Complications related to entry techniques for laparoscopy in 159 dogs and cats

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Abstract

Objective: To report the frequency and risk factors of complications related to 3 entry techniques for laparoscopy in small animals.

Study design: Single-institution retrospective case series.

Animals: 159 client-owned dogs and cats.

Methods: Medical records were reviewed for dogs and cats undergoing laparoscopic surgery with carbon dioxide (CO₂) insufflation between 2006 and 2018. Data including entry site, entry technique, signalment, body conformation, complications, and operating surgeon/resident were analyzed by univariate regression analysis. Factors with \( P < .25 \) were included in multivariate regression analysis.

Results: Complications occurred in 33 of 159 (21%) surgeries and were considered minor (CO₂ leaks, omental insufflation, repeated entry) in 30 of 33 (91%) cases. The Ternamian visual entry, modified Hasson, and Veress needle entry techniques were associated with complications in 7 (9%), 17 (26%), and 9 (60%) surgeries, respectively. Major complications occurred in 3 of 159 (2%) surgeries, in which entry-related hemorrhage prompted conversion to an open technique (2 [13%] entries with Veress needle) and 1 [1%] with the Ternamian visual). Entry location and entry technique remained significant in the final multivariate model. Complications were 11.7 times more likely after a paramedian entry than after a midline entry; the odds ratio of complications were 5 and 28 times higher after modified Hasson and Veress needle entries, respectively, than after Ternamian visual entry.

Conclusion: In this study, a Ternamian visual entry technique and midline entry site appeared associated with fewer complications than 2 other techniques.

Clinical significance: The findings in this study are preliminary, and superiority of any entry technique must be reevaluated in a prospective randomized controlled study.

1 | INTRODUCTION

Laparoscopy reduces postoperative morbidity and shortens recovery time\(^1\,\,^5\) but introduces the risk for equipment and technology-specific complications. In particular, the laparoscopic entry (ie, the initial blind introduction of the laparoscopic camera into the body cavity and carbon dioxide \([\text{CO}_2]\) insufflation of the abdomen) has been associated with complications.\(^6\,\,^8\)

Half of all complications associated with laparoscopic surgery in man have been attributed to entry-related complications.\(^6\,\,^8\) Entry-related injuries and complications range from mild to catastrophic and may lead to conversion to open technique, significant morbidity, or patient death.\(^9\) Entry-related
Complications can also have significant legal ramifications for human medicine surgeons. In a large systematic literature review of laparoscopic entry-related techniques and complications in man, trends in injuries related to specific techniques were noted. Entry-related injury occurring in medium- to low-risk patients is now considered negligent practice in the United Kingdom. Multiple studies have compared the risks of various entry techniques in human patients. Classification of laparoscopic entry-related injuries within the human literature are divided into type 1 injuries (damage to major blood vessels and normally positioned bowel) and type 2 injuries (damage to bowel adhered to the body wall). However, studies investigating the rate and severity of complications between entry techniques in veterinary medicine are lacking.

Laparoscopic entry techniques can be characterized as open or closed techniques, using single- or multiport devices and visual or nonvisual entries. Closed techniques traditionally involve the use of a spring-loaded Veress needle, which provides initial pneumoperitoneum, with subsequent cannula placement, and open techniques often include the modified Hasson technique. In a large systematic retrospective review of human laparoscopic surgeries with the Veress needle entry technique, an entry-related complication rate of 0.23% was noted in almost 700,000 surgical procedures. In another prospective study comparing 2 types of closed (blind) entry techniques in man, use of the Veress needle resulted in minor complications in 5.9% of surgeries, which was higher than reported with direct insertion of a trocar. In the same study, major complications occurred in 1.3% of surgeries, with no difference between the 2 techniques. In small animal surgery, an intercostal insertion of the Veress needle into the abdomen has been suggested to increase the effectiveness and decrease the risks associated with closed entry, but the incidence of Veress needle-related complications is unknown.

Open entry techniques such as the Hasson reduce the rate of failed entry compared with Veress needle techniques in man but do not seem to improve the safety. In the Ternamian visual entry technique, a hollow threaded cannula is placed through the body wall with a laparoscope inserted during entry. With this technique, the skin is incised, but, unlike the modified Hasson technique, the body wall is left intact and is penetrated by rotating the threaded Ternamian cannula. The surgeon can identify tissue planes as the cannula progresses into the abdomen. This technique can be used for primary entry or after placement of a Veress needle and elevation of the body wall by insufflation. No entry-related complications were observed in a prospective study of 234 human patients in which the Ternamian port was used in conjunction with Veress needle insufflation. In addition to entry technique, patient-related factors can also influence the complication rate. For example, intra-abdominal adhesions and obesity increase the risk for entry-related complications in man.

Entry techniques have not been compared in the veterinary literature. The objective of this retrospective study was to determine the frequency of complications related to 3 entry techniques for laparoscopy in small animals. This study also sought to identify risk factors for such complications. We hypothesized that the Ternamian visual entry technique would be associated with less complications compared with the modified Hasson and Veress needle entry techniques. We also hypothesized that small body size and high body condition score would constitute risk factors for entry-related complications.

## Materials and Methods

Medical records from a single institution were reviewed for all cats and dogs that had laparoscopic surgery between March 2006 and March 2018. Cases were included when CO2 insufflation was used to create working space (pneumoperitoneum). Cases were excluded when the surgery report was not detailed enough to determine the presence of potential complications. Animal breed, gender, weight, body condition score (BCS; 1–5), type of surgery, date of surgery, attending surgeon (American College of Veterinary Surgeons [ACVS] diplomate or resident), laparoscopic entry technique, entry site (midline or paramedian), and any complications that occurred during entry were noted.

Animal size was divided into the following groups: cats, small dogs (3–20 kg), large dogs (20–40 kg), and giant dogs (>40 kg). Body condition was considered lean when BCS ranged from 1 to 3 and overweight when the BCS exceeded 3 of 5. Animals were furthermore divided into an early and a late cohort. The early and late cohorts were surgically treated between 2006 and 2011, whereas the late cohort was surgically treated between 2012 and 2018.

An entry complication was defined as an accidental injury sustained by the animal or a difficulty associated with the establishment of a reliable and adequate pneumoperitoneum. Complications sustained after establishment of the primary visual field were not included.

### Entry Techniques

#### Veress Needle Entry Technique

A metal multiuse Veress needle consists of a blunt-tipped obturator inside a sharp needle (Stryker Endoscopy, San Jose, California). When no pressure is applied against it, the blunt obturator (spring loaded) protrudes in front of the sharp needle, guarding tissue from the needle. Conversely, when the instrument is pressed against a more resistant
surface (such as the body wall), the spring-loaded obturator retracts, enabling the sharp needle to cut through the tissue plane. When the body wall is penetrated, the blunt obturator springs out, protecting abdominal organs from the needle. The Veress needle is used in laparoscopy to gain access to the abdomen prior to insufflation with CO₂. Creation of a pneumoperitoneum creates space between the body wall and abdominal organs, allowing safe placement of the first cannula. A variety of techniques including digital lifting and stay sutures were used in all cases to elevate the body wall from the organs prior to needle insertions.

2.1.2 | Modified Hasson open entry technique

The skin was incised, and the body wall was elevated with stay sutures prior to making a small laparotomy (approximately 9-12 mm) and inserting a cannula with a blunt obturator (Endopath Xcel; Ethicon Endo-Surgery, Cincinnati, Ohio; or 6-mm metal trocar with multifunctional valve; Karl Storz Veterinary Endoscopy, Goleta, California) into the abdomen. Carbon dioxide was insufflated through the insufflation port in the cannula until the intraabdominal pressure reached 8-12 mm Hg, at which point the obturator was removed, and the laparoscope (Stryker Endoscopy) was placed in the abdominal cavity. This technique was modified in a subset of cases by placing 1 or 2 stay sutures around the incision to elevate the body wall away from the internal organs prior to insertion of the cannula. A ribbed cone was not used.

2.1.3 | Ternamian visual entry

A threaded cannula (EndoTIP; Karl Storz Veterinary Endoscopy; Figure 1) was inserted into the rectus abdominis fascia through a 10-12-mm skin incision. A 1-2-mm stab incision limited to the partial thickness of the rectus fascia was performed with the tip of a scalpel blade to facilitate engagement of the tip of the cannula into the rectus fascia. After the rectus fascia was well engaged by 1/2 to 1 clockwise revolution of the cannula, the laparoscope was inserted into the shaft of the cannula. Introduction of the cannula into the abdominal cavity was performed by direct visualization during clockwise revolutions of the cannula until intraabdominal or falciform fat was noted (Figure 2), at which time the abdominal cavity was insufflated to 8-12 mm Hg. The laparoscope was then introduced into the abdomen.

**FIGURE 1** The Ternamian visual laparoscopic entry technique in this study uses a reusable threaded cannula. After a skin incision and a 1-2-mm partial thickness stab incision into the rectus fascia ( linea alba) were made to facilitate engagement of the cannula tip, the cannula was inserted by rotating it in a clockwise direction. When the cannula was engaging the rectus fascia, a laparoscope was inserted into the cannula to visualize the body wall layers. The authors prefer inserting the cannula perpendicularly to the body wall. The steep angulation shown on the image is to ensure correct insertion of the tip of the cannula into the stab incision in the rectus fascia.

**FIGURE 2** View from laparoscope inserted in cannula during Ternamian visual abdominal entry. A, The connective tissue of the rectus fascia and peritoneum appears web-like. B, Falciform fat (arrow) lacks the web-like appearance.
2.2 Statistical analysis

Univariate nominal logistic regression performed in JMP Pro 12 (SAS Institute, Cary, North Carolina) was used to analyze all risk factors for entry complications, including entry technique, entry site, body condition, surgery date cohort, attending surgeon, and animal species and size. Variables with P-values < .25 were entered into a multivariate logistic regression analysis, and a final model was selected by backward elimination. Receiver operating characteristics (ROC) were performed on the final model with the area under the curve used to describe the strength of the model in prediction of entry-related complications. P < .05 was considered significant.

3 RESULTS

In total, 159 animals were included: 6 cats, 46 small breed dogs, 88 large breed dogs, and 19 giant breed dogs. The most common breeds included the Labrador retriever/mix (n = 14), German shepherd (n = 10), Australian cattle dog (n = 8), Great Dane/mix (n = 8), golden retriever/mix (n = 7), Doberman pinscher (n = 6), Yorkshire terrier (n = 6), beagle (n = 5), border collie (n = 4), domestic short hair cat (n = 4), Shetland sheepdog (n = 4), boxer (n = 3), Chihuahua (n = 3), Havanese (n = 3), mastiff (n = 3), standard poodle (n = 3), Swiss mountain dog (n = 3), and West Highland white terrier (n = 3). The early time cohort included 80 animals, and the late time cohort included 79 animals. The average age of all animals was 4.6 years (±4.2), with no difference detected between animals with entry complications or without (P = .879). Surgeries included 58 female sterilizations, 20 male sterilizations, 11 gastropexies, 26 liver biopsies, 15 adrenalectomies, 5 cholecystectomies, 6 cystotomies, and 18 other procedures with fewer than 5 total surgeries per procedure. An ACVS diplomate was surgically prepared for 144 (89%) cases, and, of those, one of the authors (BAF) was involved in 75% of cases. The presence of an ACVS board-certified surgeon had no impact on entry-related complications (P = .734).

Entry-related complications were observed in 33 of 159 (21%) surgeries. Complications included gas leaks from the initial portal site (n = 17; 11%), failed initial entry requiring 2 or more entry attempts (n = 6; 4%), splenic hemorrhage (n = 5; 3%), subomental insufflation affecting visualization (n = 3; 2%), and hemorrhage from sources other than the spleen in 2 cases (1%); retroperitoneal hemorrhage in an adrenalectomy and epigastric vein bleed in a liver biopsy surgery. Three of 159 (2%) cases were converted to open surgery because of hemorrhage during laparoscopic entry, 2 were converted because of splenic hemorrhage, and 1 was converted because of retroperitoneal hemorrhage. These 3 were consequently considered major complications. In all 3 cases, the hemorrhage resolved spontaneously with or without applied pressure at the site of bleeding. Two converted cases occurred in the early cohort, and 1 occurred in the late cohort. All other complications (ie, 30 of 33; 91%) were considered minor complications, which did not affect the outcome of the surgery or animal negatively.

Frequency of entry-related complications and odds ratios with 95% confidence intervals and investigated risk factors for all complications were analyzed by univariate regression analysis. Risk factors included were early and late cohorts, entry site, entry technique, animal size, body conformation, and surgically prepared ACVS surgeon vs resident surgeon only. Among these, the early time cohort, paramedian entry location, modified Hasson and Veress needle entry techniques, and animal being a cat were risk factors. The multivariate regression analysis for all types of entry-related complications identified only entry site and entry technique (Table 1) as independent risk factors. Complications were 11.7 times more likely after a paramedian entry than after a midline entry. The odds ratios of complications were 5 and 28 times higher after modified Hasson and Veress needle entries, respectively, than after a Ternamian visual entry. According to

<table>
<thead>
<tr>
<th>Complication, n (%)</th>
<th>Frequency all dogs, n (%)</th>
<th>Level 1 variable</th>
<th>Frequency all dogs, n (%)</th>
<th>Level 2 variable</th>
<th>Frequency all dogs, n (%)</th>
<th>Complication, n (%)</th>
<th>OR</th>
<th>95% CI Lower</th>
<th>95% CI Upper</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paramedian entry location</td>
<td>15/159 (9)</td>
<td>25 (17)</td>
<td>Midline entry</td>
<td>144/159 (91)</td>
<td>25 (17)</td>
<td></td>
<td>15/159 (9)</td>
<td>8 (53)</td>
<td>11.7</td>
<td>3.3</td>
</tr>
<tr>
<td>Modified Hasson</td>
<td>64/159 (41)</td>
<td>17 (27)</td>
<td>Ternamian Visual</td>
<td>79/159 (50)</td>
<td>7 (9)</td>
<td>5</td>
<td>1.8</td>
<td>16.6</td>
<td>.0016</td>
<td></td>
</tr>
<tr>
<td>Veress</td>
<td>15/159 (9)</td>
<td>9 (60)</td>
<td>Modified Hasson</td>
<td>65/159 (41)</td>
<td>17 (26)</td>
<td>5</td>
<td>1.7</td>
<td>19.6</td>
<td>.0042</td>
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<tr>
<td>Veress</td>
<td>15/159 (9)</td>
<td>9 (60)</td>
<td>Ternamian Visual</td>
<td>79/159 (50)</td>
<td>7 (9)</td>
<td>5</td>
<td>1.8</td>
<td>16.6</td>
<td>.0016</td>
<td></td>
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AUC, area under the curve from receiver operating characteristics analysis; OR, odds ratio.

TABLE 1 Multivariate regression analysis of risk factors for all entry complications with backward eliminationa

<.0001

aOdds ratios of comparing complications in level 2 variable (risk factor) versus level 1 variable (less risk).
The ROC of the multivariate logistic regression model, the final model accounted for 80% of all complications.

Risk factors for gas leak, the most common entry-related complication, were analyzed with multivariate regression analysis (Table 2). The risk of gas leak was 16.7 times higher when a paramedian rather than a midline entry was performed. Modified Hasson and Veress needle entry were 15.3 and 40 times more likely to lead to a gas leak, respectively, compared with Ternamian visual entry. Cats were 16.8 times more likely than small breed dogs to be affected by gas leaks. Overweight or obese animals were 4.3 times more likely than lean animals to have gas leaks. According to the ROC, the final model including entry site, entry technique, animal size, and body condition accounted for 89% of all gas leaks.

### DISCUSSION

Entry-level complications were found in 21% of laparoscopic surgeries in this population. The vast majority (91%) of observed complications were of no consequence for completion of the procedure or for the animal and were considered minor. Three (2%) procedures were converted to open surgery because of entry-related complications, and these were considered major complications. The only independent risk factors for all entry complications were the entry site and the entry technique. Midline entry and the Ternamian visual technique were associated with lower entry complications compared with the other 2 techniques in this population, supporting our first hypothesis. Body size and body condition were not consistently associated with increased risks, so the second hypothesis was rejected.

The complication rate noted here is higher than that previously suggested. However, only 2% of surgeries were associated with a type of complication that is traditionally reported (ie, those with consequences for the surgical procedure). Intraoperative complication rates in 278 laparoscopic spay procedures were reviewed a recent study. Ten (4%) of the procedures had intraoperative complications. Intraoperative complications in 1.6% of cases were found in another large study of 618 laparoscopic ovariectomies in dogs. Neither of the articles describing these studies reported laparoscopic entry-related complications or discussed minor complications such as gas leaks or repeated entry attempts. An older review of the veterinary literature noted that, of 36 reports in dogs and cats, only 7 reports revealed entry technique complications, with a total of 30 of 749 (4%) procedures having entry technique complications. The retrospective nature of the included reports likely severely underestimated the true rate of entry technique complications, particularly minor complications that may have seemed of low impact. In horses, 30% were shown to experience insufflation or cannula insertion.

### TABLE 2

<table>
<thead>
<tr>
<th>Frequency all dogs, n (%)</th>
<th>Complication, n (%)</th>
<th>OR 95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midline entry</td>
<td>144 (159/9)</td>
<td>12 (8)</td>
<td>.003</td>
</tr>
<tr>
<td>Paramedian entry location</td>
<td>15 (159/9)</td>
<td>5 (33)</td>
<td>.0044</td>
</tr>
<tr>
<td>Entry techniques</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ternamian visual</td>
<td>70 (159/9)</td>
<td>2 (3)</td>
<td>.0014</td>
</tr>
<tr>
<td>Modified Hasson</td>
<td>65 (159/4)</td>
<td>11 (17)</td>
<td>.0195</td>
</tr>
<tr>
<td>Veress</td>
<td>15 (159/9)</td>
<td>4 (27)</td>
<td>.0038</td>
</tr>
<tr>
<td>Dog size</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large breed</td>
<td>88 (159/55)</td>
<td>9 (10)</td>
<td>.0172</td>
</tr>
<tr>
<td>Small breed</td>
<td>46 (159/20)</td>
<td>5 (11)</td>
<td>.031</td>
</tr>
<tr>
<td>Lean body conformation</td>
<td>104 (148/70)</td>
<td>6 (6)</td>
<td>.0895</td>
</tr>
</tbody>
</table>

AUC: area under the curve from receiver operating characteristics analysis; OR, odds ratio.

4.1. Risk factors for gas leak, the most common entry-related complication, were analyzed with multivariate regression analysis (Table 2). The risk of gas leak was 16.7 times higher when a paramedian rather than a midline entry was performed. Modified Hasson and Veress needle entry were 15.3 and 40 times more likely to lead to a gas leak, respectively, compared with Ternamian visual entry. Cats were 16.8 times more likely than small breed dogs to be affected by gas leaks. Overweight or obese animals were 4.3 times more likely than lean animals to have gas leaks. According to the ROC, the final model including entry site, entry technique, animal size, and body condition accounted for 89% of all gas leaks.
problems, including peritoneal detachment, splenic puncture, and bowel perforation.  

The entry sites recorded in this retrospective study were limited to midline and paramedian entry. The latter was used primarily in flank approaches for laparoscopic adrenalectomies in this population of animals. The risk for gas leaks when using a paramedian technique was particularly elevated, with an almost 17-fold elevated risk compared with midline entry. Paramedian laparoscopic entry involves several muscle and fascial planes. An open modified Hasson technique may result in relatively large dissections, especially when a muscle splitting technique is used, which may have contributed to gas leaks in our findings. However, gas leaks in this population occurred independent from entry technique. It is possible that the thick facial plane such as the midline rectus fascia/linea alba simply provides a better seal around the cannulas compared to the more pliable and thinner fascias associated with the lateral abdominal wall. Because the Veress needle and Ternamian visual techniques involve less facial dissection, these techniques could reduce the risk of gas leaks.

In this population, the Ternamian visual entry was associated with lower risks compared with the modified Hasson and Veress needle techniques for entry-related complications. However, this finding is considered preliminary because prospective controlled studies are required for more accurate conclusions. This retrospective report contains multiple factors that were not controlled. The study spans many years, and instrument changes and skill development have been ongoing during this time. The Veress needle entries were few, and all were performed in the early time cohort, which makes comparisons to that specific technique particularly suspect. The time cohorts were investigated as a risk factor to control for such changes in instrumentation and skills. It has been suggested that surgical proficiency is reached after approximately 80 laparoscopic procedures. The case series resulted in 80 animals in the early and 79 in the later cohorts. The surgeries were divided over several surgeons and residents, but one of the authors (BAF) was involved in the vast majority of the cases, which may support that both cohorts may have been controlled for a learning curve. The time factor was significant only in the univariate analysis. The multivariate analysis did not find time cohort to be an independent risk factor, strengthening the hypothesis that the Ternamian visual entry technique may have some advantages compared with the other techniques at our institution.

Previous systematic reviews do not support differences in the rate of complications between a variety of entry techniques. Therefore, major governing surgical and gynecological bodies between 2002 and 2014 have released recommendations to use the entry technique of choice for the individual surgeon. However, Ternamian visual entry is a relatively late addition to the plethora of laparoscopic entry techniques, and most systemic reviews focus on the more traditional closed Veress needle entry, open Hasson, or direct trocar insertion with nonthreaded cannulas. A fairly recent systematic review of entry techniques included only 3 studies comparing visual-guided entry with other techniques; no difference in the prevalence of entry-related complications was found between techniques. This review also looked at consensus statements for obstetrics and gynecology governing bodies from the United States, Australia, France, and the United Kingdom, and no specific entry technique was recommended. A Cochrane Institute meta-analysis of the same year (2015) evaluated 4 randomized clinical trials of visual entry, 3 of which were of low-quality evidence, and direct vision entry was therefore not discussed. Because of the lack of evidence on particular entry technique superiority, it is possible that our findings reflect more on surgeons’ preference rather than a superior entry technique. However, the findings may encourage inclusion of Ternamian visual entry for future larger prospective studies of entry technique in animals.

Contrary to clinical impression, the study did not support a negative effect of body size or condition for entry-related complications. This finding was unexpected because it conflicts with findings in the human literature. The most consistent finding in the analysis was that cats appeared to be at increased risk for gas leaks compared with small breed dogs. Because of the small number of cases, this finding may be a type I error. Subjectively, cats have a more pliable body wall compared to dogs, which may provide a suboptimal seal around the cannula. However, with the low number of cats in this study, we cannot draw any solid conclusions.

Overweight animals had an increased risk for gas leaks but did not have increased entry complications overall. The lack of impact of body condition on laparoscopic entry complications may be the result of the retrospective nature in this study, relying solely on subjective body condition scores. This finding could also be attributed to the fact that the body condition scale ranged from 1-5 and not 1-9. This scale may have inadvertently placed larger numbers of mildly obese animals in an ideal body condition score category and reduced the number of obese animal complications. For future prospective studies, more objective variables such as abdominal girth measurements may have to be added to the investigations.

This study had several limitations, the most important consisting of its retrospective, nonstandardized, nonrandomized nature and low numbers. Entry complications may have been underreported because of the retrospective nature of the study. For comparison between entry techniques, prospective randomized controlled trials are required to draw conclusions. However, despite decades of collecting such information among human patients, systematic review is still lacking evidence of a single technique’s superiority. One recent meta-analysis concluded that hundreds of thousands of patients are
required to demonstrate true differences in adequately powered studies and posed the question whether the current literature is as good as it gets.\textsuperscript{27} Nonetheless, the study is, to the best of the authors' knowledge, the first to investigate entry technique complications in small animals, and veterinary surgery may still benefit from increased evidence and discussion of the topic.

An important limitation in this retrospective study is the lack of standardized surgery reports. In particular, it was difficult to ascertain where the gas leaks occurred. It is possible that in some cases gas leaks occurred because of the use of resterilized plastic cannulas, intended for single use. The surgery reports were not detailed enough to control for smooth cannula type, plastic or metal, or how many times a cannula had been reused. The reports did elucidate the use of Ternamian cannula vs smooth. In most cases in which gas leaks were mentioned, purse-string sutures were placed around the entry site, suggesting that the surgeon suspected that leaks occurred primarily around the outside of the cannula.

Finally, the complications for the 2 entry techniques with smooth cannulas may have been high because of suboptimal technique, especially for the gas leaks. A ribbed cone was not used for the modified Hasson technique. A tapered ribbed cone is designed to screw into the entry site, decreasing the gas leak associated with the incision. It is possible that gas leaks in this study would have been fewer had such a cone been used. Different methods for lifting of the body wall, digital or with stay sutures, were used for Veress needle insertion. In man, lifting the body wall prior to Veress needle insertion increases the rate of entry complications, especially failed or repeated entry.\textsuperscript{10} It is possible that complications would not have differed between techniques with modifications of the insertion techniques that were used.

In conclusion, a Ternamian visual laparoscopic entry technique must be reevaluated in a prospective, randomized, controlled study.

**CONFLICT OF INTEREST**

The authors declare no conflicts of interest related to this report.

**REFERENCES**


27. Cuss A, Bhatt M, Abbott J. Coming to terms with the fact that the evidence for laparoscopic entry is as good as it gets. *J Minim Invasive Gynecol.* 2015;22(3):332-341.

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