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**Dr. M Manohar**  
Assistant Professor, Department of  
General Surgery, Kakatiya Medical  
College/MGM Hospital, Warangal,  
Telangana, India

## A prospective clinical study and management of infantile hypertrophic pyloric stenosis

**Dr. M Manohar**

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### Abstract

**Background and Objectives:** Infantile Hypertrophic Pyloric Stenosis (IHPS) is one of the cause for vomiting in the newborn. The treatment of this condition had high mortality and morbidity until Ramstedt's showed that pyloromyotomy surgery was curative with no mortality and morbidity.

**Aim:** Our aim was to study the clinical course of IHPS, the management and outcome of these cases.

**Methods:** A prospective study was conducted between September 2018 to March 2020 over 25 cases, admitted in our health services. After subjecting the patient to clinical examination and investigation for confirming the diagnosis, all were subjected to Ramstedt's pyloromyotomy.

**Results:** In the study of 25 cases; the age of the infants ranged from 2 weeks to 12 weeks. Maximum number of cases i.e., 12 (48%) were between 2 to 4 weeks of age. This condition was more common among males than in females with a ratio of 4:1.

All the patients presented with vomiting and visible peristalsis, dehydration was seen in 20 (80%) cases, palpable lump in 18 (72%) cases. Ultrasound abdomen was the investigation of choice and as done in all infants. The pyloric muscle thickness of >3mm was considered diagnostic. Barium meal and air contrast x-ray were other investigation carried out. After correcting the dehydration all the patients were subjected to Ramstedt's Pyloromyotomy.

**Conclusion:** Ramstedt's pyloromyotomy is a curative treatment with no mortality and very low morbidity.

**Keywords:** Infantile hypertrophic pyloric stenosis; Ramstedt's pyloromyotomy

### Introduction

Infantile hypertrophic pyloric stenosis (IHPS) is a common condition affecting young infants. Despite its frequency, it has been recognized only for a little over a century. Nevertheless, understanding of the condition and of effective treatment have undergone a remarkable evolution in the 20th century, reducing the mortality rate from over 50% to nearly 0%.

In infantile hypertrophic pyloric stenosis the antropyloric portion of the stomach becomes abnormally thickened and manifests as obstruction to gastric emptying. Typically, infants with IHPS are clinically normal at birth; during the first few weeks of post-natal life, they develop non-bilious forceful vomiting described as —projectile. If this condition is not recognized early, will leads to electrolyte imbalance (hypokalemic, hypochloremia, metabolic acidosis), hypoglycaemia. Gastric outlet obstruction leads to emaciation and, if left untreated, may result in death <sup>[1]</sup>.

The visible peristaltic waves is usually seen in left upper abdomen. The clinical diagnosis hinges on palpation of the thickened pylorus or olive.

IHPS is not a surgical emergency, but it may be a medical emergency requiring aggressive intravenous resuscitation in a dehydrated and metabolically disordered infant. Surgical treatment is curative <sup>[2]</sup>. Management of IHPS involves a surgery called Ramstedt's pyloromyotomy, after correcting the dehydration. Ramstedt's pyloromyotomy is the procedure of choice with minimal morbidity and no mortality <sup>[3-6]</sup>.

Hence, early recognition of IHPS, proper pre-operative fluid resuscitation, correction of electrolyte imbalance, skilled anaesthesia, surgery and good postoperative care will definitely reduce the mortality and morbidity.

### Aim and Objectives

1. To study the clinical course of IHPS.
2. To study the management and outcome of these cases.

**Corresponding Author:**  
**Dr. M Manohar**  
Assistant Professor, Department of  
General Surgery, Kakatiya Medical  
College/MGM Hospital, Warangal,  
Telangana, India

### Source of data

All the patients admitted in Kakatiya Medical College & MGM Hospital Warangal, with signs and symptoms of infantile hypertrophic pyloric stenosis during the period of September 2018 to March 2020.

### Methods of collection of data

#### Study Design

A prospective study with a minimum of 25 cases with patients of Infantile Hypertrophic Pyloric Stenosis during the period of September 2018 to March 2020.

#### Inclusion criteria

Patients admitted in Kakatiya Medical College & MGM Hospital, Warangal with signs & symptoms of infantile hypertrophic pyloric stenosis, who are willing to undergo surgical management.

#### Exclusion criteria

Those who are not fit to undergo surgical management due to other associated morbid conditions.

### Material and Methods

The present prospective study has been conducted from September 2018 to March 2020. All the patients admitted to our medical services in Kakatiya Medical College & MGM Hospital, Warangal with a clinical diagnosis of IHPS have been the topic of study.

There were in total 25 cases of IHPS. Among them 20 were males and 5 were females.

The diagnosis was made on the clinical grounds and confirmed by radiological and ultrasound studies. Patients with other clinical conditions mimicking IHPS were not included in the study.

After admission detailed history was taken in a systematic and chronological order as soon as patient was admitted. A thorough clinical examination was carried out to establish clinically the presence of IHPS. It was later confirmed by radiological investigations.

The information sought in IHPS was,

1. Type of vomiting, its quantity, colour and contents.
2. Visible peristalsis.
3. Pyloric Tumour.
4. Signs and symptoms of dehydration.

A meticulous physical examination after a detailed history is most of the time sufficient to establish the diagnosis of IHPS. After the initial examination, all the findings were recorded. These baseline findings were useful for comparison in cases, which require repeated examination for diagnosis and to study the progress of the disease. Thereafter investigations were performed to rule out other causes of symptoms and signs mimicking IHPS.

The investigations include Haemoglobin percentage, WBC count, Differential leucocyte count, Blood urea, serum creatinine, blood sugar tests, Serum electrolytes, Blood grouping & Rh typing, bleeding time and clotting time, Hbs Ag & HIV test. Ultrasound Abdomen was performed in all the patients. Other radiological investigations like Barium Meal and Air Contrast X-ray could not be done in all the cases because of the financial constraints and physical condition of the patient.

Medical treatment was given in the dehydrated infants and the general condition stabilized. Ramstedt's pyloromyotomy was performed in all the infants and there was no mortality. All patients were given pre-operative care and discharged with

needed medication and asked the patient to follow up after a week and advised for one month follow up.

### Results

This present prospective study of infantile hypertrophic pyloric stenosis is conducted during September 2018 to March 2020 in 25 patients admitted in Kakatiya Medical College & MGM Hospital, Warangal.

In the present series of 25 cases the age of the patient ranged from 2 weeks to 12 weeks, at the onset of the condition.

**Table 1:** Age Distribution of cases

Age in Weeks	No. of Cases	Percentage
2 – 4	12	48
5 – 7	8	32
8 – 10	3	12
11 – 12	2	8
Total	25	100

In the present study maximum i.e., 12 (48%) cases were between 2 – 4 weeks of age, followed by 8 (32%); 3 (12%) and 2 (8%) infants, were between 5-7, 8-10 and 11-12 weeks respectively.

As compared to the occurrence of the infantile hypertrophic pyloric stenosis in first born, my study indicates as follows

**Table 2:** Birth order of cases

Birth Order	First		Second		Third		Fourth & above		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Male	12	48	6	24	1	4	1	4	20	80
Female	03	12	1	4	1	4	--	--	5	20
Total	15	60	7	28	2	8	1	4	25	100

Amongst 25 cases 20 were males and 5 were females. The ratio of occurrence in male: female stands 4:1. Among them 12 were first-born males, 3 were first-born females, 6 were second born males and 1 second born female. One was the third born male and one female. 1 male were of 4th and above in birth order. So the occurrence of IHPS in first born male stands at 48 percent in this study.

### Sex Distribution

**Table 3:** Sex Distribution

Sex	No. of Cases	Percentage
Male	20	80
Female	05	20
Total	25	100

### Symptoms and Signs

The symptoms in this case study varied from 1 week to 7 weeks. The following are the symptoms with which the patients presented.

**Table 4:** Signs and Symptoms

Symptoms	No. of Cases	Percentage
Projectile vomiting	25	100
Visible gastric peristalsis	25	100
Dehydration	20	80
Palpable lump	18	72
Constipation	02	08
Jaundice	02	08
Other symptoms	03	12
Total	25	100

The common symptoms in all patients were projectile vomiting and left to right visible gastric peristalsis. Dehydration was the next common presentation seen in 20 (80%) patients varying from mild to severe degree.

Pyloric tumor was palpable in 18 (72%) cases usually after vomiting. Jaundice occurred in 2 (8%) and constipation in 2 (8%) & 3 (12%) patients had associated symptoms like hiccough, dyspnoea, bronchitis and other respiratory tract symptoms.

### Investigations

Investigations were carried out in all the 25 cases to rule out any other causes of pyloric obstruction. Following are the investigations performed routinely. Haemoglobin was between 9 and 14 gram percent. The WBC count varied from 5,200 to 10,500 cells/ cumm indicating to be a normal limit in all the 25 cases. Blood urea, serum creatinine and blood sugar tests were found to be normal in all the cases. This was done to rule out any co-existing diabetes or renal disease.

**Barium Meal:** It was done in 12 cases after a thorough stomach wash. 8 cases were referred to us with this investigation already done. Depending on the narrowing of the pylorus, the X-ray showed following features:

- Dilated stomach
  - Narrowed pylorus
- a) Rat tail sign or string sign.
  - b) Double tract appearance
  - c) The shoulder sign
  - d) Beak sign at the junction of stomach and the antrum.
  - e) Mushroom effect of pyloric mass indenting duodenal cap.
  - f) Delayed emptying of the stomach, showing little or no barium distally.

**Air Contrast X-Ray of Abdomen:** 15 patients underwent this study. Through the nasogastric tube about 50-60cc of air was injected and plain x-ray of the abdomen was taken. The findings were:

- Dilated stomach.
- Delayed emptying of the stomach with little air seen distal to the pylorus.

**Ultrasonography:** All the 25 cases were subjected to non-invasive, cost effective investigation of ultrasound, which now is the investigation of choice in IHPS. The findings were;

- Dilated stomach.
- Thickened pylorus measuring > 3 mm
- Elongated pyloric channel measuring > 15 mm.

### Treatment

Out of 25 patients, 14 had been referred to us with the diagnosis of IHPS i.e., 56% of cases.

**Table 5:** Type of admission

Type of admission	Number	Percentage
Referred	14	56
Direct	11	44
Total	25	100

After admitting the patients, all were subjected to routine investigations. Surgery was never hurried because we came to a conclusion that pre-operative preparation for the patient is a

must for a better outcome post-operatively.

The standard pre-operative management followed in our studies were as follows: Correction of dehydration, electrolyte imbalance and secondary infection:

- a) Ryle's tube aspiration and stomach wash with normal saline.
- b) 250-500cc electrolyte-P, IV in 24 hours.
- c) Injection KCl 10-20 mEq/Kg in drip.
- d) Injection calcium gluconate 2-3 cc in drip.
- e) Injection ceftriaxone 75 mg/ Kg body weight/ day IV in two divided doses.
- f) Injection gentamycin 2-5 mg/Kg body weight/ day IV in two divided dose.

### Occasionally

- a) Injection Gentamycin 2-5 mg/Kg/day in 2 divided doses.
- b) Injection vitamin K intramuscularly.
- c) Blood transfusion 50 to 100 ml.
- d) Injection Calcium Gluconate 2-3 cc in drip IV.

All the patients were discharged from the hospital after sutures were removed. Patients were asked for follow-up after a week for any recurrence or residual of symptoms. All the patients were healthy during the follow-up period without any symptoms or signs, which was advised for one month follow up.

### Discussion

Infantile hypertrophic pyloric stenosis is a common condition among the newborn requiring surgery. IHPS occurs most commonly in males. In this study of 25 cases, 20 cases were males and 5 female. 84% patients were male in Kiely PD7 study as compared to 80% male infants in this study.

In the present study, the male to female ratio was 4:1 with 20 males and 5 females. Maher M8 showed a ratio of 3.6:1, it was 5.5:1 in Adelstein P study. Chiou JY9 study showed a high male to female ratio of 11:1, whereas it was 2:4:1 in Yip WC study<sup>10</sup>. 15 infants (60%) were first born issue among them 12 (48%) were males. In Kiely PD study<sup>17</sup>, 32% infants were first born, whereas it was 46% in Chiou JY study.<sup>9</sup>

In the present study, the age of patients were 2-4 weeks in 12 (48%) of cases. 5 to 7 weeks in 8 (32%) cases, 8 to 10 weeks in 3 (12%) cases. 11 to 12 weeks in 2 (8%) of cases respectively. Indicating that IHPS occurred in patients of age between 2 weeks to 12 weeks in the present study. The incidence of IHPS decreases as the age of infants increases.

In Chiou JY<sup>9</sup> study, 50% of cases had symptoms beginning between ages of 2-4 weeks. All the 25 cases in the present study did present within 2 weeks to 12 weeks of onset of their symptoms. Patients usually presented with:

- Projectile vomiting
- Visible peristalsis
- Dehydration
- Palpable lump (pyloric tumour).

The symptoms that occurred not infrequently were constipation, jaundice, hiccoughs, bronchitis and dyspnoea.

**Projectile Vomiting:** This symptom was present in all the 25 cases of pyloric stenosis. This followed immediately after breast feeding. This varied at times from 5 to 10 times a day. Patients used to bring out whole milk. The milk used to be curdled when it came after few minutes of breast feeding.

The idea derived for occurrence of the vomiting was stretching of the stomach over the obstruction and induction of anti-

peristalsis.

### Visible Peristalsis

This was as predominant as was projectile vomiting in all the 25 cases of IHPS. Visible peristalsis was usually from left to right. They were found to occur after feeds. It occurs as a lump on the left upper quadrant and disappears at the midline. Other way to initiate to stroke the abdomen, which was done as a routine. In Chiou JY<sup>9</sup> study, the visible gastric peristalsis waves were seen in 41.7% of cases.

### Dehydration

Dehydration was seen in all the patients, due to excess of vomiting and decreased retention of gastric content. Signs of dehydration were loss of skin elasticity, sunken eyes, dry tongue and irritability. There was loss of weight noted.

Out of 25 cases, palpable pyloric lump was possible in 18 cases (72%). It was felt as a firm round structure. This was felt in the upper abdomen towards the right half and felt clearly after about of vomiting. It was palpable, 66.7% in Chiou JY<sup>[9]</sup> study, 91.7% in Yip WC<sup>[10]</sup> study, whereas it was 92.6% in Maher M<sup>[8]</sup> study compared to 68% in our study.

### Jaundice and Constipation

Only 8% of cases had constipation as a result of excessive vomiting and 8% of cases had jaundice.

### Investigations

All the patients were thoroughly investigated. Most of the patients had no evidence of anemia, except for two cases, but they did present with variable degrees of dehydration from mild to severe.

Leucocyte count and ESR were normal but were high in 3 cases who had symptoms of respiratory infections. None of the patients had any systemic manifestation of congenital heart disease or any other associated anomalies. The urinary picture provided no significant abnormalities but for the acidic picture in cases with severe dehydration.

### Barium Meal Study

It was conducted in 12 cases, which showed following features:

- Dilated stomach – due to narrowed and elongated pylorus
- String sign – due to convex, narrow and elongated pyloric canal.
- Double track sign – due to unfolding of mucosa into the pyloric canal.
- The shoulder sign is a collection of barium in the dilated prepyloric antrum
- Delayed emptying even after 45 minutes to 1 hour.

### Ultrasonography

Ultrasound examination was carried out on all 25 cases. USG was accurate, rapid, non-invasive imaging technique, which was the investigation method of choice.

USG shows distended stomach, hypertrophied pyloric musculature with intervening mucosa crowded, thickened to a variable degree, and protruding into the distended portion of the antrum (the Nipple sign). The length of the hypertrophied canal is variable and may range from as little as 15mm to more than 18mm. The muscle thickness which is more reliable, ranging between 3 and 4.5mm.

### Treatment

As non-operative management is only to correct the electrolyte imbalance, dehydration, anemia, malnutrition, the definitive treatment to date stands to be operative one. This was an accidentally discovered one by Ramstedt. Hence, it is named as Ramstedt's pyloromyotomy.

All patients were given pre-operative care and subjected to Ramstedt's pyloromyotomy. The basic principle of the operation being that the hypertrophic musculature was incised and spreaded till the mucosa bulged out of the wound, hence dilating the pyloric canal.

Feeding was started postoperatively after 24 hours and delayed for 72 hours in 1 patients (4%) who had duodenal mucosal injury. One patient had wound dehiscence post operatively i.e., 4% of cases

### Conclusion

- The clinical condition of IHPS occurs predominantly in males. The male to female ratio being 4:1.
- The common age group being 2 weeks to 4 weeks. The incidence decreases as age of infants increases.
- The first born are commonly involved. Over 48% were first born males and 12% were females.
- Of 25 cases, 15 cases were Hindus and 10 cases were Muslims.
- Patient had projectile vomiting, dehydration, visible peristalsis, pyloric tumor, constipation, loss of weight, jaundice and occasionally bronchitis, dyspnea.
- Majority of patients had progressive and gradual onset of symptoms, which became pronounced later on.
- Laboratory investigations were only useful to rule out only concomitant existence of anemia, urinary tract infection and jaundice.
- Barium meal was the very useful investigative method to diagnose infantile pyloric stenosis. It showed gastric dilatation narrowed pyloric canal and delayed emptying.
- Ultrasound abdomen was the investigation of choice and was performed in all 25 cases. Muscle thickness of >3mm was considered diagnostic.
- Conservative management was given to improve the general status of the patient and has had an effective nature in bringing the post-operative period absolutely uncomplicated. This management included correction of dehydration, anemia, malnutrition and a good stomach wash.
- Ramstedt's pyloromyotomy was the only procedure carried out in all the 25 cases.
- The results were astounding as it stands to 100% in the present study as patients went totally relieved of symptoms at the time of discharge.
- The clinical pattern seen in this area resembles of that which is described as infantile hypertrophic pyloric stenosis.

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### Conflict of Interest

None

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Nil



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