—Report on Experiments and Clinical Cases—

An Abdominal Incisional Hernia Repair using the Composix® Kugel Patch: Two Cases Reports

Kiyonori Furukawa, Nobuhiko Taniai, Hideyuki Suzuki, Teruro Kiyama, Tsutomu Nomura, Tsubasa Takahashi, Toshiroh Yoshiyuki and Takashi Tajiri

Surgery for Organ Function and Biological Regulation (Surgery 1), Nippon Medical School Graduate School of Medicine

Abstract

We describe two patients with abdominal incisional hernias, which occurred after appendectomy and replacement of an artificial blood vessel. Both were treated by operative hernial repair with the Composix® Kugel Patch (C.R. Bard Inc.), a composite mesh that combines polypropylene mesh and expanded polytetrafluoroethylene (Gore-Tex®). The mesh has various beneficial characteristics. It is a reinforcing material for the abdominal wall; even when in direct contact with the intestinal tract it is minimally adherent to the intestinal tract. The mesh expands readily and is easily fixed to the abdominal wall because it has a shape-memory ring. The long-term results of operative repair with this mesh have not yet been reported, but it is hoped that the aforementioned characteristics will yield favorable outcomes.
(J Nippon Med Sch 2005; 72: 182–186)

Key words: abdominal incisional hernia, repair of incicional hernia, composite mesh, Composix® Kugel Patch

Introduction

In the event of failure of mesh coverage in repair operations involving the peritoneum for abdominal incisional hernias and abdominal wall defects, complications including adhesion of the mesh to intraperitoneal organs, intestinal fistula formation, and intestinal obstruction are possible[1,2]. To resolve these problems, a composite mesh was developed. Recently, the Composix® Kugel Patch (C.R. Bard Inc.), a composite mesh with shape-memory ring has been attracting attention[3]. The composite mesh has various beneficial characteristics.

We have carried out operative repair of abdominal incisional hernias using the Composix® Kugel Patch, and so herein report including on experiences with the patch and with a device on maneuver.

Case Reports

Patient 1: A 75-year-old woman with a recurrent abdominal incisional hernia in the right lower abdomen (after appendectomy).

Patient 2: A 67-year-old man with an abdominal incisional hernia in the epigastrium (after replacement of an artificial blood vessel).

Correspondence to Kiyonori Furukawa, Department of Surgery I, Nippon Medical School, 1–1–5 Sendagi, Bunkyo-ku, Tokyo 113–8603, Japan
E-mail: seiken-f@nms.ac.jp
Journal Website (http://www.nms.ac.jp/jnms/)

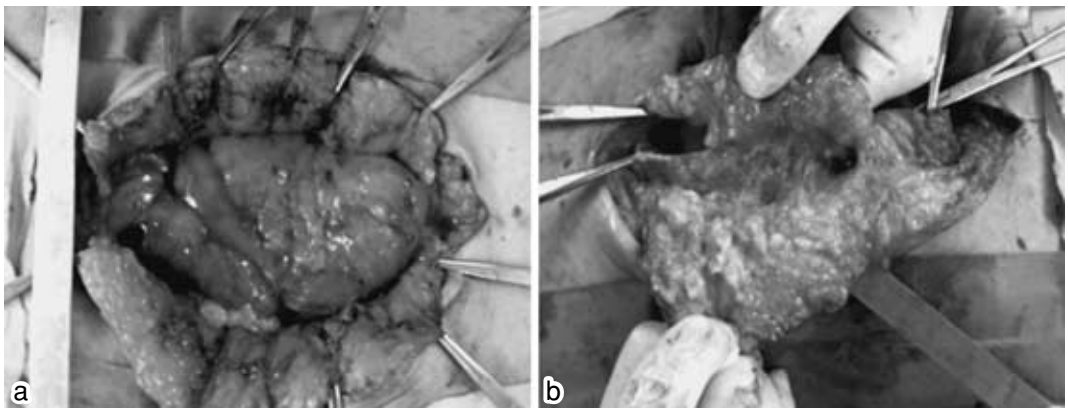

Fig. 1 From skin incision to exposure of the hernial orifice
The subcutaneous adipose tissue was separated for exposure of the entire circumference of the hernial orifice. A small incision was made on the hernial sac. While assessing intraperitoneal adhesion, laparotomy was conducted (Fig. 1a). The hernial sac and cicatricial tissue had been excised along the hernial orifice (Fig. 1b).

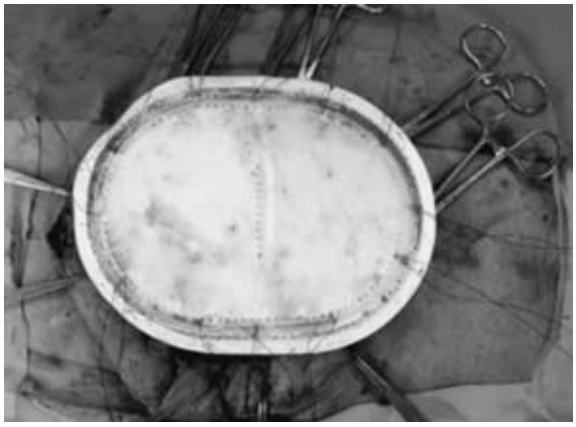

Fig. 2 Mesh preparation
A 2-0 Proline® thread was used to support the shape-memory ring of the Composix® Kugel Patch (18×14 cm) in 12 positions corresponding to a clock face, i.e. 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11 o'clock.

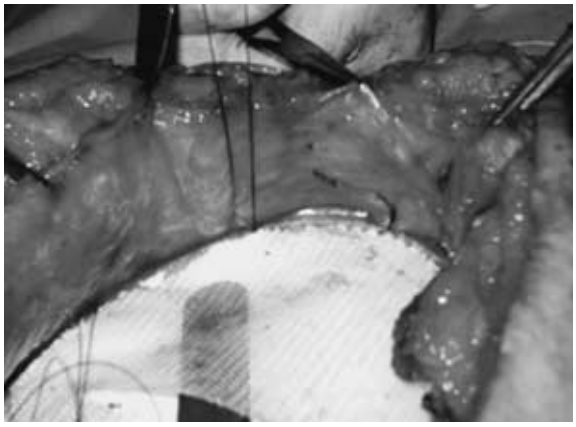

Fig. 3 Fixation of the shape-memory ring and abdominal wall
The 2-0 Prolene® thread preliminarily laid on the ring was stitched from the side of the peritoneal cavity to the abdominal wall in turn for ligation and fixation. While much attention was paid to avoiding tension after suturing, the position into which the 2-0 Prolene® thread was stitched was arranged so as to be just above the shape-memory ring.

Important Points in the Operation

1. From Skin Incision to Exposure of the Hernial Orifice

A skin incision was made along the scar from the previous skin incision, and subcutaneous adipose tissue was separated for exposure of the entire circumference of the hernial orifice. A small incision was made on the hernial sac. While assessing intraperitoneal adhesion, laparotomy was conducted (**Fig. 1a**). After the hernial sac and cicatricial tissue had been excised along the hernial orifice (**Fig. 1b**), the peritoneum adhering to intraperitoneal organs was separated over the area including the sites 4 cm leftward and 4 cm rightward from the margin of the hernial orifice. Also, 3 cm of the anterior layer of the rectus abdominis sheath were exposed. The hernial orifice measured 14×8 cm.

2. Mesh Preparation

A 2-0 Prolene® thread was used to support the

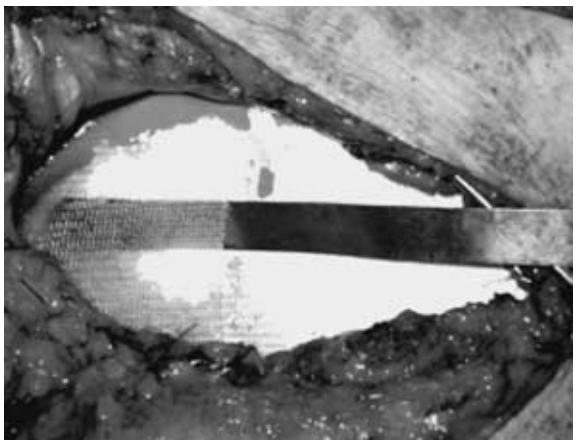

Fig. 4 Fixation of the hernial orifice and the mesh
The margin of the hernial orifice and the anterior layer of the mesh (polypropylene layer) were sutured with a 3-0 Vicryl® for fixation at intervals of 2.0 cm. On this occasion, the space formed by inserting a metal scale between the anterior and posterior layers of the mesh facilitated passage of the needle

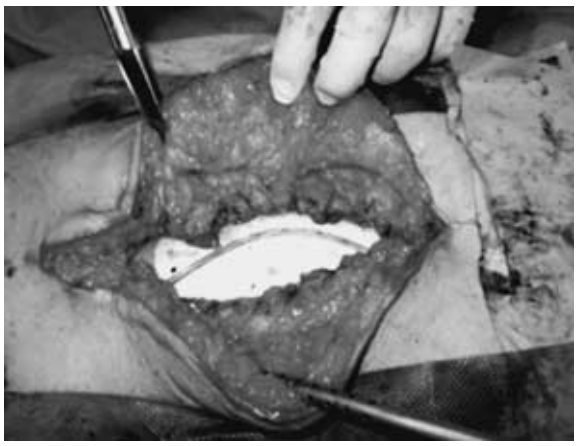

Fig. 5 Drainage
The drainage tube (3 mm in diameter) for serial aspiration (J-Vac®) was inserted on the polypropylene layer.

shape-memory ring of the Composix® Kugel Patch, 18×14 cm, 12 positions corresponding to a clock face (**Fig. 2**).

3. Intraperitoneal Retention of the Mesh

The mesh was inserted into the peritoneal cavity while slightly bent. The entire circumference of the mesh was guided with the index finger to confirm expansion of the mesh.

4. Fixation of the Shape-memory Ring

The margin of the hernial orifice was held with Kocher's forceps, and a 2-0 Prolene® thread preliminarily laid on the ring was stitched from the side of the peritoneal cavity to the abdominal wall in turn for ligation and fixation (**Fig. 3**).

5. Fixation of the Mesh

The margin of the hernial orifice was drawn closed, with care taken to avoid applying excessive tension. Then, the margin of the hernial orifice and the anterior layer of the mesh were sutured with a 3-0 Vicryl® thread for fixation at intervals of 2.0 cm. On this occasion, the space formed by inserting a metal scale between the anterior and posterior layers of the mesh facilitated passage of the needle (**Fig. 4**). The ring was placed approximately 3 cm from the hernial orifice.

6. Abdominal Wall Closure

After hemostasis of subcutaneous tissue, a drainage tube (3 mm in diameter) for serial aspiration (J-Vac®) was inserted in the polypropylene layer (**Fig. 5**). The superficial aponeurosis and the dermis were sutured with a 3-0 Vicryl® thread to close the abdominal wall.

Discussion

Abdominal incisional hernia is among the complications of laparotomy, and reportedly occurs in 11～20% of laparotomy cases[4]. The recurrence rate after operative repair of abdominal incisional hernia has been reported to be 24～63% with simple suturing closure[5-8] and 13～29% with repair operations using mesh[6-8]. Thus, it cannot always be said that good results are obtained from operative hernial repairs using mesh, though repairs with mesh tend to be better. When the hernial orifice is small, there is no difference in recurrence rate between simple closure operation and operative repair with mesh, but the latter has been recommended for cases in which the hernial orifice is 4 cm or more[9]. Thus, operative repair with mesh is assumed to be necessary when the hernial orifice

or an abdominal defect is 4 cm or larger.

The mesh sheets used for abdominal repair are classified as types 1 through 4[1]. Type 1 mesh has a pore size of 75 μm or more, corresponding to polypropylene mesh. Type 4 mesh has a pore size of less than 1 μm, corresponding to ePTFE, an absorbable film. Composite mesh, i.e. the combination of types 1 and 4, has a bilaminar (two-layer) structure, i.e. the sheet is woven from polypropylene mesh laid on top of a monolaminar (one-layer) ePTFE sheet. In the living body, tissue grows internally in the space between the two layers comprising the polypropylene mesh, resulting in facilitated fibrosis and inducing adequate strength and resistance to the mesh. Since the pore size is 75 μm or larger, macrophages, neutrophils, fibroblasts, and capillary blood vessels can invade the mesh space. This seems to be why the mesh is apparently resistant to infection. In contrast, the ePTFE sheet can prevent adhesion of the mesh to intraperitoneal organs, but is believed to easily sustain infections in response to suppression of cellular infiltration, since the sheet interferes with invasion of the ePTFE sheet layer by bacteria because the pore size is less than 1 μm, which minimizes the internal growth of tissue[1,10].

The mesh used in the present patients, the Composix® Kugel Patch, is a composite mesh on which a shape-memory ring has been placed. The Composix® Kugel Patch has the following advantageous characteristics: the shape of the entire mesh is easily maintained and the mesh is easily fixed to the abdominal wall. In fact, the Composix® Kugel Patch was intraperitoneally placed, and the mesh was easily flattened by gliding it over an index finger. The mesh was easily expanded without turning-up the margin. The postoperative complications to pay attention to are seroma and wound infection when using mesh for repair of incisional hernia. The incidence of seroma with abdominal wall reconstruction using composite mesh is high. When a broad area of tissue is separated and the amount of mesh as a foreign body is large, the incidence of seroma rises. This suggests that a drain needs to be inserted for abdominal wall reconstruction with mesh repair[10]. In the present patients, drains were inserted into the anterior surface of the Composix® Kugel Patch to achieve closure and serial aspiration drainage. The drain is removed based on the day when the amount of drainage is decreased, i.e. about 5 days after the start of drainage, but no seroma is observed.

The crisis rate of wound infection after abdominal wall reconstructive operation with mesh is not small at 11.7%, and in some cases the mesh was removed because of wound infection[11]. Therefore, post-operative wound infection preventive measures are important. With the one aim of preventing infection, we selected CEZ (or β-lactam compounds containing β-lactamase inhibitors) as antimicrobial agents having sensibility to a *staphylococcus spp*. and *streptococcus spp*. of skin normal flora. These antimicrobial agents were intravenously administered starting 15 minutes before surgery. Three hours after the start of surgery, additional doses were administered. On the following day as well, the same antimicrobial agent was administered on two occasions. Since a foreign body is left in the body, however, the antimicrobial agent should be used for 2 days. Neither of our patients developed an infection postoperatively. With the other aim of preventing infection, the thread used should be a monofilament minimally contaminated with bacteria or an absorbable thread. Theoretically, monofilament absorbable thread is optimal. Taking into consideration the sensation of use, monofilament unabsorbable thread 2-0 Prolene® was used for fixation of the shape-memory ring to the abdominal wall, and an absorbable thread 3-0 Vicryl® was used for fixation of the hernial orifice to the anterior layer of the mesh in both of our patients. A monofilament nylon thread is also considered to be an option as it is an inexpensive thread.

Conclusion

We have described two abdominal incisional hernia patients who were treated for operative repair with the Composix® Kugel Patch, which is excellent in terms of strength and resistance to infections as a reinforcing material for the abdominal wall. With this approach, which is a procedurally simple operative repair, adhesion of the mesh to the

intestinal tract is minimized. Long-term results of operative repair with the present mesh have not yet been reported, but it is hoped that the favorable characteristics of this mesh will produce excellent outcomes.

References

1. Amid K: Classification of biomaterials and their related complications in abdominal wall hernia surgely. Hemia 1997; 1: 15–21.
2. Leber GE, Garb JL, Alexander AI, Reed WP: Long-term complications associated with prothetic repair of incisional hernia. Arch Surg 1998; 133: 378–382.
3. Tsumura H, Ichikawa T, Kagawa T, Nishihara M, Murakami Y, Sueda T: A case report of abdominal incisional herniorrhaphy using Composix™ Kugel Patch. J Hiroshima Med Ass 2003; 56: 546–566.
4. Mudge M, Hughes LE: Incisional hernia; A 10 year prospective study of incidence and attitudes. Br J Surg 1985; 72: 70–71.
5. Read RC, Yoder G: Recent trends in the management of incisional herniation. Arch Surg 1989; 124: 485–488.
6. Anthony T, Bergen PC, Kim LT, Henderson M, Fahey T, Rege RV, Turnage RH: Factors affecting recurrence following incisional herniorrhaphy. World J Surg 2000; 24: 95–101.
7. Luijendijk RW, Hop WC, van den Tol MP, de Lange DC, Braaksma MM, IJzermans JN, Boelhouwer RU, de Vries BC, Salu MK, Wereldsma JC, Bruijninckx CM, Jeekel J: A comparison of suture repair with mesh repair for incisional hernia. N Engl J Med 2000; 343: 392–398.
8. Koller R, Miholic J, Jakl RJ: Repair of incisional hernia with expanded polytetrafluoroethylene. Eur J Surg 1997; 163: 261–266.
9. Hesselink VJ, Luijendijk RW, de Wilt JH, Heide R, Jeekel J: An evaluation of risk factors in incisional hernia recurrence. Surg Gynecol Obstet 1993; 176: 228–234.
10. Miyazaki K, Narita Y, Nakamura H, Masuda T, Iemiti M, Kasimura Y, Matunami O: Open abdominal wall reconstruction using composite meshes. Rinsho Geka 2002; 57: 1099–1104.
11. Oussoultzoglou E, Baulieux J, De la Roche E, Peyregne V, Adham M, Berthoux N, Ducerf C: Long-term results of 186 patients with large incisional abdominal wall hernia treated by intraperitoneal mesh. Ann Chir 1999; 53: 33–40.

(Received, December 28, 2004)
(Accepted, February 2, 2005)