Fascia Lata Allografts as Biological Mesh in Abdominal Wall Repair: Preliminary Outcomes from a Retrospective Case Series

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Background: The use of biological meshes in management of infected abdominal hernias or in abdominal fields at high risk of infection (potentially contaminated or with relevant comorbidities) is well established. Available products include xenogenic patches or decellularized dermal allografts. Despite their biomechanical features, banked fascial allografts have not been investigated yet in this setting. The authors evaluated the safety and effectiveness of banked fascia lata allografts as biological meshes in abdominal wall repair.

Methods: A consecutive series of patients affected by abdominal wall defects and who were candidates for repair by means of a biological mesh and treated in the authors' institution with banked fascia lata allografts were reviewed retrospectively. Data from clinical and instrumental follow-up evaluations up to 48 months (average, 23 months) were analyzed.

Results: Twenty-one patients (aged 1 to 86 years) with abdominal wall defects resulting from traumatic ($n = 1$), neoplastic ($n = 6$), or multiple previous laparotomies ($n = 14$) were treated from January of 2008 to October of 2012. Operations had no relevant postoperative complications. At clinical/instrumental follow-up examinations, no major signs of recurrence, laxity, infection of grafts, or other related pathologic symptoms were recorded. Three patients suffered from temporary minor complications (e.g., wound seroma, partial cutaneous dehiscence). At instrumental (computed tomographic scan or magnetic resonance imaging) evaluations, the neofascial tissue appeared stable until medium-term follow-up (3 to 6 months), later being gradually degraded and apparently replaced by host tissue.

Conclusion: According to limited preliminary outcomes, banked fascia lata allografts seem to provide a biocompatible, safe, and effective alternative to other biological meshes. (*Plast. Reconstr. Surg.* 132: 631e, 2013.)

CLINICAL QUESTION/LEVEL OF EVIDENCE: Therapeutic, IV.

Abdominal wall defects define significant surgical challenges.[1–5] Abdominal operations are burdened by high rates of incisional hernias (1 to 11 percent of laparotomies),[6,7] which provide a 16 percent chance of infection of the surgical site and recurrences in 50 percent of cases.[3,8] Hernia repair by means of synthetic meshes is considered the standard of care.[9–11] Even so, specific contraindications have been suggested.[12,13] Autologous grafts and flaps are consistently burdened by donor-site morbidity and cannot be performed in patients with challenging clinical conditions or lack of available tissue in required quantity. With the perspective of facing these issues, in the past decade, the adoption of biological implants has been investigated based on the reconstructive principle of replacing "like-with-like," in particular, in contaminated surgical fields. The Ventral Hernia Working Group has recently provided a comprehensive classification for clean, contaminated, and potentially contaminated abdominal wall defects.[14] The grading

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system is considered a reliable tool, and therapeutic guidelines have been recommended based on derived algorithms. Currently, more than a dozen biological meshes have been approved for clinical use and are available on the market: among these are xenogenic (porcine or bovine) and allogenic (acellular or cellular) products derived from different tissues (e.g., dermis, small intestine submucosa, pericardium, amniotic membrane, dura mater, and abdominal fascia).[3,8,12–28] According to the same principles, we have developed a preliminary experience in the adoption of banked fascial allografts as biological patches. In this report, we retrospectively review a consecutive series of patients affected by abdominal wall defects that have undergone abdominal wall reconstruction by surgical implantation of fascia lata allografts.

PATIENTS AND METHODS

Clinical data referring to a consecutive series of patients affected by abdominal wall defects that had undergone abdominal wall reconstruction by banked fascia lata allografts at our institution between January of 2008 and October of 2012 were reviewed retrospectively. Allografts were provided according to existing national regulations and previously processed as described below: use of fascia lata allografts had already been approved in our institution by appropriate ethical committees. Criteria of inclusion were as follows: pediatric or adult cases involving acute or chronic abdominal wall defects with a grade of II, III, or IV according to the Ventral Hernia Working Group.[14] Criteria for exclusion of patients were lack of sufficient clinical or instrumental data regarding procedure or follow-up. Selected cases were reviewed for the following data: preoperative clinical history and instrumental assessment (computed tomographic scan or magnetic resonance imaging), adopted surgical procedure, characteristics of the graft (size of implant, number of patches), postoperative clinical (rates of recurrence and infection, complications, length of hospitalization) and instrumental (computed tomographic scan or magnetic resonance imaging) assessment, and follow-up evaluations. All procedures were performed with respect for ethical standards described by the Declaration of Helsinki (1975) and subsequent amendments; every detail that might disclose patient identity has been omitted.

Origin and Manipulation of Allografts

Allografts were provided to Italian institutions by accredited tissue banks (for our Institution: Banca dei Tessuti of Treviso, Treviso, Italy) distributed on the day of surgery (or 24 to 48 hours earlier), cryopreserved and sterile. The patches were harvested under aseptic conditions from approved donor cadavers: the dimensions of each patch varied (usually, rectangular grafts, 11 to 20 cm per side). Medical history of each donor was previously screened for any abnormality, risk factor or risky behavior (drug or alcohol abuse), and infective disease. Standard serologic tests included analysis of antibodies against human immunodeficiency virus types 1 and 2, human T-lymphotropic virus types 1 and 2, hepatitis C virus, hepatitis B surface antigen, hepatitis B core antigen, cytomegalovirus (immunoglobulin M and immunoglobulin G), *Treponema pallidum*, and *Toxoplasma gondii* (immunoglobulin M and immunoglobulin G). Specific DNA/RNA sequences of human immunodeficiency virus, hepatitis B virus, and hepatitis C virus were also screened. Any positive result (excluding cytomegalovirus immunoglobulin G) led to exclusion of the donor. Collected samples underwent extensive microbiological analysis to assess for any contamination by anaerobic/aerobic pathogen or fungal microbes, and sterilization was provided by antibiotic treatment. Grafts were not treated by specific decellularization processes because of their relative acellular composition and to avoid damaging the quality of the extracellular matrix. Cost of the graft was approximately €7 per cm^2 (nearly U.S. $8.60 per cm^2).

Surgical Procedure

Most operations were performed in collaboration with the Department of General Surgery of our institution by the same two experienced surgeons under similar conditions. Indication for abdominal wall reconstruction by a biological patch was based on established algorithms, as described previously.[1–3,8,12–15] Repair by autologous grafts or flaps was not performed—unless strictly required—to avoid donor-site morbidity. In those cases in which, after reduction of the hernia, reapproximation of residual margins of rectus abdominis muscles and direct suture had been attained, repair was provided by means of an onlay graft of the fascia lata patch. This procedure was aimed to increase overall mechanical resistance of repair (Fig. 1). Otherwise, reinforcement was obtained by subfascial inlay graft of fascia lata anchored to margins of oblique muscles in the retromuscular space and under tension-free conditions with an interrupted 2-0 Prolene (Ethicon, Inc., Somerville, N.J.) suture along the edges. Importantly, in these cases, no other surgical technique could

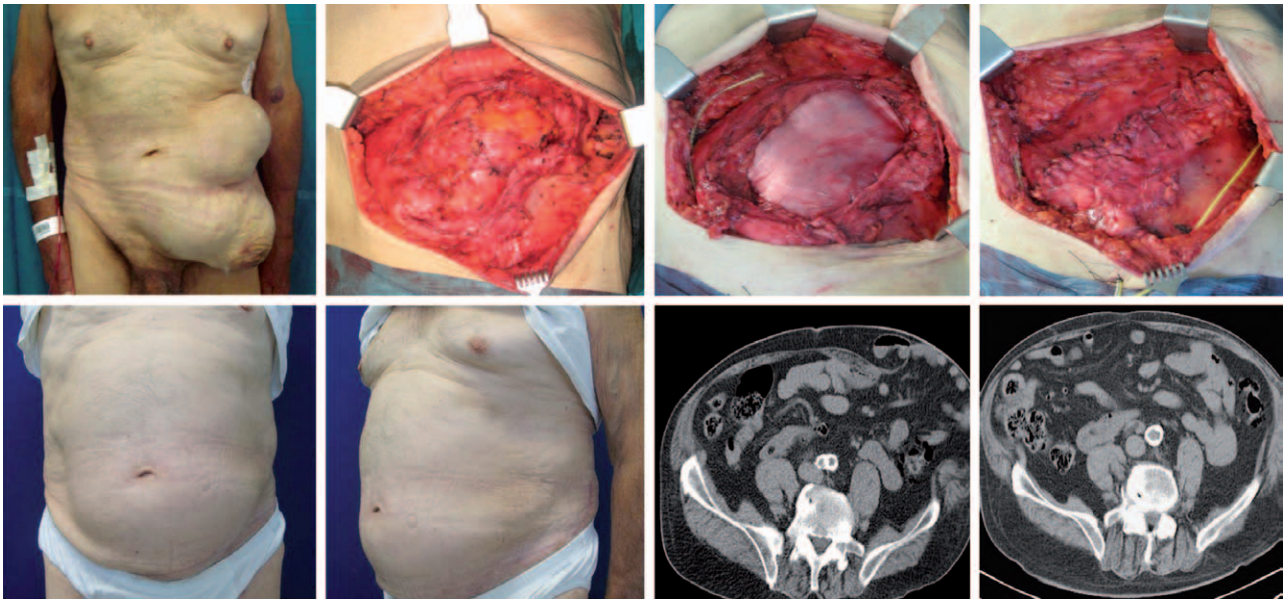

Fig. 1. Overview of surgical strategy for the patient in case 4. (*Above*, *left*) Preoperative clinical view of the recurrent incisional hernia; (*above*, *second from left*) intraoperative assessment of the defect, (*above*, *second from right*) of the fascia lata onlay graft, and (*above, right*) of the repaired abdominal wall. Postoperative (*below*, *left*) frontal and (*below*, *second from left*) lateral photographs obtained at 9-month follow-up. Radiologic images obtained (*below*, *second from right*) preoperatively and (*below*, *right*) at 9-month postoperative follow-up for comparison.

be used other than another biological patch or autologous flaps (not always available because of the general condition of the patient) (Fig. 2). In those cases in which abdominal wall defects could not be repaired by a single patch of fascia lata, multiple patches were approximated and sutured together. Drains were placed in the subcutaneous layer before cutaneous closure by direct suture. After surgery, all patients underwent a 24-hour monitoring period in the intensive care unit, and then standard postoperative treatment (including antibiotic treatment and thrombosis prophylaxis) was provided until discharge, with indication to wear an abdominal girdle for 2 months.

Follow-Up Evaluations

Standard follow-up evaluations were scheduled at 1 month, 2 months, 6 months, and then usually with 6-month intervals. Patients were examined standing and supine for morphologic and functional (Valsalva maneuver) evaluation of outcomes, with particular regard to the presence of complications (cutaneous dehiscences or seromas, infection, laxity, recurrence of defect). Radiologic (computed tomographic scan or magnetic resonance imaging evaluation) follow-up evaluations at different timelines (because of availability of patients) were reviewed by a single experienced radiologist.

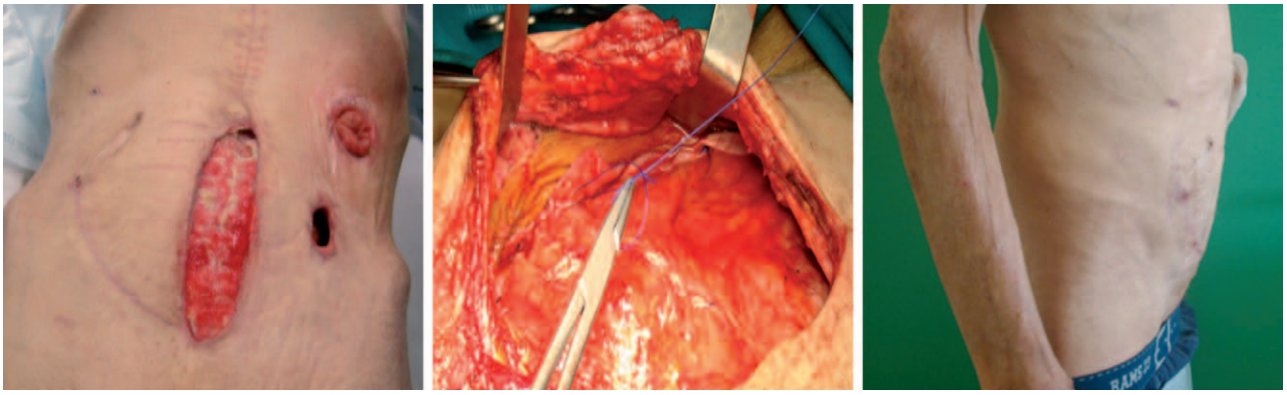

Fig. 2. Overview of surgical strategy for the patient in case 8: preoperative clinical view (*left*) of the infected postsurgical abdominal wall dehiscence, intraoperative repair by fascia lata inlay graft (*center*), and result postoperatively at 20-month follow-up (*right*).

Statistical Analysis

Mean differences of selected variables (i.e., size of grafts, rate of recurrence or infection or other complications, length of hospitalization) were provided together with a qualitative descriptive evaluation of clinical/radiologic outcomes.

RESULTS

In our institution, from January of 2008 to May of 2012, 21 consecutive patients underwent abdominal wall reconstruction by fascia lata allografts (Table 1). Fourteen patients were male patients (64 percent) and seven were female patients (36 percent), with ages ranging from 1 to 86 years (mean, 53 years). One pediatric patient was treated for exposure of a previously implanted synthetic mesh following hepatic transplantation; in this case, diagnostic evaluation was provided by ultrasonography (Fig. 3). One patient had a defect of acute traumatic origin (4 percent). Other acute defects included six cases of neoplastic infiltration or metastasis (24 percent) affecting rectus abdominis muscles (tumor desmoid tumor in three patients, colorectal cancer in two patients, and breast cancer in one patient). Chronic cases (68 percent) included 14 recurrent defects secondary to multiple laparotomies (64 percent) resulting from transplantation surgery in five patients, oncologic surgery in four patients, and other abdominal operations in five patients. Among these patients, 12 had already undergone hernia repair by means of synthetic mesh (85 percent), two by direct suture, and none by component separation techniques or by biological grafts. Other chronic defects included a colic fistula (4 percent). Grossly contaminated wounds and contaminated synthetic meshes (Ventral Hernia Working Group grade IV) included eight patients (38 percent), whereas the other 13 patients (62 percent) were considered potentially contaminated because of previous wound infection, presence of stomas, or violation of the gastrointestinal tract (10 patients; Ventral Hernia Working Group grade III) and/or at high risk of infection-associated comorbidities (three patients; Ventral Hernia Working Group grade II). Patients had an average body mass index of 29.1; two were obese (body mass index > 40). All patients had relevant comorbidities: five were diabetic, 11 were smokers, one had an enteric fistula, and six were under immunosuppressive therapy. The mean size of hernia/abdominal wall defect was 330 cm^2, ranging from 90 to 510 cm^2 (Table 2). Preoperative assessment in most cases closely and reliably anticipated actual measurements. The mean size of a fascia lata patch was 180 cm^2 (12 × 15 cm), with smaller grafts being 80 cm^2 (8 × 10 cm) and larger grafts reaching almost 260 cm^2 (13 × 20 cm) (Table 2). The average number of patches adopted for each surgical procedure was two patches per patient (ranging from one to four patches per patient). We observed no relevant complication related to adoption of multiple patches sutured together. With regard to the adopted surgical procedure, in four cases (19 percent) we could provide abdominal wall reconstruction by means of an onlay fascia lata graft, and in an additional 17 cases (81 percent), we adopted inlay grafting (Table 2). Our strategy was influenced by the size of defects and medical history, with chronic/recurrent defects being more likely to be repaired by inlay techniques. Importantly, there was no donor-site or other secondary morbidity in patients because harvesting of autologous grafts/flaps was not required and we could completely rely on banked allografts. Operations had a 100 percent survival, and the mean length of hospitalization was 10 days (range, 7 to 15 days) without relevant postoperative complications. Average length of follow-up was 23 months (range, 9 to 48 months). Surprisingly and unexpectedly, at medium-term follow-up, we could find no major sign of recurrence or infection, depicting a remarkable success rate of 100 percent (Figs. 1 through 3). No case required further surgery or removal of grafts. Among minor complications (total, 12 percent of patients), two patients (8 percent) suffered from wound seroma 7 to 9 days postoperatively, which was treated successfully by drainage, and one patient (4 percent) developed a superficial wound necrosis from postoperative day 10, which was managed by standard dressings. All patients reported good quality of life, with relief of symptoms and functional impairments, achieving complete rehabilitation. Radiologic (computed tomographic scan or magnetic resonance imaging) follow-up evaluation was performed to assess for any subclinical recurrence of hernia and to provide a preliminary qualitative analysis of biological evolution of grafts in terms of positive (i.e., biointegration, gradual degradation) or negative (i.e., foreign body reaction and fibrosis) recognition. No radiologic signs of recurrence could be observed. Neofascial tissue was stable at medium-term follow-up, constituting a continuous layer with no apparent areas of weakness or ruptures. Margins of grafts could be clearly detected in the first 3 to 6 months, later being gradually degraded and

Table 1. Synopsis of Preoperative Clinical Data Referring to the Described Series of Patients

Patient	Sex	Age	Pathologic Findings	Comorbidities	Type of Defect	Condition of the Abdominal Field	VHWG Grade
1	M	38 yr	Metastasis to the abdominal wall caused by colorectal cancer (adenocarcinoma of the cecum)	Smoking habit	Resection of rectus abdominis muscle	Potentially contaminated	III
2	F	77 yr	Colorectal cancer (adenocarcinoma of the transverse column)	Diabetes	Postsurgical abdominal wall dehiscence and exposure of synthetic mesh	Infected	IV
3	M	86 yr	Penetrating abdominal trauma (gunshot)	Diabetes, chronic kidney failure	Infected open abdomen with necrosis of the rectus abdominis muscle and of the external oblique muscle	Infected	IV
4	M	68 yr	Incisional abdominal hernia	Diabetes, obesity, smoking habit	Recurrent abdominal hernia	Potentially contaminated	III
5	F	69 yr	Breast cancer	Smoking habit	Metastasis to the abdominal wall	High risk	II
6	M	47 yr	Wegener's granulomatosis of the abdomen	Immunosuppressive therapy	Recurrent incisional hernia	Potentially contaminated	III
7	M	46 yr	Colorectal cancer (adenocarcinoma of the transverse column)	Chronic kidney failure	Incisional hernia	Potentially contaminated	III
8	M	47 yr	Kidney transplant	Immunosuppressive therapy	Postsurgical abdominal wall dehiscence	Infected	IV
9	M	13 mo	Liver transplant	Immunosuppressive therapy	Postsurgical abdominal wall dehiscence and exposure of synthetic mesh	Potentially contaminated	III
10	F	36 yr	Desmoid tumor with infiltration of the abdominal wall	Smoking habit	Resection of rectus abdominis muscle	High risk	II
11	M	65 yr	Kidney transplant	Immunosuppressive therapy, smoking habit	Postsurgical wound dehiscence	Potentially contaminated	III
12	M	50 yr	Desmoid tumor with infiltration of the abdominal wall	Diabetes, smoking habit	Resection of rectus abdominis muscle	High risk	II
13	M	27 yr	Sequelae of abdominal trauma	Smoking habit	Recurrent incisional hernia and colic fistula	Potentially contaminated	III
14	M	68 yr	Colorectal cancer (adenocarcinoma of the rectum)	Smoking habit	Metastasis to the abdominal wall	Potentially contaminated	III
15	F	55 yr	Colorectal cancer (adenocarcinoma of the transverse column)	Smoking habit	Postsurgical abdominal wall dehiscence and exposure of synthetic mesh	Infected	IV
16	M	64 yr	Incisional abdominal hernia	Diabetes	Recurrent abdominal hernia	Potentially contaminated	III
17	M	71 yr	Colorectal cancer (adenocarcinoma of the transverse column)	Smoking habit	Infection of synthetic mesh	Infected	IV
18	F	67 yr	Incisional abdominal hernia	Obesity	Recurrent abdominal hernia and infection of synthetic mesh	Infected	IV
19	F	50 yr	Desmoid tumor	Smoking habit	Infiltration of the abdominal wall	Potentially contaminated	III
20	M	43 yr	Kidney transplant	Immunosuppressive therapy	Postsurgical abdominal wall dehiscence	Infected	IV
21	F	49 yr	Kidney transplant	Immunosuppressive therapy	Postsurgical abdominal wall dehiscence	Infected	IV

VHWG, Ventral Hernia Working Group; M, male; F, female.

apparently replaced by a persisting continuous neofascial layer. Fascia lata grafts could hardly be detected at subsequent time points. Finally, based on average size of adopted patches, we could calculate an average cost per patient of €1400 (range, €600 to €2000).

DISCUSSION

A complete review of therapeutic algorithms and Ventral Hernia Working Group recommendations regarding abdominal wall reconstruction may be found elsewhere.[1,8,12–15,20,22] In our experience, autologous grafts/flaps should be

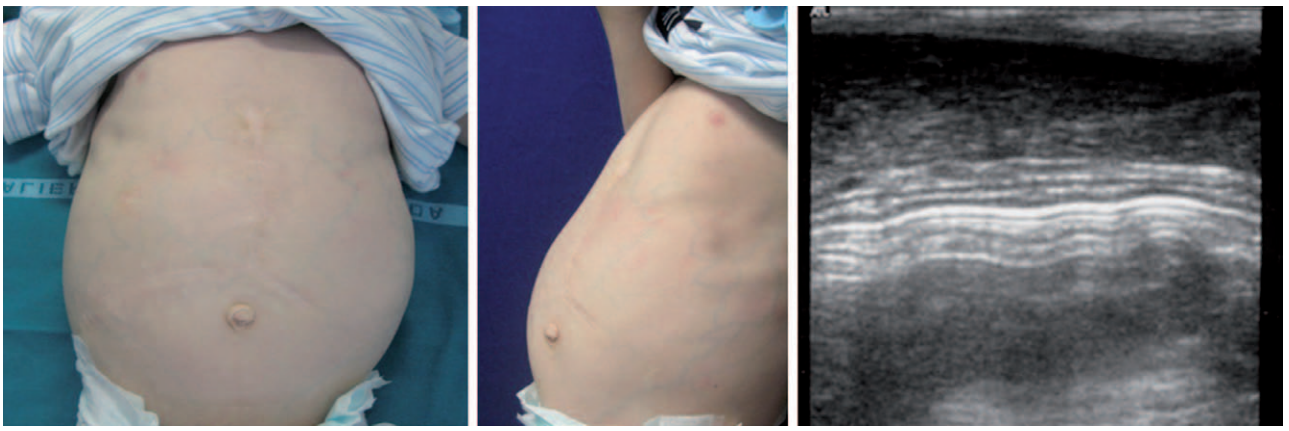

Fig. 3. Postoperative clinical (*left* and *center*) and instrumental (ultrasonography) (*right*) outcomes in a pediatric patient (case 9) at 40-month follow-up showing complete repair of the abdominal wall continence.

considered as secondary options to avoid any donor-site morbidity. For these reasons, our focus has been to investigate novel, less invasive, and more reliable (availability of patches in desired quantity and quality) options, in accordance with current literature. Allografts are facing a new dawn since first experiences in the late 1940s.[29–31] Concerns regarding transmission of infective disease have proved to be mostly unfounded,[8,12–15,20] and adoption of fascia lata has been investigated extensively in other reconstructive operations as either autologous graft or allograft.[17,32–38] Fascia lata allograft is relatively acellular and composed mainly of collagen fibers and glycosaminoglycan.[39–42] Because of limited cellularity, it does not provide relevant immunologic reactions. Thus, it may be considered a highly biocompatible product in which processes of negative recognition such as fibrosis, encapsulation, and formation of adherences are minimally promoted. Among other biological meshes, several bovine and porcine products have been investigated: even if considered potentially safe, immunologic responses still need to be taken into consideration for potential risks of rejection or negative recognition responses.[12–15,19,20] Preclinical and clinical experiences have shown that homologous products are gradually degraded in vivo, meanwhile providing a biological scaffold inducing regenerative replacement of damaged tissues by hosts.[12–27] This

Table 2. Review of Adopted Surgical Strategy and Follow-Up Outcomes for Each Different Case*

Patient	Surgical Technique	Dimensions of the Defect (cm^2)	No. of Patches of Fascia Lata (cm^2)	Follow-Up (mo)	Complications
1	Inlay graft	370	2 (380)	13	
2	Inlay graft	310	2 (320)	27	
3	Inlay graft	510	3 (510)	22	Partial cutaneous necrosis
4	PFC plus onlay graft	270	2 (260)	9	
5	PFC plus onlay graft	230	1 (220)	17	
6	Inlay graft	400	3 (410)	32	
7	Inlay graft	320	2 (330)	35	
8	Inlay graft	320	2 (310)	26	Wound seroma
9	Inlay graft	90	1 (90)	48	
10	Inlay graft	400	3 (420)	19	
11	Inlay graft	240	2 (250)	28	
12	Inlay graft	430	3 (450)	22	
13	Inlay graft	320	2 (320)	21	
14	Inlay graft	420	2 (410)	36	
15	Inlay graft	370	3 (390)	19	
16	PFC plus onlay graft	160	2 (180)	29	
17	Inlay graft	320	2 (320)	17	
18	PFC plus onlay graft	210	2 (200)	23	
19	Inlay graft	500	3 (480)	9	
20	Inlay graft	440	3 (420)	14	
21	Inlay graft	300	2 (290)	11	Wound seroma

PFC, primary fascial closure.
*There were no recurrences.

evidence has been confirmed also for fascia lata allografts. In our case series, we could observe a gradual integration of patches with surrounding regenerating fibroelastic tissue that could not be differentiated after 8 months. In studies investigating other biological meshes, follow-up evaluations reported a 17 percent rate of recurrence at a 12-month analysis.[8,12,13,15,20,22] Similar studies have observed that, consistent with our results, in vivo degradation of a fascia lata allograft occurs in 12 months, with a gradual degradation of collagen fibers, neovascularization of tissues, and fibroblast and inflammatory cell invasion after 6 to 7 months.[30–39] Although reabsorption may cause an initial decrease in strength, biomechanical properties have been shown to be stable at long-term follow-up. Our average follow-up was only 25 months, with some patients showing persistence of stable results up to 48 months. Although this follow-up does not differ substantially from that reported in the literature, we believe that a longer follow-up would be more appropriate for significant analysis of long-term recurrence rates. Several other studies on abdominal wall reconstruction provide similar or shorter follow-up analysis. In a systematic review by Janis et al. on acellular dermal matrices,[43] only two of 46 case series reported an average follow-up longer than 29 months. In a similar review by Patel and Bhanot[44] on acellular dermal matrices, only two of 29 analyzed reports provided a follow-up longer than 29 months (30 and 34 months, respectively). These reports are consistent with recent works of Kissane and Itani[45] (20.5 to 25.9 months) and Clemens et al.[46] (21 months), among others. Thus, longer follow-up analyses are required in future studies. Nonetheless, our follow-up is relatively adequate for reasonable preliminary analysis of outcomes. Long-term stability of outcomes is dependant also on adopted surgical technique.[1–6,9,22] Similar to other biological meshes, in our report, fascia lata allografts achieved positive results independent of adopted surgical procedure (inlay/onlay approach). Our case series is relatively heterogeneous and only a few cases are recurrent hernias; even so, we are confident that etiologic heterogeneity is not relevant in evaluation of effectiveness of the procedure and that our strategy may be successfully applied to different clinical situations. Although drawing definitive conclusions is difficult because of the relatively small cohort of patients, a coherent preliminary analysis is still acceptable and comparable to other studies in the literature. In the article by Janis et al.,[43] most of the considered case series (37 of 54) reported fewer than 30 patients and a relevant heterogeneity. In a similar review by Patel and Bhanot,[44] only 17 of 29 reports included more than 28 patients: consistently, Kissane and Itani have recently[45] pointed out that many studies investigating acellular dermal matrices had fewer than 40 participants (42 versus eight for larger but still heterogeneous case series). Clemens et al.[46] have also recently reported their experience with acellular dermal matrices: in their heterogeneous case series, only 50 percent of patients showed recurrent hernias. In accordance with these and other authors, we agree that larger case series are needed to provide more concrete results, but we believe that our interesting preliminary outcomes still maintain a value for prospective discussion. Moreover, functional reliability of reconstruction depends also on biomechanical characteristics of patches. Fascia lata allografts are made of different layers of collagen fibers, each obliquely overlapping and providing noteworthy tensile strength, valuable elasticity, and high flexibility.[30,39–42] An interesting debate has recently been promoted regarding adoption of biological meshes with or without a cross-linked collagen structure.[12–15,18–22,24,47] Among available products, only one patch derived from porcine dermis provides a cross-linked structure, which was obtained in vitro by patented technologies. Some studies suggest that this process may constitute a key feature providing a stronger prosthesis with more reliable long-term efficacy. Even so, other authors have argued that an elevated rate of collagen cross-linkage may sustain negative recognition processes and reduced degradation, leading to lower functional adaptability. Significantly, layers constituting fascia lata are composed of naturally partially (low-density) cross-linked collagen fibers.[30,39–42] Thus, fascia lata allograft does not fail in providing elasticity and gradual reabsorption without fibrosis or encapsulation. An "ideal" mesh for abdominal wall repair is certainly resistant to bacterial colonization, in particular, in contaminated surgical fields or in clinical conditions at high risk of infection.[3,8,12–15] The Ventral Hernia Working Group has provided comprehensive guidelines and classification of clean, at high risk (grade II), potentially contaminated (grade III), and infected hernias (grade IV). A common condition in our series of patients was infection of a previously implanted synthetic mesh that had to be removed, the presence of open trauma (grade IV), the presence of previous infections or violation of the gastrointestinal tract (grade III), or the presence of considerable comorbidities/associated risk factors for infection of the surgical field (grade II). The Ventral Hernia

Working Group recommends use of biological grafts in grade III and IV hernias, whereas adoption in selected cases with grade II hernias is still debated. In a recent article by Harth et al., adoption of biological meshes in noncontaminated high-risk patients has been discussed, with a standard use in clean settings at high risk for complications reported because of selected comorbidities by 40 percent of interviewed surgeons.[48] This percentage significantly increased when considering most experienced surgeons. Consistently, in their article on bovine/porcine acellular dermal matrix, Clemens et al. included patients classified as grade II, III, and IV according to the Ventral Hernia Working Group, with grade II representing almost 43 percent of cases.[46] Significantly, we could not observe any sign of infection/colonization of the graft, local/systemic infection, or abscess formation. These outcomes suggest that fascia lata allograft seems to be a reliable patch, comparable to other biological products already available on the market showing an even lower tendency to recur. A final consideration could be focused on costs of the patch that seem to be remarkably lower than other marketed homologous products (approximately fourfold lower than human dermis) and comparable to current xenologous products (approximately twofold lower than porcine dermis or porcine small intestine submucosa).[12,13] In addition, low recurrence and complication rates reduced indirect costs without any need for postponed discharge or secondary surgical procedures.

CONCLUSIONS

Adoption of fascia lata homograft has never been reported in the literature for repair of incisional hernias or abdominal wall defects that are infected or at high risk of infection. One study investigated use of cadaveric fascia lata for repair of a pediatric abdominal defect.[49] In our preliminary report, the allograft has proved to be a reliable prosthetic product with valuable biological and biomechanical characteristics. In particular, cadaveric fascia lata seems to offer the advantages of autologous, homologous, and xenogenic patches without retaining the respective disadvantages.[12–15] Therefore, also considering the limited cost of this product, we believe that fascia lata allografts may be considered a cost-effective product to be further considered in clinical practice. Nonetheless, these encouraging conclusions are still limited to preliminary results that should stimulate further discussion and more extensive prospective studies, including larger case series and randomized controlled trials, supported by preclinical experimental data.

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REFERENCES

1. Ghazi B, Deigni O, Yezhelyev M, Losken A. Current options in the management of complex abdominal wall defects. *Ann Plast Surg.* 2011;66:488–492.
2. Varkarakis G, Daniels J, Coker K, et al. Effects of comorbidities and implant reinforcement on outcomes after component reconstruction of the abdominal wall. *Ann Plast Surg.* 2010;64:595–597.
3. Rohrich RJ, Lowe JB, Hackney FL, Bowman JL, Hobar PC. An algorithm for abdominal wall reconstruction. *Plast Reconstr Surg.* 2000;105:202–216; quiz 217.
4. Luijendijk RW, Hop WC, van den Tol MP, et al. A comparison of suture repair with mesh repair for incisional hernia. *N Engl J Med.* 2000;343:392–398.
5. Sánchez LJ, Bencini L, Moretti R. Recurrences after laparoscopic ventral hernia repair: Results and critical review. *Hernia* 2004;8:138–143.
6. Mudge M, Hughes LE. Incisional hernia: A 10 year prospective study of incidence and attitudes. *Br J Surg.* 1985;72:70–71.
7. Santora TA, Roslyn JJ. Incisional hernia. *Surg Clin North Am.* 1993;73:557–570.
8. Cavallaro A, Lo Menzo E, Di Vita M, et al. Use of biological meshes for abdominal wall reconstruction in highly contaminated fields. *World J Gastroenterol.* 2010;16:1928–1933.
9. Bachman S, Ramshaw B. Prosthetic material in ventral hernia repair: How do I choose? *Surg Clin North Am.* 2008;88:101–112, ix.
10. Wong CH, Lin CH, Fu B, Fang JF. Reconstruction of complex abdominal wall defects with free flaps: Indications and clinical outcome. *Plast Reconstr Surg.* 2009;124:500–509.
11. Selvaggi G, Levi DM, Cipriani R, Sgarzani R, Pinna AD, Tzakis AG. Abdominal wall transplantation: Surgical and immunologic aspects. *Transplant Proc.* 2009;41:521–522.
12. Bellows CF, Alder A, Helton WS. Abdominal wall reconstruction using biological tissue grafts: Present status and future opportunities. *Expert Rev Med Devices* 2006;3:657–675.
13. Peppas G, Gkegkes ID, Makris MC, Falagas ME. Biological mesh in hernia repair, abdominal wall defects, and reconstruction and treatment of pelvic organ prolapse: A review of the clinical evidence. *Am Surg.* 2010;76:1290–1299.
14. Ventral Hernia Working Group, Breuing K, Butler CE, et al. Incisional ventral hernias: Review of the literature and recommendations regarding the grading and technique of repair. *Surgery* 2010;148:544–558.
15. Antoniou SA, Pointner R, Granderath FA. Hiatal hernia repair with the use of biologic meshes: A literature review. *Surg Laparosc Endosc Percutan Tech.* 2011;21:1–9.
16. Butler CE, Prieto VG. Reduction of adhesions with composite AlloDerm/polypropylene mesh implants for abdominal wall reconstruction. *Plast Reconstr Surg.* 2004;114:464–473.

17. Tukiainen E, Leppäniemi A. Reconstruction of extensive abdominal wall defects with microvascular tensor fasciae latae flap. *Br J Surg.* 2011;98:880–884.
18. Pomahac B, Aflaki P. Use of a non-cross-linked porcine dermal scaffold in abdominal wall reconstruction. *Am J Surg.* 2010;199:22–27.
19. Mulier KE, Nguyen AH, Delaney JP, Marquez S. Comparison of Permacol™ and Strattice™ for the repair of abdominal wall defects. *Hernia* 2011;15:315–319.
20. Hiles M, Record Ritchie RD, Altizer AM. Are biologic grafts effective for hernia repair? A systematic review of the literature. *Surg Innov.* 2009;16:26–37.
21. Hsu PW, Salgado CJ, Kent K, et al. Evaluation of porcine dermal collagen (Permacol) used in abdominal wall reconstruction. *J Plast Reconstr Aesthet Surg.* 2009;62:1484–1489.
22. Smart NJ, Bloor S. Durability of biologic implants for use in hernia repair: A review. *Surg Innov.* 2012;19:221–229.
23. Slater NJ, Hansson BM, Buyne OR, Hendriks T, Bleichrodt RP. Repair of parastomal hernias with biologic grafts: A systematic review. *J Gastrointest Surg.* 2011;15:1252–1258.
24. Gaertner WB, Bonsack ME, Delaney JP. Experimental evaluation of four biologic prostheses for ventral hernia repair. *J Gastrointest Surg.* 2007;11:1275–1285.
25. Brewer MB, Rada EM, Milburn ML, et al. Human acellular dermal matrix for ventral hernia repair reduces morbidity in transplant patients. *Hernia* 2011;15:141–145.
26. Disa JJ, Goldberg NH, Carlton JM, Robertson BC, Slezak S. Restoring abdominal wall integrity in contaminated tissue-deficient wounds using autologous fascia grafts. *Plast Reconstr Surg.* 1998;101:979–986.
27. Gondolesi G, Selvaggi G, Tzakis A, et al. Use of the abdominal rectus fascia as a nonvascularized allograft for abdominal wall closure after liver, intestinal, and multivisceral transplantation. *Transplantation* 2009;87:1884–1888.
28. Meintjes J, Yan S, Zhou L, Zheng S, Zheng M. Synthetic, biological and composite scaffolds for abdominal wall reconstruction. *Expert Rev Med Devices* 2011;8:275–288.
29. Orlando G, Wood KJ, De Coppi P, et al. Regenerative medicine as applied to general surgery. *Ann Surg.* 2012;255:867–880.
30. Smart NJ, Marshall M, Daniels IR. Biological meshes: A review of their use in abdominal wall hernia repairs. *Surgeon* 2012;10:159–171.
31. Sclafani AP, McCormick SA, Cocker R. Biophysical and microscopic analysis of homologous dermal and fascial materials for facial aesthetic and reconstructive uses. *Arch Facial Plast Surg.* 2002;4:164–171.
32. Tiengo C, Pontini A, Azzena B. Combined use of homologous fascia lata graft and acellular dermal substitute for the repair of a complex abdominal wall. *Eur J Plast Surg.* 2013;36:125–129.
33. Wright EJ, Iselin CE, Carr LK, Webster GD. Pubovaginal sling using cadaveric allograft fascia for the treatment of intrinsic sphincter deficiency. *J Urol.* 1998;160:759–762.
34. Elliott DS, Boone TB. Is fascia lata allograft material trustworthy for pubovaginal sling repair? *Urology* 2000;56:772–776.
35. O'Reilly J, Lanigan B, Bowell R, O'Keefe M. Congenital ptosis: Longterm results using stored fascia lata. *Acta Ophthalmol Scand.* 1998;76:346–348.
36. Yoon JS, Lee SY. Long-term functional and cosmetic outcomes after frontalis suspension using autogenous fascia lata for pediatric congenital ptosis. *Ophthalmology* 2009;116:1405–1414.
37. Esmaeli B, Chung H, Pashby RC. Long-term results of frontalis suspension using irradiated, banked fascia lata. *Ophthal Plast Reconstr Surg.* 1998;14:159–163.
38. Errani C, Schuster S, Biagini R, et al. Reconstruction with fascia lata allograft of the posterior vertebra elements after resection for aneurysmal bone cyst in a child. *Eur Spine J.* 2007;16:1531–1535.
39. Walter AJ, Morse AN, Leslie KO, Zobitz ME, Hentz JG, Cornella JL. Changes in tensile strength of cadaveric human fascia lata after implantation in a rabbit vagina model. *J Urol.* 2003;169:1907–1910; discussion 1910.
40. Stecco A, Macchi V, Masiero S, et al. Pectoral and femoral fasciae: Common aspects and regional specializations. *Surg Radiol Anat.* 2009;31:35–42.
41. Stecco C, Porzionato A, Macchi V, et al. Histological characteristics of the deep fascia of the upper limb. *Ital J Anat Embryol.* 2006;111:105–110.
42. Stecco C, Duparc F. Fasciae anatomy. *Surg Radiol Anat.* 2011;33:833–834.
43. Janis JE, O'Neill AC, Ahmad J, Zhong T, Hofer SO. Acellular dermal matrices in abdominal wall reconstruction: A systematic review of the current evidence. *Plast Reconstr Surg.* 2012;130(Suppl 2):183S–193S.
44. Patel KM, Bhanot P. Complications of acellular dermal matrices in abdominal wall reconstruction. *Plast Reconstr Surg.* 2012;130(Suppl 2):216S–224S.
45. Kissane NA, Itani KM. A decade of ventral incisional hernia repairs with biologic acellular dermal matrix: What have we learned? *Plast Reconstr Surg.* 2012;130(Suppl 2):194S–202S.
46. Clemens MW, Selber JC, Liu J, et al. Bovine versus porcine acellular dermal matrix for complex abdominal wall reconstruction. *Plast Reconstr Surg.* 2013;131:71–79.
47. Pui CL, Tang ME, Annor AH, et al. Effect of repetitive loading on the mechanical properties of biological scaffold materials. *J Am Coll Surg.* 2012;215:216–228.
48. Harth KC, Krpata DM, Chawla A, Blatnik JA, Halaweish I, Rosen MJ. Biologic mesh use practice patterns in abdominal wall reconstruction: A lack of consensus among surgeons. *Hernia* 2013;17:13–20.
49. Peláez Mata D, Alvarez Zapico JA, Gutiérrez Segura C, et al. Fascia lata transplant from cadaveric donor in the reconstruction of abdominal wall defects in children (in Spanish). *Cir Pediatr.* 2001;14:28–30.