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Historic analysis of complex incisional hernia: To an understanding of the double prosthetic repair technique

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A B S T R A C T

The treatment of complex incisional hernias is, on occasions, a real social and professional, and still controversial, challenge. A multitude of techniques have been described over the years in an attempt to solve this problem. The social context and technological development of each period are essential to understand the continuous changes in the way of performing these techniques.

This article caries out an historical review of the prosthetic treatment of incisional hernias, trying to understand and apply the basic principles of the treatment of all incisional hernias to the repair with a double mesh.

Análisis histórico del tratamiento de la hernia incisional compleja: hacia una comprensión de la técnica de doble reparación protésica

Palabras clave:
Hernia incisional compleja
Tratamiento quirúrgico
Doble malla

R E S U M E N

El tratamiento de las hernias incisionales complejas es, en ocasiones, un verdadero reto social y profesional todavía controvertido. Multitud de técnicas han sido descritas a lo largo de los años para intentar solucionar este problema. El contexto social y el desarrollo tecnológico de cada época son esenciales para comprender los continuos cambios en la forma de realizar dichas técnicas.

Este trabajo tiene como objetivo realizar una revisión histórica del tratamiento protésico de la eventración compleja, buscando comprender y aplicar los principios básicos del tratamiento de toda eventración a la reparación con doble malla.

Introduction

The treatment for complex incisional hernias (CIH) is at times a real social and professional challenge. Several different techniques have been described throughout the years in order to solve this problem. The social context and technological development of each era are essential for understanding the changes in the way these techniques are carried out. This

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article carries out an historical analysis in attempt to find the origins of the double repair technique (DRT) in the treatment of complex hernias and in order to better understand the concepts that support it.

Herniorrhaphies

We must look for the origin of hernial surgery at the start of the 18th century, following the discoveries of anaesthesia and antiseptic techniques. We must assume that the possibility of performing surgery on the abdominal cavity for the treatment of a multitude of diseases represents the starting point for the appearance of this medical problem. The main references on the topic show that, originally, hernias were treated by surgery using an intra-abdominal approach. Gerdy, in 1836, after opening and exploring the abdominal cavity, corrected the hernial defect using a single suture of all tissue layers,[1] and Maydi, in 1886, used a different suture for each layer of the abdominal wall.[2] However, at the end of the 18th century, the fear of visceral complications following this ever-more frequent surgery led to advising against entering the abdominal cavity to correct a hernia. This fact is accepted by the majority of surgeons and has remained a pertinent standard practice even today. Furthermore, this marked the start of a new era characterised by the development of very complex techniques for solving an ever-more frequent problem (plasties, grafts, and microsurgery).

Hernioplasties

Hernioplasties filled the imaginations of many surgeons at the time, and the therapeutic arsenal multiplied, even to the point where each author described his/her own opinion for attempting to solve a single problem. Of these, we will mention those that represent the pillars of the three major options that constitute the current surgical approach:

1) Noble, in 1893, proposed a lateral incision over the anterior rectus sheath and suturing of both free sides over the hernia.[3] This procedure was picked up and popularised by Welti-Eduel in 1941, and makes up the foundation for understanding the current Chevrel technique.[4,5]
2) In 1966, Albanese proposed mobilising the musculoaponeurotic element of the abdominal wall using releasing incisions of the external oblique muscle in order to pull the tissues together and cover the hernial defect.[6] This author must be considered as the forefather of the current technique by Ramirez and its variations with a prosthesis.[7]
3) In 1956, Bourgeon described the intra-abdominal approach using a nylon mesh.[8] This author was a pioneer in the posterior treatment of hernias, and his work is vital for understanding laparoscopic repair and DRT. Bourgeon mentions that "individual identification of the different anatomical layers is completely useless," that "the mesh can be directly situated in contact with the abdominal viscera," and that "it must be fixed using transmural sutures 5 cm from the edges of the herniation" (Figure 1). These three premises were written almost 40 years before the first laparoscopic repair was published. The advantages of the Bourgeon operation are, according to its author, "a simple procedure (no dissection of the intermediate layers), the risk of infection is minimal, and the seromas drain into the interior of the peritoneum."[9]

Starting in 1900 with Witzel,[10] the use of mesh was introduced almost at the same time in hernial surgery. In 1928, Goepel used stainless steel ring mesh.[11] In 1944, Acquaviva used nylon mesh.[12] In 1947, Goñi Moreno described the progressive pneumoperitoneum technique used to reduce large hernias.[13] In 1948, Koontz used a tantalum mesh,[14] and in 1959, Usher advocated the use of polypropylene (PP) (Marlex®) as a replacement material for defects of the abdominal wall. This was also the first publication to highlight the use of two meshes (Figure 2).[15-17] With the development of new materials, standard practices were more or less accepted by the scientific community going into the 1970's: the intra-abdominal approach is advised against except in exceptional circumstances, and the placement of a mesh behind the rectus muscle (Rives) or preperitoneal area (Stoppa) were the most academically accepted solutions to the problem.[18-20] With regard to the contributions by Stoppa, the most interesting for our purposes is not the development of placing the mesh in the extraperitoneal space, but rather the premise of using a single giant mesh in order to prevent slippage and the use of sutures to hold it in place. This principle, the "size of the prosthesis," is fundamental for understanding current DRT.

Figure 1 – Original image by Bourgeon.

Figure 2 – Original image by Usher.

During the 1970s and 1980s, the "biological theory" was developed for hernias. The studies by Peacock, Read, etc. suggest that hernias are characterised by abnormal features and biochemistry.[21-32] These advances in biochemistry were fundamental for establishing hernias as a general and systemic disease. This meant that a more complete correction of the abdominal wall was necessary for treatment, and not just a surgical procedure limited to the hernial defect. These studies were complemented with an improved understanding of the scarring process and provided the foundation for explaining the "tension-free hernioplasty" proposed by Lichtenstein in 1989.[33-36] It is also worth mentioning that this author proposed a fairly non-academic operation that went against the techniques developed using classical anatomical studies as the mesh was placed before the muscule. Howveer, it proved its benefits in patient results. In 1989, Van der Lei and Bleichrodt[37] advised the use of a double row of sutures in order to avoid recurrence, and this double fixation concept is a clear predecessor of the double suture technique used by laparoscopic surgeons.

1990's

The decade of 1990 started with two clinical and experimental findings: 1) CIH is a systemic disease, and 2) mesh is required to correct large hernial defects without generating tension and ischaemia. In 1991, laparoscopic approaches began to be developed using this basic understanding. Le Blanc, in 1993, described the laparoscopic repair of hernias (IPOM), and other relevant authors, such as Franklin, Heniford, etc., have continued to add to the technique into the 20th century,[38-44] always accompanied by the appearance of new generations of surgical meshes and improved understanding of parietal involvement. At this point, we must highlight the contributions by the German school, represented by Schumpelick, and the Spanish school, represented by Bellón.[45-52] Although in its initial stages, laparoscopic surgery did not take into account the totality of knowledge gained on the subject, as operations were limited to the defect or used small meshes, this method soon began to integrate the concepts of overlap, systemic disease, composite meshes, and the premises advised by the classical surgeons.[53-56]

At the level of parietal surgery, the most noteworthy author for our purposes is Condon, who used Usher's ideas to propose a technique using two PP prostheses in the preperitoneal and supramuscular layers of the abdominal wall. Condon used meshes as reinforcement for the hernial repair, with a limited size and complemented with a musculoaponeurotic plasty.[57] In 1994, Rubio also described a double PTFE mesh technique, one intra-abdominal and the other fixed to the edge of the defect, without any overlap (Figure 3).[58] Lastly, during this decade, with the intra-abdominal approach still advised against except for some special cases, the contribution of Arnaud and Utrera in 1999 is worth pointing out. Arnaud, following the French school, used a Marlex® mesh with a 10 cm overlap and added a Welti-Eudel-type plasty.[59,60] In Spain, Utrera performed a similar procedure employing a laparoscopic approach with a 5 cm overlap and an ePTFE prosthesis.[61] Both cases collected together and updated the previous works by Bourgeon.

Figure 3 – Original image by Rubio.

21st century

Combining much of the knowledge accumulated over the years (systemic disease, aponeurotic fibrosis, tension-free hernioplasty, maximum overlap, bilaminar mesh, incorporation and retraction, mechanical fixation, etc.), the prosthetic DRT was presented in a publication by the author in 2006.[62] In this procedure, meshes are conceived as the fundamental element and are not associated with any type of intraparietal dissection or muscular plasty (following the original concept by Bourgeon). The size of the prosthesis is not determined by the size of the defect or for overlap purposes, but rather is adapted to the wall in an attempt at "global repair." By using very large meshes, the concepts set forth by Stoppa (Pascal's law) and Lichtenstein (tension-free) are also maintained, and fixation becomes practically unnecessary. The methodology used by laparoscopic surgeons is used along with minor mechanical fixation (4 tackers), which reduces surgical time and postoperative pain. The supra-aponeurotic mesh has the advantage of reduced fibrosis and provides superior stability and safety, minimising the risk of recurrence. This concept was developed in Spain by Vidal-Sans et al.[63-66] The choice of a coated, low-weight material enables the total amount of material implanted to be reduced, the inflammatory reaction to be minimised, and a less rigid, thinner, and more elastic scar to be achieved, which favours patient wellbeing.[67-72] By simplifying the operation, current requirements for minimal aggression, patient comfort, and efficiency can be complied with through this techniques, making this an easy procedure with a short hospitalisation time (Figure 4).[73]

Another experience with two meshes was published by Schug-Pass.[74] This author described a reconstruction technique for the layers of the abdominal wall using two meshes, the first of which repaired the linea alba, and the second repaired the defect in the fascia of the anterior rectus, without any overlap (Figure 5). This operation is somehwere between the Condon and Chevrel methods, but does not comply with the principals of global repair and the fact that this is a systemic disease (Figure 5).

As a look to the future, we can venture a guess at three different procedures that will remain in constant development: 1) the retromuscular, preperitoneal approach, since it has always maintained its classic "academic" status, but is only safely feasible for defects of the medial line, and is very complex for reoperations or previous mesh placements,

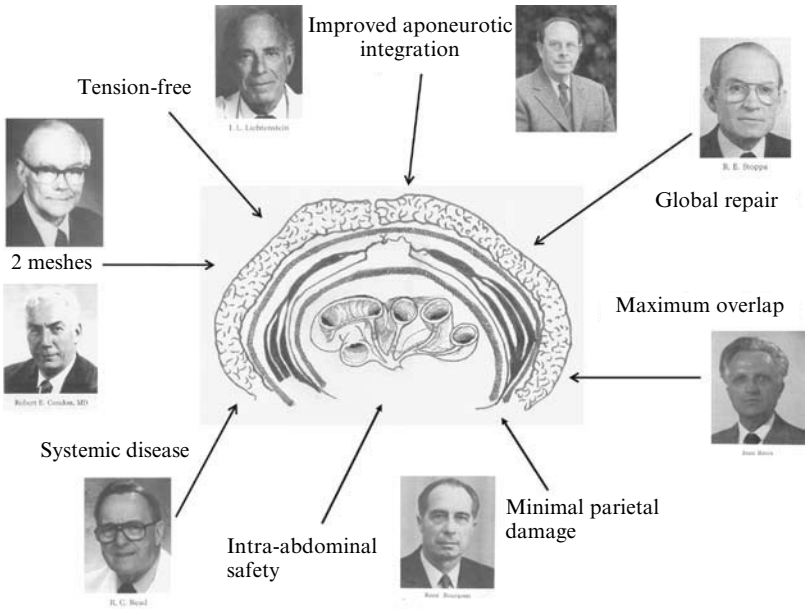

Figure 4 – Basic principles for the correction of incisional hernia applied in prosthetic double repair.

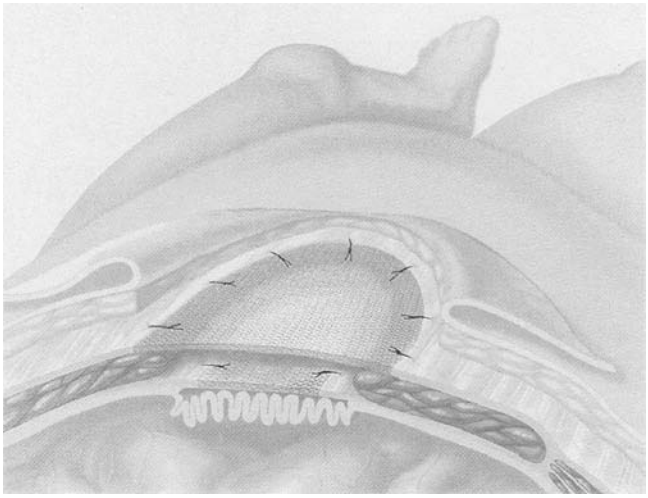

Figure 5 – Original image of the Schugg-Pass work.

and is not universally applicable[75-78]; 2) the parietal approach using component separation technique with synthetic mesh, promulgated in Spain by Carbonell-Bonafé.[79] This is an elegant operation for many different cases, although it can be difficult to apply in cases with colostomies/urostomies and severe tissue damage,[80] and 3) DRT, which is neither "classic" nor "elegant," but, as in the Lichtenstein operation for inguinal hernia, it is a very simple procedure, beneficial for the patient and the hospital. It is also universal as it can be applied in all cases of CIH. In our personal experience, we believe that the last two options have the most potential, since they can adapt well to changes in technology (new generations of meshes, glues, scarring aids, muscular growth factors, etc.), and can be integrated into any hospital protocol.[81-83]

Current double repair technique

The operation is performed under general or regional anaesthesia, based on the advice from the anaesthetists collaborating with abdominal wall unit. As a first step, the scar is resected and two wide flaps of skin and subcutaneous cellular tissue are dissected, widely surpassing the hernial defect using an electric scalpel and exposing the fat-free aponeurosis of the external oblique muscle in order to facilitate later contact with the mesh. Both flaps are protected from drying out with a wet compress. In the second step, the peritoneal cavity is opened and surveyed, and the surgeon then performs a complete adhesiolysis in order to facilitate mobilisation of the entire abdominal wall. This avoids possible inadvertent tractions and visceral damage.

For the first repair, the surgeon uses a low-weight, 30×30 cm PP mesh coated with titanium (TiMesh®, Pfm, Germany), which is placed behind parietal wall and fixed with 4 reabsorbable plastic tackers to the Cooper ligament, retroxiphoidal space, and lumbar fascia (AbsorbaTack® 20 Short Fixation Device, Covidien, USA) (Figure 6). The mesh is a bilaminar prosthesis completely covered in titanium, which ensures controlled integration into the posterior parietal layer (it reduces the reaction to a foreign body, the inflammatory reaction, and the final amount of scar tissue. It also promotes increased cell and implant growth), prevents intestinal adhesions, and reduces retraction, making the implant hydrophilic. Experimental and clinical studies have demonstrated these properties.[84-89] This first repair is finished using tissue form the sac in order to cover, as far as possible, the medial line and to isolate the prosthesis.

The second repair employs the use of another 30×30 cm mesh with supra-aponeurotic placement and is only kept in place by a few drops of synthetic surgical glue, cyanoacrylate

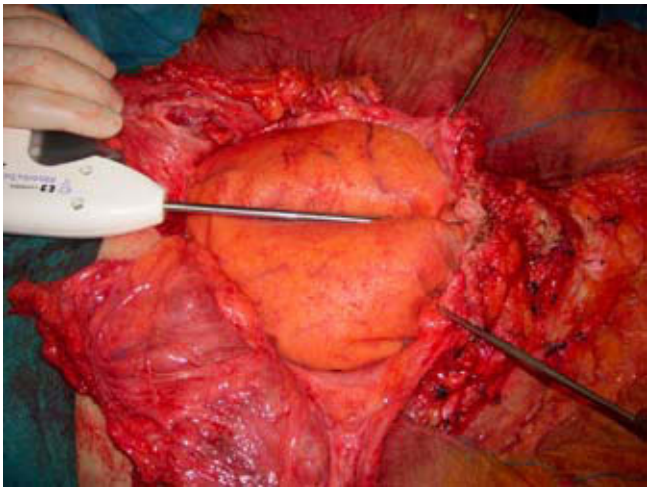

Figure 6 – Position of the first mesh at the intra-abdominal height with mechanical fixation (4 reabsorbable tackers).

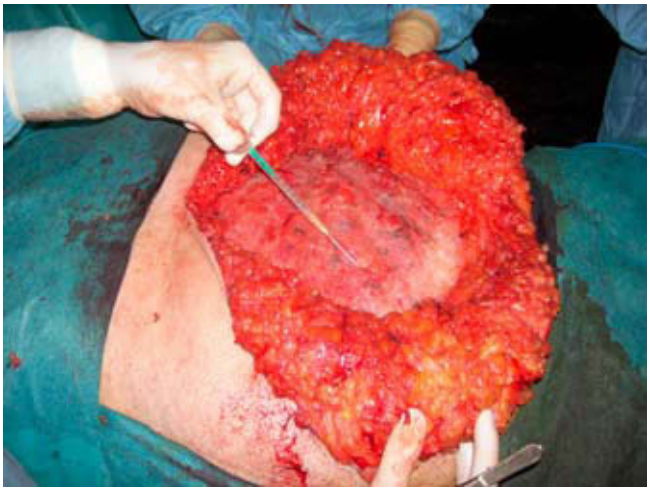

Figure 7 – Supra-aponeurotic position of the mesh and fixation with synthetic glue.

(Ifabond®, Fimed, France) (Figure 7). A drain is placed in the subcutaneous tissue and is removed when the discharge is less than or equal to 50 ml/day. The skin flaps and the skin are closed and a compress bandage is placed for 48 h.

The possible indications for this technique are cases of multi-recurrent complex hernias with the complication of previous meshes with chronic infection and/or fistulas, where the dissection of the wall is difficult and dangerous, or in large diffuse traumatic lumbar hernias or incisional hernias (normally following urological surgery), in cases of herniation with accompanying parastomal hernia (colostomy or urostomy), and following bariatric surgery with associated dermolipectomy.

Conclusion

Prosthetic DRT can be explained from an historical point of view. It brings together the basic physiopathological and surgical principles in a minimally aggressive surgery that attempts to perform a global and dynamic repair of the entire abdominal wall. Furthermore, it represents a treatment option for complex herniations with almost universal application, and is a simple technique for any surgeon to perform.

Conflict of interest

The authors affirm that they have no conflicts of interest.

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