

# Evaluation of Risk Factors and Outcome of Incarcerated Inguinal Hernia in Pediatric Age Group

Ibrahim Tariq Ameen<sup>1</sup>, Raid Hamid Abdul-Ghafoor<sup>2</sup>, Bilal Hamid Abdul-Ghafoor<sup>3</sup>

<sup>1</sup>Specialist in pediatric surgery, Al-Ramadi Hospital for Maternity and Children, Department of pediatric surgery, (Anbar/Iraq), <sup>2</sup>Specialist in internal medicine, Al- Ameriya Hospital, (Anbar/Iraq), <sup>3</sup>Consultant in pediatric surgery, Child Central Teaching Hospital, Department of pediatric surgery (Baghdad /Iraq).

## Abstract

**Background:** Incarcerated inguinal hernia is one of emergency conditions in children. It results from entrapment of bowel or other viscera within the hernia sac. High incidence of incarcerated inguinal hernia occurs in young age and preterm. The incidence of incarcerated hernia is variable and ranges from 12–17%. The aim is to evaluate the risk factor / or factors and outcomes for patients with incarcerated inguinal hernia.

**Patients and method:** This prospective study directed in department of pediatric Surgery, Central Child's Teaching Hospital, Baghdad, Iraq. Fifty-five patients with incarcerated inguinal hernia were managed for 10 months. They were evaluated for history and sent for investigations. All patients initially treated by manual reduction. Later on they treated by elective operation. Overall outcomes were evaluated in all patients.

**Results:** The patient's age range from 17 days to 5.5 years. There was male predominance with male: female ratio was 10:1. The frequency of right side incarcerated inguinal hernia was more than the left. Forty (72.7%) patients were under first year. Thirty-two (58.2%) patients were preterm. Forty-four (80%) patients have successful manual reduction and eleven (20%) patients were failed and underwent emergency surgery. Intestinal resection done to 4 patients and rate was 7.3%, and orchiectomy done to 3 patients and rate was 5.4%.

**Conclusion:** Premature and younger age patients are risk factors for incarcerated inguinal hernia. Incarceration increases the rate of overall complications. Any patient, especially young patient and preterm, with reducible hernia should be treated as soon as possible.

**Key words:** *Incarcerated inguinal hernia; Risk factors; Outcomes.*

## Introduction

Indirect inguinal hernias are fundamentally the result of failure of closure of the processus vaginalis (1, 2). Incarcerated inguinal hernia can result from entrapment of bowel or other viscera within the hernia sac (1). Approximately 1–5% of all children will develop an inguinal hernia and a positive family history is found in about 10%, while the male-to-female ratio was 5:1, and right-sided hernias were twice as common as those on the left. The mean age at diagnosis was 3.3 years. The overall incidence of inguinal hernia in premature infants is estimated to be 10–30%, whereas term newborns have a rate of 3–5 % (3, 4). Younger age and prematurity are risk factors for incarceration (5).

## Incarcerated hernia

Inguinal hernias that are difficult to reduce are “incarcerated. A strangulated hernia happens once there's vascular compromise of the entrapped viscera. This results from constriction by a tight internal or external ring. Most children can progress speedily to strangulation if the hernia isn't reduced. This method will take as very little as a pair of hours. If this process is unchecked, this will lead to gangrene and perforation of the bowel or other viscera. Incarceration and strangulation can also damage the testicle by compromising the blood supply to the testis (1).

### Clinical presentation

Incarceration symptoms are often manifested as a fussy or inconsolable child with intermittent abdominal pain and vomiting. A tender and at times erythematous irreducible mass is noted with in the groin. Abdominal distention may be a late sign; as are bloody stools. Peritoneal signs indicate strangulation. Incarceration may be the presenting sign of the hernia, especially in an infant (3). The diagnosis of incarcerated inguinal hernia is usually made on clinical grounds. Abdominal x-rays may occasionally show bowel gas within the lump in the groin and confirm the diagnosis (6). In uncertain cases ultrasound can be useful to distinguish bowel from hydrocele fluid or a testicular torsion (1). Differential diagnosis for incarcerated hernia is the primary distinction to be made is between an inguinal hernia and a hydrocele. Femoral and direct inguinal hernia are rare but should be kept in mind; a retractile or undescended testis may mislead the unwary, and in young children, an inguinal lymph node may be situated close to the external inguinal ring (7).

### Treatment

If the patients without obvious signs of shock or peritonitis, non-operative management is first tried (1). The incarcerated hernia should be reduced by taxis. Taxis is a manipulative trick, not a matter of force, and if necessary may be attempted several times. As long as the necessary monitoring is available, a distressed child may be sedated with midazolam or opiate analgesia. Taxis is successful in over 90% of cases, with virtually no chance of complication by en masse reduction (7). If positive, the hernia contents can steadily disappear into the internal ring. To be certain it is reduced; compare it with the contralateral side (1). Once an incarcerated hernia is reduced, a delay of 24 to 48 hours to allow resolution of edema is reasonable (3,8).

### Complications

The risk of recurrence after an elective inguinal hernia repair is less than 1% in several large series. Injury to the spermatic cord or testis is a rare occurrence in elective hernia repairs. Also the infection and hematoma can occurs in 1–3% of cases. Moreover loss of domain due to a huge hernia is another problem more frequently seen in adults, but it can occur in infants or children and may require staged repair or other measures. The iatrogenic cryptorchidism from failure to replace the testis in normal anatomic position is a rare

occurrence (<1%). Bladder injury in infants in whom the medial wall of the sac contains urinary bladder is also a rare complication. While Mortality directly related to inguinal hernia or its repair is exceedingly rare (<1%) (3).

### Patients and methods:

Fifty five patients with incarcerated inguinal hernia were evaluated in term of risk factors and outcome at surgical department of Central Child's Teaching Hospital in Baghdad from 1<sup>st</sup> October 2015 to 2<sup>nd</sup> August 2016. The information's been collected from the patients according to special data sheet and collected data involved:

- 1- History included: name, age, gender, maturity, presenting symptoms and sings with duration, side, and history of reducible hernia.
- 2- Investigations involved: plain erect abdominal x-ray, U\S (abdomen and inguinal), and preoperative routine investigations.
- 3- Treatment by taxis: reduction by taxis followed by elective operation and failed reduction followed by emergency operation.
- 4- Post-operative complications for elective and emergency operation.
- 5- Operative time and hospital stay.

The diagnosis depended mainly on clinical examination. Erect abdominal X-ray was taken to all patients. U/S of abdomen and inguinal was taken for some patients. Blood sample was taken and sent for preoperative routine investigations. Manual reduction by taxis was tried to all patients as they didn't have contraindication. For elective patients who succeeded by manual reduction, formal herniotomies through inguinal approach were done later on with high ligation of sac. Patients were followed in term of wound infection, hematoma, recurrence, and testicular atrophy.

### Statistical Analysis

Statistical package for social sciences version 22 (SPSS v22) was used for data input and analysis. Discrete variables presented as numbers and percentages and continuous data presented as means. Chi-square test for independence was used to test the significance of association between discrete variables. Findings with P values less than 0.05 were considered significant.

**Results**

The study includes fifty five patients with incarcerated inguinal hernia. Age range from 17 days to 5.5 years and mean age was 11 months. It consists of 50 males (90.9%) and 5 (9.1%) females with ratio male: female ratio is 10:1. In term of age distribution; 28 (50,9%) patients were less than 6 months, 12(21.8%) patients were between 6-12 months, 10 (18.2%) patients were between 12-24 months, and 5(9.1%) patients were more than 24 months. About 2/3 (72.7%) of patients were less than one year old which showed in table1.

**Table 1: Age and gender distributions of incarcerated inguinal hernias.**

Age (months)	Gender mean (percentage %)		Total mean (percentage %)
	Male	Female	
<6	24(43.6%)	4(7.3%)	28(50.9%)
6-12	12(21.8%)	0	12(21.8%)
12-24	10(18.2%)	0	10(18.2%)
>24	4(7.3%)	1(1.8%)	5(9.1%)
Total mean (percentage %)	50(90.9%)	5(9.1%)	55(100%)

The most common presenting symptom was irritability(pain) and/or excessive crying that found in 51(92.7%) patients. vomiting (bilious & non-bilious) occur in 37(67.2%) patients, poor feeding in 44(80%) patients, constipation in 17(30.9%), and abdominal distension in 12(21.8%), bleeding per rectum in 1(1.8%) patient. Tenderness of inguinal or inguinoscrotal swelling occurred in 44(80%), and redness occurred in 8 (14.5%) patients. No signs of peritonitis (Tender abdomen, high fever, guarding) were reported, as shown in table2.

**Table 2: Symptoms and signs of incarcerated inguinal hernia.**

No.	Signs & symptoms	Total No. (percentage)	
1.	Irritability(pain) and/or excessive crying	51(92.7%)	
2.	Vomiting (bilious & non-bilious)	37(67.2%)	
3.	Poor feeding	44(80%)	
4.	Constipation	17(30.9%)	
5.	Abdominal distension	12(21.8%)	
6.	Bleeding per rectum	1(1.8%)	
7.	(peritonitis)	0(0%)	
8.	Swelling	Tenderness	44(80%)
		Redness	8(14.5%)

Inguinal swelling less than 24 hrs. duration, 31(56.4%) of 32(58.2%) patients treated by taxis, 12(21.8%) of 17(30.9%) patients who presented between 24 – 48 hours treated by taxis , and only 1(1.8%) patient of 6 (10.9%) patients presented more than 48 hours duration and treated by taxis. Overall mean duration was 21.6±18.4 hrs. (R= 4-72 hrs.) as showed in table3.

**Table3: Duration of presentation and treatment of incarcerated hernia.**

Duration (hrs)	Total	reduction by taxis& elective operation	Emergency operation after taxis failure
<24	32(58.2%)	31(56.4%)	1(1.8%)
24-48	17(30.9%)	12(21.8%)	5(9.1%)
>48	6 (10.9%)	1(1.8)	5(9.1%)
Total	55(100%)	44(80%)	11(20%)
* P value < 0.001			

\* There is a significant association between duration and manual reduction (p value<0.05)

No intestinal necrosis found in patients with history of incarcerated inguinal hernia less than 24 hours of duration, while it found in 4 patients delayed more than 24 hours as showed in table 4. For these 4 patients, mean duration was 45 hrs. and mean age was 6 months .

**Table 4: Duration of symptoms and intestinal necrosis.**

Duration (hrs)	Frequency of incarceration	Intestinal necrosis
<24	32(58.2%)	0
>= 24	23(41.8%)	4(7.3%)
Total	55(100%)	
* P value = 0.014		

\* There is a significant association between duration & intestinal necrosis (P<0.05)

The overall post-operative complications of these patients with incarcerated hernia were 7(12.7%) patients. For elective operation, only 2 (4.5%) of 44 patients had post-operative complications including: 1 (2.25%) patient had hematoma and 1(2.25%) had wound infection. For emergency operation, 5(45.4%) of 11 cases had complications including: 1(9.1%) hematoma, 1(9.1%) recurrence, 2(18.2%) wound infection, and 1(9.1%) testicular atrophy as showed in table 5.

**Table 5: Frequency of post-operative complications in patients subjected for emergency and elective operations.**

Type of complication	Emergency N=11	Elective N=44	Total N=55
Hematoma	1(9.1%)	1(2.25%)	2(3.6%)
Wound infection	2(18.2%)	1(2.25%)	3(5.4%)
Recurrence	1(9.1%)	0(0%)	1(1.8%)
Testicular atrophy 1(9.1%) 0(0%)			1(1.8%)
total	5(45.5%)	2(4.5%)	7(12.6%)
* P value < 0.001			

\* There is significance for overall complications (P value < 0.05)

Regarding emergency patients, the mean duration of surgery was 55min (range 35-100 min), and mean post-operative hospital stay 63.1 hours (range 30 – 140 hrs.). For elective cases, the mean duration of surgery was 22.7 min (range 15-30) and mean post-operative hospital stay 2.7 hours (range 2-4 hours) as showed in table 6.

**Table 6: Mean operative time and hospital stay for emergency and elective patients.**

Mean operative time and hospital stay	Emergency N=11	Elective N=44
Mean Operative time	55min (R 35-100 min)	22.7 min (R 15-30)
Mean Hospital stay	63.1hrs( R 30 – 140 hrs)	2.7 hrs (R 2-4 hrs)

### Discussion

The incidence of hernia incarceration is variable and ranges from 12–17 %<sup>(3,4)</sup>. In this study, 28 (50,9%) patients were less than 6 months, 12(21.8%) patients were between 6-12 months, 10 (18.2%) patients were between 12-24 months, and 5(9.1%) patients were more than 24 months. About two third of patients (72.7%) were infants as in Kayode T. Bamigbola *etal*<sup>(9)</sup> study and Mohammed Zamakhshary *etal*<sup>(10)</sup> study which assume that two third of incarcerated hernia were infants. With higher incidence among infants, this is due to narrow rings which easily trap the herniating loops of bowel or other viscera. Mean age of occurrence was 11 months with age range from 17 days to 5.5 years, common in male 50(90.9%), and in right side.

In this study preterm infants were 32(58.2%), and 23(41.8%) were terms. prematurity considered as risk factor for incarceration and this is mentioned by Rowe MI *etal*<sup>(4)</sup> study , EinSH *etal*<sup>(8)</sup> study , and Hughes K *etal*<sup>(11)</sup> study .

Regarding clinical presentation, 51(92.7%) of patients presented with irritability (pain) and/or excessive crying. Other presentations were poor feeding in 44(80%), vomiting (bilious or non-bilious) in 37(67.2%), constipation in 17(30.9%), abdominal distension in 12(21.8%), and bleeding per rectum in 1(1.8%). No signs of peritonitis were presented. Examination of swelling demonstrates tenderness in

44(80%), and redness in 8(14.5%). The most common symptom was irritability (pain) and/or excessive crying and the most common sign of swelling was tenderness which is comparable with Wael Mohammed *etal*<sup>(12)</sup> study.

Thirty two (58.2%) patients presented less than 24 hrs. duration and twenty three (41.8%) patients were more than 24 hrs. duration. Total manual reduction rate of incarcerated inguinal hernia by taxis succeeded in 80% of patients followed by elective herniotomy later on. Less 24hrs duration, 96.8% (31 of 32 cases) had succeeded by manual reduction, this rate decreased to 56.5% (13 of 23 cases) between 24-48 hrs. duration and only 16.6% (1 of 6) above 48 hrs. The total successful rate of manual reduction is less than Puri P. *etal*<sup>(32)</sup> study, and Ein SH *etal*<sup>(8)</sup> study which range from 90-95%. This is a result of the high rate of delayed presentation with 41.8% of cases presented after 24 hrs.

Eleven patients had emergency operations because of failed manual reduction. During operation, the sac must be opened and content examined. Bowel necrosis occur in 4 patients and give rate of 7.3% and the rate equal to Kayode T. Bamigbola *etal*<sup>(9)</sup> study which is 7.3%. Frankly gangrenous testis was 3 and give rate of 5.4%. This rate is less than Kayode T. Bamigbola *etal*<sup>(9)</sup> study which is 14 % and this may be due to high operation rate in neonate due to high failure of manual reduction in his study but near to 2.6-5% as mentioned in Arnold G. Coran *etal*<sup>(1)</sup>.

The overall complications rate was 12.7% and this is comparable with reports in studies of Niedzielski *etal*<sup>(13)</sup>, Meier AH *etal*<sup>(14)</sup>, Chen LE *etal*<sup>(15)</sup>, and Ameh EA<sup>(16)</sup> with rate range between 11 and 31%. Complications rate of emergency operations was 45.4% and it is comparable to 51.7% in Sadik H Kadhem *etal*<sup>(17)</sup> study.

Mean operative time for patient with incarcerated hernia treated emergently was 55 minutes range from 35 – 100 minutes while mean time was 22.7 minutes with range of 15-30 minutes for patients who were treated electively. Mean post-operative hospital stay was 2.7 hours range from 2-4 hours for elective patients and 63.1 hours (2.7 days) range from 30-140 hours for emergency operations. So, there is prolonged operative time for emergency treated patients that will increase risk of anesthesia and complications. And there is prolong hospital stay which means more cost on hospital and more cost on patients.

## Conclusion

Younger age and prematurity are risk factors for developing incarcerated inguinal hernia. Longer duration and younger age will decrease rate of manual reduction and increase rate of testicular and intestinal necrosis. Overall complications in incarcerated hernia will be higher than those with reducible hernia and especially high in emergently operated patients. Incarcerated inguinal hernia is more costly for patient and hospital than reducible hernia, as there is prolonged operative time and hospital stay.

**Conflict of Interest:** Authors have no conflict of interest.

**Source of Funding:** The current study which was directed at Central Child Teaching Hospital, Department of Pediatric surgery in Baghdad, where personal finance was adopted by the authors.

**Ethical Clearance:** The information's been collected from the patients according to special data sheet and collected data. All patients were joining up in the study after signing a written informed consent, and their selection follows the above criteria's.

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