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A comparison of techniques and a review of the literature

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Incisional hernia, or post-laparotomy hernia, is a defect in the abdominal wall, which can produce mechanical and systemic changes in both respiratory and splanchnic circulation. This pathology has an important impact on Health and Society, with an incidence ranging from 2% to 20%, stimulating the improvement or development of surgical techniques, to reduce discomfort and complications, e.g. imprisonment, strangulation and recurrences. The growing availability of prostheses, with greater resistance and lower risk of visceral adhesions, has improved the result and reduced relapses. Over the past 15 years, further improvements have been achieved, thanks to the greater use of laparoscopy, decreasing relapses and complications and improving patient comfort. In this regard, the Ventralight Echo PS prosthesis, introduced for the first time in 2013 and routinely used by our team, have shown encouraging results. In this work, a retrospective study aims to compare in different aspects two groups of patients, suffering from defects on the abdominal wall and undergoing reconstructive surgery with laparoscopic technique. It has been used simple prostheses for the first, whereas the Echo PS- Positioning System with Ventralight – ST Mesh or Composix – L/P Mesh for the second group. In our experience, we conclude that the use of prostheses, such as the Ventralight Echo PS, in the treatment of incisional hernias, regardless of the location of the defect, is a valid and safe alternative to the use of non-self-expandable prostheses.

KEY WORDS: Incisional Hernia, Hernia Repair, Laparoscopic Technique

Introduction

Incisional hernia, or post-laparotomy hernia, is a mechanical alteration of the abdominal wall, which can induce mechanical and systemic alterations in both respiratory system and splanchnic circulation. The significant impact of this pathology on Health and Society has motivated the research to improve the surgical techniques, aimed to reduce discomfort and prevent complications, such as imprisonment, strangulation and recurrences[1-3]. However, the incidence of incisional hernias remains high and in several cases varies between 2 and 20% within 24 months of surgery[4-8]. The technological progress, in step with the video-assisted one, has allowed the development of less invasive surgical techniques, video-laparoscopic and robotic with minor complications intra and post-operative and greater benefits for the patient, thus resulting in a reduction of hospi-

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talization, early resuming the work activity and better aesthetic results [9-11]. In the light of the obtained results, the laparoscopic surgery is becoming the gold standard for the treatment of these pathologies [12,13], it is estimated that at least 4% of patients, undergoing open technique, will need another laparoscopic repair of the incisional hernia [14,15]. Several randomized clinical studies confirm that prosthetic repair has significantly improved the long term results, also reducing the number of relapses from 43% to 23%, as shown in the study of Roland W, et all, or 11% to 1% in the work of Arrojo A et all [16-18]. In the last 15 years, thanks to the greater diffusion of laparoscopy, a reduction of relapses and complications and a better patient comfort have been reached, as shown in the study of Picardi N, et all [19]. For this purpose, the Ventralight Echo PS prosthesis can be used as shown in some results [20,21]. Our work is focused on two groups of patients, with defects of the abdominal wall, undergoing reconstructive surgery with laparoscopic technique, using simple prostheses in the first and the Echo PS™ Positioning System with Ventralight™ ST Mesh or Composix™ L/P Mesh in the second group. The employed prostheses have a parietal and visceral surface for two different requirements: the first promotes fibroblastic growth, thus the adhesion process to the abdominal wall; the second reduces the risk of adhesions with the viscera and the possible colonization of pathogenic bacteria [18,22,23]. Dual Mesh® is a synthetic prosthesis manufactured with polytetrafluoroethylene foam.

This prosthesis has two surfaces with different characteristics: one surface is smooth, visceral and low porosity, other surface is rough, macroporous and facing the posterior abdomen wall. Instead, The Bard Composix E/X has both parietal layer, composed of two sheets of PP (polypropylene), and a layer, thin, formed by an e-PTFE foil with low porosity. The Ventralight prosthesis (Echo PS™ Positioning System with Ventralight™ ST Mesh or Composix™ L/P Mesh) is characterized by the presence of an inflation system placed on the lower profile, pre-ancorated, which facilitates its positioning. The prosthesis is composed of polypropylene monofilament woven with polyglycic acid fibers. The lower layer, visceral, is coated with hydrogel, based on sodium hyaluronate, and chemically modified as well as bioabsorbable, composed with carboxymethylcellulose, and polyethylene glycol (PEG) (Sepra technology), that is important as an anti-adherence barrier [24].

Materials and Methods

The comparison between the two groups aims to evaluate the results in terms of complications, recurrence in the short, medium, long term and the operator benefits derived from the positioning system, provided by Ventralight prosthesis.

In the period from January 2007 to december 2021, 408 patients with abdominal wall defects were recruited and treated with video-laparoscopic technique.

The first group, from 2007 to 2013, included 260 patients, treated with simple prosthetics (Dual Mesh; Bard Composix L/P Mesh); the second group, from january 2014 to december 2021, included 148 patients, was treated with Ventralight ECHO PS prostheses.

Technical notes: the patient position on the surgical bed is supine with arms along the body and legs slightly bent down to better position the clip applicators. In our experience, the Hasson trocar is always introduced with "open" technique on the right side, while the others, respectively 5 mm and 10 mm, are introduced in the coastal region and in the right iliac fossa. The 10 mm trocar is useful to resect preperitoneal fat or portions of omentum imprisoned in the hernial sac.

As in open surgery, the entire abdominal cavity is explored to detect any misconceived pathologies, thus the identification of the defect or defects of the wall is carried out. After a possible adhesiolysis and the complete reduction of the herniated content, pneumoperitoneum is reduced in order to ensure an accurate measurement of the hernial gate and the placement of the prosthesis with adequate overlap that, in our experience, is never less than 5 cm, also according with the data reported in the most recent literature. Then, the Ventralight ST prosthesis is soaked with physiological solution, to facilitate its passage, and inserted through the optical or 10 mm trocar. Once inside the abdominal cavity, the prosthesis is opened and oriented along the major axis of the defect, finally we proceed to pump up the pneumatic device allowing quickly and easily its expansion. The correct placement is guaranteed by the introduction of the Reverdin's needle, at the center of the parietal defect, which is superimposed on the center of the prosthesis.

Once the inflation system is intercepted by Reverdin's needle and the most suitable volume of the pneumoperitoneum is established, the system is extracted outside the abdominal wall and about 10 cc of air is injected into the Eco PS. When the prosthesis is extended inside the abdominal cavity and the complete cover of the defect is ascertained, it is fixed with a double crown of clips. In our experience, we use the not absorbable Covidien Protack 5 mm clips for the outer crown, while, for the inner ring we prefer the absorbable clips (Sorbafix 5 mm/36 cm) to limit the use of foreign materials. At the end of surgery using Duplospray system, we usually employ fibrin glue on the edges of the prosthesis to further reduce the risk of adhesions with the viscera [25,26]. Surgical incisions are sutured with a monofilament continuous suture. At the beginning of the surgery, Tap Block analgesia was performed on all patients [27,28]. In the post-operative we recommend the use of a belly band and a moderate compression of the defect to reduce the formation of any seromas for 5-6 days.

Results

The patient cohort recruited in the study is shown in Table I. Of these patients, 201 (49.26%) were female and 207 (50.74%) male (age 27-65).
In the first group of patients, the average duration of surgery was 104 minutes, with a range of 50-190 minutes (the median is 116 minutes). Only in 2.98 % of cases, the conversion to open technique was necessary due to the presence of an extensive adhesional syndrome. The average hospitalization was 3.6 days (range 2-16).
In the second group of patients, the average duration of the surgery was 44.84 minutes, with a range of 35-55 minutes (the median is 46 minutes). The average hospitalization was 2.06 days (range 2-3 days). All patients were checked after 7 and 15 days from hospital discharge and incorporated in the follow-up program that includes an outpatient clinical examination at 3, 6 months and 1 year. Tables II and III and 3 show the post-operative complications encountered in follow-up.

Discussion

For over two decades, laparoscopic treatment of abdominal wall defects has been introduced and several descriptive or comparative studies have done, with lower prevalence of cohort studies. A meta-analysis has been published in 2011 by Saurland (comparison between open and laparoscopic techniques), showing large variations in terms of recurrence [29,30].
Another meta-analysis published by Cochrane showed a reduction in re-hospitalizations and other complications such as fever and wound infection, as well as a significant reduction of rate of recurrence in subjects undergoing laparoscopic hernia repair, compared to laparotomy. All of this quoted studies demonstrate the greater validity and effectiveness of the laparoscopic technique and especially the employment of the Ventralight Echo prosthesis [31-34]. Most authors believe that the number of relapses is mainly associated to the fixing mode. Also Eker Heniford has pointed out in his experience that relapses depend on the type of devices used to fix the prosthesis. In this regard, transfascial sutures are associated with the lowest recurrence rate; moreover, the placement of a single clip ring could be responsible for a higher percentage of complications. The affixing of double-crown clips is the gold standard with a recurrence rate of 5%, according more authors. Cochrane's meta-analytical study reported a relapse rate of about 5% [29], although Hasan Eker's study showed an 18% recurrence in the first year of follow-up [35,36]. The best result was obtained in the study of Heniford, where the recurrence was only 4.7% [37,38].
Our research has not revealed significant morbidity correlated to the use of the Ventralight Echo prosthesis. Seroma is among the most significant complications in the first group of patients, especially, if it persists for more than 3 weeks or increases in size [39,40].
The average operating time in the second group of patients was 44.84 minutes, subjected to treatment with other different techniques and prostheses, compared to an average time of about 90,74 minutes, according to the different experiences reported in the literature.
This represents an important advantage of the employment of the Ventralight prosthesis, both in terms of costs for the healthcare facility that benefit for the patient, both for duration of anesthesia times and resumption of normal relationship life.
In none of the second group cases, we found the presence of hernial recurrence so far. In addition, the persistent post-operative pain did not represent a significant complication, due, probably, to the reduction in the number of metal clips used. It has never been necessary to use intra-abdominal drainage, because we usually put a compressive dressing with a tampon on the defect to reduce the formation of any seromas.
The employment of this new prosthetic system with positioning system allows the operator to perform the reconstruction of the abdominal wall more easily, with less risk of technical errors, and suggests an easier learning curve.

TABLE I - *The cohort of patients and distribution of abdominal defects.*

Site	Group 1	Group 2	Size range
Epigrastic	65 (25%)	39 (26,35%)	3-5 cm
Umbilical	143 (55%)	82 (55,41%)	4-8 cm
Sub-umbelical	52 (20%)	27 (18,24%)	3-7 cm

TABLE II - *Post-operative complications in follow-up to 6 Months Group 1*

Complication	Pazients	Rate
Recurrence	2	0,76
Seroma	6	2,31
Prosthetic infection	0	0
Abdominal pain	1	0.38
Bleeding	0	0

TABLE III - *Post-operative complications in follow-up to 6 Months Group 2*

Complication	Patient	Rate
Recurrence	0	0
Seroma	3	1,35
Prosthetic infection	0	0
Abdominal Pain	0	0
Bleeding	0	0

Conclusion

According to the data collected, we conclude that the emplyment of prostheses, such as Ventralight Echo PS, in the treatment of incisional hernias, regardless of the location of the defect, is a valid and safe option, as alternative to the use of non-self-expandable prostheses. In our opinion, this methodology could be used in all patients with a defect that not exceed the length of 15 cm. Definitely, the Ventralight Echo PS prosthesis is an effective and safe device in the field of new generation prostheses, because they have good tension and adhesion resistance, and easy positioning thanks to the innovative inflation system [41].

Riassunto

L'ernia incisionale, o post-laparotomica è un difetto della parete addominale che può causare alterazioni meccaniche e sistemiche sia di tipo respiratorio che a carico della circolazione splancnica. Questa patologia, avendo un impatto importante sulla Sanità e sulla Società con un'incidenza che varia dal 2% al 20 %, ha portato ad una costante evoluzione e miglioramento delle tecniche chirurgiche volte a ridurre il discomfort e le complicanze, quali incarceramento, strangolamento e recidiva. La crescente disponibilità di protesi con maggiore resistenza e ridotto rischio di aderenze viscerali ha migliorato i risultati e ridotto le recidive. Negli ultimi 15 anni, grazie alla maggiore diffusione della laparoscopia, si sono registrati ulteriori miglioramenti in termini di diminuzione delle recidive e complicanze associate a un migliore comfort del paziente.
A tal proposito la protesi Ventralight Echo PS, da noi usata routinariamente, e introdotta per la prima volta nel 2013, ha mostrato risultati incoraggianti. Questo studio osservazionale retrospettivo ha lo scopo di confrontare sotto diversi aspetti due gruppi di pazienti affetti da difetti acquisiti della parete addominale e sottoposti a chirurgia ricostruttiva con tecnica laparoscopica, usando nel primo gruppo protesi semplici e nel secondo gruppo la Echo PS™ Positioning System with Ventralight™ ST Mesh or Composix™ L/P Mesh. Nella nostra esperienza, concludiamo che l'uso di protesi, come la Ventralight Echo PS, nel trattamento delle ernie incisionali, indipendentemente dalla sede del difetto, rappresenta una valida e sicura opzione, in alternativa all'utilizzo delle protesi non auto-espandibili.

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