Make laparoscopy a pediatric surgeon’s armamentarium

Pediatric laparoscopic surgery though, first described as early as 1973, it was restricted to mainly diagnostic use. It is now estimated that 82% of pediatric surgeons perform laparoscopic surgery in USA, with a low complication rate (1-2%) in large centers. In India also, it has become quite popular since the first four live operative laparoscopy workshops were organized in four corners of the country, in 1998. Despite the perceived technical difficulties of working in a restricted space in small infants, laparoscopic surgery has been carried out successfully even in the neonates as small as 1.3 kg body weight without any added complications.

Laparoscopy in children requires special care. The abdominal surface/cavity ratio in infants and children is less than that of adults. The abdominal wall in children is very pliable compared to that in adults. Special attention is also needed in trocar placement to prevent intra-abdominal injuries. The trans-umbilical open technique for the the first trocar insertion under direct vision is recommended to prevent complications, which can arise by blind insertion of the Veress needle. The anaesthetic consequences of pneumo-peritoneum are to a great extent age dependent.

In neonates, the foramen ovale or the ductus arteriosus is potentially patent and may reopen during the procedure. The pulmonary arterial resistance is relatively high, pre-disposing to reverse flow through a patent ductus arteriosus or foramen ovale. In infants younger than 6 months, it is important not to increase the intra-abdominal pressure above 6 mm Hg as this can decrease the venous return and compliance of heart with decrease in cardiac output. There is a risk of reopening of right-to-left shunts in the young heart, cardiac insufficiency and gas embolism into the systemic circulation that may result in cardiac ischemia and neurological damage.

Laparoscopy in children requires general anaesthesia with controlled ventilation. Ventilation with nitrous oxide is best avoided, as it increases distension of the bowel, which may hamper the visualization of the site of interest. Carbon dioxide is preferred for pneumo-peritoneum. During pneumo-peritoneum, an increased intra-abdominal pressure and the elevation of the diaphragm can result in endobronchial intubation.

After the procedure, as much as possible of the intra-peritoneal CO2 should be removed, since it will irritate the diaphragm and may cause referred shoulder pain, nausea, and vomiting. Immediately after the operation, special attention should be paid to the respiratory status of the patient as systemic absorption of carbon dioxide may cause hypercapnia.

Though most surgical procedures have been attempted laparoscopically, it should be kept in mind that though a procedure can be done Laparoscopically, it should not necessarily be done that way. Unfortunately, very few prospective randomized clinical trials of pediatric laparoscopic surgery are available.

The question remains whether laparoscopic surgery is capable of achieving results at par with open surgery in the long run. Specific conditions also need to be identified that should be treated laparoscopically with favorable outcome.

Advantages after laparoscopic procedure claimed
1. Less post-operative pain
2. Better cosmetic results
3. Shorter hospital stay
4. Early return to normal activities including feeding, bowel movements, and work/school
5. Performance of surgery in deep cavities of small children like the hiatus and the pelvis with good illumination and magnification
6. Reduced wound complications
7. Early discharge from the hospital can decrease the hospital bill.

However, this may be achieved only in experienced centers where the complication rate is lower.

Disadvantages of the laparoscopic procedures
1. Longer operating time, especially during the learning curve
2. Expensive instruments and consumables
3. Two-dimensional visual images
4. Loss of touch sensation
5. Difficulty in controlling bleeding (limited suction, no manual pressure)
6. Limitation in the number and directions of instruments
7. Difficulty in suturing. New skills have to be acquired
8. Presence of learning curve and the skills need to be
Controversial indications

1. Hemorrhage. Intraperitoneal bleeding is more difficult to control laparoscopically and children respond poorly to hemodynamic disturbances.
2. Inadvertent visceral injury during trocar insertion.
3. Diathermy injury can lead to intestinal perforation.
4. Complications related to port sites include postoperative herniation of intra-abdominal contents, which can occur even through small port sizes.
5. Technical limitations could result in failure of the procedure.
6. Rare complications from CO2 insufflations for pneumoperitoneum include gas embolism, cardiovascular compromise and hypercapnia. The risks are minimized by the use of low pressure CO2 insufflation in children.

Diagnostic laparoscopy
1. Diagnostic gold standard for impalpable undescended testes
2. Liver biopsy
3. Direct cholangiography
4. Lower GI bleeding
5. Intersexual anomalies
6. Recurrent abdominal pain
7. Blunt/sharp abdominal trauma
8. Seromuscular bowel biopsy
9. Tumor staging

Therapeutic laparoscopy
1. Stephen-Fowler orchidectomy for intra-abdominal testes
2. Cholecystectomy
3. Anti-reflux surgery (Nissen, Thal) fundoplication
4. Resection of benign ovarian tumors
5. Pyloromyotomy
6. Gonadectomy for dysgenic gonads
7. Small bowel resection
8. Lap assisted pull through for Hirschsprung’s disease
9. Lap assisted pull through for anorectal malformations
10. Nephrectomy for non-functioning kidney
11. Partial nephrectomy for duplex system
12. Adrenalectomy
13. Varicocelectomy
14. Appendectomy
15. V-P shunt placement
16. Uncomplicated liver cysts
17. Splenectomy for minimal or moderate splenomegaly
18. Meckel’s diverticulum

Relative contra-indications include severe chronic obstructive lung disease, spinal abnormalities and large intra-abdominal malignancies.

It is possible that the physiological derangement may increase with time, particularly in children and may lead to an undesirable increase in complications. The advantages of laparoscopic surgery in children, especially in the institutional set up have not been clearly
established and have to be balanced against the potential disadvantages. Major surgical procedures that require reconstruction involving many organs and tissues (hepatobiliary reconstruction, gastrointestinal surgery, and genito-urinary surgery) require open technique with advanced surgical skills. Laparoscopy should be considered an additional tool, with specific indications, in the hands of a surgeon who is not only familiar and trained with the sound principles of child surgery but also capable of managing the complications independently, arising so, if any. It is important that the operating surgeon knows what can be and should be done safely using laparoscopy and must not do what should not be done with it.

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