

Abdominal Wall Defects and Hernia in the Pediatric age group: Retrospective study at a Tertiary Center of Eastern Nepal

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Abstract

Introduction: Abdominal wall defect is birth defect in which the abdominal wall does not close normally, which allows the abdominal viscera to protrude through an opening. Abdominal wall hernias are common where inguinoscrotal swellings are the most common in which inguinal hernia tops the list worldwide. Umbilical hernia occurs in 10 percent of infants. Omphalocele and gastroschisis are the rare abdominal wall defects.

Objectives: *Primary Objective:* To identify the abdominal wall defects and hernia in pediatric population of age 1 day to 15 years. *Secondary Objectives:* a) To detect the common predisposing factors of abdominal wall defects and hernia commonly found in our region. b) To address the management of abdominal wall defects and hernia done at our center.

Methods: The data was retrospectively collected from our center from pediatric population of age 1 day to 15 years visiting to B.P Koirala Institute of Health Sciences from June 2019 to May 2021. The data was collected on standard proforma which includes information on patient's clinical findings.

Results: In a retrospective study, 248 cases were recorded in which 209 were of inguinal hernia, 24 were of hydrocele and 7 cases of umbilical hernia. For inguinal hernia, maximum number of cases were of 3 to 4 years of age with male predominance, 66% swelling was right sided and 5.7% bilateral. Undescended testis was associated with 5.7% cases of inguinal hernia. 1.4% inguinal hernia coexisted with umbilical hernia. All the recorded cases were operated. For hydrocele 2-4 years were the confined age group. Out of 24 cases, 12 (50%) scrotal swelling were right sided, 5 (20.8%) left sided and 7 (29.2%) bilateral. All the cases were managed by high ligation at the level of deep ring. For umbilical hernia, the age group confined with one day to one year of age and 71.4% of them were linked to prematurity. None of the case of umbilical hernia was operated. Also, there were five (2.01 %) cases of omphalocele

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found in the records which was treated conservatively at the beginning and was operated eventually. Further, three (1.2%) cases of gastrochisis also found in the records which was managed surgically.

Conclusion: We have observed that most of our cases are of inguinal hernia in our setting. The probable reason behind this can be as swelling is mostly noticed by parents which make them come to the hospital at the earliest. Our results corroborate with previous findings of age and sex distribution. Only, 3.25 percent cases of umbilical hernia were present in which none were operated suggests that defect size being less than 1.5 cm. Only 1.34% gastrochisis and 2.2% omphalocele abdominal wall defects were found in the records which suggest that these are rare cases in our setting. Unawareness, lack of early detection technique, and delay in reaching the tertiary care center from rural areas can also be the reason.

Key words: Abdominal wall defects, Pediatric, Inguinal hernia, Omphalocele and Gastroschisis.

Introduction

Abdominal wall defect is birth defect in which the abdominal wall does not close normally, which allows the abdominal viscera to protrude through an opening. It includes Gastroschisis, omphalocele, bladder and cloacal exstrophy, prune belly syndrome, urachal remnants, umbilical hernia, inguinal hernia. Ventral abdominal wall defects are rare but the common ones are gastroschisis (1 case in 2000 births) (1) and omphalocele (1 case in 4000 births) (1). Abdominal wall hernias are common where inguinoscrotal swellings are the most common in which inguinal hernia tops the list globally (2). Umbilical hernia occurs in 10 percent of infants (3). A hydrocele is a buildup of serous fluid on one or both sides of the testicle in the scrotum. Although the scrotum appear enlarged due to collection of fluid, hydroceles are often painless. While they can happen at any age, hydroceles are more frequent in newborns, particularly preterm infants. Embryologically, abdominal wall forms during 4th week of gestation. During 6th week of gestation, rapid growth of intestine causes physiological herniation of the midgut into the umbilical cord. On the 10th week, the midgut returns back to the abdominal cavity and is followed by the closure of the abdominal wall. Any disruption in this process may result in gastroschisis and omphalocele.

Omphalocele involves herniation of abdominal viscera (such as liver, small and large intestines, stomach, spleen or gallbladder) through an enlarged umbilical ring covered by amnion. This disorder is frequently due to chromosomal abnormality - aneuploidy, familial occurrence and is linked to various congenital cardiac malformations, Beckwith-Wiedemann syndrome, and neural tube defects (4). This umbilicus-based deformity typically measures ≥ 4 cm and is situated in the umbilical area (5). It is prevalent in fully developed, large gestational age infants.

Gastroschisis refers to protrusion of abdominal contents through the body wall usually lateral to the umbilicus and is not covered by peritoneum or amnion (6). This condition is common in babies born to young maternal age (21 years or less), premature births and low birth weights, mothers who are poorly nourished and take recreational drugs and smoke during pregnancy (4). Gastroschisis is associated with other anomalies like intestinal atresia in twenty-five percent cases and cryptorchism in thirty-one percent cases. The defect occurs to the right of the umbilicus (5).

Both Omphalocele and Gastroschisis can be diagnosed in the antenatal period in routine ultrasonography and assessment of Alpha Fetoprotein level which is found to be raised in them (7). Karotyping is useful in detecting Omphalocele. Therefore, screening during pregnancy can be useful. These are surgically corrected by using a silo technique.

Hernia is a protrusion of a viscus or part of a viscus through a normal or an abnormal opening in the wall of its containing cavity (8). All pediatric umbilical hernias develop through a persistent umbilical ring and are congenital. The peritoneum, which is

typically adhering to the dermis of the umbilical skin, forms the hernia sac. Their occurrence incidence is higher in premature babies and is often symptomless but increases in size in crying, coughing and straining (3). It is also associated with obstruction and/or strangulation which are extremely uncommon below the age of three years. Ninety-five percent of umbilical hernias resolve spontaneously, this rectification depends on the size of the defect (3). If the defect is smaller than 1.5 cm, it will heal on its own. But if the hernia is 1.5 cm or larger in size and it continues even after the age of two years, then the surgical treatment is recommended since it is unlikely to resolve on its own (9, 10).

Inguinal hernia in children is almost always indirect and due to a patent processus vaginalis (11). They are more frequent in boys, especially if premature, and 15% is bilateral (3). This is presented as an inguinoscrotal swelling on crying or straining. In infants it is often confused with hydrocele. Common predisposing factors are cryptorchidism, ascites, connective tissue disorder like Ehler Danlos Syndrome, Marfan syndrome. Inguinal hernias are managed surgically by herniotomy.

This type of study has not been conducted in the eastern region of Nepal. Therefore, in a developing nation like ours, there is a need to know such cases, common predisposing factors associated with them and their effective management which may aid in raising awareness at different sectors of health and community. Thus, we hypothesize that this approach would enable in early identification from antenatal period to as soon as from the first day of life as well as implementation of surgical intervention for controlling the mortality rate in children. Therefore, the study aimed to assess the abdominal wall defects and hernia along with their age, sex and side prevalence, and their management in pediatric population.

Objectives:

Primary: To identify the commonly found abdominal wall defects and hernia in pediatric population of age 1 day to 15 years.

Secondary Objectives: 1) To detect the common predisposing factors of abdominal wall defects and hernia commonly found in our region. 2) To address the management of abdominal wall defects and hernia done at this hospital.

Materials and Methods

This is the retrospective hospital based study carried at the tertiary region of eastern Nepal from Pediatric Surgery Division, Department of Surgery and Department of Paediatrics and adolescent, at BP Koirala Institute of Health Sciences (BPKIHS) center, Nepal. The data was collected from a retrospective hospital based study from pediatric population of age 1 day to 15 years visiting to B.P Koirala Institute of Health Science from June 2019 to May 2021.

A total of 595 patients were admitted in the paediatric surgical unit during two years, among them 248 cases were recorded in which 209 were of inguinal hernia, 24 were of hydrocele and 7 cases of umbilical hernia. Also, there were 5 cases of omphalocele and 3 cases of gastroschisis found in our records and were considered for this study. The data was collected on standard proforma and documented information on patient's clinical findings. The institutional ethical committee approved the study. The inclusion criteria includes patients within age group 1 day to 15 years with inguinoscrotal swelling, umbilical swelling, viscera lying outside the abdominal wall were undertaken for this study. The exclusion criteria of the study includes emergency surgeries, epigastric hernia, paraumbilical hernia and those patients who cannot be contacted for the information required for the study.

Statistical Analysis

The statistical package for social studies (SPSS 22.0) was used for the statistical analysis. Descriptive data presented on categorical scale were expressed as frequencies and corresponding percentages. A diagrammatic comparison was carried out using pie chart and bar diagrams for the groups.

Results

In this study, 248 cases were recorded in which 209 were of inguinal hernia, 24 cases of hydrocele and 7 cases of umbilical hernia as presented by the flow chart diagram in Figure 1. In the inguinal hernia category the age of patients ranges from 1 day to 15 years which were divided into fifteen groups, each with a gap of 1 year (see Table 1). The maximum number of cases was in 3 to 4 years of age with 12.9% and minimum in 10-11 years with 1% as shown in Figure 2. The youngest being of one and half month. The Figure 3 showed the Pie chart distribution of gender in which 165 (78.9%) were male and female were 44 (21.1%). While analyzing the side distribution of swelling among 209 patients, 66% of the swelling was on the right side followed by 28.2% on the left and 5.7% was bilateral as shown in Figure 4. Undescended testis was associated with 5.7% cases of inguinal hernia. Herniotomy was the surgical approach used to manage all the inguinal hernia cases. The surgical management carried out for undescended testis was orchidopexy.

For hydrocele 2-4 years were the confined age group. Out of 24 cases, 12 (50%) scrotal swelling were right sided and 5 (20.8%) left sided and 7 (29.2%) bilateral. All the cases were managed by high ligation at the level of deep ring.

Umbilical hernia with inguinal hernia: In this group, 3 cases (1.4%) of umbilical hernia were reported along with inguinal hernia out of 209 cases. Umbilical hernia was managed conservatively, however herniotomy was carried out for the inguinal hernia.

For umbilical hernia, the age group confined with one day to one year of age. Out of 248 cases, 7 cases were of umbilical hernia which accounts to 3.14%. While analyzing the gender distribution it was found that male predominance was 85.7% followed by female 14.3%. And 5 cases (71.4%) of them were linked to prematurity. None of the case of umbilical hernia was operated. Umbilical hernia with granuloma was detected in 2 (28.6%) cases where the electro cauterization was the surgical approach to manage the granuloma.

Also, there were 5 (2.01%) cases of omphalocele and 3 (1.2%) cases of gastroschisis found in our records. The median gestational age and weight of the neonates with omphalocele was found to be 33 weeks and 2000 gm respectively, whereas in case of gastroschisis the median gestation age and weight was reported to be 34 weeks and 2000 gm respectively. The median age of omphalocele and gastroschisis mother were 27 and 26 years, respectively. Cesarean section delivery was done for all the cases in both the category. Two cases of omphalocele were primarily repaired but rest 3 cases were managed on follow up basis with mercurochrome along with crepe bandage and secondary closure was done for ventral hernia. Newborn with all gastroschisis cases were managed with silo and further closure of the defects were performed. The median length of stay was 39 days for gastroschisis and 15 days for omphacele in neonatal intensive care unit. Fifty percent of patients with abdominal wall defects had intra uterine growth retardation (IUGR) in this study. Cardiac anomalies were associated in 3 cases of omphalocele and 2 newborn of gastroschisis cases. One case of gastroschisis was also associated with ileal atresia. Mortality was documented in one infants of gastroschisis with ileal atresia.

Discussion

A total of 595 patients were admitted in the paediatric surgical unit during two years, among them 248 cases were of abdominal wall defects and hernia and they were considered for this study in which 209 cases were of inguinal hernia observed in the pediatric population. In this study for inguinal hernia, most of the children were between 3-4 years of age, whereas a study conducted on the clinical management of inguinal hernia in pediatric age group by Ravikumar V et al. 2013 reported that most of the children belonged to the 1-5 years age group in their study (8). Also, the study of inguinal hernia in children by Jadhav DL et al. 2014 showed that the 46% of patients were between the ages of 2 to 7 years (2). Few other studies reported were also less comparable with one another. This may be due to parent's late decision or disagreement for surgery in children (12-14).

Our results showed that higher percentage of male patients with inguinal hernia i.e. 78.9% and female was 21.1%. Similar results was reported by a study conducted by Ravikumar V. et al. 2013 showing higher percentage of male population i.e.94 % and lower percentage (4%) of female in their data (8). Other researchers have also reported similar results where the comparison reveals the predominance of male patients over female in inguinal hernia (2, 15-18).

In our study, side distribution of inguinoscrotal swelling hernia is accounted for 66% on right side, 28.2% on left side and 5.7% occurred bilaterally. A study conducted on the clinical management of inguinal hernia in pediatric age group by Ravikumar V. et al. 2013 showed cases of inguinal hernias accounted for 54% on the right side and for 42% on the left side and 4% occurred bilaterally (8). Another study also reported similar results of right sided (68%) inguinal hernia was more common than left (28%) (2). Therefore, in childhood inguinal hernia, right sided are more common and this has been attributed to delay in descent of right sided testis (2) The results in the present study correlates well with other studies mentioned (15,19-21). Herniotomy was the surgical approach used to manage all the inguinal hernia cases. Similar surgical approach was reported in a study by Ravikumar V. et al. 2013, where 99% of patients underwent herniotomy. Incidence of undescended testis in this study is 5.7%. Our results corroborate with similar previous findings reported by various research groups (2, 8, 22, 23). Undescended testis is one of the common predisposing factors of inguinal hernia in children as seen from above data. The surgical management carried out for undescended testis was orchidopexy in our study.

For hydrocele 2-4 years were the confined age group. Out of 24 cases, 12 (50%) scrotal swelling were right sided, 5 (20.8%) left sided and 7 (29.2%) bilateral. All the cases were managed by high ligation at the level of deep ring. This study is in accordance with study by Duckett J.W et al. 1952 who conducted 380 hernia operations and found 25 cases of hydrocele (22). Various studies reported the incidence of hydroceles like Javad Ghoroubi et al. 2008 reported in 27.6% of the cases, Duckett J.W. et al. 1952 in 13.4% of cases, Hugh B. Lynn 1961 in 17% of cases, Thomas E. Simpson et al. 1969 in 35.3% of cases and Willis J. Potts et al. 1959 in 9% of their studied population (22, 24-27).

In the present study, the percentage of umbilical hernia cases was 2.8 % out of 248 cases. Out of seven cases, two cases were associated with umbilical granuloma. Prematurity has been found to be associated with umbilical hernia in this study with five cases (71.4%). The Management of Umbilical Hernias in infancy and childhood by Aletta LL et al. 1975 (28) reported that premature infants have been observed to have a higher incidence of umbilical hernias and the reported incidence of umbilical hernia was as high as 26.6%. The incidence of umbilical hernia is not reported as high as the comparison data in our setup. The link between umbilical hernia and prematurity is significant, thus, shows prematurity being the common predisposing factor (8).

Also, there were 5 (2.01%) cases of omphalocele and 3 (1.2%) cases of gastroschisis found in our records. The median gestational age and weight of the neonates with omphalocele was found to be 33 weeks and 2000 gm whereas, in case of gastroschisis the median gestation age and weight was reported to be 35 weeks and 1700 gm. The median age of omphalocele and gastroschisis

mother were 27 and 29 years, respectively. Cesarean section delivery was done for all the cases in both the category. Two cases of omphalocele were primarily repaired but rest 3 cases were managed on follow up basis with mercurochrome along with crepe bandage and secondary closure was done for ventral hernia. Newborn with all gastroschisis cases were managed with silo and further closure of the defects were performed. The median length of stay was 15 days for omphalocele and 39 days for gastroschisis in neonatal intensive care unit. Cardiac anomalies were associated in 3 cases of omphalocele and 2 newborn of gastroschisis cases. One case of gastroschisis was also associated with ileal atresia. Mortality was documented in one infants of gastroschisis with ileal atresia. However, almost double mortality rate was observed in three infants (25%) in the study by Abdellatif M et al. 2017(29).

The most of the cases of abdominal wall defects were referred cases. One case of omphalocele and two cases of gastroschisis babies were born in our center (BPKIHS). Majority of the cases were diagnosed antenatally and the ultrasonography (USG) was the diagnostic method used. The remaining two patients (25%) were diagnosed after birth in primary health centre (PHC) where USG facility was unavailable. Alpha-fetoprotein levels in the maternal blood are known to be higher in both gastroschisis and omphalocele (30, 31), however our patients were unable to obtain this information.

In the current study, the median maternal age for the patients with gastroschisis was higher than that for omphalocele, the literature is not yet clear on why patients with gastroschisis in the present study had a greater median maternal age than those with omphalocele (30, 31). In our setting, caesarean deliveries were used for all pregnancies. Some published articles have reported on the method of delivery and the timing of pregnancies in cases with gastroschisis, which is still up for debate. For babies with gastroschisis, several institutions choose to deliver them preterm at 36 to 38 weeks. However, the research on this topic has produced confusing and conflicting results. Furthermore, the average gestational age and delivery time, according to several published papers, were 36 to 37 weeks. This is consistent with information from a small randomized trial that was a part of a recent systematic review of preterm delivery for children with gastroschisis, but the study did present a firm conclusion (32).

Other study has been reported that 30% of patients with gastroschisis are delivered prematurely (33). The primary challenges in managing gastroschisis are related to preventing late intrauterine mortality. In the current study, a patient with gastroschisis who was prenatally identified and delivered at our center had IUGR and a caesarean surgery at 37 weeks due to fetal distress. Additionally, the indications for preterm delivery in pregnant women who have fetal omphalocele have not been established, and the manner of delivery for these babies is determined by obstetric considerations because no controlled randomized studies have addressed this problem (34, 35).

However, one published research have shown that 17 of 21 (81%) children were born vaginally, while the remaining four were delivered by caesarean sections, which were totally performed on the basis of obstetric grounds rather for difficulties such as liver herniation (36). All of the neonates with omphalocele (100%) have been delivered by caesarean section in the present study. The reason for the caesarean section was unclear, and the method of delivery may only depend on obstetric considerations. Fetal discomfort led to the caesarean section deliveries of two children with omphalocele at 34 and 36 weeks at the PHC.

Fifty percent of patients in this study had IUGR. IUGR frequently co-occurs with gastroschisis. Although the exact cause of such newborns' IUGR is unknown, it may be linked to placental abnormalities and direct nutritional waste owing to the exposed viscera (37). According to the published research study, inutero injury to the exposed viscera might account for the lengthening of hospital stays in individuals with gastroschisis (38). In the present study, one newborn with gastroschisis had IUGR, and 50% of the babies with omphalocele had IUGR, although patients with omphalocele are known to have a lower incidence of IUGR.

Although IUGR is more frequent in infants with gastroschisis, chromosomal abnormalities have mostly been recorded in infants with omphalocele, where the occurrence is believed to be 30% and trisomy 13, 18, and 21 are the most typical abnormalities (39). According to published research, congenital heart disease and specific anterior abdominal-wall abnormalities, notably gastroschisis and omphalocele, are related congenital heart diseases (CHD). Omphalocele has been found to have a stronger relationship with CHD than gastroschisis, which has a weaker association (39-41). In this study, associated cardiac anomalies were detected in five babies with abdominal-wall defects. Two infants with gastroschisis had ventricular septal defects (VSD). Three infants (60%) with omphalocele had associated cardiac anomalies VSD. The cause of patients' having a greater risk of CHD who have abdominal-wall abnormalities is yet unknown. It has been proposed that these patients' embryological development contributes to the prevalence of these abnormalities (42).

The major challenges in managing gastroschisis are related to preventing late intrauterine mortality, while the main challenges in managing omphalocele are related to ruling out additional linked disorders and defects that were not detected antenatally. Recent advancements in prenatal diagnosis, neonatal anesthesia, and surgical methods have significantly improved the survival prognosis in these instances.

The best treatment method for both gastroschisis and omphalocele is primary surgical closure. According to reports, this strategy shortens hospital stays and the number of days patients require mechanical breathing, while also lowering infection and mortality rates. Depending on the degree of visceroperitoneal disproportion, a silo closure may be utilized when primary closure is not achievable in cases of gastroschisis (43, 44). Except for two patients with omphaloceles without concomitant congenital defects, all patients in this research had stepwise surgical closure repair to prevent abdominal compartment syndrome.

In newborns with omphalocele, the extent of the abdominal-wall defect at delivery and the existence of congenital abnormalities are important predictors of death (37). According to reports, patients with omphalocele have a mortality rate of 10% compared to those with gastroschisis, who have a rate of 4-7% (38). In the present study, one patient with gastroschisis associated with ileal atresia died of sepsis post-surgery. The severity of the gastrointestinal condition directly affects the mortality and morbidity in individuals with gastroschisis, and the majority of these deaths are caused by severe necrosis, short-bowel syndrome, and multiple atresia (38, 45). This might be explained by the fact that in patients with gastroschisis, characteristics like as the extent of the abdominal-wall defect and the length of amniotic fluid exposure have a negative long-term impact on gut motility and function (43). In our current study the average length of hospital stay were increased in both patients with gastroschisis compared with those in patients with omphalocele.

Conclusion

We have observed that most of the cases in this setting are of inguinal hernia. The probable reason could be that the swelling is mostly noticed by parents which bring them to the hospital at the earliest. Maximum patients were of 3 to 4 years of age, in which unilateral hernia was common. There was significant association between undescended testis and inguinal hernia. However, the cases of only umbilical hernia in total hernia cases was found to be low which confined within one day of life to one year of age and most of them were associated to prematurity. For Inguinal hernia, choice of surgery was herniotomy. If not done at the right time, it might lead to permanent loss of ovaries, testis or a portion of bowel, strangulation and incarceration. For patients with umbilical hernia, conservative management was done which suggested that defect was less than 1.5 cm.

Few cases of gastrochisis and omphalocele were found in the records which suggest that their uncommonness in our setting. Unawareness, lack of early detection technique, and delay in reaching the tertiary care center from rural areas can also be the reason. The recommendations after analysing the data is that proper follow up record of cases should be maintained to keep a check on recurrence of inguinal hernia and post-surgery complications. Further, a follow up record should be made for umbilical hernia to keep a check on the size of defect as if not resolved at its own might require a surgery. Birth details of patients should be recorded in detail so that good number of risk factors can be correlated with the defect. Early detection of gastrochisis and omphalocele can be done at antenatal period; this information should be kept in mind for the management from beforehand if pregnancy is continued.

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Table and Figures

Tables

Table 1: The table shows the age distribution, frequency and percentage in inguinal hernia in (n=209) cases.

Age in years	Frequency	Percentage
0-1	16	7.7
1-2	26	12.4
2-3	24	11.5
3-4	27	12.9
4-5	26	12.4
5-6	19	9.1
6-7	21	10.0
7-8	16	7.7
8-9	7	3.3
9-10	4	1.9
10-11	2	1.0
11-12	8	3.8
12-13	4	1.9
13-14	9	4.3
Total	209	100.0

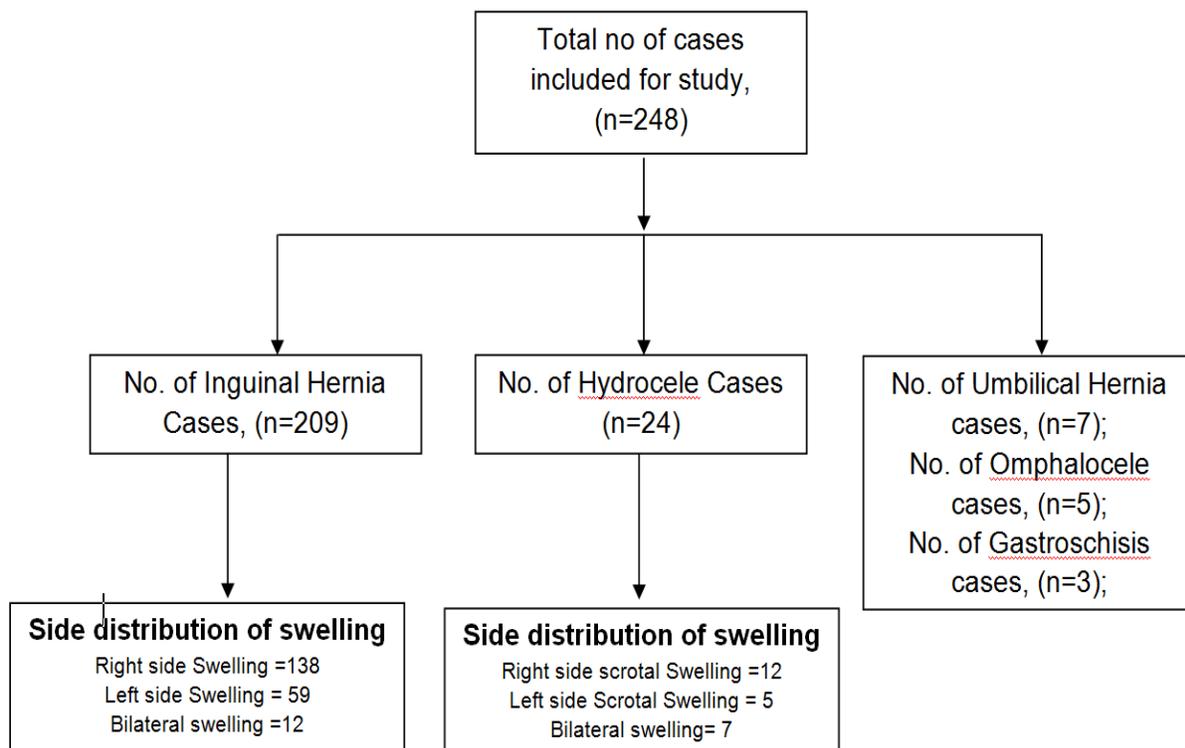
Table 2: The Table presents details of omphalocele cases of newborn along with mother’s age

	Age (weeks)	Weight (gram)	Associated anomalies	Duration of stay (Days)	Mother’s age (Years)	Surgical approach
Newborn	36	1950	VSD	9	27	Staged closure
	33	2100	-	15	26	Primary closure of

						the defect
	31	2000	-	21	28	Primary closure of the defect
	35	2300	VSD	19	27	Staged Closure
	31	1900	VSD	12	31	Staged Closure

Table 2: The Table shows all details about gastroschisis cases of newborn along with mother’s age

Newborn	Age (weeks)	Weight (gram)	Associated Anomalies	Duration of stay (Days)	Mother’s age (Years)	Surgical approach
	36	1900	VSD	39	28	Silo and staged closure
	35	1700	VSD	45	32	Silo and staged closure
	37	2100	Ileal atresia	27	29	Primary closure with resection and anastomosis of the ileum



Figures

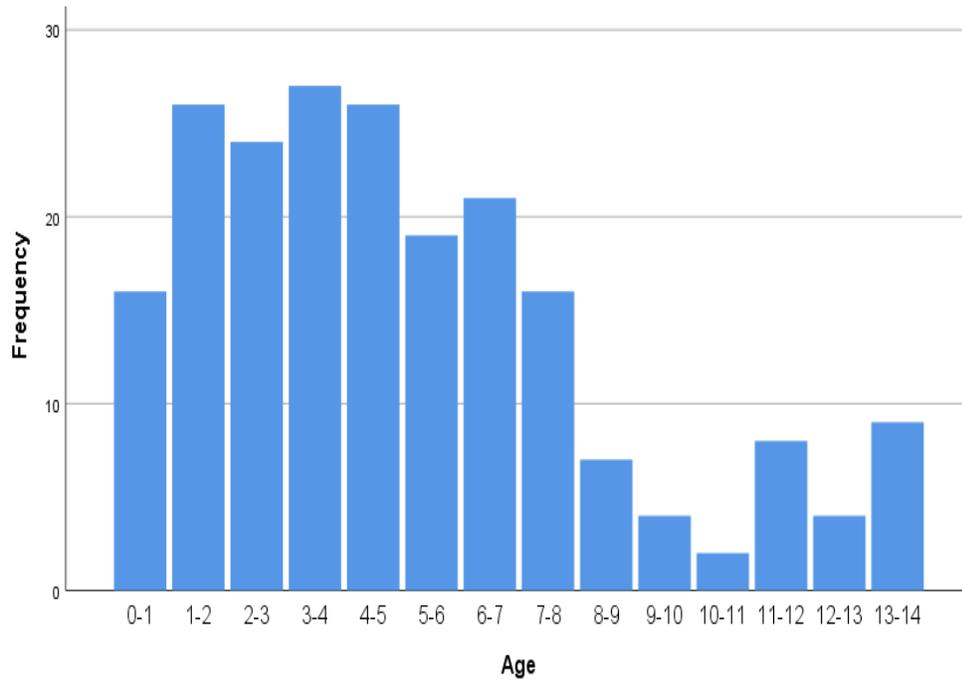


Figure 2: The bar diagram showing the age distribution and frequency of inguinal hernia in pediatric age group in n=209 cases.

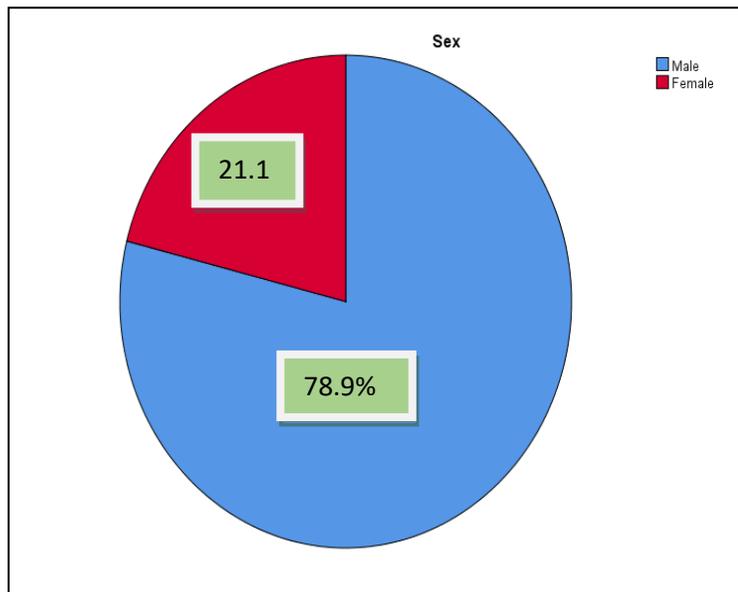


Figure 3: The Pie chart showing gender distribution in percent in inguinal hernia (n=209).

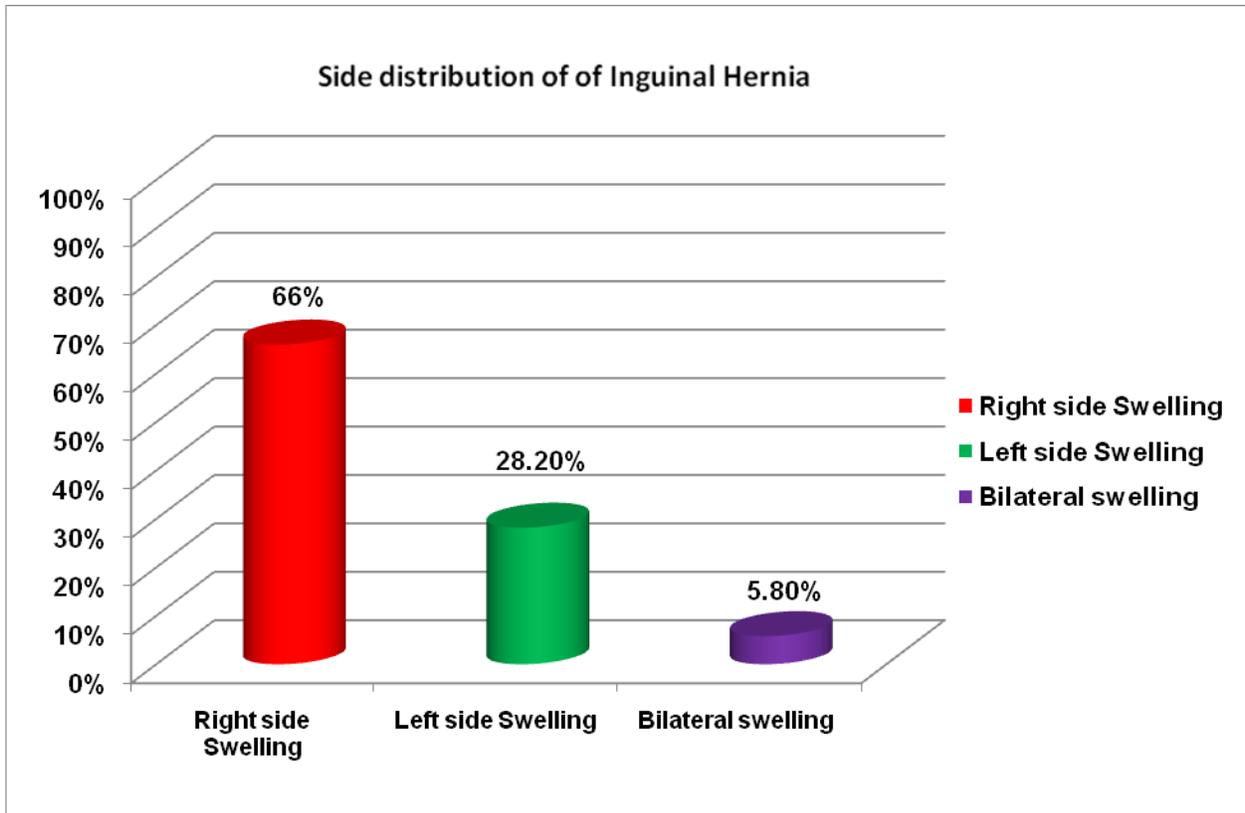


Figure 4: Bar Graph showing side distribution of swelling in percentage in all the inguinal hernia cases.

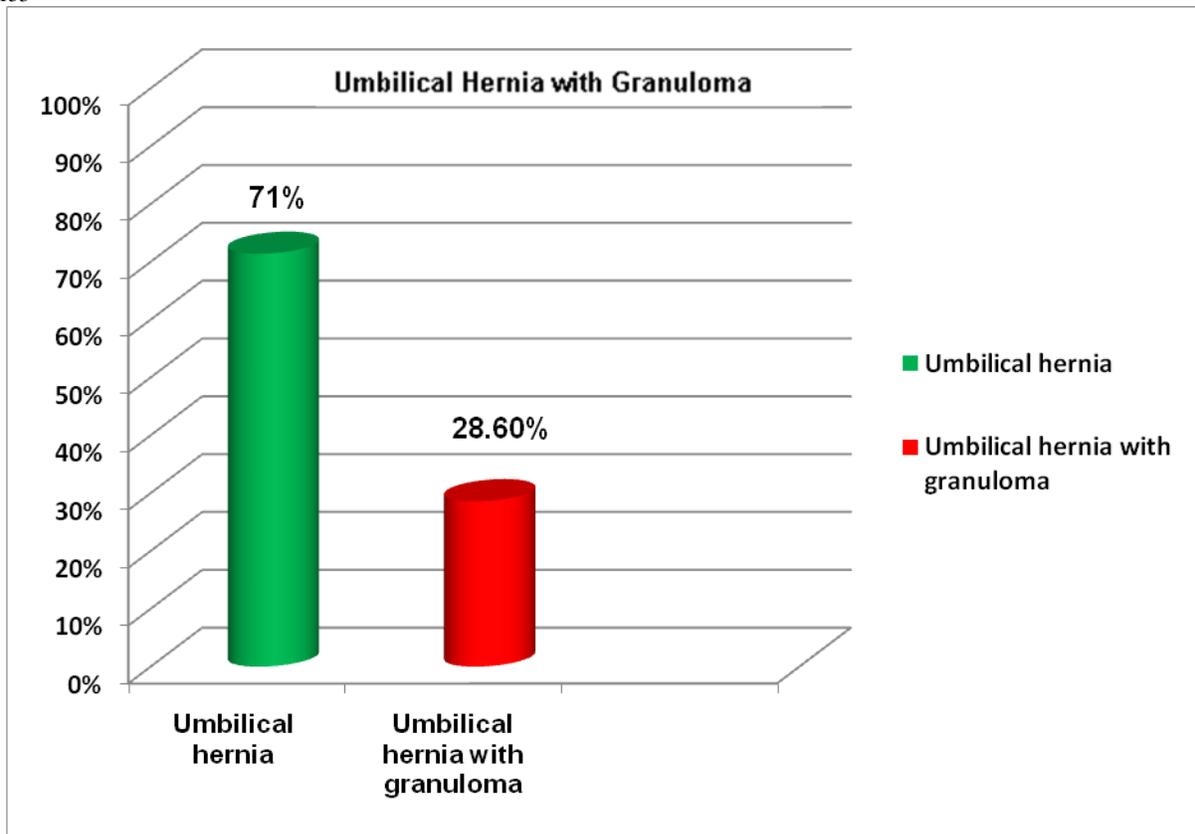


Figure 5: The bar graph showing percentage of umbilical hernia with granuloma.