Minimal Access Surgery in Children: A 5 Year Study

SK Chowdhary and D Kandpal

From the Department of Pediatric Urology and Pediatric Surgery, Apollo Centre of Advanced Pediatrics, Indraprastha Apollo Hospitals, Sarita Vihar, New Delhi, India.

Over a period of 5 years, we analyzed our data on outcome, feasibility, and safety of Minimal Access Surgery (MAS) in 211 children. The outcome was compared objectively with age matched controls with similar diagnosis undergoing open surgery over the same period. There was no significant difference between mortality, morbidity, re-exploration rates and analgesic requirement between MAS and open surgery. There was a significant difference in the length of stay in hospital, in favour of laparoscopic cholecystectomy, appendectomy, nephrectomy, splenectomy, surgery for intra-abdominal testis compared to open surgery but not for children undergoing surgery for appendicular perforation and intestinal pathology. All parents preferred the cosmetic outcome of minimal access surgery.

Key words: India, Laparoscopy, Minimal access surgery.

Minimal access surgery (MAS) has gradually become available for children for selective surgeries in limited centers. Few retrospective studies without follow up data have been reported from our country [1-3]. Minimal access surgery is far more demanding in children due to the small size of peritoneal cavity, higher risk of iatrogenic injuries, smaller blood volume, anesthetic risks and majority of the operations being reconstructive. We report the first prospective study from our country on minimal access surgery in children with a minimum 12 month follow up.

METHODS

All consecutive babies and children who underwent minimal access surgery between 2005-2010 were recruited into the study. Children older than three weeks and upto 14 year of age who required surgery for the clinical diagnosis of impalpable/intra-abdominal testis, symptomatic or non-resolving gall stone disease, acute appendicitis, focal small bowel pathology, Hirschsprung's disease of rectosigmoid, non-functioning kidney with secondary pathology, focal mesenteric pathology, tubo-ovarian pathology, early empyema thoracis, small mediastinal mass or lung biopsy and Not Otherwise Specified (NOS) lesion were included. Any patient with major reconstructive procedure, risk of intra-abdominal adhesions, and more than ASA (American Society of Anaesthesiology) grade 1, was excluded.

Each one of them was offered the option of open versus minimally invasive approach and an informed consent was obtained. All the surgeries were video recorded for future reference. Age matched controls of patients undergoing laparotomy or thoracotomy for similar disease in the same period were compared in terms of mortality and morbidity, length of stay, postoperative pain based on duration and dose of morphine infusion and cosmetic outcome. Standard statistical methods were used to compare results between the two groups.

RESULTS

During the study period, 211 babies and children were recruited into the study. All patients who were recruited into study reported back for at least two follow up visits in the outpatients until 12 months after surgery (***Table*** I). There was no mortality among the babies recruited for minimal access surgery. There was no patient taken back to theatre following MAS in the follow up period. During minimal access surgery 10 patients were converted to open surgery. These included appendicular perforation with dense intestinal adhesions-3, Meckel's diverticulum with volvulus-1, ovarian tumour with torsion-1, nephrectomy-2, empyema-2, congenital diaphragmatic hernia-1. During the early period of study, laparoscopic hernia repair was discontinued due to an early recurrence, higher reported recurrence rate and excellent existing outcome of open hernia repair.

There were 32 children who underwent laparoscopic appendectomy; 1 of them had normal appendix at exploration and underwent appendectomy, all others had various stages of the disease and 3 with perforation were converted to open procedure. There was no morbidity, unexpected prolonged stay, or a significant difference in

TABLE I MINIMAL ACCESS SURGERY IN CHILDREN 2005–2010 ($N = 211$)

Surgery	Number	Mean time in minutes	Mean stay in days	Morbidity minimum follow up 12 months	Mean age in years
Appendectomy	32	(45-90) 60	(2-4) 2.5	Nil	5.5
Cholecystectomy	21	(45-100) 60	(1.5-3) 2.0	Nil	4
Splenectomy	5	(50-120) 75	(2-5) 3.0	Nil	5
Diaphragmmatic hernia repair	02	(75-105) 90	(1-3) 2.0	Nil	4
* Inguinal hernia repair	12	(40-70) 50	(0.5-2) 01	02	3.5
Orchidopexy, Single stage (intra-abdominal testis)	42	(55-90) 75	(0.5-3) 1.5	01	2.5
Orchidopexy, two stage (intra-abdominal testis)	15	(50-90) 70	(0.5-2) 1.5	Nil	2.5
Oopheropexy / oopherectomy / Biopsy	07	(30-100) 60	(0.5-2) 01	Nil	2.5
Nephrectomy	10	(105-150) 120	(1.5-4) 02	Nil	4
Nephroureterectomy/Excision ureterocele	04	(100-160) 120	(1-3) 02	Nil	4.2
Panhysterectomy for Congenital Adrenal Hyperplasia (CAH)/others	03	(90-120) 100	(1.5-3) 02	Nil	3.1
Small bowel resection Meckel's 5, tumour 2, mesenteric cyst 2, Segmental dilatation 1, TB stricture 1, trauma-perforation 1, hemangioma 1,hemicolectomy2	15	(80-140)100	(6-9)07	Nil	3.5
Hartmann's operation/colostomy, reduction ileocolo/colic intussusception	08	(30-120) 70	(2-5)3.5	Nil	4
Abdomino perineal pull thru	04	(100-150) 120	(4-7) 05	Nil	6 wks
Others (Tenchkoff catheter, peritonitis, trauma gastrostomy,ambiguous external genitalia, feeding jejunostomy, mesenteric node Bx,etc)	23	(45-90) 70	(1-7) 03	Nil	4.5
Video Assisted Thoracic Surgery (VATS)Early empyema, lung biopsy, excision mass, exposure for anterior spine surgery	08	(50-120) 90	(3-6) 04	Nil	6

*Discontinued in the middle of the study period.

analgesic requirement and complications from the laparotomy group. Table II compares the hospital stay duration between the minimal access and laparotomy groups.

There were 57 patients who underwent laparoscopic orchidopexy. In six patients no testis was found intra-abdominally or on inguinal exploration. In 15 patients the gonadal vessels were short and they were subjected to two stage Fowler- Stephens orchidopexy. There was testicular atrophy in three out of 15 patients. Single stage orchidopexy was possible in 42 patients and there was no testicular loss. In five patients the result was unsatisfactory with the testis outside abdomen but high up at the root of scrotum.

There were 21 laparoscopic cholecystectomies during the study period. There was no conversion to open surgery.

Majority were girls, the youngest child being a two year old boy. There was no difference in analgesic requirement, morbidity and complications. There was no significant difference between mortality, morbidity, re-exploration rates between MAS and open surgery. All parents preferred the cosmetic outcome of laparoscopic surgery.

DISCUSSION

Our study is on a controlled pediatric population who have undergone laparoscopic surgery in specific conditions where there is a clearly established benefit in favour of MAS in the adult population. Follow up to twelve months after surgery in each child, gave an opportunity to evaluate for several well known delayed complications which do not manifest in early post-operative period i.e. ischemic bile duct stricture after laparoscopic cholecystectomy.

The benefit reported in our study in favour of minimal access surgery for acute appendicitis has been reported by other authors and now the standard of care in children [4-6]. Our results were equally encouraging with laparoscopic cholecystectomy. There were no conversions to open cholecystectomy and no late complications. The open approach for cholecystectomy for children should be adopted only in the rare circumstance if laparoscopic assessment reveals dense adhesions [7].

Laparoscopic exploration of small bowel allows confirmation of diagnosis of focal small bowel pathology of some typical focal lesions like Meckel's diverticulum, mesenteric cyst, tubercular strictures, and rarely tumours. In the 14 cases treated, it was possible to localize these lesions, dissect and decompress whenever necessary and exteriorize the small bowel segment bearing the pathology through the umbilical port. The segmental resection of small bowel and extracorporeal end to end anastomosis could be done easily and the loop dropped back into the peritoneal cavity as reported previously [8].

The largest experience of laparoscopic hernia repair has revealed a recurrence rate of 4.1% versus a reported recurrence rate of less than 0.5% in the open technique [9]. We had one recurrence and another boy had a hydrocele develop early in postoperative period among the first few operated. This was not an acceptable outcome for hernia repair at our centre, and hence at this stage we discontinued laparoscopic hernia repair. There may be a role for laparoscopic repair in a girl or bilateral hernia. However, the scientific benefit to such an attitude is yet to be shown [10].

Laparoscopy can also easily localize presence or absence of testis beyond any doubt. In 42 children, single stage orchidopexy was done with no testicular loss.

However, although there was no testicular atrophy, five (10%) had unsatisfactory position of testis at the root of scrotum. Among 15 children who had short gonadal vessels, two stage Fowler-Stephens orchidopexy was done with testicular atrophy in three cases (20%).This is comparable to the previously published data with postoperative follow-up [11].

In diseases like Hirschsprung's disease, laparoscopy offers the chance to identify the transition zone and perform Hartmann's procedure or single stage laparoscopic abdominoperineal surgery with frozen section control. The single stage approach is feasible on short segment disease without massive proximal dilatation. Our experience is still very early and numbers are small to make any definite conclusion on this approach.

Laparoscopic paediatric renal surgery has become an attractive alternative to open surgery and is being done in several centers [12]. In our patients the indications for laparoscopic nephrectomy were symptomatic multicystic dysplastic kidneys (MCDK) and non functioning kidneys secondary to pelviureteric junction obstruction or reflux nephropathy and laparoscopic pyelolithotomy for a pelvic stone with large extrarenal pelvis. Even complex conditions like poorly functioning kidney with ureterocele have been managed in one stage laparoscopic surgery. In this study there has been low threshold for conversion to avoid morbidity.

Laparoscopic splenectomy is an attractive option in children with small spleen, typically those who have early diagnosis of hemolytic anemia like hereditary spherocytosis [13]. Those with large spleen like portal hypertension of Thalassemia continue to be removed by open surgery. We have followed both approaches with selective use of laparoscopic approach and no morbidity.

Our results suggest that MAS can be done in children without lowering the bar of quality outcomes in surgery.

TABLE II Mean Duration of Hospital Stay in Days

Surgery	MAS	Age matched control*
Cholecystectomy[#]	(1.5-3) 2	(3-5) 4
Appendectomy[#]	(2-4) 2.5	(2-6) 4.5
Splenectomy[#]	(2-5) 3	(3-6) 5
Orchidopexy (impalpable testis)[#]	(0.5-3) 1.5	(2-4) 3
Nephrectomy[#]	(1.5-4) 2	(3-6) 4
Small bowel resection	(6-9) 7	(6-9) 7
VATS[†]	(3-6) 4	(3-7) 5

Age matched controls undergoing laparotomy for comparable diagnosis; [†]VATS- Video assisted thoracoscopic surgery;[#] P <0.01.

References

1. Udwadia TE. Laparoscopy in India- A personal perspective. J Minim Access Surg. 2005;1:51-2.
2. Oak SN, Parlekar SV, Akhtar T. Minimal access surgery in children-5 years institutional experience. J Minim Access Surg. 2005;1:121-8.
3. Saravanan K, Kumaran V, Rajamani G. Minimally invasive pediatric surgery: our experience. J Indian Assoc Pediatr Surg. 2008;13:101-3.
4. Lee SL, Yaghoubian A, Kaji A. Laparoscopic vs open

appendectomy in children: outcomes comparision based on age, sex and perforation status. Arch Surg. 2011;146:1118-21.

5. Sauerland S, Jaschinski T, Neugebauer EA. Laparoscopic versus open surgery for suspected appendicitis. Cochrane Database System Rev. 2010;6:CD001546.

6. De U. Laparoscopic versus open appendicectomy: An Indian perspective. J Minim Access Surg. 2005;1:15-20.

7. Deepak J, Agarwal P, Bagdi RK. Paediatric cholelithiasis and Laparoscopic management: A review of twenty two cases. J Minim Access Surg. 2009;5:93-6.

8. Clark JM, Koontz CS, Smith LA. Video assisted transumblical Meckels diverticulectomy in children. Ann Surg. 2008;74:327-9.

9. Schier F. Laparoscopic inguinal hernia repair- a prospective personal series of 542 children. J Pediatr Surg. 2006;41:1081-4.

10. Alzahem A. Laparoscopic versus open inguinal herniotomy in infants and children: A meta-analysis. Pediatr Surg Int. 2011;27:605-12.

11. Kirsch AJ, Escala J, Duckett JW. Surgical management of nonpalpable testis: The Children's Hospital of Philadelphia experience. J Urol. 1998;159:1340.

12. Gundati MS, Patel Y, Duffy PG. An initial experience of 100 paediatric laparoscopic nephrectomise with transperitoneal or posterior prone retroperitoneoscopic approach. Pediatr Surg Int. 2007;23:795-9.

13. Murawski M, Patkoswki D, Korlacki W. Laparoscopic splenectomy in children- a multicenter experience. J Pediatr Surg. 2008;43:951-4.