



# Patient selection criteria for an effective laparoscopic intraperitoneal ventral hernia repair in day surgery

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Received: 14 January 2018 / Accepted: 10 December 2018 / Published online: 19 December 2018  
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## Abstract

The laparoscopic treatment of abdominal wall defects is currently a valid alternative to the open technique, given the possibility to significantly reduce the length of hospital stay and, consequently, to allow its carrying out in a day surgery setting. The comparison between the two methods has also been the subject of a Cochrane meta-analysis performed by Sauerland et al. (Cochrane Database Syst Rev 3: CD007781, 2011), which pointed out how, in spite of many clinical trials indicating the superiority of laparoscopy in terms of invasiveness and postoperative pain control, the quality of evidence is low due to the excessive variability among the different series in terms of reported complications. Moreover, what should be the selection criteria of patients fit for laparoscopic treatment in day surgery is not yet defined. This retrospective study considered 94 patients with primary or recurrent incisional wall hernias treated with laparoscopic technique over a 7-year period of time, from 2011 to 2018. The aim was to define the selection criteria for an effective day surgery laparoscopic treatment, considering as outcome the rate of conversion to ordinary hospitalization (discharge > POD1). Discharge > POD 1 was necessary in 15 cases out of 94 (16%). Concerning this outcome, statistically significant risk factors were ASA score > I ( $p=0.022$ ), number of hernia orifices > 1 ( $p=0.001$ ), recurrent hernias ( $p=0.002$ ) and hernia diameter > 10 cm ( $p<0.0001$ ). These factors were confirmed by univariate binary logistic analysis. A stepwise model of multivariate analysis showed as determinants for adverse events ASA score > 1 (OR 5.2, 95% CI 1.1–25.6,  $p=0.043$ ) and hernias > 10 cm (OR 7.0, 95% CI 1.1–46.4,  $p=0.045$ ). This work highlighted some useful criteria for preoperative selection of patients fit for laparoscopic abdominal wall defects repair in a day surgery setting. In particular, criteria related to a favorable clinical outcome were ASA score < II and a hernia diameter < 10 cm.

**Keywords** Abdominal wall defects · Laparoscopy · Day surgery · Selection criteria

## Introduction

Incisional hernias represent a major problem in the context of abdominal wall diseases: according to literature, the incidence of postoperative incisional hernia appears to vary from 2 to 16% of all laparotomies, with an increase of up to 31% in relation to the presence of a surgical site infection [2–4]. In the last few years, laparoscopic hernia repair technique has gained growing diffusion as a therapeutic approach to abdominal wall defects [5–16]; however, literature analyzing the feasibility of this technique in a day surgery setting is

lacking [17–19]. The following study considers laparoscopic incisional hernia repair as a day surgery procedure, by defining the selection criteria for an optimal result in terms of short hospital stay.

## Materials and methods

This study retrospectively examined 94 patients affected by primary or recurrent incisional abdominal wall hernias referred for laparoscopic treatment in day surgery at the Turin University Hospital “City of Health and Science” between January 1, 2011 and January 1, 2018. We considered as recurrent incisional hernias ( $n=15$ , 16%) the first recurrences after a repair attempt without mesh. The variables examined for each patient were sex, age, body mass

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index (BMI), number and size of defect, relapse and ASA score (Table 1).

The percentage of shifts to standard hospitalization was evaluated as the primary outcome.

The selection criteria for patients to be treated in day surgery were:

- Anesthesiologic risk category ASA I or II (even compensated ASA III patients were excluded according to our Day Surgery Unit regulation, e.g., ischemic heart disease, decompensated diabetes, ongoing infections, OCBP, arrhythmias, kidney and liver failure, coagulopathies).
- BMI < 40.
- Absence of previous mesh repair of an incisional abdominal defect.

The operative procedure was always performed in general anesthesia and all patients received a one-shot antibiotic EV prophylaxis. Nasogastric tube was always placed during the intervention and removed at the end: a vesical catheter was deemed necessary in case of sub-umbilical defects. The main technical steps were: a 13 mmHg pneumoperitoneum induction with a Veress needle, the operating trocars positioned according to the defect location and the use of a 30° camera. The mesh, once inserted in the abdomen, was secured with four transparietal stitches to the interior aspect of the abdominal wall and the fixation completed with absorbable clips (ABSORBATAK<sup>®</sup>, Medtronic). An abdominal drainage was positioned at the end of all procedures and removed on the first postoperative day.

Patients were discharged on postoperative day (POD) 1 from the Day Surgery Unit after verifying: pain control, spontaneous diuresis, absence of nausea and vomiting, spontaneous ambulation and no bleeding. To assess postoperative pain, the Visual Analogic Scale (VAS) was employed; patients were discharged in presence of VAS ≤ 3. Our analgesic protocol was based on oral paracetamol (1 g × 3), with ketorolac 10 mg × 3 (1° choice) and oral tramadol 100 mg × 3 (2° choice) as rescue therapy.

**Table 1** Variables examined for each patient

Variable	Value
Sex	M, F
Age	< 60, ≥ 60
BMI	< 30, ≥ 30
Number of hernias	One, two or more defects
Size of hernia, according to EHS <sup>a</sup> indications	Small < 4 cm, medium 4–10 cm, large > 10 cm
Relapse	No relapse R0, relapse R1
ASA	I, II

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Surgical complications, evaluated according to the Clavien-Dindo classification [20] were categorized into two nosographic categories according to the onset time: intraoperative and postoperative.

Following discharge, patients were subjected to 3, 6, and 12 month clinical controls. The mean follow-up was 26 months (range 6–36).

The association between complications and major risk factors such as age > 60 years, gender, BMI > 30, orifice number, recurrent hernias, ASA score > I and hernia diameter has been investigated through a series of univariate and multivariate binary logistic regression models. The *p* value was estimated using the exact method, two-tailed. The analyses were carried out using IBM SPSS 22.0.

## Results

The average age was of 59.3 years with a slight prevalence of female gender (48 patients, 51.1%).

The mean surgical time was 64 ± 7 min. The mean adhesiolysis time was 28 ± 5 min.

79 patients (84% of cases) were discharged the day after the procedure; in the remaining 15 patients (16% of cases), a conversion to ordinary hospitalization was required. The patient characteristics are shown in Table 2.

19 complications were observed (20.2%), 3 intraoperative (15.8%) and 16 postoperative (84.2%). 95% of complications were classifiable as Clavien-Dindo I. The intraoperative complications consisted of two mild bleedings (Clavien-Dindo I) and one bowel damage with subsequent peritonitis (Clavien-Dindo IIIB) in a patient with a recurrent > 10 cm diameter hernia who had required an extensive adhesiolysis. He was treated with immediate laparotomy, mesh removal and direct bowel repair. Bleeding was observed in the immediate postoperative period as a moderate drain flow, and was treated conservatively without a need for transfusion (Hb > 10 g/dl). In all three cases, a precautionary hospitalization was required. Postoperative complications were represented by 12 poorly controlled pain episodes (Clavien-Dindo I) which also required an inpatient precautionary observation and 4 wound seromas (Clavien-Dindo I), managed on an outpatient basis.

From the analyzed data, the outcome was not significantly influenced by gender (*p* = 0.576), age ≥ 60 (*p* = 0.086) or BMI ≥ 30 (*p* = 1.000). The number of hernia orifices seemed to be significantly associated with the risk of developing an adverse event (*p* = 0.001); in 21 patients with more than one orifice, 9 (42.9%) showed complications. A recurrent hernia, defined as a first recurrence following the treatment of an incisional hernia without a mesh implant, is a statistically significant risk factor for adverse events (*p* = 0.002); in fact, of the 15 patients with

**Table 2** Patients in which conversion to ordinary hospitalization was required: main characteristics

Patient	Gender	Age	BMI	Number of holes	Relapse	Size of hole	ASA
1	F	61	35	2	R1	Large	II
2	F	52	35	2	R1	Large	I
3	F	62	30	1	R0	Medium	II
4	M	72	35	2	R1	Large	II
5	M	73	40	2	R0	Large	II
6	F	75	40	2	R1	Large	II
7	F	67	30	2	R1	Large	II
8	F	78	27	1	R2	Medium	II
9	M	65	26	1	R0	Large	I
10	F	64	23	1	R0	Medium	II
11	M	36	21	1	R0	Medium	II
12	M	70	32	3	R0	Medium	II
13	F	68	31	1	R0	Medium	II
14	F	53	29	2	R4	Medium	II
15	M	60	31	2	R0	Small	I

**Table 3** Stepwise multivariate binary logistic regression for adverse events risk factors

	OR	Confidence interval	<i>p</i>
Orifices > 1	2.4	0.5–11.4	0.267
Recurrent hernia	1.6	0.3–8.4	0.548
Diameter > 10 CM	7.0	1.1–46.4	0.045
ASA > I	5.2	1.2–25.5	0.043

a previously treated hernia, 7 (46.7%) had peri- or post-operative Clavien-Dindo I complications. The diameter of the hernia hole represented a further significant risk factor ( $p < 0.0001$ ), as the probability of complications increased proportionally to the size of the defect. 27 patients had a defect of less than 4 cm in size and only 1 (3.7%) of them developed complications; of the 55 with defects ranging from 4 to 10 cm, 7 had complications (12.7%). Of the 12 patients with a defect greater than 10 cm, 7 (58.3%) developed complications. Comorbidities (ASA > I) significantly affected the outcome ( $p = 0.022$ ).

An univariate binary logistic regression confirmed as determinants for adverse events the presence of more than one hernia orifice (OR 8.4, 95% CI 2.5–27.9,  $p = 0.001$ ), of recurrent abdominal defects (OR 7.8, 95% CI 2.2–27.1,  $p = 0.001$ ), of hernias > 10 cm (OR 13.0, 95% CI 3.3–50.5,  $p < 0.0001$ ) and of an ASA score > I (OR 5.0, 95% CI 1.3–19.2,  $p = 0.018$ ).

Using a stepwise model of multivariate analysis, hernias > 10 cm (OR 7.0, 95% CI 1.1–46.4,  $p = 0.045$ ) and ASA score > I (OR 5.2, 95% CI 1.2–25.5,  $p = 0.043$ ) were significantly associated with a shift to standard hospitalization (Table 3).

After a mean follow-up of 26 months, we observed five recurrences (5.3%): two out of five had a defect > 10 cm and one was a recurrent hernia, while in four out of five, the defects were  $\geq 2$ .

### Discussion

Laparoscopy is one of the most commonly used methods to repair abdominal wall defects. This is a procedure supported by the continuous introduction of innovative techniques [21–27] and whose learning curve can be completed after an average of thirty interventions [1]. The main advantages consist of less surgical trauma, better control of postoperative pain and reduced hospital stay. As a matter of fact, laparoscopic surgery can be performed in a 1-day surgery setting, as long as a strict selection of patients is made. However, literature data concerning the criteria to be adopted are lacking and not homogeneous [17–19]. In 2002, Moreno-Egea et al. [17], treated abdominal wall defects with laparoscopy in a day surgery setting: 300 patients, mainly affected by inguinal hernias (256), were included. The criteria for exclusion were the need of emergency surgery, the presence of neoplasia, acute infection or risk of sepsis or patients not mentally competent. All the patients treated with an extraperitoneal approach were completed as a day surgery procedure. The rate of conversion to open surgery was 2.3%. 12 out of 40 patients affected by ventral hernia and treated with intraperitoneal technique required hospitalization, 7 of them for pain. The recurrence rate was 0.78% for inguinal hernias and 2.5% for ventral hernias.

In another study (2008), the same authors [18] compared data of 127 patients affected by incisional hernia treated with

laparoscopy in a day surgery setting with those of 72 patients in ordinary hospitalization. Inclusion criteria were ASA I or II, presence of caregiver at home, wall defect > 5 cm without skin lesions. No significant differences between the two groups were observed in terms of morbidity and rate of recurrence.

Lorence-Herte et al. [19] underlined the necessity to define the criteria for selection of patients undergoing laparoscopy in a day surgery setting. In their study (2015), they applied six inclusion criteria: patients aged 18 and older, hernia without loss of domain, absence of trophic skin disorders, ASA grade of I, II or III well-compensated, availability of caregiver at home, patient mentally competent and easy to keep in touch during the follow-up. 259 patients with diagnosis of incisional hernia or recurrent hernia underwent surgery. The procedure was completed in laparoscopy in 98% of cases. 50 of these were discharged the same day of surgery and 179 the day after. Pain resulted as severe in 10% of patients and complications, mainly minor, were observed in 25 patients. After a 29-month mean follow-up, the recurrence rate was 7%.

The more complex the hernia defects are, the higher the risk of complications: our analysis showed that multiple holes or defects with a diameter greater than 10 cm and recurrent hernias are variables strictly linked to surgical morbidity, resulting in a higher chance of conversion from day surgery to an ordinary hospitalization. This fact is probably due to the fact that these cases are more prone to develop abdominal adhesions and subsequently to be submitted to a more extensive adhesiolysis.

Optimal pain control is crucial for a good postoperative outcome. In our series, of the 15 conversions to ordinary hospitalization, 12 (80%) were due to the lack of pain control, probably due to the large size of the hernia and the number of holes requiring larger meshes and an increased number of fixation clips, which are associated with a risk of prolonged postoperative pain [28]. Even the extension of adhesiolysis may be considered a factor influencing postoperative pain. As a matter of fact, in our series 11/12 cases with poor pain control were hernias with diameter > 4 cm and 5 out of 12 were recurrent hernias, in which adhesiolysis may have resulted more extended compared to other cases.

According to multivariate binary logistic regression, risk factors for the development of complications are a hernia diameter > 10 cm and ASA score > I. In spite of the statistical significance, the reliability of these results may be affected by the reduced number of events, as can be seen from the quite wide confidence ranges (see Table 3). Further studies are needed to confirm the validity of the results presented here.

The analysis of our results shows that the main factors to consider are the number of defects, size of the hernia hole, presence of recurrent hernia and comorbidities. In particular,

the patient most suitable for this type of approach should have an ASA score < II, a primary diagnosis of incisional hernia with single wall defect and an orifice < 10 cm. It also emerged that postoperative analgesia remains one of the mainstays for a successful day surgery-based procedure. Laparoscopic hernia repair performed in day surgery is a safe, reliable and well-tolerated solution in selected patients which can offer the patient an earlier discharge with a better quality of life at the same rate of complications seen during ordinary hospitalization.

## Compliance with ethical standards

**Conflict of interest** The author declares that they have no conflict of interest.

**Research involving human participants and/or animals** The project has been submitted for the approval by Ethical Committee.

**Informed consent** All the patients sign the informed consent.

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