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Original Research Article

The comparative study of intraperitoneal access by open versus close method to create pneumoperitoneum in laparoscopic surgeries

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ABSTRACT

Background: Laparoscopy is a Latin word; 'laparo' means abdomen and 'scopein' means to examine, hence it is an art of examination of abdomen and visceral contents. laparoscopic procedure has been revolutionized and come under routine practice by surgical subspecialties because of it has many advantages over conventional laparotomy like small size scar, short hospital stays, less chance of wound infection, minimal postoperative pain, quick recovery after surgery. The aim of the study was to compare the rates and nature of complication during creation of pneumoperitoneum in open and closed laparoscopic procedure.
Methods: This is a single centre, comparative, observational study. Tools of study include, observation, intraoperative and post-operative observation of complications. Nonprobability sampling (purposive sampling) technique was used in this study. Sample size was 44 (in each group). Written and Informed consent has been taken from all patients who were underwent abdominal laparoscopic surgery.
Results: This study represents the comparison between different open and closed methods for creation of pneumoperitoneum in laparoscopic abdominal surgeries. In this study, according to classification of complication at entry level in open method omental injury found in 2 (12%) patients; extra peritoneal insufflations 1 (6%), port site gas leakage 10 (59%), loss of space 1 (6%), entry in wrong plane 3 (17%). In closed method omental injury found in 4 (13%) patients; extra peritoneal insufflations 4 (13%), port site gas leakage 8 (27%) loss of space 5 (17%), entry in wrong plane 7 (23%), abdominal wall haematoma 4 (13%).
Conclusions: Open method is merely safer than closed technique but due to small number of patients took into study as well as study time period is short. Final judgment for the research, multi centric trials in different institutions are required for the initial, crucial, and technically challenging step of newly emerging field of surgery.

Keywords: Closed method, Laparoscopic surgery, Open method, Pneumoperitoneum

INTRODUCTION

Laparoscopy is a Latin word; 'laparo' means abdomen and 'scopein' means to examine, hence it is an art of examination of abdomen and visceral contents.[1] A Swedish surgeon Jacobus was the first to perform this procedure in 1910, also he introduces air first time into abdominal cavity and creates pneumoperitoneum with use of cystoscope and trocar.[2] laparoscopic procedure has been revolutionized and come under routine practice by surgical subspecialties because of it has many advantages over conventional Laparotomy like small size scar, short hospital stay, less chance of wound infection, minimal postoperative pain, quick recovery after surgery.[3] Although many evidences are there of overall less complication in laparoscopy.[3] In spite of safety there is a chance of major injury to bowel, injury to bladder, injury to major vessels.[4] Majority of cases mentioned and observed, injuries can be inflicted at 1st port insertion.[4] Then it becomes very crucial and careful step of creating

pneumoperitoneum. It was Veress needle initially, which was used and was called as closed method, later on open method came in existence where, peritoneal cavity was opened under vision. Size of opening was just to the size of trocar. The use of disposable shielded trocar, radially expanding trocar and visual entry system along with their modification.[5,6] Various studies have been compared and met analysis of these had been inconclusive. All techniques are associated with either vascular or visceral injuries and no study has proved the superiority of one technique over other and till today debate still continuous as to which method is best and safe.[7,8] This study was conducted to compare the rates and nature of complication during creation of pneumoperitoneum in open and closed laparoscopic procedure.

Aim and objectives

TheaAim of the study was to compare intra peritoneal access by closed versus open method in laparoscopic abdominal surgeries to create pneumoperitoneum. Objectives of the study were to assess efficacy of both techniques in manner of intra peritoneal creation of pneumoperitoneum in abdominal laparoscopic surgeries, to study time require for both techniques for port site entry, to examine complications at entry level and examination and evaluation of complications in post-operative period.

METHODS

This is an institution based observation study.

After obtaining approval from the ethics committee of TMU hospital, Moradabad, this study was conducted at general surgery unit of TMU hospital, Moradabad with 44 sample size (in each group) from January 2019 to February 2022. Written and Informed consent has been taken from all patients who were underwent abdominal laparoscopic surgery.

Tools of study were observation, intraoperative and post-operative observation of complications.

Sampling technique used was nonprobability sampling (purposive sampling).

Inclusion criteria

All patients undergoing abdominal laparoscopic surgeries, age >20 years and <70 years were included and patients of both gender were included.

Exclusion criteria

Patients with previous abdominal surgeries, patients with local skin infections, past history of abdominal or pelvic tuberculosis, patients having co morbid medical illness and patients with umbilical and ventral hernia.

Closed technique

Commonly with the knife (no. 11) supraumbilical 5-6 mm transverse incision is to be given, blunt dissection of subcutaneous tissue is to be done with artery forceps, after dissection umbilical fascia will be palpable, abdominal wall inferior to the umbilicus is lifted.[9] By doing blunt dissection rectus sheath is identified. After lifting the abdominal wall with one hand, Veress needle is inserted through umbilical fascia from the base of umbilicus at 45 angles towards pelvis with other hand. This technique prevents injury to aorta and inferior vena cava. The surgeon can feel two clicks one at the time of piercing umbilical fascia and another one is at the time of piercing peritoneum. After that free movement of Veress needle is a confirmation of intraperitoneal placement.[10]

Saline drop test should be done for confirmation of intraperitoneal placement of verse needle.

Open technique

This technique was invented by Hasson in 1974. In this technique one of the skin incision supraumbilical, infraumbilical or trans umbilical is given approximately 2.5 cm in size. After incision, upper and lower skin flap are retracted, and subcutaneous blunt dissection done with artery forceps and reached up to rectus sheath. During incision of sheath, muscle and peritoneum should not be incised. After exposing muscle layer, with the help of artery forceps muscles are separated. Peritoneum is stabbed by artery forceps, after that peritoneum is opened and expanded carefully. If any adhesions are found, blunt dissection with fingers are done with care and should not damage underlying structures.[11] At last Hasson canula passed through above said small incision beyond peritoneum with care. Cannula will dilate incision and gives airtight fitting. If the incision is made too big to hold port in proper position, cannula is fixed with stay suture and port should be hold in proper position.[12] After connecting insufflating tube pneumoperitoneum is created under direct vision of surgeon.

At the period of enrolment of patients, need to obtain history, focus on past history of any abdominal surgery, social history of comorbid diseases, perform physical examination focusing on abdominal examination, to assess time for port entry in peritoneum, evaluation of difficulties and complications at entry level, examination and evaluation of post-operative complications, Determine the diagnosis and indication; stratify the risk factor for abdominal laparoscopic surgery, selection of technique for creation of pneumoperitoneum in laparoscopic surgery patients according to surgeons choice has been checked.

RESULTS

Table 1 illustrates, most number of patients are belonging to 31-40 year age group with frequency 12 (26.7%)

followed by 41-50 year age group, frequency 11 (24.4%) and least number of patients are from 51-60 group with frequency of 4. Highest Age of participant is 70 years and lowest age of participant is 21 years.

Table 1: Age group for open method.

Age group (Years)	N (%)
21-30	9
31-40	12 (26.7)
41-50	11 (24.4)
51-60	4
61-70	9
Total	45

In open method, total various 3 types of procedures are operated, names are as mentioned in Table 2. Among all 3 procedures, majority of patients have been operated by Lap. Cholecystectomy, frequency is 40 (88.9%) and frequency of Lap. appendicectomy patients are only 2 (4.4%), where Trans abdominal preperitoneal inguinal hernioplastyprocedure is done in 3 patients (6.7%).

Table 2: Surgical procedures for open method.

Procedure	N	Percentage (%)
Laparoscopic cholecystectomy	40	88.9
Laparoscopic appendicectomy	2	4.4
Trans abdominal preperitoneal inguinal hernioplasty	3	6.7
Total	45	100.0

Table 3 represents the open method procedure duration. Majority of procedures in open method are belonging to 2nd and 1st group of procedure duration which is 6-10 minutes and 1-5 minutes and frequency observed in both group are 22 (48.9%) and 20 (44.4%) respectively among the all operated patients. Where, 3rd group of procedure duration (11-15 minutes) have frequency of 3 (6.7%) among the all operated patients.

As described in Figure 1, there are many entry complications noticed during the procedures. Among all the entry complications in open methods, Port site gas leakage, Entry in wrong plane, omental injury, loss of space and Extra peritoneal insufflations are noticed with frequency of 10 (59%), 3 (17%), 2 (12%), 1 (6%), 1 (6%), respectively.

Table 3: Procedure duration for open method.

Duration (minutes)	N	Percentage (%)
1-5	20	44.4
6-10	22	48.9
11-15	3	6.7
Total	45	100

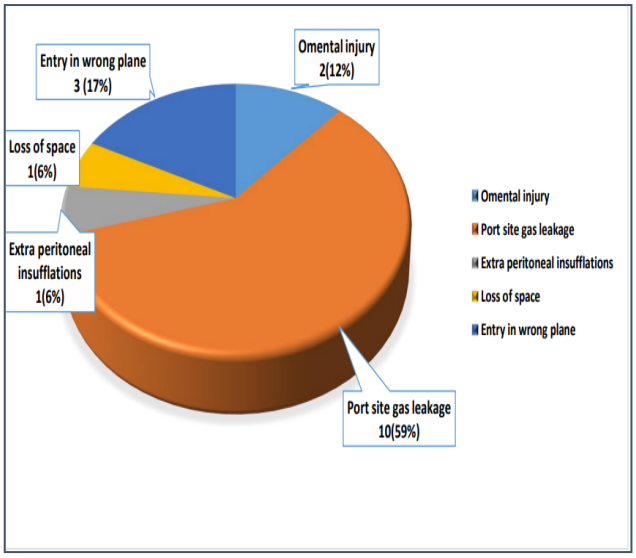

Figure 1: Entry complications of open method.

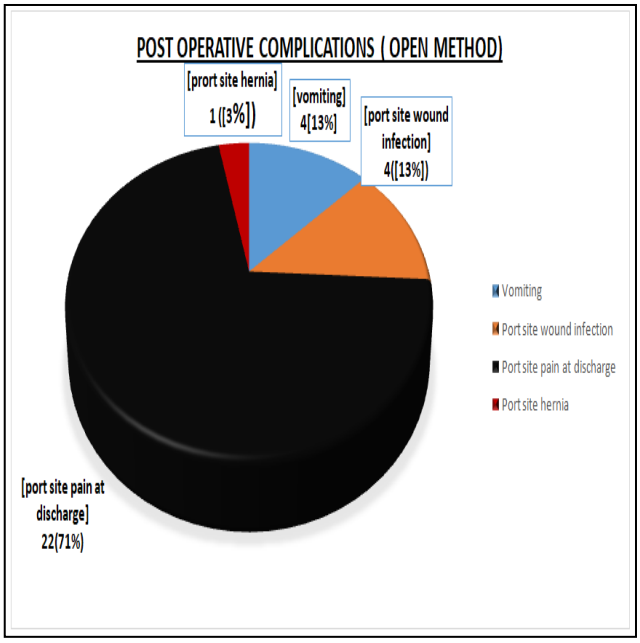

Figure 2: Post-operative complications of open method.

According to Figure 2, port site pain at discharge, port side wound infection, vomiting and port site hernia are noticed with frequency of 22 (71%), 4 (13%), 4 (13%) and 1 (3%) respectively.

Table 4: Age group for closed method.

Age group (Years)	N
21-30	19
31-40	11
41-50	7
51-60	3
61-70	5
Total	45

As Table 4 suggests, among the patients, participated in the study, most number of patients are belonging to 21-30 year age group with frequency of 19 followed by 31-40 year age group, frequency 11 and least number of patients are from 51-60 year age group with frequency of 3.

Table 5: Surgical procedures for closed method.

Procedure	N	Percentage (%)
Laparoscopic cholecystectomy	37	82.2
Laparoscopic appendicectomy	5	11.1
Trans abdominal preperitoneal inguinal hernioplasty	1	2.2
Diagnostic laparoscopy	2	4.4%
Total	45	100.0

In closed method, total various 4 types of procedures were operated, names are as follows; Lap. cholecystectomy, lap. appendicectomy, trans abdominal preperitoneal inguinal hernioplasty and diagnostic laparoscopy

Among all 4 procedures, Table 5 shows majority of patients have been operated by lap. cholecystectomy, frequency is 37 (82.2%). On the other hand, frequency of lap. Appendicectomy operated patients are 5 (11.1%). Whereas diagnostic laparoscopy is done in 2 patients (4.4%) and trans abdominal preperitoneal inguinal hernioplasty procedure is done in 1 patient (2.2%).

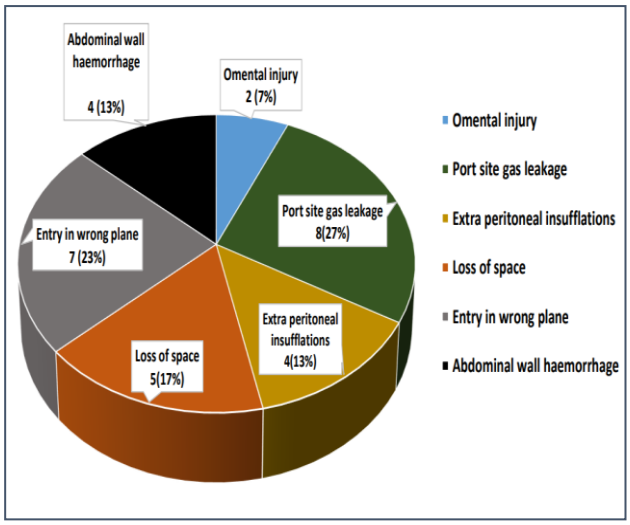

Figure 3: Entry complications for closed method.

Figure 3 shows, there are many entry complications noticed during closed method. Among all the entry complications in closed methods, port site gas leakage, entry in wrong plane, loss of space, extra peritoneal insufflations, abdominal wall hemorrhage and omental injury are noticed with frequency of 8 (27%), 7 (23%), 5 (17%), 4 (13%), 2 (7%) respectively.

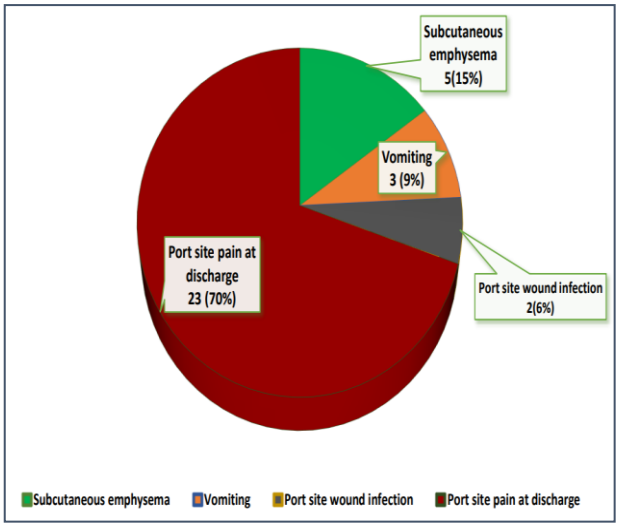

Figure 4: Post-operative complications for closed method.

According to Figure 4, various post-operative complications in closed method are noticed majority in port site pain at discharge with frequency of 23 (70%) whereas least complications were found in port site wound infection 2 (6%).

DISCUSSION

In past two decades rapid advancements have been occurred in endoscopic surgeries, which make it a well-established procedure. Main reason being, it is a minimal access approach surgery mostly done as day-care procedure, cosmetically good, minimal scarring, less chance of post-operative morbidity and wound infection, it becomes choice of patients particularly among young individuals.[13] Primary trocar insertion and/or pneumoperitoneum creation is a crucial step because of it being a blind procedure. As it can cause procedure related intra operative major injuries like bowel perforation, major vascular injuries, and hematoma in subcutaneous planes, subcutaneous emphysema etc.[14] To create pneumo-peritoneum, access to the peritoneal cavity can be gained through either open or closed methods of laparoscopic procedures. This is a comparative study between different open and closed methods for creation of pneumoperitoneum in laparoscopic abdominal surgeries. In the present study; demographic characteristics, like Age and gender were compared and analysed. Result in each group was compared. In open method, majority of pt. fall in 31 to 40 years, while in close one maximum pts. Age range between 40 to 50 years. Lap. Surgeries can be emergency or elective, and mostly in this study following elective lap. Operations were performed in the study institute: Laparoscopic cholecystectomy, lap appendicectomy, lap. transabdominal preperitoneal mesh hernioplasty, diagnostic laparoscopy. Diagnostic laparoscopy was performed only in 3 cases with closed method. In the current study majority of Lap. Surgery was

cholecystectomy in both methods followed by appendicectomy. Ballem et al and Merlin et al found similar results in study of close versus open technique in different laparoscopic surgeries.[15,16] Mean duration for open method procedures is 9.3±1.2 SD and mean duration for closed method is 4.8±3.2 SD, mean duration difference between both procedures is 4.5±2.4 SD. Chotai et al found mean time in open method 3.94±2.2774 and in closed method 5.12±2.5172.[1] Chana et al. found duration result in closed method 5.4±0.7 and in Hasson method mean time duration is 4.6±1.1.[2] Results of both studies did not match our results. Hamid et al, Chapron et al, Soomro et al shows result unfavourable to this study.[17-19] In present study, according to classification of complication at entry level in open method omental injury found in 2 (12%) patients; extraperitoneal insufflations 1 (6%), port site gas leakage 10 (59%), loss of space 1 (6%), entry in wrong plane 3 (17%). In closed method omental injury found in 4 (13%) patients; extraperitoneal insufflations 4 (13%), port site gas leakage 8 (27%) loss of space 5 (17%), entry in wrong plane 7 (23%), abdominal wall haematoma 4 (13%). Taye et al in similar study found no omental injury in open method while 4 (0.07%) in closed one, hematoma 3 (0.21%) in open method and 16 (1.07%) in closed method, were almost favourable to our observation, other complications like extraperitoneal insufflations 2 (0.13%) in open and 10 (0.67%) in closed, failure to create pneumoperitoneum (0.13%) n open and 10 (0.67%) in closed one, loss of space 0 (0%) in open and 26 (1.73%) in closed, bowel perforation in open 0 (0%) and in closed technique 3 (0.21%) entry in wrong plane 0 (0%) in open and (0.21%) in closed, were also similar to this study.[6] Chana et al compared intraoperative and post-operative complications, in closed technique gas leakage 0 (0%) while 15 (25%) in open method, port site hematoma, 0 (0%) in Veress and 1 (1.7%) in open method.[2] Schäfer et al demonstrate after comparing both technique that open technique fails to show any superiority over closed method, that study shows unfavourable result to this study.[20] Post operatively in open method group patients had port site infection 4 (13%), port site pain at discharge 22 (71%), port site hernia 1 (3%). While in Verres needle method subcutaneous emphysema 5 (15%), port site infection 2 (6%), port site pain at discharge 23 (70%), port site hernia 0 (0%) was noted. Chotai et al localized emphysema in closed 17 (1.13%) and in open 13 (0.87%), vomiting 12 (0.8%) in open method and 27 (1.8%) in closed method, port site pain at discharge (100%) and (100%) in closed method.[1] Chana et al demonstrate that post op wound infection 0 (0%) inn closed method and 2 (3.3%) in open method which is not support to this study results.[2] A recent comprehensive Cochrane review on the topic failed to reveal any significant differences among contemporary techniques.[21] This likely reflects the limited statistical power to demonstrate a difference between these techniques when the incidence of vessel and bowel injury is so low.[22] In various literatures and meta-analysis studies, injury to viscera and major vascular injuries have been reported with Veress needle technique.[23] Even though comparison of complications in both methods different, result showing frequency of complication low in Hasson method as compared to closed method.[24] Correlation of comparative study between both methods is 0.023 (p=0.05), which is significant result.

CONCLUSION

Comparison of perioperative complications done in the research, after comparing and completing the study, we concluded that open method shows less complication during operative procedure as well as after operation, while closed method shows higher rate of complication. So, open method is merely safer than closed technique but due to small number of patients took into study as well as study time period is short. Final judgment for the research, multi centric trials in different institutions are required for the initial, crucial, and technically challenging step of newly emerging field of surgery.

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REFERENCES

1. Chotai NR, Choksi DB, Damor S, Bhedi A. Intraperitoneal access by closed method (Veress needle) versus open (Hasson's) method in laparoscopic surgery to create pneumoperitoneum. Int Surg J. 2017;4:2786-90.
2. Chana GA, Siddiqui AJ, Zafar SN. Open versus closed method of establishing pneumoperitoneum for Laparoscopic Cholecystectomy. Collage of physicians and surgeons pak. J. 2009;19(9):557-60.
3. Nuzzo G, Giuliante F, Tebala GD, Vellone M, Cavicchioni C. Routine use of open technique in laparoscopic operations. J Am Coll Surg. 1997;184:58-62.
4. Jansen FW, Kolkman W, Bakkum EA, de Kroon CD, Trimbos-kemper TC, Trimbos JB. Complications of laparoscopy: an injury about closed versus open entry technique. Am J obstet Gynecol. 2004;190:634-8.
5. Peitgen K, Nimtz K, Hellinger A, Walz MK. Open approach or Veress needle in laparoscopic interventions? Results of a prospective randomized controlled study. Chirurg. 1997;68:910-3.
6. Taye MK, Fazal SA, Pegu D, Sakia D. Open vs closed laproscopy: Yet an unresolved controversy. J Clin Diagn Res. 2016;10:4-7.
7. Ballem RV, Rudomanski J. Techniques of pneumoperitoneum. Surg Laparosc Endosc. 1993;3:423.
8. Catarci M, Carlini M, Gentileschi P, Santoro E. Major and minor injuries during the creation of pneumoperitoneum: A multicenter study on 12,919 cases. Surg Endosc. 2001;15:566-9.

9. Hasson HM. A modified instrument and method for laparoscopy. Am J Obstet Gynecol. I971;110(6):886-7.
10. Azevedo OC, Azevedo JL, Sorbello AA, Miguel GP, Wilson Junior JL, Godoy AC. Evaluation of tests performed to confirm the position of the Veress needle for creation of pneumoperitoneum in selected patients: a prospective clinical trial. Acta Cirurgica Brasileira. 2006;21(6):385-91.
11. Roviaro GC, Varoli F, Saguatti L, Vergani C, Maciocco M, Scarduelli A. Major vascular injuries in laparoscopic surgery. Surgical Endoscopy and Other Interventional Techniques. 2002;16:1192-6.
12. Peterson HB, Greenspan JR, Ory HW. Death following puncture of the aorta during laparoscopic sterilization. Obstetr Gyneco. 198259(1):133-4.
13. Vilos GA, Ternamian A, Dempster J, Laberge PY. Clinical practice gynaecology committee. Laparoscopic entry: a review of techniques, technologies, and complications. J Obstet Gynaecol Can. 2007;29(5):433-47.
14. Nord HJ. Complications of laparoscopy. Endoscopy. 1992;24(8):693-700.
15. Ballem RV. Laparoscopic cholecystectomy in a community hospital. N J Med. 1993;90(1):41-2.
16. Merlin TL, Hiller JE, Maddern GJ, Jamieson GG, Brown AR, Kolbe A. Systematic review of the safety and effectiveness of methods used to establish pneumoperitoneum in laparoscopic surgery. J Bri Surg. 2003;90(6):668-79.
17. Hamid K, Ahmad S. Comparison of the number of attempts in creating pneumoperitoneum for laparoscopic cholecystectomy using direct trocar versus Veress needle insertion. Age (Years). 2021;47:11-01.
18. Chapron C, Querleu D, Bruhat MA, Madelenat P, Fernandez H, Pierre F et al. Surgical complications of diagnostic and operative gynaecological laparoscopy: a series of 29,966 cases. Human Reproduction (Oxford, England). 1998;13(4):867-72.
19. Conacher ID, Soomro NA, Rix D. Anaesthesia for laparoscopic urological surgery. Bri J Anaesthesia. 2004;93(6):859-64.
20. Schäfer M, Krähenbühl L. Effect of laparoscopy on intra-abdominal blood flow. Surgery. 2001;129(4):385-9.
21. Woodham BL, Cox MR, Eslick GD. Evidence to support the use of laparoscopic over open appendicectomy for obese individuals: a meta-analysis. Surgical Endoscopy. 2012;26:2566-70.
22. Elbiss HM, Abu-Zidan FM. Bowel injury following gynecological laparoscopic surgery. African Heal Sci. 2017;17:1237-45.
23. Molloy D, Kaloo PD, Cooper M, Nguyen TV. Laparoscopic entry: a literature review and analysis of techniques and complications of primary port entry. Aust N Zeal J Obstetr Gynaecol. 2002;42:246-54.
24. Vilos GA, Ternamian A, Dempster J, Laberge PY, Vilos G, Lefebvre G et al. Laparoscopic entry: a review of techniques, technologies, and complications. J Obstetr Gynaecol Canada. 2007;29(5):433-47.

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