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Laparoscopic Access Techniques: Experience in a Developing Country, Sudan

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Abstract: *Background*: Minimal access surgery has revolutionized the field of surgery. Access to the abdominal cavity represents a critical step in laparoscopic procedures. Various techniques have been used to obtain safe access into the abdominal cavity, with no apparent superiority of one technique over another. *Aim*: This study was conducted to assess the different types of laparoscopic access techniques used at Almak Nimir University Hospital in the period from January to December 2019. *Methodology*: This descriptive cross-sectional study compared the use and outcomes of different laparoscopic access techniques in various laparoscopic procedures performed at Almak Nimir University Hospital, (Shendi University, Shendi, Sudan). *Results*: The study included 324 patients with a mean age of 26.2±15.3 years (range 1–85 years). Most of the patients were female (266 patients, 82.1%). Of the laparoscopic procedures, 77.2% were laparoscopic appendicectomy while 18.8% were laparoscopic cholecystectomy. The Veress needle technique was used in 158 patients (49.7%), the open technique was used in 97 patients (29.9%) and direct trocar insertion was used in 66 patients (20.4%). Direct trocar insertion showed a statistically shorter procedure duration (mean 2.9±0.9 min) compared to the other techniques (p=0.001). Access-related complications occurred in five patients (0.6%), but there was no statistically significant difference between the three access techniques. *Conclusion*: This study confirms the safety of various access techniques used in laparoscopic procedures; however, the choice of access type should be individualized.

Keywords: Laparoscopic Access, Veress Needle, Blind Trocar Insertion, Open, Pneumoperitoneum

1. Introduction

Over the last two decades, laparoscopy has emerged as one of the primary operative techniques within the field of abdominal surgery. During this time, it has undergone significant changes as new technologies and operative approaches have become available [1]. Laparoscopic techniques have revolutionized the field of surgery, with numerous benefits including decreased postoperative pain, earlier return to normal activities following surgery, and fewer postoperative complications (e.g., wound infection, incisional hernia) compared to open techniques [2]. Complications arising from laparoscopy are often related to the initial entry into the abdomen [3]. The introduction of the first trocar, which often follows creation of the pneumoperitoneum, is considered crucial, but is also the most dangerous step of a laparoscopic procedure. Over the years, several methods of laparoscopic entry have been described [4].

Various techniques are used to access the abdominal cavity, the mostcommon of which include the open Hasson's technique, the closedVeress needle technique and direct trocar insertion [5]. There is currently insufficient evidence to support the use of one laparoscopic entry technique over another. Some researchers have noted an advantage of direct trocar entry over Veress needle entry based on a reduced rate of failed entries and lower risk of minor complications [3, 6-8].

Although uncommon, a significant percentage of complications from laparoscopic surgery are related to the initial access. While these complications can be minimized, they can never be completely avoided. Therefore, we need to know the best ways to resolve them when they occur [9, 10]. The most common entry-related complications are

preperitoneal insufflation, vascular injury, and bowel and bladder injury [9, 11].

1.1. Open (Hasson) Technique

The open (Hasson) technique isamethod of accessing the abdomen for laparoscopic surgeryvia an open approach. It was initially described by Harrith Hasson in 1971 [12]. In this method, a small, 1.5–2 cm incision is made either inferior or superior to the umbilicus. The incision is deepened to the sheath, which is grasped and incised, followed by the introduction ofa blunt trocar or Hasson'scannula [13].

1.2. Closed (Veress Needle) Technique

Here, a small incision (stab) is made either superior or inferior to the umbilicus, then a specialized needle (Veress needle) is used to puncture the abdominal wall into the peritoneal cavity at an angle or 45 to 90 degrees to the abdominal wall. Several clicking sounds indicate that the needle has passed through the facia and peritoneum. Proper needle placement is then checked by aspiration using a syringe, followed by saline injection and creation of the pneumoperitoneum. The previous incision is then enlarged, and the primary trocar is introduced [14].

1.3. Direct Trocar Insertion Technique

In 1978, Dingfelder first published the description of thistechnique as a single blind step without prior creation of a pneumoperitoneum. A small incision is made below or above the umbilicus, dissected deeply with an artery forceps. Then, a suitable trocar is introduced blindly after lifting the abdominal wall, followed by pneumoperitoneum creation [15].

In the present study, we aimed to evaluate the current practice and outcome of different access techniques in various laparoscopic procedures performed at Almak Nimir University Hospital, Shendi, Sudan.

2. Methodology

2.1. Setting

All of the procedures were performed at Almak Nimir University hospital which is located in Shendi city. Three general surgeons performed most of the procedures with contribution of surgical residents who worked under supervision.

Shendi is a city located in River Nile state of Sudan, about 172 km north of the capital Khartoum. It is famous forits historical sites including the famous pyramids of the ancient Meroe kingdom.

2.2. Study Design

This descriptive cross-sectional study compared the use and outcomes of different laparoscopic access techniques in various laparoscopic procedures performed at Almak Nimir University Hospital (Shendi University, Shendi, Sudan) in the period from January to December 2019.

2.3. Data Collection

The study included all patients who underwent various laparoscopic procedures and agreed to participate in the study. A predesigned questionnaire was used for data collection.

2.4. Main Outcomes

Patient demographic data and characteristics, including modified World Health Organization (WHO) body mass index (BMI) classification, access technique used (Veress needle technique, direct trocar insertion or open technique), duration of access (from incision to insertion of the primary trocar) and short-term complications, were recorded.

2.5. Data Analysis

Data were analyzed using SPSS (version 26). Comparisons between the three techniques in terms of the duration and complications were performed using analysis of variance (ANOVA). P-value of < 0.05 was considered statistically significant.

3. Results

The study included 324 patients with a mean age of 26.2±15.3 years (range 1–85 years). Most of the patients were female (266 patients, 82.1%). Of the laparoscopic procedures, 77.2% were laparoscopic appendicectomy and 18.8% were laparoscopic cholecystectomy, as shown in Table 1. Most patients (60.1%) had a normal BMI, while 8.4% were classified as obese (Table 2).

Table 1. *Frequency and percentage of different laparoscopic procedures.*

Procedure	Frequency	Percent
Appendicectomy	250	77.2
Cholecystectomy	61	18.8
Laparoscopic assisted orchidopexy	9	2.8
Inguinal hernia repair	4	1.2
Total	324	100.0

Table 2. *Distribution of the study population according to body mass index (BMI) categories.*

BMI category	Frequency	Percent
Underweight	42	13
Normal	195	60.2
Overweight	60	18.5
Obese	27	8.3
Total	324	100.0

Regarding the laparoscopic access technique used, the Veress needle technique was used in 161 patients (49.7%), the open technique was used in 97 patients (29.9%) and direct trocar insertion was used in 66 patients (20.4%).

Regarding the duration of access, we observed a statistically significant correlation between the access type and the duration of access (p=0.00). Blind trocar insertion showed the shortest duration, followed by the open technique, as shown in Tables 3 and 4.

Table 3. *Access duration for the three methods of access (open, Veress needle and direct trocar insertion), presented as the mean, standard deviation and range (in minutes).*

Access type	Mean duration	SD	Range
Open	3.3	1	2–10
Veress needle	4.1	1.3	2–10
Blind trocar insertion	2.9	0.9	1–5

Table 4. *Differences between the three methods of access (open, Verres needle and direct trocar insertion) according to access duration (multiple comparisons).*

	Mean difference	P-value	Significance
Open * closed	-0.82	0.000	Significant
Open * blind	0.42	0.023	Significant
Blind * closed	-1.24	0.000	Significant

Access complications occurred in five patients (1.5%). Small bowel injury occurred in one patient (0.3%) in the open access group. Two patients (0.6%) suffered a urinary bladder injury, one in the direct trocar insertion group and one in the Veress needle group (Table 5).

Table 5. *Complications related to access technique used.*

Access type	No complication	Urinary bladder injury	Bowel injury	Preperitoneal insufflation	Total
Open	95 (97.93%)	0 (0.00%)	1 (1.03%)	1 (1.03%)	97 (100%)
Veress needle	159 (98.76%)	1 (0.62%)	0 (0.00%)	1 (0.62%)	161 (100%)
Blind trocar insertion	65 (98.48%)	1 (1.51%)	0 (0.00%)	0 (0.00%)	66 (100%)
Total	319 (98.45%)	2 (0.61%)	1 (0.3%)	2 (0.61%)	324 (100%)

There was no statistically significant correlation between the type of access and the occurrence of complications (p=0.65) as well as the BMI (p=0.127).

4. Discussion

Over the past few decades, many techniques, technologies and guidelines have been introduced to eliminate the risks associated with laparoscopic entry. However, no single technique or instrument has been proven to eliminate laparoscopic entry-associated injury [8]. Creation of a pneumoperitoneum and placement of laparoscopic ports remains a critical first step in endoscopic surgery. It is estimated that up to 50% of laparoscopic complications are entry-related, and most injury-related litigations are related to the trocar [16]. In the present study, we assessed three laparoscopic access techniques used in different laparoscopic procedures. Selection of the most appropriate entry technique is dependent on patient factors and setup, as well as the surgeon's preference and experience [17].

Debate on the safest entry technique has continued for the last two decades, yet we are no closer to arriving at a scientifically valid conclusion regarding technique superiority. With hundreds of thousands of patients required to perform adequately powered studies, it is unlikely that appropriately powered comparative studies can be undertaken [3, 18].

In this study, the Veress needle technique was used in most cases, followed by the open technique. Veress needle entry is widely used to create the pneumoperitoneum, and is considered both safe and easy [19-21]. On the other hand, some studies in the literature have reported that open laparoscopy is the only method that offers precisely controlled entrance into the abdominal cavity, with low risk of trauma and no serious vascular or organ injuries. The advantages of this procedure are that, with proper practice, it takes less time and can be used in all possible situations with low intraoperative risk, even in patients who have undergone previous abdominal operations [22-25]. However, one study reported a significantly higher number of entry-related complications in the open technique compared to the closed-entry technique [26].

Regarding the length of time required to obtain laparoscopic access, blind trocar insertion was faster than the two other techniques. Many other studies have also shown this finding [15, 27, 28].

Complications related to access in this study were limited (five cases, 1.5%). Only two cases required conversion to an open procedure, one of which suffered bowel injury following the open technique, and the other was urinary bladder injury following direct trocar insertion. The other three complications were treated conservatively. According to the literature, access-related complications can be managed conservatively or laparoscopically [17]. No deaths were reported for any of the access techniques.

In one multicenter study that included a large number of patients, there were seven major vascular injuries (0.05%), eight visceral lesions (0.06%) and nine minor vascular lesions (0.07%), with an overall morbidity of 0.18%. There were no deaths related to these complications. The rate of complications differed significantly ($p < 0.0001$) depending on the type of approach used. It was 0.27% with the optical trocar (3 of 1009 cases), 0.18% with the closed approach (20 of 10,664 cases), and 0.09% with the open approach (1 of 1135 cases) [29].

5. Conclusion

Various laparoscopic access techniques used in many laparoscopic procedures were proved to be safe; however, the choice of access type should be individualized. Veress needle technique was used so often while blind trocar insertion was found to be faster than other techniques.

Limitations of the study

1) Number of trials to obtain access was not stated.
2) No randomization was done, just observation of the actual practice.

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