present in 61.25% of cases. Most common cause of this imbalance was due to late admission after appearing of symptoms. Normal serum electrolytes were present in 38.25% of patients in our study. These patients operated early and duration of hospital stay became short.

USG abdomen was imaging modality of choice for confirmation of diagnosis. All patients operated after confirmation by USG abdomen.

A study by Said Meena et al suggests that there was a statistically significant relationship between pyloric muscle wall thickness and patient age as well as wall thickness and patient weight. The same analysis proved that there was no significant relationship between pyloric length and patient age or weight. In our study pyloric muscle wall thickness had proportional increasing pattern with age of patient but not with weight. In this study same analysis proved that there was no significant relationship between pyloric length and age or weight of patient [**24**].

Conclusion:-

IHPS is more common in male infants. Most common age of presentation was between 4 to 8 weeks. Clinical presentation was triad of non-bilious vomiting, visible peristalsis and palpable olive tumor. Delayed presentation and Serum electrolytes imbalance are most common causes of poor outcome. USG abdomen is best imaging modality for confirmation of diagnosis. Pyloric muscle wall thickness had proportional increasing pattern correlation with age of patients but not with weight.

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