



LAPAROSCOPIC MANAGEMENT OF PAEDIATRIC INTRA ABDOMINAL CYSTIC LESIONS

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ABSTRACT

Background: Historically, laparoscopy in neonates & children which was initially limited to only simple procedures has now grown manifold & has also given good results. The etiopathogenesis, histology and clinical presentation of benign intra-abdominal cystic masses in paediatric age group differs significantly. Improvements in laparoscopic methods, instruments as well as increasing safety in paediatric anaesthesia have allowed for wide spread application of laparoscopy even in neonates.

Material & methods: This is a retrospective study of all paediatric patients who presented with intra-abdominal cystic lesions that were managed laparoscopically at a single tertiary care institute. 101 patients presenting to the paediatric surgical department were included in the study over a duration of 13 years (June 2005 to September 2018).

Results: The spectrum of cystic lesions that were managed laparoscopically included ovarian cysts, splenic cysts, liver cysts, choledochal cysts, enteric duplication cysts, omental cysts, mesenteric cysts, lymphangiomas, pre sacral cystic teratomas, omental cysts, hydatid cysts and pseudocysts secondary to pancreatitis & VP shunts. After appropriate investigations the patients were managed laparoscopically. 7 patients were converted to open, there were 3 recurrences and 22 patients required laparoscopy assisted excision. Complications were encountered in 10 children.

The index study includes 16 neonates with intra abdominal cysts of which single port access was used for management of the cyst in 6 neonates.

Conclusion: The majority of abdominal cystic lesions have been managed successfully laparoscopically, thus providing excellent cosmetic outcomes even in neonates.

KEYWORDS :**INTRODUCTION**

History has witnessed that laparoscopy in neonates & children was initially limited to only simple diagnostic & therapeutic procedures. However, in the decades to follow, laparoscopic approach in paediatric age group has grown manifold & has also given good results. Laparoscopy has the unique advantage of allowing visual inspection of the whole abdomen through a tiny incision & also to be able to select the best possible incision in case conversion to open is mandated.

The etiopathogenesis, histology and clinical presentation of benign intra-abdominal cystic masses in paediatric age group differ significantly. Antenatally, they may arise virtually from any abdominal viscera; however, the urogenital and gastrointestinal systems are the ones most commonly involved. Antenatal detection of cystic masses allows them to be followed up in the postnatal period for appropriate management.

Improvements in laparoscopic methods, instruments as well as increasing safety in paediatric anaesthesia have allowed for wide spread application of laparoscopy even in neonates.

MATERIALS & METHODS

All paediatric patients who presented to us with intra-abdominal cystic lesions were included in the study over a duration of 13 years (June 2005 to September 2018). This included two sets of patients- antenatal & postnatal. The antenatally diagnosed cysts were usually asymptomatic & continued follow up in the post natal period. The post natal symptomatic set presented to us either with incidentally diagnosed cyst or with an acute abdomen. The patients were evaluated on individual basis and underwent appropriate blood investigations, ultrasonography, CT scan or MRI. They then underwent laparoscopic

surgery as the pathology demanded. Patients presenting with poor general condition (contra indicating general anaesthesia) and complications like volvulus secondary to cyst of bowel or mesentery and choledochal cyst with perforation were excluded from the study.

Surgical approach:

All patients were catheterised on table after induction of general anaesthesia. The camera port was commonly placed in the sub umbilical position using Hasson's technique. Supra umbilical or epigastric port were used in small babies with paucity of intra-abdominal space or large intra-abdominal lesions precluding intra-abdominal space. Initially a diagnostic laparoscopy was done after which the number of ports or single incision access as well as size of instruments were decided as per the pathology and surgeon preference. Large intra-abdominal cysts which compromised the intra-abdominal working space were decompressed after placing the camera port to facilitate manipulation & placement of working instruments. Ovarian cysts if associated with torsion were first detorted, followed by definitive management in the form of partial or total excision, deroofting, oophorectomy or oophoropexy. The splenic cysts underwent either excision, marsupialisation or hemi splenectomy. Choledochal cysts underwent excision with hepatico-duodenostomy. Presacral teratomas (Altman type III & IV) mandated total excision with coccygectomy. Enteric duplication cysts, omental cysts, mesenteric cysts were excised or marsupialised. Enteric duplication cysts frequently mandated resection of the adjacent bowel sharing the common wall. Pseudocysts developing secondary to VP shunts were managed by deroofting with repositioning of the shunt tip in sub hepatic space. The pancreatic pseudocyst required a cysto-gastrostomy. Hydatid cysts were treated by excision (partial or total), capitonage or marsupialisation.

After completion of the surgical procedure, all(except 3mm) ports were closed with absorbable sutures followed by skin approximation with skin glue.

RESULTS

In the study duration, we have managed 101 children with 105 intra-abdominal cystic lesions using minimal access surgical techniques. With the availability of dedicated paediatric operation theatre & paediatric anaesthesia team, minimal access procedures have been performed on emergency & planned basis.

Out of the 101 patients operated laparoscopically, there were 21 males & 80 females. Age ranged from D7 of life to 12 years.

The various pathologies dealt with laparoscopically include ovarian cysts, splenic cysts, liver cysts, choledochal cysts, enteric duplication cysts, omental cysts, mesenteric cysts, lymphangiomas, pre sacral cystic teratomas, omental cysts, pseudocysts secondary to pancreatitis of VP shunts & hydatid cysts. The duration of surgery varied from minimum of 45minutes(for an infant with ovarian cyst) to a maximum of 480minutes for a case of choledochal cyst with accessory bile duct, averaging 285minutes.

We used 3 ports on an average, the range varying from single port to 5 ports. The maximum number of ports(5) were used for excision of choledochal cyst with hepatic duodenostomy during our early experience. 15 patients were operated using single port, 22 required placement of one additional port, 49 patients required 3 ports, 4 & 5 ports were used in 18 and 1 patients respectively.

Conversion to open surgery was required in 7 patients: 5 lymphatic malformations & 2 ovarian cysts. The recurrent lymphatic malformation was converted to open during the second surgery also. The main reasons for conversion included dense adhesions, technical difficulties or intra operative complications.

Till date we have had 3 recurrences; one each of hydatid cyst, splenic cyst & lymphatic malformation. The hydatid cyst was reoperated laparoscopically, the recurrent splenic cyst required laparoscopic upper polar hemisplenectomy & the recurrent lymphatic malformation was excised via formal laparotomy following an attempt of laparoscopic excision.

22 cysts required laparoscopy assisted approach(Figure 1).

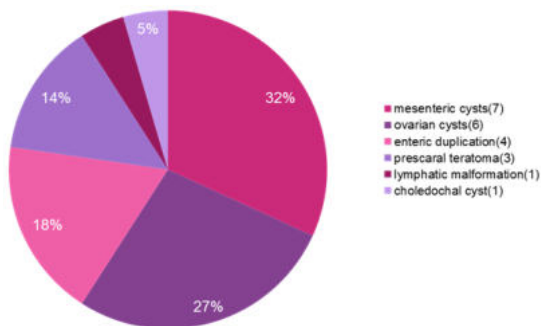


Figure 1- laparoscopy assisted approach

The incision taken helped to deal with the pathology appropriately, as also to ease the further surgery as well as providing the best possible cosmetic outcome. Extension of either the umbilical(8) or working port(4) was done in 12 cases, pfannelstein incision- 5 cases, posterior sagittal incision - 3 cases, right iliac fossa & right hypochondriac incisions were utilised in 2 & 1cases respectively. One of the cases of pre sacral cystic teratomas required both posterior sagittal & pfannenstiel incisions to achieve complete excision.

The complications have been encountered in 11 babies. 4 choledochal cysts had post operative biliary leak which settled spontaneously, 3 patients had neurogenic bladder (2 of which improved with time and one is on intermittent catheterisation), there were 3 recurrences one each of hydatid cyst, splenic cyst and lymphangioma and one patient had intra abdominal bleeding and was converted to open.

Ovarian cyst:

Of the 42 cases of ovarian cysts operated laparoscopically, 19, 17 & 6 patients had right, left and bilateral cysts. There was associated

adnexal torsion in 12 cases. 7 patients with either free lying cyst (because of torsion) or presence of complex cystic mass required oophorectomy, the rest were managed conservatively with detorsion, partial or total excision of the cyst & oophorectomy(8 patients). 3 patients also underwent appendectomy simultaneously, either because of concurrent appendicitis or associated dense adhesions to the adnexa.

Choledochal cysts:

With increasing experience & acquisition of 3D system, we have started operating choledochal cysts laparoscopically in the recent past. In the first case, the cyst was mobilised laparoscopically & biliary-enteric anastomosis was completed extracorporeally through a small right hypochondriac incision. The remaining have undergone laparoscopic excision with hepatico-duodenostomy. 14 patients from 18months to 12 years have been managed laparoscopically using minimum of three to maximum of five ports. The minimum duration of surgery was 3 hours to maximum 8 hours. 4 patients had post operative bile leak, 3 were managed conservatively & one required exploration.

Mesenteric cysts:

11 cases of mesenteric cysts from day 15 of life to 8 years have been managed laparoscopically. Of these, in 3 patients the procedure was completed laparoscopically and the rest required extension of either the umbilical(4) or working(4) ports. Laparoscopy assisted procedure was undertaken to either ensure complete removal of the cyst or to facilitate resection anastomosis. Surgery lasted from 120-180minutes. For 3 patients, single umbilical camera port was placed & the cyst was decompressed under vision. The umbilical port was then extended in 2 cases & right iliac fossa incision was taken in 1 patient to deal with the cyst extra corporeally. The 3 cases completed laparoscopically needed placement of 3 ports each. Of the remaining 5 cases of laparoscopy assisted mesenteric cyst excision 2 and 3 ports were placed in 4 and 1 patients respectively.

Hydatid cyst:

Our experience with intra-abdominal hydatid cysts spans 12cysts in 10patients, which included 9 cases of liver hydatid & 1 case of liver with splenic hydatid cyst and 1 case of liver with renal hydatid cyst. The hepatic & renal hydatid cysts were operated with 3 ports, whereas the associated splenic cyst required the placement of an additional port. Minimal duration of surgery was 90min to a maximum of 240minutes. None of the patients required conversion to open surgery, however there was one recurrence which was also reoperated laparoscopically and marsupialisation with omentopexy was done.

Lymphatic cysts:

7 patients with intra-abdominal lymphatic malformations were managed laparoscopically. Duration of surgery was 150minutes to maximum of 240minutes. There was 1 recurrence and 5 had to be converted to open including the one that recurred to ensure complete excision(4) or in view of intra operative complications like bleeding(1). One patient underwent laparoscopy assisted excision of the cyst using 3 ports followed by extension of the right iliac fossa port. 2 patients who underwent complete excision laparoscopically required placement of 3 ports each. For the converted cases, 2 and 3 ports were placed in 4 and 1 patient respectively.

Enteric duplication cysts:

4 patients from day 8 of life to 3years of age with enteric duplication cysts have been managed with laparoscopy assisted procedures. Duration of surgery ranged from 2-3 hours. After placement of the camera port, the cyst was decompressed and delivered extra corporeally for excision and resection anastomosis. Single port was used in 1 patient followed by extension of the umbilical port; 2 & 3 ports were used two & one patients respectively.

Omental cysts:

3 patients with omental cysts has been operated laparoscopically using either single port access, two or three ports. Duration of surgery was 90minutes in each case. There have been no recurrences or conversions.

Splenic cysts:

3 patients with splenic cysts, 11- 12 years of age underwent laparoscopic partial excision with deroofering or marsupialisation. Of these, there was one recurrence, who underwent laparoscopic upper polar splenectomy. The recurrent case required placement of 4 ports. The other cysts were managed using 2 or 3 ports in one and two patients

respectively. Duration of surgery ranged from 70minutes to maximum of 240minutes for the upper polar splenectomy. No conversion to open surgery was required

Cystic teratomas:

3 patients underwent laparoscopy assisted excision of presacral cystic teratomas. The youngest was day 10/f and the eldest was a 4month female. 3 ports were used in all patients. Duration of surgery ranged from 180-240minutes. One patient had pre existing neurogenic bladder which continued post operatively and another one developed neurogenic bladder post operatively for which they were started on clean intermittent self catheterisation. Two patients required PSARP approach for complete excision of the tumour, One required PSARP & pfannenstiell incisions for complete removal.

Pseudocysts:

2 patients with VP shunt related pseudocysts underwent laparoscopic marsupialisation or deroofting with reposition of the VP shunt tip & pancreatic pseudocyst underwent cystogastrostomy. Both the shunt related pseudocyst were managed using 2 ports, the cystogastrostomy required 4 ports. The minimum duration was 90minutes for marsupialisation to maximum of 390 min for the cystogastrostomy. There have been no recurrences or conversions.

Liver cysts:

A day16/female neonate with liver cyst was excised laparoscopically using 2 ports. The cyst was decompressed & excised via the 3mm working port. The surgery lasted 90minutes & there has been no recurrence.

Table 1: Intra-abdominal cystic lesions – Our Data

Pathology	No of cysts	Ports					Duration (minutes)		Conversion	Recurrence
		1	2	3	4	5	Min	Max		
Ovarian cyst	42	9	8	25	-	-	45	150	2	-
Choledochal cyst	14	-	-	3	10	1	180	360	-	-
Mesenteric cyst	11	3	4	4	-	-	120	180	-	-
Hydatid cyst	12	-	1	8	3	-	90	240	-	1
Lymphatic cyst	8	1	3	4	-	-	150	240	5	1
Enteric duplication cyst	4	1	2	1	-	-	120	180	-	-
Omental cyst	3	1	1	1	-	-	90	120	-	-
Splenic cyst	4	-	1	2	1	-	70	240	-	1
Cystic teratoma	3	-	-	3	-	-	180	240	-	-
VP shunt pseudocyst	2	-	2	-	-	-	90	120	-	-
Pancreatic pseudocyst	1	-	-	-	1	-	390		-	-
Liver cyst	1	-	-	1	-	-	120		-	-

DISCUSSION

First peritoneoscopy(laparoscopy) in children was published in 1971 by Stephen Glans(1)

The concerns related to laparoscopy in children have been manifold; those related to anatomy, physiology, anaesthesia, effects of creation of capnoperitoneum and the availability of miniature instruments ; to name a few. Initially, laparoscopic procedures in children throughout the world are restricted to few centres, whereas for the majority of paediatric surgical departments, minimal access procedures are performed only for diagnostic procedures or simple procedures like appendectomy. With improved understanding of the various physiological changes during laparoscopic procedures and availability of appropriate sized equipment, the number of procedures performed with this technique progressed rapidly. Currently, minimally invasive approach is preferred for majority of procedures even in children with the obvious advantage of shorter hospital stay, reduced postoperative pain, and earlier postoperative return to daily activities.

'No investigation' including CT scan/MRI can give the origin of intra abdominal lesions especially large & antenatally diagnosed cysts with 100% accuracy. Laparoscopy as a means of management of intra-abdominal cystic lesions in paediatric patients is an excellent approach as it gives panoramic view of the entire abdomen, the origin of the pathological lesion, as also allows it being aspirated under vision so as to facilitate further manipulation or excision.

Ovarian cysts: Primary cysts and tumours of the ovaries are uncommon in children. The side of the ovarian cyst can be accurately confirmed on diagnostic laparoscopy.

Various studies as summarised below deals with the laparoscopic management of ovarian cysts. The index study forms the largest cohort studied in paediatric patients with the majority of patients managed with ovarian preservation procedures.

As compared to the other studies(Table2) by Hong bae kim et al(2) & C.Esposiato et al (3) who used 3 ports in all their patients; in the index study 21% of ovarian cysts(N=9) have been operated using single incision and 19% patients (N=8) needed placement of an additional port . The rest were operated using the conventional 3 ports(N=25). The index study also puts forth the maximum rate of ovarian preservation procedures(83.3%) as compared to rates of 48%, 57% and 63.6% respectively for the others. The index study has a 5% conversion rate to open which is between that of the study by C.Esposiato et al(Nil) and Panteli Christina et al(19%) (4).

Table 2: Ovarian Cysts

	Index study	Hong bae kim et al (2015)	Panteli Christina et al (2009)	C. Esposiato et al (1998)
Sample Size	42	25	21	22
Duration of study (years)	13	6	10	12
Age of patients	Day 7-12 years	<15 years	Day 6-16 years	Day 7-5 months
Ports	1, 2 or 3	3	-	3
Pressure (mm hg)	6 – 10	<10	-	6 – 8
Procedure	Conservative	35	12	14
	Oophorectomy	7	13	2
Average time (minutes)	45 – 150	61.6 (+/- 24)	-	40
Post-operative stay	-	3.5 (+/-1.9) days	1.8 days	<3 days
Complications	-	-	-	Nil
Conversion	2	-	4	Nil

Choledochal cysts:

Laparoscopic approach to choledochal cyst was first described by Farello et al(5) in a 6year old child.

Our experience with laparoscopic excision of choledochal cysts spans last 6 years, during which 14 cases have been managed. This was facilitated by the excellent image definition, magnification, depth and volume perception offered by the 3D laparoscopy vision leading to improvements in eye focusing, real-time anatomical delineation, hand eye co-ordination, spatial orientation & precision.

The first case required placement of 5 ports, but with increasing experience only 3 ports are sufficient. 13 of the choledochal cysts were excised laparoscopically and hepatico-duodenostomy done; in one patient, the cyst was excised laparoscopically but the hepatico-jejunal anastomosis was done extra corporeally. Kim Hung Lee et al(6) & D.M.Lee et al(7) have described a conversion rate of 8.1% and 12.5% in their respective studies. The duration of surgery ranges from 180-480minutes which is greater than the other studies. 4 operated patients had bile leak leading to complication rate of 28.57% as compared to 10.9% and 40.5% in studies by P.Senthilnathan(8) et al and Kim Hung Lee et al respectively(table3).

The debate over bilio-enteric reconstruction using duodenum versus jejunum continues. The index study has used duodenum for re-establishing bilio-enteric continuity in all but one case.

Table 3: Choledochal Cysts

	Index study	P. Senthilnathan et al (2015)	Kim Hung Lee et al (2009)	D. M. Lee et al (2006)	H. L. Tan et al (2003)
Sample size	14	55	37	8	2
Duration of study (years)	6	15	8	-	-
Conversion	-	-	3	1	-
Complications	4	6	15	-	-

Operative time (minutes)	180 – 480	155 – 245	-	155	-
Procedure	Excision with hepatico-duodenostomy	Excision with biliary-enteric anastomosis	Excision with biliary-enteric anastomosis	Excision with hepatico-jejunosotomy	Excision with hepatico-duodenostomy
Ports	3, 4 or 5	-	-	5	4

Mesenteric cysts, omental cysts, enteric duplication cysts & lymphatic cysts:

Mesenteric cysts & omental cysts are rare, incidence 1/20000 admissions to paediatric hospitals. The goal of surgery is complete excision of the mass. Omental cysts can be usually excised without bowel resection. Enucleation can be attempted for mesenteric cysts, however frequently require bowel resection in children to ensure blood supply to the bowel is not compromised.

The laparoscopic approach to excision of mesenteric cysts was first described by Mackenzie(9) in 1993. Comparing the index study with larger series of mesenteric & omental cysts described by Tran Ngoc Son et al(10), 4 cysts have been successfully treated laparoscopically using only single port. 5 cysts each needed placement of 2 & 3 ports; whereas the reference study used minimum of 4 ports. 83% cysts were managed laparoscopically and the remaining via laparoscopy assisted approach as compared to 50% each in the index study(Table4). There were no conversions, recurrences or complications in the index study as compared to 3 conversions and 1 recurrence in the reference study.

Karkera et al(11) & Lagausie et al(12) described a cohort of 6 & 15 lymphatic cysts respectively(Table5), of which 2 & 9 were managed laparoscopically. 4 and 6 patients were primarily treated by open surgery. 7 of the 8 lymphatic cysts of the index study have been approached laparoscopically of which 5 were converted to open; and there was one recurrence. Lagausie et al stated 2 post operative adhesive intestinal obstruction as complications; none have been described in the index study.

Larger cohorts of laparoscopic management of enteric duplication cysts(Table6) by M.Lima et al(13) (N=22) & Pablo laje et al(N=18)(14) have described laparoscopic approach in 45% and 22% patients. All 4 enteric duplication cysts mentioned in the index study have been managed by laparoscopic assisted method; however none had to be converted to open as compared to conversion of 80% and 25% in the other mentioned studies.

Table 4: Mesenteric and Omental cysts

	Mesenteric cyst (index study)	Omental cyst (index study)	Mesenteric + Omental (index study)	Tran ngoc son et al	Arzu pampal et al
Year	2019	2019	2019	2012	2012
Sample Size	11	3	14	47	3
Age	15d-8y	1m-5y	15d-8y	-	13m-3y
Lap (% of Sample size)	4 (36%)	3 (100%)	7 (50%)	39 (83%)	-
Lap assisted (% of Sample size)	7 (64%)	-	7 (50%)	8 (17%)	3 (100%)
Open	-	-	-	-	-
Ports	1-3	1-3	1-3	4-6	3
Duration (minutes)	120-180	90-120	90-180	40-120	30-45
Conversion	-	-	-	3	-
Recurrence	-	-	-	1	-
Complication	-	-	-	-	-

Table 5: Lymphatic cyst

	Index study	P J Karkera et al	P d Lagausie et al
Year	2019	2012	2006
Sample Size	8	6	15
Age	3m-7y	-	-
Lap (% of Sample size)	7 (88%)	2 (33%)	9 (60%)

Lap assisted (% of Sample size)	1 (12%)	-	-
Open (% of Sample size)	-	4 (67%)	6 (40%)
Ports	1-3	-	-
Duration (minutes)	150-240	-	-
Conversion	5	1	-
Recurrence	1	-	-
Complication	-	-	2 (Intestinal obstruction)

Table 6: Enteric duplication

	Index	M. Lima et al	Pablo Laje et al	J Scharamon et al
Year	2019	2012	2010	2000
Sample Size	4	22	18	13
Age	8d-3y	-	-	-
Lap	0	10	4	-
Lap assisted	4	2	-	3
Open	-	10	14	10
Ports	1-3	-	-	-
Duration (minutes)	120-180	-	-	-
Conversion	-	8	1	-
Recurrence	-	-	-	-
Complication	-	-	-	-

Hydatid cysts:

The larva of the dog tapeworm Echinococcus granulosus leads to formation of hydatid cysts; liver being involved in 80% of cases. Surgical options include total excision of the cyst(cystectomy)or cystostomy with drainage, capitonnage or omentoplasty.

A large series of laparoscopic management of paediatric hydatid cysts(34 cases) by Kais Maazoun (15) concluded that laparoscopy represents an excellent approach for the treatment of hydatid cyst of the liver in children. Their duration of surgery varied from 30-210minutes, and have reported no recurrence or complications in their series. In another series, S.V.Minaev et al(16) managed 21 cases of hepatic hydatid cysts laparoscopically of the total 81 described by them using 3-4 ports. They reported local complications like residual cavity infection, biliary fistula 14.3% in the laparoscopy group and no recurrences.

In the index study, 12 abdominal hydatid cysts were managed laparoscopically using 3-4 ports with duration of surgery ranging from 90-240minutes. There were no complications but one recurrence which was managed laparoscopically by marsupialisation & omentopexy.

Splenic cyst:

Splenic cysts are primary or secondary pseudocysts due to trauma. Enlarging & symptomatic cysts require definitive management. Sclerotherapy & marsupialisation are associated with recurrences which may require partial splenectomy. Isolated reports of laparoscopic management of splenic cysts have been described by D.V.Vander zee et al(17)& Hualei Cui(18) et al in which the cyst was decapsulated or deroofed respectively. Large literature review by C.K.Sinha et al (N=166)(19) highlights laparoscopic management in 40% cysts comprising of total splenectomy(2%), partial splenectomy(4%) and cystectomy/decapsulation/deroofing in the remaining(34%). Of the last group, recurrence of 41% was noted. 3splenic cysts have been treated laparoscopically (deroofing/partial excision/marsupialisation) in the index study with recurrence in 1 which was managed by laparoscopic upper polar hemi splenectomy.

Cystic teratoma:

Sacrococcygeal teratomas are the most common extragonadal tumor in neonates accounting for 70% of teratomas in childhood. Laparoscopic excision can be considered for patients presenting with larger intra-abdominal component, the III & IV, which may still need to be combined with posterior sagittal approach to ensure complete removal. Laparoscopic management of cystic teratomas as described by Hector Osei et al(20), Solari et al(21), Lee et al(22) focuses on the laparoscopic ligation of the Median sacral artery. The largest series(N=5) but forth by Bax et al(23) in 2003 focusses on the laparoscopic interruption of the median sacral artery as well as laparoscopic dissection of the pre sacral component. The advantages sited include reduced incidence of blood loss due to prior ligation of

the median sacral artery as well as reduced damage to the nerves of the anorectic & urogenital system due to better access to the pre sacral area than conventional open approach, thus improving functional outcomes.

Hepatic cyst:

Simple hepatic cysts are rare in the pediatric population. They are congenital in origin, non-lobulated and more commonly single, arising from aberrant bile ducts obstructed from the main biliary system. Lin et al(24) in 1968 first introduced the technique of deroofting the cyst and internal drainage into the free peritoneal cavity, which has since become the standard treatment for symptomatic SHC and is now performed using minimally invasive approaches.

We have managed a neonate with hepatic cyst laparoscopically using 2 ports(5mm optical & 3mm working), cyst was decompressed & removed via umbilical portion 90minutes. There were no intra operative complications & no recurrence. In a retrospective review Linden Allison et al(25), described laparoscopic management of 4 children from day5 to 14years of age with simple hepatic cysts with no complications & no recurrence at one year follow up.

Pseudocysts:

Pancreatic pseudocysts are usually secondary to acute pancreatitis and blunt abdominal trauma in pediatric age group. The diverse treatment options for PPS include both medical and surgical interventions. The most commonly used internal drainage technique is cystogastrostomy, in which the pseudocyst is drained directly into the posterior wall of the stomach.

In a large series by Suzanne Yoder et al(26) retrospectively reviewed 13 cases with mean age of 10.4 years. Cystogastrostomy was done using staplers/sutures/harmonic with mean surgical time of 113minutes; none requiring conversion to open; and 92% relief of symptoms of follow up. Daniel F Saad et al described 2 cases of trans gastric cystogastrostomy for traumatic & idiopathic pancreatic pseudocyst and put forth that laparoscopic drainage provides advantage of definitive drainage and minimal invasive technique. Guido seitz et al(27) described his experience with one case of cystojejunostomy with extra corporeally performed Roux en Y anastomosis using three 5mm ports with no complications. C.Esposito et al(28) performed 10 laparoscopies for VP shunt related complications and found 4 patients having intra abdominal CSF pseudocyst formation which were managed laparoscopically. In the index study the laparoscopic cystogastrostomy required 4 ports and surgical time of 390minutes, whereas the VP shunt related pseudocysts were managed laparoscopically using 2ports with average duration of 90minutes. There have been no recurrences or conversions to open.

As compared to a similar articles (Table7)published by R.Raghupathy et al(29) & M.Narendrababu et al(30) which highlights their experience of 16 cases over a duration of 2 1/2 years and 106 cases over 5 years respectively, the index case series puts forth our experience with 105 intra-abdominal cystic lesions over 13 years.

All the three studies have a wide spectrum of distribution of paediatric cystic lesions managed laparoscopically. The index study has the longest duration of study with a lowest conversion rate of 5.7% as compared to that of the series by R.Raghupathy & M.Narendrababu being 12.5% and 13.2% respectively. The study also represents the largest cohort of laparoscopic management of ovarian cysts as compared to the other two studies. The choledochal cyst with the accessory duct took the longest duration; however the management of omental cyst took the shortest time amongst the three studies. The complication rate is 10.5%. The index study used single port for management of the cyst in 15 patients which also included 6 neonates as compared to at least 3 ports used for all patients in the above mentioned studies. The index study also puts forth the largest cohort of neonates operated laparoscopically(21 neonates-20%) as compared to 7.5%neonates in the study by Narendrababu et al. In the index study, 16neonates had ovarian cysts, 3 had enteric duplication cysts and one each had cystic teratoma & liver cyst. The neonates had a complication, conversion to open & laparoscopy assisted rate of 4.7% each as compared to overall rates of 10.5%, 6.7% & 21% respectively.

Table 7: Comparative study

	R. Raghupathy et al	M. Narendrababu et al	Index study
Duration (years)	2.6	5	13

Sample Size	16	106	105
Ovarian	4	9	42
Mesenteric	1	9	11
Urachal	4	2	-
Pseudo cyst pancreas	1	9	1
Hematometocolpos	3	-	-
Splenic	1	7	4
Duplication	1	5	4
MCDK	1	8	-
Hydatid	-	10	12
Cystic teratoma	-	-	3
Choledochal cyst	-	31	14
Utrical cyst	-	2	-
Liver cyst	-	4	1
Lymphatic cyst	-	5	8
Omental cyst	-	5	3
VP shunt pseudocyst	-	-	2
Recurrence	1	-	3
Conversion to open	2	14	6
Duration of surgery (minutes)	60-90	57-170	45-480

CONCLUSION:

Laparoscopic surgery has both diagnostic and therapeutic advantages in the management of intra-abdominal cysts in children. In case an open procedure is mandated, the incision can be planned according to the pathology; it can be smaller & more cosmetically placed like a pfannenstiel or an umbilical incision can be taken. However, complex cystic lesions in small children pose technical challenges requiring advanced laparoscopic skills.

To conclude, laparoscopic management of intra-abdominal cysts is a feasible & safe approach with excellent cosmetic outcomes; even in neonates.

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