

Two decades of laparoscopic surgery in Brunei Darussalam

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ABSTRACT

Introduction: The introduction of laparoscopic surgery into clinical practice has dramatically changed the field of surgery. Patients undergoing laparoscopic surgery have less post-operative pain, less impairment of vital functions, a shorter hospital stay, earlier resumption of oral intake and normal activities and, a better cosmesis. The last two decades (1992-2011) have seen a tremendous advancement of laparoscopic surgery in Brunei Darussalam. **Materials and Methods:** This article reviews the current position of laparoscopic techniques for the most frequently performed procedures in General Surgery and reflects two decades of experience with laparoscopic surgery, in the diagnosis and treatment of abdominal conditions in Brunei Darussalam. **Results:** A total of 4,094 cases of laparoscopic procedures have been performed during this period. The majority of our experience involves laparoscopic cholecystectomy, laparoscopic appendectomy, laparoscopic colorectal resections, laparoscopic perforated peptic ulcer repair, laparoscopic adrenalectomy, laparoscopic splenectomy and more recently laparoscopic adjustable gastric banding. **Conclusions:** In Brunei Darussalam, we have accumulated 20 years of clinical experience and scientific research with laparoscopic surgery. Given the high success rates achievable by our skilled surgeons, and the high levels of patient satisfaction, laparoscopic surgery has become the patient's procedure of choice.

Keywords: Laparoscopic surgery, advantages, frequently performed procedures

INTRODUCTION

The introduction of laparoscopic surgery into clinical practice approximately 25 years ago has dramatically changed the field of surgery. Laparoscopic surgery has often been considered as the third paradigm shift in surgery, following the introduction of aseptic techniques and anaesthesia. Countless case stud-

ies, numerous randomised controlled trials and several meta-analyses have demonstrated the advantages of this technique. Patients undergoing laparoscopic surgery have less post-operative pain, less impairment of vital functions, a shorter hospital stay, earlier resumption of oral intake and normal activities post-operatively, and a better cosmesis.^{1, 2}

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Despite the proven advantages of laparoscopic surgery, the integration of this technique into daily clinical routine has been

initially sluggish as it is often considered 'difficult' by the surgeon. It is a completely novel technique that must be learned by even the most experienced conventional surgeon. The optic field is different, the surgeon works indirectly and tactile sensations are greatly reduced. The operating field is displayed on a monitor, leading to changes in the axis between head, arm, eye and operating field. The surgeon must develop new strategies to compensate for the two-dimensionality and the resulting loss of depth perception. The instrumentation is also different; the long and rigid instruments requiring greater agility. Considering these difficulties, especially in mastering the 'video-eye-hand' coordination,¹ it is not surprising that laparoscopic surgery has a substantial learning curve. It demands time, patience, mental strength and persistence. Many have attempted this new technique but only a few have integrated it into their daily routine, with the exception of cholecystectomy. Another concern is cost. Patient advantages are often offset by the high expenditure for specialised equipment, longer operating times and use of more material, all of which increases cost.

Despite the shortcomings mentioned

above, the last decade has seen a tremendous expansion of laparoscopic surgery in General Surgery, mainly due to the development of new instruments and the refinement of established techniques. The benefits of laparoscopic surgery have also ensured that this technique is now the standard of care for many operative procedures across different surgical specialties.

In Brunei Darussalam, we started to embrace laparoscopic surgery in 1992. The surgeons in Raja Isteri Pengiran Anak Saleha (RIPAS) Hospital then, deserve credit for their foresight as they immediately recognised the benefits and potential of laparoscopic surgery, which was at the time considered a novel technique. They were also cautious and took a measured approach to the introduction of laparoscopic surgery to Brunei Darussalam. The approach included initially attending laparoscopic surgery courses overseas, followed by live surgical sessions conducted in RIPAS Hospital with the help of experienced laparoscopic surgeons from Singapore (Figure 1). Following the successful introduction of laparoscopic surgery in RIPAS Hospital, other hospitals in Brunei Darussalam began to adopt this technique. Suri Seri Begawan (SSB) Hospital



Fig. 1: Live laparoscopic surgery session conducted in 1992 in RIPAS Hospital with the help of experienced laparoscopic surgeons from Singapore.

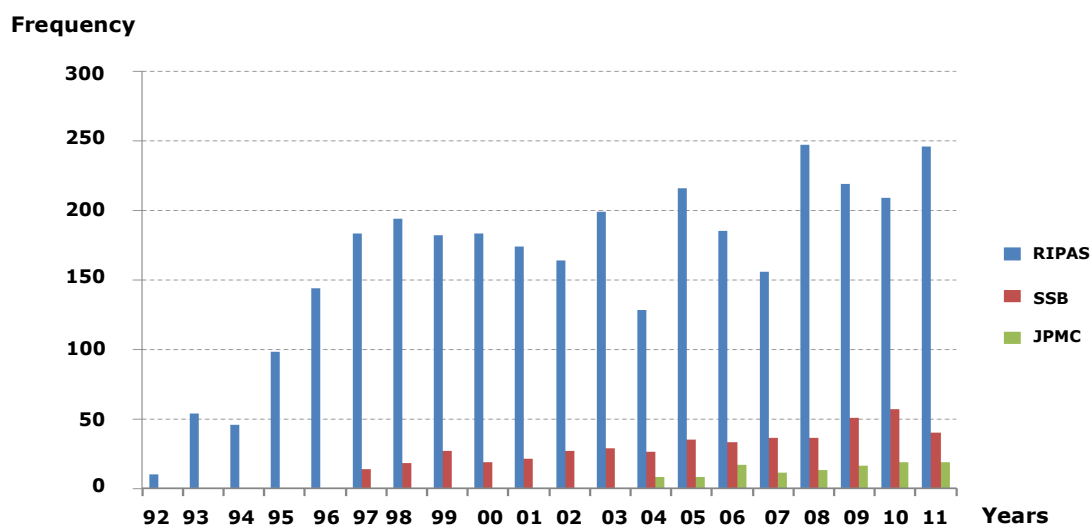


Fig. 2: Total number of laparoscopic procedures performed in the three hospitals in Brunei Darussalam (1992 to 2011). RIPAS-Raja Isteri Pengiran Anak Saleha; SSB-Suri Seri Begawan; JPMC-Jerudong Park Medical Centre.

first laparoscopic surgery in 1997 and Jerudong Park Medical Centre performed their first laparoscopic surgery in 2004 (Figure 2).

The last two decades (1992 – 2011) have seen a tremendous advancement of laparoscopic surgery in Brunei Darussalam. A total of 4,094 cases of laparoscopic procedures were performed during this period. The majority of our experience involves laparoscopic cholecystectomy, laparoscopic appendectomy, laparoscopic colorectal resections, laparoscopic perforated peptic ulcer repair, laparoscopic adrenalectomy, laparoscopic splenectomy and more recently laparoscopic adjustable gastric banding (Figure 3).

This article reviews the current position of laparoscopic techniques among the most frequently performed procedures in General Surgery and reflects on the two decades of experience with laparoscopic surgery, in the diagnosis and treatment of abdominal conditions in Brunei Darussalam. This article, however, does not include laparoscopic gynaecological procedures.

Laparoscopic Cholecystectomy (LC)

The first reported laparoscopic removal of a gallbladder was in 1987 by Phillippe Mouret.³ Since then, rapid development and refinement of this technique has made LC the gold standard for the surgical treatment of gallstone disease.⁴ Randomised controlled trials have shown significant advantages of laparoscopy over the conventional open technique. It has been shown that patients undergoing LC have less pain, less restriction in pulmonary function, a shorter length of hospital stay, shorter time to return to work, fewer incisional hernias and higher quality of life.⁵⁻⁷ Most importantly, laparoscopic approach with small incisions makes this technique especially attractive to patients. Laparoscopic surgery is ideal for cholecystectomy; the conventional approach requiring an inordinately large access and resulting in greater intra-abdominal surgical trauma. In the laparoscopic approach, both the access and intra-abdominal surgical trauma are minimal. For the general surgeon, the unparalleled success of LC became the stimulus for expanding the role of laparoscopic surgery.

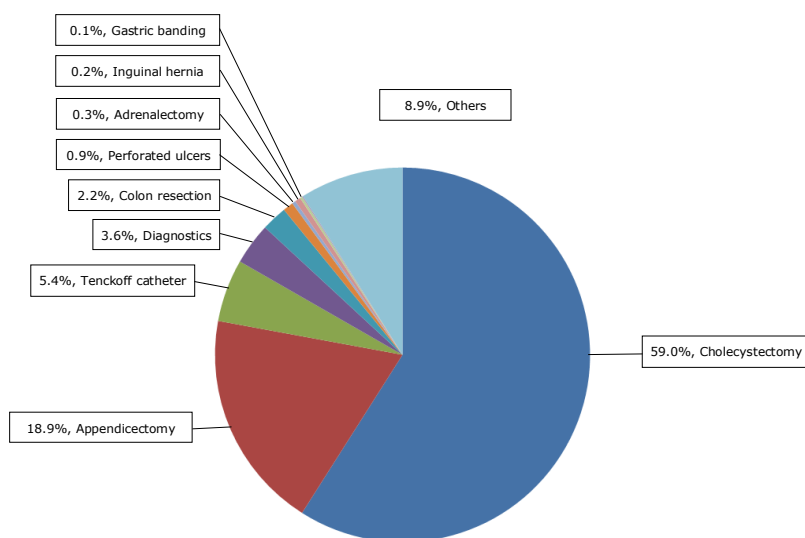


Fig. 3: Types of laparoscopic procedures performed in Brunei Darussalam from 1992 – 2011.

Our patient population included a total of 2,419 cases of LC performed over the last two decades. LC is the commonest laparoscopic procedure performed in Brunei Darussalam. Our technique and preliminary results of LC have been previously published.⁸ Briefly, LC is performed using the standard 4-port technique with an open Hasson trocar placed at the umbilicus. Pre-operative endoscopic retrograde cholangiopancreatography was employed selectively in the removal of suspected common bile duct stones by our gastroenterologists colleagues. Analysis of our patients showed that our initial results were comparable to published series,^{9,10} with a conversion rate to open surgery of 3.2%, morbidity rate of 4%, bile duct injury rate of 0.3% and a mortality rate of 0.3%. A major complication of LC is injury to the common bile duct. An earlier publication showed a distinctly higher percentage of this serious complication of laparoscopic surgery (0.5%),¹¹ while a later study showed no difference in complication rate between laparoscopic and open cholecystectomy (0.17%).¹² This was attributed to the increasing competence of surgeons by over-

coming the learning curve for the laparoscopic procedure.

Acute cholecystitis still presents a particular challenge to LC. Success rates varying from 30% to 75% for different hospitals have been reported, depending on the surgeon's experience.¹³ Moreover, the conversion rate from laparoscopic to open surgery increases from 3.6% in uncomplicated gallbladder to 19.5% in acute cholecystitis.¹³ Acute cholecystitis was considered a relative contraindication and LC was only performed six weeks after the acute episode. With experience, LC is now performed for acutely inflamed gallbladder. However, it is recommended that surgery should be performed as early as possible following the onset of symptoms. The sooner the operation is performed, the lower the rates of conversion and morbidity.^{14,15} In addition, a significantly shorter hospital stay helps to lower health care costs.

Laparoscopic Appendectomy (LA)

LA was first described by Kurt Semm in 1981.¹⁶ Since then, there have been many reports,

including randomised controlled trials and meta-analyses comparing LA and open appendectomy.¹⁷⁻¹⁹ Laparoscopic approach has been shown to result in lower incidence of wound infection, shortened post-operative recovery time and better diagnostic accuracy; but, longer operating time and higher hospital costs. A recent analysis of 7,532 patient showed that LA was associated with lower infection rates, fewer complications, shorter hospital stays, and lower expenditures than open surgery.²⁰

In the last two decades, we have performed a total of 775 cases of LA. Our earlier analysis showed that LA was employed in only 10.5% of patients with suspected acute appendicitis in RIPAS Hospital.¹³ For those patients who underwent LA, there were equal numbers of males and females with a mean age of 30.3 years, the mean operating time was 62 minutes, the conversion rate to open appendectomy was 3% (due to perforated appendicitis with abscess formation) and a morbidity of 2%. There was no wound infection and no mortality.²¹

Perforated appendicitis was initially considered a contraindication for LA. However, several studies since, have shown that complicated appendicitis can also be treated successfully laparoscopically,²²⁻²⁴ with an increase in the conversion rate to 47%. Operative success in complicated appendicitis depends on a diligent intra-abdominal lavage, placement of drain and safe removal of the appendix.

Laparoscopic Insertion of Tenckhoff Catheter

Continuous ambulatory peritoneal dialysis (CAPD) using a Tenckhoff catheter is a well-

established treatment for patients with end-stage renal disease. In Brunei Darussalam, it has been shown that CAPD is a viable renal replacement therapy with comparable peritonitis rate, patient employment rate and patient survival rate, to other countries.²⁹ A major and frustrating complication of CAPD is mechanical outflow obstruction due to migration of the catheter tip followed by omental wrapping, which is reported to occur in up to 60% of the patients undergoing the open technique. We have described a 2-port technique of laparoscopically placing the Tenckhoff catheter with a means to secure the catheter tip in the pelvic cavity.³⁰

We have used this laparoscopic technique in placing Tenckhoff catheter in 216 patients with end-stage renal failure. Our series showed that this laparoscopic technique can be performed safely with no mortality and low morbidity.³¹ This technique increases catheter longevity by minimising catheter migration while providing all the advantages of laparoscopic surgery.

Laparoscopic Colorectal Resection (LCRR)

Since the first report on the feasibility of LCRR was demonstrated in 1991,³² the uptake of LCRR is increasing. Nevertheless, laparoscopic surgical techniques for the colon have not enjoyed as rapid a rise in popularity as many other laparoscopic procedures have throughout the 1990s. Several factors have accounted for this difference, including a steep learning curve for the surgeon, the need for laparoscopic intra-abdominal vascular control, longer operative time, the need for larger incisions to retrieve specimens, and concerns over the oncologic safety of the procedure in malignant disease.³³

LCRR has been shown to be feasible and safe, provided the surgeon has appropriate experience and the patients have been properly selected.³⁴⁻³⁶ A meta-analysis of 12 randomised controlled trials assessing the short-term outcome following LCRR confirmed the advantages of the laparoscopic technique for the patient.³⁷ These include less pain leading to earlier mobilisation, reduced impairment of pulmonary function leading to lower rates of pneumonia and more rapid recovery of intestinal function leading to more rapid nutritional recovery. Additionally, the laparoscopic technique is associated with less surgical trauma, higher quality of life and fewer wound complications. A recent analysis has shown that LCRR was associated with lower infection rates, fewer complications, shorter hospital stays and lower expenditures than open surgery.²⁰

The role of laparoscopy in the management of benign colorectal diseases is more clearly defined and its benefits are clearly demonstrated.^{38, 39} However, its application in malignant colorectal conditions has been controversial. The most important question in LCRR concerns oncological radicality. Studies have shown that LCRR for malignancy was as good as or superior to open surgery in terms of length of specimen, safety margins and number of lymph nodes retrieved.^{36, 40} A published meta-analysis of 35 studies with more than 3,935 patients came to the same conclusion that laparoscopy can ensure adequate oncological resection.⁴¹ A Cochrane review of the short term outcomes among 3,526 patients from 25 randomised trials, showed that quality of life was improved in patients undergoing laparoscopic surgery and hospital stay was reduced by 1.4 days.⁴² Another system-

atic review of long term outcomes has also shown equivalence between laparoscopic and open techniques and more importantly, no difference between tumour recurrence rates.

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In the last two decades, a total of 88 LCRRs were performed in Brunei Darussalam. Our own experience with LCRR⁴⁴ also showed a low morbidity and mortality coupled with a rapid return of gastrointestinal function and earlier discharge from hospital and better cosmesis.

Laparoscopic Perforated Duodenal Ulcer (PDU) Repair

Elective surgery for peptic ulcer disease has decreased significantly over the years due to the introduction of effective medical therapies (histamine type 2-receptor antagonists and proton pump inhibitors). However, the principal complications of perforation and haemorrhage remain indications for surgery.⁴⁵

Since the first description of laparoscopic repair of perforated peptic ulcer,⁴⁶ many techniques have been recommended. Perforations can be repaired by intracorporeal suturing or using surgical stapling devices, covering the defect using an omental patch or closing it with a fibrin sealant or a gelatin plug product.^{47, 48} Published reports have suggested that the laparoscopic approach may offer the advantages of reduced surgical wound and diminished post-operative pain, fewer post-operative complications, less intestinal manipulation with diminished post-operative ileus and reduced long-term risk of adhesive obstructive complications and an earlier return to daily activities.^{49, 50}

We have performed 38 cases of lapa-

roscopic PDU repair in the last two decades. Our series comparing laparoscopic and open PDU repair showed that patients with laparoscopic repair required less post-operative analgesia; however, there was no significant difference between the resumption of normal diet, hospital stay, morbidity or mortality between the two groups.⁵¹

A meta-analysis of three randomised trials comprising of 315 patients showed that although there was a tendency to a decrease in septic intra-abdominal complications, surgical site infection, post-operative ileus, pulmonary complications and mortality with laparoscopic repair as compared to open surgery, none of these were statistically significant. An increased tendency in the number of intra-abdominal abscesses and re-operations was observed; but, without statistical significance.

52

Laparoscopic Inguinal Hernia (IH) Repair

Laparoscopic IH repair was first reported in the early 1990's.^{53, 54} Currently, the two most commonly performed laparoscopic IH repairs are the transabdominal pre-peritoneal repair (TAPP) and the totally extra-peritoneal repair (TEP). The TAPP procedure approaches the groin area by first entering the peritoneal cavity, whereas the TEP enters only the pre-peritoneal plane. Both procedures allow good visualisation of the entire groin region and identification of direct, indirect or femoral hernia. As in open surgery, the aim of laparoscopic IH repair is reduction of the hernial sac and its contents followed by a tension free repair with a mesh.

The issues regarding laparoscopic IH repair were: Which is the better approach,

TAPP or TEP? and hernia recurrence rate. A Cochrane collaboration meta-analysis published in 2005 comparing TAPP and TEP repair reported no difference in recurrence rates, duration of operation, haematoma formation, length of hospital stay or time to return to work or activity.⁵⁵ The review also found that the TAPP approach was associated with higher rates of port-site hernias and visceral injuries though there was no difference in infection rates or vascular injury. In addition, there appeared to be a higher rate of conversion to open surgery in attempted TEP repair. The authors concluded that with seemingly similar results and complications' the choice between the two procedures should firmly be based on the surgeon's experience and preference. Randomised trials comparing open and laparoscopic IH repair showed no difference in the recurrence rate between the two procedures.

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In the last two decades, we have only performed 24 laparoscopic IH repairs using the TAPP technique. Our series is too small to make any meaningful deductions. The reason for the slow pick-up rate of laparoscopic IH repair in Brunei Darussalam is the steep learning for laparoscopic technique (reported to be between 60-100 cases) and the excellent result with open mesh repair. The open mesh repair is easier to learn and readily adopted by trainee surgeons. Currently laparoscopic IH surgery requires a general anaesthetic while many open hernias can be performed under local anaesthetic.

Laparoscopic Adrenalectomy

Since its first report in 1992,⁵⁸ laparoscopic adrenalectomy has been shown to be safe and effective in the treatment of functioning and

non-functioning adrenal lesions.⁵⁹ Traditional open surgery involves large incisional access to the adrenal glands via the anterior or flank transperitoneal, posterior or flank retroperitoneal or thoracoabdominal approaches. There is no doubt that adrenal lesions offer the ideal indication for laparoscopic surgery, provided that a certain tumour size is not exceeded. In a review analysing 50 studies on laparoscopic adrenalectomy and 48 studies on open adrenalectomy, it was concluded that laparoscopic adrenalectomy resulted in fewer wound and pulmonary complications, less post-operative pain, faster post-operative recovery and a shorter length of hospital stay than open adrenalectomy.⁶⁰ Both the transperitoneal and retroperitoneal laparoscopic approaches have advantages over the open method. One randomized controlled trial found no difference between these two laparoscopic approaches in terms of operating time, analgesic consumption, complications and length of hospital stay.⁶¹

We have performed 13 laparoscopic adrenal-sparing or partial adrenalectomy surgery for primary hyperaldosteronism due to adosterone-producing adenoma, in the last two decades. One of our cases involved laparoscopic bilateral partial adrenalectomies. Our results showed minimal post-operative pain, early post-operative ambulation and shorter hospital stay with no morbidity or mortality.⁶²

Laparoscopic Splenectomy

The first cases of laparoscopic splenectomy were on patients with Hodgkin's disease, reported in 1992⁶³ and on patients with thrombocytopenic purpura, reported in 1993.⁶⁴ Since then, many published articles have reported the efficacy of laparoscopic splenecto-

my for haematologic diseases⁶⁵ and have concluded that laparoscopic splenectomy was the procedure of choice for most haematologic disorders.⁶⁶ We had reported our technique and have since then performed 8 cases of laparoscopic splenectomy for haematological conditions.⁶⁷

Laparoscopic Adjustable Gastric Banding (AGB)

Surgery for morbid obesity (or bariatric surgery) has a long history and is medically indicated for morbidly obese patients who fail to respond to dietary, behavioral, nutritional and medical therapies. Bariatric surgery is the most effective treatment for severe obesity, producing durable weight loss, improvement of comorbid conditions and prolonging life. Roux-en-Y gastric bypass, adjustable gastric banding (AGB), biliopancreatic diversion with duodenal switch and sleeve gastrectomy are validated surgical procedures that may be performed laparoscopically.⁶⁸

Inspired by the open gastric banding procedures, laparoscopic AGB was first described in 1993.⁶⁹ It involves the placement of a restrictive inflatable balloon device around the gastric cardia approximately 1cm below the gastro-oesophageal junction. This balloon is connected by tubing to a subcutaneous port, which is attached below the skin of the abdominal wall. Saline injected into the port will cause balloon inflation, which results in narrowing of the stomach at the level of the balloon. The laparoscopic AGB is placed via the pars flaccida approach, through a retrogastric tunnel between the pars flaccida medially and the angle of His laterally. Application of the commercially available adjustable gastric band at this level creates a 15-25ml gastric pouch.⁶⁹ The first balloon adjustment

usually occurs 6 weeks after band placement. Fluid is added if weight loss falls below expectations or if meal volumes increase with loss of satiety. Adjustment is not needed if there is adequate weight loss, satiety and tolerance. Fluid should be removed if there is vomiting, coughing, choking or significant solid food intolerance.

In the last two years, we have started performing laparoscopic AGB in RIPAS Hospital. Although our numbers are currently small, we have found that laparoscopic AGB surgery is a safe and effective procedure that enables major and durable weight loss in association with improvement or resolution of a broad range of serious health problems, comparable to published reports.^{70, 71}

The Current Status of Laparoscopic Surgery

To reduce intra-operative and post-operative morbidity, and improve post-operative cosmesis, research has focused on further minimising the invasiveness of laparoscopic procedures. The single-incision laparoscopic surgery (SILS) uses the same anterior abdominal wall access as laparoscopic surgery, but only requires one small 2cm incision, placed in the umbilicus, which offers good cosmesis as the scar is hidden within the umbilical folds.⁷² Since its description in 1992,⁷³ there has recently been an increase in the popularity of SILS, due to a shift away from the traditional concept of laparoscopic surgery and the availability of specialised instrumentation.⁷⁴⁻⁷⁶ The currently cited benefits SILS include the potential for reduced cost and improved patient satisfaction.⁷⁷

Laparoscopic surgery with a completely scarless approach can be achieved

with natural orifice transluminal endoscopic surgery (NOTES). NOTES procedure allows access to the peritoneal cavity through the natural orifices (oral, rectal, vaginal or vesical routes), thereby avoiding the need for abdominal wall incisions.⁷⁸ However, the progress of NOTES has been slow due to a number of drawbacks e.g. increased operative time as compared to conventional laparoscopic surgery, the need for specialised equipment (which requires additional training) and a steep learning curve for the surgeon due to the new instrumentation and operative approach. Of major concern are the potential complications arising from the intentional breaching of the orifice wall during access to the peritoneal cavity.⁷⁹ To date, both SILS and NOTES have not been introduced to Brunei Darussalam.

CONCLUSIONS

In Brunei Darussalam, we have accumulated 20 years of clinical experience and scientific research with laparoscopic surgery. Given the high success rates achieved by our skilled surgeons, and the high levels of patient satisfaction, laparoscopic surgery has become the patient's procedure of choice. The advantages of laparoscopic over conventional surgery are primarily, pain reduction, shorter length of hospital stay and faster resumption of usual activities. In addition, it also has lower morbidity rates and less impairment of the immune system. Furthermore, it has no disadvantages in terms of oncological radicality when applied to colorectal cancer excision.

However, one must realize that laparoscopic surgery only represents a different technique that offers an alternative to open surgery. The indications for surgery are simi-

lar for both laparoscopic and open surgery. Hence, the same preoperative criteria must be followed rigorously.

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REFERENCES

1: Soper NJ, Brunt ML, Kerbl K. Laparoscopic general surgery. *N Engl J Med* 1994; 330:409-19.

2: Himel HS. Minimally invasive (laparoscopic) surgery: the future of general surgery. *Surg Endosc* 2002; 16:1647-52.

3: Mouret P. From the first laparoscopic cholecystectomy to the frontiers of laparoscopic surgery: the future prospectives. *Dig Surg* 1991; 8:124.

4: Bittner R. The standard of laparoscopic cholecystectomy. *Arch Surg* 2004; 389:157-63.

5: McMahon AJ, Russell IT, Bacter JN, et al. Laparoscopic vs. minilaparotomy cholecystectomy: a randomized trial. *Lancet* 1994; 343:135-8.

6: Hendolin HI, Paakonen ME, Alhava EM, et al. Laparoscopic or open cholecystectomy: a prospective randomized trial to compare postoperative pain, pulmonary function and stress response. *Eur J Surg* 2000; 166:394-9.

7: Ros A, Gustafsson L, Krook H, et al. Laparoscopic cholecystectomy vs. mini-laparotomy cholecystectomy: a prospective, randomized, single-blind study. *Ann Surg* 2001; 234:741-9.

8: Kok KY, Mathew VV, Tan KK, Yapp SKS. A prospective review of laparoscopic cholecystectomy in Brunei. *Surg Laparosc Endosc* 1998; 8:120-2.

9: Cushieri A, Dubois F, Mouriel J, et al. The European experience with laparoscopic cholecystectomy. *Am J Surg* 1991; 161:385-7.

10: Southern Surgeons Club. A prospective analysis of 1,518 laparoscopic cholecystectomy. *N Eng J Med* 1991; 324:1073-8.

11: Williams LF, Chapman WC, Bonau RA, et al. Comparison of laparoscopic cholecystectomy with open cholecystectomy in a single center. *Am J Surg* 1993;165:459-65.

12: Archer SB, Brown DW, Smith CD, et al. Bile

duct injury during laparoscopic cholecystectomy: result of a national survey. *Ann Surg* 2001; 234:549-59.

13: Krahenbuhl L, Sclabas G, Wente MN, et al. Incidence, risk factors, and prevention of biliary tract injuries during laparoscopic cholecystectomy in Switzerland. *World J Surg* 2001; 25:1325-30.

14: Lo CM, Liu CL, Lai EC, et al. Early vs. delayed laparoscopic cholecystectomy for treatment of acute cholecystitis. *Ann Surg* 1996; 223:37-42.

15: Johansson M, Thune A, Blomqvist A, et al. Management of acute cholecystitis in the laparoscopic era: results of a prospective, randomized clinical trial. *J Gastrointest Surg* 2003; 7:642-5.

16: Semm K. Endoscopic appendectomy. *Endoscopy* 1983; 15:59-64.

17: Kazemier G, de Zeeuw GR, Lange JR, et al. Laparoscopic vs. open appendectomy: a randomized clinical trial. *Surg Endosc* 1997; 11:336-40.

18: Chung RS, Rowland DY, Li P, Diaz J. A meta-analysis of randomized controlled trials of laparoscopic vs. conventional appendectomy. *Am J Surg* 1999; 177:250-6.

19: Golub R, Siddiqui F, Pohl D. Laparoscopic vs. open appendectomy: a meta-analysis. *J Am Coll Surg* 1998; 186:545-53.

20: Fullum TM, Ladapo JA, Borah BJ, Gunnarsson CJ. Comparison of the clinical and economic outcomes between open and minimally invasive appendectomy and colectomy: evidence from a large commercial payer database. *Surg Endosc* 2010; 24:845-53.

21: Kok KY. Laparoscopic Surgery: RIPAS Hospital's experience. *Brunei Int Med J.* 1999;1:115-20.

22: Wullstein C, Barkhausen S, Gross E. Results of laparoscopic vs. conventional appendectomy in complicated appendicitis. *Dis Colon Rectum* 2001; 44:1700-5.

23: So JB, Chiong EC, Chiong E, et al. Laparoscopic appendectomy for perforated appendicitis. *World J Surg* 2002; 26:1485-8.

24: Mancini GJ, Mancini ML, Nelson HS Jr. Efficacy of laparoscopic appendectomy in appendicitis with peritonitis. *Am Surg* 2005;71:1-4.

25: Kok KY, Yapp Samuel KS. Laparoscopic surgery

in acute peritonitis. *J Endosc Laparosc Surg Asia* 1997; 3:4-5.

26: Geis WP, Kim HC. Use of laparoscopy in the diagnosis and treatment of patients with surgical abdominal sepsis. *Surg Endosc* 1995; 9:178-82.

27: Cueto J, Diaz O, Garteiz D, et al. The efficacy of laparoscopic surgery in the diagnosis and treatment of peritonitis. *Surg Endosc* 1997; 11:366-70.

28: Kok KY, Yapp Samuel KS. Laparoscopic drainage of postoperative complicated intra-abdominal abscesses. *Surg Laparosc Endosc* 2000; 10:311-3.

29: Dwarakanathan R, Alwi IK, Aung H, Chin SSI. Continuous ambulatory peritoneal dialysis, is it adequate therapy for end stage renal diseases in small countries? *Brunei Int Med J.* 1999; 1:281-5.

30: Kok KY, Tan KK, Yapp SKS. A two-port technique of laparoscopic placement of Tenckhoff catheter with a means to prevent catheter migration. *Surg Endosc* 1999; 13:1057-8.

31: Kok KY. Laparoscopic placement of continuous peritoneal dialysis catheter. *Brunei Int Med J* 2000; 2:411-4.

32: Fowler DL, White SA. Laparoscopy-assisted sigmoid resection. *Surg Laparosc Endosc* 1991;1:183-8.

33: Lacy A. Colon cancer: laparoscopic resection. *Ann Oncol* 2005; 16:88-95.

34: Monson JR, Darzi A, Carey PD, Guillou PJ. Prospective evaluation of laparoscopic-assisted colectomy in an unselected group of patients. *Lancet* 1992; 340:831-3.

35: Phillips EH, Franklin M, Carroll BJ, et al. Laparoscopic colectomy. *Ann Surg* 1992; 216:703-7.

36: Kok KY, Ngoi SS. Laparoscopic colon resection: current status. *Asian J Surg* 1998; 21:37-42.

37: Abraham NS, Young JM, Solomon MJ. Meta-analysis of short-term outcomes after laparoscopic resection for colorectal cancer. *Br J Surg* 2004; 91:1111-24.

38: Tan JJ, Tjandra JJ. Laparoscopic surgery for ulcerative colitis a meta-analysis. *Colorectal Dis* 2006; 8:626-36.

39: Gervz P, Inan I, Perneger T, et al. A prospective, randomized, single-blind trial of laparoscopic vs. open sigmoid colectomy for

diverticulitis. *Ann Surg* 2010; 252:3-8.

40: Franklin ME Jr, Rosenthal D, Abrego-Medina D, et al. Prospective comparison of open vs. laparoscopic colon surgery for carcinoma, five-year results. *Dis Colon Rectum* 1996; 39:35-46.

41: Korolija D, Tadic S, Simic D. Extent of oncological resection in laparoscopic vs. open colorectal surgery: meta-analysis. *Langenbecks Arch Surg* 2003; 387:366-71.

42: Schwenk W, Haase O, Neudecker JJ, Muller JM. Short term benefits for laparoscopic colorectal resection. *Cochrane Database Syst Rev* 2005; 2:CD003145.

43: Kuhry E, Schwenk W, Gaupset R, et al. Long-term results of laparoscopic colorectal cancer resection. *Cochrane Database Syst Rev* 2008; 2:CD003432.

44: Kok KY. Laparoscopic colorectal surgery: inception, expectations and tribulations. *Brunei Int Med J* 2000; 2:49-55.

45: Svanes C, Lie RT, Kvale G, et al. Incidence of perforated ulcer in western Norway, 1935-1990: cohort or period-dependent time trends? *Am J Epidemiol* 1995; 141:836-44.

46: Mouret P, Francois Y, Vagnal J, et al. Laparoscopic treatment of perforated peptic ulcer. *Br J Surg* 1990; 77:1006.

47: Matsuda M, Nishiyama M, Hanai T, et al. Laparoscopic omental patch repair for perforated peptic ulcer. *Ann Surg* 1995; 221:236-40.

48: Tate JJ, Dawson JW, Lau WY, Li AK. Sutureless laparoscopic treatment of perforated duodenal ulcer. *Br J Surg* 1993; 80:235.

49: Naesgaard JM, Edwin B, Reiertsen O, et al. Laparoscopic and open operation in patients with perforated peptic ulcer. *Eur J Surg* 1999; 165:209-14.

50: Michelet I, Agresta F. Perforated peptic ulcer: laparoscopic approach. *Eur J Surg* 2000;66:405-8.

51: Kok KY, Mathew VV, Yapp SK. Laparoscopic omental patch repair for perforated duodenal ulcer. *Am Surg* 1999; 65:27-30.

52: Sanabria A, Villegas MI, Morales Uribe CH. Laparoscopic repair for perforated peptic ulcer disease (Review). *Cochrane Collaboration* 2010; 4:1-29.

- 53:** Arregui ME, Davis CJ, Yucel O, et al. Laparoscopic mesh repair of inguinal hernia using a preperitoneal approach: a preliminary report. *Surg Laparosc Endosc* 1992; 2:53-8.
- 54:** McKernan JB, Laws HL. Laparoscopic repair of inguinal hernias using a totally extraperitoneal prosthetic approach. *Surg Endosc* 1993; 7:26-8.
- 55:** Wake BL, McCormack K, Fraser C, et al. Transabdominal preperitoneal (TAPP) vs. totally extraperitoneal (TEP) laparoscopic techniques for inguinal hernia repair. *Cochrane Database Syst Rev* 2005; 1:CD004703.
- 56:** Neumayer L, Giobbie-Hurder A, Jonasson O, et al. Open mesh versus laparoscopic mesh repair of inguinal hernia. *N Engl J Med* 2004; 350:1819-27.
- 57:** Butters M, Redecke J, Köninger J. Long-term results of a randomised clinical trial Shouldice, Lichtenstein and transabdominal preperitoneal hernia repairs. *Br J Surg* 2007; 94:562-5.
- 58:** Gagner M, Lacroix A, Bolte E. Laparoscopic adrenalectomy in Cushing's syndrome and pheochromocytoma. *N Engl J Med* 1992; 327:1033.
- 59:** Gupta PK, Natarajan B, Pallati PK, et al. Outcomes after laparoscopic adrenalectomy. *Surg Endosc* 2011; 3:784-94.
- 60:** Brunt LM. The positive impact of laparoscopic adrenalectomy on complications of adrenal surgery. *Surg Endosc* 2002; 16:252-7.
- 61:** Fernandez-Cruz L, Saenz A, Benarroch G, et al. Laparoscopic unilateral and bilateral adrenalectomy for Cushing's syndrome. Transperitoneal and retroperitoneal approaches. *Ann Surg* 1996; 224:727-34.
- 62:** Kok KY, Yapp SKS. Laparoscopic adrenal-sparing surgery for primary hyperaldosteronism due to aldosterone-producing adenoma. *Surg Endosc* 2002; 16:108-11.
- 63:** Carroll BJ, Phillips EH, Semel CJ, et al. Laparoscopic splenectomy. *Surg Endosc* 1992; 6:183-5.
- 64:** Lefor AT, Melvin WS, Bailey RW, Flowers JL. Laparoscopic splenectomy in the management of Immune thrombocytopenic purpura. *Surgery* 1993; 114:613-8.
- 65:** Pasquallacci A, Bresadola F. Laparoscopic vs. open splenectomy in the management of hematologic diseases. *Surg Endosc* 1999;13:1220-5.
- 66:** Katkhouda N, Mavor E. Laparoscopic splenectomy. *Surg Clin North Am* 2000; 80:1285-97.
- 67:** Kok KY, Mathew VV, Yapp SKS. Laparoscopic splenectomy: a report of two cases. *Singapore Med J* 1998; 39:473-4.
- 68:** Farrell TM, Haggerty SP, Overby DW, et al. Clinical application of laparoscopic bariatric surgery: an evidence-based review. *Surg Endosc* 2009; 23:930-49.
- 69:** Belachew M, Legrand MJ, Defechereux TH, et al. Laparoscopic adjustable silicone gastric banding in the treatment of morbid obesity: a preliminary report. *Surg Endosc* 1994; 8:1354-6.
- 70:** O'Brien PE, Dixon JB, Laurie C, Anderson M. A prospective randomized trial of placement of the laparoscopic adjustable gastric band: comparison of the perigastric and pars flaccida pathways. *Obes Surg* 2005; 15:820-6.
- 71:** Dixon JB, O'Brien P. Health outcomes of severely obese type 2 diabetic subjects 1 year after laparoscopic adjustable gastric banding. *Diabetes Care* 2002; 25:358-63.
- 72:** Gill IS, Advincola AP, Aron M, et al. Consensus statement of the consortium for laparoendoscopic single-site surgery. *Surg Endosc* 2010; 24:762.
- 73:** Pelosi MA, Pelosi 3rd MA. Laparoscopic appendectomy using a single umbilical puncture (mini laparoscopy). *J Reprod Med* 1992; 37:588.
- 74:** Antoniou SA, Pointner R, Grandrath FA. Single-incision laparoscopic cholecystectomy: a systematic review. *Surg Endosc* 2011; 25:367-77.
- 75:** Nguyen NT, Hinojosa MW, Smith BR, Reavis KM. Single laparoscopic incision transabdominal (SLIT) surgery adjustable gastric banding: a novel minimally invasive surgical approach. *Obes Surg* 2008; 18:1628.
- 76:** Lee YY, Kim TJ, Kim CJ, et al. Single port access laparoscopic adnexal surgery vs. conventional laparoscopic adnexal surgery: a comparison of perioperative outcomes. *Eur J Obstet Gynecol Reprod Biol* 2010; 151:181.
- 77:** Rao A, Kynaston J, Macdonald ER, Ahmed I. Patient preferences for surgical techniques: should we invest in new approaches? *Surg Endosc* 2010;24:3016-25.

78: Gettman MT, Box G, Averch T, et al. Consensus statement on natural orifice transluminal endoscopic surgery and single-incision laparoscopic surgery: heralding a new era in urology? *Eur Urol* 2008; 53: 1117-20.

79: Lehmann KS, Ritz JP, Wibmer A, et al. The German registry for natural orifice transluminal endoscopic surgery: report of the first 551 patients. *Ann Surg* 2010; 252:263-70.

