

Original Research Article

Prospective study of laparoscopic surgery in paediatric patients

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ABSTRACT

Background: Laparoscopic cholecystectomy and laparoscopic appendectomy is gold standard treatment modality for symptomatic cholelithiasis and appendicitis. Laparoscopy in paediatric patient have many limitations and factors restricting its use in paediatric patient are smaller surface area for access, compliant abdominal wall, the liver margin below the rib cage, the bladder being an intra-abdominal structure, the viscera close to anterior abdominal wall and small sized abdominal cavity and conventional instruments too long for paediatrics use. The so-called obliterated structures like umbilical vein, umbilical artery and urachus remain relatively large and partially patent in infants further restricting use of therapeutic laparoscopy.

Methods: The present study was carried out in Department of General Surgery, MDM Hospital, Dr. S. N. Medical College, Jodhpur, Rajasthan. Total 50 patients were included in the present study of laparoscopic surgery in paediatric patients below 14 years of age and were studied in terms of, duration of surgery, postoperative pain, analgesic requirement, postoperative hospital stay, intraoperative and postoperative complication and factors necessitating conversion of laparoscopic procedure to open method.

Results: As per the present study inguinal hernia was most common diagnosis (48%) followed by hydrocele (22%) and acute appendicitis (22%).

Conclusions: It is concluded from the present study that laparoscopic surgery in paediatric patients is safe, complication free, had less analgesic requirement, shorter duration of surgery, short postoperative hospital and total hospital stay and better cosmetic results.

Keywords: Laparoscopic appendectomy, Cholecystectomy, Herniotomy, Adhenolysis, Numerical pain scale

INTRODUCTION

Laparoscopy is visualization of the peritoneal cavity using endoscope introduced through abdominal wall. Laparoscopy may be used for diagnosis of the disease or to treat different conditions. Diagnostic laparoscopy is widely used in many different clinical situations like chronic abdominal pain caused by pelvic inflammatory disease, endometriosis, tubercular abdomen, intra-abdominal adhesions are best diagnosed by laparoscopy as other investigations like X-ray, ultrasonography etc.

are usually negative and tissue can be obtained by laparoscopy for confirmation of diagnosis. Acute abdominal pain caused by acute appendicitis, typhilitis, regional ileitis or ectopic pregnancy may require diagnostic laparoscopy as ultrasonography may yield equivocal finding. Diagnostic laparoscopy can also be used to assess extent of the disease (staging) in cancer patients and to obtain tissue from lesion for histopathological confirmation of different malignancies like hepatic, pancreatic, ovarion, gall bladder etc.

The first case of laparoscopy in pediatric surgery was reported by Stephen Gans in 1971, in his landmark publication, "Advances in Endoscopy of Infants and Children," as a peritoneoscopy. The term peritoneoscopy was soon replaced by pediatric laparoscopy.¹

Laparoscopy in paediatric patient have many limitations and factors restricting its use in paediatric patient are smaller surface area for access, compliant abdominal wall, the liver margin below the rib cage, the bladder being an intra-abdominal structure, the viscera close to anterior abdominal wall and small sized abdominal cavity and conventional instruments too long for paediatrics use. The so-called obliterated structures like umbilical vein, umbilical artery and urachus remain relatively large and partially patent in infants further restricted use of therapeutic laparoscopy. Physiological changes secondary to insufflation of the abdomen or the chest are generally well tolerated in the adult patient but can present a challenge to the anaesthesiologist in the paediatric patient.²⁻⁴

These anatomical characteristics make access and manipulation in the paediatric age group a more demanding and difficult task when compared to adults. However, well defined anatomical landmarks due to lack of excess fat, making recognition and dissection of structures a relatively easy and may be favourable factors as compared to adults. However, complications of pneumoperitoneum in laparoscopic surgery like hypercarbia, hypothermia, risk for diaphragmatic splinting, reduction in tidal volume, cardiac and pulmonary complications are more common in paediatric patient as compared to adults.

Common diseases in paediatrics are acute appendicitis, hydrocele, inguinal hernia, undescended testis, hypertrophic pyloric stenosis, cholelithiasis, intestinal obstruction, intussusception, Hirschprung disease, diaphragmatic hernia, congenital anomalies like duodenal atresia, duodenal stenosis, malrotation, imperforated anus. The surgical procedures amenable to laparoscopy in paediatrics are herniotomy, cholecystectomy, appendectomy, pyloromyotomy, gastrostomy, fundoplication, diaphragmatic hernia repair, orchidopexy or orchidectomy, adhesiolysis and reduction of intussusception.

However, advantage of laparoscopic surgery like reduced postoperative complication like pain, reduced pulmonary complications, shorter hospital stay, early mobilization and minimal scar with better cosmetic results may be extended to paediatric patient as in adults.

With availability of electronic insufflators with special mode for paediatric patients, smaller size hand instruments, multipara monitors for continuous CO₂ monitoring and better postoperative care are the factors that gain acceptance to the therapeutic laparoscopy in paediatric patients.

METHODS

The present study was carried out in Department of General Surgery, MDM Hospital, Dr. S. N. Medical College, Jodhpur (Rajasthan) in September 2011 to March 2014. All patients below 14 years of age, admitted in general surgical ward were clinical examined and relevant investigations were done to confirm the diagnosis and for pre-anaesthetic check-up and fitness for laparoscopic surgery. Laparoscopic surgery was planned for various indications. Age, sex, symptoms, clinical examination finding and preoperative investigation, diagnosis, number, site and size of ports, intraoperative intra-abdominal pressure during procedure, intraoperative finding, procedure performed, intraoperative and postoperative complication, duration of surgery, postoperative analgesic requirement, postoperative and total hospital stay, indication for converting to open and percentage of conversion will be recorded on predesigned proforma. Results were compared with other studies from literature.

Numerical pain assessment scale (0-10) was used to grade the postoperative pain and the reading was taken just after procedure, 6 hrs, 12 hrs, 18 hrs and 24 hrs.

Analgesic was used in all paediatric patient as injection Tramadol 1-2 mg/kg body weight in 500 ml IV fluid for 6-8 hourly. First analgesic was given just after operative procedure then after patient demand.

RESULTS

This is a prospective study done in MDM Hospital, associated with Dr. S. N. Medical College, Jodhpur. The present study included 50 cases below 14 year of age.

In this study, 50 patients below 14 years of age were included. Out of them 40% of patients were between 7 to 10 years of age. The mean age was 8.06±3.62 year.

Most of the patients were male (82%) and only 18% were female (M:F=4.5:1).

In 50 cases, most common diagnosis was inguinal hernia, followed by hydrocele and acute appendicitis.

Table 1: Age distribution.

S. no.	Age (in years)	N	%
1	1-2	5	10
2	3-4	4	8
3	5-6	7	14
4	7-8	10	20
5	9-10	10	20
6	11-12	8	16
7	13-14	6	12

Table 2: Sex distribution.

S. no.	Sex	N	%
1	Male	41	82
2	Female	9	18

Table 3: Diagnosis.

S. no.	Diagnosis	N	%
1	Inguinal hernia	Rt.	18
		Lt.	4
		B/l	2
2	Hydrocele	Rt.	8
		Lt.	3
		B/l	0
3	Acute appendicitis	11	22
4	Cholelithiasis	2	4
5	Acalculous cholecystitis	1	2
6	Saio	1	2

Table 4: Operative procedure.

S. no.	Operative procedure	N	%
1	Herniotomy	35	70
2	Appendectomy	11	22
3	Cholecystectomy	3	6
4	Diagnostic laparoscopy (adhesiolysis)	1	2

The commonest surgical procedure done was herniotomy (70%) followed by appendectomy (22%).

56% patients were operated within 30 minutes. The mean operation time was 32.44±9.48 min.

According to the numerical pain scale, 74% of patients had mild pain and 24% patients had moderate pain postoperatively. The mean pain scale was 2.52±1.41.

In this study, post-operative analgesic requirement was 50 to 100 mg tramadol in 74% of patients. The mean post-operative analgesic requirement was 116±77.22 mg (tramadol).

Complication like recurrence of hernia was present in only one case out of 24 cases. No minor or major complication was reported

66% cases had postoperative hospital stay of 1 day followed by 2 days for 20% cases. Only 2% cases stayed more than 5 days. The mean post-operative hospital stay was 1.64±1.14 days.

Total hospital stay from day of admission to discharge was 3-4 days for 56% of patients. Only 4% of patients

had prolonged total hospital stay of more than 10 days. The mean total hospital stay was 4.68±2.68 days.

Conversion rate was present only 2% of patients. Out of 50 cases only one case was converted from laparoscopic to open herniotomy due to dense adhesions between hernial sac and omentum.

Table 5: Duration of procedure.

S. no.	Operation time (in min.)	N	%
1	1-10	0	0
2	11-20	3	6
3	21-30	25	50
4	31-40	15	30
5	41-50	4	8
6	51-60	3	6

Table 6: Post-operative pain.

S. no.	Numerical pain scale	N	%
1	No pain (0)	0	0
2	Mild pain (1-3)	37	74
3	Moderate pain (4-6)	12	24
4	Severe pain (7-10)	1	2

Table 7: Post-operative analgesic requirement.

S. no.	Post operative analgesic (tramadol in mg)	N	%
1	50	18	36
2	100	19	38
3	150	2	4
4	200	5	10
5	250	2	4
6	300	4	8

Table 8: Intraoperative and postoperative complications.

S. no.	Complications	N	%
1	Intraoperative	0	0
2	Postoperative	1 (recurrence)	2

Table 9: Post-operative hospital stay.

S. no.	Post-operative hospital stay (days)	N	%
1	1	33	66
2	2	10	20
3	3	1	2
4	4	5	10
5	≥5	1	2

Table 10: Total hospital stay.

S. no.	Total hospital stay (days)	N	%
1	1-2	6	12
2	3-4	28	56
3	5-6	8	16
4	7-8	3	6
5	9-10	3	6
6	>10	2	4

Table 11: Conversion rate.

S. no.	Total No. of cases	Converted to open	Reason for conversion
1	50	1	Adhesions between omentum and hernial sac

DISCUSSION

40% of patients in the present study were belonged to 7 to 10 years of age followed by 11 to 12 years (16%) and only 8% patients were between 3 to 4 years (Table 1). Mean age of the patients was 8.06±3.62 years. Out of them, 41 patients were males (82%) and 9 females (18%) with male female ratio of 4.5:1 (Table 2). In this study 48% cases were diagnosed as inguinal hernia followed by hydrocele in 22% of cases, acute appendicitis in 22% of cases, cholelithiasis in 4% of cases and only 2% of cases had acalculus cholecystitis and subacute intestinal obstruction (Table 3). Of 24 cases of inguinal hernia, right inguinal hernia (18 cases) was most common followed by left inguinal hernia (4 cases) and only 2 cases were presented as bilateral inguinal hernia. Out of 11cases of hydrocele, right side (8 cases) was most common followed by left side (3 cases). Various operative procedures carried out during this study such as herniotomy (35 cases; 70%), appendectomy (11 cases; 22%), cholecystectomy (3 cases; 6%) and one case (2%) operated for adhesiolysis for subacute intestinal obstruction (Table 4).

Operative time was calculated from the insertion of first trocar to the end of skin suturing. 50% cases were operated in time interval between the 21 to 30 minutes and maximum time duration of 51 to 60 minutes was taken for 6% of cases. The mean duration of procedure was 32.44±9.48 minutes (Table 5). One meta-analyses of appendectomy by Aziz et al concluded the operative time to be similar in open surgery and laparoscopic surgery.⁵ Randomized controlled trial of inguinal hernia repair by Koivusalo et al and Chan et al suggested laparoscopic surgery to be lengthier than open surgery.^{6,7}

In present study to the numerical pain assessment scale was used for assessing postoperative (Table 6).⁸ Out of 50 patients only one case had severe pain postoperatively

and remaining 37 cases (74%) experienced mild pain and 12 cases (24%) had moderate pain. The mean of the postoperative pain was 2.52±1.41 (Table 6). Koivusalo et al have reported the median pain score on the second postoperative morning to be significantly higher after laparoscopic hernia repair than after open herniotomy.⁶ Lejus et al noted referred shoulder pain in 35% of the children undergoing laparoscopic appendectomy, while only 10% of those who underwent open surgery experienced it.¹⁰

In this study postoperative analgesic requirement was 50 to 100 mg tramadol in 74% of patients. The mean post-operative analgesic requirement was 116±77.22 mg (Table 7). A single-blinded randomised controlled trials (RCT) on appendectomy by Lintula et al and inguinal herniotomy by Him et al showed significantly lesser pain and lesser analgesic requirement in laparoscopic surgery than in open surgery.^{9,10}

Complication like recurrence of hernia was present in only single case out of 24 cases (Table 8). No other minor or major complication like subcutaneous emphysema, gut injury, omental injury, haemorrhage, wound infection, neuralgia, testicular atrophy and fever was noted. In a prospective series of children aged 4-12 years, reported by Cairo et al underwent open appendectomy and 34 laparoscopic operations over a 6-month period where wound complications were fewer, cosmetic appearance was better, and time to return to normal activities was quicker (7 to 12 days) in the laparoscopic group.¹²

Lintula et al studied the effect of laparoscopic appendectomy in children between 4-15 yr of age and demonstrated that laparoscopic appendectomy was not associated with any increased risk of intra-operative or long term complications.¹¹ Lee and Liang performed micro laparoscopic herniotomy in infant and children with good results.¹³ They reported no complications of the surgery and a remarkably low recurrence rate (0.88%).

Marte et al stated that the incision of the peritoneum lateral to the internal inguinal ring and the W-shaped suture, compared to the sole W-shaped suture, is safe and effective in preventing hernia recurrence.¹⁴ Ozgediz et al and Bharathi et al stated that avoiding the vas deferens and gonadal vessels during subcutaneous endoscopically assisted ligation repair in males may leave a small gap at internal inguinal ring as well as leaving the hernia sac in situ, which has the potential to contribute to a higher incidence of recurrence in male patients.^{15,16}

Yang et al in their meta-analysis stated that the recurrence rate of laparoscopic hernia repair was higher than open hernia repair along with in 2 studies; Koivusalo et al and Hassan et al and lower in 3 studies; Tsai et al, Endo et al, Niyogi and equal (zero) in 2 studies; Saranga et al, Chan et al.^{6,17-23}

Nagraj et al reported six cases (2.7%) of testicular atrophy after open hernia repair (four of the six patients presented with an incarcerated hernia).²⁴ There were six cases of iatrogenic ascent of the testis requiring subsequent orchidopexy (2.7%). Barqawi et al reported testicular atrophy in 2 cases (1%) after open surgery.²⁵ Esposito et al reported that the incidence of complications in paediatric laparoscopy to be around 4-5%.²⁶

Bharathi et al stated that subcutaneous endoscopically assisted ligation repair resulted in marked reduction of operative time than two needle holders technique (unilateral, 15 versus 25 minutes, and bilateral, 25 versus 40 minutes).¹⁶ They added that avoiding the vas deferens and testicular vessels during subcutaneous endoscopically assisted ligation repair in males may leave a small gap at the internal ring as well as leaving the hernial sac in situ, which has the potential to contribute to a higher incidence of hydrocele and recurrence in male patients (Bharathi et al, Tsai et al).^{16,19}

The present study shows that most of the patients (66%) were kept for only one day postoperatively and the remaining were discharge in 2 to 4 days. Only one case had postoperative hospital stay of more than five days in our study. The mean postoperative hospital stay was 1.64 ± 1.14 days (Table 9).

In this study 56% of patients had total hospital stay of 3 to 4 days which include from day of admission to discharge day. Out of 50 cases, only two cases had prolonged hospital stay of more than ten days. The mean duration of total hospital stay was 4.68 ± 2.68 days (Table 10). In a large, nationwide, multicentric study by Faiz et al involving 89,497 pediatric appendectomies, there was no difference in length of stay and 28-day readmission rates and the 30-day and 365-day mortality were similar in the laparoscopic surgery and open surgery groups.²⁷

In present study conversion rate was insignificant. Only one case out of 50 cases was converted from laparoscopic herniotomy to open herniotomy due to dense adhesions between omentum and hernial sac as it was difficult to reduce the content of hernial sac (Table 11). Chen et al reported that conversion rate of 5-10% has been acceptable.²

Yang et al reported that laparoscopic herniorrhaphy is superior to open herniotomy in the repair of bilateral inguinal hernia and lower rate of metachronous contralateral hernia, with similar operative time for unilateral hernias, length of hospital stay, recurrence, and complication rates.¹⁷

CONCLUSION

The present prospective study was conducted to assess the feasibility of performing laparoscopic surgery in paediatric age group and study various procedures amenable to laparoscopic surgery. It is concluded from

the present study that laparoscopic surgery in paediatric patients is safe, complication free, had less analgesic requirement, shorter duration of surgery, short postoperative hospital and total hospital stay and better cosmetic results.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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