



Teres lift-up technique: a retrospective comparative study for an alternative route for laparoscopic entry in gynecologic and oncologic surgery

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Abstract

Objective Laparoscopic surgery is the favored method for the surgical treatment of gynecologic diseases and malignancies. We have defined an anatomic landmark-based, easy-to-perform, and an alternative way of open laparoscopic entry technique named the ligamentum teres lift-up technique (TLU) that can be used in obese or normal-weight women to tackle the risks of the closed laparoscopic entry technique, namely, Veress needle entry (VNE).

Study design In this retrospective comparative study, the participants were equally distributed to either the TLU group (n=36) or the VNE group (n=36) in a 1:1 ratio. The participants were stratified according to their BMI as follows: BMI between 20–25 kg/m² (average weight), 25–30 kg/m² (overweight), 30–35 kg/m² (class I obesity), and 35–40 kg/m² (class II obesity). Both laparoscopic access techniques were compared according to the entry time, vascular or visceral injuries, insufflation failures, trocar-related complications, and omental damage.

Results The TLU group had a considerably shorter entry time than the VNE group (74.43 ± 21.45 s versus 192.73 ± 37.93 s; p < 0.001). Only one failed insufflation occurred in the VNE group (p = 0.32); however, that case was successfully insufflated with the TLU technique. Only one intestinal injury was seen in the VNE group, encountered during trocar site closure (p = 0.32). The subgroup analyses of the TLU and VNE groups based on BMI strata revealed a continuation of the statistical significance of entry time between BMI-matched groups.

Conclusion The current study reveals that the new alternative TLU technique supplies an alternative, validated, and rapid access to the abdominal cavity in normal-weight and obese women. This new approach offers an easy-to-teach and easy-to-perform technique for surgical mentors and residents in gynecologic and oncologic surgeries.

Keywords Laparoscopy · Veress needle · Teres lift-up technique · Open technique · Gynecology

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What does this study add to the clinical work

The new TLU technique provides an anatomical landmark-based and easy-to-handle technique for surgical mentors and residents.

The new approach offers quick and safe access to the abdominal cavity, not only in normal-weight but also in obese women.

Introduction

Laparoscopic surgery is the favored method for the surgical treatment of gynecologic diseases and malignancies [1]. The laparoscopic approach has better surgical outcomes than laparotomy in the context of surgical scarring, recovery time, discharge time, blood loss, and pain scores [2, 3]. Despite its superiority, a quarter of the complications of laparoscopic surgery are encountered during the first phase, namely, Veress needle insertion, carbon dioxide (CO₂) insufflation, and trocar entry [4, 5].

It has been estimated that laparoscopy-related complications range between 0.1 and 1.3% depending on the surgeon's dexterity and technical knowledge. The complications encountered during the first phase of laparoscopy can be classified as visceral and vascular and/or early and delayed [6]. Iatrogenic vascular injuries include both minor (epigastric, omental, and mesenteric) or major (iliac vessels, aorta, and inferior vena cava) vascular structures that endanger women's lives by hemorrhage or gas embolism [7]. Iatrogenic visceral injuries related to the access site include the stomach, bowel, omentum, liver, spleen, or bladder. Even if gynecologic surgeons prefer the closed technique, there is no agreement as to which entry technique, closed or open, poses a minimum risk for surgical complications [6].

The ligamentum teres hepatis (LTH), or rotundum, is a remnant of the left umbilical vein found between the umbilical ring (UR) and the falciform ligament [8]. LTH is generally fused to the superior border of the UR, and together, they play a protective role against umbilical hernia [9]. We have defined an anatomic landmark-based, easy-to-perform, and an alternative way of open laparoscopic entry technique named the ligamentum teres lift-up technique (TLU) that can be used in obese or normal-weight women to tackle the risks of the closed laparoscopic entry technique in gynecological surgery. The current study discusses the pros and cons of the

new alternative TLU technique by comparing it to the closed technique, which is classically known as Veress-needle entry (VNE).

Materials and methods

Study design

VNE technique has been used as the favored method in the Obstetrics and Gynecology Department of Balikesir University since 2010, and TLU technique has been performed since 2018. The participants' medical files were retrospectively reviewed between 2019 and 2022. Participants were equally distributed to the TLU or VNE groups. Each group contained 36 participants who were stratified into four strata according to their BMI, such as BMIs between 20–25 kg/m² (normal weight), 25–30 kg/m² (overweight), 30–35 kg/m² (class I obesity), and 35–40 kg/m² (class II obesity).

Inclusion and exclusion criteria

Women who underwent laparoscopic surgery for gynecologic diseases and malignancies were included in the study. Participants' body mass index (BMI) was between 20–40 kg/m², and women with a history of cesarean section and appendectomy were also included. The indications for gynecological operations were as follows: myoma uteri, adenomyosis, endometrial hyperplasia with atypia, suspicious adnexal masses, endometrioma and endometriosis, stress urinary incontinence, and pelvic organ prolapse. On the other hand, the indications for oncological surgeries are Stage I endometrial cancer and Stage I-II borderline ovarian tumors.

However, women with a history of surgery with a midline incision, umbilical hernias, mesh placement to the umbilicus, massive ascites, intraperitoneal implant, or liver diseases were excluded from the study.

Women underwent elective gynecologic or oncologic operations requiring endotracheal intubation under general anesthesia at the dorsal lithotomy position. These operations were performed by three experienced surgeons at Balikesir University Hospital. Anticoagulation was discontinued at least 24 h before surgery, and 2 g of cefazolin was administered before the skin incision for antimicrobial prophylaxis. Gastric decompression was provided with an orogastric tube before the skin incision. The umbilicus was cleansed with povidone-iodine, and lint was mechanically removed if present.

Participants' demographic and anthropometric parameters were recorded. Their past and current surgical procedures and menopausal status were documented. Both laparoscopic access techniques were compared according to the entry time, vascular or visceral injuries, insufflation failures, trocar-related complications, and omental injury. The duration of laparoscopic access was defined as the period between the incision and the visualization of the abdominal cavity determined using a cell phone chronometer. If the surgeon made more than two attempts with a Veress needle, it was considered a failed insufflation. The primary outcome of this study was the entry time. Secondary outcomes were vascular or visceral injuries, insufflation failures, and trocar-related complications.

The definition of surgical techniques

TLU technique

After a 12 mm vertical skin incision was made to the upper border of the UR, the subcutaneous fat was dissected with a pean clamp until the ligamentum teres, also known as the ligamentum rotundum, was visualized or palpated with an index finger. Then, the caudal part of the teres ligament, which is joined to the umbilical ring, was elevated with the help of a straight Kocher clamp. Afterward, a Farabeuf retractor was placed on one side of the teres ligament, and the cranial part of the teres ligament was elevated with the help of a curved Kocher clamp, which was placed 1 cm above the first clamp. Finally, an 11 mm incision that gives a 30 to 45-degree angle to the teres ligament was made between the Kocher clamps. A central 11-mm trocar was inserted into the abdominal cavity without an inner tube through the incision, and the abdominal organs were visualized (Supplementary video).

VNE technique

Following the elevation of the umbilicus with two towel clips placed on the lateral border of the UR, a single-use Veress needle was vertically inserted into the lowest point of the umbilicus without using a scalpel. Laparoscopic entry into the abdominal cavity was confirmed by a double-pop test, saline drop test, and verification of intra-abdominal pressure (< 10 mmHg) [11]. After the intra-abdominal pressure reached 20 mmHg, a supraumbilical 12 mm slightly concave horizontal skin incision was made. The central trocar was placed into the abdominal cavity, and the abdominal organs were visualized.

Statistics

The study's statistical analysis and power analysis were performed with open-source Jamovi statistical software (version 2.3.21) and G* Power software (version 3.1.9.7). The minimum sample size was calculated as 36 per group based on α error: 0.001, power: 0.95, and effect size $d: 1$ according to the literature. The distribution and homogeneity of groups were evaluated by skewness, kurtosis, Levene's test, and Kolmogorov–Smirnov test. Independent-sample Student's t-test was used to compare the group variables. After log₁₀ conversion of variances, subgroup analysis was conducted using one-way ANOVA and Tukey's post hoc test.

Results

The study groups (TLU Group $n = 36$ and VNE Group $n = 36$) had no significant differences regarding BMI, age, menopausal status, or previous abdominal surgery (Table 1). The participants' baseline characteristics and BMI status are summarized in Table 1.

However, it was revealed that the TLU group had considerably shorter entry times than the VNE group (74.43 ± 21.45 vs. 192.73 ± 37.93 ; $p < 0.001$) [Table 2]. Only one failed insufflation was detected in the VNE group ($p = 0.32$); however, that case was successfully insufflated with the TLU technique. Only one intestinal injury occurred during trocar site closure in the VNE group ($p = 0.32$). There was no statistical significance between the study groups regarding vascular or omental injury and trocar-related complications. The outcomes of the study groups are summarized in Table 2.

The subgroup analyses of TLU and VNE groups based on BMI strata revealed a continuation of the statistical significance of entry time between BMI-matched groups (Table 3).

Discussion

The current study evaluated the safety and feasibility of the newly introduced open technique called TLU through comparison with the VNE technique in obese and normal-weight women. Laparoscopic surgery supplies better visualization of the pelvis in gynecologic and oncological cases, even though the operative time is longer than that of open surgery. It offers a shorter hospital stay, faster recovery, decreased pain, blood loss, and surgical site infection, even in obese women [2, 12, 13].

Table 1 Baseline characteristics of the study groups

Patients' characteristics	VNE group (n=36)	TLU group (n=36)	p value
Age (year) (a)	47.73 ± 14.77	49.63 ± 13.46	0.60
BMI (a)	28,52 ± 6,34	29.58 ± 5	0.47
Normal 20-BMI-25 (b)	10 (27.7%)	8 (22.2%)	–
Overweight 25-BMI-30 (b)	11 (30.5%)	7 (19.4%)	–
Class I obesity 30-BMI-35 (b)	8 (22.2%)	10 (27.7%)	–
Class II obesity 35-BMI-40 (b)	7 (19.4%)	11 (30.5%)	–
Menopause (b)	12 (33)	14 (39%)	0.64
Previous surgery (b)	11 (30.5%)	13 (36%)	0.65

Data are expressed as mean ± standard deviation (a) or percentage (b). *BMI* body mass index, *VNE* veress needle-entry, *TLU* teres lift-up. **p* < 0.05, ***p* < 0.01, ****p* < 0.001

Table 2 Primary and secondary outcomes of the study groups

Variables	VNE group (n=36)	TLU group (n=36)	p value
Entry time (a)	192.73 ± 37.93 s	74.43 ± 21.45 s	< 0.001***
Failed insufflation (b)	1 (2.7%)	0	0.32
Minor vascular injury (b)	2 (5.5%)	1 (2.7%)	0.56
Significant vascular injury (b)	0	0	–
Intestinal damage (b)	1 (2.7%)	0	0.32
Omental injury (b)	1 (2.7%)	0	0.32
Trocar site bleeding (b)	0	1 (2.7%)	0.32
Trocar site haematoma (b)	0	0	–
Trocar site infection (b)	0	0	–
Trocar site hernia (b)	0	0	–

Data are expressed as mean ± standard deviation (a) or percentage (b). *VNE* veress needle-entry, *TLU* teres lift-up. **p* < 0.05, ***p* < 0.01, ****p* < 0.001

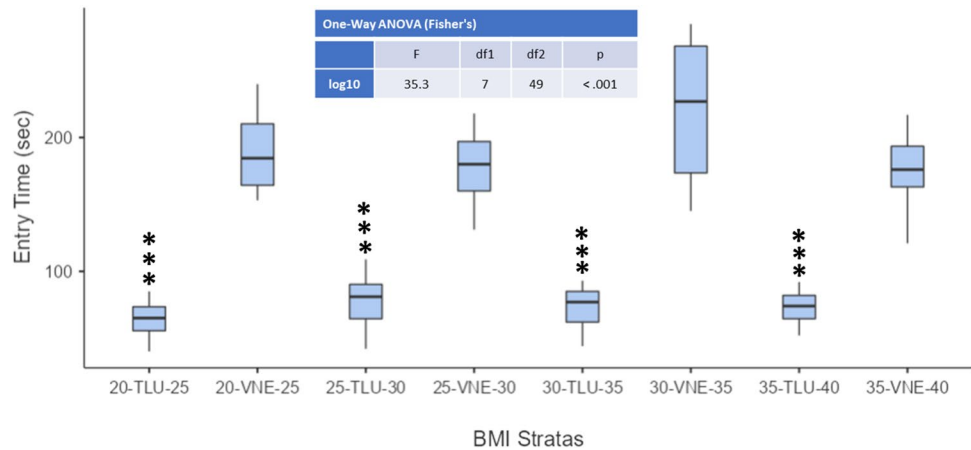
The literature has four standardized entry techniques: VNE, open entry technique (OET), Hasson technique, optic trocar entry (OTE), and direct trocar entry (DTE) [5, 14, 15]. Compared with OET, the VNE technique carries a high risk of failed entry, vascular injury, extraperitoneal insufflation, and omental injury. Although OET may be linked with bowel injury, there are no significant differences between entry techniques regarding major vascular and visceral injuries [16]. It has been proven that OET is reliable, easy to perform, and provides rapid access to the abdominal cavity [15]. Although the ongoing debate over which entry technique is safer and quicker is inconclusive, gynecologic laparoscopists are inclined to use the closed method [6, 15].

Even if the umbilicus is the most popular laparoscopic entry point into the abdomen in gynecologic and oncological surgery, there is a dearth of literature regarding the surgical anatomy of UR and its relationship with adjoined ligaments. The vasculature of the umbilical cord and urachus in fetal life become fibrous ligaments on the posterior face of the anterior abdominal wall and conjoin the umbilical ring in adulthood [9, 17]. The umbilical arteries, veins, and urachus become the medial umbilical ligaments, ligamentum teres

hepatis, and median umbilical ligament, respectively [9]. Both umbilical fascia and LTH are primary protective factors against developing a hernia [9, 17]. Given the above facts, we conceptualized two anatomic landmark-based techniques based on the ligament's origin: Teres lift-up (TLU) and Urachus lift-up (ULU) techniques (unpublished data).

Conclusion

The current study unveils that the TLU technique may be a new alternative way of access to abdomen. This new approach offers an easy-to-teach and easy-to-perform technique for surgical mentors and residents. Lifting the ligamentum teres with Kocher clamps, whether in normal-weight or obese women, ensures access to the abdominal cavity without compromising major vascular and visceral organs. The TLU technique provides an alternative and validated route to create pneumoperitoneum in gynecologic and oncologic surgeries, not only in normal-weight but also in obese women.

Table 3 Subgroup analysis of study groups

BMI body mass index, VNE veress needle-entry, TLU teres lift-up. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ and log10 represents the conversion of the variances

The limitations of the study

As a retrospective comparative study, this study provides Level III-of-evidence. Therefore, a multicenter, double-blind randomized controlled trial must confirm the study results. A small number of participants in the subgroups may have biased the study results. Additionally, the limitations of this study include the absence of the Class III obesity strata and other entry technique groups, such as optic trocar entry and direct trocar entry in BMI-matched groups.

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Author contributions SA: conceptualization, methodology (lead), investigation, validation, visualization, writing-original draft (lead), writing-review and editing (lead), supervision (equal). CSU: investigation, supervision (equal). AU: conceptualization (lead), methodology, investigation, supervision. DL: investigation, validation. IG: validation (lead), visualization, writing-original draft. CBK: validation, visualization (lead), writing-original draft.

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Data availability The authors do not have the right to share any data information per their institution's policies.

Code availability Not applicable.

Declarations

Conflict of interest The authors declare no conflict of interest.

Ethical approval This retrospective comparative study was carried out as per the Helsinki Committee's principles after ethical approval of the study design by the Ethics Committee of Balikesir University (E-94025189-050.04-216887), and informed consent and consent to publish were acquired from all participants. STROBE (The Reporting of Observational Studies in Epidemiology) guidelines were followed during reporting [10].

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