Minimal access surgery in children: An initial experience of 28 months

Abhaya R. Gupta, Rahul Gupta, Vinay Jadhav, Beejal Sanghvi, Hemanshi S. Shah, S. V. Parelkar

ABSTRACT

Background: This study reports our 28 months experience with minimal access surgery (MAS) in children. **Materials and Methods**: This was a review of all children who underwent MAS between December 2004 and March 2007 at the Departments of Paediatric Surgery, Seth Gordhandas Sunderdas Medical College (GSMC) and King Edward the VII Memorial (KEM) Hospital, India. Results and observations were tabulated and analysed, comparing with observations by various other authors regarding variety of indications such as, operative time, hospital stay, conversion rate, complications, safety, and feasibilty of MAS in neonates, in the appropriate operative groups. **Results**: A total of 199 procedures were performed in 193 children aged between 10 days and 12 years (average age: 5.7 years). One case of each, adrenal mass, retroperitoneoscopic nephrectomy, laparoscopic congenital diaphragmatic hernia (CDH) repair, and abdominoperineal pull-through for anorectal malformation, were converted to open surgeries due to technical difficulty. The overall conversion rate was 3%. Morbidity and mortality were very minimal and the procedures were well tolerated in majority of cases. **Conclusion**: We concluded that MAS procedures appear to be safe for a wide range of indications in neonates and children. Further development and expansion of its indications in neonatal and paediatric surgery requires further multi-institutional studies and larger cohort of patients, to compare with standards of open surgery.

Key words: Children, laparoscopy, minimal access surgery, video-assisted thoracoscopic surgeries

DOI: 10.4103/0189-6725.54771

INTRODUCTION

Minimal invasive surgery and keyhole surgery are terms that are synonymous with minimal access surgery (MAS), and it includes laparoscopic, thoracoscopic, and other endoscopic procedures. Any minimally invasive operation must produce results that are at least as good as those of a standard open procedure and must do it safely. The MAS aims to minimise the physiologic consequences of an operation. In comparison to open surgery, MAS has several advantages: Less pain, faster recovery time, and improved cosmesis.

The use of the laparoscopy in children is not a new development. In early 70's, Gans first published his experience on peritoneoscopy in infants and children, well before the landmark development of laparoscopic cholecystectomy in adults (in 1987).[1] Although adult laparoscopic surgery, or "keyhole" surgery, has undergone tremendous development since the late 80's, its application in infants and children had been lagging behind until the mid 90's when it took an explosive pace.[2,3] The initial skepticism regarding the potential benefits of MAS in infants and young children,[4,5] has given way for a wide application of MAS in various fields of paediatric surgery with the development of fine laparoscopic instruments for small infants and children.[6,7]

This study reports our 28 months experience with MAS in children at the Departments of Paediatric Surgery of Seth GSMC and KEM Hospital, Mumbai, Maharashtra, India.

MATERIALS AND METHODS

This was a review of all children who underwent MAS between December 2004 and March 2007 at the Departments of Paediatric Surgery, Seth GSMC and KEM Hospital.

The preoperative workup for MAS included assessment of haemodynamic stability, severe cardiac disease, pulmonary insufficiency, bleeding disorders, and previous surgical procedures. Preoperative bowel preparations and rectal washouts were carried out in cases of Hirschsprung's disease. Chest physiotherapy and incentive spirometry were employed in patients who underwent thoracoscopic procedures.

Department of Paediatric Surgery, Seth GSMC and KEM Hospital, Parel, Mumbai - 400 012, India

Address for correspondence:
Dr. Abhaya R. Gupta,
A-2/8, Tapovan Building, Dongre Park Cooperative Housing Society Limited, Chembur, Mumbai - 400 074, Maharashtra, India.
E-mail: drabhayg@rediffmail.com

Single lumen endotracheal tube ventilation was used, although double lumen endotracheal tube or single lung ventilation is recommended in thoracoscopic procedures. Carbon-dioxide insufflation was used in thoracoscopic cyst excision and in cases of congenital diaphragmatic hernia (CDH).

In all laparoscopic procedures, the primary port placement was by the Hasson's open technique: The abdomen was insufflated with carbon dioxide with pressures between 6 mm Hg to 12 mm Hg; a 5 mm 0° telescope was used. We used 5 mm and 3 mm instruments depending on the pathology and size of the child. Diagnostic laparoscopy was performed in all cases before the procedure was completed depending on the pathology. In retroperitoneoscopy the ports were placed in the retroperitoneum by open technique in lateral position.

Patients of empyema with duration of illness less than 15 days were taken up for video-assisted thoracoscopic surgeries (VATS) decortication using a two port technique. Primary VATS decortication was done in patients who were not in respiratory distress. Patients with distress were managed initially by intercostal drainage tube insertion followed by surgical procedure. The telescope was introduced in primary VATS decortication through intercostal space as close to the scapula in mid axillary line; in the secondary VATS decortication access was through the intercostal drain (ICD) insertion site, after removing the ICD. Another port was used for debridement of peel.

In cases of thoracoscopic cysts, secondary ports placement and number of ports were dependent on the position and size of the cyst. VATS-based CDH repair was done by using three 5 mm ports. Inclusion criteria included hernia with sac with normal arterial blood gas analysis; patient not requiring preoperative ventilator support.

RESULTS

A total of 193 children, aged between 10 days and 12 years (average age: 5.7 years), underwent a total of 199 MAS procedures, which included; 134 laparoscopic surgeries, one retroperitoneoscopy, and 64 VATS. Emergency MAS was performed for, 10 cases of acute appendicitis; 4 of ovarian torsion; two cases each of, intestinal obstruction, intussusception, mesenteric lymphadenitis; and one case of primary peritonitis.

MAS was converted to open procedure in one case of each, VATS CDH repair, VATS decortication, adrenal mass, retroperitoneoscopic nephrectomy, laparoscopic CDH repair, and abdominoperineal pull through for anorectal malformation, due to technical difficulty. The overall conversion rate was 3% [Table 1].

Laparoscopic and retroperitoneoscopic procedures were carried out for various paediatric surgical conditions [Tables 1-3]. A total of 31 patients underwent laparoscopic appendectomies: 15 had acute appendicitis and 16 had subacute or recurrent appendicitis. Two patients developed infection of port site from where the appendix was removed.

Four patients had laparoscopic cholecystectomy; two of these had calculus cholecystitis and the other two had choledochal cyst; the choledochal cyst was excised in addition to cholecystectomy.

Thirty-six boys with 46 nonpalpable testes (NPTs) underwent diagnostic and therapeutic laparoscopy. Out of these 46 NPTs: 10 were absent; 15 were located at the internal ring (at laparoscopy and were converted to open inguinal exploration); two were excised; one had Persistent Mullerian duct syndrome (PMDS); the remaining 18 were intraabdominal testes (IAT), of

Table 1: Laparoscopic and retroperitoneoscopic procedures

Procedure	
Gastrointestinal	
Appendectomy	31
Adhesiolysis	3
Anorectal malformation pull through	2*
Morgagni's hernia	1
CDH	1*
Laparoscopic lavage for primary peritonitis	1
Laparoscopic biopsy with endoanal pull through for Hirschsprung's	1
Marsupialisation of cerebrospinal fluid pseudocyst	1
Hepatobiliary	
Cholecystectomy	4
Liver cyst excision	1
Genitourinary	
Orchiopexy	18
Salpingo-oophorectomy	4
Adrenalectomy	1*
Nephrectomy (non-functioning kidney with pelviureteric junction obstruction)	2**
Varicocele ligation	1
Nephroureterctomy (dysplastic kidney and non functioning kidney with ectopic ureter)	2
Laparoscopic derotation for ovarian torsion	2
Laparoscopic ovarian cyst aspiration	1

*One case converted to open surgery; **One case of retroperitoneoscopy with conversion

Table 2: Laparascopic assisted procedures

Nephroureterctomy (dysplastic kidney)	1
Orchiopexy	1
Nephrectomy (ectopic kidney)	1
Total colectomy	1

Table 3: Diagnostic laparoscopic procedures

Gastrointestinal	
Chronic abdominal pain	9
Abdominal lump	2
Intestinal obstruction	2
Malrotation	2
Intussuception	2
Kochs abdomen	3
Acute abdomen	1
Hiatal hernia	1
Meckels diverticulitis	1
Lumbar hernia	1
Hepatobiliary	
Hydatid cyst liver	1
Genitourinary	
Undescended testis	23
Adrenal mass	2
Urachal cyst	2
Intersex	1
Ovarian cyst	1
Ovarian tumor	1

which, seven were within 2.5 cm from the internal ring underwent single-stage orchidopexy without sectioning of the spermatic vessels, while 9 other were situated more than 2.5 cm from the internal ring underwent two-stage Fowler-Stephens (FS) procedure. The surgical time for the procedures was between 45-60 mins.

Seven girls presented with tubo-ovarian pathology: Four had ovarian torsion, two had benign ovarian cyst, and one had malignant ovarian cyst. Two of the patients with ovarian torsion underwent oophorectomy because of gangrene and the remaining two had distortion. A 10 day neonate presented with an antenatally diagnosed simple ovarian cyst, which was aspirated and marsupalised, under the laparoscopic guidance.

Upper urinary tract problems: Nephroureterectomy (one laparoscopic-assisted) was performed in three cases, two were dysplastic kidneys and one was nonfunctioning kidney, in a case of ectopic ureter with vesicoureteral reflux (VUR). Nephrectomy was performed in three cases (one laparoscopic, one laparoscopic-assisted and one retroperitoneoscopic-assisted) for nonfunctioning kidney with pelviureteric junction obstruction.

Other laparoscopic procedures included, adhesiolysis in three patients who had adhesive intestinal; CDH repair in two patients (in one of them, the operation was completed by open procedure); definitive pull through operation in one case each of anorectal malformation and Hirschsprung's disease and excision of a hepatic cyst; in an 18-day old female neonate.

There were 64 cases of VATS procedures: 55 patients underwent decortications (Male:F = 2:1), 36 had right-sided disease, and the remaining 19 had left-sided disease.

Primary VATS decortication was performed on 16 patients. Two patients developed significant postoperative surgical emphysema, which required observation but settled with time. The average day of discharge was 6.2 postoperative day. Other VATS cases included CDH repair in five patients, and excision of bronchogenic and neuroenteric cysts in four patients.

DISCUSSION

Paediatric surgeons have trailed behind the adult surgeons in applying MAS with the false belief that children do not experience pain, have a faster postoperative recovery and are operated upon by smaller incisions.[8] Also, physiological implications and anatomical consideration of the surgical neonates and paediatric population are the other reasons for this slow pace. However, evidences do not abound that MAS is safe in neonates and older children.[9] This safety profile of MAS was confirmed in neonates who undergone laparoscopic and thoracoscopic procedures in this study. Nicolas Kalfa *et al*,[10] also alluded to such safety, but reported that neonates were highly sensitive to insufflations.

VATS for empyema thoracis and recurrent pneumothorax has been in vogue since several years.[11,12] Our average operative time was 85 mins in VATS excision compared to the mean operation time of 70 + 25 mins reported by Tolg.[13] Thanh Liem Nguyen and Anh Dung Le[14] in a series of 45 VATS cases, reported four conversions and two deaths. We did not have any conversion in the VATS group, but this maybe attributable to the relatively fewer cases in our study.

One of the complications of VATS is empyema. McGahren ED III[15] advocated early thoracoscopic surgical debridement as a key to prevent long-term complications of empyema. Kalfa[16] suggested surgery as early as within four days of history in view of technical ease and lower postoperative morbidity. Akin Eraslan Balci[17] alluded that there was higher morbidity in patients treated with fibrinolytic agents compared to surgical debridement. The aim of empyema treatment is to restore the lung to a normal function, by preventing the organisational phase of the empyema.[18,19] In this study, we observed that early VATS decortication in patients who presented within 15 days and without respiratory distress, was associated with less incidence of empyema and shorter postoperative hospital stay, compared to secondary VATS decortication. However,

when compared to open decortications, both of the VATS decortication groups had fewer days of postoperative hospital stay and earlier ICD removal.

Laparoscopic appendectomies in children have been found to be effective and safe even in complicated cases and abscess.[20,21] In this report, laparoscopic appendectomy was associated only with very low rate of port site infections, there were no major postoperative complications and the postoperative hospital stay was very short.

Proctor compared the role of laparoscopic and open subtotal colectomy for inflammatory bowel disease and found out that subtotal colectomy could be performed safely and with similar perioperative outcome by laparoscopic means. We lack enough experience at the moment to draw definitive conclusions with regard to the efficacy of laparoscopic colectomy, but the procedure appears rewarding according to our limited experience.

Laparoscopic-assisted procedures for anorectal malformation[22-24] have been found to be safe and effective. Again our limited experience of a single case of total colectomy does not justify conclusions on this.[25]

Jona[26] and Georgeson[27] suggested that laparoscopic procedure should be the gold standard for hirschsprung patients. Hirschsprung's disease is traditionally treated in our institution by the conventional modified Duhamel procedure; we hope to explore laparoscopic procedure for Hirschsprung's disease in our setting.

Several authors[28-30] have expressed satisfaction with laparoscopic renal surgeries, including laparoscopic nephrectomy and nephroureterctomy. Based on the experience gained from six cases in this study, we agree that laparoscopic nephrectomy and nephroureterctomy are safe in benign renal conditions. Similarly, laparoscopy was found useful and handy in tubo- ovarian pathology in neonates and adolescents in this study similar to others.[31-33] The procedure enabled us to salvage two gonads conservatively without the need for open gonadal biopsy or oophorectomy. Similar experience was applied to undescended testis, and permitted single-stage orchiopexy was possible in single-stage without dividing the spermatic vessels, although a few required FS staged procedure. Esposito[34] advocated that orchiopexy without division of spermatic vessels should be the preferred technique. Although Chandrasekharam[35] failed to agree with the role of laparoscopy in undescended testis, we believe that laparoscopy has a definite role to play in the management and evaluation of undescended testis.

In conclusion, MAS procedures appear to be safe for a wide range of indications in neonates and children. The MAS has established its role in the management of empyema thoracis, undescended testis, and genitourinary pathologies. It offers the advantage of definitive diagnosis, cosmesis, less pain, early recovery, and early discharge of patients. Further development and expansion of its indications in neonatal and paediatric surgery in the coming years requires further multi-institutional studies and larger cohort of patients, to meet the standards of open surgery.

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Source of Support: Nil, **Conflict of Interest:** None.

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