

Incisional Hernia After Liver Transplantation: Analysis of Tailored Open Mesh Repair

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Objective: Incisional hernia is a frequent complication post liver transplantation (LT). The aim of this study was to compare divergent approaches to open abdominal wall repair post-LT.

Summary of background data: After liver transplantation (LT) via Mercedes incision (MSI) we observed an incidence of incisional hernia between 5% and 34%. Conventional repair consists of reopening the whole incision and reinforcement of the whole fascia using a mesh plastic in sublay position. This retrospective analysis compares open mesh repair with complete reinforcement of the Mercedes incision and open mesh repair of solely the abdominal wall defect.

Methods: Between 2010 and 2015, 218 orthotopic liver transplantations (LT) were performed at our institution, and 25 (11.5%) of those patients required an incisional hernia repair post-LT. One group received a local hernia repair ($n = 15$) while the other group obtained a reconstruction of the whole MSI ($n = 10$). We analyzed the preoperative status, causative factors for incisional hernia, operative details, and long-term outcome of these patients.

Results: Analyzing preoperative details no significant differences were found between the 2 groups. The mean time post-LT at which the abdominal wall defect appeared was 18 ± 12 months. The mean follow-up time after abdominal wall repair was 15 (11–19) months. Additionally, 1 (4%) patient developed a hernia recurrence without statistic significant difference between the 2 groups ($P = 0.400$).

Conclusion: Local mesh reinforcement seems to be feasible and safe in incisional hernia patients after Mercedes incision due to liver transplantation.

Key words: Incisional hernia – Mesh repair – Liver transplant – Long-term outcome

Incisional hernia is a common complication after solid organ transplantation. Especially after liver transplantation (LT) via Mercedes incision (MSI) we observe an incidence of incisional hernia between 5% and 34%.^{1,2} Various reconstruction techniques are available; however, the use of a mesh is a safe and recommended method to reduce hernia recurrence.^{3,4}

Conventional incisional hernia repair usually consists of reopening the whole incision and reinforcement of the whole fascia using a mesh plastic in sublay position with an overlap of at least 5 cm in every direction.^{5,6} We analyzed all patients with incisional hernia repair post-liver transplantation. In case of an abdominal wall defect affecting solely either the longitudinal part or the transversal part of the MSI, we performed a local abdominal wall repair without reopening the whole fascial incision.

The aim of this study was to compare these divergent approaches to open abdominal wall repair specifically regarding recurrence rates and postoperative complications. Therefore, we retrospectively divided 25 patients who developed an abdominal wall defect post-LT since 2009 into 2 groups. One group received a local hernia repair whereas the other one obtained a reconstruction of the whole fascial MSI.

Materials and Methods

Between 2010 and 2015, 218 orthotopic LT were performed at our institution. Clinical data were collected and retrospectively analyzed. During this period 25 (11.5%) patients required an incisional hernia repair due to an abdominal wall defect of the MSI. Patients were divided into 2 groups, the first group receiving a local hernia repair ($n=15$) and the second one receiving a reconstruction of the whole MSI ($n=10$). We analyzed the preoperative status, the existence of causative factors for incisional hernia, operative details, and the postoperative course as well as the long-term outcome. The mean follow-up time post-hernia repair was 15 (11–19) months.

Standard access for LT was a transverse bilateral subcostal laparotomy with a cranial midline extension (Mercedes incision). Closure of the abdomen was performed with a slowly absorbable 2-layer running suture (polydioxanone 0, PDS, Ethicon Norderstedt, Germany). Standard immunosuppressive therapy consisted of triple therapy with tacrolimus (FK), mycophenolate mofetil (MMF),

and corticosteroids (Decortin). Corticosteroids were tapered to 0 within 6 weeks.

All LT patients had scheduled follow-up outpatient clinic visits with a routinely performed ultrasound examination every 3 months post-transplantation. In case of an incisional hernia the patient was presented to a specialized surgeon to confirm the diagnosis by physical examination and a surgical ultrasound.

All hernia repairs were performed via an open access. We reconstructed the abdominal wall by reopening the whole incision and reinforcement of the whole fascia using a mesh plastic with an overlap of at least 5 cm in every direction. In case of an incisional hernia affecting exclusively either the longitudinal part or the transversal part of the MSI we performed a local mesh reinforcement of the defect with an overlap of 5 cm in every direction without reopening of the whole fascial incision. Mesh reinforcement was achieved by a standard retromuscular sublay technique using a light weight polypropylene-polyglactin composite mesh (Ultrapro, Johnson and Johnson, New Brunswick, NJ, USA). We anchored the mesh with 4-6 polyglactin-910-polyfilament single stitch sutures (Vicryl 3-0, Johnson and Johnson) on the fascia. Prophylactic suction drainage was placed on the mesh in all patients (Redon size 12, PSM Medical Solutions, Tuttlingen, Germany). All patients received a single perioperative shot of antibiotic prophylaxis (cefuroxime, 500 mg; Cefuroxim Fresenius, Fresenius Kabi Deutschland GmbH, Bad Homburg, Germany).

Statistics

Statistics were performed using SPSS 23.0 for Windows (SPSS Inc., Chicago, IL, USA) on a PC. Means and standard deviation were calculated, tests for significant differences were done using the Mann-Whitney *U* test for ordinal values and the Student's *t*-test for metric values. Significant difference was assumed at $P < 0.05$. All values shown are mean \pm SD.

This study was approved by the institutional review board under the approval number EK 107-16.

Results

A total of 25 (11.5%) patients were treated with incisional hernia repair after LT between March 2010 and December 2014 at our institution. There were 10

Table 1 Preoperative data

	Defect-only reinforcement (n = 15)	Complete reinforcement (n = 10)	P value	Total (n = 25)
Gender			0.267	
Male	14 (93%)	7 (70%)		21 (84%)
Female	1 (7%)	3 (30%)		4 (16%)
Age in yr	58.1 ± 6.6	60.3 ± 6.6	0.359	59.0 ± 6.6
BMI in kg/m ²	26.5 ± 4.7	26.4 ± 4.5	0.956	26.5 ± 4.5
Diabetes	4 (27%)	3 (30%)	1.000	7 (28%)
Nicotine	4 (27%)	2 (20%)	1.000	6 (24%)
Alcohol abuse	8 (53%)	6 (60%)	1.000	14 (56%)
Myocardial disease	3 (20%)	0 (0%)	0.250	3 (12%)
Renal failure	8 (53%)	2 (20%)	0.211	10 (40%)
Art. hypertension	9 (59%)	6 (60%)	1.000	15 (60%)
COPD	1 (7%)	1 (10%)	1.000	2 (8%)
Warfarin	1 (7%)	0 (0%)	1.000	1 (4%)
ASS	2 (13%)	2 (20%)	1.000	4 (16%)
Other surgical treatment than LT	2 (13%)	0 (0%)	0.500	2 (8%)

Art., arterial; ASS, acetylsalicylic acid; BMI, body mass index; COPD, chronic obstructive pulmonary disease; LT, liver transplantation.

patients who received an open abdominal wall repair with mesh reinforcement of the whole MSI, whereas 15 patients obtained a local hernia repair affecting exclusively either the longitudinal part or the transversal part of the MSI.

Analyzing the patient details, no significant differences between the 1 groups were found concerning gender, age, body mass index (BMI), presence of diabetes or cardiac, renal and pulmonary diseases, nor previous surgical treatments other than LT. Preoperative details are shown in Table 1.

Also investigating the previously performed LT, we did not find a significant difference between the 2 groups. The investigation was done regarding preoperative MELD (model for end-stage liver disease) score, amount of blood transfusions, duration of LT, preexistent malignant tumor, additional

immunosuppression with mycophenolate mofetil, treated rejection with application of a steroid bolus, performed relaparotomy, laparostoma, or intensive care unit stay duration post-LT as shown in Table 2.

The mean time post-LT at which the abdominal wall defect appeared was 18.3 ± 11.8 months. In the local group (n = 15), 13 (87%) patients obtained a defect of the longitudinal part while 2 (13%) patients developed a hernia on the transversal part of the MSI. In the full repair group (n = 10), 8 (80%) patients received an abdominal wall defect repair because of a combined hernia of both the longitudinal and transversal part of the MSI, whereas 2 (20%) patients needed a full repair due to a hernia of only the longitudinal part of the MSI (Table 3).

In the postoperative course, 2 patients developed a postoperative hematoma, while 5 patients obtained a surgical site infection with the need of a

Table 2 LT details

	Defect-only reinforcement (n = 15)	Complete reinforcement (n = 10)	P value	Total (n = 25)
Preoperative MELD	17 ± 11	16 ± 10	0.781	17 ± 11
Median amount of blood transfusion	7 (2–24)	9 (0–27)	0.511	8 (0–27)
Duration of LT (min)	320 ± 99	279 ± 64	0.261	304 ± 88
Malignant tumor	4 (27%)	4 (40%)	0.667	4 (16%)
Immunosuppression with additional MMF	10 (67%)	8 (80%)	0.659	18 (72%)
Steroid bolus in graft rejection	5 (34%)	1 (10%)	0.345	6 (24%)
Relaparotomy	7 (47%)	6 (60%)	0.688	13 (52%)
Laparostoma	0 (0%)	1 (10%)	0.400	1 (4%)
ICU stay in days	14.9 ± 20.5	3.7 ± 1.3	0.249	10.4 ± 16.6

ICU, intensive care unit; LT, liver transplantation; MELD, model for end-stage liver disease; MMF, mycophenolate mofetil.

Table 3 Operation details

	Defect-only reinforcement (n = 15)	Complete reinforcement (n = 10)	P value	Total (n = 25)
Hernia repair post-LT (months)	20.0 ± 12.8	15.9 ± 10.1	0.405	18.3 ± 11.8
Hernia location				
Longitudinal incision	13 (87%)	10 (100%)	0.500	23 (92%)
Transversal incision	2 (13%)	8 (80%)	0.002	10 (40%)
Both	0 (0%)	8 (80%)	<0.001	8 (32%)

LT, liver transplantation.

wound vacuum-assisted closure (VAC) dressing system. Mean duration of hospital stay was 8.6 ± 4.6 days. No significant statistical difference between the 2 study groups was found.

The mean follow-up time after abdominal wall repair was 14.5 (10.5–18.6) months. Only 1 (4%) patient of the full repair group developed a hernia recurrence without a significant statistical difference between the 2 groups ($P = 0.400$) (Table 4).

Discussion

The occurrence of incisional hernia after LT remains a frequent complication. According to the literature the incidence of post-LT incisional hernia varies between 5% and 34%,^{2,7,8} which is comparable to the incidence of 12% at our institution. Predisposing factors for incisional hernia after LT are similar to patients with other major abdominal surgery including obesity, patient age >45 years, nicotine-associated chronic obstructive pulmonary disease, relaparotomy, and postoperative wound infection.^{9–13} In addition to this, Fikatas *et al* identified the use of MMF as risk factor for hernia formation post liver transplantation.¹³ In our cohort, hernia patients had a mean age of 59 ± 7 years, and a mean BMI of 27 ± 5 . In 52% of the cases a relaparotomy post-LT was necessary, and an immunosuppressive regime including the use of MMF

was applied in 72% of the patients. We did not find a significant difference between our 2 study groups regarding these predisposing factors. Piazzese *et al* reported that the use of the MSI was also associated with the development of an incisional hernia.¹⁴ In our study MSI incision as surgical access was chosen for all 25 patients who developed an abdominal wall defect after LT.

In case of the clinical appearance of a postoperative incisional hernia, our standard procedure consists of reopening of the whole incision and reinforcing of the whole fascia using a mesh with an overlap of at least 5 cm in every direction according to the findings of Conze *et al* and Klinge *et al*.^{6,15} We did not perform any type of primary suture due to reported recurrence rates of up to 63%.^{5,16,17} However, divergent to our standard procedure in non-transplant patients, in case of an abdominal wall defect affecting exclusively either the longitudinal or the transversal part of the MSI, we performed a local abdominal wall repair with retromuscular mesh reinforcement without reopening of the whole fascial MSI, which is contrary to the aforementioned published data. A total of 10 patients (40%) received a reinforcement of the whole MSI, whereas 15 patients (60%) obtained a local hernia repair affecting exclusively either the longitudinal or the transversal part of the MSI. The aim of this study was to analyze these 2 different therapy

Table 4 Postoperative course

	Defect-only reinforcement (n = 15)	Complete reinforcement (n = 10)	P value	Total (n = 25)
Hematoma	2 (13%)	0 (0%)	0.500	2 (8%)
Surgical site infection	4 (27%)	1 (10%)	0.615	5 (20%)
Other complications	1 (7%)	1 (10%)	1.000	2 (8%)
ICU stay in days	0.4 ± 0.7	0.0 ± 0.0	0.082	0.2 ± 0.06
Hospital stay in days	9.7 ± 5.6	7.1 ± 1.3	0.182	8.6 ± 4.6
Follow-up in months	14.2 ± 11.3	14.9 ± 7.7	0.542	14.5 ± 9.8
Hernia recurrence	0 (0%)	1 (10%)	0.400	1 (4%)

strategies. Data dealing with this particular problem is remarkably limited.

Many studies compare primary suture repair and mesh implantation in transplant patients. There is strong evidence that mesh reinforcement significantly reduces recurrence rates at low complication rates.^{1,4,18} In our retrospective analysis, 1 patient (4%) with mesh reinforcement of the whole fascial MSI showed a recurrent hernia. Comparing the 2 study groups, we did not observe a significant difference in recurrence rates during the follow-up. Mean follow-up time was 14.5 ± 9.8 months. Results of the long-term follow-up care have to be awaited; however, we did not observe a trend toward inferior results in our rather short follow-up interval.

It has been discovered that dysfunctions in collagen metabolism mediated by matrix metalloproteinases (MMPs) are associated with incisional hernia and high recurrence rates, supporting the hypothesis that abdominal hernia represents a disease of the extracellular matrix.^{19,20} Taking into account that we did not observe a higher recurrence rate after performing a local hernia repair without reinforcement of the whole fascia, the question arises whether there is a different regulation of the collagen metabolism in post-LT hernia patients. Susa *et al* observed a significantly reduced MMP-2/MMP-9 activity after tacrolimus treatment in a rat model.²¹ Future research on this topic with molecular testing, for example, is necessary to decode the correlation between collagen metabolism and immunosuppressive treatment in hernia patients.

Our study is subject to major limitations. First, due to the retrospective design and the fact that all data is from a single institution it may not be extrapolated. Additionally, our study analyzes exclusively the open approach for abdominal wall repair, while a comparison to laparoscopic hernia repair is lacking. Furthermore, our cohort consists of 25 patients, which is relatively small but comparable to the published data.^{1,7,18,22,23}

Our data shows that the recurrence rate of open mesh repair of exclusively the defect area in LT patients with MSI does not significantly differ to patients with reinforcement of the whole fascial MSI due to an abdominal wall defect. However, reconstruction techniques in each group were chosen in different clinical situation, which may be subject to a selection bias. In summary, we may conclude that in the case of a local circumscribed hernia of either the longitudinal of the transversal incision, a targeted repair is safe and suitable. Randomized controlled trials are needed and justified to further investigate

the impact of exclusively reconstruction of the defect area in patients with incisional hernia after liver transplantation.

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