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Hernia Correction After Liver Transplantation Using Nonvascularized Fascia

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Background. Liver transplantation is an increasingly frequent surgical procedure, with elevated rates of postoperative incisional hernias ranging from 5% to 46%. There are numerous known risk factors for incisional hernia, including the type of incision, patient sex, and presence of comorbidities such as diabetes, ascites, older age, and the use of steroids. Most studies on the treatment of incisional hernias in patients who have undergone liver transplantation have shown consistently high rates of complications. Consequently, we propose the use of nonvascular fascia for the symptomatic treatment of incisional hernias in patients with concomitant liver transplantation. **Methods.** We performed our new technique on 8 patients, who had previously undergone liver transplantation, between January 2019 and January 2023. The patients were examined using imaging techniques during the follow-up period. **Results.** Of the 8 patients, 7 were liver transplant recipients and 1 was a combined liver-kidney transplant patient. The median donor age was 57 y (5–66 y), whereas the mean recipient age was 58 y (31–66 y). The median patient height and weight were 163 cm (117–185 cm) and 76 kg (17–104 kg), respectively. Immunosuppression did not change in fascia recipients. The median time between transplantation and hernia repair surgery was 41 mo (5–116 mo). The sizes of the aponeurotic defects varied from 6 × 6 to 25 × 20 cm. Two patients experienced complications: one experienced bulging that required reintervention and the other experienced surgical site seroma. There was no mortality related to the use of the technique, and none were reported during follow-up. **Conclusions.** With its promising results, nonvascularized fascial transplantation can be a successful treatment for incisional hernias in patients who had previously received a liver transplant.

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Liver transplantation (LT) is an increasingly frequent surgical procedure involving a considerably sized abdominal wall incision, such as a J, inverted T, or Mercedes-Benz incision.[1] Given the improvement in results obtained from this type of transplantation, the focus has shifted toward the improvement of quality of life of patients and functional outcomes after the procedure. Despite these efforts, post-LT incisional hernias continue to be one of the most frequent complications that significantly affect the patient quality of life.[2-5]

LT is most often performed in patients with cirrhosis, who are profoundly immunosuppressed in the immediate postoperative period. These patients may often require reoperation, leading to delayed scarring that contributes to the elevated rates of incisional hernias in the postoperative period, with an incidence ranging from 5% to 46%.[5-8] There are numerous known risk factors associated with incisional hernia, including the most frequent type of incision used, patient sex, and presence of comorbidities such as diabetes and ascites, older age, use of steroids, body mass index, and duration of stay in the intensive care unit.[5-8]

Some studies have reported that the use of a prophylactic mesh reduces the risk of incisional hernia after median laparotomy in up to 85% of cases.[9] Among the patients who underwent transplantation, the greatest benefit of using a prophylactic mesh was observed in patients with the highest risk of herniation, who often require multiple interventions and have difficulties with scarring, leading to controversial indications for using this prophylactic procedure.[10]

Most studies involving the treatment of incisional hernias after LT showed consistently high rates of complications, including up to 42% for recurrent herniation, 17% for surgical site infection, 12% for seroma, and 26% for overall complication rates after the intervention.[6] It seems that the

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The Ethics Committee of the Doce de Octubre University Hospital waived the need for an approval because of the retrospective nature of the study.

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approach, be it the open or laparoscopic approach, did not affect the results.[6,7]

Abdominal wall transplantation, as described by Levi et al,[11] has been proven to be a good alternative to aponeurotic closure after abdominal organ transplantation in patients who have undergone several interventions.[12] The greatest benefit of this technique is that it expands the abdominal capacity, allowing for lower intra-abdominal pressure after the abdominal transplant, which in turn improves blood flow to the new graft while preserving the tensile and pressure strengths in the new abdominal cavity.[13]

Therefore, the purpose of this study was to evaluate the efficacy and safety of nonvascular fascia in patients who had undergone abdominal fascial transplantation for symptomatic incisional hernias after LT who also developed intra-abdominal vascular complications. To our knowledge, this is the first report of hernia treatment after LT using a nonvascularized fascia.

MATERIALS AND METHODS

We performed our new technique on 8 patients, who had previously undergone LT, between January 2019 and January 2023. We initially treated only patients with vascular complications in the posttransplant period who required techniques that did not increase the intra-abdominal pressure. Written informed consent was obtained from all the patients. The Ethics Committee of the Doce de Octubre University Hospital waived the need for an ethical approval owing to the retrospective nature of the study.

We considered our surgical approach for patients who had undergone abdominal transplantation with one or more of the following conditions:

1. Abdominal vascular complications.
2. Multiple previous abdominal surgeries.
3. Abdominal wall or intra-abdominal infections in the post-LT period.
4. Pulmonary arterial hypertension.
5. Previous significant ascites.
6. Generalized weakness of the abdominal wall.

After procurement and before nonvascularized fascial transplantation, abdominal fascia was preserved in a refrigerator for a period of <14 d, ideally aiming for <7 d.

Planning for fascial graft procurement began approximately 1 wk before the expected surgical date for hernia repair. If no appropriate fascia donors arose during this time,[13] the patients were treated using conventional techniques for hernia repair.

All patients who underwent hernia repair with fascial transplantation were followed up with an annual imaging technique, excluding patients with previous vascular complications in whom the follow-up depended on the type of complication (ie, portal venous or hepatic arterial). All abdominal fascia transplants were performed by 2 surgeons experienced in the surgical management of the abdominal wall.

Description of the Technique

The technique and donor selection were previously described in detail.[13] Briefly, a graft in the shape of a house is performed beyond the limits of the union of the oblique muscles to maximize the size of the graft, expanding it toward the anterior oblique fascia. Before performing the aortic clamp and after dissecting the remaining abdominal organs that were retrieved, the common iliac arteries were dissected below the aortic bifurcation and cannulated until the origin of the inferior epigastric arteries, independent of aortic cannulation, for perfusion of the abdominal organs. This allowed for synchronous perfusion of the abdominal wall graft and the rest of the abdominal organs.

Back Table Preparation

The back table preparation was performed on the same day as the organ procurement in all cases. Back table preparation involved separating the anterior fascia of the rectus abdominis, attempting to expand it as much as possible at the level of the oblique muscles, and cleaning all adipose tissue. This last step is fundamental because the graft is a nonvascularized graft, and adipose tissue suffers necrosis, increasing the risk of seromas and infections in the recipient. The graft is maintained in Celsior preservation solution at 4 °C until it is needed for closure of the hernia defect. The maximum preservation time in this series was 7 d.

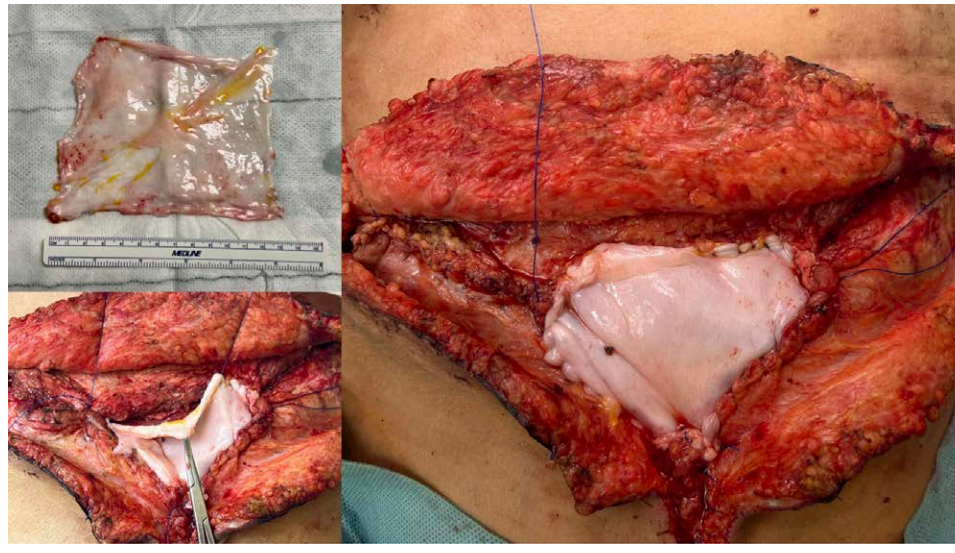

FIGURE 1. Details of back table preparation and nonvascularized facial implantation.

Technique of Fascial Implantation in the Recipient

The graft was placed such that it fully covered the abdominal wall defect and sutured to the recipient's fascia; the fascia could belong to the rectus abdominis or obliques of the recipient, depending on the previous dissection. The graft was fixed in place using either continuous or interrupted sutures using polypropylene 2/0 (Figure 1). The skin was closed with interrupted polypropylene 3/0 and a subcutaneous drain was left in place. In cases with defects >10 × 10 cm, we considered the use of a polypropylene onlay mesh to avoid bulging or proposed a 2-stage surgery.

RESULTS

Of the 8 patients included in this series, 7 required LT and 1 required a combined liver-kidney transplant. Fascial transplantation was not performed synchronously with abdominal organ transplantation in any of the patients. All donors were brain-dead; however, we did not exclude, neither in future or past, donors after circulatory death. The median donor age was 57 y (range, 5–66 y), and the mean recipient age was 58 y (range, 31–66 y). The median donor height was 163 cm (range, 117–185 cm) and the median weight was 76 kg (range, 17–104 kg). Immunosuppression remained unchanged in fascia recipients. Since these patients underwent LT, the following treatments were provided: 3 (37.5%) patients received double therapy with tacrolimus (TAC) + mycophenolate mofetil (MMF), 2 received monotherapy with MMF, 1 patient received triple therapy with TAC + MMF + steroids, and 2 patients received TAC + steroids. The median time between LT and fascial transplantation was 41 mo (range, 5–116 mo) (Table 1).

The sizes of the aponeurotic defects varied from 6 × 6 to 25 × 20 cm. Celsior was used as the preservation solution for all grafts. The median donor warm ischemia time (time between the ligation of the aorta for cannulation and the time of initiating perfusion of the fascia, since there was no flow through the epigastric arteries from the aortic clamping) was 4 min (range, 2–5 min), and the median cold ischemia time for the graft was 48 h (range, 10–264 h).

Two patients experienced complications. The first patient experiencing a combination of thrombosis of the splenomesenteric axis and pulmonary hypertension underwent our technique without a mesh to avoid increasing intra-abdominal pressures. The patient suffered from bulging, which was confirmed by tomography, showing continuity of the fascia. Once the portal thrombosis was resolved, a preaponeurotic polypropylene mesh was successfully placed. The second patient developed a seroma, which was treated with drainage. There were no mortalities related to the use of the technique. Furthermore, none were reported during follow-up.

DISCUSSION

Applications of abdominal wall transplants, as described by Levi et al,[11] continue to expand. Considering the appalling results of conventional treatments, the use of this treatment for the management of posttransplant incisional hernia should be considered.[6,14,15] Hernia recurrence rate is as high as 42%, with complications because of surgery reaching approximately 26%.[5,7] In our study, the percentage of complications was similar.

TABLE 1.
Characteristics of fascial transplantation donors and recipients

N	Donor age (y)	Donor height (cm)	Donor weight (kg)	Recipient age (y)	Tx	Time from Tx (mo)	IS	Defect size	Reason for fascia Tx	Mesh used	CIT	Hospital stay (d)	Follow-up (mo) complication
1	66	163	76	56	LTx	5	TAC + MMF	25 × 15	Portal thrombosis	No	264	7	Alive (22 mo) Mesh reparation for bulging
2	53	158	58	66	LTx	14	MMF	7.5 × 7	Multiple surgeries	No	48	3	Alive (30 mo)
3	57	158	58	61	LTx	105	MMF	6 × 6	Multiple surgeries	No	48	2	Alive (30 mo)
4	59	167	60	64	LTx	116	TAC + MMF	7 × 7	Multiple surgeries	No	136	2	Alive (18 mo)
5	18	185	100	31	HRTx	41	TAC + MMF + STE	15 × 5	Multiple surgeries	No	10	3	Alive (17 mo)
6	55	166	104	58	LTx	58	TAC + STE	25 × 15	Portal thrombosis	Yes	154	7	Alive (15 mo)
7	57	172	100	58	LTx	10	TAC + STE	5 × 10 × 2	Multiple surgeries	No	156	4	Alive (16 mo) seroma
8	5	117	17	32	LTx	22	TAC + MMF	8 × 6	Arterial thrombosis	No	10	3	Alive (9 mo)

CIT, cold ischemia time; cm, centimeters; HRTx, hepato-renal transplantation; IS, immunosuppression; kg, kilograms; LTx, liver transplantation; MMF, mycophenolate mofetil; STE, steroids; TAC, tacrolimus; Tx, transplant.

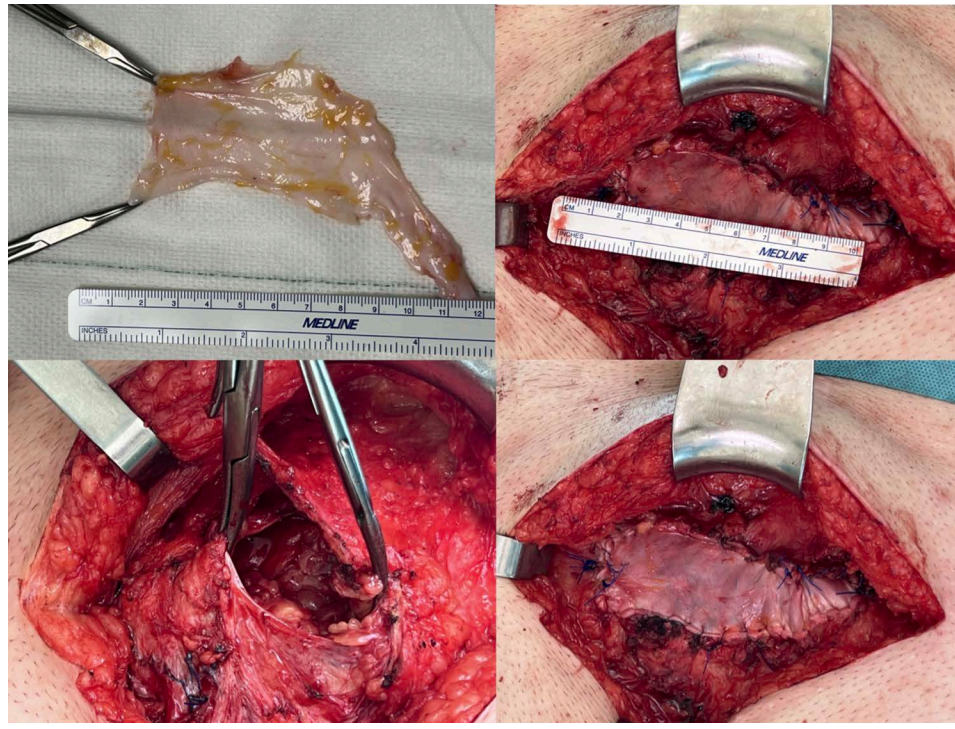

FIGURE 2. Examples of fascia defects covered by nonvascularized fascia.

Hernia recurrence is unlikely in the context of nonvascularized fascial transplantation; in fact, no cases were seen in our study. Since our technique allows for more physiologic regulation and distribution of abdominal pressure during abdominal compression, it will never result in an increase in the intra-abdominal pressure.[16,17] This is because the technique enhances abdominal continence.[18] Theoretically, this would halt the progression of posttransplant venous thrombosis. However, the effect on arterial thrombosis is more difficult to estimate, as its behavior is less predictable, and abdominal hypertension is less likely to affect it given the appearance of revascularization through diaphragmatic and omental collaterals.[19] However, the risk of bulging is likely higher,[12] although it is probably less frequent than that with peritoneal flaps.[20]

It is difficult to estimate the exact size of the fascia required for standard closure. Unlike meshes, the fascia does not need to be 1 cm wider than the hernia defect[21]; however, the exact shaping and cutting of the fascia to maintain adequate tension remains more of an art than science. If we extrapolate the evidence derived from the use of meshes in conventional repairs, we should use a mesh concomitantly with the fascia to cover defects larger than 7.5 cm to maintain tensile strength.[22] However, our technique also enhanced abdominal continence, which potentially results in the ability to close larger defects with the fascia alone, without the concomitant use of a mesh. In our experience, we did not observe the need to use meshes simultaneously with the fascia in patients with defects <7 × 7 cm (Figure 2). In patients with larger defects, using a mesh along with the fascia appears reasonable to avoid bulging rather than to prevent recurrence. Based on our experience, a 2-step surgery could be considered: the first intervention, that is, the use of the fascia graft to expand the abdominal cavity, would occur when the abdominal complications justifying the use of nonvascularized fascia are unresolved. Subsequently, a suprafascial polypropylene mesh is used to increase the integrity. This 2-step alternative is especially important for patients who are symptomatic and for whom initial mesh placement can worsen intra-abdominal complications.

In general, surgical correction of incisional hernia in patients who had undergone transplantation results in high complication and recurrence rates because of multiple factors, including immunosuppression and chronic nutritional deficits in this population, and the need for multiple reinterventions.[7,23] Although the anatomical defect of the incisional hernia in patients who underwent transplantation does not significantly differ from that of most incisions used in hepato-pancreato-biliary surgery,[1] the patient population differs because of higher rates of previous alcoholism, diabetes, and, in many cases, use of mammalian target of rapamycin inhibitors.[24,25]

Our complication rates were similar to those of the previously published studies despite dealing with patients with vascular graft complications. However, it must be noted that the patients included in this study were clinically asymptomatic from a liver perspective, showing no signs of portal hypertension or severe hepatopathy. We did not observe any cases of surgical site infection or hernia recurrence; however, our follow-up period was not particularly long (median, 18 mo [9–30 mo]). Furthermore, we did not find any cases of serious complications with other techniques, such as anterior and posterior separation, despite dealing with large abdominal wall defects in a population with intra-abdominal complications that required the expansion of the abdominal capacity to decrease intra-abdominal pressure or at least prevent an increase in pressure.[26] Our technique also avoids the need for right colectomy to manage closure and intra-abdominal pressure.[27] We observed 1 case of bulging and seroma, each. Notably, our patients' recovery times were longer than those described for minimally invasive surgery.[28]

Our technique could be used in the context of complex incisional hernias derived from renal transplants, where complication and recurrence rates are higher because of risk factors such as an increased need of immunosuppression, more complex incisions, and a higher rate of diabetes and cardiovascular diseases in this patient population.[29,30]

We did not encounter hyperacute, acute, or chronic rejection in our study, and there was no need to adjust the immunosuppression regimens, even in patients receiving monotherapy with mycophenolate, which is a minimally tolerable immunosuppressant. This forced us to consider whether this technique could be applied to immunocompetent patients. We performed a biopsy of the fascia graft in only 1 patient during an hepaticojejunostomy showing adequate fibrosis and integration into the surrounding tissue and no signs of rejection. According to our experience, fascial transplantation does not appear to be immunogenic given its lack of direct vascularization.

Our study had several limitations; first is the cohort size and short-term follow-up (median, 14 mo), although imaging was performed as a follow-up for all patients. Second, the availability of nonvascularized fascia was an issue, and we lacked knowledge regarding the maximum preservation time deemed safe for the use of nonvascularized fascial grafts,[12,13] thus limiting the use of our technique. There were instances when our technique was indicated, but viable fascia was unavailable. Thus, after careful consideration, we deemed 1 wk to be the optimal preservation time in Celsior at 4 °C in a refrigerator.

A significant advantage of this technique is that it is cost-effective when compared with standard meshes.

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