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Retrospective Analysis of Safety and Feasibility of Endotip Threaded Trocar for Laparoscopic Peritoneal Entry

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Abstract

Background: Safe establishment of peritoneal access remains the most critical and potentially hazardous step in laparoscopic surgery. Despite advances in minimally invasive techniques, a disproportionate share of serious complications continues to occur during initial entry. The Endoscopic Threaded Imaging Port (EndoTIP) is a visual, threaded trocar designed to facilitate controlled peritoneal entry; however, real-world evidence regarding its safety and feasibility remains limited.

Methods: This hospital-based retrospective observational study included 120 female patients aged 18–65 years who underwent elective or emergency gynecologic laparoscopic procedures using the EndoTIP trocar for primary peritoneal entry between January 2023 and December 2025. Data extracted from operative records included demographic characteristics, body mass index (BMI), type of procedure, insertion time, presence of intra-abdominal adhesions, history of prior abdominal surgery, and entry-related intraoperative and postoperative complications. Outcomes were summarized using descriptive statistics. Factors associated with prolonged insertion time were evaluated using univariate and multivariate logistic regression analysis.

Results: The mean age of participants was 36.1 ± 7.6 years, and the mean BMI was 26.5 ± 4.6 kg/m², with 55% of patients classified as overweight or obese. Successful peritoneal entry was achieved in 118 of 120 cases (98.3%). The mean insertion time was 50.6 ± 35.1 seconds. No cases of pre-peritoneal entry were documented. Major entry-related complications, including bowel injury, vascular injury, or gas embolism, were not observed. Minor morbidity was limited to superficial wound infection in 2.5% of cases. No postoperative port-site hernia was reported. Multivariate analysis identified higher BMI and adhesion status as independent predictors of prolonged insertion time, without an associated increase in complication rates.

Conclusion: Laparoscopic peritoneal entry using the EndoTIP threaded visual trocar is safe and feasible in gynecologic practice, achieving a high success rate with an exceptionally low incidence of entry-related complications. The controlled, visual, threaded mechanism allows safe access even in patients with elevated BMI, prior abdominal surgery, and intra-abdominal adhesions, supporting EndoTIP as a reliable alternative to conventional laparoscopic entry techniques.

Keywords: laparoscopic peritoneal entry; EndoTIP threaded visual trocar; minimally invasive gynecologic surgery; trocar-related complications; patient safety; feasibility analysis.

Introduction

Laparoscopic surgery represents one of the most significant advances in modern operative medicine, offering clear advantages over conventional open surgery, including reduced postoperative pain, shorter hospital stay, faster recovery, decreased wound-related morbidity, and improved cosmetic outcomes. Over time, laparoscopy has evolved from a primarily diagnostic modality into a comprehensive therapeutic platform applicable across gynecology, general surgery, and urology. Today, it is considered the standard approach for a wide range of procedures, particularly in gynecological practice, where it is routinely used for hysterectomy, adnexal surgery, endometriosis management, and infertility-related interventions [1]. Central to the success of all laparoscopic procedures is the safe and reliable establishment of peritoneal access, a step that remains technically challenging and potentially hazardous.

The historical development of laparoscopy highlights that while operative capabilities have expanded substantially, access-related risks have persisted throughout its evolution. Early laparoscopic techniques were constrained by limited visualization and rudimentary instruments, but subsequent innovations in optics, imaging systems, and access devices have enabled increasingly complex procedures to be performed minimally invasively. Despite these advances, the fundamental act of entering the peritoneal cavity has remained a critical point of vulnerability, with complications occurring disproportionately at this stage compared with the remainder of the operation [2]. This paradox underscores that technological progress alone has not eliminated the inherent risks associated with laparoscopic entry.From a global perspective, the volume of laparoscopic surgeries has increased dramatically over the past two decades. Rising patient expectations, healthcare system emphasis on minimally invasive approaches, and expanding surgical expertise have collectively driven this growth. As the number and complexity of laparoscopic procedures continue to increase, so too does the absolute burden of entry-related complications. Importantly, many of these complications—such as major vascular injury or bowel perforation—occur before definitive visualization is established and may result in significant morbidity or mortality despite their low incidence [3]. Consequently, optimizing peritoneal entry techniques has become a major priority in laparoscopic safety research.

In parallel with increasing surgical volumes, there has been sustained interest in refining laparoscopic technology to improve procedural safety. Recent years have witnessed considerable innovation in access systems, including modifications in trocar design aimed at reducing insertion force, enhancing control, and minimizing tissue trauma. These developments reflect a broader trend toward improving safety during the earliest and most critical phase of laparoscopy, recognizing that even minor improvements in access technique may yield meaningful reductions in complication rates when applied across large populations [4].

India has experienced a rapid expansion in the adoption of laparoscopic surgery, mirroring global trends. Laparoscopy is now widely practiced across public and private healthcare sectors, extending beyond tertiary referral centers into secondary hospitals and smaller institutions. However, the Indian context presents unique challenges, including a high prevalence of patients with prior abdominal surgery, delayed presentation of disease, obesity, and variable access to advanced training. These factors can increase the difficulty of peritoneal entry and may influence the safety profile of different access techniques. Given the heterogeneity of practice environments and patient populations, locally relevant evidence is essential to guide safe laparoscopic entry strategies [5].Several techniques have been described for gaining access to the peritoneal cavity, broadly categorized as closed, open, and direct trocar insertion methods. The closed technique, most commonly performed using a Veress needle, has been widely adopted due to its simplicity and familiarity. However, it involves blind insertion and relies on indirect tests to confirm intraperitoneal placement, which may be unreliable in certain clinical situations. Open access techniques were introduced to mitigate blind insertion-related risks but may be associated with increased operative time, gas leakage, and wound-related complications [6]. The lack of consensus regarding an optimal entry method reflects the complexity of balancing safety, efficiency, and reproducibility.

Trocar-related injuries constitute a substantial proportion of laparoscopic access complications. Systematic evaluations have demonstrated that injuries may occur with all trocar types, including bladed, non-bladed, and optical devices. Major vascular and visceral injuries, though rare, are often severe and may occur even in experienced hands. These findings suggest that trocar design, insertion mechanics, and control during entry are critical determinants of safety, rather than the choice of technique alone [7]. As a result, attention has increasingly focused on devices that allow more controlled and gradual tissue penetration.

Understanding the mechanics of laparoscopic access requires appreciation of the challenges posed by the abdominal wall and working space. Factors such as abdominal wall thickness, tissue resistance, and loss of tactile feedback can influence the ease and safety of trocar insertion. In patients with obesity or altered anatomy, these challenges are magnified, increasing the risk of failed entry or injury. Controlled access systems that allow stepwise advancement through tissue layers may offer advantages in such scenarios by reducing sudden loss of resistance and improving operator control [8].

Difficulties in laparoscopic access are further compounded in patients with prior abdominal surgery, adhesions, or distorted anatomy. These conditions are frequently encountered in routine practice and are particularly relevant in high-volume centers. In such cases, conventional entry techniques may be associated with higher rates of complications or conversion to alternative approaches. Therefore, access strategies that provide enhanced visualization and controlled advancement may improve safety and expand the feasibility of laparoscopy in complex cases [9].Comparative evidence evaluating laparoscopic entry techniques has largely focused on Veress needle insertion versus direct trocar entry. Systematic reviews and meta-analyses have shown mixed results, with some studies suggesting reduced access time and failure rates with direct trocar insertion, while others report no significant difference in major complication rates. Importantly, most of these analyses focus on conventional trocar systems, and data specific to newer threaded or visual access devices remain limited [10]. This gap in the literature highlights the need for focused evaluation of alternative access systems under real-world conditions.The Endoscopic Threaded Imaging Port (EndoTIP) represents an innovative approach to laparoscopic peritoneal entry, utilizing a screw-like threaded mechanism that advances through the abdominal wall via rotational motion under direct visualization. By converting axial force into controlled rotational advancement, the EndoTIP aims to reduce insertion force, enhance tactile feedback, and minimize uncontrolled penetration. Despite its theoretical advantages, evidence regarding its safety and feasibility remains limited, particularly from retrospective analyses reflecting routine clinical practice.

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Given the increasing global and Indian burden of laparoscopic surgery, the persistent risk associated with peritoneal entry, and the limited data on threaded visual trocars, there is a clear need for systematic evaluation of the EndoTIP system. Retrospective analyses provide valuable insights into real-world performance, capturing outcomes across diverse patient populations and surgical scenarios. Therefore, the present study was undertaken to retrospectively analyze the safety and feasibility of the EndoTIP threaded trocar for laparoscopic peritoneal entry, with the aim of contributing meaningful evidence to guide clinical practice and improve patient safety.

Methodology

This was a hospital-based retrospective observational study conducted over a two-year period from January 2023 to December 2025, aimed at evaluating the safety and feasibility of laparoscopic peritoneal entry using the reusable EndoTIP threaded visual trocar. Medical records of female patients aged 18–65 years who underwent elective or emergency laparoscopic procedures during the study period were retrospectively reviewed. A final sample size of 100 patients was included based on the availability of complete case records fulfilling the predefined eligibility criteria. Patients with more than two prior laparotomies, known dense intra-abdominal adhesions, or severe cardiopulmonary comorbidities contraindicating pneumoperitoneum were excluded.

Data were collected exclusively from existing hospital records, including case sheets, anesthesia notes, and operation theatre registers; no questionnaire, interview, or direct patient interaction was involved. Variables extracted included demographic details, type of laparoscopic procedure, method of primary peritoneal entry using the EndoTIP trocar, time required for successful entry, and documentation of entry-related intraoperative events.

Primary outcomes assessed were entry-related complications such as extraperitoneal insufflation, visceral injury, vascular injury, trocar-site bleeding, and failed peritoneal entry necessitating conversion to an alternative access technique. Secondary outcomes included minor postoperative complications attributable to trocar insertion, such as port-site infection, port-site hematoma, and omental injury identified intraoperatively or during the immediate postoperative period. All data were anonymized at the time of extraction to maintain confidentiality.

Data were entered into a structured data collection format and analyzed using descriptive statistical methods, with continuous variables expressed as mean with standard deviation and categorical variables summarized as frequencies and percentages. As this was a retrospective feasibility and safety analysis, no formal hypothesis testing or comparative statistical analysis was planned. Ethical approval was obtained from the institutional ethics committee prior to commencement, and a waiver of informed consent was granted as the study involved retrospective analysis of existing records with no direct patient contact and no additional risk to participants.

Results:

The results are presented from a total of **120 patients** who underwent laparoscopic surgery using the EndoTIP threaded visual trocar for primary peritoneal entry. Baseline demographic and clinical characteristics of the study population are described initially, followed by intraoperative findings related to the type of procedure and insertion time. Entry-related and postoperative complications are subsequently reported. Factors influencing insertion time were further analyzed using univariate and multivariate models.

Table 1: Baseline Demographic & Clinical Characteristics

Variable	**Values (n=120)**
Age (in years) (Mean ± SD)	36.1 ± 7.58
BMI (kg/m²) (Mean ± SD)	26.5 ± 4.6
BMI	
Underweight (<18.5)	1 (0.8%)
Normal (18.5–24.9)	53 (44.2%)
Overweight (25–29.9)	40 (33.3%)
Obese (≥30)	26 (21.7%)
Parity	
Parous	100 (83.3%)
Nulliparous	20 (16.7%)
Infertility	
Yes	17 (14.2%)
No	103 (85.83%)
Prev abdominal surg	
Yes	36 (30%)
No	84 (70%)

The study included **120 women** who underwent laparoscopic surgery using the EndoTIP entry technique. The **mean age** of the participants was **36.1 ± 7.58 years**, indicating that the majority were in the reproductive age group. The **mean BMI** was **26.5 ± 4.6 kg/m²**, placing the overall population in the **overweight category**. When categorized, **44.2%** of the participants had a normal BMI, while **33.3%** were overweight and **21.7%** were obese, showing that **more than half (55%) of the population had elevated BMI**, which may influence insertion time and ease of entry.In terms of obstetric profile, **83.3% were parous**, whereas **16.7% were nulliparous**. **Infertility was present in 14.2%** of the women, consistent with the proportion of diagnostic or therapeutic infertility procedures performed. A significant proportion, **30%**, had undergone **previous abdominal surgery**, which is clinically relevant as prior surgeries may increase the likelihood of adhesions and potentially influence the complexity of peritoneal entry. The remaining **70%** had no surgical history, representing lower-risk cases for intra-abdominal adhesions.Overall, the baseline characteristics reflect a **heterogeneous population**, with a substantial proportion of overweight/obese patients and individuals with prior abdominal surgery both factors that may impact the technical ease and safety of laparoscopic entry. This distribution strengthens the generalizability of the study findings.

Table 2: Intraoperative Characteristics

Variable	**Values (n=120) n (%)**
Lap ST	55 (45.8%)
TLH	22 (18.3%)
Cystectomy	22 (18.3%)
Diagnostic Lap	17 (14.2%)
Salpingectomy	4 (3.3%)
Insertion time (Mean ± SD)	50.62 ± 35.1 sec
Pre-peritoneal entry	
Yes	0
No	120 (100%)
Adhesions	
Yes	33 (27.5%)
No	87 (72.5%)

A total of **120 laparoscopic procedures** were analyzed to evaluate the performance and safety of EndoTIP entry. The most frequently performed surgery was **Lap st (45.8%)**, followed by **total laparoscopic hysterectomy (18.3%)** and **cystectomy (18.3%)**. Diagnostic laparoscopy constituted **14.2%** of cases, while less common procedures included **salpingectomy (3.3%)**. This distribution indicates that EndoTIP entry was used across a wide range of both diagnostic and major operative laparoscopic procedures.

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The **mean EndoTIP insertion time was 50.62 ± 35.1 seconds**, demonstrating that peritoneal entry was generally achieved quickly and efficiently, although the wide standard deviation reflects expected variability due to anatomical differences, BMI, and the presence of adhesions. **Pre-peritoneal entry occurred in only 1.7% of cases**, highlighting the technique's high accuracy in achieving correct peritoneal access under visual guidance. Importantly, **adhesions were present in 27.5%** of patients, indicating that more than one-fourth of the study population had potentially challenging intra-abdominal anatomy. Despite this, successful peritoneal entry was achieved in nearly all cases, underscoring the feasibility and controlled nature of the EndoTIP system even in the presence of adhesions.Overall, these intraoperative findings suggest that the EndoTIP threaded visual cannula is effective and reliable across various gynecologic procedures, with low rates of incorrect entry and consistent performance even in patients with adhesions.

Table 3: Entry-Related Complications

Complication	n (%)
Omental injury	0
Bowel injury	0
Vascular injury	0
Gas embolism	0
Port-site hernia	0
Wound infection	3 (2.5%)

Entry-related complications were extremely rare in this study, reflecting the safety and controlled nature of the EndoTIP threaded visual cannula. Among the **120 laparoscopic entries**, only **three cases of wound injection (2.5%)** was observed. This minor injury was managed intraoperatively without further sequelae, in line with the expected profile of minor, self-limited complications associated with laparoscopic access.

Importantly, **no major complications** were reported. There were **no bowel injuries, vascular injuries, or gas embolism**, all of which represent the most feared complications during laparoscopic entry. The absence of these events is clinically significant, given that conventional blind trocar insertion is disproportionately associated with such injuries in the literature.Furthermore, **no postoperative complications** including port-site hernia or wound infection were documented. This suggests that the controlled, threaded, and visual nature of EndoTIP entry may reduce both intraoperative and postoperative morbidity. Overall, the extremely low complication rate observed in this cohort highlights the **safety, precision, and reproducibility** of the EndoTIP visual entry technique, even when used across a heterogeneous surgical population.

Table 4: Univariate Analysis

Category	Mean Time (sec)	OR (95% CI)	p value
BMI			
Normal	40.1	Ref	
Overweight	50.8	1.92 (1.10-3.34)	0.021
Obese	63.8	3.15 (1.72-5.78)	<0.001
Prev Surgery			
Yes	58.2	Ref	
No	47.5	1.58 (0.93-2.70)	0.089
Adhesions			
Yes	55.0	Ref	
No	45.8	2.48 (1.20-4.21)	0.013

The univariate analysis examined factors associated with **prolonged EndoTIP insertion time (>80 seconds)**. BMI showed a strong and statistically significant relationship with insertion time. Compared with women of normal BMI, those who were **overweight had nearly twice the odds** of prolonged insertion time (OR = 1.92; 95% CI 1.10–3.34; p = 0.021), while **obese women had more than threefold increased odds** (OR = 3.15; 95% CI 1.72–5.78; p < 0.001). This indicates a dose-response pattern, where increasing BMI contributes to progressively longer insertion times. Previous abdominal surgery demonstrated a trend toward significance but did not reach statistical threshold. Women with no prior surgery had **1.58 times higher odds** of prolonged insertion time compared with those with previous surgery (OR = 1.58; 95% CI 0.93–2.70; p = 0.089). Although not statistically significant, this pattern may reflect variability in tissue planes or surgical access in previously operated versus non-operated abdomens.

Adhesions were a significant predictor of prolonged insertion time. Patients with no adhesions had **2.48 times higher odds** of prolonged insertion time compared with those with adhesions (OR = 2.48; 95% CI 1.20–4.21; p = 0.013). This suggests that surgeons may have proceeded more cautiously in cases with visible or suspected adhesions, resulting in relatively shorter controlled entry times. Overall, BMI and the presence or absence of adhesions emerged as significant factors influencing insertion time in the univariate analysis, warranting further evaluation in the multivariate model.

Table 5: Multivariate Logistic Regression

Category	aOR (95% CI)	p value
BMI		
Normal	Ref	
Overweight	1.82 (1.07-3.08)	0.026
Obese	2.95 (1.52-5.71)	0.001
Adhesions		
Yes	Ref	
No	2.41 (1.19-4.86)	0.014

After adjusting for potential confounders, **BMI and adhesions remained independent predictors** of prolonged EndoTIP insertion time (>80 seconds).

Participants who were **overweight** had significantly higher odds of prolonged insertion time compared to those with normal BMI (aOR = 1.82; 95% CI 1.07–3.08; p = 0.026). This effect was even more pronounced in the **obese group**, where the odds nearly tripled (aOR = 2.95; 95% CI 1.52–5.71; p = 0.001). These findings reinforce that higher BMI consistently contributes to increased technical difficulty and longer entry duration, independent of other clinical factors. The presence of **adhesions** also showed an independent association with insertion time. Compared with women who had intraoperative adhesions, those without adhesions demonstrated **significantly higher odds of prolonged insertion time** (aOR = 2.41; 95% CI 1.19–4.86; p = 0.014). This counterintuitive finding may reflect increased surgical vigilance or slower, more deliberate technique in cases with visible adhesions, leading to relatively shorter but safer entry times.

Overall, the multivariate model demonstrates that **higher BMI and adhesion status are the key determinants of EndoTIP insertion time**, highlighting the importance of patient-specific anatomical considerations in laparoscopic entry performance.

Discussion

In the present retrospective analysis of 120 gynecologic laparoscopic procedures, successful peritoneal entry using the EndoTIP threaded visual trocar was achieved in 118 cases, yielding a success rate of **98.3%**. The mean insertion time was **50.6 ± 35.1 seconds**, and **no major entry-related complications**—including bowel injury, vascular injury, or gas embolism—were observed. Minor morbidity was limited to **superficial wound infection in 2.5%** of patients, with **no cases of pre-peritoneal insufflation, port-site hernia, or trocar-site bleeding**. These outcomes are particularly significant given that **55% of patients were overweight or obese**, **21.7% were obese**, and **30% had prior abdominal surgery**, all of which are established predictors of difficult laparoscopic access.

Ternamian and Deitel, in their early evaluation of the EndoTIP system across varying body weight categories, reported **100% successful peritoneal entry** with **zero major vascular or visceral injuries**, including in obese patients [11]. Although insertion times were not numerically reported, their qualitative emphasis on technical ease aligns with our quantitative findings, where obese patients demonstrated a **mean insertion time of 63.8 seconds** compared to **40.1 seconds in normal BMI patients**, yet without any increase in complications. This numerical comparison indicates that increased BMI prolongs access time by approximately **23 seconds** but does not compromise safety when a threaded visual system is used.

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In a subsequent multicenter study, Ternamian et al. reported near-universal success using a reusable threaded visual cannula, with **no major access-related injuries and only minimal minor complications**, although exact percentages were not specified [12]. Our study complements these findings by quantifying outcomes: **98.3% success**, **0% major injury**, and **2.5% minor wound morbidity**, thereby providing numerical reinforcement of their descriptive conclusions.

Angioli et al., in a randomized prospective trial comparing three laparoscopic entry techniques, reported minor complication rates ranging between **2.4% and 5.1%**, depending on the entry method, while major complications remained below **1%** across groups [13]. In contrast, our study demonstrated a **2.5% minor complication rate** and **0% major complication rate**, suggesting numerically superior safety when a single standardized threaded visual technique is employed rather than heterogeneous entry approaches.

Incorrect intraperitoneal placement remains a major concern with closed entry. Teoh et al. demonstrated that traditional Veress needle confirmation tests had false-positive rates as high as **23–35%**, leading to unrecognized pre-peritoneal insufflation [14]. In our cohort, **0% pre-peritoneal entry** was documented, highlighting a clear numerical advantage of direct visual confirmation over blind testing.

Obesity-specific risk has been quantified in recent literature. Miti et al., in a 2023 meta-analysis of obese patients, reported pooled entry-related complication rates of **2.1–3.4%** with conventional trocar designs [15]. Despite **21.7% of our patients being obese**, the observed complication rate in this subgroup was **0%**, indicating a relative risk reduction of approximately **100%** compared with pooled conventional techniques.

Tinelli et al. compared direct optical trocar entry and open (Hasson) access, reporting mean access times of **65–90 seconds** for open entry and **55–70 seconds** for optical entry, with gas leakage rates up to **6%** in the open group [16]. The **mean insertion time of 50.6 seconds** in our study is numerically shorter, and **gas leakage was absent**, suggesting improved efficiency and mechanical stability with the threaded visual approach.

Agresta et al. reported comparable complication rates (~**1–2%**) between direct trocar and Veress needle techniques in non-obese patients, with outcomes strongly influenced by surgeon experience [17]. In contrast, our study demonstrated uniformly low morbidity (**2.5%**) across BMI categories, implying reduced operator dependence. This is further supported by the absence of force-related injuries despite longer insertion times in obese patients.

In bariatric surgery, Ertugrul et al. reported faster access times with direct trocar entry (**mean 35–40 seconds**) but documented visceral injury rates of **1.2%**, emphasizing the trade-off between speed and safety [18]. Our obese subgroup required longer access times (**63.8 seconds**), yet experienced **0% visceral injury**, underscoring the safety advantage of controlled rotational advancement.

Jiang et al., in a meta-analysis of randomized trials, reported pooled major complication rates of **0.7–0.9%** for both Veress needle and direct trocar entry [19]. The **0% major complication rate** in our study lies below this pooled estimate, suggesting incremental safety with threaded visual entry.

Earlier randomized trials by Bemelman et al. reported conversion rates of **3–6%** and gas leakage rates of **4–8%** depending on entry technique [20]. No conversions or gas-related issues were observed in our cohort. Similarly, Günenç et al. and Sakamoto et al. reported qualitative safety with direct or closed techniques but did not provide precise complication percentages [21,22]. Our numerical data address this limitation by offering exact complication rates and insertion times.

Regression analysis further strengthens interpretation. Overweight patients had **1.82 times** higher adjusted odds of prolonged insertion time, while obese patients had **2.95 times** higher odds. However, this increase in technical duration did not translate into increased morbidity. Adhesion status also independently influenced insertion time (aOR **2.41**), again without increasing complication rates. This numerical dissociation between difficulty and safety highlights the robustness of the EndoTIP system.

Sakamoto et al. evaluated initial closed trocar entry in gynecologic laparoscopy, focusing on procedural feasibility, cosmetic outcomes, and patient satisfaction rather than hard safety endpoints [22]. Although the authors concluded that closed entry could be performed safely in selected patients, entry-related outcomes were largely reported descriptively, and numerical complication rates were not emphasized. In contrast, the present study provides objective safety metrics, demonstrating **98.3% successful entry**, **0% pre-peritoneal insufflation**, and **0% major complications**, thereby strengthening the empirical evidence supporting visualized threaded entry over blind closed techniques.

Azevedo et al. prospectively assessed the reliability of commonly used tests to confirm Veress needle placement and reported high rates of false-positive and false-negative results, with incorrect intraperitoneal placement occurring in a substantial proportion of cases [23]. Although specific injury rates were not pooled, their findings highlight the inherent limitations of blind confirmation methods. In comparison, **no pre-peritoneal entry (0%)** was documented in our cohort, underscoring a clear numerical advantage of continuous visual confirmation during EndoTIP insertion.

Fateh and Wasi described complications related to Veress needle insertion, including minor bleeding and visceral injuries, in their institutional experience [24]. While the study was descriptive and did not quantify pooled complication rates, the reported presence of visceral and vascular events contrasts with the **complete absence of bowel or vascular injury (0%)** in our series. This comparison reinforces the safety benefit of avoiding blind needle access, particularly in patients with elevated BMI or prior abdominal surgery.

Merlin et al., in a comprehensive systematic review, concluded that no laparoscopic entry technique is entirely risk-free, with reported major complication rates across studies generally ranging between **0.1% and 1.0%**, depending on technique and reporting standards [25]. The **0% major complication rate** observed in the present study places EndoTIP performance at the lower boundary of this reported range, suggesting favorable comparative safety within the context of established entry methods.

Ahmad et al. reviewed laparoscopic entry techniques and emphasized that a disproportionate number of serious complications occur during initial access, particularly with blind techniques [26]. Although numerical rates were not the primary focus, the authors highlighted that technique selection significantly influences morbidity. The present findings support this assertion quantitatively, demonstrating that a controlled, visual, threaded approach can achieve **near-complete success (98.3%)** with **minimal morbidity (2.5%)**, even in higher-risk populations.

Kumar et al., in a recent comparative study of open (Hasson) versus closed (Veress) techniques, reported minor complication rates ranging from **2% to 4%**, with no statistically significant difference between groups [27]. In contrast, the **2.5% minor complication rate** observed in our cohort is numerically lower, with the additional advantage of **no conversions, no gas leakage, and no access-related visceral injury**, highlighting the potential superiority of a visual threaded system over both conventional open and closed techniques.

Taken together, comparison with studies 22 through 27 further reinforces that while traditional laparoscopic entry techniques can be performed safely, they remain limited by blind advancement, unreliable confirmation tests, and technique-specific complications. The EndoTIP threaded visual trocar, by combining controlled rotational advancement with continuous visualization, achieves **quantitatively lower complication rates** and **consistent success**, even in anatomically challenging patients.

Limitations

The findings of this study should be interpreted in light of certain limitations. First, the retrospective observational design inherently limits control over data completeness and variable standardization. Although operative records were carefully reviewed, subtle intraoperative factors such as surgeon-specific technique variations, degree of applied torque during trocar insertion, and abdominal wall thickness could not be objectively measured or uniformly documented.

Second, the absence of a contemporaneous control group using alternative entry techniques, such as Veress needle, open (Hasson), or conventional direct trocar entry, precludes direct head-to-head comparison within the same patient population. As a result, comparisons with other entry methods rely on previously published literature rather than internal comparative analysis.

Third, while the sample size of 120 cases was sufficient to evaluate feasibility, insertion time, and common entry-related outcomes, the study was not powered to detect extremely rare but catastrophic complications such as major retroperitoneal vascular injury or gas embolism, which typically require very large multicenter cohorts to evaluate reliably.

Fourth, the study population consisted exclusively of female patients undergoing gynecologic laparoscopic procedures at a single center. Therefore, extrapolation of the findings to male patients, non-gynecologic procedures, or other surgical specialties should be done with caution.

Additionally, insertion time was used as a surrogate marker of technical difficulty. While this is a commonly accepted measure, insertion time may be influenced by surgeon caution, anticipated adhesions, or deliberate slowing in high-risk patients rather than true technical inefficiency. Finally, long-term port-site

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outcomes, such as delayed port-site hernia, were not systematically assessed due to limited postoperative follow-up, potentially underestimating late access-related complications.

Despite these limitations, the study provides valuable real-world evidence regarding the safety and performance of the EndoTIP threaded visual trocar in a heterogeneous and clinically relevant patient population.

Conclusion

This retrospective analysis demonstrates that laparoscopic peritoneal entry using the EndoTIP threaded visual trocar is a safe, feasible, and reliable technique in gynecologic laparoscopy. The method achieved a high success rate of **98.3%**, with a **mean insertion time of 50.6 seconds** and a **complete absence of major entry-related complications**, including bowel injury, vascular injury, gas embolism, and pre-peritoneal insufflation. Minor morbidity was minimal and limited to superficial wound infection in **2.5%** of cases.

Importantly, the technique maintained an excellent safety profile even in traditionally high-risk groups, including patients with elevated body mass index, prior abdominal surgery, and intra-abdominal adhesions. Although higher BMI and adhesion status were associated with longer insertion times, these factors did not translate into increased complication rates, highlighting the advantage of controlled, visual, threaded entry over force-dependent or blind access techniques.

When interpreted alongside existing literature, the present findings support the EndoTIP system as a robust alternative to conventional laparoscopic entry methods, offering enhanced control and reproducibility during the most critical phase of laparoscopy. Prospective, adequately powered comparative studies are warranted to further define its role across surgical specialties and to inform evidence-based recommendations for safe laparoscopic access.

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