10.5005/jp-journals-10033-1288

REVIEW ARTICLE

Challenges in the Widespread use of Minimal Access Surgery for the Management of Abdominal Trauma: A Primer

[1]Ebrahim Mansoor, [2]RK Mishra

ABSTRACT

Minimal access surgery (MAS) has made great strides in the evaluation and treatment of elective surgical pathology. The use of MAS for intervention in the patient with abdominal trauma has cautiously lagged behind. We undertook an in-depth analysis of published surgical literature in this regard. The aim was essentially to succinctly summarize current evidence and identify obstacles to its more widespread use. Lack of skill and experience has been identified as the main factor. Addressing this issue with further training and education will be the panacea for the success of MAS for abdominal trauma henceforth. Nevertheless, laparoscopy remains an integral component of the surgical armamentarium in dealing with abdominal trauma.

Keywords: Blunt, Laparoscopy, Minimal access, Penetrating, Trauma.

How to cite this article: Mansoor E, Mishra RK. Challenges in the Widespread use of Minimal Access Surgery for the Management of Abdominal Trauma: A Primer. World J Lap Surg 2016;9(3):122-125.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Since the advent of minimal access surgery (MAS), patients have benefitted from all its purported advantages. Less pain, earlier mobilization, reduced wound sepsis, and limited hospital stay are just some of the features of MAS that has sparked interest for its use in the trauma patient. The reduced financial implication was of further relevance to developing countries plagued by a high trauma rate. After the initial enthusiasm for MAS in the elective setting, it began to be utilized for the trauma patient. Several studies have since attested to the applicability of MAS for trauma, mainly for diagnosis. However, the therapeutic benefit appears illegitimately more controversial and general skepticism still prevails.

[1]Specialist, [2]Consultant Laparoscopic Surgeon

[1]Department of General Surgery, University of KwaZulu-Natal Durban, South Africa

[2]World Laparoscopy Hospital, Gurgaon, Haryana, India

Corresponding Author: Ebrahim Mansoor, Specialist Department of General Surgery, University of KwaZulu-Natal Durban, South Africa, e-mail: dremansoor@gmail.com

AIMS

- Review the surgical literature to assess the current global stance for the use of MAS in the trauma setting.
- Identify challenges and obstacles to more widespread use of MAS for abdominal trauma.
- Suggest possible solutions to the challenges and obstacles with a view to maximizing the benefits of MAS for the trauma patients.

MATERIALS AND METHODS

- A thorough online search of the surgical literature regarding the relationship of MAS and abdominal trauma was conducted.
- Google Scholar, HighWire Press, and PubMed databases were used for the purpose of literature review.
- Main keywords used in the search were "laparoscopy," "minimal access," and "abdominal trauma."
- Emphasis was placed on literature published in the last decade, that is, from 2005 onward.

RESULTS

The results of 11 randomly selected papers are shown on the next page.

Studies evaluating the relationship of MAS and abdominal trauma are marred by heterogeneity. In addition, the majority of these studies are retrospective and have small population sizes. Conversion rates are heavily influenced by surgeon preference, institutional protocol and algorithms, surgeon skill and experience, and the availability of suitable equipment and adjuncts, such as energy devices and surgical staplers. As such, the results are entrenched in selection bias. While the mean success rate for MAS in abdominal trauma is approximately 80%, there is definitely room for improvement. Authors are unanimous in identifying lack of skill and experience as the Achilles heel to the more widespread use of laparoscopy in abdominal trauma.

There is a general consensus that MAS is safe and cost-effective in the management of blunt and penetrating abdominal trauma. Furthermore, it has been shown to markedly limit the number of unnecessary laparotomies.

Table 1: Management of Blunt and Penetrating abdominal trauma

Study	*Total number*	*Blunt trauma*	*Blunt trauma converted*	*Penetrating trauma*	*Penetrating trauma converted*	*Overall conversion rate (%)*	*Overall success rate (%)*
Kaban et al[1]	43	18	9	25	9	42	58
Bombil et al[2]	40	6	1	34	7	20	80
Matsevych et al[3]	189	–	–	189	0	0	100
Zafar et al[4]	4,755	1,579		3,176		20	80
Memon et al[5]	32	32	2	–	–	6	94
Yehia et al[6]	40	40	13	–	–	33	67
Kawahara et al[7]	75	–	–	75	20	27	73
Lim et al[8]	41	30		11		18	82
Morsi et al[9]	65	21	5	44	7	18	82
Gohil et al[10]	25	25	1	–	–	4	96
O'Malley et al[11]	2,563	–	–	2,563		34	66

Missed injury rates in open and laparoscopic surgery appear similar. Missed small bowel trauma can be prevented by a hand-over-hand evaluation at 10 cm intervals from the ligament of Treitz to the ileocaecal valve (Table 1).[1-11]

DISCUSSION

There is unquestionable hesitation in embarking on MAS where intervention is anticipated. Furthermore, there is unnecessary trepidation in utilizing minimal access techniques for penetrating abdominal trauma. In order to promote the more widespread use of MAS, the treating surgeon has to select the case appropriately. On that score, the indications and contraindications for MAS use in the patient with abdominal trauma are enlisted below:

Indications[12-14]

- Blunt abdominal trauma with equivocal computed tomography (CT) scan in the setting of ongoing abdominal pain
- Penetrating injury
- Blunt trauma with CT scan suggesting intra-abdominal injury not amenable to conservative management, or presence of free intraperitoneal fluid
- Hemodynamic instability that improves with resuscitation.

Contraindications[13,14]

- Established peritonitis/sepsis
- Polytrauma (relative)
- Major vessel injury
- Inexperience and poor skill
- Previous abdominal surgery (relative)
- Distended abdomen (relative) or abdominal compartment syndrome
- Ruptured abdomen
- Several/large penetrating wounds to abdominal wall precluding establishment of pneumoperitoneum
- Ongoing hemodynamic instability, that is, despite best resuscitation attempts
- Concomitant head injury with increased intracranial pressure
- Explosive or blast injuries.

GENERAL PRINCIPLES, ACCESS, AND PORT POSITION

General anesthesia is recommended. However, diagnostic laparoscopy can be accomplished with local anesthesia. Patients with a concomitant pneumothorax must have an intercostal drain placed prior to induction of anesthesia. In patients with mild head trauma, it is best to avoid Trendelenburg position. Attempts must be made to maintain normothermia during the procedure. Prophylactic antibiotic is administered.

Access method and establishment of pneumoperitoneum is at the discretion of the treating surgeon. Where a patient has a small puncture wound to the abdominal wall, this could be used as the site for the first port placement. Alternatively, the infraumbilical crease may be the default primary port position. Most studies, however, anecdotally prefer the Hasson technique. Should a CT scan detect specific organ injury or there is clinical suspicion of specific organ trauma prior to embarking on surgery, it is best to stay away from the area of concern for the primary port. The preset abdominal pressure should be 8 mm Hg initially and increased, as tolerated, to 12 to 15 mm Hg. Further port positions follow the baseball diamond concept as popularized by Dr RK Mishra subsequent to the detection of trauma. At the expense of ergonomics, longer instruments may be used to obviate the insertion of additional ports merely for diagnostic purpose. The priority when first examining the peritoneal contents is to suction all blood and free fluid, arrest hemorrhage, control ongoing sepsis, and then, finally, to undertake a thorough examination of the abdomen in systematic and controlled fashion. The importance of meticulously evaluating the gastrointestinal tract from stomach to rectum cannot be overemphasized.

SPECIFIC-ORGAN TRAUMA[4,14]

The advancements in stapler technology and energy devices, (as well as the enhanced knowledge of suturing and knotting techniques), have enabled the minimal access surgeon to intervene efficiently and safely for specific-organ trauma. There is little minimal access techniques cannot accomplish equivocally or better than open surgery. Some examples are shown below (Table 2).

Table 2: Suturing and knotting technique

Injured organ	*Possible intervention*
Diaphragm	Suture repair ± mesh application
Liver	Suture; application of hemostatic agent
Gallbladder	Cholecystectomy
Stomach	Repair or resection and anastomosis
Pancreas	Drain placement; distal pancreatectomy
Spleen	Splenectomy
Small bowel/ colon/rectum	Repair/resect and anastomosis/stoma
Ureter	Anastomosis over stent
Mesenteric bleed	Suture, clip, or hemostasis with energy device
Bladder	Repair
Abdominal wall defect	Repair

Copious peritoneal lavage with warmed saline and intraperitoneal drain placement is indicated for peritoneal soiling. At the conclusion of the operation, all 10 mm port sites must be repaired.

CONTROVERSIES AND SPECIAL CIRCUMSTANCES

Laparotomy versus Laparoscopy[4,8,12,13,15]

Laparoscopy has been shown to be equally efficacious as laparotomy in selected circumstances as indicated above. The missed injury rate is negligible with good technique. Conversion to open surgery must not be deemed to be a failure of the laparoscopic modality. However, the conversion rate is minimized in experienced hands. Length of stay and costs are comparatively reduced with laparoscopy. The concern that carbon dioxide pneumoperitoneum promotes septicemia in the setting of bowel content spillage or peritonitis appears to be unwarranted.

Second-Look Laparoscopy

This has not been clearly validated in the trauma literature. Technically, it is viable and must be done on demand. Previous port sites or the drain site can be used for a "second-look."

Damage Control Laparoscopy

Damage control laparoscopy has not been adequately described in the trauma literature. Patients in extremis are often only candidates for open surgery. In very experienced hands and in a highly controlled environment, it appears intuitively possible to conduct damage control laparoscopy especially when surgical staplers and a wide array of energy devices are at the disposal of the surgeon.

Pediatric Considerations[16]

There is a relative paucity of literature for the use of MAS in the pediatric trauma patient. Diagnostic laparoscopy has been shown to be feasible and safe. Interventional work is possible in the hands of a surgeon *au fait* with pediatric minimal access surgical techniques and with the availability of appropriately sized instruments.

Pregnancy[14]

Surgery in the gravid patient is hazardous in emergent open surgery and often results in maternal and child morbidity or mortality. This is especially more pronounced with MAS especially in light of trocar injuries and the effects of pneumoperitoneum. Extrapolating from the nontrauma setting, MAS may be possible in the first and second trimester. Intense maternal counseling is advocated. More studies are recommended prior to firm recommendations on MAS for the pregnant patient with abdominal trauma.

CONCLUSION[4,8,12-15]

Minimal access surgery represents a viable, safe, and cost-effective alternative in the adult and pediatric trauma patient for selected injuries. Lack of training and experience in minimal access techniques is the main impediment to widespread use. Trauma centers and other surgical facilities dealing with trauma patients are encouraged to incorporate minimal access techniques in their training programs. Results obtained with laparoscopic examination and therapy utilizing MAS techniques are commensurate with the skill and experience of the operator. Preliminary data suggest that laparoscopy should be further popularized for abdominal trauma; however, randomized controlled studies are required to truly validate the role of MAS for the trauma setting.

REFERENCES

1. Kaban GK, Novitsky YW, Perugini RA, Haveran L, Czerniach D, Kelly JJ, Litwin DE. Use of laparoscopy in evaluation and treatment of penetrating and blunt abdominal injuries. Surg Innov 2008 Mar;15(1):26-31.
2. Bombil I, Maraj A, Lunda WS. Laparoscopy at Sebokeng Hospital with emphasis on trauma. Global J Med Res 2014; 14(4).

3. Matsevych OY, Koto MZ, Motilall SR. The role of laparoscopy in management of stable patients with penetrating abdominal trauma and organ evisceration. J Trauma Acute Care Surg 2016 Aug;81(2):307-311.
4. Zafar SN, Onwugbufor MT, Hughes K, Greene WR, Cornwell EE, 3rd, FullumTM, Tran DD. Laparoscopic surgery for trauma: The realm of therapeutic management. Am J Surg 2015 Apr;209(4):627-632.
5. Memon MR, Sanghi AG, Abassi SA. Role of laparoscopy in blunt abdominal trauma. Rawal Med J 2013;38(1):40-43.
6. Yehia MA, Khalifa SA, Atia ME. Role of laparoscopy in blunt abdominal trauma. ZUMJ 2013 Sep;19(5):374-380.
7. Kawahara NT, Alster C, Fujimura I, Poggetti RS, Birolini D. Standard examination system for laparoscopy in penetrating abdominal trauma. J Trauma 2009 Sep;67(3):589-595.
8. Lim KH, Chung BS, Kim JY, Kim SS. Laparoscopic surgery in abdominal trauma: A single center review of a 7-year experience. World J Emerg Surg 2015 Mar;10:16.
9. Morsi M, Mansy W, Zakaria Y. Use of laparoscopy in the management of abdominal trauma: A center experience. Egypt J Surg 2015;34(1):11-16.
10. Gohil VD, Palekar HD, Ghoghari M. Diagnostic and therapeutic laparoscopy in various blunt abdomen trauma. World J Laparosc Surg 2009 May-Aug;2(2):42-47.
11. O'Malley E, Boyle E, O'Callaghan A, Coffey JC, Walsh SR. Role of laparoscopy in penetrating abdominal trauma: A systematic review. World J Surg 2013 Jan;37(1):113-122.
12. Uranues S, Popa DE, Diaconescu B, Schrittwieser R. Laparoscopy in penetrating abdominal trauma. World J Surg 2015 Jun;39(6):1381-1388.
13. El-Bendary YB, Al-Adawi J, Al-Qadhi H. The use of laparoscopy in the management of trauma patients (brief review). Sultan Qaboos Univ Med J 2016 Feb;16(1):e9e14.
14. Grushka J, Ginzburg E. Through the 10-mm looking glass: Advances in minimally invasive surgery in trauma. Scand J Surg 2014 Apr;103(2):143-148.
15. Li Y, Xiang Y, Wu N, Wu L, Yu Z, Zhang M, Wang M, Jiang J, Li Y. A comparison of laparoscopy and laparotomy for the management of abdominal trauma: A systematic review and meta-analysis. World J Surg 2015 Dec;39(12):2862-2871.
16. Numanoglu A. Laparoscopy in abdominal trauma. CME 2010 Mar;28(3):119-121.