Comparison of Veress needle and direct trocar technique during laparoscopic initial entry via Palmer's point

Srovnání Veressovy jehly a techniky přímého trokaru při laparoskopickém počátečním vstupu přes Palmerův bod

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Summary: Objective: In laparoscopic surgery, initial entry into the abdomen becomes more risky in patients with a history of abdominal surgery. In such cases, initial entry is usually performed with a Veress needle via Palmer's point (PP). However, it is associated with an increased failure rate, especially in obese patients. On the other hand, direct trocar entry is a convenient and safe technique with a low failed entry rate. Direct trocar entry via PP may be the preferred approach for initial abdominal entry in patients with a history of abdominopelvic surgery. **Materials and methods:** The present study included 438 patients with a previous history of abdominopelvic surgery undergoing laparoscopic gynecological surgery, during which two different entry techniques via PP were tested. **Results:** There were 88 patients (20.1%) in the Veress needle group and 350 patients (79.9%) in the direct trocar group. The time to create a pneumoperitoneum was significantly shorter in the direct trocar group (P < 0.001). Successful entry was achieved at the initial attempt in 78 patients (88.6%) from the Veress needle group and in 347 patients (99.1%) from the direct trocar group (P = 0.012). Minor complication rates were similar in both groups. However, one major complication was observed in the direct trocar group, while no major complications were noted in the Veress needle group. **Conclusion:** Provided that the basic surgical principles are respected, direct trocar entry technique via PP is a safe, effective, and fast initial entry approach into the abdomen and may be preferred in patients with previous abdominopelvic surgery.

Key words: direct trocar entry – direct trocar insertion – Veress needle – Palmer's point – safe abdominal access

Souhrn: Cíl: Při laparoskopické operaci se počáteční vstup do břicha stává rizikovějším u pacientů s anamnézou břišní operace. V takových případech se počáteční vstup obvykle provádí Veressovou jehlou přes Palmerův bod (PP). Je však spojena se zvýšenou mírou selhání, zejména u obézních pacientů. Na druhou stranu je přímý vstup trokarem pohodlnou a bezpečnou technikou s nízkou mírou neúspěšných vstupů. Přímý vstup trokarem přes PP může být preferovaným přístupem pro počáteční vstup do břicha u pacientů s anamnézou abdominopelvické operace. **Materiály a metody:** Do této studie bylo zařazeno 438 pacientek s předchozí anamnézou abdominopelvické operace podstupujících laparoskopickou gynekologickou operaci, během níž byly testovány dvě různé techniky vstupu přes PP. **Výsledky:** Ve skupině s Veressovou jehlou bylo 88 pacientek (20,1 %) a ve skupině s přímým trokarem 350 pacientek (79,9 %). Doba k vytvoření pneumoperitonea byla významně kratší ve skupině s přímým trokarem (p < 0,001). Úspěšného vstupu bylo dosaženo při prvním pokusu u 78 pacientek (88,6 %) ze skupiny s Veressovou jehlou a u 347 pacientek (99,1 %) ze skupiny s přímým trokarem (p = 0,012). Míra menších komplikací byla v obou skupinách podobná. Jedna velká komplikace však byla pozorována ve skupině s přímým trokarem, zatímco ve skupině s Veressovou jehlou nebyly zaznamenány žádné velké komplikace. **Závěr:** Za předpokladu respektování základních chirurgických principů je technika přímého vstupu trokarem přes PP bezpečným, efektivním a rychlým vstupním přístupem do břicha a může být preferována u pacientů s předchozí abdominopelvickou operací.

Klíčová slova: přímý vstup trokarem – přímé zavedení trokaru – Veressova jehla – Palmerův bod – bezpečný přístup do břicha

Introduction

In laparoscopic surgery, the initial entry into the abdomen may be considered the most critical step due to the blind insertion of the Veress needle and/or primary trocar [1]. During laparoscopy, almost half of the injuries occur at the time of trocar insertion before the surgical procedures begins [2,3]. However, initial entry becomes more significant and risky in patients with a history of abdominal surgery, particularly with midline

laparotomy [4,5]. On the other hand, obesity, which causes thickening of the abdominal wall, may increase the risk of injury during initial entry [6,7]. Although the umbilicus is the main site of primary insertion in laparoscopic surgery, the most preferred alternative entry site for such patients is Palmer's point (PP) [8]. PP is located 3 cm below the left costal border on the midclavicular line and is considered a very safe site for initial insertion [9,10]. On the other hand, direct trocar entry via PP is an alternative technique and is rarely preferred over Veress needle entry. However, lower failure rates have been reported during abdominal entry via the umbilicus using the direct trocar entry compared to Veress needle entry. Moreover, decreased insufflation-related complications were reported with the technique of direct trocar entry [11]. Direct trocar entry is a safe, effective, and fast technique [12]. This technique may routinely be preferred for the initial entry into the abdomen via the umbilicus or PP [13,14].

The aim of the present study is to examine the safety and efficiency of direct trocar entry via PP as an alternative method in patients with a history of abdominopelvic surgery and to compare the outcomes of the Veress needle and direct trocar entry in the same cohort who had laparoscopic gynecologic surgery.

Materials and methods

All data from the patients who had laparoscopic surgery at the Gynecologic Oncology Clinic of Eskisehir City Hospital between January 2020 and June 2022 were retrospectively collected and analyzed. During laparoscopic surgery, PP was used as the initial site of abdominal entry in all cases with a history of abdominopelvic surgery, including both laparotomy and laparoscopy. PP was not used for the initial entry site, as it is contraindicated in patients with hepatosplenomegaly, pancreatic mass, history of gastric or splenic surgery, and left hemicolectomy [15]. Complications were categorized as

intraoperative or postoperative, and intraoperative complications were categorized as either entry-related or surgical procedure-related. This research was approved by the Ethics Committee of Osmangazi University (Ethics Date-No: 2021–194/25). Medical records including age, parity, menopausal status, body mass index (BMI), number of previous abdominal surgeries, and the time interval between the skin incision and first visualization of the abdomen after the pneumoperitoneum has been created (called visualization time), number of failed attempts, intraoperative and postoperative complications, and management strategy were tabulated. The primary endpoint was to identify the type and frequency of complications during direct trocar entry via PP. The secondary endpoint was to evaluate the efficacy of direct trocar entry via PP in terms of procedural success rate. The surgeons who participated in the study were Asst. Prof. Yagmur Minareci, MD (YM) and Huseyin Oguz Yuvanc, MD (HOY). All surgeries included in the study were performed by either YM or HOY as the primary surgeon. However, all surgeries for malignancies were conducted exclusively by YM.

The SPSS software v20.0 was used for data interpretation and statistical analysis. The normality of distribution was checked initially by the Shapiro-Wilk test. Mann-Whitney U-Test was used to compare non-parametric variables, χ^2 test was used for comparing categorical variables. Fisher's exact test was used when the group size was less than 5. P-value less than 0.05 was considered statistically significant.

Operative technique

After general anesthesia, either a nasogastric or orogastric tube was inserted to aspirate the gastric content and to decompress the stomach. The patients were placed horizontally on the operating table with proper stirrups in a dorsolithotomy position. The endo-insufflator was preset to a pressure of 14 mmHg

and a flow rate of 10 L/min. A 5–6 mm skin incision was made at PP for allowing entry of the five mm cannula with a pyramidal tip sharp trocar (Karl Storz, Tuttlingen, Germany). The abdominal wall wasn't grasped and lifted during the entry in either method.

Direct trocar entry

First, the surgeon prevented unexpected and uncontrolled entry by maintaining his index finger 2–3 cm away from the trocar tip. The tip of the trocar was then advanced slowly through the incision perpendicular to the fascia with gently twisting semicircular movements at a steady speed, which also avoided sudden vertical acceleration. Meanwhile, two structures (fascia first and then peritoneum) that created resistance against the trocar were felt. After peritoneal perforation felt due to loss of resistance, the movement of the trocar was stopped, then the blade of the trocar was withdrawn, and the cannula was left in place. The position of the cannula was confirmed by the introduction of a 5mm 0º laparoscope into the abdomen, allowing direct visualization [16,17]. After confirming correct positioning by visualizing the free omental fat and bowel loops, the laparoscope was withdrawn, and insufflation was started (see supplementary videos on the journal's website).

Veress needle entry

A reusable Veress needle (Karl Storz, Tuttlingen, Germany) was advanced through the incision perpendicularly to the fascia with constant speed. Meanwhile, two structures (fascia first and then peritoneum) that created resistance against the needle were felt. The needle was left in place after the final click was felt upon peritoneal perforation. Confirmation of the proper needle placement was conducted through safety tests, including double-click and aspiration tests. The former was done during intra-abdominal access as described above, and the latter was

performed using a disposable 10mL syringe filled with 5 mL of NaCl connected to the Veress needle with the flow tap open. The syringe was aspirated to exclude perforation of vessels or bowels. Subsequently, NaCl was gently injected and then re-aspirated to confirm successful intra-abdominal access. Then, insufflation was started, and a pneumoperitoneum was established, the needle was withdrawn, and a 5mm cannula with a pyramidal tip sharp trocar (Karl Storz, Tuttlingen, Germany) was introduced into the abdomen. Finally, a 5mm 0° laparoscope was introduced to verify final placement.

Results

A total of 581 laparoscopic surgeries were performed within the specified period, and 438 patients had initial abdominal entry via PP. There were 88 patients (20.1%) in the Veress needle group and 350 patients (79.9%) in the direct trocar
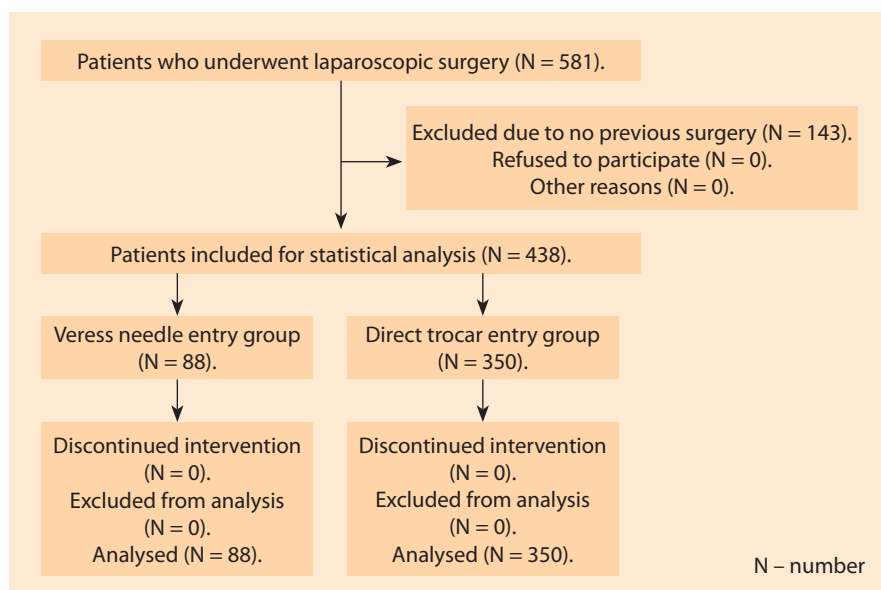

Fig. 1. Flow diagram of the study.
Obr. 1. Vývojový diagram studie.

group. Fig. 1 shows the flow diagram. All 438 patients had a history of abdominopelvic surgery at least once, and 107 patients at least three times. There was no statistical difference in terms of age, BMI, parity, menopausal status, and number of past abdominopelvic surgeries between groups (Tab. 1). In the

Tab. 1. Comparison of the patient characteristics.
Tab. 1. Porovnání charakteristik pacienta.

Parameters	Veress needle group N = 88	Direct trocar group N = 350	P-value
Age, median (years)	52 (28–87)	50 (22–75)	0.237
BMI, median (range)	32.0 (17.3–43.4)	33.2 (18.2–45.2)	0.574
Parity, median (range)	2 (0–6)	2 (0–7)	0.298
One previous surgery[†], N (%)	23 (26.1%)	87 (24.9%)	0.737
Two previous surgeries[†], N (%)	46 (52.3%)	156 (44.5%)	0.084
≥ Three previous surgeries[†], N (%)	19 (21.6%)	107 (30.6%)	0.078
Menopausal status, N (%)			0.467
yes	32 (36.4%)	141 (40.3%)	
no	56 (63.6%)	209 (59.7%)	
Smoking status, N (%)			0.103
yes	20 (22.7%)	57 (16.3%)	
no	68 (77.3%)	293 (83.7%)	
Incision type of previous surgery, N (%)			0.093
laparoscopy	55 (30.2%)	225 (29.8%)	
lower abdominal transverse & oblique incisions	94 (51.7%)	444 (58.8%)	
lower abdominal midline incision (up to umbilicus)	22 (12.1%)	56 (7.4%)	
upper abdominal incision[¶]	11 (6.0%)	30 (4.0%)	

[†]Abdominopelvic surgery performed by laparotomy or laparoscopy.
[¶]Including a lower midline incision extending above the umbilicus as well.
BMI – body mass index, N – number

Tab. 2. Comparison of the previous surgeries of the patients.
Tab. 2. Porovnání předchozích operací pacientů.

Parameters	Veress needle group	Direct trocar group	P-value
Previous open procedure, N (%)	127 (100%)	530 (100%)	0.237
ceserean section	56 (44.1%)	225 (42.5%)	
ovarian cystectomy	13 (10.2%)	61 (11.5%)	
hernia repair	11 (8.7%)	39 (7.3%)	
myomectomy	15 (11.8%)	48 (9.0%)	
endometriosis	4 (3.2%)	30 (5.7%)	
cholecystectomy	3 (2.3%)	11 (2.1%)	
appendectomy	12 (9.5%)	64 (12.1%)	
GIS surgery	4 (3.2%)	18 (3.4%)	
hepatobilier surgery	1 (0.8%)	2 (0.4%)	
urologic surgery	3 (2.3%)	9 (1.7%)	
tubo-ovarian abcess	2 (1.6%)	7 (1.3%)	
other[†]	3 (2.3%)	16 (3.0%)	
Previous laparoscopic procedure, N (%)	55 (100%)	225 (100%)	0.318
cholecystectomy	17 (30.9%)	77 (34.2%)	
hernia repair	12 (21.8%)	50 (22.2%)	
appendectomy	2 (3.6%)	6 (2.7%)	
ectopic pregnancy	3 (5.6%)	17 (7.6%)	
endometriosis surgery	2 (3.6%)	5 (2.2%)	
ovarian cystectomy	5 (9.1%)	23 (10.2%)	
myomectomy	1 (1.8%)	3 (1.3%)	
hysterectomy	1 (1.8%)	2 (0.9%)	
bariatric surgery	0 (0%)	1 (0.4%)	
GIS surgery	0 (0%)	2 (0.9%)	
other[¶]	12 (21.8%)	39 (17.4%)	

[†] Including tubal ligation, ectopic pregnancy, diagnostic laparotomy, salpingo-oophorectomy.
[¶] Including tubal ligation, diagnostic laparoscopy, salpingectomy and salpingo-oophorectomy.
GIS – gastro-intestinal system, N – number

Veress needle group, 13 patients previously underwent laparoscopy alone, compared to 35 patients in the direct trocar group. Furthermore, 42 patients in the Veress needle group had a history of both laparoscopy and laparotomy, while 190 patients in the direct trocar group had such a history (Tab. 2). The pneumoperitoneum was created at the initial attempt in 78 patients (88.6%) in the Veress needle group and in 347 patients (99.1%) in the direct trocar group. Thus, the direct trocar group had a lower rate of entry failure compared to the Veress needle group at the initial attempt, which was statistically significant

(99.1 vs. 88.6%; P = 0.012). Median visualization time was 152 (range 120–225) seconds for the Veress needle group and 41 (range 31–55) seconds for the direct trocar group (Tab. 3). The time to create a pneumoperitoneum was significantly shorter in the direct trocar group (P < 0.001). In 433 cases, the entire surgical procedure was performed laparoscopically. However, the remaining five cases were converted to a laparotomy due to extensive adhesions. There was one major complication in the direct trocar group (0.3%), which included full-thickness perforation of the anterior wall of the stomach with a 5 mm

trocar. No major complications were reported in the Veress group, and there was no statistically significant difference (P = 0.204). On the other hand, two minor complications (2.3%) were documented in the Veress needle group, and 11 minor complications (3.1%) were recorded in the direct trocar group. The minor complication rates were similar (P = 0.769).

Moreover, we stratified the patients into two subgroups depending on the type of prior surgical procedure they had undergone. The first subgroup consisted of patients who had undergone any prior laparotomy, while the second

Tab. 3. Comparison of surgical characteristics.
Tab. 3. Porovnání chirurgických charakteristik.

Parameters	Veress needle group N = 88	Direct trocar group N = 350	P-value
Successful entry on the initial attempt, N (%)	78 (88.6%)	347 (99.1%)	0.012
Number of punctures, N, mean (SD)	1.13 (± 0.37)	1.01 (± 0.09)	0.967
Visualization time, seconds, mean (SD)	167.7 (± 30.95)	39.1 (± 3.86)	< 0.001
Surgery-related complications, N (%)	3 (3.4%)	10 (2.9%)	0.908
Entry-related complications, N (%)	2 (2.3%)	12 (3.4)	0.835
major complications[†]	0 (0%)	1 (0.3%)	0.204
minor complications	2 (2.3%)	11 (3.1%)	0.769
port site bleeding, N (%)	1	6	
pneumo-omentum, N (%)	1	3	
omental bleeding, N (%)	0	1	
subcuteneous emphysema, N (%)	0	1	

[†] Including great vessel puncture and/or perforative organ injury
N – number, SD – standard deviation

included patients with any prior laparoscopy. Additionally, patients with a history of both laparoscopy and laparotomy were included in the first subgroup. We conducted analyses comparing the subgroups regarding Veress needle entry and direct trocar entry. Accordingly, the direct trocar technique demonstrated a significantly higher success rate on the initial entry attempt compared to the Veress needle technique, both in patients with prior laparatomy (99.4 vs. 89.3%; P = 0.027) and in those with prior laparoscopy (97.1 vs. 84.6%, P = 0.008). Similarly, the direct trocar technique showed a significantly shorter visualization time compared to the Veress needle technique both in patients with prior laparotomy (40.1 ± 5.36 vs. 151.4 ± 41.11; P < 0.001) and in those with prior laparoscopy (41.2 ± 4.25 vs. 155.5 ± 38.75; P < 0.001). Finally, there were no statistically significant differences in the rates of major and minor complications between the two subgroups when comparing the Veress needle and direct trocar technique (Tab. 4).

In the case of gastric perforation, which was the only major complication we experienced, we immediately noticed via direct visualization that

the trocar tip was located in the stomach. Then, we slightly withdrew the trocar. Accordingly, the scope left the gastric cavity, and after the creation of the pneumoperitoneum, the main trocar was inserted through the umbilicus under direct vision for access to a 10 mm optical telescope. Thereafter, we noticed that the liver and stomach widely adhered to the anterior abdominal wall. Then, we repaired the stomach laparoscopically with double-layer interrupted sutures and continued the operation from where it left off. Finally, we believed that the primary cause of this complication was adhesions that pulled and fixed the stomach to the anterior abdominal wall. Subsequent re-evaluation of the patient's medical record revealed a prior episode of pelvic inflammatory disease, suggesting Fitz Hugh Curtis syndrome as evidenced by peri-hepatic and gastric adhesions.

Discussion
The initial entry into the abdomen, whether with a Veress needle or a trocar, is a blind procedure and therefore carries the risk of visceral and/or vascular injury. The risk of visceral injury due to adhesion formation increases even

more in patients who have had previous abdominopelvic surgery. In addition, obesity makes the initial abdominal entry technically difficult and increases the risk of complications. The present study revealed that direct trocar entry via PP had a lower entry failure rate than Veress needle entry via PP (for the initial attempt 88.6 vs. 99.1%; P = 0.012; for the second attempt 10.2 vs. 0.9%; P = 0.001). Moreover, the visualization time using the direct trocar technique was significantly faster, with a similar complication rate compared to the Veress needle entry (P < 0.001). Results of the present study may encourage surgeons to prefer the direct trocar technique via PP to create a pneumoperitoneum in patients with previous abdominopelvic surgery or failed entry via the umbilicus, particularly in the presence of concomitant obesity.

Failed entry is the primary problem of the Veress needle. Accordingly, in obese cases, the umbilicus is a challenging site for the initial entry due to increased thickness of the abdomen. Many authors recommend an alternative entry site after three failed attempts with the Veress needle to avoid pre-peritoneal insufflation and further possible

Tab. 4. Comparison of surgical characteristics in subgroups according to the previous procedure type.
Tab. 4. Porovnání operačních charakteristik v podskupinách podle předchozího typu výkonu.

Parameters	Veress needle group	Direct trocar broup	P-value
Successful entry on the initial attempt, N, successful initial attempt / total initial attempt, (%)			
in patients with previous L/T ± L/S	67/75 (89.3%)	313/315 (99.4%)	0.027
in patients with previous L/S only	11/13 (84.6%)	34/35 (97.1)	0.008
Number of punctures, N, mean (SD)			
in patients with previous L/T ± L/S	1.12 (± 0.05)	1.01 (± 0.01)	0.583
in patients with previous L/S only	1.15 (± 0.03)	1.03 (± 0.01)	0.726
Visualization time, seconds, mean (SD)			
in patients with previous L/T ± L/S	151.4 (± 41.11)	40.1 (± 5.36)	< 0.001
in patients with previous L/S only	155.5 (± 38.75)	41.2 (± 4.25)	< 0.001
Entry-related major complications[†], N, complication / total patient, (%)			
in patients with previous L/T ± L/S	0/75 (0%)	1/315 (0.3%)	0.497
in patients with previous L/S only	0/13 (0%)	0/35 (0%)	0.999
Entry-related major complications[¶], N, complication / total patient, (%)			
in patients with previous L/T ± L/S	1/75 (1.3%)	10/315 (3.2%)	0.142
in patients with previous L/S only	1/13 (7.7%)	1/35 (2.9%)	0.092

[†] Includes great vessel puncture and/or perforative organ injury.
[¶] Includes port site bleeding, pneumo-omentum, omental bleeding, subcuteneous emphysema.
N – number, L/S – laparoscopy, L/T – laparotomy, SD – standard deviation

complications [12,18]. In the same manner, Azevedo et al. compared initial entry into the abdomen via the umbilicus and PP using a Veress needle, and the authors reported similar failure rates between groups [19]. Pre-peritoneal insufflation is another problem of abdominal entry using the Veress needle. Incorrect placement of the Veress needle may cause pre-peritoneal insufflation. The possibility of pre-peritoneal insufflation occurs more frequently as the amount of fat in the abdomen increases [20]. Although not as much as the umbilical region, in obese cases, a similar thickening of the fatty tissue in the abdominal wall occurs around PP, which makes entry challenging. Accordingly, some authors advocate a trans-uterine or trans-vaginal route with the Veress needle in case of failed entry via PP [9,21]. However, in many cases, the deep pelvis may not be suitable for initial entry due to adhesion formation related to previous surgery. Moreover, most surgeons are less familiar with these entry sites and have

rarely practiced. On the other hand, the direct trocar entry technique reduces the rate of both failed entry and pre-peritoneal insufflation [22,23]. The present study, designed using PP as the initial entry site, showed that direct trocar insertion had a significantly lower failure rate than Veress needle insertion. Accordingly, the main benefit of the direct trocar entry technique might be the very low probability of failed entry. With the direct trocar entry technique, while the trocar, which has a larger diameter tip than the Veress needle, is carefully and slowly advanced into the anterior abdominal wall, a more pronounced resistance and tactile sensation can be obtained from anatomical landmarks. Accordingly, the penetration of the fascia and then the peritoneum may be felt more precisely during entry. Furthermore, abdominal entry is precisely confirmed under direct vision with the laparoscope. In contrast, the safety tests which are performed after Veress needle entry provide indirect information [20].

The present study showed no significant difference in terms of entry-related complications between the two groups. Similarly to our findings, many authors stated that direct trocar insertion is related to fewer insufflation-related complications, such as extraperitoneal insufflation and pneumo-omentum [11,12,23].

Since no time is lost with insufflation, the diagnosis of a vascular or visceral complication that occurs during the initial entry can be made more quickly with direct trocar insertion. Thus, that may create a chance of rapid reaction to the related complication, including laparoscopic repair of the injury [13]. Finally, direct trocar insertion has the advantage of more rapid access to the abdominal cavity [11,22,24,25]. The present study revealed that the visualization time using the direct trocar entry was significantly faster than Veress needle entry. It can be stated that a rapid and successful entry into the abdomen undoubtedly enables the surgeon to concentrate and focus on the actual surgical procedure [26].
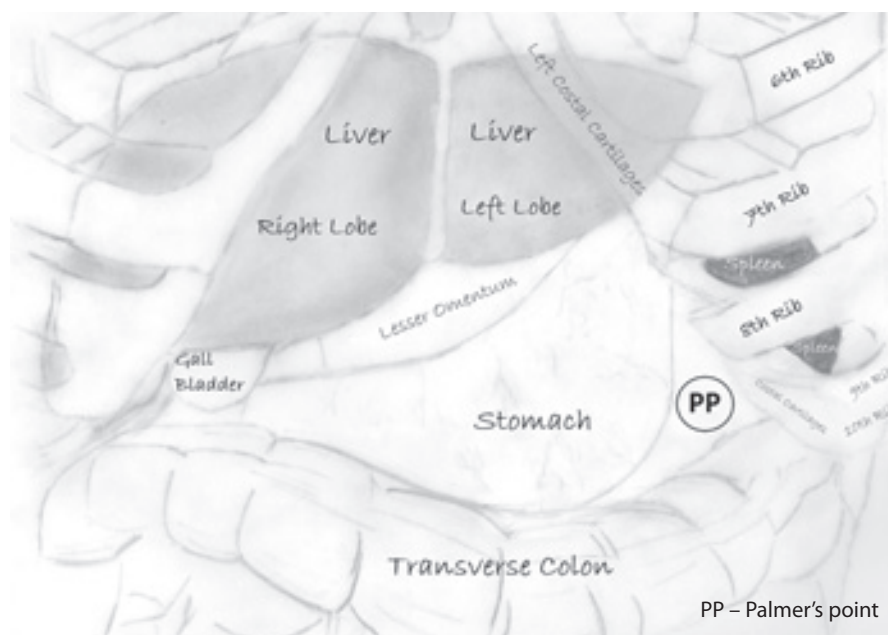
Fig. 2. Schematic illustration of Palmer's point and visceral organs in the upper abdomen.
Obr. 2. Schematické znázornění Palmerova bodu a viscerálních orgánů v horní části břicha.

From an anatomical point of view, the risk of serious vascular injury during initial entry via PP may be considered an unusual complication due to its distance from the great vessels along the midline (Fig. 2). In a healthy woman, the left lobe of the liver, splenic flexure of the colon, and spleen are located well away from the vertical projection of PP [27]. On the other hand, although the stomach does not lie under PP, it may be as close as 1.5 cm in some cases [28]. Therefore, gastric decompression should be performed before entry via PP to avoid gastric injury.

For successful and safe initial insertion via PP, many authors recommend that (a) the skin incision should be slightly larger than the trocar diameter, (b) the trocar should have a sharp tip (non-shielded trocar is preferable), (c) small diameter trocar should be chosen (5 mm is preferable), (d) gastric content should be aspirated before entry, (e) the trocar should be inserted perpendicularly to the fascia and peritoneum, avoiding sudden acceleration, and (f) the operating table should be positioned parallel to the floor during entry [4,12,23,29,30].

There were some limitations in the present study which should be discussed. First, the open entry technique was not studied in the cohort. However, including an open entry in the study would have enriched the manuscript and brought new perspectives. Another limitation was that no comparison was made between obese (BMI > 30) and normal-weight patients.

Conclusion

Provided that the basic surgical principles are respected, the direct trocar entry technique via Palmer's point is a safe, effective, and rapid initial entry approach into the abdomen during laparoscopic gynecologic surgery and may be preferred in patients with previous abdominopelvic surgery.

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