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Laparoscopic entry techniques: a survey of current preferences of South African general surgeons

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Laparoscopic entry techniques: A survey of current preferences of South African general surgeons

Nishlin Naidoo

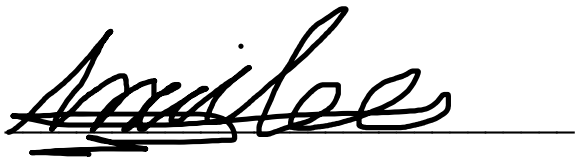


A dissertation submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in fulfilment of the requirements for the degree of Master of Medicine

Johannesburg 2021

DECLARATION

I, Nishlin Naidoo (student number:1598439), declare that this dissertation is my own unaided work. It is being submitted for the Degree of Master of Medicine in Surgery at the University of the Witwatersrand, Johannesburg, South Africa. It has not been submitted before for any other degree or examination at any other University.



___8th __Day of _____November_____2021 in Johannesburg

PRESENTATIONS ARISING FROM THIS STUDY

2019 Bert Myburgh Research Forum presentation, Wits Department of Surgery.

ABSTRACT

Introduction: Laparoscopy has been popularized over the past few decades due to numerous proposed benefits over open surgery. Entry injuries at the time of placing the primary access port remain a significant risk to the patient. We conducted this study to evaluate the current practice of laparoscopic entry techniques among general surgeons in South Africa.

Objectives: The primary objectives were to determine the preferred techniques of primary access and whether the preferred choice of technique has changed over the last decade. We also sought to determine the factors influencing choice of technique and with which techniques surgeons have had the most complications.

Methods: A national survey created using Surveymonkey.com was distributed via email to practicing general surgeons. We included surgeons affiliated with ASSA (Association of Surgeons of South Africa) and the eight medical schools across the country. Questions were asked to fulfil the objectives and a descriptive analysis was undertaken.

Results: Responses were received from 124 surgeons. The Hasson open entry technique is currently used by 54.8% for primary access whilst 31.4% use visual access techniques. 37.1% reported a change in routine over the last decade and two thirds of those surgeons changed to visual access systems. Bowel injury related complications were reported by 33.9% of respondents and 11.3% reported major vascular injury related complications during primary access. Approximately 45% of bowel and major vascular injuries occurred with the use of visual access techniques.

Conclusions: Most general surgeons prefer the use of the Hasson open entry technique. The past decade has seen almost a quarter of general surgeons change their routine to visual access systems. The concerning factor is that approximately 45% of major vascular and bowel injuries have been reported with use of visual access systems. Primary access during laparoscopy requires ongoing evaluation due concerns over patient safety. Further study is required to determine which type of visual access technique poses the greatest risk.

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TABLE OF CONTENTS

DECLARATION ii

PRESENTATIONS ARISING FROM THIS STUDY iii

ABSTRACT iv

ACKNOWLEDGEMENTS v

TABLE OF CONTENTS vi

LIST OF ABBREVIATIONS vii

LIST OF FIGURES viii

LIST OF TABLES viii

1. INTRODUCTION 1

2. METHODS 5

3. RESULTS 6

4. DISCUSSION 12

5. CONCLUSION 14

REFERENCES 15

APPENDIX 1: Approved protocol 17

APPENDIX 2: QUESTIONNAIRE 25

APPENDIX 3: ETHICS CLEARANCE 30

LIST OF ABBREVIATIONS

ASSA- Association of Surgeons of South Africa

IVC- Inferior vena cava

UK- United Kingdom

LIST OF FIGURES

Figure 1. An image of a commercially available Veress needle…….....……2

Figure 2. An image of the Visiport visual entry system…….....3

Figure 3. Most favoured laparoscopic entry technique in a patient with no previous abdominal surgery…….....8

LIST OF TABLES

Table 1. Demographic data of study participants..... 7

Table 2. Change in laparoscopic entry technique. 9

Table 3. Factors influencing choice of laparoscopic entry technique 10

1. INTRODUCTION

1.1 Background

Laparoscopy can be traced back to the early 20th Century where its advancement led to the first laparoscopic cholecystectomy in 1987.[1,2] Since then a wide array of procedures using laparoscopy have been conducted.[2] Laparoscopy is now used across most surgical sub-specialties due its advantages over open surgery.[3] A decrease in operative trauma and a lower number of major wound complications, as well as quicker recovery, are cited as benefits. Health care centres and funders can also benefit from reduced hospital stays and thus lower costs.[4]

The initial step in laparoscopic surgery is insertion of the primary port into the abdomen. Gaining entry is potentially challenging and has been associated with injuries to major blood vessels and the gastrointestinal tract. The numerous techniques available for entry, are broadly classified into two groups of either open or closed entry techniques.[5,6]

The open entry technique was first described by Hasson in 1971 and general surgeons commonly favour this technique.[3] Previous literature has shown both the benefits and disadvantages to this technique.[1] Of benefit, a lower incidence of vascular injuries has been reported using the Hasson technique in comparison to veress needle and direct blind trocar insertion.[7] The other benefit being assessment and potential clearance of adherent abdominal contents to the umbilicus during port placement.[7] Among the disadvantages are the documented higher incidence of bowel injuries and the increased length of time for primary access into the abdominal cavity.[7,8]

The closed entry technique historically involves insertion of a thin cannula into the abdomen, after which gas is insufflated into the abdomen through the cannula to create a pneumoperitoneum. Following this, sharp trocars are inserted into the abdomen and the laparoscope passed through the cannula into the abdomen.[8] The first type of closed entry technique, also the oldest entry technique, is the Veress needle system which has become a popular choice throughout the world, especially for gynaecologists.[8] Major complications related to this technique include bowel and vascular

injuries, mainly retroperitoneal large vessels such as the inferior vena cava and aorta, subcutaneous emphysema and gas embolism.[5] An image of a commercially available Veress needle is seen in Figure 1.



Figure 1. An image of a commercially available Veress needle.

Direct blind trocar insertion is considered an alternative to the Veress needle technique. This technique does not require pre-insufflation of the abdominal cavity. A sharp, bladed trocar is held in the dominant hand whilst the abdominal wall is grasped with the non-dominant hand. The trocar is then blindly advanced into the abdomen usually through the umbilicus.[5] This technique, shown to be quicker than the Veress needle insertion, has the advantage of potentially not causing gas embolism but does carry a higher risk of bowel and vascular injury.[9]

Visual entry systems in laparoscopy were first introduced in 1994 and various companies have created different systems.[8] The principles of this technique involve a trocar with a hollow cannula and transparent sharpened tip. A zero-degree camera is inserted into the cannula and the device is advanced by the surgeon through the abdominal wall. The layers of the abdominal wall are visualized as the device is advanced into the abdomen. This technique may be advantageous as it allows for clear visualization of the abdominal wall layers as it is advanced, although this has not been fully explored.[8] The Visiport™ is an example of a visual entry system that has a short-bladed cannula tip with a hollow trocar. It is intermittently fired with downward axial pressure on the abdomen to allow entry into the abdominal cavity layer by layer.[8] In terms of trocar related complications, vascular and visceral injuries are associated with the highest morbidity and mortality, and these injuries can have severe consequences and result in conversion to open surgery.[10] An image of the Visiport™ is shown in figure 2.



Figure 2. An image of the Visiport™ visual entry system.

Unquestionably, the initial step of entry in laparoscopic surgery is the most dangerous as roughly half of all injuries occur on entry, with 80% of those occurring during insertion of the primary port. As discussed above, these injuries include damage to abdominal organs and major blood vessels.[11] Where vascular injuries are usually apparent soon after the injury, bowel injuries may be missed initially resulting in later spillage of bowel content with resultant peritonitis.[12] A study in 2005 by

Fuller et al. showed that a third of all malpractice injury claims associated with laparoscopic surgery were due to injuries caused by laparoscopic trocars.[11] Previous observational studies have suggested the open technique to be more beneficial over the closed technique as it may cause fewer vascular injuries,[6,7] however a systematic review by Amad et al. in 2015 suggested that there is no significant difference in injury rates amongst the various entry techniques and the conclusion was reached that no single technique can be recommended over another.[6]

A previous study conducted in Canada amongst surgeons evaluating preferences of Laparoscopic entry techniques via a survey, showed that more than 80% of Canadian surgeons favoured the open technique. The data points collected in this study included entry technique, device usage and safety during laparoscopy. Response rate achieved was 24.8% with a sample size of 1000 practising general surgeons.[13] In a similar study from the United Kingdom and Ireland, more than 90% of gynaecologists reportedly preferred the Veress needle technique.[13]

Currently there are no local data on preferred laparoscopic entry techniques amongst general surgeons in South Africa. Therefore, this study aimed to determine the preferred entry techniques, whether this preference has changed over the last decade and the factors potentially influencing this change. This study also attempted to identify factors that predict or influence the most common practice and identify the techniques with which surgeons have had the most complications.

1.2 Objectives

The aim of this study was to survey the current practice of laparoscopic entry techniques amongst general surgeons in South Africa. The primary objective was to determine the preferred techniques of entry amongst general surgeons in South Africa and whether the preferred choice of technique has changed over the last decade. Secondary objectives were to determine the factors that predict or influence the most common practice and with which techniques local surgeons have had the most major complications.

2. METHODS

2.1 Study population and technique

This was a prospective, cross-sectional and observational study amongst general surgeons in South Africa using an electronic survey to collect the data. Questions were formulated based on input from multiple experts in the field, whose opinion was requested in line with study objectives. The types of questions included multiple choice, drop-down, demographic and open-ended questions. No pre-test pilot study was conducted. The electronic survey was created using the SurveyMonkey® website and distributed nationally via email to all registered general surgeons associated with Medical Schools and/or training institutions in South Africa, as well as those affiliated with the Association of Surgeons of South Africa (ASSA). This broad distribution allowed inclusion of registered general surgeons with laparoscopic experience in both the private practice and public healthcare sector with laparoscopic experience. Specifically, general surgeons were recruited as the study participants because many have high levels of laparoscopic experience and thus exposure to varying types of laparoscopic entry techniques.

2.2 Ethical Approval

Ethical approval was obtained from the University of the Witwatersrand Human Research Ethics Committee (Medical) (clearance number M171148). All participants remained anonymous to study investigators.

2.3 Statistical Analysis

Data were collected using the SurveyMonkey® website and then exported to a Microsoft Excel spreadsheet for descriptive statistical analysis. Summary statistics of categorical data are expressed as proportions of the total.

2.4 Conflict of Interest

There are no known conflicts of interest associated with this study and no financial support was received that could influence the study outcome.

3. RESULTS

This survey was sent to 500 surgeons with 124 surveys completed which is a received a response rate of 24.8%. As illustrated in Table 1, males comprised of 87% of the survey respondents highlighting a dominance with regard to gender. Forty one percent of the participating surgeons were aged between 35 and 44 years, and 34.7% in the age category 45-54 years. Those aged 65 years and above were least represented. Of the survey respondents, 98.4% were actively performing laparoscopic surgery, with 76.6% doing more than 5 laparoscopic procedures per month. Experience of more than 10 years in the surgical profession was seen in 61.2% of participants and 67.7% also had a qualification in a sub-specialty of surgery. Most respondents (41.9%) were practicing surgery in public healthcare facilities, 27.4% were practicing in the private sector and 30.6% practicing in both the healthcare sectors (Table 1).

The majority of respondents indicated that they perform advanced laparoscopic surgery (n = 83, 66.9%), of which 39.8% (n = 33) indicated they perform only advanced laparoscopy, 8.4% (n = 7) also performed intermediate and 51.8% (n = 43) also performed basic and intermediate level laparoscopic surgery. Five respondents in the study (4.0%) only performed basic laparoscopic surgery.

Table 1. Demographic data of study participants.

Parameter	**Number (%)** *(n = 124)*
Gender	
Male	108 (87%)
Female	15 (12%)
Unknown	1(0.8%)
Age range (years)	
25-34	6 (4.8%)
35-44	51 (41.1%)
45-54	43 (34.7%)
55-64	22 (17.7%)
65+	2 (1.6%)
Practice sector	
Public Practice	52 (41.9%)
Private Practice	34 (27.4%)
Both	38 (30.6%)
Level of experience	
> 10 years	76 (61.2%)
< 10 years	46 (37.1%)
Number of procedures per month	
>5	95 (76.6%)
<5	22 (17.7%)

As shown in Figure 3, the most favoured laparoscopic entry technique in a patient with no previous abdominal surgery was the Hasson open entry technique [54.8% (n = 72) of respondents]. This was followed by a visual entry system technique in 31.5% (n = 39) and the Veress needle technique in 7.3% (n = 9) of respondents. This question within the survey allowed respondents to select more than one answer. A small proportion (3.2%, n = 4) of surgeons had selected a combination of the Hasson open entry and visual entry system techniques as their preferred choice, but the direct blind trocar insertion was the least favoured technique at 1.6% (n = 2).

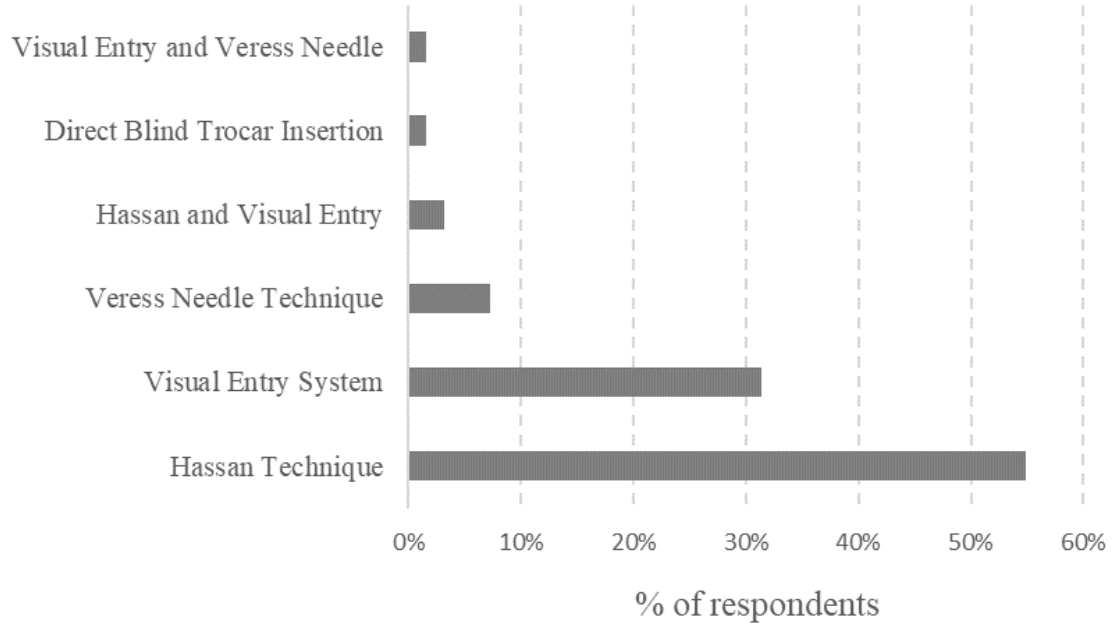


Figure 3. Most favoured laparoscopic entry technique in a patient with no prior abdominal surgery.

Table 2 demonstrates that 62.9% (n = 78) of respondents indicated that there was no change in their routine choice of laparoscopic entry technique over the last 10 years. However, the remaining 37.1% reported that they had changed their primary technique, with nearly a half changing from Hasson technique to the visual entry system and just over fifth changing from Veress needle to the visual entry system, and almost a fifth from Veress needle to Hasson technique. Looking at the total cohort of respondents, 19% of surgeons had changed from using the Hasson open entry technique and 15% from favouring the Veress needle technique. The group with the least changes in technique were respondents favouring the visual entry system.

Table 2. Change in laparoscopic entry technique.

Technique	Frequency *(n = 124)*	Percentage (%)
No change in routine	78	62.9
From Hasson technique	(24)	(19.3)
Hasson to Visual entry system	20	16.1
Hasson to Veress needle	3	2.4
Hasson to Direct blind trocar insertion	1	0.8
From Veress Needle	(19)	(15.4)
Veress needle to Hasson	9	7.3
Veress needle to Visual entry system	10	8.1
From Visual Entry System	(3)	(2.4)
Visual entry system to Direct blind trocar insertion	1	0.8
Visual entry system to Hasson technique	1	0.8
Visual entry system to Veress needle	1	0.8

The factors which influence the surgeon's choice of entry technique are summarized in Table 3. Safety was the main influencing factor with 83% of participants choosing this option. Technical ease for 49.2% of surgeons, speed of entry for 33.8%, closure technique for 25.8% and cost for 24.2% of respondents were also common factors influencing the choice of technique.

Table 3. Factors influencing choice of laparoscopic entry technique

Factor	**Number (%)** *(n = 124)*
Safety	103 (83%)
Technical ease	61(49.2%)
Speed of entry	42(33.8%)
Closure Technique	32(25.8%)
Cost	30 (24.2%)
Gas leakage	23 (18.5%)
High BMI	22(17.7%)
Equipment	16(12.9%)
Speed of insufflation	15 (12%)
Port Site bleeding	9 (7.2%)
Low BMI	9 (7.2%)

Table 4 shows the number of respondents that reported major injury related complications of the bowel or vasculature with each of the four entry techniques. Overall, 33.9% of surgeons reported bowel injury related complications during primary access, whilst 11.3% reported major vascular injury related complications. Surgeons who reported major vascular related injuries had more than 10 years' experience in laparoscopic surgery and 93% were performing more than 5 laparoscopic cases per month. Half of the surgeons who reported bowel injuries during primary access were using a visual access system at the time of injury. Similarly, half of the surgeons who reported major vascular injuries were also using a visual access system. No respondents reported vascular injury related complications using the Hasson open entry technique, however one in three reported bowel related injuries using this technique. Respondents using the Veress needle technique were responsible for reporting a third of major vascular injuries. These figures are summarized in Table 4.

Most participants were of the opinion that the lowest rates of bowel and vascular injury related complications occur whilst using the Hasson technique, 78% and 83.8% respectively. However, 16% and 13% of respondents were of the opinion that bowel and vascular injury related complications, respectively are unlikely to be caused whilst using the visual access techniques.

Interestingly out of the 16% that are of the opinion that visual access techniques are the least likely to cause bowel injury, two-fifths of those surgeons have experienced bowel injury related complications when using this technique.

Table 4. Surgeons' experience of major injuries during primary access

Technique	**Bowel***	**Vascular**
Number of respondents of total (%)	42 (33.9%)	14 (11.3%)
Hasson Technique	14 (33.3%)	0
Visual entry system	21 (50.0%)	7 (50.0%)
Veress needle technique	11 (26.2%)	5 (35.7%)
Direct blind trocar insertion	2 (4.8%)	2 (14.3%)

**These entries exceed 100% as some respondents selected more than one technique*

4. DISCUSSION

This study is the first to report on the practice of laparoscopic entry techniques amongst general surgeons in South Africa. With a survey response rate of 24.8% the results from this study reflect the experience of at least a quarter of registered surgeons in our country who are performing laparoscopic surgery. There were 124 respondents out of 500 surveys distributed, which is a response rate that is comparable to other similar studies conducted in other countries, albeit those studies reported larger numbers of between 700 and 1000 respondents.[8,13]

This highlights the active involvement of and willingness of the surgeons in South Africa to be a part of on-going research in MAS. However, one of our challenges was surveying all surgeons in South Africa as no formal database or platform exists in which to access all surgeons in the country. We had assistance from the national surgical society (ASSA) and the medical schools across South Africa to access the email addresses of their membership base and university departments to distribute our survey.

We found that just over half of responding South African general surgeons who perform laparoscopic surgery (54.8%) prefer the use of the Hasson open entry technique, which is in keeping with the practice of general surgeons in other countries.[13] The second most preferred technique was the Visual entry system, followed by the Veress needle, which is in contrast to the findings of a similar study conducted in the UK amongst gynaecologists, whose preferred choice was the veress needle technique.[8]

Over the last decade almost a quarter of surgeons that responded to the survey have moved towards using the visual access techniques and 19% have deviated from the Hasson open entry technique. This has resulted in visual access techniques being the second most popular choice amongst this cohort of general surgeons practicing laparoscopic surgery. The perception of surgeons in this study is that visual entry systems, after the Hasson open entry technique, are less likely to cause major injuries. Most surgeons in this study prioritised safety and technical ease as factors influencing choice, which are probable contributing factors to the choice of visual entry system for primary access.

Our study found that the main factor influencing choice of entry technique used is safety, with 83% of respondents selecting this option. The perception of most surgeons surveyed is that the Hasson open entry technique was least likely to cause bowel or major vascular injuries. This is despite there being no proven significant difference between techniques in terms of injury rates.[6] Technical ease and speed of entry are the other main factors contributing to technique preference, selected by almost half the respondents.

Injuries during primary access pose a significant risk to the patient.[5,11] Studies have shown a high prevalence of malpractice lawsuits related to the placement of the primary trocar.[14] We found that 38% of surgeons have encountered major injury related complications during primary access, which is lower than a similar observational studies conducted amongst Canadian general surgeons where over half of their respondents reported major injury during primary access.[13] Of note in our study is that injuries to bowel and major blood vessels were mostly reported with the use of the visual entry systems with 45% of the total injuries being caused by this method. We however did not specify to ask which type of visual access technique contributed to these injuries and we recommend this be investigated in future studies.

One of the limitations with respect to our survey as the data collection instrument was that there was no formal process of expert consensus used to formulate survey questions. This resulted in the omission of key questions like specifying the type of visual entry system used. An initial pilot study would potentially have allowed refinement of the survey, for example changing some of the questions to allow single rather than multiple options to be selected.

5. CONCLUSION

Most general surgeons in South Africa who participated in this study prefer the use of the open entry technique. However, the visual access technique has also become a popular choice over the last decade with almost a quarter of general surgeons changing their routine to the use this technique. Visual entry systems which are now the second most popular choice for primary access amongst surgeons at the time of this survey. Surgeons reported that safety, technical ease and speed of entry are the main factors influencing their choice of technique and these seem to further contribute to the growing popularity of the visual entry systems.

However, this survey identifies a relatively high rate of major vascular and bowel injury related complications whilst using the visual access systems. This is in contrast to the lower reported rate in the literature. It must be borne in mind however, that the reported complication rate relies on the memory of the respondents, and thus there is a potential for both under- and over-reporting. This high reported rate of injuries sustained during primary access, will potentially put patients at risk for unnecessary complications during routine laparoscopic surgery. Further prospective studies interrogating the type of visual entry system used by general surgeons will be required to help delineate the cause of the high rate of these reported injuries.

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APPENDIX 1: Approved protocol

Title

Laparoscopic entry techniques: a survey of current preferences of South African general surgeons

Introduction

Laparoscopy is a procedure in which a narrow optical device that, at its end, has a light source coupled with a camera is inserted into the peritoneal cavity. A small incision is made in the umbilicus or close to it through which a cannula (trocar) is placed which permits entry of the laparoscope. The abdomen is then inflated with an inert gas gas which allows adequate room to both visualize the abdominal organs and allow what is known as key-hole surgery to be performed[1].

The history of this procedure can be traced back to the early 20th century. A German surgeon by the name of Georg Kelling conducted a procedure which he called “coelioscopy.” This involved insertion of an endoscope into the abdominal cavity of a dog. Following this a Swedish internist named Hans Christian Jacobaeus in 1910 described his technique of “laparothorascopy” in humans. Using a trocar in the abdomen he successfully drained ascites. He then proceeded to describe further uses for his technique including examining areas of the liver[2]. Interest began to grow in laparoscopy amongst gynaecologists after the advent of the rod lens optical system developed by Hopkins[3]. Operative laparoscopic surgery became popularized amongst general surgeons after the first accepted laparoscopic cholecystectomy was performed in 1987 by French gynaecologist Mouret[4]. A wide array of operative procedures has been conducted using Laparoscopy[4].

Laparoscopic surgery is now used across most surgical sub-specialties. It has its advantages over open surgery[5]. A decrease in operative trauma and a lower number of major wound complications as well as quicker recovery are cited as benefits. Health care centers and funders can also benefit from reduced hospital stays and thus lower costs[6].

The initial step in laparoscopic surgery involves insertion of the primary port into the abdomen[7]. There are a few techniques available to surgeons in order to gain access. This initial step of is the most dangerous as roughly half of all injuries in laparoscopic surgery occur on entry, with 80

percent of those occurring during insertion of the primary port. On insertion of the trocar, its tip can damage intra-abdominal vessels such as the vena cava or aorta and visceral organs such as the stomach and small bowel[8]. Secondary ports are less likely to cause damage on insertion as they are visualized as they enter the peritoneum[1].

In terms trocar related complications, vascular and visceral injuries are associated with the highest morbidity and mortality[9] These major vascular and visceral injuries can have severe consequences and can result in conversion to open (laparotomy) surgery[9]. Vascular injuries are usually apparent soon after the injury whereas bowel injuries may be missed resulting in later spillage of bowel content with resultant peritonitis[10].

A third of all malpractice claims associated with Laparoscopic surgery is due to laparoscopic trocar injuries[8]. The reported incidence of these injuries is 3 to 4 per 1000[9] and the mortality rate has been reported as 0.05-2%[11] The incidence of bowel injuries is less than 1% and vascular injuries occur less frequently with the average incidence 0.1%[7].

The most common entry point is through the umbilicus. This area is advantageous as it is devoid of significant blood vessels and nerves and allows for better post-operative cosmetic results. However, when access is not available due to previous surgery or an umbilical hernia, other points of entry have been used. A common alternative is Palmer's point, which is located anatomically in the left upper quadrant of the abdomen. This area is advantageous as it is further away from major vessels[12].

Techniques of gaining entry into the abdomen can be broadly classified into two groups either open or closed[1].

The open technique was first described in 1971 by Hasson. General surgeons generally favour this technique[5]. In order to gain access an incision is made at the umbilicus and dissection is carried out down to the fascia. The peritoneal cavity is then entered under direct vision by incising the fascia. The port is placed in the abdomen with a blunt obturator at its end, which is removed when the port has been place in the abdomen. A purse string suture is then placed around the port to seal it around the fascia. The abdomen is then insufflated with gas to create pneumoperitoneum and the camera is placed through the port into the peritoneal cavity to visualize the abdominal and pelvic contents[13].

Previous literature has shown both benefits and disadvantages to this technique. It has been noted that there has been a lower incidence of vascular injuries using this technique. The disadvantage however is the documented higher incidence of bowel injuries using this technique more so amongst general surgeons. These bowel injuries can result in serious consequences as they may present late[13].

Closed entry technique historically involved insertion of a thin cannula into the abdomen. Gas is then insufflated into the abdomen through the cannula to create pneumoperitoneum. Sharp trocars are then inserted into the abdomen and the laparoscope is then passed through the trocar into the abdomen.

Use of the Veress needle system was popularized in 1947. This technique has become a popular choice for gynaecologists as evidenced by multiple surveys conducted throughout the world[13].

The veress needle technique involves insertion of a needle into the abdomen at the umbilicus. The needle is placed at a 45-degree angle towards the pelvis in non-obese patients and 90 degrees in an obese patient. Carbon dioxide is then insufflated into the abdomen to establish pneumoperitoneum. Various methods have been created to confirm placement of the needle into the abdomen. Trocars of various sizes are then inserted into the abdomen at the same site of the veress needle[13].

Major complications related to this technique include both bowel and vascular injuries (mainly retroperitoneal large vessels such as the IVC and aorta) as well as subcutaneous emphysema with gas embolism[7].

Direct trocar insertion can be considered an alternative to veress needle technique.

The first publication of this technique was done by Dingfelder in 1978[13].

This technique does not require pre-insufflation of the abdominal cavity. A sharp trocar (bladed) is held in the dominant hand whilst the abdominal wall is grasped with the non-dominant hand. The trocar is then blindly advanced into the abdomen usually through the umbilicus. The trocar has a port for gas which is kept on prior to its advancement. Once the peritoneal cavity has been breached the trocar the negative pressure of the abdomen is relieved by the insufflation of the gas[7].

This technique has been shown to be quicker than the veress needle insertion and has the advantage of not potentially causing gas embolism but still runs the risk of bowel and vascular injury[14].

Visual entry systems in laparoscopy have been around since 1994. Various companies have created different systems. The principles of this technique

Involve a trocar with hollow cannula and transparent sharpened (but not bladed) tip. A zero-degree camera is inserted into the cannula the device is advanced by the surgeon through the abdominal wall. The layers of the abdominal wall are visualized as the device is advanced into the abdominal wall. This technique can be done with or without pneumoperitoneum depending on which system is used. This technique may be advantageous as it allows for clear visualization of the abdominal wall layers as it is advanced. This possible advantage has however not been fully explored[13].

Previous observational studies have suggested that there may be benefit of the open technique over the closed as it may cause fewer vascular injuries[1,15] however in 2015 a systematic review by Amad et al[1] suggested that there is no significant difference in injury rates amongst the various techniques and no single technique can be recommended over another. Suggestions were also made by the authors that larger randomized control trials with patient numbers in the hundreds of thousands need to be conducted, in order to have more accurate statistics to detect major complications.

Previous studies conducted in Canada amongst surgeons evaluating preferences of Laparoscopic entry techniques via a survey, showed that more than 80% of Canadian surgeons favored the open technique. A survey response rate of 24.8% was achieved to yield these statistics[16]. In the UK and Ireland, a similar study, showed that most gynaecologists (more the 90%) prefer the veress needle. They achieved a better survey response rate of 64%[6].

Currently there are no published South African studies on preferred laparoscopic entry techniques amongst general surgeons.

Study Objectives

The aim of this study is to evaluate current practice of laparoscopic entry techniques amongst general surgeons in South Africa.

The primary objectives are:

- To determine the preferred techniques of entry amongst general surgeons in South Africa.
- To determine whether the preferred choice of technique has changed over the last decade.

The secondary objectives are:

- To determine which factors predict the most common practice.
- To determine with which techniques surgeons have had the most major complications.

I hypothesize that general surgeons in South Africa will not have a common choice of entry technique as there no specific technique that has proven to superior.

Methods

Study design

The research will be carried out as a prospective, observational study amongst general surgeons in South Africa. A survey, in the form of a questionnaire, will be used as a tool to obtain the data required to answer the study objectives.

Study population

This study will include qualified, registered General Surgeons in both private practice and the public sector. These surgeons will be recruited as study participants as they have high levels of experience and exposure to varying types of laparoscopic entry techniques. It will exclude surgeons without laparoscopic surgery experience and non-practicing qualified surgeons. There are roughly 900 registered, qualified surgeons in South Africa and, where we would like to survey all the general surgeons registered and in practice in South Africa, we expect an approximate 20% response rate based on the literature.

Data collection

Data collection will be done by means of a survey. The questionnaire is attached to this protocol. This questionnaire will be sent out via email to all registered general surgeons in South Africa. A

list of email addresses and names and details of registered surgeons will be obtained from the Health Professions Council of South Africa and various surgical societies such as the Association of Surgeons of South Africa.

Data Analysis

All data collected will be entered into a datasheet, using either Excel or RedCap. The data will be analyzed by myself, in collaboration with my supervisors and a statistician. All data analysis will be conducted using the STATISTICA suit of statistical software. A survey response rate of roughly 20% is expected. Categorical and ordinal data analysis will be done using the Chi-square and Fisher's exact tests, where appropriate.

Ethics

Attached to the survey will be a cover page detailing information about the study and reason for it being done. The cover page of the survey will also include a section required for completion in order to obtain informed consent from the participant. An ethics application will be submitted to the University of the Witwatersrand Human Research Ethics Committee (Medical) in November 2017.

Timing

This study will be carried out from early 2018. Surveys will be emailed and participants will be given a two-month time period in order to complete the survey. A reminder will be sent after the first month. Once data is collected it will be analyzed with the study concluding after data has been collected.

Timeline of MMed

	Oct 2017	Nov 2017	Dec 2017	Jan 2018	Feb 2018	Mar 2018	Apr 2018	May 2018	June 2018	July 2018	Aug 2018
Protocol submission	X										
Ethics application		X									
Protocol assessment		X									
Data Collection				X	X	X					
Analysis and report write up							X	X			
Report submission and Paper write-up									X	X	X

Funding

No funding will be required for this study

Problems

I anticipate the following problems

- Refusal of participation
- Incomplete surveys
- Inability to access all registered surgeons in South Africa

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APPENDIX 2: QUESTIONNAIRE

Dear Colleague

You have been invited to participate in a study titled: **Laparoscopic entry techniques: a survey of current preferences of South African general surgeons**

This study aims to identify the most preferred methods of laparoscopic entry techniques amongst general surgeons and determine factors that could possibly influence the choice of technique. This will allow us to evaluate the current practice of surgeons in South Africa.

- Data will be collected via an online survey.
- The questionnaire will take approximately 5-10 minutes of your time to complete.
- Participation in this research is voluntary.
- Your identity will be confidential.
- If you agree to participate, your answers will be stored confidentially and anonymously.
- The project has received institutional ethical approval.

The feedback from this survey is integral as it will aid in the advancement of Minimally Invasive Surgery in South Africa and help improve both practice and knowledge in this field.

If you require further assistance or have any enquiries, please contact

Dr. N Naidoo (nnaidoo2404@gmail.com)

TO PARTICIPATE IN THE SURVEY PLEASE CONTINUE TO THE NEXT PAGE

Questionnaire

This survey was done using SurveyMonkey

The following questions will be asked**:**

1. Please State your specialty
    a. General Surgery
    b. other
2. Do you have a Certificate in a sub-specialty?
3. Do you have a special interest in any field of general surgery- please state
4. Which year did you qualify?
5. Please state your Age
6. Please state your Sex
7. Do you currently perform laparoscopic surgery?
8. If yes, how many cases?
    a. < 5 per month
    b. > 5 per month
9. Do you perform basic (e.g. diagnostic laparoscopy), intermediate (e.g. appendicectomy, cholecystectomy) or advanced laparoscopy (e.g. Colorectal, bariatric, anti-reflux)?
10. If yes, how many years of experience
    a. >10 years
    b. <10 years)
11. What type of practice are you in?
    a. Full time public practice
    b. Full private practice
    c. Both public and private practice

12. Are you familiar with the following techniques of entry?
    a. Hasson open entry technique
    b. Veress Needle technique
    c. Direct blind trocar insertion
    d. Visual Entry system
13. In a patient with no previous abdominal surgery which technique do you most commonly use?
    a. Hasson open entry technique
    b. Veress Needle technique
    c. Direct blind trocar insertion
    d. Visual Entry system
14. Have you had major vascular injury (retroperitoneal vessels) during primary access?
15. If yes, how many
16. Have you had bowel perforation during primary access?
17. If yes, how many
18. Which method/s did you sustain bowel injuries with?
    a. Hasson open entry technique
    b. Veress Needle technique
    c. Direct blind trocar insertion
    d. Visual Entry system
19. Which method/s did you sustain vascular injuries with?
    a. Hasson open entry technique
    b. Veress Needle technique
    c. Direct blind trocar insertion
    d. Visual Entry system

20. In your opinion which technique do you think causes lowest rate bowel of injury?

    a. Hasson open entry technique
    b. Veress Needle technique
    c. Direct blind trocar insertion
    d. Visual Entry system

21. In your opinion which technique do you think causes lowest rate vascular of injury?

    a. Hasson open entry technique
    b. Veress Needle technique
    c. Direct blind trocar insertion
    d. Visual Entry system

22. Have you changed routine choice of entry over the last 10 years if yes please select

    a. Veress to Hasson
    b. Visual entry to Hasson
    c. Hasson to visual entry system
    d. Hasson to Direct blind trocar insertion
    e. Direct blind trocar insertion to Hasson
    f. Veress to Visual entry system
    g. Visual entry system to veress
    h. Veress to Direct blind trocar insertion
    i. Direct blind insertion to veress
    j. Visual entry system to Direct blind trocar insertion
    k. Direct blind trocar insertion to Visual entry system
    l. No change in routine

23. What was your reason for change? Please state

24. Which of the following factors influence your current choice of technique? Please tick all that apply

    a. Speed of entry
    b. Safety
    c. Port site bleeding
    d. Technical ease
    e. Speed of closure
    f. Closure technique
    g. Equipment availability
    h. Low BMI
    i. High BMI
    j. Other (please specify)

25. Has industry had a role in determining your choice of access technique

    a. No role
    b. Minimal role
    c. Moderate role
    d. Major role

APPENDIX 3: ETHICS CLEARANCE

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG	HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

Office of the Deputy Vice-Chancellor (Research & Post Graduate Affairs)

TO: Drs N Naidoo and D Kruger
School of Clinical Medicine
Department of Surgery
Chris Hani Baragwanath Academic Hospital

E-mail: nnaidoo2404@gmail.com

CC: Supervisor: Professor D Bizos <Damon.Bizos@wits.ac.za>
and <HREC-Medical.ResearchOffice@wits.ac.za>

FROM: Iain Burns
Human Research Ethics Committee (Medical)
Tel: 011 717 1252

E-mail: Iain.Burns@wits.ac.za

DATE: 07/02/2018

REF: *R14/49*

PROTOCOL NO: **M171148** *(This is your ethics application study reference number. Please quote this reference number in all correspondence relating to this study)*

PROJECT TITLE: *Laparoscopic entry techniques: a survey of current preferences of South African general surgeons*

Please find attached the Clearance Certificate for the above project. I hope it goes well and that an article in a recognized publication comes out of it. This will reflect well on your professional standing and contribute to the Government funding of the University.

MSWorks2000/Iain0007/Clearscan.wps