Laparoscopic management of non-midline incisional hernia: A multicentric study

LAPAROSCOPIC MANAGEMENT OF NON-MIDLINE INCISIONAL HERNIA: A MULTICENTRIC STUDY

Running title: management of non-midline incisional hernia

Alessia Ferrarese[1], Stefano Enrico[1], Mario Solej[1], Alessandra Surace[1], Mario Junior Nardi[2], Paolo Millo[2], Rosaldo Allieta[2], Cosimo Feleppa[3], Luigi D'Ambra[3], Stefano Berti[3], Enrico Gelarda[4], Felice Borghi[4], Gabriele Pozzo[5], Bartolomeo Marino[5], Emma Marchigiano[6], Pietro Cumbo[6], Maria Paola Bellomo[7], Claudio Filippa[7], Paolo Depaolis[7], Mario Nano[1], Valter Martino[1]

University of Turin – Department of Oncology – School of Medicine – Teaching Hospital "San Luigi Gonzaga" – Section of General Surgery – Orbassano – Turin

[1]Hospital "San Luigi Gonzaga" – Section of General Surgery – Orbassano – Torino

[2]Hospital "Umberto Parini" – Section of General Surgery – Aosta

[3]Hospital "Sant'Andrea" – Section of General Surgery – La Spezia

[4]Hospital "Santa Croce e Carle" – Section of General Surgery – Cuneo

[5]Hospital "Civile" – Section of General Surgery – Asti

[6]Hospital "Santa Croce" – Section of General Surgery – Moncalieri

[7]Hospital "Gradenigo" – Section of General Surgery – Torino

e-mails

AF: alessia.ferrarese@gmail.com

SE: Stefano_e@libero.it

MS: mariosolej@gmail.com

AS: alessandra_sur@gmail.com

MJN: marionardijr@libero.it

PM: pmillo@ausl.vda.it

RA: rallieta@ausl.vda.it

CF: cosimofeleppa@gmail.com

LDA: luigidambra68@libero.it

SB: Stefano.berti@asl5.liguria.it

EG:enricogelarda@email.it

FB: borghi.f@ospedale.cuneo.it

GP: gpozzo@asl.at.it

BM: bmarino@asl19.asti.it

EM: emma.marchigiano@libero.it

PC: pietrocumbo@gmail.com

MPB: paola.bellomo@fastwebnet.it

CF: claudio.filippa@fastwebnet.it

PD: paolo_depaolis@fastwebnet.it

MN: mario.nano@unito.it

VM: valtermartino.md@gmail.com

AF: Assistant of General Surgery at General Surgery Section – Orbassano- University of Torino

SE: General Surgeon at General Surgery Section – Orbassano- University of Torino

MS: General Surgeon at General Surgery Section – Orbassano- University of Torino

AS: Assistant of General Surgery at General Surgery Section – Orbassano- University of Torino

MJN: General Surgeon at General Surgery Section of Aosta

PM: General Surgeon at General Surgery Section of Aosta

RA: General Surgeon at General Surgery Section of Aosta

CF: General Surgeon at General Surgery Section of La Spezia

LDA: General Surgeon at General Surgery Section of La Spezia

SB: General Surgeon at General Surgery Section of La Spezia

EG: General Surgeon at General Surgery Section of Cuneo

FB: General Surgeon at General Surgery Section of Cuneo

GP: General Surgeon at General Surgery Section of Asti

MM: General Surgeon at General Surgery Section of Asti

EM: General Surgeon at General Surgery Section of Carmagnola

PC: General Surgeon at General Surgery Section of Carmagnola

MPB: General Surgeon at General Surgery Section of Torino

CF: General Surgeon at General Surgery Section of Torino

PD: General Surgeon at General Surgery Section of Torino

MN: Ordinary Professor of General Surgery at University of Torino

VM: General Surgeon at General Surgery Section – Orbassano- University of Torino

Correspondence to:

Alessia Ferrarese MD, Department of Oncology, University of Turin, Section of General Surgery, San Luigi Gonzaga Teaching Hospital, Regione Gonzole 10, 10043 Orbassano – Turin (Italy), e-mail alessia.ferrarese@gmail.com

The Authors have no conflict of interest or any financial support

Abstract

Background

Laparoscopic repair of Non Midline Ventral Hernia is actually debated. The aim of this study is to analyze the 6 years' experience of laparoscopic approach in NMVH in northwest of Italy.

Methods

We analyzed 78 patients who underwent to Laparoscopic repair of Non-Midline ventral hernia (LNM) between March 2008 and March 2014 in the selected institutions. We retrospectively analyzed perioperative and postoperative data and recurrence rate of 4 subgroups of NMVH: subcostal, sovrapubic, lumbar and epigastric. We also performed a literature review.

Results

There is no difference in 4 subgroups in terms of demographic data, defect characteristics, admission data and complications. Subcostal defects have a lower operating time. Obesity was a risk factor for recurrence.

Conclusions

In our experience Subcostal defects seems easier to perform, with a lower recurrence rate, lower chronic pain and faster surgical performance. Attending more specific prospective randomized trial with larger sample, we conclude that laparoscopic approach is a safe treatment for NMVH hernias in specialized centers.

Keywords: Non-Midline Ventral Hernia, ventral hernia, laparoscopic repair

Abbreviations:

NMVH: Non-Midline ventral hernia

LNM: Laparoscopic repair of Non-Midline ventral hernia

SCd: Subcostal defects (SCd),

SPd: Sovrapubic defects (SPd),

Ld: Lumbar defects (Ld),

Ed: Epigastric defects (Ed).

BMI: Body Max Index-BMI,

COPD: Chronic Obstructive Pulmonary Disease COPD,

NRS: numerical rating scale

ASA: American Society of Anesthesiologist score

1. Introduction

Incisional hernias are defined as 'Any abdominal wall gap with or without a bulge in the area of a postoperative scar perceptible or palpable by clinical examination or imaging' [1]. The incidence of incisional hernia following open surgery is about from 2 to 11% [2-4]. In 2000 Chevrel made a classification of ventral hernia and he proposed three parameters for a correct classification: localization of defects (median or lateral), size of hernia and recurrence at diagnosis [5]. The use of laparoscopy in last years reduced incisional hernia incidence [6, 7], but overall impact remains high. Non-Midline Ventral Hernia (NMVH) is a subgroup of ventral hernias and its incidence ranges between 6 and 17% of all ventral hernias. Moreno-Egea et al. [8] defined that the role of laparoscopy is not so clear in NMVH, because of involvement of different muscle groups; actually there are few articles about mini-invasive repair of these specific defects. Certainly, laparoscopic approach in abdominal surgery plays a key role in terms of length of incision, total hospital stay and patient preference. The main rules in laparoscopic abdominal wall surgery seem to be the adequate patient selection, correct defect dimension misurement and surgical ability. It is impossible to establish a gold standardized technique for all NMVH repair because of different topographic variations of these defects [9].

The aim of this study is to analyze the 6 years' experience of laparoscopic approach NMVH in northwest of Italy and to analyze the stratifications of results for age.

2. Methods

A multicentric prospective study involving 7 North-Italian institutions led to the recruitment of 78 patients who underwent to Laparoscopic repair of Non-Midline ventral hernia (LNM) between March 2008 and March 2014 in the selected hospitals. Patients were divided into four subgroups according to defect position: Subcostal defects (SCd), Sovrapubic defects (SPd), Lumbar defects (Ld), Epigastric defects (Ed).

We retrospectively analyzed: demographic data (age, gender, Body Max Index-BMI, Chronic Obstructive Pulmonary Disease COPD, previous surgery), defects data (localization, numbers, kind of previous surgery), type of pre-operative study, intraoperative data (operating time, conversion rate, drain), devices characteristic (mesh, method of fixation) and surgical complications (seroma, hematoma, recurrence, chronic pain) (Table 1).

Post-operative pain was evaluated using a VAS one-dimensional numerical rating scale (NRS), graded from 0 to 10 [10]. Evaluation was performed at day one after surgery, at the discharge and one month after surgery; the patients were also invited to contact us if pain occurred in 4 months after. We used definition proposed in prevention of chronic postoperative pain guidelines, in which chronic pain was defined as pain that persists for more than six months after the operation and that

is due to synthetic material (mesh and fixing devices) used to repair the defect [11]. Exclusion criteria were: patients with American Society of Anesthesiologist (ASA) score > 3, urgent approach and neoplastic patients.

2.1 Surgical technique

All repairs were performed in laparoscopic approach; in 74 % of cases, the pneumoperitoneum was established at 12 mmHg by open Veress-assisted approach. Numbers of trocars depends on size and defects localization; in all cases we used triangular trocars position philosophy. Additional trocars placement depends on new defects discovery during laparoscopic abdominal wall exploration and on a difficult large mesh fixation. Lysis of adhesion was performed "à la demande" and a bladder catheter was inserted in all procedures for lower defects (SPd and Ld). Hernia fibrotic ring was always closely cleared and type of mesh was choosen during operation according to intraoperative defect measurement. Five centimeters overlap was respected; some surgeons used a suture-passer needle to place the mesh using guidewire previously placed on mesh cardinal points. Different fixation techniques depend on defect localization; stapler, glue and suture are most used. In some cases we used two different fixation techniques at the same time. Pneumoperitoneum is always reduced (at 10 mmHg) before fixing. Trocars were removed under visual control and umbilical trocar access fascia was sutured. All procedures were performed by expert surgeons in abdominal wall reconstruction.

2.2 Follow-up evaluation

Follow-up analysis was performed in ambulatory setting at 1 week and a 1 months after surgery. We performed physical examinations and, only in selected cases, CT scan for detecting delayed complications. Chronic pain, recurrence rate and patient satisfaction were evaluated.

2.3 Bibliographic study

We performed a literature review to identify all case-series, review and case reports of NMVH. Pubmed, OVID platform, Cochrane library, Scopus, ISI web of Knowledge and Google Scholar were used to detect scientific publications using the following headings: non-midline ventral hernia, laparoscopy/ventral hernia, ventral hernia, laparoscopic hernioplasty, incisional hernia.

2.4 Statistical analysis

Statistical proportions of dichotomous variables (classification and type of hernia, number of complications) were compared using the Chi-square test and Fisher's exact test.

Continuous variables (age distribution, BMI distribution, mean operative time, postoperative length of hospital stay, operating time, ASA evaluation) were expressed as the average (range) and analyzed using Mann-Whitney U test. All statistical analyses were performed using R software (vers. 2.6.2); a P value of <0.05 was considered statistically significant.

3. Results

Patient clinical characteristics are shown in Table 1. All patients were > 55 years (89 % > 60 yeasr). The mean age was 61 years (+/- 7.1) Fourty patients of 78 were female (%) and mean BMI was 28 kg/m^2 (+/- 6). The most common defect was Ld, followed by SCd, Ed and SPd. Ld were more often single defects; Ed had the highest multiple defects incidence.

Preoperative study was performed with TC scan in 54/78 patients; US evaluation was performed in 46/78 patients.

"Skin to skin time" (in min) was significantly different and surgery for SCd (87.9 min) seems to be faster than other procedures; SPd repair was the longest (131.3 min). An additional trocars was added in 8 case of SCd, 6 cases of Ld, 4 cases of Ed and 1 case of SPd. Ed and SPd were similar at midline defects and fixation was performed by tacks in all defect perimeter (also on bone). In 50% of SCd, surgeon used tacks and suture passed association; in only 1 case glue was used to fix the mesh. In Ld usually meshes were fixed with resorbable tacks; in only 5 cases, additional suture pass was used.

Five conversions to open surgery were required: 1 in SPd, 2 in Ld and 2Ed. No conversion was made in SCd. Intra- and post-operative complications, early and delayed, were similar to different groups (Table 1); seroma was the most common post-operative complications in all groups. We describe 4 cases of chronic pain, 2 in SCd 1 in SPd and 1 in Ed: pain persisted up to 6 months after surgery.

Fixing system was different depending on defect type and localization; the use of passed suture was significative different between subcostal defects and others.

Meshes most frequently used were 10x15 cm and 15x20 cm, usually Flexible Composite Polypropylene Mesh.

We report only one early recurrence in epigastric hernia; instead, we had 3 delayed recurrence, one in Ed and 2 in SPd (1 at 10 months from the repair, 1 at 18 month e 1 at 24 months). Despite no statistical significance ($p>0.05$), comparation between defects site and recurrence rate showed that epigastric defects recurred earlier and frequently, while sovrapubic defects recurred later (Table 1). No recurrence has been reported in subcostal and lumbar group.

Univariate analysis concerning recurrence shows no significant correlation between recurrence incidence and defects localization, gender or age. We focused on SPd that in our experience was not a significative risk factor in recurrence, but only on limit range ($p=0.0552$). Instead, there is a statistical significance between recurrence rate and obesity (Table 2); all patients who have relapsed had BMI > 31.

Mean hospital stay was higher (6.4 days) for Ed and lower (4.55 days) for Ld.

Results for NMVH repair literature review are shown in Table 2. After primary research, we found 23 articles dealing with NMVH; we excluded 9 articles because they concerned peristomal defects, inguinal hernias recurrence and Grynfelt&Petits hernias. Finally included articles are 14: 4 case reports, 3 case series, 4 prospective studies, 3 retrospective studies. These studies were analyzed according to variables of interst for our study.

4. Discussion

In 1971 Ryan was one of the first authors describing NMVH repair with open approach; he presented a series of two patients (one male and one female, with a mean age of 36.5 years) affected by two single sovrapubic defects; the mean follow-up of 12 years. In 1994, Bendavid described a series of 7 patients that underwent to open NMVH repair, followed by only one recurrence. In the same year, Norris described a surgical repair of a sovrapubic defect in a 54 years-old man [13].

In 1999, the first two articles about NMVH laparoscopic repair were published: Matuszewski reported a case report of a 56 years-old man affected by sovrapubic defect after prostatectomy [14]. Surgical result was excellent, but follow-up was only of 6 months. Hirasa described a 7 defects serie, 6 male and 1 female, with one recurrence at 5.8 months follow-up [15].

Afterwards, other authors studied laparoscopic approach feasibility in NMVH (Table2); Moreno-Egeas and his group performed many appropriate studies: a randomized prospective trial in 2002 [16], a clinical study in 2007 [17] and 3 prospective studies in 2008 [18, 19] and 2012 [8].

According to laparoscopic instruments development, laparoscopic approach becomes safe and effective in most patients (young and elderly, elective and emergency surgery) [20, 21, 22] and mini-invasive approach for hernia repair become seductive for surgeon in terms of lower hospital stay and patient satisfaction, as shown in a meta-analysis published in 2011 [23].

In our series all procedures were performed in laparoscopy because of our belief that mini-invasive approach, in specialized centers, may be an excellent strategy also in elderly.

Mean hospital stay in our series is 5.2 days; Moreno-Egea et al. show a hospital stay of only 2.7 days [24] and Lal et al. published a mean hospital stay of 7 days [19].

We believe that hospital stay is a really important element, expecially for patients with clinical relevant co-morbidity and risk factors for early and delayed complications.

In our series, “Skin to skin time” was significantly different between different types of wall defects: SCd repair was the fastest procedure compared to other defects surgery; SPd repair was the longest.

This result does not have a clear explanation: we believe that a possible explanation could be that in SCd, defect is more "localized", so trocars setting and adhesion-lysis could be easier than in midline-defects, in which trocars positioning is often obstructed by adhesions all-over abdominal wall.

Some articles published before 2005 show that laparoscopic approach for incisional hernias is associated with pain related to transmural sutures and tackers used to fix the mesh on posterior abdominal wall, causing long hospital stay [25-29].

In 2000 DeMaria et al. conducted a comparative study between open and laparoscopic approach: laparoscopic approach could be performed in outpatient for 90% of cases, with less postoperative pain and lower hospital cost [30].

In 2014 Lal et al. described a zero rate of chronic pain in their NMVH laparoscopic experience [31].

Moreno-Egea prospective study published in 2012 reports a chronic pain rate of 9.5 %[25].

According with literature, we report 4 cases of postoperative chronic pain (5.1 %): 2 in SCd , 1 in SPd and Ed repair.

A meta-analysis of randomized controller trial of open versus LS approach in ventral and incisional hernia published in 2009, demonstrated that there was no difference in perioperative complications [8].

Olmi shown that laparoscopic incisional hernia repair is associated with shorter operative time and hospital stay and lower wound infections incidence compared to the anterior-open procedure [32].

Some authors reported a risk of 26 % for early minor complication in LS approach: hematoma and seroma rates are 6.5-17% [33].

In our analysis seroma appears in 20.5 % and no hematoma was observed: the higher seroma rate may be due to lightweight mesh use.

Although some authors aim that large pore-sized lightweight meshes are not better compared to ‘‘classic’’ heavyweight meshes [19], we agree with other authors that have demonstrated that seroma formation is related to small pore-sized heavyweight meshes [34].

Heniford, in a retrospective review of 407 patients undergoing laparoscopic repair, reported a recurrence rate of 3-4 % [35].

Moreno-Egea et al. published 11 recurrences in 199 ventral hernia laparoscopic repair (146 midline defects and 53 NMVH) [19].

We described 4 cases of recurrence (5%): 2 in Ed and 2 in Ld. Two recurrence occours in the first year of surgical experience, so they could depend on a technical error. The last recurrence has a multifactorial genesis.

We believe that most of recurrences developed in first 12-14 months of surgical experience depends on technical error like inadequate fixation, excessive mesh shaping, inadequate tension of the prothesis when fixed on a non-physiologic wall (damaged wall) [36].

Some authors describe defect site like a non-dependent recurrence factor [37]. In our series there wasn’t a statistical significance about this, but we believe that the absence of recurrence observed after SCd could be due to bone wall as a stronger substrate for fixing the mesh, although it could give a higher rate of chronic pain.

Defect size is a variable universally defined as independently associated with long-term recurrences. In our series the accurate patient selection has allowed to include all patients with defects in range with literature guideline.

Our study results are notable for prosthetic infection absence: its incidence is reported in literature as low (2 cases in Moreno-Egea [19] serie and 1 in Carbonell [38]), but its consequences can be dire as severe sepsis, re-operation and septic shock to exitus.

Patients with ventral hernia are generally complex patients with many risk factors associated and strong co-morbidities [39, 40]. In literature, the risk factors that are principally related at the increasing of recurrence are: previous hernia repair, obesity and obstructive pulmonary disease [3].Also in our experience obesity has proved to be a related factor in recurrence. In according to Moreno-Egea et al., we believe that obesity could be an adeguate indication for laparoscopic surgery, but it can also be considered as a limiting factor [8].

In literature, there is not consensus concerning drainage positioning after incisional hernia repair [41]. Some authors demostrated that drain can decrease seroma rate but may increase mesh infections risk [42]. In our experience we apposed an abdominal drain in only 8 cases: 4 in ld, and 2 in SPd and 2 in Ed. No drain was apposed in subcostal defects repair.

5. Conclusion

The retrospective, nonrandomized nature of this study, the multicentric data and the requirements of different patients in terms of environment are the major limitations of this study.

Laparoscpic approach in NMVH should be a safety procedure also in patients > 60 years old.

In our experience Subcostal defects seems to be the easier to performed, with a lower recurrence rate, lower chronic pain and faster surgical performance.

We are in agreement with Moreno-Egea that declared that technical difficulty of laparoscopic repair, in expert hands, is not a prognostic factor in non-midline incisional hernias [8].

We believe that excellent knowledge of abdominal wall anatomy and consciousness that a wall defects requires a normal abdominal wall anatomy restore are crucial points.

In clinical practice all patients with NMVH have their own defect characteristics, unique medical e surgical history, regardless age, so trying to defend a single technique seems to be complicated and wrong.

Attending more specific prospective randomized trial with larger sample, we conclude that, in our experience, the laparoscopic approach is a safe treatment for NMVH in specialized centers.

References

1. M. Korenkov, A. Paul, S. Sauerland, E. Neugebauer, M. Arndt, J.P. Chevrel et al. Classification and surgical treatment of incisional hernia. Results of an experts' meeting. Langenbecks Arch Surg. 386 (2001) 65–73

2. T.E. Bucknall, P.J. Cok, H. Ellis. Burst abdomen and incisional hernia: a prospective study of 1129 major laparotomies. Br Med J. 284 (1992) 931–933.
3. M. Mudge, L.E. Hughes. Incisional hernia: a ten year prospective study of incidence and attitudes. Br J Surg. 72 (1985) 70–71.
4. R.C. Read, G. Yoder. Recent trends in management of incisional herniation. Arch Surg. 124 (1989) 485–488.
5. J.P. Chevrel, A.M. Rath. Classification of incisional hernias of the abdominal wall. Hernia. 4 (2000) 7–11.
6. H.J. Duepree, A.J. Senagore, C.P. Delaney, V.W. Fazio . Does means of access affect the incidence of small bowel obstruction and ventral hernia after bowel resection? Laparoscopy versus laparotomy. J Am Coll Surg. 197 (2003) 177–181.
7. C. Laurent, F. Leblanc, F. Bretagnol, M. Capdepont, E. Rullier. Long-term wound advantages of the laparoscopic approach in rectal cancer. Br J Surg. 95 (2008) 903–908.
8. A. Moreno-Egea, A. Carrillo-Alcaraz. Management of non-midline incisional hernia by the laparoscopic approach: results of a long-term follow-up prospective study. Surgical endoscopy. 26 (2012) 1069-1078.
9. N. Veyrie, T. Poghosyan, N. Corigliano, G. Canard, S. Servajean, J.L. Bouillot. Lateral Incisional Hernia Repair by the Retromuscular Approach with Polyester Standard Mesh: Topographic Consideration sand Long-term Follow-up of 61 Consecutive Patients. World J Surg. 37 (2013) 538–544.
10. EC Huskisson. Measurement of pain. Lancet. 2 (1974) 1127-1131.
11. S. Alfieri, P.K. Amid, G. Campanelli, et al. (2011) International guidelines for prevention and management of postoperative chronic pain following inguinal hernia surgery. Hernia. 15 (2011) 239–249.
12. E.A. Ryan. Hernias related to pelvic fractures. Surg Gynecol Obstet. 133 (1971) 440-446 .
13. R. Bendavid. Incisional parapubic hernias. Surgery 108 (1990) 898-901.
14. M. Matuszewski, A. Stanek, H. Maruszak, K. Krajka. Laparoscopic treatment of parapubic postprostatectomy hernia. Eur Urol. 36 (1999) 418-420.
15. T. Hirasa, J. Pickleman, V. Shayani. Laparoscopic repair of parapubic hernia. Arch Surg. 136 (2001) 1314-1317.
16. A. Moreno-Egea A, Carrasco L, Girela E, Martín JG, Aguayo JL, Canteras M. Arch Surg. 137 (2002) 1266-1268.
17.Moreno-Egea, P. Guzmán, G. Morales, A. Carrillo, J.L. Aguayo. Treatment of non-midline ventral hernia: experience in an abdominal wall unit and literature review. Cir Esp. 81 (2007) 330-334.
18. A. Moreno-Egea, J. Cartagena, J.P. Vicente, A. Carrillo, J.P. Aguayo. Laparoscopic incisional hernia repair as a day surgery procedure: audit of 127 consecutive cases in a university hospital. Surg Laparosc Endosc Percutan Tech. 18 (2008) 267-271.
19. A. Moreno-Egea, A. Carrillo, J.L. Aguayo. Midline versus nonmidline laparoscopic incisional hernioplasty: a

comparative study. Surg Endosc. 22 (2008) 744-749.

20. M. Solej, V. Martino, P. Mao, S. Enrico, R. Rosa, M. Fornari, I. Destefano, A.G. Ferrarese, E. Gibin, F. Bindi, A. Falcone, U. Ala, M. Nano. Early versus delayed laparoscopic cholecystectomy for acute cholecystitis. Minerva Chirurgica. 67 (2012) 381-387.
21. A.G. Ferrarese, V. Martino, S. Enrico, A. Falcone, S. Catalano, E. Gibin, S. Marola, A. Surace, M. Solej. Laparoscopic repair of wound defects in the elderly: Our experience of 5 years. BMC Surgery. 13 (2013) Suppl 2: S23.
22. A.G. Ferrarese, S. Enrico, M. Solej, A. Falcone, S. Catalano, E. Gibin, S. Marola, A. Surace, V. Martino. Transabdominal pre-peritoneal mesh in inguinal hernia repair in elderly: end point of our experience. BMC Surgery. 13 (2013) Suppl 2: S24.
23. A.G. Ferrarese, S. Marola, A. Surace A, A. Borello , M. Bindi, J. Cumbo, M. Solej , S. Enrico, M. Nano, V. Martino. Fibrin glue versus stapler fixation in laparoscopic transabdominal inguinal hernia repair: A single center 5-year experience and analysis of the results in the elderly. Int J Surg. 12 (2014) Suppl 2:S94-S98.
24. S. Sauerland, M. Walgenbach, B. Habermalz, et al. Laparoscopic versus open surgical techniques for ventral or incisional hernia repair. Cochrane Database Syst Rev 2011;3:CD007781.
25. R. Lal, D. Sharma, P. Hazrah, P. Kumar, S. Borghaia, A. Agarwal. Laparoscopic management of nonmidline ventral hernia. J Laparoendosc Adv Surg Tech A. 24 (2014) 445-450.
26. A. Park, D.W. Birch, P Lovrics. Laparoscopic and open incisional hernia repair: a comparison study. Surgery 124 (1998) 816–822.
27. B.T. Heniford, A. Park, B.J. Ramshaw, et al. Laparoscopic repair of ventral hernias. Nine years' experience with 850 consecutive hernias. Ann Surg. 238 (2003) 391–400.
28. G.M. Eid, J.M. Prince, S.G. Mattar, et al. Medium-term follow-up confirms the safety and durability of laparoscopic ventral hernia repair with PTFE. Surgery. 134 (2003) 599–604.
29. J.M. Perrone, N.J. Soper, J.C. Eagon, et al. Perioperative outcomes and complications of laparoscopic ventral hernia repair. Surgery. 138 (2005) 708–716.
30. S. Bageacu, P. Blanc, C. Breton, et al. Laparoscopic repair of incisional hernia: a retrospective study of 159 patients. Surg. Endosc. 16 (2002) 345–348.
31. E.J. DeMaria, J.M. Moss, H.J. Sugerman. Laparoscopic intraperitoneal polytetrafluoroethylene (PTFE) prosthetic patch repair of ventral hernia. Surg Endosc. 14 (2000) 326–329.
32. S.S. Forbes, C. Eskicioglu, R.S. McLeod, A. Okrainec. Meta-analysis of randomized controlled trials comparing open and laparoscopic ventral and incisional hernia repair with mesh. Br J Surg. 96 (2009) 851-858.

33. S. Olmi, A. Scaini, G.C. Cesana, L. Erba, E. Croce. Laparoscopic versus open incisional hernia repair: an open randomized controlled study. Surg Endosc. 21 (2007) 555-559.

34. D. Den Hartog, A.H. Dur, W.E. Tuinebreijer et al. Open surgical procedures for incisional hernias. Cochrane Database Syst Rev 2008;CD006438.

35. D. Weyhe, O. Belyaev, C. Muller et al. Improving outcomes in hernia repair by the use of light meshes—a comparison of different implant constructions based on a critical appraisal of the literature. World J Surg. 31 (2007) 234–244.

36. B.T. Heniford, A. Park, B.J. Ramshaw, G. Voeller. Laparoscopic ventral and incisional hernia repair in 407 patients. J Am Coll Surg. 190 (2000) 645-650.

37. N. Veyrie, T. Poghosyan, N. Corigliano, G. Canard, S. Servajean, J.L. Bouillot. Lateral Incisional Hernia Repair by the Retromuscular Approach with Polyester Standard Mesh: Topographic Considerations and Long-term Follow-up of 61 Consecutive Patients. World J Surg. 37 (2013) 538–544.

38. A.M. Carbonell, K.W. Kercher, B.D. Matthews, R.F. Sing, W.S. Cobb, B.T. Heniford. The laparoscopic repair of suprapubic ventral hernias. Surg Endosc. 19 (2005) 174-177.

39. Ventral Hernia Working Group, K. Breuing, C.E. Butler, S. Ferzoco, M. Franz, C.S. Hultman, J.F. Kilbridge, M. Rosen, R.P. Silverman, D. Vargo. Incisional ventral hernias: review of the literature and recommendations regarding the grading and technique of repair. Surgery. 148 (2010) 544–558.

40. K. Cassar, A. Munro. Surgical treatment of incisional hernia. Br J Surg. 89 (2002) 534–545.

41. K.S. Gurusamy, K. Samraj. Wound drains after incisional hernia repair. Cochrane Database Syst Rev 2007;CD005570

42. P. Pessaux, S. Msika, D. Atalla et al. Risk factors for postoperative infectious complications in non colorectal abdominal surgery: a multivariate analysis based on a prospective multi center study of 4718 patients. Arch Surg. 138 (2003) 314–324.

		Type of defects	**Statistical Analysis**

	TOTAL	Subcostal	Sovrapubic	Lumbar	Epigastric	*chi-square*	*p-value*
Number	78	22	13	27	16		
Follow-up (months)		15.8	11	22.7	11.7		ns
Age (years)		55.6	61.5	61.3	58.25		ns
Male		12	4	14	8	2.09	ns
Female		10	9	13	8		ns
BMI (Obesity)		24.9	26.9	26.2	30		ns
Diabets		9	2	8	14	18.7	ns
COPD		15	4	18	16	6.4	ns
Previous surgery	Digestive	22	0	26	11	36.3	ns
	Gynechologic	0	9	0	0	50.9	ns
	Urologic	0	4	1	0		ns
	Other	0	0	0	5		ns
Defects	Single	13	11	20	6	8.7	ns
	Multiple	9	2	7	10		ns
	Size (diam cm)	6.7	7.5	7.37	11.7		ns
Preoperative Staging	US	12	5	14	12	4.13	ns
	TC	14	8	20	12	1.23	ns
Hospital admission	Mean H stay (days)	5.2	4.77	4.55	6.4		ns
	Discharge (days)	4.3	3.77	3.22	4.9		ns
Intraoeprative variables	Operating time (min)	87.9	131.3	97.44	111.87		< 0.05
	N° of port	3	3	3	3		ns
	Additional trocar	8	1	6	4	4.47	ns
	Drain	0	2	4	2	3.58	ns
	Conversion in open procedure	0	1	2	2	2.58	ns
	Other defects	0	3	3	1	5.63	ns
	Other procedure associated	0	3	3	1	5.63	ns
Early complications	Hematoma	0	0	0	0		ns
	Seroma	4	1	7	4		ns
	Recurrence	0	0	0	1		ns
	Port-site infection	0	0	1	0		ns
	Mesh infection	0	0	0	0		ns
Delayed complications	Chronic pain	2	1	0	1		ns
	Recurrence	0	2	0	1		ns
Fixing devices	Resorbable tacks	6	6	12	4	2.99	ns
	Titanium tacks	2	4	5	2	2.29	ns
	Glue	0	1	0	0		ns
	Stitches	1	0	1	6		ns
	Resorbable tacks + stitch	11	1	5	1		< 0.05
	Resorbable tacks + Glue	1	1	2	1		ns
Type of mesh	Polyester	4	7	11	11	5.36	ns
	Composite polypropylene	16	2	7	2	20.6	< 0.05
	Carboxymethylcellulose	1	3	3	2	2.77	ns
	Polietrafluoroethylene	0	0	4	1		ns
	Prolene and polypropylene	1	1	2	0		ns

Measures of mesh	10 x 15 cm	7	4	11	4	1.23	ns
	15 x 20 cm	12	5	7	5	4.55	ns
	12 cm	1	0	0	1		ns
	15 cm	2	2	2	0		ns
	20 cm	0	1	2	2		ns
	20 x 30 cm	0	1	5	4		ns

Table 1: Perioperative data
(BMI: boody max index, COPD: Chronic Obstructive pulmonary disease)

		Recurrence	**Non Recurrence**	***p-value***
Age		61.4 ± 7.2	61.2 ± 7.0	ns
Gender	M	1	37	ns
	F	3	37	ns
BMI (Obesity)		4	55	< 0,05
COPD		3	50	ns
Site defects	SC	0	22	ns
	SP	2	11	0,0552
	L	0	27	ns
	E	2	14	ns

Table 2: Analysis of risk factors in recurrence.
(SC: subcostal defect SP: sovrapubic defect L: lumbar defect E: epigastric defect , BMI: boody max index, COPD: Chronic Obstructive pulmonary disease)