

## Port-site hernia following laparoscopic cholecystectomy: personal experience and literature review

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**Aim.** The purpose of our study was to define the real incidence of port-site hernias (PSH) following laparoscopic cholecystectomy (LC) through a long-term follow-up and to evaluate the significance of several technical and patient-related factors.

**Methods.** A total of 513 consecutive patients who underwent LC at Section of General and Thoracic Surgery of the University Hospital of Palermo in the period between January 2008 and January 2012 were retrospectively examined. The pneumoperitoneum at 12 mmHg was always established with Hasson's technique at the umbilical site. Surgery was performed using the French technique. Closure of the fascial defect was performed only at the umbilical site. The effects of several variables, including age, gender, size of gallstones, coexisting umbilical hernia, diabetes, obesity, malnutrition, smoking, and heavy manual work on the development of TSH were assessed.

**Results.** A total of twelve patients (2.3%) were identified with PSH over a mean follow-up period of 49.5 months (range: 31-68 months). Of these, 10 developed at the umbilicus and 2 at the 10 mm epigastric site. Statistical analysis performed using Student's t-test and chi-square test, previous umbilical hernia ( $P<0.01$ ), gallstones  $\geq 2$  cm ( $P<0.001$ ), fascial incision enlargement ( $P<0.01$ ), umbilical wound infection ( $P<0.01$ ) and BMI  $>30$  kg/m<sup>2</sup> ( $P<0.01$ ) were found to be related the risk of PSH development.

**Conclusion.** After long-term follow-up, the our incidence of PSH following LC was in line with literature data. Previous umbilical hernia, huge gallstones and relative fascial incision enlargement, umbilical wound infection and obesity play a key role in the development of PSH.

**KEY WORDS:** Hernia - Cholecystectomy, laparoscopic - Patient outcome assessment.

Port-site hernias (PSH), although a infrequent complication of laparoscopic cholecystectomy (LC), are significant as they require an additional surgical procedure, and may be a cause of significant morbidity.<sup>1</sup>

The aim of our retrospective study was to assess PSH incidence, in relation to trocar size, tip design and site of insertion, and to identify the risk factors correlated with the patients and with the main technical aspects of the procedure through the review of recent literature.

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### Materials and methods

A consecutive series of 513 patients who underwent LC at Section of General and Thoracic Surgery of the University Hospital of Palermo in the period between January 2008 and January 2012 were retrospectively examined. The mean age was  $53.2 \pm 16.3$  years SD (range: 17-82) and a male/female ratio 1:4.2. Indications for surgery were symptomatic gallstones (413 patients =80.5%), followed by acute cholecystitis (66 patients =12.8%), and gallbladder polyps (34 patients =6.7%); the patients' characteristics are shown in Table I.

All the procedure were performed by the same equipe (GG & CS) with the French position and "open Hasson technique" for the introduction of the first 10 mm umbilical trocar. Subsequent trocar were positioned along the arcuate line (5 mm trocars in the right flank and in epigastrium, 10 mm trocar in the upper mesogastric region, left of the midline).

Umbilical incision was performed by a curved skin incision just above the umbilicus, with an approximately 20 mm opening of the fascia and the peritoneum along the linea alba. The operative trocars were inserted under direct vision after transillumination of the abdominal wall in order to prevent injury to the epigastric vessels. The pneumoperitoneum was established at 12 mmHg.

We always used reusable trocars in polyether ether ketone (PEEK) with micro-roughness of the tube and 45° sharp blade.

At the end of procedure, we do not place routinely drainage through the 5-mm right flank port. The gallbladder is removed into an endobag through the umbilical port together with the Hasson's trocar, than the trocar is re-inserted to enable extraction of the operating trocars under direct vision. Fascial closure is performed routinely only at the umbilical site by grasping the fascial margins with Kocher clamps in order to lift it upward, and closing the defect with an interrupted hand-sewn absorbable suture of 0 Polyglactin 910 with atraumatic hook needle 5/8 circle.

TABLE I.—Patients' characteristics and risk factors. Port-site hernia following laparoscopic cholecystectomy: personal experience and literature review.

Variable	Patients without PSH (N.=501)	Patients with PSH (N.=12)	P
Sex			
Female	382 (76%)	10 (83%)	NS
Male	119 (24%)	2 (17%)	NS
Age (years)			
≤60	183 (37%)	1 (8%)	NS
>60	318 (63%)	11 (92%)	NS
Heavy manual work	59 (8%)	1 (8%)	NS
Diabetes mellitus	184 (37%)	1 (8%)	NS
Diagnosis			
Symptomatic gallstones	402 (80%)	11 (92%)	NS
Acute cholecystitis	65 (13%)	1 (8%)	NS
Gallbladder polyps	34 (7%)	0	NS
Hepatitis/ascites	51 (10%)	3 (25%)	NS
BMI>30 Kg/m <sup>2</sup>	108 (22%)	7 (59%)	< 0.01
Previous umbilical hernia	67 (13%)	6 (50%)	< 0.01
Gallstone dimension			
≤1 cm/microlithiasis/polyps	327 (65%)	1 (8%)	< 0.01
>1 cm	126 (26%)	0	NS
≥2 cm	48 (9%)	11 (92%)	< 0.001
Fascial incision enlargement	68 (13%)	11 (92%)	< 0.001
Wound infection	19 (4%)	10 (83%)	< 0.001

PSH: port-site hernia; BMI: Body Mass Index.

At extra umbilical ports, we performed fascial hemostatic suture only in the case of wall bleeding (in our experience this has been necessary in 34 cases =6.7%).

The patients were discharged in the first or second postoperative day, and they returned for follow-up examinations one week and 4 weeks after; long-term follow-up (up to 68 months, range 31-68 months, mean 49.5 months) was performed with telephonic interview and subsequent outpatient clinical and ultrasonographic evaluation in the suspect of PSH.

### Results

The overall incidence of PSH was 2.3% (12/513), 83% (10/12) of which developed at the umbilicus, and 17% (2/12) at the epigastric site. The only two cases of epigastric PSH occurred after the use of 10-mm bladed trocars.

Table I shows the incidence data stratified by risk factor.

All the patients were examined in the course of the follow-up. Twentytwo of them had suspicious signs or symptoms for TSH, but abdominal ultrasound only confirmed this condition in 12 of them.

All hernias occurred using 10-mm 45° sharp blade trocars without fascial closure only in the cases of epigastric PSH (2/12); all ten patients (83%) with umbilical PSH experienced wound site infection before the development of PSH.

All 12 patients experienced moderate and intermittent discomfort at the trocar site scars, with bulging in 5 cases (42%).

No patients developed small-bowel obstruction symptoms.

No patients were managed conservatively; at surgery, 7 of the 12 patients (58%), with discomfort but few symptoms, had an intrafascial incisional hernia: the omentum

herniated through a defect in the transversalis and internal oblique fasciae, but the external oblique fascia was intact. The 5 patients remaining developed PSH through all abdominal wall fascial layers.

Local exploratory surgery disclosed entrapped omentum ("hernia reduction") and the wall defect was corrected with the union of aponeurosis edges in the transverse direction with simple stitches of Poliglactin 910, without tension. The postoperative evolution was without complications in all 12 patients and hospital discharge occurred between the first (8/12=67%) and the second (4/12=33%) postoperative day.

### Discussion

Tonouchi and Fear in 1968 reported the first two case of PSH in the context of gynecological surgery while the first manuscript of a PSH following LC dates back to 1991 by Maio.<sup>2,3</sup>

Today, the clinical significance of PSH is becoming more important with the widespread diffusion of LC; in fact, the incidence in literature of PSH after LC ranges between 0.12% and 25%,<sup>2</sup> although is most frequently reported an incidence of less than 3%;<sup>3-5</sup> moreover, the general incidence of TSH has been described as a well-known postoperative complication in laparoscopic surgery (colorectal surgery for cancer, 0.6%; colectomy for sigmoid diverticulitis, 0.9%; Roux-en-Y gastric bypass, 0.3%-1.0% and gastric banding, 0.5%).<sup>6</sup>

In our study with a long-term follow-up (up to 48 months), PSH incidence was 2.3%, in agreement with international data (1.8%) [6]; however, is well accepted that without long-term follow-up, most cases will remain undiagnosed or misdiagnosed.<sup>7</sup>

The onset of symptoms produced by PSH could range

from a few to several months after intervention and may be pain, but severe complications as bowel obstruction, strangulation, and perforation are described, especially in early-onset cases (less than 2 weeks after surgery).<sup>2, 6</sup>

From a recent literature review, 52.1% of PSH presented with symptoms of small bowel obstruction or strangulation, while 39.1% of hernias presented as symptomatic/asymptomatic PSH. If small bowel obstruction occurs, it typically presents in the early postoperative period unlike PSH which may present years later and are thus lost to clinical follow-up.<sup>1</sup>

Diagnosis of PSH may be more difficult due to the small size of the hernia, confusing it for a seroma or haematoma. Ultrasonography and magnetic resonance may be useful in these situations, but computed tomography is the most commonly reported imaging modality, particularly in early onset hernia presenting as small bowel obstruction, often with the aid of gastrointestinal contrast studies.<sup>1</sup>

Fascial defects created by 10-mm or larger trocars should be closed whenever possible to prevent hernia formation,<sup>6, 8</sup> because the use of large trocars ( $\geq 10$  mm) is considered, as in our data, one of the most important risk factor for

PSH (86% of PSH occurs in sites where the diameter was at least 10 mm), even if we cannot ignore that PSH may also occur at 5-mm port sites (3%).<sup>6</sup>

Leibl *et al.* founded in their series that cutting trocars were associated with a significantly higher PSH rate than blunt trocars (1.8% vs. 0.2%,  $P < 0.01$ ).<sup>4</sup>

In our experience, we cannot identify type of blade trocar as a risk factor because we have always used the same type of port; however, in literature, bladeless radially dilating trocars have been considered to reduce the incidence of PSH: unlike bladed trocars, these bladeless, blunt-tipped, radially-dilating trocars allow for atraumatic dilatation of tissues, penetrating the abdominal wall layers by splitting fibers without cutting them.<sup>5</sup>

In agreement with the literature data, we confirm that leaving the fascial defect open or make an insufficient closure increase the risk of a TSH: in fact, in our experience, fascial closure is performed routinely at the umbilical site,<sup>6</sup> even in the case of blunt trocars.<sup>3</sup>

Some authors consider that the incision should be extended, if necessary, to suture the fascia under direct vision; other authors propose the use of special materials

TABLE II.—Review of recent literature.

Author, year	Patients	Follow-up (days)	PSH Incidence	Port site, size, fascial closure
Maio, 1991 [13]	1 (CR)	3	NA	Umbilical, 11 mm
Baird, 1992 [14]	782	NR	1 (0.13%)	Umbilical, size and closure not stated
McMillan, 1993 [15]	1 (CR)	2	NA	Umbilical, 10 mm, left open
Horgan, 1993 [16]	2 (CR)	5-547.5	NA	Subumbilical, 10 and 12 mm
Plaus, 1993 [17]	4 (CR)	7-365	NA	3 subxiphoid 10 mm, 1 umbilical 5 mm
Morris, 1993 [18]	82	222	1 (1.22)	Epigastric
Hass, 1993 [19]	1 (CR)	3	NA	Umbilical, 10 mm, closed
Patterson, 1993 [20]	1 (CR)	2	NA	Umbilical
Kopelman, 1994 [21]	1 (CR)	5	NA	Right side, 10 mm
Birdi, 1994 [22]	501	NR	2 (0.39%)	NR
De Giuli, 1994 [23]	1 (CR)	30	NA	Umbilical
Wagner, 1994 [24]	1 (CR)	5	NA	Right side, 8 mm, closed
Schiller, 1994 [25]	1 (CR)	2	NA	NR
Azurin, 1995 [12]	1300	42	10 (0.77%)	All umbilical, $\geq 10$ mm, closed
Freedman, 1995 [26]	1 (CR)	390	NA	Umbilical
Williams, 1995 [27]	1 (CR)	2	NA	Umbilical, 10 mm
Matter, 1996 [28]	1 (CR)	45	NA	5 mm, Right upper lateral, no closed
Bender, 1996 [29]	1 (CR)	7	NA	10 mm, closed
Nassar, 1997 [11]	870	120	16 (1.8%)	15 umbilical, 10 mm; 1 right side, 5 mm, 1 closed, 9/16 repaired
Mayol, 1997 [30]	373	336	6 (1.6%)	Umbilical, 10 mm, 1 closed, 4/6 repaired
Ahmad, 1997 [31]	1300	NR	11 (0.85%)	Umbilical, all closed
Sanz Lopez, 1999 [8]	142	1095	2 (1.4%)	1 umbilical, 1 umbilical and subxiphoid, 10 mm, 2 closed, 1 left open
Coda, 2000 [32]	1210	NR	16 (1.3%)	13 umbilical 10 mm, all closed
Ok, 2000 [33]	1 (CR)	30	NA	Umbilical
Duca, 2003 [34]	9542	90-365	12 (0.18%)	Umbilical, 10 mm, who required either extend incision or who developed local infection; all repaired
Losanoff, 2003 [35]	1 (CR)	5	NA	Right lateral
Charles, 2005 [36]	1 (CR)	14	NA	Subxiphoid, size not stated
Uslu, 2007 [37]	776	7-30	42 (5.4%)	41 umbilical, no fascial closure
Balakrishnan, 2008 [38]	1332	30	5 (0.38%)	Epigastric, 10 mm, closure not stated
Hussain, 2009 [39]	1621	28-42	2 (0.12%)	5-10 mm, sites not stated, all closed
Helgstrand, 2011 [40]	3896	4392	59 (1.5%)	43 at umbilicus site, 10 mm, all closed
Erdas, 2012 [41]	313	2694	13 (4.15%)	11 umbilicus, 2 xiphoid, all 10 mm, all umbilical close
Comajuncosas, 2014 [7]	241	1404	57 (25.9%)	All umbilical 12-mm port site, all umbilical close

NR: not reported; NA: not applicable (only for case report); CR: case report without indication of mean follow-up and overall incidence.

to close the fascia and peritoneum together such as spinal cord needle, a Deschamps or Reverdin needle, the use of a polypropylene double-sided mesh (ePTFE), but all these technique has not yet been evaluated with adequate follow-up studies.<sup>3</sup>

The anatomical weakness of the median and umbilical region may lead to a TSH: in many studies, midline PSH (umbilical and epigastric) are reported in more than 75% (*versus* about 25% of lateral site) of all PSH.<sup>9, 10</sup>

As in our study, umbilical wound enlargement to retrieve gallbladder might be involved in the occurrence of TSH.<sup>11</sup>

Azurin DJ has been shown that more than 90% of THS occur in patients with comorbidity as diabetes mellitus (defective healing of fascial gap), obesity and poor nutrition (thicker preperitoneal space), preexisting umbilical hernia and ascites (elevated intra-abdominal pressure) or after complications (wound infection, reoperation).<sup>12</sup>

For literature review (data are reported in Table II), Medline was searched using the words "port site hernia", "laparoscopic port hernia" "laparoscopic complications" and "trocar site hernias". The search was limited to articles on cholecystectomy and digestive surgery. A total of 33 articles (10 literature review, 17 case reports and 6 hospital report) were included for literature review (manuscripts were also cross-referenced), for a total of 24301 patients, 273 cases of PSH (mean 3.14%, range 0.12-25.9%) and variable follow-up (2-2964 days) from 1992 to 2014.

### Conclusions

PSH is a complication, often subclinical, and its incidence may be much higher than that reported in most of the studies.

To prevent PSH formation using trocar  $\geq 10$  mm, all large fascial defects must be properly closed under direct vision using all technical means available, above all in obese, diabetic or patients older than 60 years.

In our opinion, PSH is a completely preventable cause of morbidity that requires a second surgical procedure to repair and further studies with a large number of cases including all risk factors and long-term follow-up are needed before drawing further conclusions.

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*Conflicts of interest.*—The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

Received on September 22, 2014.

Accepted for publication on October 22, 2014.