

OPTICAL TROCAR TO FACILITATE THE PNEUMOPERITONEUM CREATION IN BARIATRIC SURGERY: OUR EXPERIENCE AND SYSTEMATIC REVIEW

Running Head: Optical trocar in bariatric surgery

NCT NUMBER not available.

Date of document: 15/12/2023

ABSTRACT

INTRODUCTION: Laparoscopic bariatric surgery (BS) are becoming the most used procedure to treat the obesity. To facilitate safe initial access to the abdominal cavity, we insert an optical viewing trocar at the left hypocondrium. The aim of this study is to systematically evaluate all published data existing in the literature to analyze the safety of optical trocars in patients undergoing bariatric surgery and to compare these data with our experiences.

MATERIALS AND METHODS: Our study retrospectively identified 403 consecutive obese patients who underwent laparoscopic bariatric procedure between 03 July 2017 and 31 December 2023 in our Department of Medical and Surgical Sciences, University of Foggia.

RESULTS: Pneumoperitoneum was successfully induced in all of obese patients underwent bariatric surgery in our center using optical trocar access. The average age is of 40.35 ± 10.23 years, a mean BMI of 44.2 ± 12.21 kg/m², a mean length of stay of 4.15 ± 2.31 days and a mean operative time of 63.25 ± 10.45 min. Complications occurred in 5 patients (1.24 %): 4 postoperative bleeding from the port site and 1 intestinal perforation treated with direct suture. No conversion to laparotomy, no deaths.

CONCLUSIONS: Our study highlights an important technique that can facilitate access into the peritoneal cavity in patients with obesity. Although we observe a low complication rate extreme caution should always be used when utilizing this approach as it is not immune to major injuries as demonstrated. The most important safety factor is the surgeon's experience and familiarity with the use of this technique.

Key words: Sleeve Gastrectomy; Bariatric Surgery; Obesity; Optical Trocar; Laparoscopy; Pneumoperitoneum; Abdominal entry; Complications in laparoscopy; Laparoscopic insufflation.

INTRODUCTION

Obesity is a worldwide epidemic and bariatric surgery has established itself as the most effective modality in combating the condition. Laparoscopy has become the preferred approach to bariatric surgery which is associated with more rapid wound healing and recovery and a decrease in certain complications, including pain, abdominal wall hernias, and wound infections when compared with traditional open surgery [1-3].

Establishing pneumoperitoneum is classically performed using a Veress needle or the open Hasson technique, but obesity presents its own challenges when using these techniques, including thickened abdominal wall, variable anatomical landmarks, difficult and time-consuming dissection, air leak, inadequate pneumoperitoneum, subcutaneous emphysema, and difficulty with fascial closure [4,5]. The use of a bladeless optical trocar before insufflation has been reported to be safe and effective in laparoscopic bariatric surgery [6, 7]. This trocar does not have a sharp shaft and abdominal entry is facilitated via a tapered tip with plastic tabs that dissect tissue when pressure is applied during insertion. A slight rotary movement of the trocar accompanies insertion. This movement separates the layers rather than cutting them, and the passage through each layer of the abdominal wall, as well as the entry into the abdominal cavity, can be continuously visualized through the clear plastic tip.

The aim of this study is to systematically evaluate all published data existing in the literature to analyze the safety of optical trocars in patients undergoing bariatric surgery and to compare these data with our experiences.

MATERIALS AND METHODS

In this study we analyze data existing in the literature about the use of the optical trocars in patients undergoing bariatric surgery and we compare these data with our experiences.

Our study retrospectively identified 403 consecutive obese patients who underwent laparoscopic bariatric procedure between 03 July 2017 and 31 December 2023 in our Department of Medical and Surgical Sciences, University of Foggia.

This systematic review was conducted in accordance with the guidelines for Preferred Reporting Items for Systematic Review. The work has been reported in line with the PRISMA 2020 criteria [8].

We evaluated the quality and risk of bias of this Systematic Review using AMSTAR 2 checklist [9]. A systematic search was performed using electronic searches in EMBASE, Medline, Cochrane Library, and Psychinfo. Free text search in all fields was performed for "Sleeve Gastrectomy", "Bariatric Surgery", "Obesity", "Optical Trocar", "Laparoscopy", "Pneumoperitoneum", "Abdominal entry", "Complications in laparoscopy", "Laparoscopic insufflation". The search included all study designs, with additional non-research captured studies identified through bibliographic cross-references. Published studies that contained outcome data for optical trocar during laparoscopic sleeve gastrectomy listed below were included.

RESULTS

A total of 403 patients underwent bariatric surgery in our center during this period of approximately 5 years with an average age of 40.35 ± 10.23 years, a mean BMI of 44.2 ± 12.21 kg/m², a mean length of stay of 4.15 ± 2.31 days and a mean operative time of 63.25 ± 10.45 min. Pneumoperitoneum was successfully induced in all of these patients. Complications occurred in 5 patients (1.24 %), with a mean BMI of 50.73 ± 2.31 kg/m²: 4 postoperative bleeding from the port site and 1 intestinal perforation treated with direct suture. No conversion to laparotomy, no deaths (Table 1).

The technique involves the use of 4 12 mm trocars. Pneumoperitoneum is induced by a 0° optical trocar and maintained at 15 mmHg. The first trocar is usually inserted along the left mid-clavicular line approximately 2 fingers from the costal arch, another trocar along the left axillary line, a third trocar 1 cm to the right of the midline, and the fourth trocar along the right mid-clavicular line. A 10 mm, 30 ° laparoscope is used.

Figure (PRISMA Flow Chart) shows the study selection flowchart. Through the literature search, we identified 35 citations. We removed any duplicates and were left with 52 references. After excluding irrelevant reports by reviewing titles and abstracts, we then retrieved 23 full-text articles that were eligible. There were 8 articles with unrelated topics, 2 without full text, 2 conference abstracts, and 1 non-English/Chinese literature excluded. Ultimately, 10 original articles were included, as shown in the study flowchart. (Table 2) [10-19].

DISCUSSION

Dingfelder described the direct trocar insertion technique 1978. He tested the trocar insertion technique without prior pneumoperitoneum. No technical failures reported among 301 patients included [20]. The technology was expanded in 1994 with the use of the optical trocar: Laparoscopy allows observation of all layers of the abdominal wall when accessing. These trocars are designed for use with blades or blunt-tipped trocars and their use to facilitate peritoneal access in obese patients. In our center during this period of approximately 5 years, pneumoperitoneum was always induced with an optical trocar in patients undergoing bariatric surgery. The mean operative time was 63.25 ± 10.45 min, with a mean BMI of 44.2 ± 12.21 kg/m², a mean length of stay of 4.15 ± 2.31 days. Complications occurred in 5 patients (1.24%), with a mean BMI of 50.73 ± 2.31 kg/m²: 4 postoperative bleeding from the access site and 1 intestinal perforation treated with direct suture. This means that a high BMI can probably make it more difficult to visualize the layers of the abdominal wall during the induction of pneumoperitoneum with an optical trocar, favoring possible complications.

Madan et al [10,11], Bernante et al [12], Amiki et al [19] with their studies concluded that initial trocar placement using a non-bladed trocar with an optical view without prior abdominal insufflation is safe and effective in morbidly obese patients. They didn't observe any bowel or vessel injury during initial trocar placement. This method can be applied even in the super obese.

Sabeti et al [13] in a series of 2207 patients underwent bariatric surgery using optical trocar for pneumoperitoneum has been observed 4 injuries occurred (.18%). All 4 patients had previously undergone abdominal surgery. Three required conversion to laparotomy and mesenteric repair, and the fourth was treated with laparoscopic pressure in the retroperitoneal fat.

Sundbom et al [14,16] studied 11,744 patients undergoing laparoscopic gastric bypass. The analysis revealed 5 aortic lesions, all of which occurred in patients in whom an optical trocar had been placed before establishing pneumoperitoneum. Outcomes ranged from no major sequelae to bilateral lower extremity amputation and death. The risk of aortic injury was 0.043% overall and 0.091% when an optical trocar was used.

Martínez-Ubieto et al [15] analyzed Sixty obese patients underwent sleeve gastrectomy using a device equipped with 3-D optics that allows the surgeon to view the surgery in 3 dimensions using a specific monitor and wearing appropriate glasses. Only 1 intraoperative complication was recorded: retroperitoneal bleeding upon insertion of the optical trocar.

Usman et al [17] presented a rare case of infrarenal abdominal aortic injury caused by the insertion of an optical trocar for bariatric surgery. Immediate recognition of the injury, implementation of life-

saving maneuvers, timely resuscitation, followed by definitive repair of the aorta by the vascular surgeon saved this patient's life. The recovery phase was uneventful and the patient had no residual clinical problems during follow-up.

Bucheeri et al [18] analyzed a case series of 821 patients who underwent bariatric surgery over 3 years. Optical trocars successfully established pneumoperitoneum in all these patients. Complications attributed to optical trocar entry were found in 8 patients (0.97%), 3 males and 5 females. The average BMI of these 8 patients is 52.7 kg/m². The complications encountered include 3 hepatic lacerations, 4 mesenteric lesions and 1 laceration of the omental vessel.

With this systematic review we observed a low complication rate reported in the literature using the optical trocar for the pneumoperitoneum, which predominantly include vascular or intestinal injuries.

CONCLUSION

Access to the abdominal cavity with an optical trocar can be considered a safe method to establish pneumoperitoneum in patients with morbid obesity, with the further advantage of not necessarily having to close the surgical breach. Our study highlights an important technique that can facilitate access into the peritoneal cavity in patients with obesity. Although we observe a low complication rate extreme caution should always be used when utilizing this approach as it is not immune to major injuries as demonstrated. The most important safety factor is the surgeon's experience and familiarity with the use of this technique.

Our experience is perfectly in line with the literature, although this technique requires further studies to be certified

REFERENCES

1. Rosenthal RJ, Szomstein S, Kennedy CI, Zundel N. Direct visual insertion of primary trocar and avoidance of fascial closure with laparoscopic Roux-en-Y gastric bypass. *Surg Endosc* 2007;21:124–128.
2. Cottam DR, Nguyen NT, Eid GM, Schauer PR. The impact of laparoscopy on bariatric surgery. *Surg Endosc* 2005;19: 621–627.
3. Matthews BD, Heniford BT, Sing RF. Preperitoneal Richter hernia after a laparoscopic gastric bypass. *Surg Laparosc Endosc Percutan Tech* 2001;11:47–49.
4. H.J. Bonjer, E.J. Hazebroek, G. Kazemier, M.C. Giuffrida, W.S. Meijer, J.F. Lange, Open versus closed establishment of pneumoperitoneum in laparoscopic surgery, *Br. J. Surg.* 84 (5) (1997 May) 599–602.
5. N. Sabeti, M. Tarnoff, J. Kim, S. Shikora, Primary midline peritoneal access with optical trocar is safe and effective in morbidly obese patients, *Surg. Obes. Relat. Dis.* 5 (5) (2009 Sep-Oct) 610–614.
6. Madan AK, Menachery S. Safety and efficacy of initial trocar placement in morbidly obese patients. *Arch Surg.* 2006;141:300–3
7. Berch BR, Torquati A, Lufti RE, et al. Experience with the optical access trocar for safe and rapid entry in the performance of laparoscopic gastric bypass. *Surg Endosc.* 2006;20:1238–41.
8. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71. doi: 10.1136/bmj.n71
9. Shea BJ, Reeves BC, Wells G, Thuku M, Hamel C, Moran J, Moher D, Tugwell P, Welch V, Kristjansson E, Henry DA. AMSTAR 2: a critical appraisal tool for systematic reviews that include randomised or non-randomised studies of healthcare interventions, or both. *BMJ*. 2017 Sep 21;358:j4008.
10. Madan AK, Menachery S. Safety and efficacy of initial trocar placement in morbidly obese patients. *Arch Surg.* 2006 Mar;141(3):300-3. doi: 10.1001/archsurg.141.3.300. PMID: 16549697.

11. Madan AK, Taddeucci RJ, Harper JL, Tichansky DS. Initial trocar placement and abdominal insufflation in laparoscopic bariatric surgery. *J Surg Res.* 2008 Aug;148(2):210-3. doi: 10.1016/j.jss.2007.08.029. Epub 2007 Sep 25. PMID: 18262554.
12. Bernante P, Foletto M, Toniato A. Creation of pneumoperitoneum using a bladed optical trocar in morbidly obese patients: technique and results. *Obes Surg.* 2008 Aug;18(8):1043-6. doi: 10.1007/s11695-008-9497-8. Epub 2008 May 14. PMID: 18478308.
13. N. Sabeti, M. Tarnoff, J. Kim, S. Shikora, Primary midline peritoneal access with optical trocar is safe and effective in morbidly obese patients, *Surg. Obes. Relat. Dis.* 5 (5) (2009 Sep-Oct) 610–614.
14. Sundbom M, Hedberg J, Wanhainen A, Ottosson J. Aortic injuries during laparoscopic gastric bypass for morbid obesity in Sweden 2009-2010: a nationwide survey. *Surg Obes Relat Dis.* 2014 Mar-Apr;10(2):203-7. doi: 10.1016/j.soard.2013.06.019. Epub 2013 Jun 27. PMID: 24209880.
15. Martínez-Ubieto F, Jiménez-Bernadó T, Martínez-Ubieto J, Cabrerizo A, Pascual-Bellosta A, Muñoz-Rodriguez L, Jiménez-Bernadó A. Three-Dimensional Laparoscopic Sleeve Gastrectomy: Improved Patient Safety and Surgeon Convenience. *Int Surg.* 2015 Jun;100(6):1134-7. doi: 10.9738/INTSURG-D-14-00287.1. PMID: 26414836; PMCID: PMC4587518.
16. Sundbom M, Ottosson J. Trocar Injuries in 17,446 Laparoscopic Gastric Bypass-a Nationwide Survey from the Scandinavian Obesity Surgery Registry. *Obes Surg.* 2016 Sep;26(9):2127-2130. doi: 10.1007/s11695-016-2080-9. PMID: 26839110.
17. Usman R, Ahmed H, Ahmed Z, Ali M. Optical Trocar Causing Aortic Injury: A Potentially Fatal Complication of Minimal Access Surgery. *J Coll Physicians Surg Pak.* 2020 Jan;30(1):85-87. doi: 10.29271/jcpsp.2020.01.85. PMID: 31931939.
18. Buccheeri MM, Menon S, Mhatre A, Abusel AY. The use of optical trocars in abdominal entry among patients with obesity- A case series. *Ann Med Surg (Lond).* 2021 Aug 10;69:102698. doi: 10.1016/j.amsu.2021.102698. PMID: 34484719; PMCID: PMC8390951.
19. Amiki M, Ishiyama Y, Harada T, Mochizuki I, Tomizawa Y, Ito S, Oneyama M, Hara Y, Narita K, Tachimori Y, Goto M, Sekikawa K, Kuba M. Initial entry via the left upper quadrant with an optical trocar in laparoscopic bariatric surgery. *Asian J Endosc Surg.* 2022 Apr;15(2):463-466. doi: 10.1111/ases.13019. Epub 2022 Jan 6. PMID: 34994085.
20. J.R. Dingfelder, Direct laparoscope trocar insertion without prior pneumoperitoneum, *J. Reprod. Med.* 21 (1) (1978) 45–47.

