

# Treatment of median incisional hernia

## Laparoscopic vs. open surgery: meta-analysis



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### Treatment of median incisionale hernia. Laparoscopic vs open surgery:meta-analysis

*In the last ten years we assisted to spreading of laparoscopic approach on the correction of median incisional hernia, although for increased interesting toward mini-invasive techniques than for matching results between lap and open approaches.*

*The aim of our study is the critical analysis of the results of lap and open surgery in the approach of ventral hernia, through the meta-analytical revision of the principal checked prospective trials.*

*There were emerged 7 perspective studies to fit to a meta-analysis with the revision of the literature, with 1165 patients in total. Among the perioperative outcomes the briefer surgical time and a reduction of postoperative hospitalization were observed with the significant statistic data in favor of the lap.*

*Laparoscopy can be considered a valid technical alternative to traditional open surgery in the treatment of ventral incisional hernia.*

*The advantages of mini-invasive approach are the reducing of the surgical time and of the total hospital stay. There were not emerged any significant differences regarding the other surgical end-points or the recurrences of hernias after 1 and 5 years.*

KEY WORDS: Laparoscopy, Median incisional hernia, Open surgery

### Background and objectives

There are a lot of studies which compare lap and open surgery approaches to median incisional hernia. In these studies we've noticed that both the techniques are comparable in terms of their results at a distance of time. As for the early post operative results, the conclusions

are conflicting and range from the absence of any significant difference and a trend in favor of laparoscopy. Our study provides a meta-analytic review of the above mentioned scientific works, in order to get a deeper knowledge in the confrontation between laparoscopic surgery and laparotomy in the approach to median incisional hernia.

### Materials and Methods

The studies were selected using a specific search in PubMed and by the entering into the searching system the following keywords: ventral hernia, hernia surgery, hernia repair, laparoscopic surgery, laparoscopic-assisted surgery, laparoscopic ventral hernia, laparoscopic versus open, laparoscopy.

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Among all the results there were selected the studies since 1999, when Ramshaw BJ<sup>1</sup> effected the first comparative study between laparoscopic surgery and open surgery of ventral hernia, till 2009. Once the abstracts were read, we took in consideration only the works which had the proper characteristics for a meta-analytical approach<sup>2-8</sup>. In the analysis are included only the comparative controlled studies (Table I) with the following characteristics: comparison between open and laparoscopic techniques regarding the surgery of the approach to median incisional hernia; preferably studies with randomized patients; clear and unambiguous description of the open and laparoscopic surgical techniques; the presence of most of the outcomes of interest; accuracy and reliability in the description of the obtained results; when the same author / institution reported two studies, we used the one with greater statistical weight or the more recent one. There were excluded from the analysis: studies in which the main outcomes of interest are not reported the two techniques or are not considered; inability to define the required data for meta-analysis of the published results.

The outcomes used to compare the two techniques (Table II) are:

- Operator outcomes: surgical time;
- Morbidity: complications;
- Functional outcomes: postoperative pain, postoperative hospital stay;
- Relapse: recurrence after 1 year, recurrence after 5 years.

In our study the statistical analysis was conducted with Hintze J. (2006), NCSS, Kaysville (Utah). It was performed with the NCSS program: using the Meta Analysis of proportions for the values of the outcomes of interest. The statistical analysis for variable categories is conducted using the odds ratio (OR) as the primary statistical method. This ratio represents the adverse events that are caught by the laparoscopic surgical treatment compared with the reference group, in open surgery.

An odds ratio less than 1 favors the treatment group and the value of OR is considered statistically significant when  $P < 0.05$  if the confidence interval of 95% does not include the value 1<sup>9-11</sup>.

## Results

Among the studies reported in literature between 1999 and 2009<sup>2-8, 12-46</sup>, 7 studies were selected (Table I) as suitable for meta-analysis because they were the only which dealt with the most of the outcomes pursued and allowed us to gather a total of 1165 patients:

*Outcomes operators* (Table III). The average surgical time was for the laparoscopic surgery (96.4 min, range 43.5-149) than for the open surgery (108.3 min, range 72-179): the difference was significant for the statistical analysis (OR 77.70 95% CI 17,98-137,41,  $p < 0.0001$ ).

TABLE I - Characteristics and demography of the studies.

Study	Cases		Total Cases	Age (years)		Male/Female		Size of Defect		BodyMass Index (BMI)	
	Lap	Op		Lap	Op	Lap	Op	Lap	Op	Lap	Op
Naveen Ballem 2008	106	119	225	58	58	N/A		11.2 Cm	9.8 cm	34	30
McGreevy J.M 2003	65	71	136	53.8	55.8	N/A		N/A		N/A	
Misra M.C 2006	33	33	66	45.9	45.2	11/22	7/26	65.66 cm <sup>2</sup>	42.12 cm <sup>2</sup>	26.2	25.4
Earle D 2006	249	220	469	51	53	92/156	112/107	N/A		N/A	
Chris M. Pring 2008	30	24	54	64.5	55	17/13	11/13	23.8 Cm <sup>2</sup>	23.2 cm <sup>2</sup>	N/A	
Olmi S 2007	85	85	170	60	65	38/47	35/50	9.7 Cm	10.5 cm	28	28
Barbaros U 2007	23	23	46	50.7	54.1	4/19	9/14	N/A		31.6	31.2

Legend: LAP: laparoscopic; OP: open surgery; N/A: not available.

TABLE II - *Outcomes*

Study	Operative time-mean (min)		Days in hospital		Complications		Recurrence(%)				Pain VAS Score (1 day)		Blood Loss(ml)	
	Lap	Op	Lap	Op	Lap	Op	Lap	Op	Lap	Op	Lap	Op	Lap	Op
Naveen Ballem 2008	N/A		N/A		N/A		15	11	29	28	N/A		N/A	
McGreevy J.M 2003	140	130	1.1	1.5	5(8%)	15(21%)	N/A		N/A		N/A		N/A	
Misra M.C 2006	86	75	1.47	3.43	7	14	6.25	3.33	N/A		5.95	6.05	28.5	127
Earle D 2006	149	179	1	2	N/A		8	7	N/A		N/A		N/A	
Chris M. Pring 2008	43.5	42.5	1	1	10	12	0	1	0		N/A		N/A	
Olmi S 2007	61	151	2.7	9.9	16.4%	29.4%	2.3	1.	N/A		N/A		N/A	
Barbaros U 2007	99	72	2.5	6.3	N/A		0	1	N/A		N/A		N/A	

Legend: VAS: visual analog scale; LAP: laparoscopic; OP: open surgery; N/A: not available.

TABLE III - *Results of the meta-analysis: lap vs. open surgery*

Outcomes	N. of patients	N. of studies	OR	95% CI	Chi-squared	P value
Operating time	941	6	77,7006	17,98-137,4187		
Complications	319,8715	0,0001*				
	426	4	1,8683	1,2046-2,8976	8,4084	0,0777
Postoperative pain	66	4	1,0000	1,0000-1,0000	N/A	0,500
Recurrence 1 year	1030	6	0,7714	0,4522-1,3157	3,3294	0,7665
Recurrence 5 years	279	2	0,8419	0,4769-1,4863	0,5405	0,7632
Length of stay	941	6	79,6516	8,7792-150,52	8793,8837	0,0001*

Legend: OR: Odds ratio; CI: Confidence Interval; \*: statistically significant (p < 0,05).

The level of complications was lower in the laparoscopic group in all the 4 studies; in the meta-analytic valuation the overall morbidity was lower in the laparoscopic group with no significant statistical difference (OR 1.863, 95% CI 1.2046 / 2.8976, p < 0.0777): this parameter has included a cumulative assessment of all the abdominal and extra-abdominal complications.

#### *Postoperative functional outcomes* (Table III)

The average postoperative hospital stay was 1.62 days respectively (range 1-2,7) for laparoscopy and 4.2 days (range 1-9,9) for the open surgery (79.6516 OR 95% CI 8.7792 -150.52, p < 0.0001).

The postoperative pain was evaluated only in one of the

seven effected studies, it was analyzed with an index VAS on a scale of 1-10, taking into consideration only the first postoperative day. The extrapolated value was not statistically significant (OR 1.000, 95% CI 1,000-1,000, P < 0.500).

#### *Long-term outcomes* (Table III)

Recurrence rates after 1 year were similar in both the groups, without significant differences in the statistical analysis (OR 0.7714 95% CI 0,4522-1,3157, p 0.7665). There were no significant differences either in terms of relapses after 5 years (OR 0.8419 95% CI 0,4769-1,4863, p < 0.7632).

## Discussion

Since the 90s, we have seen a gradual diffusion of minimally invasive techniques, of new biocompatible materials and increased procedures carried out with new technologies. The results are a significant reduction of morbidity and especially of postoperative hospital stay<sup>1-8,12-46</sup>. The laparoscopic technique becomes the first choice in specialized hospitals for many surgical procedures, including repair of ventral hernia and the abdominal cavity. In this way a scientific debate starts, first on technical aspects of this kind of surgery and then on its validity. In literature there are already meta-analytic studies which compare the minimally invasive and open surgical approaches regarding the treatment of medial incisional hernia<sup>11,12</sup>.

Our literature search led us to analyze seven studies, and it allowed us to have a comprehensive and thorough case studies.

Today, controlled studies comparing laparoscopy and traditional surgery in the treatment of median incisional hernia are enough to support some technical and clinical considerations: the seven studies considered in this review bring together a total of 1165 patients and both the results of perioperative and remote evaluation of recurrences are considered among the end-points<sup>2-8</sup>.

It is important to say that the measures of parietal defect considered in both study groups are of the similar size: Naevee reports hernia orifice of 11.2 cm for the laparoscopy and 9.9 cm for the open surgery, Misra 66.6 cm<sup>2</sup> for the lap and 42.2 cm<sup>2</sup> for the open surgery, Chris approximately 23 cm<sup>2</sup> for both the techniques, Olmi 9.7 cm<sup>2</sup> for the lap, 10 cm<sup>2</sup> for the open surgery. There should be also mentioned the types of implants used in both the surgical approaches:

- McGreevy, OP: Polypropylene. LAP: Dual-Mesh (Gore) or Composix mesh (Bard).
- Misra: Polypropylene mesh on both the types of surgery.

Cris-M Pring: PTFE mesh on both the types of surgery. Olmi: OP: Polypropylene. LAP: Polyester mesh (Parietex Composite Mesh) consists of 3 strands of multifilament polyester with a coating of collagen to prevent the forming of adhesions.

Our study shows that recurrence rates after 1 and 5 years of ventral incisional hernia and postoperative pain in 24 hours are not significantly different for the open and lap techniques. However, there were found significant differences between surgical time and the length of hospital stay in favor of mini-invasive technique.

Regarding postoperative complications there were no differences. The prevalence of postoperative complications, however, was more for the open than for the laparoscopic approach, but without any statistical significance. McGreevy reports 5 complicated cases (8%) in the laparoscopic group (2 seroma, 2 mesh infected, 1 enterotomy not recognized), while in the open group 15 cases (21%)

were reported, 3 of them are more severe (1 wound dehiscence, 1 intraperitoneal abscess, 1 respiratory failure) and 12 are less important (6 wound infections, 3 cases of seroma drained and 3 cases of ileum). Misra reported 14 complicated cases in the open group (9 of superficial wound infections, 1 deep wound infection, 1 mesh infection, 1 skin necrosis, 1 urinary retention, 1 seroma) and 7 in the laparoscopic group (2 superficial wound infections, 1 urinary retention and 4 seroma). In the laparoscopic group, Cris M Pring reported 10 complicated cases (5 seroma, 1 wound infection, 2 patients with urinary retention and 2 with pulmonary microembolism) and in the open group 12 complicated cases (8 seroma, 4 wound infections). Olmi reported 11 complicated cases (14.4%) in the laparoscopic group (6 persistent seroma, 4 patients have neuralgia, 1 intestinal obstruction) and 24 complicated cases (29.4%) in the open group: 20 of them with the less severe complications (6 wound infections, 1 seroma, persistent serous secretions 2, 1 fecal obstruction, 2 with intestinal obstruction, 8 with neuralgia) and 4 with the more severe complications (1 wound infection which led to severe sepsis, 1 caval thrombosis, 1 case of pulmonary embolism and 1 case with postoperative hemorrhage).

The average postoperative pain in both the groups which was taken consideration in the first 24 h with the VAS scale, is not significantly different, although if it was evaluated in the only one study of the seven.

The same thing may be said about recurrences, taken into consideration after 1 and 5 AA: both the techniques are equally effective in the repair of wall defect.

From the analysis of the outcomes data, however, there were emerged two significant factors: the operative time and hospital stay.

The average surgery time is shorter in laparoscopic surgery than in open surgery (96.4 vs. 108.3 minutes). This is quite common to all the experiences, because of the increased speed with which the defect is repaired from inside the abdominal cavity rather than the traditional surgery that requires extensive preparation of the wall.

In this way, the average postoperative hospital stay was shorter for the cases with the minimally invasive surgery access, with a more rapid recovery to common activities.

As for the regarding health care costs, we have no data on it. Surely minimally invasive surgery is more expensive than the open surgery, especially for the materials used. However the most rapid recovery and decreased hospital days are often sufficient to reduce the overall costs of surgery, as in all laparoscopic operations.

In our review we do not speak about the average conversion rate from laparoscopic to open surgery for lack of the data.

## Conclusions

The approach to laparoscopic surgery of the median incisional hernia is feasible, standardized and secure. Certainly

it is more expensive, but it can guarantee the same results of the common approach of the open surgery, encouraging a faster return to the normal daily activities.

## Riassunto

Nell'ultimo decennio abbiamo assistito ad una progressiva diffusione dell'approccio chirurgico laparoscopico nella correzione del laparocele mediano. L'obiettivo di questo studio consiste nell'analisi critica dei risultati della chirurgia laparoscopica e laparotomica nell'approccio al laparocele mediano, attraverso la revisione meta-analitica dei principali trials prospettici controllati. Sono emersi 7 studi idonei ad una meta-analisi, per un totale di 1165 pazienti. Tra gli outcomes perioperatori sono stati osservati, con significatività statistica, una riduzione del tempo operatorio ed una riduzione della degenza post-operatoria a favore della laparoscopia. Non sono emerse differenze significative sugli altri end-points perioperatori, nè su recidiva di malattia a distanza di 1 e 5 anni. La laparoscopia è da considerarsi una valida alternativa tecnica alla chirurgia tradizionale laparotomica nel trattamento del laparocele mediano.

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## Commento e Commentary

PROF. NICOLA PICARDI

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*Lo scopo indiscutibile della riparazione chirurgica di un laparocele è quello di abolire l'area di debolezza parietale e di contrastare la possibilità che i tessuti o gli organi prolapsati possano andare incontro a complicazioni vascolari.*

*In tal senso la riparazione laparoscopica dimostra la sua indiscutibile efficacia per i laparoceli di dimensioni limitate e la ricostruzione della continuità parietale vale anche a restaurare la corretta dinamica respiratoria.*

*Per i grandi laparoceli la questione si presenta con diversi aspetti sia anatomici che funzionali. Le grandi brecce parietali si accompagnano a vistosi prolapsi degli organi mobili dall'addome, soprattutto l'intestino, con completa alterazione della dinamica respiratoria: abbassamento stabile del diaframma, inefficienza della respirazione addominale, aumento del volume residuo e quindi riduzione della capacità vitale e, dal punto di vista del circolo, riduzione del ritorno venoso e stasi in ambito portale con tutte le conseguenze ben note.*

*La riparazione di questi grandi laparoceli si avvale dell'impiego di reti protesiche a sostegno di una parete addominale non più suscettibile di riparazione con i tessuti autoctoni ma deve rispondere a due finalità: la chiusura della breccia e la ricostruzione della continuità della parete addominale con quella tensione calibrata che valga a riportare il diaframma al suo livello anatomico-fisiologico. La riparazione laparoscopica è certamente valida per la prima finalità, ma non può proporsi di raggiungere validamente la seconda. Pertanto si ritiene del tutto valida e proponibile per i laparoceli di piccole dimensioni ma non certamente per quelli più ampi.*

*Se essa è valida per una ricostruzione anatomica, con gli indubbi vantaggi di un accorciamento dei tempi operatori ed una riduzione della degenza postoperatoria, per non parlare del contenimento della sintomatologia dolorosa e la più precoce mobilitazione possibile del paziente, purtroppo essa non è in grado di rappresentare un valido riferimento di chirurgia ricostruttiva in senso funzionale nel caso dei grandi laparoceli, ottenibile soltanto con una serie di accorgimenti della chirurgia a cielo aperto*

\* \* \*

*The authors of the valuable study aims to compare the statistically comparable aspects between the two surgical methods, but does not discuss any of the purposes of functional reconstructive surgery in the abdominal incisional hernia.*

*The main goal of the surgical repair of an abdominal incisional hernia is to abolish the parietal area of weakness and to oppose the possibility that tissue or prolapsed organs can suffer of vascular complications.*

*In this sense, the laparoscopic repair proves its undeniable effectiveness for hernia of small size and the reconstruction of continuous wall, with the second result of restoring the correct respiratory dynamics.*

*For large incisional hernias the question presents different aspects, not only anatomical but also functional.*

*The large parietal gaps are associated with the prolapse of a major bulk of abdominal content, especially the intestine, with consequent complete alteration of the respiratory dynamics: stable lowering of the diaphragm, abdominal breathing inefficiency, increased residual volume and thus a reduction in vital capacity and, from the point of view of the haemodynamics a decreased venous return to the heart and a stasis within the portal system, with all the well known consequences.*

*The repair of these large incisional ventral hernias takes advantage of the use of prosthetic meshes as support of the abdominal wall, because it is no more possible a reparation with native tissues but must meet two needs: the closure of the breach and the reconstruction of continuity of the abdominal wall with that calibrated tension necessary to return back the diaphragm to its anatomical and physiological level. The laparoscopic repair is certainly valid for the first purposes, but cannot fulfill the second purpose. Therefore it is considered to be fully valid and feasible for small incisional hernias, but certainly not for large ones.*

*If it is valid for an anatomic reconstruction, with the undoubted advantages of a shortening of the operative time and a reduction of hospital stay, not to mention the containment of the pain symptoms and the most anticipated mobilization of the patient, nevertheless it is not capable of represent a valid reference to reconstructive surgery in a functional sense in the case of large ventral hernia, obtainable only with a series of features of open surgery.*

*Il pregevole studio degli Autori si propone di paragonare gli aspetti statistici confrontabili tra le due metodiche, ma non prende in esame uno degli scopi funzionali della ricostruzione chirurgica della parete addominale nel laparocele.*

## References

Picardi N, Sigismondi G, Di Paolo S, Vene M, Visini R: *Identificazione di un parametro obiettivo di riferimento per la ricostruzione secondo criteri fisiopatologici del grande laparocele.* Ann.Ital.Chir. 2005; 76(1): 31-37