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Laparoscopic entry techniques: clinical guideline, national survey, and medicolegal ramifications

Rajesh Varma · Janesh K. Gupta

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Abstract
Background This study aimed to establish criteria for safe laparoscopic entry through a systematic literature search and evidence-based medicine appraisal, to determine surgeon preferences for laparoscopic entry in the United Kingdom, and to appraise the medicolegal ramifications of complications arising from laparoscopic entry.
Methods A systematic literature search of MEDLINE and EMBASE (1996–2007) was performed as well as a national surgeon survey by questionnaire (May–December 2006).
Results Laparoscopic entry criteria involving 10 steps were established based on the systematic literature search and evidence-based critical appraisal. The national survey had 226 respondents, with the majority aware of the Middlesbrough consensus or Royal College of Obstetricians and Gynaecologists [RCOG]-sourced guidance. There was considerable variation in preferred laparoscopic entry techniques. Currently, there is clear judicial guidance on the medicolegal stance toward laparoscopic entry-related complications.
Conclusions Despite widespread awareness of laparoscopic entry guidelines, there remains considerable variation in the techniques adopted in clinical practice. Unless practice concurs with recommended guidance, women undergoing laparoscopy will be exposed to increased unnecessary operative risk. Laparoscopic entry-related injury in an uncomplicated woman is considered negligent practice according to UK legal case law.

Keywords Laparoscopic entry · Guidelines · Laparoscopy · Pneumoperitoneum · Artificial · Surgical procedures · Minimally invasive · Intraoperative complications

Although complications associated with laparoscopic surgery fortunately are rare, a significant proportion of these occur at the time of laparoscopic abdominal wall entry [1–26]. Metaanalyses and large multicenter studies have provided pooled risks of vascular and bowel injury at the time of laparoscopic entry as 0.2 per 1,000 and 0.4 per 1,000, respectively [1, 19, 27–38]. Such complications may incur serious morbidity and mortality, which are compounded if such injuries are not detected at the time of original surgery, particularly in the case of bowel injury [1, 5, 39–47].

Two laparoscopic entry methods are used principally in gynecology and general surgery:

1. Closed entry laparoscopy with creation of a pneumoperitoneum at the umbilicus (or Palmer's point).
2. Open (Hasson) laparoscopy [48–50].

Other techniques, used less frequently and with limited supporting evidence [6] are direct entry [51–59], optical access trocars [60–70], and radially expanding trocars [71–76].

According to current evidence, based mainly on observational studies, no one laparoscopic entry method has demonstrated clear superiority over another. This has led to wide variation among clinicians as to which entry method should be recommended [6, 77, 78]. It has been suggested

R. Varma (✉)
Department of Women's Health, Guy's and St. Thomas' NHS Foundation Trust, St. Thomas' Hospital, 10th Floor, North Wing, Westminster Bridge Road, London SE1 7EH, UK
e-mail: rajesh.varma@gstt.nhs.uk

J. K. Gupta
Department of Obstetrics and Gynaecology, Birmingham Women's Hospital, 2nd Floor, Birmingham B15 2TG, UK
e-mail: j.k.gupta@bham.ac.uk

that open (Hasson) entry is superior to closed entry techniques because vascular injury is less likely to occur [28, 32, 49, 50, 57, 77, 79–89], although this viewpoint has been challenged [28].

There is significant variation in laparoscopic entry practice in the United Kingdom [90–93] and at international locations [27, 94, 95]. In an attempt to minimize the risks of laparoscopy and unify clinical practice, a number of international bodies (International Middlesbrough Consensus [96], RCOG [draft version only] [97], SOGC [78], RANZCOG [98], EAES [99], Society of American Gastrointestinal Endoscopic Surgeons [SAGES] [100], the French Society of Endoscopic Gynecology [101], the Netherlands [102] and individual experts [103–105]) have recommended specific "safe laparoscopic entry" principles. In fact, several small studies [106–108] have shown that adoption of a recommended technique [78, 96] can reduce the incidence of laparoscopic entry-related complications.

We aimed to evaluate the status of gynecologic laparoscopic entry in the United Kingdom, bearing in mind that litigated cases normally consider both what should be (published recommendations) and what is (questionnaire enquiries) occurring in clinical practice. To achieve this, we planned to establish evidence-based criteria for safe laparoscopic entry through a systematic literature search and critical appraisal of the literature, to identify what laparoscopic entry techniques are used currently in the United Kingdom, and to explore any factors that may influence the preference for a particular technique. This was determined through a United Kingdom-wide questionnaire survey. The current judicial viewpoint on laparoscopic entry injuries was identified from the published literature.

Methods

Establishing criteria for safe laparoscopic entry

Electronic searches of MEDLINE (Ovid version 1996–December 2007) and EMBASE (Ovid version 1996–December 2007) were performed using relevant combinations of medical subject headings (laparoscopy, gynecologic surgical procedures, intraoperative complications, postoperative complications, pneumoperitoneum, artificial, malpractice, risk assessment, legal liability, judicial role, jurisprudence) and text words. International guidelines were identified by interrogating specialized electronic repositories (e.g., national guideline clearinghouse, national electronic library for health, Organising Medical Networked Information [OMNI], Turning Research into Practice [TRIP] database, E guidelines, and Geneva Foundation for Medical Education and Research [GFMER] databases) and by searching national Collegiate (e.g. Royal College of Obstetricians and Gynaecologists [RCOG], American College of Obstetricians and Gynecologists [ACOG], Royal Australian and New Zealand College of Obstetricians and Gynaecologists [RANZCOG], Society of Obstetricians and Gynaecologists of Canada [SOGC] and specialist international laparoscopy organization (e.g., American Association of Gynecologic Laparoscopists [AAGL], Society of Laparoendoscopic Surgeons [SLS], International Society for Gynecologic Endoscopy [ISGE], British Society of Gynaecological Endoscopy [BSGE], SAGES, European Association forEndoscopic Surgery [EAES], Australian Safety and Efficacy Register of New Interventional Procedures-Surgical (part of Royal Australasian College of Surgeons) [ASERNIP-S]) Web sites. The literature was critically appraised according to established evidence-based criteria (see Appendix and Scottish Intercollegiate Guidelines Network [SIGN] recommendations [109, 110]) to generate a list of key steps necessary for safe laparoscopic entry. For each step, we denoted a level of evidence and grade of recommendation and discussed their derivation from the supporting literature.

Questionnaire survey

The questionnaire, developed in collaboration with the BSGE, recorded

- Clinician grade and method of entry into the uncomplicated woman or high-risk woman (defined as any woman with previous suprapubic or midline laparotomy and very thin or obese women)
- The angle of entry for the Veress needle and primary trocar
- The criteria used to test for correct placement of the Veress needle
- Adequacy of carbon dioxide (CO_2) pneumoperitoneum before primary trocar insertion
- Whether the clinician routinely inspected the abdomen for laparoscopic injury at the beginning or end of the laparoscopy procedure
- Whether the clinician had experienced (personally or through witnessing) any laparoscopic entry-related bowel or vascular injury
- Awareness of the Middlesbrough Consensus
- RCOG-sourced information on recommended laparoscopic entry practice.

In contrast to previous questionnaire studies, we aimed to compare practice among trainee grades and consultant specialists. The study population consisted of three groups:

1. *Registered BSGE members May 2006*. The questionnaire and a prepaid postage reply envelope were

included in the BSGE May 2006 quarterly newsletter sent to all 180 registered BSGE members.

2. *Specialist registrar trainees*. The questionnaire was distributed to all trainees who attended regional study days at Birmingham Women's Hospital, UK.
3. *Attendees at the joint RCOG/BSGE* conference held Friday, December 8, 2006, at the Royal College of Obstetricians and Gynaecologists, London, UK, at which a questionnaire through an electronic audience participation format was used. Audience members responded through handheld devices, and instantaneous feedback on the entire audience was electronically displayed after each question.

Results

Evidence-based criteria for safe laparoscopic entry

The original systematic literature review identified 276 primary studies relating to laparoscopic techniques and complications, 21 secondary studies (13 metaanalyses and 8 clinical guidelines), and 12 citations relating to medico-legal aspects of laparoscopy entry-related complications. A further 17 relevant citations were identified through the bibliography of primary and secondary (clinical guidelines, reviews) studies. Through a process of critical literature appraisal, 10-step evidence-based criteria for safe closed umbilical laparoscopic entry were constructed (Table 1). The level of evidence justifying each step is outlined in the following sections.

Suitability criteria (step 1)

Women who are extremely thin [111–113], obese [114–117], or known to have abdominal adhesions are at increased risk for laparoscopic entry-related injury at the umbilical entry point. The estimated risks for umbilical and/or anterior abdominal wall adhesions are 0–5% for women with no prior laparoscopic surgery, 20–30% for those with a previous suprapubic laparotomy, and 50–65% for those with a previous midline laparotomy [118–138].

Table 1 Evidence-based criteria for safe laparoscopic entry: 10 steps

Step	Intervention	Level of evidence and grade of recommendation (see Appendix)	Supporting references
1	Suitability criteria: consider alternative entry (e.g., Palmer's point or open [Hasson] technique) for patients with risk factors such as previous abdominal surgery, obesity, extremely thin physique, or known abdominal adhesions	2++, B	Adhesion risks: [118–138]
2	Safety criteria: patient should be lying flat with an empty bladder; palpation should be used for the abdominal aorta, any masses; and the Veress needle should be checked for spring action and gas patency	4, GPP	
3	Incision: 10-mm vertical intraumbilical incision starting deep inside the umbilicus pit and extending caudally	4, GPP	
4	Insertion of the Veress needle: at the deep umbilical pit, 90° to the skin, with or without stabilizing or elevating the umbilical sheath/fascia or anterior abdominal wall, and in a controlled manner with insertion of less than 2 cm of the Veress needletip	2+, C (indirect evidence from knowledge of abdominal anatomy)	[51, 111–113, 145–149]
5	No movement of the Veress needle after insertion to avoid converting a possible needlepoint injury into a large complex tear	4, GPP	
6	Safety abdominal pressure check of Veress placement: most reliably achieved by using a Veress IAP of less than 10 mmHg	2+, C	[108, 150–152]
7	Safety abdominal pressure check for primary trocar: the IAP should be 25 mmHg to achieve the maximum safe distance between the anterior abdominal wall and the underlying abdominal contents	2+, C	[108, 153–157]
8	Vertical primary trocar insertion: inserted in a controlled two-handed screwing manner vertically at 90° to the skin, with only the tip of the trocar inserted through the abdominal wall	2+, C >	[111–113, 145–147]
9	Injury check: an initial 360° laparoscopic check for intraperitoneal organ injury is performed	4, GPP	
10	No epigastric for secondary trocar(s) insertion: inserted under direct vision in a controlled two-handed manner at 90° to the skin, avoiding inferior epigastric vessels	2+, C (indirect evidence from knowledge of abdominal anatomy)	[158–162]

GPP, good practice points; IAP, intraabdominal pressure

Note: The acronym, SCIIN (suitability, criteria, incision, insertion, no movement) SAVE (safety abdominal Veress), SAVING (safety, abdominal pressure [trocar], vertical trocar, injury check, no epigastrics) is suggested for the 10 steps

Prospective observational studies suggest that the risk of laparoscopic entry-related injury may be considerably reduced by the use of an alternative entry (e.g., left upper-quadrant Palmer's point or open Hasson technique) for women with such risk factors. However, the actual relative risk reduction is not quantified because the studies have no comparator. Left upper-quadrant Palmer's laparoscopic entry also could be considered if there has been failure to achieve pneumoperitoneum at the umbilicus. Notably, limited evidence shows that testing for reduced (<1 cm) visceral slide (ultrasound-visualized movement of the underlying bowel or omentum) may be helpful in detecting subumbilical adhesions, thereby allowing consideration of an alternative laparoscopic entry strategy [139–144].

Supine patient positioning, safety checks, and umbilical incision (steps 2 and 3)

Reliable data on appropriate patient positioning and on location and type of umbilical incision were not identified. Consequently, we suggest that the patient be laid flat at the commencement of laparoscopy to avoid the theoretical risk of the "pelvic" bowel being displaced toward the umbilicus, thereby exposing the bowel to entry-related injury. On a similar stance, adoption of an alternative entry technique is advisable if a prominent abdominal aorta pulsation is identified in close proximity to the undersurface of the umbilicus. Current consensus among clinicians is for a 10-mm vertical intraumbilical incision extending caudally.

Controlled vertical (90°) Veress needle entry (steps 4 and 5)

No comparative studies have assessed the optimum angle of Veress needle entry. However, fusion of the parietal peritoneum and linea alba at the pit of the umbilicus logically dictates that a vertical (90° to the horizontal abdomen) Veress insertion represents the shortest skin-to-peritoneum anatomic distance to enable direct peritoneal entry. According to computed tomography (CT) abdominal mapping [111, 112, 145] and actual laparoscopy [113, 146, 147], this skin-to-peritoneum distance at the umbilical pit is consistently no greater than 2 cm, irrespective of abdominal obesity. Nevertheless, it is suggested that the Veress angle of entry should vary (45° in nonobese women and 90° in obese women) because CT abdominal imaging [112]) and visualization at laparoscopy [113] have shown that the location of the underlying aortic bifurcation (which may be prone to Veress injury) tends to be directly under the umbilicus in nonobese women or 2–3 cm caudal to the umbilicus in obese women. The umbilicus pit (and underlying parietal peritoneum) also may be stabilized or successfully elevated away (either by grasping of the lower abdominal wall or by application of tissue forceps/towel clips within 2 cm of the umbilicus) from underlying abdominal viscera during Veress insertion [51, 147–149]. However, a reasonable summary of the indirect evidence stated is that traversing the abdomen's thinnest portion by controlled 90° vertical entry, with Veress needle tip insertion no greater than 2 cm and selective umbilical stabilization/elevation, is likely to be the safest route of Veress insertion for the vast majority of women, regardless of any caudal displacement of their umbilicus.

Safety test for correct Veress placement using an intraabdominal pressure of 10 mmHg or less (step 6)

A variety of safety tests for correct intraperitoneal placement of the Veress needle are used in clinical practice including double-click, aspiration, and hanging-drop tests. Prospective studies of women undergoing laparoscopy have shown that a Veress intraabdominal pressure (IAP) of 10 mmHg or less reliably indicates correct Veress placement at umbilical [108, 150, 151] and Palmer's point entry [152] locations. The Veress IAP pressure correlates positively with the weight and body mass index (BMI) and negatively with the parity of women [151].

Controlled vertical (90°) primary trocar insertion at 25 mmHg IAP (steps 7, 8, and 9)

Prospective observational studies have shown that higher intraabdominal CO_2 insufflated pressures achieve greater anterior abdominal wall splinting and intraabdominal CO_2 gas bubble space [108, 153–155]. An IAP of 25 mmHg has been shown to achieve a maximum safe distance between the anterior abdominal wall and underlying abdominal contents without compromising cardiorespiratory function [156, 157]. A two-handed, screwing manner-controlled vertical (90°) entry of only the primary trocar tip uses the safe CO_2 bubble depth afforded through an IAP of 25 mmHg and is highly unlikely to injure underlying vessels according to actual laparoscopy [113, 146, 147] and abdominal vasculature CT mapping studies [111, 112, 145]. Although there is no direct supporting evidence, an initial check for bowel and vascular injury immediately after primary trocar insertion is recommended to avoid missing this complication and exposing the women to serious morbidity.

Controlled insertion of secondary trocars under direct vision (step 10)

Epigastric vessels can be identified reliably through a combination of direct visualization (vessels lie 1–2 cm lateral to the medial umbilical ligaments [obliterated

umbilical arteries]), transillumination, and external anatomic landmarks [158–162]. In most women, a useful and safe point of insertion is 2 cm from the anterior superior iliac crest along an imaginary line connecting the iliac crest to the umbilicus. Controlled insertion, at a 90° angle to the skin, using a two-handed screwing manner for the secondary trocar (analogous to that used for insertion of the primary trocar), should be observed under direct vision to ensure that no inadvertent injury of abdominal organs occurs.

Questionnaire survey

There was a 62% ($n = 112$) response rate for the postal questionnaire and 100% response rates for the SpR registrars ($n = 82$) and attendees ($n = 32$) at the RCOG/BSGE meeting. Analysis of all 226 total respondents was performed.

Entry technique for uncomplicated versus high-risk women

The vast majority of surgeons would use a closed umbilical laparoscopic entry for uncomplicated women and a Hasson or Palmer's point entry for women with a previous midline laparotomy (Table 2). However, there was inconsistency in the selection of entry technique for women with previous suprapubic laparotomy or obesity and for those who were extremely thin (Table 2).

Veress and primary trocar entry

Only 18% of surgeons would use the recommended 90°/90° Veress and primary trocar entry method (Table 3). Safety checks performed to ensure correct Veress placement and those used before primary trocar insertion are depicted in Tables 4 and 5 respectively. The proportion of respondents aware of evidence-based guidance or possessing previous experience of laparoscopic injury is depicted in Table 6.

Medicolegal ramifications

The civil standard of law is used in UK medicolegal litigation. This means the claimant (woman patient) has the responsibility to prove it more likely than not (>51% probability) that the injury she incurred arose through a negligently performed surgical technique rather than a nonnegligently performed procedure by the defendant (surgeon).

Laparoscopic entry-related complications have contributed significantly to medical litigation in gynecologic surgery [26, 40, 41, 163–170]. Until recently, there was inconsistency in the judicial viewpoint in the awarding of negligent or nonnegligent verdicts. However, the case of Palmer v Cardiff and Vale NHS Trust [171] has now set judicial guidance in this area. The court ruled that the likelihood of laparoscopically related bowel injury occurring in an uncomplicated case if there has been good surgical technique is highly unlikely. If there is no alternative plausible nonnegligent explanation for the complication, then the defendant is liable, in compliance with the legal maxim *res ipsa loquitir* ("the thing speaks for itself"). This overruled the defendant's viewpoint that injury is a recognized complication of laparoscopy and that its occurrence is therefore not proof of negligence per se.

Table 2 Laparoscopic entry technique for uncomplicated versus high-risk women[a]

Veress entry technique	Uncomplicated women *n* (%)	High-risk women			
		Women with previous suprapubic laparotomy *n* (%)	Women with previous midline laparotomy *n* (%)	Women with obesity *n* (%)	Women who are extremely thin *n* (%)
Closed umb	213 (94)	193 (85)	37 (16)	179 (79)	189 (84)
Open (Hasson)	5 (2)	14 (6)	49 (22)	13 (6)	15 (7)
Palmer's point	1 (<1)	8 (4)	102 (45)	4 (2)	2 (<1)
Suprapubic point	3 (1)	1 (<1)	4 (2)	9 (4)	6 (3)
Direct entry	3 (1)	2 (<1)	0	3 (1)	2 (<1)
Transvaginal culdoscopy	1 (<1)	1 (<1)	1 (<1)	1 (<1)	1 (<1)
Closed umb or suprapubic	0	0	1 (<1)	4 (2)	1 (<1)
Hasson or Palmer's	0	3 (1)	23 (10)	0	1 (<1)
Closed umb or Palmer's	0	2 (<1)	5 (2)	0	4 (2)
Closed umb or Hasson or Palmer's	0	0	3 (1)	1 (<1)	0
Closed umb or Hasson	0	2 (<1)	1 (<1)	9 (4)	6 (3)

umb, umbilical

[a] Direct entry would be gasless direct primary trocar abdominal entry and would not use a Veress needle

Table 3 Frequency of angle of entry for Veress needle and primary trocar

	Angle of primary trocar entry *n* (%)					Total (*n*)
	90°	60°	45°	30°	Z-angle[b]	
Angle of Veress needle entry						
90°	40 (18)	28 (12)	24 (11)	1	1	94
60°	6	34 (15)	9	0	2	51
45°	1	11	57 (25)	1	3	73
30°	0	1	1	0	0	2
Not used[a]	3	1	1	1	0	6
Total	50	75	92	3	6	226

[a] Veress needle angle not determined because practitioner prefers to use either the Hasson or direct entry method for insertion of the primary trocar

[b] Z-angle system corresponds to initial shallow angle <30°, then a steeper angle >60°

Note: The five most frequent Veress and primary trocar combinations are shaded in grey with bold type

Table 4 Safety checks performed to ensure correct Veress placement[a]

Tests	SpR 1–3 ($n = 63$)	SpR 4–5 ($n = 41$)	Consultant ($n = 122$)	Total count *n* (%)
Pressure & saline aspiration & two Veress clicks	14	11	28	53 (23)
Pressure & saline aspiration	13	11	24	48 (21)
Saline aspiration	20	6	10	36 (16)
Pressure & two Veress clicks	6	5	21	32 (14)
Pressure	3	4	14	21 (9)
Saline aspiration & two Veress clicks	6	1	4	11 (5)
Pressure & freely moving Veress & two Veress clicks	0	0	7	7 (3)
Two Veress clicks	1	1	3	5 (2)
Freely moving Veress & two Veress clicks	0	1	2	3 (1)
Pressure and freely moving Veress	0	0	3	3 (1)
Freely moving Veress	0	0	2	2 (<1)
Veress not used	0	1	4	5 (2)

SpR, Specialist Registrar

[a] Pressure refers to preinsufflation intraabdominal pressure recorded as lower than 8 mmHg. Two Veress clicks refers to the audible or tactile impression of two Veress clicks at abdominal insertion. Saline aspiration refers to the four-component saline aspiration, injection, aspiration, drop test commonly known as Palmer's test

Table 5 Safety checks performed before primary trocar insertion[a]

Tests	SpR 1–3	SpR 4–5	Consultant	Total count *n* (%)
IAP 25 mmHg	29	22	48	99 (44)
Distension and IAP 25 mmHg	20	6	14	40 (18)
Distension and IAP 12–15 mmHg	4	0	21	25 (11)
Distension	2	4	13	19 (8)
IAP 12–15 mmHg	4	4	8	16 (7)
Distension >3 l CO_2, IAP 12–15 mmHg	1	3	6	10 (4)
Distension >3 l CO_2, IAP 25 mmHg	2	2	6	10 (4)
Distension >3 l CO_2	0	0	5	5 (2)
CO_2 >3 l	1	0	1	2 (<1)

IAP, intraabdominal pressure

[a] Distension refers to clinical abdominal wall distension

The judicial guidance accepted that given a woman without risk factors and a surgeon following a safe technique (i.e., correct insertion of the Veress needle, its position checked, insufflation of the peritoneal cavity to 25 mmHg, and controlled insertion of the primary trocar with penetration of the cavity by just the trocar tip), the risk of injury is highly improbable. Thus the occurrence of any injury under these circumstances would imply a negligent technique.

Table 6 Awareness of evidence-based guidance and previous experience of laparoscopic injury

	SpR 1–3 ($n = 63$)	SpR 4–5 ($n = 41$)	Consultant[a] ($n = 122$)	Total ($n = 226$) n (%)
Awareness of Middlesbrough consensus				
Yes	27	22	100	149 (66)
No	36	19	22	77 (34)
Awareness of RCOG guidance				
Yes	55	33	90	78 (79)
No	8	8	32	48 (21)
Previous experience of laparoscopic injury				
Yes, bowel injury	14	13	57	84 (37)
Yes, vascular injury	7	4	7	18 (8)
Yes, both vascular and bowel injury	4	5	32	41 (18)
No	38	19	26	83 (37)
Routine inspection of the abdomen				
Yes	48	38	110	196 (87)
No	15	3	12	30 (13)

RCOG, Royal College of Obstetricians and Gynaecologists

[a] Consultant category includes 4 staff grades, 5 associate specialists and 113 consultants

Discussion

On the basis of our systematic literature search and critical appraisal of the published literature and available guidelines, we constructed a 10-step evidence-based guideline for safe closed laparoscopic entry. Our findings are analogous to the original 11 safety steps of Semm and Semm [105]. However, we have updated these steps in line with current evidence-based literature and have ascribed the level of evidence to each step supported by the literature citation or citations for that step. We believe that these 10 steps represent the current most up-to-date evidence enabling clinicians to practice safe closed laparoscopic entry.

Our national questionnaire study showed considerable heterogeneity in laparoscopic entry practice despite widespread awareness of the Middlesbrough Consensus or RCOG-sourced guidance. The inconsistency, inherent throughout every step of the laparoscopic entry procedure, has been identified by previous UK-based surveys [90–93]. Fundamentally, there was a failure to appreciate risk factors that would justify a change in entry technique as well as failure to adopt the correct safety checks after Veress insertion and before primary trocar insertion. Even if there were authoritative guidance on safe laparoscopic entry technique, it is unclear how many practitioners actually would change their clinical practice accordingly. However, an Australian-based questionnaire study suggests that this would be supported by the majority of minimally invasive surgeons [94].

We acknowledge that our sample size was limited and that we surveyed a highly selected group. It is reassuring that we have shown no real differences between trainees and specialists. However, it is of great concern that even in the "expert" specialist group, entry technique varies widely. It is possible that a survey of general gynecologists may identify an even wider and more alarming variation in practice.

We strongly believe that safe laparoscopic entry guidance, such as the 10 steps shown in Table 1, should be disseminated widely. However, we accept that following such guidance would not necessarily negate the risk of laparoscopic entry-related injury, nor would it protect the clinician against any ruling of negligence should a complication occur. We believe that written guidance should be reinforced through simulated training [172, 173], structured formal assessment, and consistent clinical direction by specialists. Unless practice concurs with recommended guidance, women undergoing laparoscopy will be exposed to increased unnecessary operative risk.

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Appendix. Scottish Intercollegiate Guidelines Network (SIGN) grading system

Levels of evidence	
1++	High-quality metaanalyses, systematic reviews of RCTs or RCTs with a very low risk of bias
1+	Well-conducted metaanalyses, systematic reviews of RCTs or RCTs with a low risk of bias
1–	Metaanalyses, systematic reviews of RCTs or RCTs with a high risk of bias

Appendix continued

Levels of evidence	
2++	High-quality systematic reviews of case-control or cohort studies High-quality case-control or cohort studies with a very low risk of confounding, bias, or chance and a high probability that the relationship is causal
2+	Well-conducted case-control or cohort studies with a low risk of confounding, bias, or chance and a moderate probability that the relationship is causal
2–	Case-control or cohort studies with a high risk of confounding, bias, or chance and a significant risk that the relationship is not causal
3	Nonanalytic studies (e.g., case reports, case series)
4	Expert opinion

Grades of recommendation	
A	At least one metaanalysis, systematic review, or RCT rated as 1++ and directly applicable to the target population, or a systematic review of RCTs or a body of evidence consisting principally of studies rated as 1+, directly applicable to the target population, and demonstrating overall consistency of results
B	A body of evidence including studies rated as 2++, directly applicable to the target population and demonstrating overall consistency of results; or extrapolated evidence from studies rated as 1++ or 1+
C	A body of evidence including studies rated as 2+, directly applicable to the target population and demonstrating overall consistency of results; or extrapolated evidence from studies rated as 2++
D	Evidence level 3 or 4; or extrapolated evidence from studies rated as 2+
GPP	Good practice points: recommended best practice based on the clinical experience of the guideline development group

RCT, randomized clinical trial

References

1. Van Der Voort M, Heijnsdijk EA, Gouma DJ (2004) Bowel injury as a complication of laparoscopy. Br J Surg 91(10):1253–1258
2. Tarik A, Fehmi C (2004) Complications of gynaecological laparoscopy–a retrospective analysis of 3572 cases from a single institute. J Obstet Gynaecol 24(7):813–816
3. Orlando R, Palatini P, Lirussi F (2003) Needle and trocar injuries in diagnostic laparoscopy under local anesthesia: what is the true incidence of these complications? J Laparoendosc Adv Surg Tech A 13(3):181–184
4. Roviaro GC, Varoli F, Saguatti L, Vergani C, Maciocco M, Scarduelli A (2002) Major vascular injuries in laparoscopic surgery. Surg Endosc 16(8):1192–1196
5. Bhoyrul S, Vierra MA, Nezhat CR, Krummel TM, Way LW (2001) Trocar injuries in laparoscopic surgery. J Am Coll Surg 192(6):677–683
6. Munro MG (2002) Laparoscopic access: complications, technologies, and techniques. Curr Opin Obstet Gynecol 14(4):365–374
7. Philips PA, Amaral JF (2001) Abdominal access complications in laparoscopic surgery. J Am Coll Surg 192(4):525–536
8. Chapron C, Pierre F, Querleu D, Dubuisson JB (2000) Major vascular complications from gynecologic laparoscopy. Gynecol Obstet Fertil 28(12):880–887
9. Chapron CM, Pierre F, Lacroix S, Querleu D, Lansac J, Dubuisson JB (1997) Major vascular injuries during gynecologic laparoscopy. J Am Coll Surg 185(5):461–465
10. Chapron C, Querleu D, Mage G et al (1992) Complications of gynecologic laparoscopy. Multicentric study of 7,604 laparoscopies. J Gynecol Obstet Biol Reprod (Paris) 21(2):207–213
11. Leonard F, Lecuru F, Rizk E, Chasset S, Robin F, Taurelle R (2000) Perioperative morbidity of gynecological laparoscopy. A prospective monocenter observational study. Acta Obstet Gynecol Scand 79(2):129–134
12. Leng J, Lang J, Huang R, Liu Z, Sun D (2000) Complications in laparoscopic gynecologic surgery. Chin Med Sci J 15(4):222–226
13. Mac CC, Lecuru F, Rizk E, Robin F, Boucaya V, Taurelle R (1999) Morbidity in laparoscopic gynecological surgery: results of a prospective single-center study. Surg Endosc 13(1):57–61
14. Marret H, Harchaoui Y, Chapron C, Lansac J, Pierre F (1998) Trocar injuries during laparoscopic gynaecological surgery. Report from the French Society of Gynaecological Laparoscopy. Gynacological Endoscopy 7(5):235–241
15. Rosen DM, Lam AM, Chapman M, Carlton M, Cario GM (1998) Methods of creating pneumoperitoneum: a review of techniques and complications. Obstet Gynecol Surv 53(3):167–174
16. Nezhat C, Childers J, Nezhat F, Nezhat CH, Seidman DS (1997) Major retroperitoneal vascular injury during laparoscopic surgery. Hum Reprod 12(3):480–483
17. Soderstrom RM (1997) Injuries to major blood vessels during endoscopy. J Am Assoc Gynecol Laparosc 4(3):395–398
18. Bateman BG, Kolp LA, Hoeger K (1996) Complications of laparoscopy–operative and diagnostic. Fertil Steril 66(1):30–35
19. Champault G, Cazacu F (1995) Laparoscopic surgery: injuries caused by trocars. (French Survey 1994) in reference to 103,852 interventions. J Chir (Paris) 132(3):109–113
20. Saville LE, Woods MS. (1995) Laparoscopy and major retroperitoneal vascular injuries (MRVI). Surg Endosc 9(10):1096–1100
21. Nordestgaard AG, Bodily KC, Osborne RW Jr., Buttorff JD. (1995) Major vascular injuries during laparoscopic procedures. Am J Surg 169(5):543–545
22. Hanney RM, Alle KM, Cregan PC. (1995) Major vascular injury and laparoscopy. Aust N Z J Surg 65(7):533–535
23. Geers J, Holden C. (1996) Major vascular injury as a complication of laparoscopic surgery: a report of three cases and review of the literature. Am Surg 62(5):377–379
24. Sokol AI, Chuang K, Milad MP (2003) Risk factors for conversion to laparotomy during gynecologic laparoscopy. J Am Assoc Gynecol Laparosc 10(4):469–473
25. Baggish MS (2003) Analysis of 31 cases of major-vessel injury associated with gynecologic laparoscopy operations. J Gynecol Surg 19(2):63–73
26. Fuller J, Ashar BS, Carey-Corrado J (2005) Trocar-associated injuries and fatalities: an analysis of 1399 reports to the FDA. J Minim Invasive Gynecol 12(4):302–307
27. Jansen FW, Kolkman W, Bakkum EA, de Kroon CD, Trimbos-Kemper TC, Trimbos JB (2004) Complications of laparoscopy: an inquiry about closed- versus open-entry technique. Am J Obstet Gynecol 190(3):634–638

28. Chapron C, Cravello L, Chopin N, Kreiker G, Blanc B, Dubuisson JB (2003) Complications during set-up procedures for laparoscopy in gynecology: open laparoscopy does not reduce the risk of major complications. Acta Obstet Gynecol Scand 82(12):1125–1129
29. Chapron C, Pierre F, Querleu D, Dubuisson JB (2001) Complications of gynaecological laparoscopy. Gynecol Obstet Fertil 29(9):605–612
30. Chapron C, Fauconnier A, Goffinet F, Breart G, Dubuisson JB (2002) Laparoscopic surgery is not inherently dangerous for patients presenting with benign gynaecologic pathology. Results of a meta-analysis. Hum Reprod 17(5):1334–1342
31. Chapron C, Querleu D, Bruhat MA et al (1998) Surgical complications of diagnostic and operative gynaecological laparoscopy: a series of 29,966 cases. Hum Reprod 13(4):867–872
32. Merlin TL, Hiller JE, Maddern GJ, Jamieson GG, Brown AR, Kolbe A (2003) Systematic review of the safety and effectiveness of methods used to establish pneumoperitoneum in laparoscopic surgery. Br J Surg 90(6):668–679
33. Catarci M, Carlini M, Gentileschi P, Santoro E (2001) Major and minor injuries during the creation of pneumoperitoneum. A multicenter study on 12,919 cases. Surg Endosc 15(6):566–569
34. Schafer M, Lauper M, Krahenbuhl L (2001) Trocar and Veress needle injuries during laparoscopy. Surg Endosc 15(3):275–280
35. Wang PH, Lee WL, Yuan CC et al (2001) Major complications of operative and diagnostic laparoscopy for gynecologic disease. J Am Assoc Gynecol Laparosc 8(1):68–73
36. Harkki-Siren P, Sjoberg J, Kurki T (1999) Major complications of laparoscopy: a follow-up Finnish study. Obstet Gynecol 94(1):94–98
37. Harkki-Siren P, Kurki T (1997) A nationwide analysis of laparoscopic complications. Obstet Gynecol 89(1):108–112
38. Jansen FW, Kapiteyn K, Trimbos-Kemper T, Hermans J, Trimbos JB (1997) Complications of laparoscopy: a prospective multicentre observational study. Br J Obstet Gynaecol 104(5):595–600
39. Brosens I, Gordon A, Campo R, Gordts S (2003) Bowel injury in gynecologic laparoscopy. J Am Assoc Gynecol Laparosc 10(1):9–13
40. Chandler JG, Corson SL, Way LW (2001) Three spectra of laparoscopic entry access injuries. J Am Coll Surg 192(4):478–490
41. Corson SL, Chandler JG, Way LW (2001) Survey of laparoscopic entry injuries provoking litigation. J Am Assoc Gynecol Laparosc 8(3):341–347
42. El Banna M, Abdel-Atty M, El Meteini M, Aly S (2000) Management of laparoscopic-related bowel injuries. Surg Endosc 14(9):779–782
43. Chapron C, Pierre F, Harchaoui Y et al (1999) Gastrointestinal injuries during gynaecological laparoscopy. Hum Reprod 14(2):333–337
44. Schrenk P, Woisetschlager R, Rieger R, Wayand W (1996) Mechanism, management, and prevention of laparoscopic bowel injuries. Gastrointest Endosc 43(6):572–574
45. Bishoff JT, Allaf ME, Kirkels W, Moore RG, Kavoussi LR, Schroder F (1999) Laparoscopic bowel injury: incidence and clinical presentation. J Urol 161(3):887–890
46. Ferriman A (2000) Laparoscopic surgery: two thirds of injuries initially missed. West J Med 173(6):372
47. Gordts S, Watrelot A, Campo R, Brosens I (2001) Risk and outcome of bowel injury during transvaginal pelvic endoscopy. Fertil Steril 76(6):1238–1241
48. Gett RM, Joseph MG (2004) A safe technique for the insertion of the Hasson cannula. ANZ J Surg 74(9):797–798
49. Hasson HM, Rotman C, Rana N, Kumari NA (2000) Open laparoscopy: 29-year experience. Obstet Gynecol 96(5 Pt 1):763–766
50. Hasson HM (1999) Open laparoscopy as a method of access in laparoscopic surgery. Gynacol Endosc 8(6):353–362
51. Gunenc MZ, Yesildaglar N, Bingol B, Onalan G, Tabak S, Gokmen B (2005) The safety and efficacy of direct trocar insertion with elevation of the rectus sheath instead of the skin for pneumoperitoneum. Surg Laparosc Endosc Percutan Tech 15(2):80–81
52. Agresta F, De Simone P, Ciardo LF, Bedin N (2004) Direct trocar insertion vs Veress needle in nonobese patients undergoing laparoscopic procedures: a randomized prospective single-center study. Surg Endosc 18(12):1778–1781
53. Rahman MM, Mamun AA (2003) Direct trocar insertion: alternative abdominal entry technique for laparoscopic surgery. Mymensingh Med J 12(1):45–47
54. Kaloo P, Cooper M, Reid G (2002) A prospective multicentre study of laparoscopic complications related to the direct-entry technique. Gynaecol Endosc 11(2):67–70
55. Nezhat FR, Silfen SL, Evans D, Nezhat C (1991) Comparison of direct insertion of disposable and standard reusable laparoscopic trocars and previous pneumoperitoneum with Veress needle. Obstet Gynecol 78(1):148–150
56. Kaali SG, Barad DH (1992) Incidence of bowel injury due to dense adhesions at the sight of direct trocar insertion. J Reprod Med 37(7):617–618
57. Byron JW, Markenson G, Miyazawa K (1993) A randomized comparison of Verres needle and direct trocar insertion for laparoscopy. Surg Gynecol Obstet 177(3):259–262
58. Hill DJ, Maher PJ (1996) Direct cannula entry for laparoscopy. J Am Assoc Gynecol Laparosc 4(1):77–79
59. Jacobson MT, Osias J, Bizhang R et al (2002) The direct trocar technique: an alternative approach to abdominal entry for laparoscopy. Journal of the Society of Laparoendoscopic Surgeons 6(2):169–174
60. Schoonderwoerd L, Swank DJ (2005) The role of optical access trocars in laparoscopic surgery. Surg Technol Int 14:61–67
61. Jirecek S, Drager M, Leitich H, Nagele F, Wenzl R (2002) Direct visual or blind insertion of the primary trocar. Surg Endosc 16(4):626–629
62. Kaali SG (2002) Complications associated with optical-access laparoscopic trocars. Obstet Gynecol 100(3):614
63. Lombezzi R, Galleano R, Lucarini L, Falchero F (2002) New technique for optical control of the first trocar insertion. Minerva Chirurgica 57(4):527–529
64. Sharp HT, Dodson MK, Draper ML, Watts DA, Doucette RC, Hurd WW (2002) Complications associated with optical-access laparoscopic trocars. Obstet Gynecol 99(4):553–555
65. String A, Berber E, Foroutani A, Macho JR, Pearl JM, Siperstein AE (2001) Use of the optical access trocar for safe and rapid entry in various laparoscopic procedures. Surg Endosc 15(6):570–573
66. Marcovich R, Del Terzo MA, Wolf JS Jr. (2000) Comparison of transperitoneal laparoscopic access techniques: optiview visualizing trocar and Veress needle. J Endourol 14(2):175–179
67. Hallfeldt KK, Trupka A, Kalteis T, Stuetzle H (1999) Safe creation of pneumoperitoneum using an optical trocar. Surg Endosc 13(3):306–307
68. Mettler L, Schmidt EH, Frank V, Semm K (1999) Optical trocar systems: laparoscopic entry and its complications (a study of cases in Germany). Gynaecol Endosc 8(6):383–389
69. Kaali SG, Merkatz IR (1998) Clinical experience with an optical access trocar in gynecological laparoscopy-pelviscopy. JSLS 2(3):315
70. Kaali SG (1993) Introduction of the Opti-trocar. J Am Assoc Gynecol Laparosc 1(1):50–53
71. Rubenstein JN, Blunt LW Jr., Lin WW, User HM, Nadler RB, Gonzalez CM (2003) Safety and efficacy of 12-mm

radial dilating ports for laparoscopic access. BJU Int 92(3): 327–329
72. Bhoyrul S, Payne J, Steffes B, Swanstrom L, Way LW (2000) A randomized prospective study of radially expanding trocars in laparoscopic surgery. J Gastrointest Surg 4(4):392–397
73. Galen DI, Jacobson A, Weckstein LN, Kaplan RA, DeNevi KL (1999) Reduction of cannula-related laparoscopic complications using a radially expanding access device. J Am Assoc Gynecol Laparosc 6(1):79–84
74. Ternamian AM (1997) Laparoscopy without trocars. Surg Endosc 11(8):815–818
75. Ternamian AM, Deitel M (1999) Endoscopic threaded imaging port (EndoTIP) for laparoscopy: experience with different body weights. Obes Surg 9(1):44–47
76. Yim SF, Yuen PM (2001) Randomized double-masked comparison of radially expanding access device and conventional cutting tip trocar in laparoscopy. Obstet Gynecol 97(3):435–438
77. Molloy D, Kaloo PD, Cooper M, Nguyen TV (2002) Laparoscopic entry: a literature review and analysis of techniques and complications of primary port entry. Aust N Z J Obstet Gynaecol 42(3):246–254
78. Vilos GA, Ternamian A, Dempster J, Laberge PY (2007) Laparoscopic entry: a review of techniques, technologies, and complications. Society of Obstetricians and Gynaecologists of Canada Clinical Practice Guideline. J Obstet Gynaecol Can 29(5):433–447
79. Larobina M, Nottle P (2005) Complete evidence regarding major vascular injuries during laparoscopic access. Surg Laparosc Endosc Percutan Tech 15(3):119–123
80. Moberg AC, Montgomery A (2005) Primary access-related complications with laparoscopy: comparison of blind and open techniques. Surg Endosc 19(9):1196–1199
81. Merlin TL, Hiller JE, Maddern GJ, Jamieson GG, Brown AR, Kolbe A (2001) A systematic review of the methods used to establish laparoscopic pneumoperitoneum. ASERNIP-S Report No. 13. Adelaide, South Australia: ASERNIP-S. http://www.surgeons.org/asernip-s. 2001
82. Pasic RP, Kantardzic M, Templeman C, Levine RL (2006) Insufflation techniques in gynecologic laparoscopy. Surg Laparosc Endosc Percutan Tech 16(1):18–23
83. Hender K (2001) What is the safety of open (Hasson) technique versus closed (blind Veress needle) technique for laparoscopy? Centre for Clinical Effectiveness – Evidence Report. Centre for Clinical Effectiveness (CCE), Clayton, Victoria
84. Woolcot R (2001) The efficacy and safety of different techniques for trocar insertion in laparoscopic surgery. Minim Invasive Ther Allied Technol 10(1):11–14
85. Bemelman WA, Dunker MS, Busch OR, Den Boer KT, de Wit LT, Gouma DJ (2000) Efficacy of establishment of pneumoperitoneum with the Veress needle, Hasson trocar, and modified blunt trocar (TrocDoc): a randomized study. J Laparoendosc Adv Surg Tech A 10(6):325–330
86. Bonjer HJ, Hazebroek EJ, Kazemier G, Giuffrida MC, Meijer WS, Lange JF (1997) Open versus closed establishment of pneumoperitoneum in laparoscopic surgery. Br J Surg 84(5): 599–602
87. McKernan JB, Champion JK (1995) Access techniques: veress needle–initial blind trocar insertion versus open laparoscopy with the Hasson trocar. Endosc Surg Allied Technol 3(1):35–38
88. Mayol J, Garcia-Aguilar J, Ortiz-Oshiro E, Diego Carmona JA, Fernandez-Represa JA (1997) Risks of the minimal access approach for laparoscopic surgery: multivariate analysis of morbidity related to umbilical trocar insertion. World J Surg 21(5):529–533
89. Cravello L, Banet J, Agostini A, Bretelle F, Roger V, Blanc B (2002) Open laparoscopy: analysis of complications due to first trocar insertion. French. Gynecol Obstet Fertil 30(4):286–290
90. Ahmad G, Duffy JMN, Watson AJS (2007) Laparoscopic entry techniques and complications. International Journal of Gynecology & Obstetrics 99(1):52–55
91. Chin K, Newton J (1996) Survey of training in minimal access surgery in the West Midlands region of the UK. Gynacol Endosc 5(6):329–333
92. Lalchandani S, Philips K (2005) Laparoscopic entry technique-a survey of practices of consultant gynaecologists. Gynecol Surg 2(4):245–249
93. Lingam K, Cole RA (2001) Laparoscopic entry port visited: a survey of practices of consultant gynaecologists in Scotland. Gynaecol Endosc 10(5):335–342
94. Kaloo P, Cooper M, Molloy D (2002) A survey of entry techniques and complications of members of the Australian Gynaecological Endoscopy Society. Aust N Z J Obstet Gynaecol 42(3):264–266
95. Marret H, Golfier F, Cassignol A, Raudrant D (2001) Methods for laparoscopy: open laparoscopy or closed laparoscopy? Attitude of the French Central University Hospital. Gynecol Obstet Fertil 29(10):673–679
96. Garry R (1999) A consensus document concerning laparoscopic entry techniques: Middlesbrough, March 19–20 1999. Gynacol Endosc (8):403–406
97. Sutton CJG, Philips K (2007) Preventing Gynaecological Laparoscopic Injury. Guideline No. 48
98. RANZCOG (2006) Use of the Veress needle to obtain pneumoperitoneum prior to laparoscopy. Statement C-Gyn 7. Consensus statement of the Royal Australian & New Zealand College of Obstetricians & Gynaecologists (RANZCOG), the Australian Gynaecological Endoscopy Society (AGES). Royal Australian and New Zealand College of Obstetricians and Gynaecologists, Australia
99. Neudecker J, Sauerland S, Neugebauer E et al (2002) (EAES) The European Association for Endoscopic Surgery clinical practice guideline on the pneumoperitoneum for laparoscopic surgery. Surg Endosc 16(7):1121–1143
100. SAGES. Society of American Gastrointestinal Endoscopic Surgeons (SAGES). SAGES guidelines for diagnostic laparoscopy. Los Angeles (CA): Society of American Gastrointestinal Endoscopic Surgeons (SAGES); 2002 Mar. 5 p. [13 references] www.sages.org. Society of American Gastrointestinal Endoscopic Surgeons (SAGES); March 2002
101. Pierre F, Chapron C, Deshayes M, Madelenat P, Magnin G, Querleu D (2000) Initial access for laparoscopic gynecologic surgery. French Society of Endoscopic Gynecology, International Society of Pelvic Surgery and the National College of French Gynecologists-Obstetricians. J Gynecol Obstet Biol Reprod (Paris) 29(1):8–12
102. Bakkum EA, Timmermans A, Admiraal JF, Brolmann HAM, Jansen FW (2006) Laparoscopic entry techniques: a protocol for daily gynaecological practice in The Netherlands. Gynecol Surg 3(2):84–87
103. Garry R (2006) Laparoscopic surgery. Best Pract Res Clin Obstet Gynaecol 20(1):89–104
104. Vilos GA (2006) The ABCs of a safer laparoscopic entry. J Minim Invasive Gynecol 13(3):249–251
105. Semm K, Semm I (1999) Safe insertion of trocars and the Veress needle using standard equipment and the 11 security steps. Gynaecol Endosc 8(6):339–347
106. Jones KD, Fan A, Sutton C (2002) Safe entry during laparoscopy: a prospective audit in a district general hospital. Gynaecol Endosc 11(2):85–89

107. Richardson RE, Sutton CJG (1999) Complications of first entry: a pospective laparoscopy audit. Gynacol Endosc 8(6):327–334
108. Vilos GA, Vilos AG (2003) Safe laparoscopic entry guided by Veress needle CO2 insufflation pressure. J Am Assoc Gynecol Laparosc 10(3):415–420
109. RCOG. (2006) Development of RCOG Green-top Guidelines: Producing a Clinical Practice Guideline. Clinical Governance Advice No. 1c. Royal College of Obstetricians and Gynaecologists, London, UK
110. SIGN. Scottish Intercollegiate Guidelines Network . SIGN 50: A guideline developers' handbook. Section 6: Forming guideline recommendations. http://www.sign.ac.uk/guidelines/fulltext/50/section6.html. 2007. Ref Type: Internet Communication
111. Hurd WH, Bude RO, DeLancey JO, Gauvin JM, Aisen AM (1991) Abdominal wall characterization with magnetic resonance imaging and computed tomography. The effect of obesity on the laparoscopic approach. J Reprod Med 36(7):473–476
112. Hurd WW, Bude RO, DeLancey JO, Pearl ML (1992) The relationship of the umbilicus to the aortic bifurcation: implications for laparoscopic technique. Obstet Gynecol 80(1):48–51
113. Nezhat F, Brill AI, Nezhat CH, Nezhat A, Seidman DS, Nezhat C (1998) Laparoscopic appraisal of the anatomic relationship of the umbilicus to the aortic bifurcation. J Am Assoc Gynecol Laparosc 5(2):135–140
114. Parker J, Rahimpanah F (2001) The advantages of microlaparoscopic left upper quadrant entry in selected patients. Aust N Z J Obstet Gynaecol 41(3):314–316
115. Pasic R, Levine RL, Wolf WM Jr. (1999) Laparoscopy in morbidly obese patients. J Am Assoc Gynecol Laparosc 6(3):307–312
116. Pelosi MA III, Pelosi MA (1998) Alignment of the umbilical axis: an effective maneuver for laparoscopic entry in the obese patient. Obstet Gynecol 92(5):869–872
117. Schwartz ML, Drew RL, Andersen JN (2003) Induction of pneumoperitoneum in morbidly obese patients. Obes Surg 13(4):601–604
118. Agarwala N, Liu CY (2005) Safe entry techniques during laparoscopy: left upper quadrant entry using the ninth intercostal space–a review of 918 procedures. J Minim Invasive Gynecol 12(1):55–61
119. Audebert AJ, Gomel V (2000) Role of microlaparoscopy in the diagnosis of peritoneal and visceral adhesions and in the prevention of bowel injury associated with blind trocar insertion. Fertil Steril 73(3):631–635
120. Brill AI, Nezhat F, Nezhat CH, Nezhat C (1995) The incidence of adhesions after prior laparotomy: a laparoscopic appraisal. Obstet Gynecol 85(2):269–272
121. Chang FH, Lee CL, Soong YK (1994) Use of Palmer's point for insertion of the operative laparoscope in patients with severe pelvic adhesions: experience of seventeen cases. J Am Assoc Gynecol Laparosc 1(4, Part 2):S7
122. Chang FH, Chou HH, Lee CL, Cheng PJ, Wang CW, Soong YK (1995) Extraumbilical insertion of the operative laparoscope in patients with extensive intraabdominal adhesions. J Am Assoc Gynecol Laparosc 2(3):335–337
123. Chi DS, Abu-Rustum NR, Sonoda Y et al (2004) Ten-year experience with laparoscopy on a gynecologic oncology service: analysis of risk factors for complications and conversion to laparotomy. Am J Obstet Gynecol 191(4):1138–1145
124. Childers JM, Brzechffa PR, Surwit EA (1993) Laparoscopy using the left upper quadrant as the primary trocar site. Gynecol Oncol 50(2):221–225
125. Durand-Reville M, Guichard-Checchi C, Ejnes L et al (2003) Gynecologic laparoscopy and abdominal scars: what approach for the peritoneal cavity? J Gynecol Obstet Biol Reprod (Paris) 32(7):625–633
126. Gersin KS, Heniford BT, Arca MJ, Ponsky JL (1998) Alternative site entry for laparoscopy in patients with previous abdominal surgery. J Laparoendosc Adv Surg Tech A 8(3):125–130
127. Golan A, Sagiv R, Debby A, Glezerman M (2003) The mini-laparoscope as a tool for localization and preparation for cannula insertion in patients with multiple previous abdominal incisions or umbilical hernia. J Am Assoc Gynecol Laparosc 10(1):14–16
128. Howard FM, El Minawi AM, DeLoach VE (1997) Direct laparoscopic cannula insertion at the left upper quadrant. J Am Assoc Gynecol Laparosc 4(5):595–600
129. Jacobson TZ, Davis C (2003) A prospective studiy of Palmer's point entry, the rate of sub-umbilical adhesions in women undergoing laparoscopy with previous abdominal surgery. Abstract P04. Rev Gynaecol Pract 3[1]
130. Kumakiri J, Takeuchi H, Sato Y et al (2006) A novel method of ninth-intercostal microlaparoscopic approach for patients with previous laparotomy. Acta Obstet Gynecol Scand 85(8):977–981
131. Lam KW, Pun TC (2002) Left upper quadrant approach in gynecologic laparoscopic surgery using reusable instruments. J Am Assoc Gynecol Laparosc 9(2):199–203
132. Lecuru F, Leonard F, Philippe JJ, Rizk E, Robin F, Taurelle R (2001) Laparoscopy in patients with prior surgery: results of the blind approach. JSLS 5(1):13–16
133. Levrant SG, Bieber EJ, Barnes RB (1997) Anterior abdominal wall adhesions after laparotomy or laparoscopy. J Am Assoc Gynecol Laparosc 4(3):353–356
134. Parker J, Reid G, Wong F (1999) Microlaparoscopic left upper quadrant entry in patients at high risk of periumbilical adhesions. Aust N Z J Obstet Gynaecol 39(1):88–92
135. Parker MC, Ellis H, Moran BJ et al (2001) Postoperative adhesions: ten-year follow-up of 12,584 patients undergoing lower abdominal surgery. Dis Colon Rectum 44(6):822–829
136. Rafii A, Camatte S, Lelievre L, Darai E, Lecuru F (2005) Previous abdominal surgery and closed entry for gynecologic laparoscopy: a prospective study. Obstet Gynecol Surv 60(4):229–230
137. Sepilian V, Ku L, Wong H, Liu CY, Phelps JY (2007) Prevalence of infraumbilical adhesions in women with previous laparoscopy. JSLS 11(1):41–44
138. Szigetvari I, Feinman M, Barad D, Bartfai G, Kaali SG. (1989) Association of previous abdominal surgery and significant adhesions in laparoscopic sterilization patients. J Reprod Med 34(7):465–466
139. Kolecki RV, Golub RM, Sigel B et al (1994) Accuracy of viscera slide detection of abdominal wall adhesions by ultrasound. Surg Endosc 8(8):871–874
140. Tu FF, Lamvu GM, Hartmann KE, Steege JF (2005) Preoperative ultrasound to predict infraumbilical adhesions: a study of diagnostic accuracy. Am J Obstet Gynecol 192(1):74–79
141. Hsu WC, Chang WC, Huang SC, Torng PL, Chang DY, Sheu BC (2006) Visceral sliding technique is useful for detecting abdominal adhesion and preventing laparoscopic surgical complications. Gynecol Obstet Invest 62(2):75–78
142. Kothari SN, Fundell LJ, Lambert PJ, Mathiason MA (2006) Use of transabdominal ultrasound to identify intraabdominal adhesions prior to laparoscopy: a prospective blinded study. Am J Surg 192(6):843–847
143. Nezhat CH, Adib T (2007) A Diagnostic Study to Predict Subumbilical Adhesions using Preoperative Ultrasound for Visceral Slide and a Novel Peri-umbilical Ultrasound-guided Saline Infusion (PUGSI) Technique. Abstract 212. J Minim Invasive Gynecol 14(6, Supplement 1):S78
144. Larciprete G, Cirese E, Flora R, Fanning J (2007) 171: Safe peritoneal access for laparoscopy in women with previous

abdominal open surgery. Ultrasound preoperative evaluation of the subumbilical field. J Minim Invasive Gynecol 14(6, Supplement 1):S63–S64
145. Sriprasad S, Yu DF, Muir GH, Poulsen J, Sidhu PS (2006) Positional anatomy of vessels that may be damaged at laparoscopy: new access criteria based on CT and ultrasonography to avoid vascular injury. J Endourol 20(7):498–503
146. Narendran M, Baggish MS (2002) Mean Distance Between Primary Trocar Insertion Site and Major Retroperitoneal Vessels During Routine Laparoscopy. J Gynecol Surg 18(4):121–127
147. Roy GM, Bazzurini L, Solima E, Luciano AA (2001) Safe technique for laparoscopic entry into the abdominal cavity. J Am Assoc Gynecol Laparosc 8(4):519–528
148. Angelini L, Lirici MM, Papaspyropoulos V, Sossi FL (1997) Combination of subcutaneous abdominal wall retraction and optical trocar to minimize pneumoperitoneum-related effects and needle and trocar injuries in laparoscopic surgery. Surg Endosc 11(10):1006–1009
149. Briel JW, Plaisier PW, Meijer WS, Lange JF (2000) Is it necessary to lift the abdominal wall when preparing a pneumoperitoneum? A randomized study. Surg Endosc 14(9):862–864
150. Teoh B, Sen R, Abbott J (2005) An evaluation of four tests used to ascertain Veres needle placement at closed laparoscopy. J Minim Invasive Gynecol 12(2):153–158
151. Vilos AG, Vilos GA, Abu-Rafea B, Hollett-Caines J, Al Omran M (2006) Effect of body habitus and parity on the initial Veres intraperitoneal CO_2 insufflation pressure during laparoscopic access in women. J Minim Invasive Gynecol 13(2):108–113
152. Azevedo OC, Azevedo JL, Sorbello AA, Miguel GP, Wilson Junior JL, Godoy AC (2006) Evaluation of tests performed to confirm the position of the Veress needle for creation of pneumoperitoneum in selected patients: a prospective clinical trial. Acta Cir Bras 21(6):385–391
153. Reich H, Ribeiro SC, Rasmussen C, Rosenberg J, Vidali A (1999) High-pressure trocar insertion technique. JSLS 3(1):45–48
154. Reich H, Rasmussen C, Vidali A (1999) Peritoneal hyperdistention for trocar insertion. Gynacological Endoscopy 8(6):375–377
155. Tsaltas J, Pearce S, Lawrence A, Meads A, Mezzatesta J, Nicolson S (2004) Safer laparoscopic trocar entry: It's all about pressure. Aust N Z J Obstet Gynaecol 44(4):349–350
156. Abu-Rafea B, Vilos GA, Vilos AG, Ahmad R, Hollett-Caines J, Al Omran M (2005) High-pressure laparoscopic entry does not adversely affect cardiopulmonary function in healthy women. J Minim Invasive Gynecol 12(6):475–479
157. Abu-Rafea B, Vilos GA, Vilos AG, Hollett-Caines J, Al Omran M (2006) Effect of body habitus and parity on insufflated CO2 volume at various intraabdominal pressures during laparoscopic access in women. J Minim Invasive Gynecol 13(3):205–210
158. Epstein J, Arora A, Ellis H (2004) Surface anatomy of the inferior epigastric artery in relation to laparoscopic injury. Clin Anat 17(5):400–408
159. Saber AA, Meslemani AM, Davis R, Pimentel R (2004) Safety zones for anterior abdominal wall entry during laparoscopy: a CT scan mapping of epigastric vessels. Ann Surg 239(2):182–185
160. Nezhat CH, Nezhat F, Brill AI, Nezhat C (1999) Normal variations of abdominal and pelvic anatomy evaluated at laparoscopy. Obstet Gynecol 94(2):238–242
161. Hurd WW, Bude RO, DeLancey JO, Newman JS (1994) The location of abdominal wall blood vessels in relationship to abdominal landmarks apparent at laparoscopy. Am J Obstet Gynecol 171(3):642–646
162. Hurd WW, Amesse LS, Gruber JS, Horowitz GM, Cha GM, Hurteau JA (2003) Visualization of the epigastric vessels and bladder before laparoscopic trocar placement. Fertil Steril 80(1):209–212
163. Wind J, Cremers JE, Berge Henegouwen MI, Gouma DJ, Jansen FW, Bemelman WA (2007) Medical liability insurance claims on entry-related complications in laparoscopy. Surg Endosc 5
164. Vilos GA (2002) Laparoscopic bowel injuries: forty litigated gynaecological cases in Canada. J Obstet Gynaecol Canada: JOGC 24(3):224–230
165. Vilos GA (2000) Litigation of laparoscopic major vessel injuries in Canada. J Am Assoc Gynecol Laparosc 7(4):503–509
166. Soderstrom RM (1993) Bowel injury litigation after laparoscopy. J Am Assoc Gynecol Laparosc 1(1):74–77
167. Sutton CJ (1996) Medico-legal implications of keyhole surgery. Medico-Legal J 64(Pt 3):101–113
168. Rein H (2001) Complications and litigation in gynecologic endoscopy. Curr Opin Obstet Gynecol 13(4):425–429
169. Ellis H (2001) Medicolegal consequences of postoperative intra-abdominal adhesions. J R Soc Med 94(7):331–332
170. Jansen FW, Wind J, Cremeres JEL, Bemelman WA (2007) 146: Entry Related Complications in Laparoscopy and Their Medical Liability Insurance. J Minim Invasive Gynecol 14(6, Supplement 1):S54–S55
171. Driscoll V (2004) Bowel injury during laparoscopic sterilization – Vanessa Palmer v Cardiff & Vale NHS Trust. The AvMA Med Legal J 10(3):109–111
172. Hart R, Doherty DA, Karthigasu K, Garry R (2006) The value of virtual reality-simulator training in the development of laparoscopic surgical skills. J Minim Invasive Gynecol 13(2):126–133
173. Kolkman W, Wolterbeek R, Jansen FW (2005) Gynecological laparoscopy in residency training program: Dutch perspectives. Surg Endosc 19(11):1498–1502