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REVIEW

Strategies for preventing port-site hernia following robot-assisted radical prostatectomy: A systematic review

Pier Paolo Prontera [1], Francesca R. Prusciano [2], Marco Lattarulo [1], Gianluigi Califano [3], Francesco Di Bello [3], Claudia C. Ruvolo [3], Simone Morra [3], Angelo D'Elia [1], Angelo Porreca [4], Luca Di Gianfrancesco [4], Filippo Marino [4], Giulia Marino [5], Francesco Saverio Grossi [1]

[1] Department of Urology, "S.S. Annunziata" Hospital, Taranto (TA), Italy;
[2] Department of Urology, Hospital "Valle D'Itria", Martina Franca (TA), Italy;
[3] Department of Neurosciences, Reproductive and Odontostomatologic Sciences, University of Naples "Federico II", Naples, Italy;
[4] Department of Urology, Humanitas Gavazzeni Hospital, Bergamo (BG), Italy;
[5] Department of Precision and Regenerative Medicine, Ionean Area, Taranto (TA), Italy.

Summary *Background: Trocar site hernia is a recognized but often underreported complication of minimally invasive surgery, including robotic-assisted radical prostatectomy. While relatively rare, trocar site hernia can lead to severe complications such as bowel obstruction, strangulation, and the need for emergency surgical intervention. Trocar size has been identified as a primary risk factor, with hernias occurring predominantly at sites where 10 mm or larger trocars are used. However, the role of fascial closure is still debated.*

Methods and Results: A systematic literature review (1992-2022) identified 21 cases of trocar site hernia in 13 studies. Only 8 papers provided data on the total number of RaRP procedures which were associated to the reported cases of TSH, with 15 cases of TSH identified out of 3,418 RaRP procedures. Statistical analyses were conducted to assess significant risk factors and potential prevention strategies. Specifically, of the 19 cases in which trocar size was explicitly reported, 15 hernias were associated with 12 mm trocars and 4 with 8 mm trocars (p value < 0.001). Fascial closure was not performed in all reported cases involving 12 mm trocars. No significant correlations were found between trocar site hernia incidence and patient-related factors such as age, body mass index, or prior hernias. Additionally, we report a case of trocar site hernia following RARP in a 67-year-old male with a BMI of 33.46 and a history of prior abdominal hernioplasty. The patient developed bowel obstruction on postoperative day 4 due to a hernia at a 12 mm trocar site, requiring emergency laparotomy and bowel resection with end-to-end anastomosis.

Conclusions: Given the strong association between TSH and 12 mm trocars, we suggest routine fascial closure at these sites to reduce the risk of postoperative complications. Further studies are necessary to confirm these findings. Additionally, other potential risk factors and mechanisms contributing to trocar site hernia development in patients undergoing Robot-Assisted Radical Prostatectomy should be investigated.

KEY WORDS: *Port-site hernia; Trocar site hernia; Robot-assisted radical prostatectomy; Surgical compli-cations; Robotic surgery; Prostate cancer; Urology; Surgical technique.*

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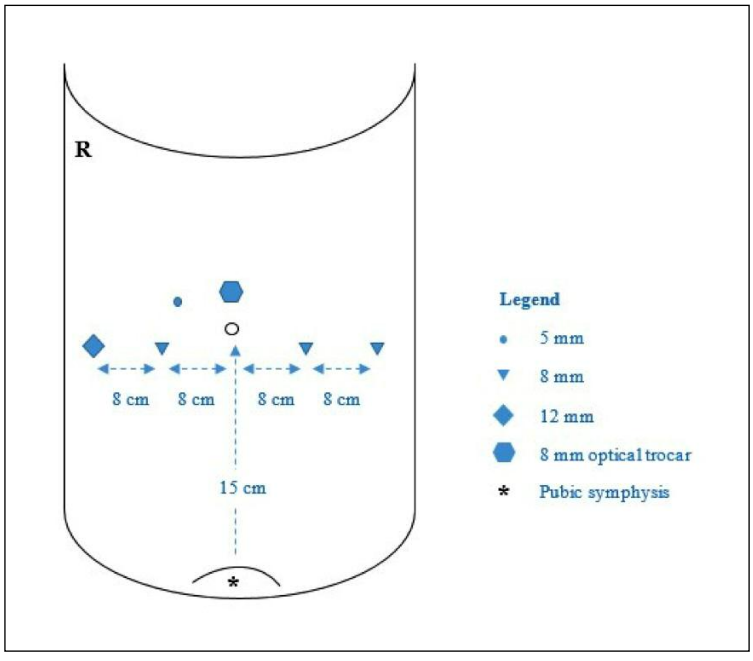
INTRODUCTION

Minimally invasive surgery, including laparoscopic and robotic-assisted procedures, has revolutionized surgical practice by offering significant advantages over open surgery, including reduced blood loss, shorter hospital stays, faster postoperative recovery and decreased postoperative pain (1). Moreover, minimally invasive radical prostatectomy techniques (laparoscopic and robot-assisted) appear to be associated with a lower risk of postoperative inguinal hernia (2), a condition for which radical prostatectomy has been identified as a risk factor (3). Despite these advantages, minimally invasive approaches are not devoid of risks, with *trocar site hernias* (TSH) representing a recognized complication of laparoscopic and robotic surgery (4). TSH, while relatively rare (estimated to occur in 0.2% to 4.8% of cases of laparoscopic and robotic procedures) (5), can lead to severe complications such as bowel obstruction, strangulation or even intestinal perforation requiring bowel resection (5-6). The literature suggests that approximately 90% of reported TSH cases develop at trocar sites measuring 10 mm or larger (7). In a literature review, *Richards* analysed 153 TSH cases among over 31,000 patients undergoing laparoscopic or robotic surgery across multiple surgical fields, including general, gynecologic, and urologic procedures. The study examined four key variables: trocar type (bladed *vs.* non-bladed), follow-up duration, previous abdominal surgery and trocar size at the hernia site. The findings indicated that bladed trocars increase the risk of muscular layer injury, leading to prolonged healing time and a higher TSH incidence, a conclusion corroborated by *Gutierrez et al.* (2020) (7, 8). Additionally, *Damani et al.* in 2020, investigated the impact of trocar insertion angle on TSH risk. However, no strong evidence currently supported trocar angle as a significant etiological factor for TSH development (6). The onset of TSH is highly variable, with reported cases ranging from 1 day to 7 years post-operatively, underscoring the necessity for long-term follow-up to fully assess this complication (9). Several studies, including those by *Damani et al.*, *Timm et al.*, and *Seveso et al.*, have demonstrated a positive correlation

between previous abdominal surgery and TSH occurrence (6, 8, 9). This correlation is likely due to the weakening of previous trocar sites during subsequent laparoscopic procedures, as the current standard practice does not require fascial closure for trocar sites up to 8 mm in diameter. However, further research is needed to confirm this hypothesis. *Damani et al.* reported a lower TSH risk for trocar sites smaller than 8 mm, whereas *Seveso et al.* found no statistically significant difference in TSH rates between 5-mm trocar sites with or without fascial closure (6-10). Furthermore, *Seveso et al.* noted an increased incidence of TSH with bladed trocar use, reinforcing the potential influence of trocar type on hernia development. Nonetheless, TSH cases have also been documented in patients where bladeless trocars were used, suggesting that additional risk factors may contribute to hernia formation (10). Several patient-related and technical factors have been investigated in TSH development. Patient-related factors include increased intra-abdominal pressure, obesity, chronic cough, diabetes, smoking, wound infection, chemotherapy and malnutrition. Technical factors include trocar insertion angle, bladed versus radially expanding trocars, pneumoperitoneum induction, port placement, operative duration, specimen extraction site and fascial closure techniques. Notably, an increased incidence of TSH has been observed in obese and bariatric patients, likely due to elevated intra-abdominal pressure and greater pneumoperitoneum volumes (11). TSH is classified as an incisional hernia occurring at the trocar site following minimally invasive surgery (12). The most widely recognized risk factor for TSH is trocar size, as highlighted by *Swank et al.* and *Owens et al.* (13, 14). *Robotic-assisted radical prostatectomy* (RaRP) is now the standard surgical approach for eligible prostate cancer patients requiring surgery. The typical RaRP trocar placement configuration consists of six ports: the 8-mm primary camera port was placed 2 to 3 cm at the superior umbilical region. The two 8-mm robotic ports were introduced lateral to the rectus muscle and at the level of umbilicus on both sides. An 8-mm robotic port for the fourth arm was placed above the left iliac crest in the mid-axillary line and a second 12-mm port for the assistant was placed in the opposite site. A 5-mm port for the assistant was placed between the robotic and camera ports on the right (Figure 1). The prostate specimen is typically extracted through a small laparotomy, extending the camera port incision (15-17). Given the increasing adoption of robotic surgery and the associated risk of TSH, this review aims to synthesize current evidence on trocar site hernias in patients underwent RaRP, in order to recognized useful strategies to prevent this uncommon but potential severe complication.

Figure 1.
Trocar placement for Robot-Assisted Radical Prostatectomy (RaRP).



Materials and methods

Literature review

The systematic review was conducted in accordance with the PRISMA 2020 guidelines (Figure 2).

The literature search was performed using the PubMed and Google Scholar databases, applying the Boolean search terms "*trocar hernia*" OR "*port-site hernia*" AND "*Robot assisted radical prostatectomy*". The search was restricted to studies published starting from 1992 onwards, which marks the introduction of laparoscopic radical prostatectomy. Prior to this year, the radical prostatectomy procedure was performed exclusively through an open surgical approach. The aim of the review was to identify case reports or case series describing the occurrence of trocar site hernias following laparoscopic or robot-assisted radical prostatectomy. Records were screened by evaluating titles and abstracts, followed by a full-text assessment of potentially eligible studies. Only articles published in peer-reviewed journals and available in English or with an English abstract were considered.

Studies were excluded if the described hernia cases were unrelated to radical prostatectomy or if the herniation occurred in anatomical sites other than the trocar or port site. Records that did not meet these criteria were systematically excluded. No automation tools were used in the selection process, and all stages of screening and data extraction were independently conducted by two reviewers, with any disagreements resolved through discussion. Through this process, 13 articles were identified and included in the final qualitative synthesis (Figure 2), reporting a total of 21 cases of TSH. The selected studies were divided into two groups: those that reported both the total number of RaRP performed and the number of TSH cases observed and those that only reported the number of TSH cases without mentioning the total number of RaRP performed. Articles explicitly reporting the caliber of the trocar placed at the TSH site were identified, while in the remaining articles, indirect information was

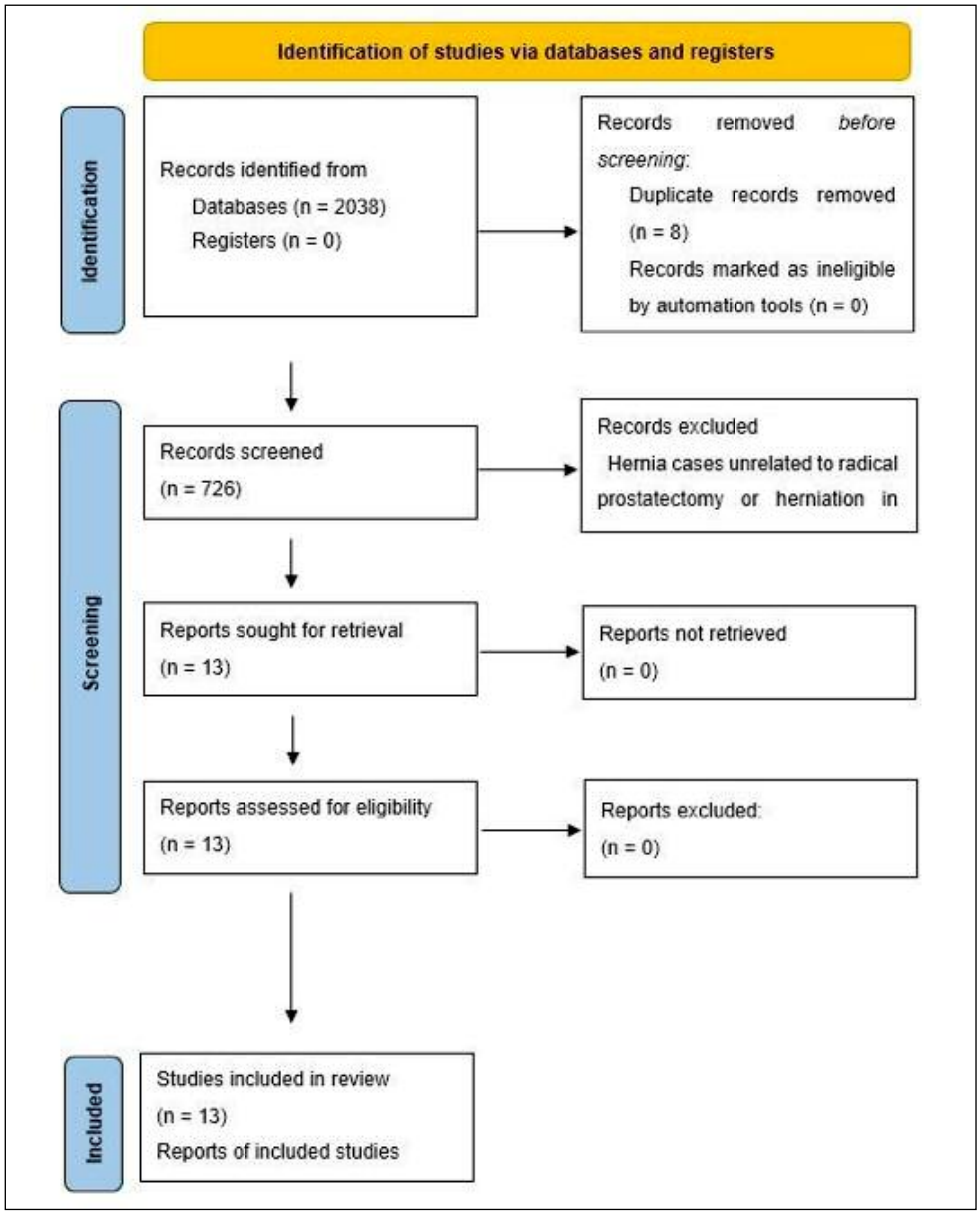


Figure 2.
PRISMA 2020 flow diagram for new systematic reviews which included searches of databases and registers only.

sought to infer this data (e.g., the anatomical location of the TSH). Data were extracted for the following variables: age, BMI, presence of metabolic diseases, hypertension, chronic medication use, history of prior inguinal or umbilical hernias, timing of TSH onset relative to RaRP, type of initial symptoms (subtle, symptoms without bowel obstruction, bowel obstruction), presence of abdominal bulging at the hernia site upon physical examination, anatomical location of TSH, trocar size, Gleason score, preoperative PSA levels, prostate volume, fascial closure at the RaRP site where TSH occurred, time to resumption of oral intake after RaRP, type of TSH repair (minimally invasive, mini-laparotomy, laparotomy), need for bowel resection and hernia type (Table 1). Some of these factors (presence of metabolic diseases, hypertension, chronic medication use, history of prior inguinal or umbilical hernias, timing of TSH onset relative to RaRP, Gleason score, preoperative PSA levels, prostate volume and time to resumption of oral intake after RaRP) were inconsistently reported by different authors and were therefore not considered suitable for analysis.

Statistical analysis

Statistical analyses were conducted to evaluate associations between TSH occurrence and various clinical and surgical factors. Descriptive statistics were used to summarize patient demographics and surgical characteristics. Associations between categorical variables, such as trocar size, fascial closure, hernia type, and the need for bowel resection, were assessed using the chi-square test or Fisher's exact test, as appropriate. *Relative risk* (RR) was calculated to estimate the impact of fascial closure on TSH occurrence. When not directly stated by the study authors, Since the total number of trocars used in each procedure was not consistently reported, we estimated trocar counts based on standard RaRP templates. For each RaRP, we assumed the use of one 12 mm assistant port, three 8 mm robotic ports, one optical trocar, and

Table 1.

Summary of Reported Trocar Site Hernia (TSH) Characteristics of Selected Studies: This table summarizes the characteristics of Trocar Site Hernia (TSH) cases reported in selected studies. Variables include TSH type, bowel re-section, intervention type, fascial closure, trocar size, port site, abdominal bulging, bowel obstruction at onset, symptomatic onset, time of TSH presentation, mean BMI, and mean age.
For authors reporting multiple TSH cases, the partial number of variables for each case is indicated in parentheses.

Author	RaRP performed (n°)	TSH reposted (n°)	Mean age (range)	Mean BMI (range)	Time of TSH presentation	Symptomatic onset, (n°)	Bowel obstruction at onset, (n°)	Abdominal bulging, (n°)	Port-site	Port-dimension (mm)	Fascial closure after RaRP	Type of intervervention, (n°)	Bowel resection, (n°)	Type of TSH
Ogasa et al., 2020 (16)	N/A	1	56	25.7	4	Yes	Yes	Yes	Right Pararectal	8	Yes	Laparoscopy	No	Richter
Mancini et al., 2020 (18)	1531	3	67 (60-71)	23.43 (20.1-25.7)	4.5 (1-4)	Yes (3)	Yes (2), No (1)	Yes (2), No (2)	Right Literal (2), Left Lateral (1)	12 (2), 8 (1)	No	Open (2), Laparoscopy (1)	Yes (1), No (2)	Spigelian
Tobe et al., 2022 (15)	N/A	1	73	22.2	11	Yes	Yes	No	Supre-Umbilical	12	Yes	Open	Yes	Incisional
Schmocker et al., 2016 (22)	N/A	1	66	28	730	Yes	No	Yes	Right Literal	12	N/A	Open	Yes	Vermiform Appendix
Hotston et al., 2009 (19)	500	2	68.5 (67-70)	N/A	5 (1-4)	Yes	No	Yes	Right Literal	12	N/A	Open	Yes (1), No (1)	Spigelian
Damani et al., 2020 (6)	N/A	1	N/A	N/A	N/A	N/A	N/A	N/A	Right Literal	8	N/A	Open	Yes	Spigelian
Tsu J.H.L. et al., 2013 (20)	200	1	75	N/A	4	Yes	No	Yes	Left Lateral	8	No	Open	No	Spigelian
Singh Wazir J.P. et al., 2021 (21)	N/A	1	65	N/A	2	Yes	No	Yes	Right Literal	12	N/A	Open	No	Spigelian
Jazayeri S.B. et al., 2016 (23)	N/A	1	71	N/A	3	Yes	No	Yes	Right Literal	12	Yes	Laparoscopy	Yes	Spigelian
Kang D.I. et al., 2012 (25)	498	2	59 (52-66)	30.6 (29.8-31.4)	547	Yes	No	Yes	Supre-Umbilical	12	Yes	Open	(2) No	Incisional
Christie M.C. et al., 2016 (17)	38	2	69 (65-73)	26.85 (22.4-31.3)	N/A	Yes	No	Yes	Supre-Umbilical	12	Yes	Open	(2) No	Incisional
Chiong E. et al., 2014 (24)	441	4	65 (60-70)	25.15 (17.9-32)	97.5 (2-335)	Yes	No	Yes (1), No (3)	Right Literal	12	No	Open	Yes (1), No (3)	Spigelian
Fischer B. et al., 2008 (4)	210	1	64	27	N/A	N/A	N/A	N/A	N/A	12	N/A	Open	No	Spigelian

one 5 mm accessory port. The chi-square analysis on TSH occurrence by trocar size was conducted using only those articles in which both the total number of trocars and their caliber could be directly determined. A p-value < 0.05 was considered statistically significant. The results were interpreted in the context of their clinical relevance, particularly in the prevention and management of TSH in robotic-assisted laparoscopic surgery.

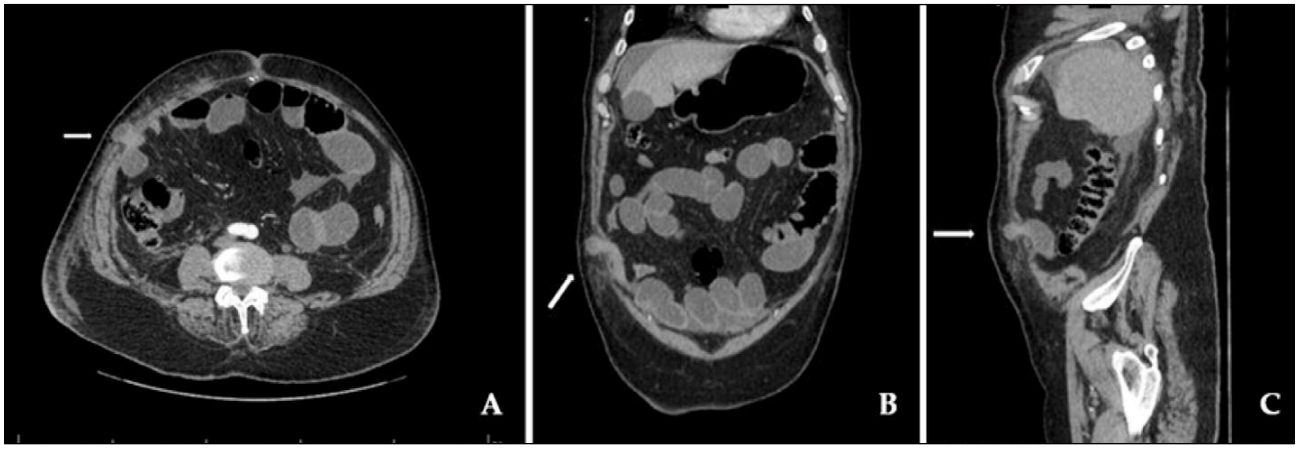
Risk of bias

A risk of bias assessment was performed using the JBI critical appraisal approach for case series and descriptive observational studies.

Results

A literature review was conducted using the PubMed and Google Scholar platforms to identify studies describing cases of TSH in patients undergoing RaRP. Studies reporting cases of TSH in patients undergoing general laparoscopic surgery or other urological surgeries different from RaRP were excluded. A total of 13 papers were evaluated: 5 case reports, 5 retrospective original articles, 2 combining case reports and retrospective original data, and 1 case report with a literature review. Overall, the reported cases refer to patients who underwent RaRP between 2003 and 2020. In 8 of these articles, it was possible to extract the total number of RaRP procedures performed (3,418 cases) and the number of reported TSHs (15 cases) between 2008 and 2020, resulting in an estimated incidence of 0.44% (5-6, 15-26). Upon analysis of the included studies, it was found that trocar placement by the various authors was generally consistent with the configuration outlined in the Figure 1, which adheres to the manufacturer's recommended setup for the robotic platform. In detail, an 8-mm optical trocar was placed supraumbilically; three additional 8-mm robotic trocars were positioned at a minimum distance of 8 cm from each other (right pararectal, left pararectal, and left lateral locations); and two assistant laparoscopic trocars were utilized - a 12-mm trocar placed laterally on the right side, and a 5-mm trocar inserted on the right in a triangulated position between the optical trocar and the right pararectal robotic trocar (Figure 1). Due to inconsistent reporting across studies, variables such as presence of metabolic diseases, hypertension, chronic medication use, Gleason score, PSA levels, prostate volume, and time to resumption of oral intake were not included in the statistical analysis. Among the 21 described cases of TSH, 16 were classified as "*Spigelian*" hernias, 3 as incisional hernias at the optical trocar site used for specimen extraction, 1 as a "Richter's" hernia, 1 as a hernia of the vermiform appendix (Table 1). In 13 cases (61.9 %), abdominal bulging was reported; however, this finding was not statistically correlated with the presence of bowel obstruction at onset (p-value: 0.52), hernia type (p-value: 0.62), or the need for bowel resection during TSH repair (p-value: 1). To assess the statistical correlation between trocar type and TSH incidence, descriptive analyses and chi-square tests were performed based on data extracted from the 7 articles that provided information on the total number of procedures. Across all these cases, a total of 15 TSHs were reported: 2 were associated with 8 mm trocars and 13 with 12 mm trocars. The authors of these 7 articles explicitly stated the size of the trocar placed at the TSH site. Among the 13 studies included in this review, only two did not directly report the trocar size; however, both provided indirect information (i.e., anatomical location of the hernia site), strongly suggesting that the two TSHs described (accounting for 9.5% of the total) were also related to 12 mm trocars (21, 23).
The analysis included 8 mm robotic trocars and 12 mm

Figure 3.
Contrast-enhanced CT images: Contrast-enhanced CT images in the arterial phase (A axial plane, B coronal plane, and C sagittal plane) performed at the onset of symptoms for the hernia. The arrow highlights a small defect in the lateral abdominal wall at the right flank, with herniation of an ileal loop at this level and concomitant upstream distension of the small bowel loops, suggestive of mechanical obstruction.



laparoscopic trocars. The optical trocar was analysed separately, as it represents the incision site for specimen extraction and an incisional hernia at this location may have a different pathogenic significance, compared to a hernia occurring through one of the other trocars used during robotic surgery. The chi-square test demonstrated a strong statistically significant correlation between TSH incidence and the 12 mm laparoscopic trocar ($\chi^2 = 27.25$, $p < 0.0001$) and the corresponding incidence rates were 3.80 per 1000 for 12-mm ports and 0.20 per 1000 for 8-mm ports. In none of the TSH cases involving the 12 mm laparoscopic trocar was fascial closure at this site described at the end of the RaRP. In all patients, fascial closure was performed at the extraction site (optical trocar), whereas only one case reported fascial closure at other trocar sites, in which a TSH was observed at an 8 mm trocar site. Among the 21 total cases of TSH, 7 were treated with bowel resection at the time of TSH repair and 14 underwent hernia reduction without the need for bowel resection. No statistically significant differences emerged in terms of bowel resection rates between TSH occurring at the optical trocar site and TSH at other trocar sites (p-value: 0.92, Chi²: 0.0099). The analysis of the impact of fascial closure on TSH onset, performed using the chi-square test, revealed a statistically significant correlation (p-value: 0.00068, Chi²: 11.55, RR: 16). The impact of other factors, such as age, BMI, and history of prior inguinal or umbilical hernias, was also evaluated; however, no statistically significant associations were found (p-values: 0.85, 0.61, 0.60, and 1, respectively).
In addition, we report the case of a 67-year-old obese male (BMI 33.46) with a history of multiple prior abdominal wall hernioplasties, who developed bowel obstruction on postoperative day 4 following RaRP. The obstruction was caused by a trocar site hernia at the 12 mm right lateral port site, requiring emergency laparotomy and ileal resection with primary anastomosis. No abdominal bulging was observed prior to symptom onset, and the fascial plane at the 12 mm trocar site had not been closed (Figure 3). Using the JBI critical appraisal approach for case series and descriptive observational studies (27), the included studies were evaluated across eight methodological domains. The overall risk of bias was considered moderate, with several domains satisfactorily addressed, including the presence of clear inclusion criteria, adequate case description, and consistent diagnostic criteria for TSH. However, heterogeneity in the reporting of clinical variables (e.g., BMI, prior hernias, fascial closure) and follow-up duration was noted. Most studies did not discuss internal sources of bias such as selection or measurement bias, and the representativeness of cases may be affected by selective reporting. These limitations underline the need for cautious interpretation of pooled data.

Discussion

TSH represent a recognized but often underreported and potentially severe complication of minimally invasive surgery (5-6), including RaRP. The estimated incidence of TSH after RaRP, according to our results, is 0.44%, close to estimated incidence of TSH after others mini-invasive surgery (5). The findings from our literature review, in accordance with the case report described, highlight a significant correlation between the use of a 12 mm assistant trocar and the occurrence of TSH, reinforcing the hypothesis that trocar size plays a critical role in hernia formation (7). Notably, this observation is not limited to patients undergoing RaRP but has also been reported in other minimally invasive abdominal procedures, both laparoscopic and robotic-assisted, across various surgical fields, including urology, gynecology and general surgery (7). This broader trend further supports the hypothesis that trocar diameter significantly contributes to TSH development. The type of the trocar is another key factor in TSH pathogenesis. Some studies have shown that the use of bladed (cutting) trocars increases the risk of herniation due to greater disruption of the fascial and muscular layers, leading to prolonged healing time and a higher likelihood of hernia formation (7, 8). However, the insertion angle of the trocar remains a debated factor, as current evidence does not strongly support a

significant correlation between trocar angulation and TSH onset (6). Additionally, while our review did not identify a statistically significant correlation between TSH incidence and BMI, some authors have reported a higher TSH incidence in bariatric patients, likely due to increased intra-abdominal pressure and greater pneumoperitoneum volumes (11). Similarly, patients with a history of prior abdominal surgery appear to be at greater risk, possibly due to pre-existing weaknesses at previous trocar sites (6-9). However, the limited number of TSH cases observed in our review prevents definitive conclusions regarding these associations, suggesting the need for larger studies to clarify the role of BMI and prior surgery in TSH development. An important consideration is the surgical approach itself. TSH is primarily a complication associated with the transperitoneal approach to RaRP, as the peritoneum is breached during trocar placement, facilitating potential herniation through the defect. Conversely, extraperitoneal RaRP, as in the case of extraperitoneal laparoscopic radical prostatectomy (28), eliminates this risk by avoiding peritoneal penetration altogether, thereby reducing the risk of internal organ herniation. This technical difference may explain the lower incidence of TSH reported with extraperitoneal techniques and warrants more structured comparative studies. Additionally, extraperitoneal RaRP may offer particular advantages in patients at high risk for postoperative hernias, such as those with prior intra-abdominal surgery, obesity, or peritoneal adhesions. This distinction suggests that surgical approach selection may itself be a preventive factor, warranting further comparative studies to evaluate the impact of transperitoneal versus extraperitoneal RaRP on TSH incidence. Given the multifactorial nature of TSH, an integrated preventive strategy should include: careful selection of trocar type and size, routine fascial closure, and a tailored approach based on patient-specific risk factors. Moreover, surgical approach selection, transperitoneal *vs*. extraperitoneal, should be considered as a potential modifiable factor when planning prostate cancer surgery in high-risk populations. The statistically significant correlation between TSH incidence and the 12 mm trocar ($\chi^2 = 27.25$, $p < 0.0001$) and the statistically significant impact of fascial closure on the incidence of TSH (p-value: 0.00068), suggests that fascial closure at this site may be a crucial preventive strategy to prevent the occurrence of TSH after RaRP, especially in bariatric patients and those with a history of prior abdominal surgery. Future studies should further investigate these risk factors to refine preventive strategies and optimize patient outcomes in robotic surgery.

Limitations

This study presents several limitations that should be acknowledged. First, the overall number of TSH cases identified in the literature review is relatively small (n = 21) with only 15 cases were described by authors who also reported the total number of RaRP procedures performed and the corresponding trocar size, limiting the statistical power and generalizability of the findings. Second, the review is retrospective and relies on data extracted from previously published case reports and case series, which may be subject to publication bias and inconsistencies in reporting. Third, there is significant heterogeneity among the included studies in terms of study design, data completeness, and follow-up duration, which could affect the accuracy of comparisons and pooled analyses. Several potentially relevant variables, such as metabolic comorbidities, Gleason score, prostate volume, and time to oral intake resumption, were not consistently reported across studies and were therefore excluded from statistical analysis. Consequently, the results and conclusions presented in this manuscript should be interpreted with caution and validated in prospective, multicenter studies with standardized data collection protocols.

Declarations

Ethical approval: *This study was approved by the Local Ethics Committee of Bari (BA), IRCCS Oncological Institute "Gabriella Serio" (Protocol number: 2112/CEL - Study "PrOPT").*

Availability of data and material: *The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.*

Competing interests: *The authors declare no competing interests.*

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Conclusions

TSH represent a rare but potentially severe complication of minimally invasive surgery, including RaRP. Our findings, supported by a systematic literature review and a case report, confirm a strong correlation between TSH incidence and the use of 12 mm trocars, reinforcing the critical role of trocar size in hernia formation. The absence of routine fascial closure at these trocar sites appears to be a significant risk factor, suggesting that implementing systematic fascial closure could serve as a protective strategy. Additionally, although no statistically significant correlation was found between TSH incidence and patient-related factors such as BMI or prior abdominal surgery, some studies indicate an increased TSH risk in bariatric patients and those with a history of previous laparotomy, likely due to elevated intra-abdominal pressure and pre-existing wall weakness. These findings, although not conclusive in our review, underscore the need for further prospective studies to clarify the impact of these factors. Furthermore, while bladed trocars have been associated with a higher risk of TSH due to increased fascial trauma, trocar insertion angle does not currently appear to be a significant contributing factor. Another key consideration is that TSH is inherently a complication of transperitoneal RaRP, whereas the extraperitoneal approach avoids peritoneal penetration, potentially reducing this risk. Given these insights, routine fascial closure of 12 mm trocar sites is strongly considered, particularly in high-risk patients, as a simple yet effective measure to minimize the occurrence of TSH. Future research should focus on refining preventive strategies, evaluating the impact of surgical approach selection, and identifying additional risk factors to enhance patient safety and optimize outcomes in robotic prostatectomy.

References

1. Cao L, Yang Z, Qi L, et al. Robot-assisted and laparoscopic vs open radical prostatectomy in clinically localized prostate cancer: perioperative, functional, and oncological outcomes A Systematic review and meta-analysis. Medicine 2019; 98:e15770.

2. Alder R, Zetner D, Rosenberg J. Incidence of inguinal hernia after radical prostatectomy: a systematic review and meta analysis. J Urol. 2020; 203:265-274.

3. Perugia G, Prontera PP, Corongiu E, et al. Inguinal hernia after radical prostatectomy: incidence and risks factors. J Urol. 2017; 197(4 Suppl):E1305.

4. Fischer B, Engel N, Fehr JL, et al. Complications of robotic-assisted radical prostatectomy. World J Urol. 2008; 26:595-602.

5. Chennamsetty A, Hafron J, Edwards L, et al. Predictors of incisional hernia after robotic-assisted radical prostatectomy. Adv Urol. 2015; 2015:457305.

6. Damani T, James L, Fisher J, et al. Incidence of acute post operative robotic port-site hernias: results from a high volume multispeciality centre. J Robot Surg. 2020; 15:457-463.

7. Richards Y. Port-site hernias in patients undergoing laparoscopic and/or robotic surgery: Can they be prevented? J Minim Access Surg. 2022; 33:269-275.

8. Gutierrez M, Stuparich M, Behbehani S, et al. Does closure of fascia, type, and location of trocar influence occurrence of port-site hernias? A literature review. Surg Endosc. 2020; 34:5250-5258.

9. Tim B, O'Connor E, Bolton D, et al. Are we failing to consent to an increasingly common complication? Incisional hernias at robotic prostatectomy. J Robot Surg. 2020; 54:58-64.

10. Seveso M, Melegari S, Bozzini G, et al. Does site of specimen extraction affect incisional hernia rate after robot-assisted laparoscopic radical prostatectomy? Int J Surg. 2017; 47:96-100.

11. Singal R, Zaman M, Mittal A, et al. No need of fascia closure to reduce trocar-site hernia rate in laparoscopic surgery: a prospective study of 200 non obese patients. Gastroenterol Res. 2015; 9:70-73.

12. Delmonaco P, Cirocchi R, La Mura F, et al. Trocar site hernia after laparoscopic colectomy: a case report and literature review. ISRN Surg. 2011; 2011:725601.

13. Swank HA, Mulder IM, La Chapelle CF, et al. Systematic review of trocar-site hernia. Br J Surg. 2012; 99:315-323.

14. Owens M, Berry M, Janjua AZ, et al. A systematic review of laparoscopic port-site hernias in gastrointestinal surgery. Surgeon. 2011; 9:218-224.

15. Tobe T, Keiji Y, Tomihiko Y, et al. Laparoscopic port site Richter's hernia after robot-assisted radical prostatectomy. IJU Case Rep. 2022; 5:501-504.

16. Ogasa T, Msayoshi N, Hiroki K, et al. Port site hernia at the robotic arm port after robotic-assisted laparoscopic radical prostatectomy. IJU Case Rep. 2020; 3:153-156.

17. Christie MC, Manger JP, Khiyami AM, et al. Occult radiographically evident port-site hernia after robot-assisted urologic surgery: incidence and risk factors. J Endourol. 2016; 30:99-96.

18. Mancini M, Righetto M, Dal Moro F, et al. Incidence and treatment of incarcerated trocar-site hernias after Robotic surgery: presentation of three cases. J Endourol Case Rep. 2020; 6:271-274.

19. Hotston MR, Beatty JD, Shendi K, et al. Port site hernias following robot-assisted laparoscopic prostatectomy. J Robot Surg. 2009; 3:49-51.

20. Tsu JHL, Tsui-Lin Ng A, Ka-Wing Wong J, et al. Trocar-site hernia at the 8-mm robotic port after robot-assisted laparoscopic prostatectomy: a case report and review of the literature. J Robot Surg. 2014; 8:89-91.

21. Singh Wazir JP, Hussain J, Bashir A, et al. Port site hernia presenting as intestinal obstruction following robot-assisted laparoscopic transperitoneal radical prostatectomy. IOSR J Dent Med Sci. 2021; 20:35-39.

22. Schmocker RK, Greenberg JA. An unusual trocar-site hernia after prostatectomy. Case Rep Surg. 2016; 2016:3257824.

23. Jazayeri SB, Tsui JF, Samadi DB. Abdominal mass after robotic assisted laparoscopic prostatectomy: spigelian type trocar hernia. Curr Urol. 2016; 10:163-165

24. Chiong E, Hegarty PK, Davis JW, et al. Port-site hernias occurring after the use of bladeless radially expanding trocars. Urology. 2010; 75:574-580.

25. Kang DI, Woo SH, Lee DH, et al. Incidence of port-site hgernias after Robot-Assisted Radical Prostatectomy with the fascial closure of only the midline 12-mm port site. J Endourol. 2012; 26:848-851

26. Liatsikos E, Rabenalt R, Burchardt M, et al. Prevention and management of perioperative complications in laparoscopic and endoscopic radical prostatectomy. World J Urol. 2008; 26:571-580.

27. Munn Z, Stone JC, Aromataris E, et al. Assessing the risk of bias of quantitative analytical studies: introducing the vision for critical appraisal within JBI systematic reviews. JBI Evid Synth. 2023; 21:467-471.

28. Grossi FS, Utano E, Minafra P, et al. Oncological and functional outcomes of extraperitoneal laparoscopic radical prostatectomy: An 18-years, single-center experience. Arch Ital Urol Androl. 2021; 93:268-273.

Correspondence

Pier Paolo Prontera (Corresponding Author)
pierpaolo.prontera@asl.taranto.it
Department of Urology, "S.S. Annunziata" Hospital
Bruno Francesco, 1 Street - 74010 Taranto (Italy)

Francesca Romana Prusciano
francescaprusciano@gmail.com
Marco Lattarulo
marco.lattarulo@asl.taranto.it
Angelo D'Elia
angelo.delia@asl.taranto.it
Francesco Saverio Grossi
francescos.grossi@asl.taranto.it
Department of Urology, "S.S. Annunziata" Hospital, Taranto (TA), Italy

Gianluigi Califano
gianl.califano2@gmail.com
Francesco Di Bello
fran.dibello12@gimail.com
Claudià Collà Ruvolo
c.collaruvolo@gmail.com
Simone Morra
simonemorra93@gmail.com
Department of Neurosciences, Reproductive and Odontostomatologic Sciences,
University of Naples "Federico II", Naples, Italy

Angelo Porreca
angelo.porreca@hunimed.it
Luca Di Gianfrancesco
luca.digian@libero.it
Filippo Marino
filippo.marino@gavazzeni.it
Giulia Marino
giulia.marino91@gmail.com
Department of Urology, Humanitas Gavazzeni Hospital, Bergamo (BG), Italy