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Comparative study of laparoscopy and open surgery in the treatment by prosthesis of incisional hernia

Alexis Mupepe Kumba[1], Filippo Banchini[2], Setondji GR Attolou[3], Enrico Banchini[4], Delphin K. Mehinto[3], Patrizio Capelli[2]

1 *Medical Technic's Institute of Uvira, Uvira, South Kivu province, Democratic Republic of Congo*
2 *Operational Unit of General, Vascular and Senology Surgery of "Guglielmo da Saliceto" Hospital of Piacenza in Italy*
3 *University Clinic of Visceral Surgery "B" at the National University Hospital Center Hubert Koutoukou Maga of Cotonou, Republic of Benin.*
4 *Anesthesia and Reanimation Service, "Santa Maria Nuova" Hospital, Reggio Emilia city, Italy*

Abstract

Purpose: authors aimed to compare laparoscopy and open surgery in prosthesis repair of incisional hernias. **Methods:** in this descriptive and analytical retrospective study of 4years, 179 cases were operated by prosthesis, 120 cases of open surgery and 59 cases of laparoscopy. We compared epidemiologic, anatomic and therapeutic variables using SPSS software. **Results:** programmed cases have more than 30% of chance of being operated by laparoscopy than by open surgery, OR [95% CI] = 0.3 [0.12-0.92]. Clean cases are statistically 8% more likely to be laparoscopically operated than open surgery (OR [95% CI] = 0.08 [0.01-0.68]). Patients operated by laparoscopy were 30% more likely to have less than 5 days of hospitalization compared to those operated by open surgery, hospital stay ≤5 days: OR [95% CI] = 0.3 [0.03-2.81]. P-value was 0.42 for duration of intervention and 0.024 for complications. **Conclusion:** clean and programmed cases preferentially benefit from laparoscopy and the hospital stay is reduced. Open surgery is preferred in an infectious context.

Keywords: incisional hernia, open surgery, laparoscopy, prosthesis.

INTRODUCTION

Incisional herniaare a common complication after abdominal surgery, occurring in 10 to 20% of cases after laparotomy, but may also occur after laparoscopy [1]. This postoperative complication is promoted by abdominal hyperpressure (which occurs during coughing, vomiting, meteorism) and circumstances that alter the healing process: Undernutrition, obesity, infection or ischemia parietal, corticosteroids, chemotherapy, and iterative interventions on the same site [2]. Two parietal repair techniques are validated, the parietorraphy (simple fascial suture) and the fascial suture associated with the interposition of prosthetic material [1]. Since the era of pioneers and first parietal prostheses, polypropylene in the USA and polyester in France, the use of prostheses has become essential in parietal surgery, as well for the hernias of the groin as for the incisional hernias [3].

But there is still no consensus on the optimal approach, hence the need for comparative studies, laparoscopy versus open surgery in the repairing by prosthesis of incisional hernias.

METHODS

Our study was conducted at the Operational Unit of General, Vascular and Senology Surgery of "Guglielmo da saliceto" hospital of Piacenza in Italy. This is a descriptive and analytical retrospective study over a period of 4 years from January 1, 2013 to December 31, 2016.

The study concerned all patients brought to the operating room with pre- or perioperative diagnosis of incisional hernia. Were included all cases registered in the hospital database during the study period and who had been treated by prosthesis procedure.

We used the European Hernia Society classification for incisional abdominal wall hernias [4] to make 2 groups according to the location: *Midline* (subxiphoidal, epigastric, umbilical, infraumbilical, suprapubic)

***Corresponding author:**
Alexis Mupepe Kumba
Medical technic's institute of Uvira, Uvira, South Kivu province, Democratic Republic of Congo
Email:
mupepekumba@gmail.com

and *lateral* (subcostal, flank, iliac and lumbar). In relation to the size, 3 groups: *small* (<4cm), *medium* (≥ 4cm to 10cm) and *large* (≥ 10cm).

The following variables were studied: *epidemiology:* age and gender; *anatomy:* location, size, number of orifice; *therapeutic*: Character of procedure, Duration of surgery, Type of anesthesia, State of the operating site, Hospital stay, Associated procedures, Surgical approach, Surgical technique, Type of prosthesis and complications.

Variables were analyzed using SPSS statistical software (IBM SPSS Statistics for Windows, version 20.0 Armonk, NY: IBM Corp.).The Pearson Khi2 test was used to test the correlation of the variables. The link was retained as statistically significant for a P-value of less than 5% (P≤0.05).

RESULTS

We collected 239 cases of incisional hernias including 179 cases operated by prosthesis: 120 cases by open surgery and 59 cases by laparoscopy; 54 cases of parietorraphy and 6 cases of surgical abstention. The mean age of the laparoscopic cases was 63 ± 12.87 years vs 66 ± 14.25 for open surgery. The p-value was p = 0.10. The laparoscopic sex ratio was 0.51 and 0.66 per open surgery. The p-value was p = 0.42. The variable elective or urgent character had the p-value p= 0.034. The p-value of the anatomical variables, size, location and orifice number were 0.699; 0.243; and 0.349. (Table 1)

Table 1: Case Distribution by Epidemiological and Anatomic Variables

Variables	Laparoscopy	Open surgery	Total	P
Age	59	120	179	0,1*
[20-41]	2	7	9	
[41-61]	35	66	101	
[61-81]	19	27	46	
≥ 81	3	20	23	
Mean ± SD	63±12,87	66±14,25	-	
min	20	24	-	
max	88	88	-	
Gender	59	120	179	0,42*
Male / Female	20/39	48/72	68/111	
Character	59	120	179	0,034
Elective	54	94	148	
Urgent	5	26	31	
Size	59	120	179	0,699*
- Small	34	70	104	
- Medium	8	21	29	
- Large	17	29	46	
Number of orifices	59	120	179	0,349*
- double	9	5	14	
- unique	41	102	143	
- more than 2	9	13	22	
Location	59	120	179	0,243*
- Lateral	5	15		
- Midline	54	105		

*non statistically significant

The mean intervention time was 132 ± 206 minutes by laparoscopy and 194 ± 236 minutes by open surgery. The p-value was p = 0.42. The average laparoscopic hospital stay was 4 days and 7 days for open surgery. Patients who exceeded 23 days were operated by open surgery. Statistically, the p-value was p <0.0001. The polypropylene prosthesis was used in 44 out of 59 patients operated laparoscopically and 88 patients out of 120 patients operated by open surgery, for a total of 132 cases out of 179. The biological and absorbable prostheses were not used in laparoscopy. Statistically, the p-value was p = 0.06. (Table 2)

Table 2: Distribution by Therapeutic Variables: Duration of surgery, Hospital stay and Type of prosthesis

Variables	Laparoscopy	Open surgery	Total	P
Duration of surgery (minutes)	59	120	179	**0,42***
<45	5	32	37	
[45-90]	29	35	64	
[90-180]	6	16	22	
≥180	16	37	53	
Mean ± SD	132±206	194±236	-	
min	34	23	-	
max	968	967	-	
Hospital stay (days)	59	120	179	**(p<0,0001)**
≤5	50	61	111	
[6-16]	8	54	62	
[16-30]	1	3	4	
≥30	0	1	1	
Mean ± SD	4±3,3	7±10,9	-	
min	1	1	-	
max	22	112	-	
Type of prosthesis	59	120	179	**0,060***
absorbable	0	5	5	
e-PTFE	1	9	10	
polypropylene	44	88	132	
polyester	14	11	25	
biologic	0	7	7	

*non statistically significant

Laparoscopy was performed exclusively under general anesthesia 59 cases / 59. 110 cases out of 120 of open surgery were operated under general anesthesia, 5/120 by local anesthesia and 5/120 under locoregional anesthesia. The p-value was p= 0.28. For the state of the operative site, the p-value was p = 0.007. No infected cases (0/59) were operated by laparoscopy. 19 cases / 20 contaminated were operated by open surgery. All cases with reported infection were operated by open surgery 3cases / 3. Of 59 cases operated laparoscopically, 58 cases were clean, with no infection or concept of perioperative contamination. The associated procedures variable had p-value p= 0.387. p-value of the complications variable was p= 0.024. 58cases/59 laparoscopic patients had no complications, 1case / 59 had acute urine retention. 22 cases out of 120 cases operated by open surgery presented complications, 2 cases of death, 4 cases of respiratory distress, 2 cases of surgical site infection, 3 cases of subcutaneous hematoma, 6 cases of transit disorder and 5 cases with other complications such as entero-cutaneous fistula, hematuria, intraoperative bladder lesions, and generalized acute peritonitis. (Table 3)

Table 3: Distribution by Therapeutic Variables: Type of prosthesis, State of the operating site, associated procedures and complications

Variables	Laparoscopy	Open surgery	Total	P
Type of anesthesia	59	120	179	0,28*
- General anaesthesia	59	110	169	
- local anesthesia	0	5	5	
- locoregional anesthesia	0	5	5	
State of the operating site	59	120	179	0,007
- infected	0	3	3	
- clean	58	98	156	
- contamineted	1	19	20	
Associated procedures	59	120	179	0,387*
ablation of infected prosthesis	1	3	4	
Inguinal hernia treatment	1	5	6	
Extra abdominal surgery	0	1	1	
Intra-abdominal surgery	2	2	4	
Bowel resection	1	13	14	
Any	54	96	150	
Complications	59	120	179	0,024
deceased	0	2	2	
Respiratory distress	0	4	4	
infection	0	2	2	
Hematome	0	3	3	
Transit trouble	0	6	6	
Others	1	5	6	
Any	58	98	156	

*non statistically significant

Four variables presented a statistically significant p-value: Character (p = 0.034); state of intervention (p = 0.007), hospital stay (p <0.001) and complications (p = 0.024). The programmed patients have an odd-ratio OR [95% CI] = 0.3 [0.12-0.92]. Patients with a clean surgical site had odd ratio OR [95% CI] = 0.08 [0.01-0.68], Cases with less than 5 days of hospitalization had Odd-Ratio OR [95% CI] = 0.3 [0.03-2.81]. (Table 4)

Table 4: Distribution showing Odd Ratio of character, state of the operating site and hospital stay.

Variables	Laparoscopy	Open surgery	OR [IC 95%]	P
	Effectif (59)	Effectif(120)		
Character			0,3[0,12-0,92]	0,034
elective	54	94	0,3[0,12-0,92]	0,034
urgent	5	26	Ref	*
State of the operating site			3.16 [1,03-9,6]	0,043
Clean	58	98	0.08 [0,01-0,68]	0,02
Infected	0	3	Ref	*
Contaminated	1	19	1	*
Hospital stay			3.81 [1,86-7,79]	p<0,0001
≤5	50	61	0.3 [0,03-2,81]	0,29
[6-16]	8	54	1.7 [0,16-17,06]	0,65
[16-30]	1	3	1	*
≥30	0	1	Ref	*

DISCUSSION

- **Age, gender and character**

In our study, age (p = 0.1) and sex (p = 0.42) do not have a statistically significant relationship with surgical approach for prosthetic repair of incisional hernia. The mean age of the laparoscopic cases was 63 ± 12.87 years versus 66 ± 14.25 for open surgery. Laparoscopic sex ratio was 0.51 and 0.66 for open surgery. The elective or urgent character of operative indication had statistically significant relationship with surgical approach p= 0.034. The programmed cases have more than 30% chance of being operated by laparoscopy than by open surgery, OR [95% CI] = 0.3 [0.12-0.92]. According to the 2013 Medico-Surgical Encyclopedia, when either approach can be used, laparoscopy is preferred [2].

- **Location, size, and orifice number**

The p-value was respectively 0.243; 0.699 and 0.349 for location, size and orifice number. Therefore, statistically, do not influence the approach in the prosthetic treatment of incisional hernias (p> 0.05). The Guidelines for Laparoscopic Treatment of Ventral and Incisional Abdominal Wall Hernias showed that size correlates with recurrence, and the authors recommended a restriction of the laparoscopic approach to an incisional hernia with a diameter greater than of 10 cm. [5] Because the laparoscopy needs other orifices remote from the opening of hut to be corrected, which increases the risk of recurrence and poses a technical problem of the implantation site of the prosthesis which must have a margin of about 5cm.

- **Type of anesthesia, state of the operative site and associated procedures.**

In our study, the type of anesthesia (p = 0.28) and associated procedures (p = 0.387) did not have statistically significant relationships with the approach. However, it should be noted that a general anesthesia is used in 100% of cases operated by laparoscopy. Infectious status was found as a factor influencing the approach (p = 0.007). Of the 59 cases operated laparoscopically, 58 were clean and 1 contaminated. Individual cases statically, 8% more likely to be operated laparoscopically than open (OR [95% CI] = 0.08 [0.01-0.68]). All infected cases were operated by open surgery.

The principles of repair of herniation in the context of surgical contamination and site infection involve the removal of the source of contamination and the reconstruction of the abdominal wall. These operations are difficult and often lead to complications that lead to the frustration of the surgeon and the patient [6]. This explains why open surgery is preferred to laparoscopy in case of infection. For large incisional hernias with an infected site, Zafar *et al*. [7] have successfully experimented with open-surgery implantation of a prolene prosthesis because of his physical properties, a monofilament that allows neutroplils and macrophages to eradicate bacteria, and have left the wound open to promote the granulation of the tissues and the progressive incorporation of the prosthesis. Only this requires a daily change of dressings and the complete healing of wounds can take up to a year.

- **Duration of procedure, hospital stay, complications and type of prosthesis.**

The duration of intervention did not depend on the approach, there is no significant difference between the two approaches (p = 0.42). Surgeons experience can explain the almost null difference of operating time between the two approaches. Egea *et al*. [8] have shown that learning reduces mortality and the duration of procedure-related intervention, minimum mortality beyond 100 interventions. The p-value in our study for the hospital stay is p <0.0001, which is

statistically significant. Laparoscopy has a mean of hospitalization of 4 days versus 7 days for open surgery. Patients who exceeded 23 days of hospitalization were operated by open surgery. Patients operated by laparoscopy were 30% more likely to have less than 5 days of hospitalization compared to those operated by open surgery, stay ≤5 days: OR [95% CI] = 0.3 [0.03-2.81].

Laparoscopic repair of incisional hernia has a shorter hospital stay, less wound infection, with identical or even lower recurrence rates [9]. The short hospital stay after laparoscopic prosthetic hernia repair found in the literature is similar to our results. There is a statistically significant relationship between the 2 approaches for complications (p = 0.024). Almost all laparoscopic patients had no complications. This can be explained in part by the fact that they are programmed patients, in good general conditions and uninfected state, unlike patients operated by open surgery who are often taken urgently for strangulation or intestinal incarceration.

The morbidity associated with laparoscopy was lower than that of open surgery in Park *et al*. [10] and Robbins *et al*. [11] studies. Nevertheless, each of these studies had limitations which did not allow concluding to the superiority of the laparoscopic technique over that used by the open route: in the study of Park *et al*., the choice of technique and equipment used in the group operated in open surgery could alone explain the number and nature of major complications. In the study of Robbins *et al*. there was no statistical analysis of the results, which seemed to benefit the laparoscopic approach by its lower rate of complications, although the deep infections requiring the removal of the ePTFE patch and the intestinal lesions were the same number on both sides. We recorded 2 deaths related more to the pathologies associated with the cure of herniation; these two cases had been operated by open surgery. Chevrel *et al*. [12] also explain the mortality in incisional hernia repair by no control of pathologies in per or post-operative, evolving with the herniation, independently of her, or due to her.

In our studies, the approach does not have a statistically significant relationship with the type of prosthesis (p = 0.06). Polypropylene, polyester and ePTFE prostheses have been used both open and laparoscopically. In laparoscopy, polypropylene and polyester prostheses are placed in retro-peritoneum. The ePTFE prosthesis was used in open surgery for cases of recurrence, due to fibrosis and the difficulty of parietal dissection. Biological and absorbable prostheses have not been used in laparoscopy.

In literature, for laparoscopy, the most used prostheses are those of ePTFE: GoreTex®, DualMesh®, DualMesh Plus®. The main feature of these prostheses is not to promote the adhesions of the viscera to the prosthesis. Their disadvantage is to be opaque and not to be rehabilitated by the granulation tissue. Other prostheses tending to avoid the formation of adhesions have recently been put on the market: Composix® and Parietex®. The prosthesis most used in open surgery, polypropylene (Prolene® or Marlex®) should be used in laparoscopy in extra-peritoneal position then the large omentum interposed between the loops and the peritoneum covering the prosthesis, taking into account the risk adhesions to the viscera and visceral fistulization [13, 14].

Limitations / Weaknesses

Some parameters were deliberately ignored in the study because the information was incompletely filled in the database in some patients. These include the Body Mass Index (BMI), surgical history, hernial sac contents, and conversion.

CONCLUSION

Prosthetic repair of hernias is recognized today as the most optimal. The programmed cases (elective) have more than 30% chance of being operated by laparoscopy and spend less than 5 days in hospitalization. These patients operated by laparoscopy present almost no complications. Clean cases are 8% more likely to be operated laparoscopically than open. On the other hand, open surgery is preferable when there is an infectious context. The duration of the intervention does not depend on the approach (route) of procedure.

Conflicts of interests: All authors of this study do not claim any conflict of interests.

Author's contribution

- Alexis MUPEPE KUMBA. and Filippo BANCHINI: acquisition of data, drafting the article, Substantial contribution to conception and design,

- Setondji GR. ATTOLOU and Enrico BANCHINI: Revising it critically for important intellectual content.

-Patrizio CAPELLI and Delphin K. MEHINTO: Final approval of the version to be published.

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