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An innovative abdominal wall repair technique for infected prosthesis: the Eskimo technique

Enfekte proteze yönelik yeni bir karın duvar tamiri: Eskimo tekniği

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The use of meshes to repair incisional hernias has been shown to reduce the recurrence rate, though it may increase the risk of surgical site infection. This is one of the most feared and devastating complications of surgical abdominal wall repair. The aim of this work is to describe a new surgical technique that was used to treat two patients suffering from chronic prosthesis infection. Additionally, the outcome of this procedure will be analyzed in terms of its safety, subsequent site infection and recurrence prevention. Two case reports are presented. The procedure was based on a wide surgical excision of the infected prosthesis and the surrounding tissues, plus abdominal wall repair with biological prosthesis. Both patients experienced an uneventful postoperative course. Infection of the surgical site resolved following the procedure and, after a mean follow-up of 36 months, no recurrences of the incisional hernia had occurred. This unique surgical technique not only proved to be safe, but it also solved the chronic prosthesis infection through its use of radical excision, without any postoperative complications or recurrence. This technique confirmed that biological prostheses can be used safely and effectively for implantation in sites of infection.

Key Words: Biological prosthesis; surgical site infection; surgical technique; infected fields.

İnsizyonel hernilerin tamirinde yama kullanımının nüks oranını azalttığı, ancak cerrahi bölgesi enfeksiyonu riskini arttırabildiği gösterilmiştir. Bu durum, cerrahi olarak karın duvarı tamirinde en çok korkulan ve yıkıcı olan komplikasyonlardan biridir. Bu çalışmanın amacı, kronik protez enfeksiyonlu iki hastada uygulanan yeni bir cerrahi tekniği tanımlamaktır. Ek olarak, bu işlemin sonucu, güvenilirlik, daha sonraki cerrahi bölgesi enfeksiyonu ve nüks önlenmesi bakımından analiz edilmiştir. Burada iki olgu sunuldu. Prosedürün temelini enfekte protez ile çevre dokuların geniş cerrahi eksizyonu + biyolojik protezle karın duvar tamiri oluşturmaktadır. Her iki hasta da ameliyat sonrası problemsiz takip edildi. Prosedürden sonra cerrahi bölgenin enfeksiyonu ortalama 36 aylık bir takipten sonra tamamen iyileşti. İnsizyonel herni nüks etmedi. Bu benzersiz cerrahi teknik, yalnızca güvenilir olduğunu kanıtlamakla birlikte, aynı zamanda radikal eksizyon yoluyla kullanılması ve hiçbir ameliyat sonrası komplikasyon veya nüks oluşmaması ile kronik protez enfeksiyonunu da çözmüştür. Bu teknik, biyolojik protezlerin enfeksiyon bölgelerinde implantasyon ile ilgili olarak güvenle ve etkin bir şekilde kullanılabileceğini doğrulamıştır.

Anahtar Sözcükler: Biyolojik protez; cerrahi bölgesi enfeksiyonu; cerrahi teknik; enfekte alanlar.

Abdominal wall hernia repair is one of the most frequent surgical procedures performed annually worldwide. Each year, more than 990,000 surgical procedures involving such pathology are performed in the United States alone.[1,2] Incisional hernias occur in 11-23% of laparotomies.[3] They tend to enlarge over time and can result in serious complications such as pain, bowel obstruction, incarceration and strangulation, and enterocutaneous fistula.

In abdominal wall surgery, one of the main problems that surgeons often address is the threat of subsequent prosthesis infection. This is one of the most feared and devastating complications of surgical abdominal wall repair and of any procedure generally involving the implantation of synthetic material. The type, rate and effect of infection all depend on which surgical technique is used, the site itself, and the material composition of the prosthesis.[4-11] Currently, no

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definitively safe or standardized techniques have been established for treating infections of abdominal wall mesh.

In this paper, we report our experiences treating two cases with chronic mesh infection using a new, original surgical technique.

CASE REPORT

We report in this study two patients suffering from large abdominal wall incisional hernias who were both treated using a composite PP-ePTFE (expanded-PolyTetraFluoroEthylene) prosthesis that became infected postoperatively, resulting in a chronic surgical site infection (SSI).

Case 1- A 32-year-old man, overweight, with a history of drug addiction and hepatitis C virus (HCV) infection, was admitted to the emergency unit. He presented with acute abdominal pain due to an incarcerated median incisional hernia that had arisen from a laparotomy, performed for a liver trauma, and closed with direct suture. The patient immediately underwent surgery. A small bowel resection with anastomosis and abdominal wall repair of the incisional hernia with direct suture were performed. Approximately one year later, the patient presented again with a wide xiphoid-pubic incisional hernia (35 cm vertical x 30 cm horizontal). Since it was not possible to close the entire peritoneal layer, a double-layered PP-ePTFE (Composix®, Bard, USA) prosthesis was placed using the Rives-Stoppa technique. Broad-spectrum antibiotic therapy was begun immediately prior to the operation and continued for one week following the procedure. Two weeks after the intervention, during the outpatient follow-up visit, a SSI was discovered. The infection led to substantial abdominal wall tissue loss (8 cm vertical x 5 cm horizontal).

Many attempts were made to treat this SSI, none of which resulted in a second intention healing of the wound and the site resulted in a sinus. Vacuum Assisted Closure technique (V.A.C.®, KCL, USA) was also

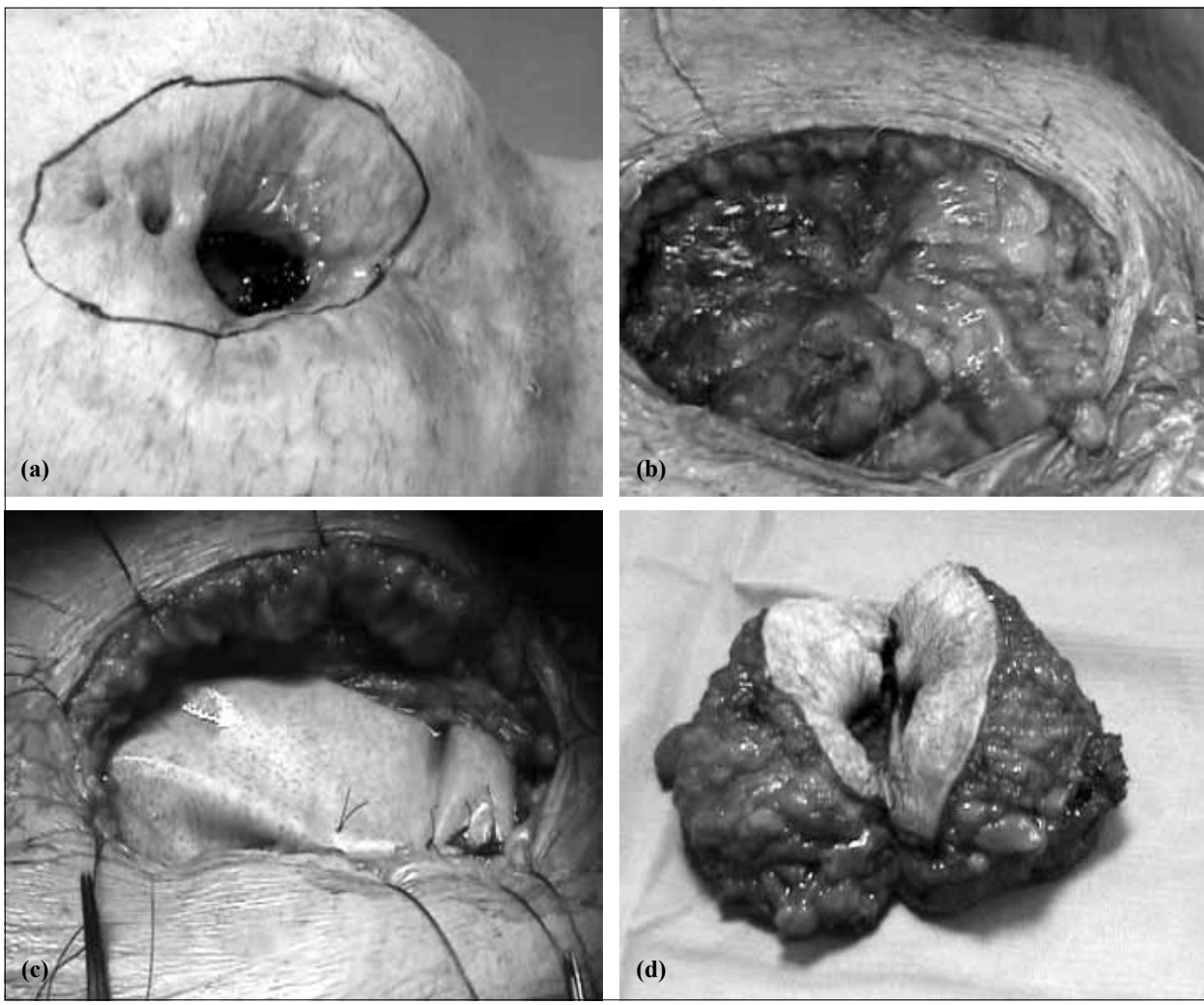

Fig. 1. **(a)** The SSI before the intervention. **(b)** The full-thick abdominal wall resection. **(c)** The prosthesis. **(d)** The full-thickness removed portion of the abdominal.

used. After two years of conservative treatment with no definitive results, the patient was advised to undergo surgical intervention using the Eskimo technique using Collamend® (see over). The postoperative course was uneventful and the patient was discharged one week following the operation. Thirty-seven months after the intervention, during the follow-up evaluation in our outpatient clinic, the patient demonstrated no clinical or radiological evidences of recurrence.

Case 2- A 67-year-old man was admitted to the emergency unit for empyema of the gallbladder and a hepatic abscess. A cholecystectomy was performed through the right subcostal access. One year later, the patient developed an incisional hernia, and 10 months later, he underwent another operation. Since it was not possible to close the entire peritoneal layer, a double-layered PP-ePTFE prosthesis (Composix®, Bard, USA) was placed using the Rives-Stoppa technique. A SSI developed during the postoperative period. A conservative treatment protocol was attempted but it yielded no positive results. The SSI resulted in a sinus. The patient was admitted to the hospital one year later, and the Eskimo Technique using Surgisis® (see over) was performed in an attempt to treat the chronic infection. The postoperative period was free of any major complications and the patient was discharged eight days after the procedure. Thirty-five months after the operation, during the follow-up evaluation in our outpatient clinic, the patient demonstrated no clinical or radiological evidence of recurrence.

Eskimo Technique

The sinus opening is first filled with an iodine gauze and wrapped with a sterile drape. A round incision that includes the entire infection site as well as a substantial part of surrounding healthy tissues is then performed. The incision must be perpendicular to the skin. Once adhesiolysis is completed and the peritoneal layer is completely free of adhesions, the entire abdominal wall segment, from the skin to the peritoneum, including the actual site of infection, is removed en bloc. This maneuver is necessary in order to ensure the complete removal of the infection along with the surrounding necrotized tissues and prosthesis. It is important to verify the complete excision of the infected zone, being careful not to leave any residual tissue that could induce another infection, thereby negating the entire surgical procedure.

It is possible to dissect the subcutaneous tissue immediately overlying the anterior fascia to create a large flap. The flap should be as thick as possible so as not to impair the skin's vascularization.

Once preparation of the flap is complete, the reconstructive phase begins. The rectus muscle must be dissected from the posterior fascia. The prosthesis must then be placed beneath the rectus abdominis muscle with an overlap of at least 5 cm onto the fascia. The mesh is fixed beneath the rectum muscle but above the posterior fascia, fastened using U stitches that pass through the anterior fascia, rectus abdominis, prosthesis, posterior fascia, peritoneum, and back. The knots must be on the side of the anterior fascia. At least 6-8 stitches are typically required, 4 of which should be positioned at the cardinal points. The prosthesis should be positioned so that it is completely flat, without any folds or wrinkles.

Before closing the skin and subcutaneous tissue, one or more suction drains should be placed over the prosthesis to prevent serum collection. It would be best to draw up the subcutaneous tissue with a running suture of absorbable thread. The skin should be approximated with single non-absorbable stitches.

DISCUSSION

In general, there are two strategies for open surgical treatment of abdominal wall defects: tension-free and non-tension-free techniques. The tension-free techniques have two further subcategories: the first involves bridging the defect using the patient's own tissue, synthetic products or biological material. The second option is to draw up the natural tissues after utilizing a relaxing incision, as described by Ramirez et al.,[12,13] or to employ preoperative measures such as tissue expansion or progressive pneumoperitoneum. The aim is a full restoration of the abdominal wall function, including muscular support, prevention of visceral protrusion and adequate soft tissue coverage.[13]

Although surgical techniques have improved, recurrence is still a common complication of surgically repaired abdominal walls, and is more frequent in open suture repairs than in tension-free repairs, with recurrence rates of 54% and 32%, respectively.[14-17]

Given that mesh implantation appears to be the best option for abdominal wall repair, the technique has peaked the interest of the medical community, and the general research focus has shifted towards analyzing the compatibility of different materials for mesh production.

In 1962, Uscher[18] introduced the use of polypropylene (PP) for hernia repair. The positive results of such findings prompted researchers to improve the biocompatibility of prostheses. Many subsequent studies involved systematically comparing biomaterials and searching for the optimal mesh that featured high biocompatibility, low adhesion formation and low infection rates.[2] At present, a wide variety of meshes are available for surgical implementation.

Meshes differ in terms of tissue ingrowth, the likelihood of subsequent infection and the rate of hernia

recurrence. The constituents used to produce these different meshes include absorbable synthetic, non-absorbable synthetic and biological materials. Those meshes constructed from biological components are typically comprised of several different materials: partially remodeling prostheses are made of porcine dermal collagen (Collamend®, Permacol®), human dermal collagen (Alloderm®) and bovine pericardium collagen (Tutomesh®). Completely remodeling prostheses are often made of swine intestinal submucosa (Surgisis®). The differences in remodeling times should be kept in mind when considering these materials. Each prosthesis permits and encourages host tissue ingrowth. The partially remodeling prostheses are also optimal for resisting mechanical stress. They are physically modified with cross-linkages between the collagen fibers to strengthen the prosthesis.[19] These prostheses are also ideal in terms of adhesiogenic power. Biological prostheses have the lowest adhesiogenic power among all prosthetic materials available for intraperitoneal use.[20] The meshes, acting as a scaffold upon which the host tissue cells and fibroblasts can replicate, provide resistance to tension stress, supporting the abdominal wall until it is fully recovered. Even if biological prostheses still require more evidence-based data, as do all the other mesh types,[21] they have already demonstrated their usefulness and versatility in many fields.[4-10] Such mesh prosthetics have been studied in experimental animal trials before being implemented in Phase Three study protocols.[11,19,22] The positive and negative effects of biological prostheses have been investigated,[20] and no adverse effects have been reported. In this paper, we have presented a new, original surgical technique for the management of mesh infections following abdominal wall surgical repair. This procedure has proven to be safe, considering that no major complications occurred in the postoperative period, and effective, given that the chronic abdominal wall infection was finally resolved. This procedure also confirmed the safety and usefulness of biological prosthesis when implanted in infected fields.

The success observed in these two cases is probably attributable to the radical excision of the infected tissue. We not only removed the infected mesh, but we also completely resected the inflamed tissues of the muscular, fascial, subcutaneous, and cutaneous layers. After performing this radical cleansing process, the type of biological mesh used plays a pivotal role in preventing, or at least reducing, the possibility of any recurrences of the incisional hernia and the SSI.

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