

A Study of Inguinal Hernia in Children

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Abstract: ***Background & Objective:** Inguinoscrotal swellings are one of the commonest anomalies in infancy and childhood throughout the world. Delay in diagnosis and treatment leads to loss of testis, ovaries or portion of bowel to incarceration or strangulation. This study was undertaken to evaluate the age, sex and sidewise distribution and the complications like incarceration, strangulation and gonadal infarction. **Methodology:** A total of 50 children were selected ranging in age from 2 months to 12 years presenting with inguinoscrotal swelling which were examined, followed up and managed. **Results:** The inguinal hernia was most common among male children (92%) thereby giving a ratio of M: F=11.5:1. The children were aged 2 months-12 years and most of the patients presented around 2 to 7(46%) years and prematurity noticed in 10% of cases. Right sided (64%) inguinal hernia was more common than left (28%). In this study indirect hernia is 98% and direct is 2%. In 16 cases of hydrocele, 10 were on the left side and 6 were on the right and 6 cases were encysted hydrocele. High ligation at the level of deep ring was done in all the cases. In this series of 50 children, there were 2 cases of incarceration. But none had strangulation and gonadal infarction.*

Keywords: Incarceration; strangulation; inguinal hernia; hydrocele; Herniotomy

1. Introduction

The disease which makes the subject of the following tract, is one in which mankind are, on many accounts, much interested. No age, sex, rank, or condition of life, is exempted from it; the rich, the poor, the lazy, and the laborious, are equally liable to it; it produces certain inconvenience to all who are afflicted by it... It sometimes puts the life of the patient in such hazard, as to require one of the most delicate operations in surgery; and it has in all times, from the most ancient down to the present, rendered those who labor under it subject to the most iniquitous frauds and impositions." ¹

Inguinoscrotal swellings are one of the commonest anomalies in infancy and Childhood throughout the world. Among the inguinoscrotal swellings, inguinal hernia and hydrocele top the list in frequency. They represent the conditions most frequently requiring surgical repair in the pediatric age group. Hernia is a Latin term meaning rupture of a portion of a structure. It can be defined as a "protrusion of a viscus or part of a viscus through a normal or an abnormal opening in the wall of its containing cavity."² As a result of improved neonatal intensive care, more and more premature babies are being delivered and consequently the incidence of neonatal inguinal hernia and hydrocele is increasing. All pediatric inguinal hernias require operative treatment to prevent the development of complications, such as inguinal hernia incarceration or strangulation.

This study was aimed to know the age, sex and side prevalence of inguinal Hernia in children. To know the clinical presentation of inguinal Hernia in children age ranged from 1 day to 12 years. preoperative sonographic evaluation of contralateral processes vaginalis in children with unilateral hernia. Management of inguinal Hernia in children and post operative pain management. Assessment of Bilaterality, association with Hydrocele, cryptorchidism and intersex.

2. Methods

The present study is a prospective hospital based study in the department of surgery, KIMS, Hubli during the period from Dec 2007 to Nov 2008. All children age ranged from 1 day to 12 years with inguinal hernia who attended Pediatric surgical OPD, KIMS, Hubli were selected for the study. Total numbers of inguinal hernia were 50. Congenital inguinal hernia were diagnosed by taking detailed history from parents in the form of site, size, variability of size, history of non-reducibility or any underlying straining for micturition or presence or absence of testis in scrotal sac, were collected in a prescribed proforma which contains history, clinical examination, investigation and management in one year time bound study. After obtaining the history children were examined systematically which includes examination of inguinal and groin region, scrotum and its contents. Respiratory system, cardiovascular system and per abdomen to know other associated congenital anomalies like undescended testis and other connective tissue disorder. Children were subjected to routine investigations like Hb%, BT, CT and USG for CPPV. Children with unilateral inguinal hernia underwent US examination using a 7.5-MHz linear transducer. If a CPPV was visible as a hydrocele owing to the inflow of physiologic ascites into a processus vaginalis on straining, then US scanning were performed while the patient was at rest and while inducing straining by standing or crying. A groin with a hydrocele in the inguinal canal on straining was diagnosed as a CPPV and cases were followed for 1 year to know development of C/L hernia. Female children with hernia were evaluated for inter sex problems in the form of ultrasonography of abdomen and buccal Barr bodies. After proper evaluation of preoperative condition and appropriate preparation, surgery is considered. Surgery is decided by age. If the children <1 year of age, Mitchell banks operation is selected where in herniotomy done without opening the external oblique aponeurosis. If the children >1 year of age, Fergusson technique is selected

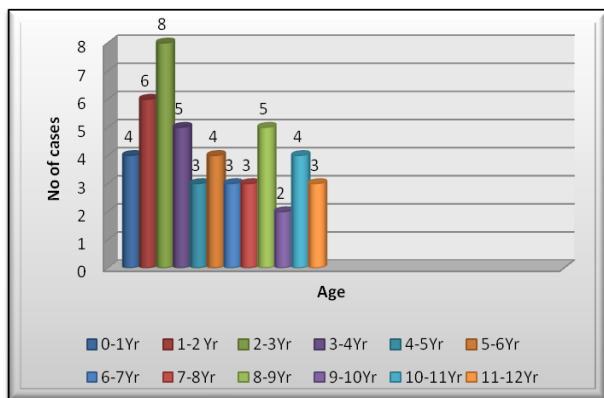
where in herniotomy done after opening the external oblique aponeurosis, under suitable anesthesia as decided by anesthesiologist. After the surgery, children were nursed in post operative ward with one dose of IV antibiotics. Post operative complications were being taken care off. Observed for 6 hours and finally decided to discharge once patient is fit for discharge on the same day. All patients were asked to attend the Pediatric surgical OPD for follow-ups.

3. Results and Observations

In the present study following observation were made.

3.1 Age Distribution

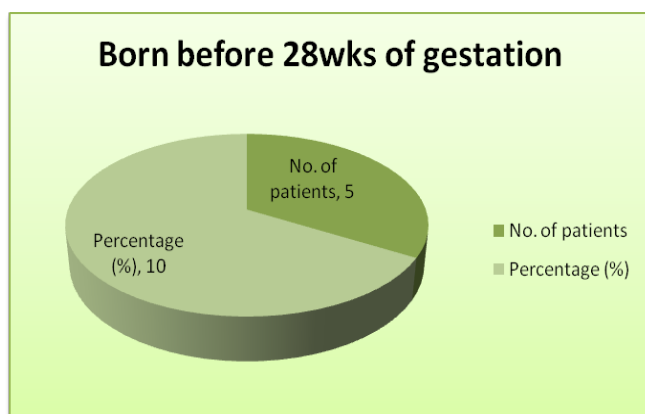
The age of the patients ranged from 2 month to 12 year. They were divided into 12 groups, each with a gap of 1 year. The maximum numbers of cases were in the age group of 2-3 year (16 %) and the minimum number was in the age group 9-10 year. 46% of cases were between 2 to 7 years.



Graph 1: Age Distribution

3.2 Prematurity

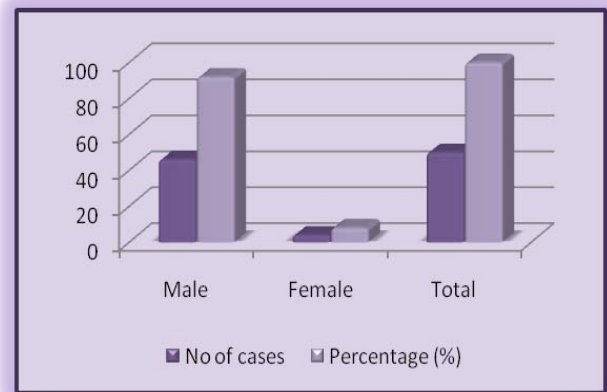
In this study, following table showed the percentage of prematurity with inguinal hernia. 5 babies are born before 28 weeks of gestation in this study.



Graph 1: Prematurity

Sex Distribution

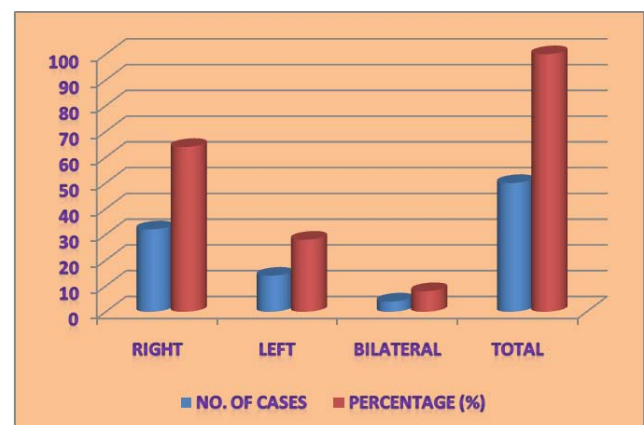
In this study of 50 children, 46 were males and 4 were females, the ratio being 11.5:1.



Graph 3: Showing Sex Distribution

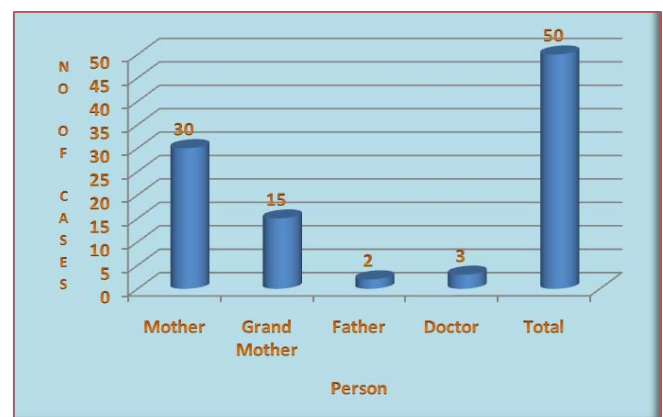
3.3 Side Distribution

Among these 50 cases, 32(64%) cases were on the right side, 14(28%) cases on the left side and 4(8%) cases were bilateral. Of those 32 cases on the right side, 28 were boys and 4 were girls. Among the 14 cases on the left side and 4 bilateral, all were boys.

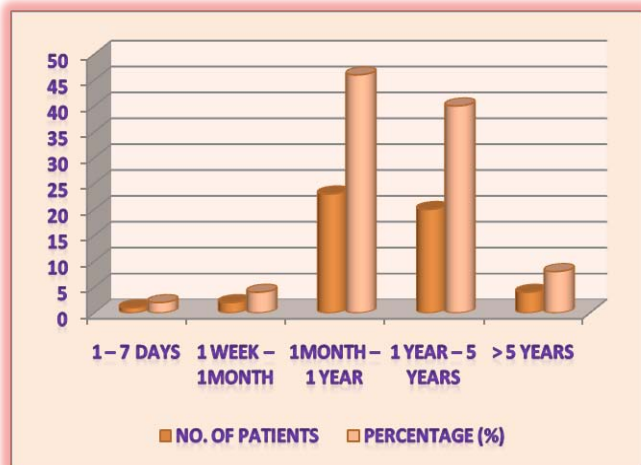


Graph 4: Showing Side Distribution First Person To Notice The Swelling

In the present series of 50 cases, 30 swellings were first noticed by their mothers, 15 by grandmother, and 2 by father and in 3 cases it was noticed by doctors during routine check up for immunization.

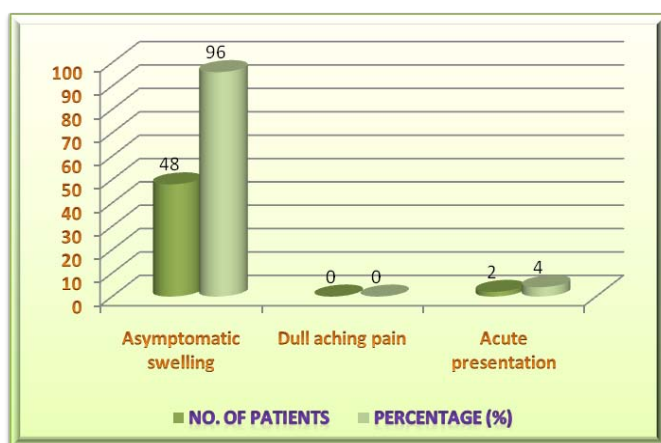


Graphs 5: Showing First Person to Notice Swelling

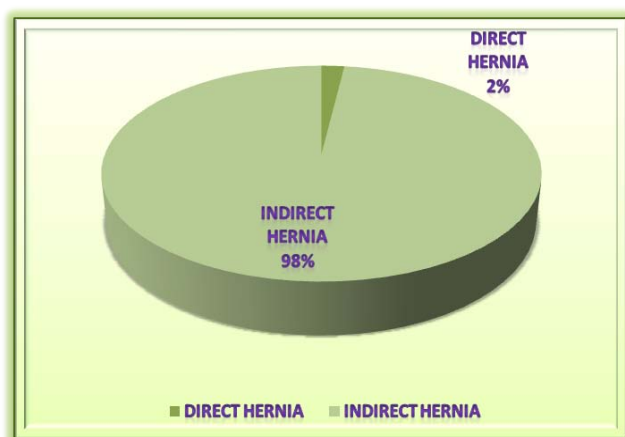


Graph 6: Showing Duration of Symptoms

In the present study the duration of symptoms, from 1 month to 1 year is seen in 23 patients (46%) and next from 1 year to 5 years in 20 patients (40%)



Graph 7: Showing Symptomatology Direct and Indirect Component

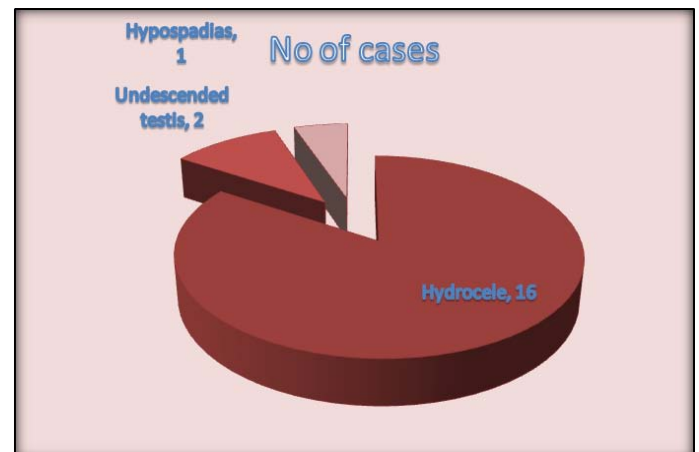


Graph 8: Showing Direct and Indirect Component

Associated Congenital Anomalies

In this series, there were 16 cases of hydroceles of which 10 were on the right side and 6 on the left side. Among these 6 cases were encysted hydrocele of the cord, 3 were on the left side and 3 on the right side. There were 2 cases of undescended testis. All were on the right side and located in

the inguinal pouch. They underwent orchiopexy at the time of hernia repair and the testis was placed in the sub dartos pouch. 1 case was associated with Hypospadias. Association with intersex was not observed in our study.



Graph 9: Showing Associated Congenital Anomalies

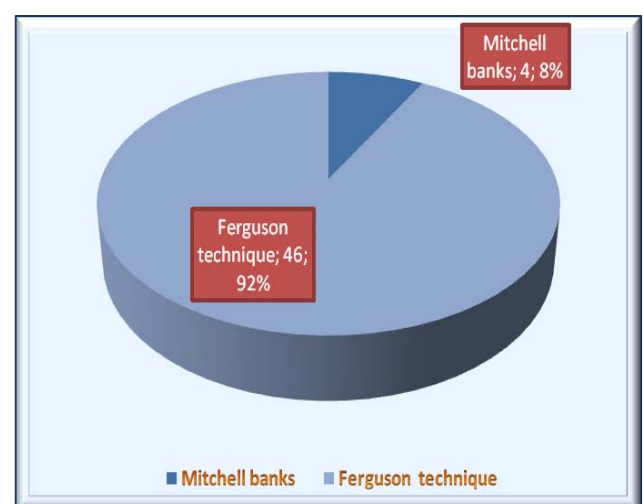
Preoperative Sonographic Evaluation Of CPPV

In our study 46 patients (42 boys and 4 girls) with unilateral inguinal hernia underwent Ultrasound examination using a 7.5 MHz linear transducer. In 46 cases 4 cases (8%) were diagnosed by US as CPPV. Out 4 cases 3 were on right side, 1 one left and all were boys and all are below 2 years. 1 case developed C/L inguinal hernia on right side after 6 month.

Anaesthesia

Out of 50 cases 40(80%) cases received GA, 5(10%) cases received caudal block (0.25% bupivacaine, 1 ml/kg), and 5(10%) cases received spinal anesthesia. Postoperatively it was noticed that patient were comfortable with caudal block (good analgesia) compared to other types.

Operation Performed



Graph 10: Operative technique for herniotomy

4. Discussion

Inguinal & Scrotal swellings in children form a majority of surgical conditions requiring treatment. Inguinal hernia repair

is the most frequently performed operations in the pediatric age group. The legendary Robert Gross had said "There is nothing as interesting as an inguinal hernia." In controlled population based studies, there are between 10 and 20 inguinal hernias per 1000 live births³.

4.1 Age Distribution

In the present study of 50 cases, the youngest patient was 2 month of age and oldest was 12 years old. 46% of cases were between 2 to 7 years

TABLE 1: Showing percentage of age distribution

Studies	Age group	Percentage (%)
Okuribido et al., ³	3 to 7 years	47.4
Adesunkanmi AR et al ⁴	5 years and below	71
Wright JE ⁵	< 7yrs, <5yrs, and <1yrs	87,65,and 25 respectively
Present study	2 to 7 years	46

The figures in the present study less compared other studies mentioned. . This is may be due to parental disagreement for surgery in infants.

Table 2: Showing percentage of prematurity

Author	Inc (%)
Gray. S.W. skandalakis ⁶	44-55
Rescorla and Grosfeld ⁷ & Frederick J. et al ⁸	30
Davis N. et al ⁹	35
Present study	10

The figures in the present study do not correlate with other studies mentioned. This may due to increased mortality of preterm babies at our hospital or lack of educated parents or they do not know the history of prematurity.

Sex Distribution

In all the studies of inguinal hernia in children, there is male preponderance. Female cases were evaluated for intersex. USG was done to rule out intersex, we have not found case of intersex.

Table 3: Showing sex distribution

Author	Boys (%)	Girls (%)	M:F Ratio
Grosfeld J.L. ¹¹	87.5	12.5	7:1
Ralph M Larsen et al ⁶³	91.7	8.3	11 :1
Willia B Keisewetter ⁶⁴	86	14	6 :1
Marc I Rowe ⁶⁵	87	13	7 :1
Present study	92	8	11.5;1

The figures in the present study correlates well with other studies mentioned

Side Distribution

Childhood inguinal hernias are generally more predominant on the right side and this has been attributed to the delay in descent of the right testis. B/L cases were evaluated for intersex and connective tissue disorder but were not associated.

Table 4: Showing percentage of side distribution

Author	Rt (%)	Lt (%)	B/L (%)
Rowe and Grosfeld et al ⁶²	55 to 60	25	15
Michel Gilbert et al ⁶⁶	63.5	27	9.5
Muhammad T. et al ⁶⁷	60	30	10
Present study	64	28	8

The figures in the present study correlates well with other studies mentioned

5. First Person to Notice the Swelling

In the present series of 50 cases, 47 swellings were first noticed by their parents and in 3 cases it was noticed by doctors during routine check up for immunization. Parents are usually the first person to notice the swelling and this has been documented in earlier studies (Scherer L.R and Grosfeld J.L⁶⁹ and Javad Ghoroubi et al⁷⁶ they noticed, in 99% of the cases, hernia was diagnosed by the parents for the first time). Usually parents and grandmother notice the swelling while bathing the child or changing clothes. This could be because of the closeness of parents and grandmother to the child.

5.1 Duration of Symptoms

In the present study the duration of symptoms, from 1 month to 1 year is seen in 23 patients (46%) and next from 1 year to 5 years in 20 patients (40%) The delay in recognizing the swelling in inguinal region is size. Size may be small where patients / parents could not able to pick up or the surgeon is unable to confirm its presence

5.2 Symptomatology

According to Llyod and Rowe most of the hernias are asymptomatic swelling and acute presentation seen in 12% of children. In our study most of the patients presented with asymptomatic swelling (96%) and acute presentation seen in 2 patients (4%). They presented with acute pain, vomiting, fever, swelling and irreducibility. According the Llyod and Rowe⁷⁷ the incarceration of inguinal hernia is 17% on right side and 7% on left side with over all rates being 12%. In our study cases of incarceration seen on the right side with 4% and overall rate being 4% this showed that incarceration is more common on right side. Incidence of incarceration is low in our study this may be due to early diagnosis and most of the surgeons do not hesitate to operate on infants as early as possible due to availability of newer anesthesia and better NICU care.

5.3 Direct and Indirect Component

Direct inguinal hernias in children are rare and represent 0.5% to 1% of all groin hernias. In our study 1 case was found to have direct hernia for which posterior wall repair was done. This case was evaluated and was not associated with connective tissue disorder.

Table 5: Showing percentage of direct hernia.

Author	Direct hernia (%)
Wright J.E ⁵	1.2
Gorsler and Schier. ³	3.9
Fonkalsrud et al. ³¹	0.2
Present study	2

The figures in the present study correlates well with other studies mentioned. Sliding inguinal hernias are uncommon in children. It is more common in girls than in boys. In the series of Grosfeld et al ovary and fallopian tube were found in the sac in as many as 15% of hernias in girls. The structures encountered in sliding hernias are caecum, appendix, bladder, sigmoid colon and rarely uterus. In the present study, we have not found any case of Sliding inguinal hernias.

5.4 Associated Congenital Anomalies

(i) Undescended Testis

During the course of this study, 2(4%) cases of undescended testis were detected, all of them were on the right side and situated in the superficial inguinal pouch. These patients had orchiopexy at the time of hernia repair and testis was placed in the subdartos pouch. According to Orver Swenson, the commonest site for undescended testis is superficial inguinal pouch. From this study we can noticed that commonest site is superficial inguinal pouch.

Table 6: Showing percentage of undescended testis

Author	UDT (%)
Javad Ghoroubi et al. ²⁹	5.85
Duckett J.W. et al. ²⁴	4
Hugh B. Lynn ²⁵	8
Venugopal S ²⁶	1.8
Present study	4

The figures in the present study correlates well with other studies mentioned

(ii) Encysted hydrocele of the cord

There were 6 cases of encysted hydrocele of the cord, 3 on the left side and 3 on the right. All had PPV. This study is in accordance with Duckett J.W et al²⁴ who conducted 380 hernia operations and found 25 hydroceles of the cord.

(iii) Congenital hydrocele.

Table 6: Showing percentage of associated hydrocele

Author	Percentage (%)
Javad Ghoroubi et al. ²⁹	27.6
Duckett J.W. et al. ²⁴	13.4
Hugh B. Lynn ²⁵	17
Thomas E. Simpson ²⁷	35.3
Willis J. Potts ²⁸	9
Present study	32

The figures in the present study correlates well with other studies mentioned

(iv) Hypospadias

Out of 50 cases in this study, association of hypospadias was observed in 1(2%) case. According to Andre Hebra,

hypospadias is associated with an increased risk of inguinal hernia

6. Preoperative Sonographic Evaluation for CPPV

In our study 46 patients with unilateral inguinal hernia underwent US examination. In 46 cases 4 cases (8%) were diagnosed as CPPV. Out 4 cases 3 were on right side, 1 one left and all were boys and were within 2 years. Since our study is observational and there is chance of spontaneous closure within 2 year, we have not explored contralateral side and no comparison was done with operative findings. But for these cases regular follow up was done and found that 1 case developed C/L inguinal hernia on right side after 6 months. Hata S; Takahashi Y et al studied 348 patients with unilateral inguinal hernia. All underwent US examination using a 7.5-MHz linear transducer and a groin with a hydrocele in the inguinal canal on straining was diagnosed as a CPPV and was explored bilaterally through surgery. The US findings were compared with surgical results. In 348 patients, 78 cases (22.4%) were diagnosed by US as patients with a CPPV; these patients underwent bilateral surgery. Seventy-four of 78 cases (94.9%) were confirmed surgically as patients with CPPV, and concluded a CPPV was detected correctly by US in 74 of 348 patients (21.3%) with clinically diagnosed unilateral inguinal hernias. As there was no comparison we cannot concludes from this study. But it is observed that USG is good alternative to detect CPPV as 1 case developed C/L hernia during follow up in those who had CPPV and parents were informed about possibility of C/L hernia and follow up is advised for earlier diagnosis, hence risk of incarceration can be prevented.

6.1 Anaesthesia

Out of 50 cases 40 cases received GA, 5 cases received caudal (0.25% bupivacaine, 1ml/kg), and 5 cases received spinal anesthesia. Most commonly children were operated under GA. Use of caudal block will have better pain control postoperatively.

6.2 Operation Performed

Recent 'Inguinal Hernia' guidelines of the Association of Surgeon of the Netherlands³² recommended that the operations be carried out in daycare and that the use of local anesthesia should be considered more often. The diagnosis of inguinal hernia is based on the physical examination. It is recommended that the surgeon should not rely solely on the history but confirm the presence of a hernia personally. The treatment of a pediatric inguinal hernia is always operative. Generally, younger the child, the more urgent the operation, because of the increased risk of incarceration in infants, particularly premature babies. There is no indication for routine exploration of the contralateral groin. If an incarcerated hernia cannot be reduced, emergency operation is necessary and referral to a pediatric surgical centre must be considered. Routine hernia repairs are performed on day care basis. In this study all the cases were confirmed by physical examination, were asked to come on day of surgery. All the

cases were treated by operation. Younger children and infants particularly premature babies were operated at earliest date available. 92% of the cases are treated by Fergusson procedure as 46 children were >1 year of age and 8% treated with Mitchell banks procedure for 4 children were <1 year of age under appropriate anesthesia. For all cases high ligation of sac was done. There was no operative or post operative morbidity or mortality related to congenital hernia surgery in this series. In those 2 cases which were operated as emergency, the hernial sac was opened to evaluate for incarceration or sliding structures. All incarcerated hernia treated by elective surgery after reduction. Rowe et al³⁰ recommended elective surgery after reduction, since it has a lower rate of complication compared to emergency surgery (1.7 Vs 22.1%). In the present study there were no case of strangulation and gonadal infarction. The less number of complications in this series could be attributed to larger number of elective cases and fewer emergencies that too operated in time.

Controversy exists for routine C/L exploration in presence of a clinical inguinal hernia. Various modalities to detect C/L hernias have been described, like USG and laparoscopy, but its efficacy and necessity are debatable. Recent 'Inguinal Hernia' guidelines of the Association of Surgeon of the Netherlands³² there is no indication for routine C/L exploration. In this study only the side with an obvious hernia was operated. Carneiro PM et al³³ concluded in his study that the risk of occurrence of contralateral inguinal hernia following unilateral inguinal herniotomy is not significantly excessive when compared by age or sex. Despite the significant risk of developing a C/L hernia in children with left-sided hernia, the authors do not recommend routine right-sided exploration as the frequency is not high.

6.3 Post Operative Analgesia

Postoperative analgesics were provided on a routine basis and were consist of either acetaminophen suppositories (10mg/kg every 4 hours for 24 hours, then as needed) or diclofenac suppositories in children more than 1 year or caudal block. For 45 cases intraoperative rectal suppositories was put at the end of surgery and observed that 90% of cases were comfortable and were not required additional analgesia. For 5 cases caudal block given, it was observed that post operatively patient were comfortable without additional analgesia up to 6 hours after surgery. Use of suppositories have adequate pain control and can be used routinely.

6.4 Duration of Hospital Stay

Most operations are performed on an outpatient basis and sent on day of surgery. 3 cases had inadequate pain control and 2 cases had emesis and were kept under observation in the recovery room. 2 cases that were discharged on the day of surgery had emesis and came next day in coma with pin point pupil due to hypoglycemia. Patient recovered after infusion of 25% Dextrose. Average duration of stay was 1.2 days. Hernias in children were operated as Day care procedure but in our study 2 cases had hypoglycemia on next day after discharge. Generally preterm babies that are below 60 weeks (CGA) are kept under observation.

7. Complication

In the post operative period of 50 children, there were 2 cases of wound infection and 2 cases had hypoglycemia. No other complications were noted. All of them responded to conservative treatment. Carneiro P.M.R.⁶⁸ had six years retrospective review of 397 herniotomy in 380 children up to the age of 10 years and encountered 16 minor post operative complication. Lawrence R. Moss and Edwin I. Hatch⁷⁰ in a study of 384 patients who underwent inguinal hernia repair during a 5 years period found 9 minor post operative complications.

8. Recurrence

During the period of 1 & ½ years study and follow up period of 12 weeks to 52 weeks, 3(6%) cases had recurrence. Recurrent inguinal hernias are relatively uncommon. Reports from most children's document an incidence of 1% to 2%. The recurrence may be associated with comorbid conditions including increased abdominal pressure, prematurity, malnutrition, and anemia and connective tissue disorders. Other causes of recurrence include a missed sac and injury to the floor of the inguinal canal resulting in a direct hernia. Recurrence is also seen more frequently after an initial operation for incarcerated hernia. The repair of a child's hernia is not a parlor piece, but a master's work and should be preformed or supervised by a skilled surgeon.

9. Conclusion

Inguinal hernia and hydrocele in children remain one of the most common congenital anomaly observed by surgeons. The threat to loss of testis, ovary or a portion of bowel due to incarceration or strangulation remains. Prompt diagnosis and early treatment of the inguinal hernia continues to be the mainstay if these complications are to be avoided. The childhood inguinal hernias are generally more predominant on the right side and this has been attributed to the delay in descent of the right testis. Regarding the sex prevalence, males are more commonly affected. Congenital anomalies like undescended testis and hypospadias can be associated with inguinal hernia and hydrocele. In the case of undescended testis, orchiopexy should be done at the time of hernia repair. Parents are usually the first person to notice the swelling or bulge. USG is a good alternative tool for diagnosing CPPV.

An inguinal hernia will not resolve spontaneously and should be repaired as soon as possible after the diagnosis because of the risk of incarceration or strangulation. In general, infants and children require general anesthesia for the operative repair of inguinal hernia and hydrocele. Post operative complications are usually rare following elective operation whereas minor complications do occur after emergency operation. There was no disabling or prolonged morbidity related to the common operative procedure. Recurrence is usually rare if operated by experienced surgeons but it can occur. Inguinal herniotomy in children is a safe and effective operation done as Day care procedure but risk of

hypoglycemic shock has to be kept in mind which can be a grave consequence of Day care surgery.

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