Incisional hernia after liver transplantation: Risk factors and health-related quality of life

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ABSTRACT

The aim of this cross-sectional study was to analyze the incidence of incisional hernia after liver transplantation (LT), to determine potential risk factors for their development and to assess their impact of incisional hernia on health-related quality of life (HRQoL).

Patients who underwent LT through a J-shaped incision with a minimum follow-up of 3 months were included. Follow-up was conducted at the outpatient clinic. Short form 36 (SF-36) and body image questionnaire (BIQ) were used for the assessment of HRQoL.

A total of 140 patients was evaluated. The mean follow-up period was 33 (SD 20) months. Sixty patients (43%) were diagnosed with an incisional hernia. Multivariate analysis revealed surgical site infection (OR 5.27, $p = 0.001$), advanced age (OR 1.05, $p = 0.003$), and prolonged ICU stay (OR 1.54, $p = 0.022$) to be independent risk factors for development of incisional hernia after LT. Patients with an incisional hernia experienced significantly diminished HRQoL with respect to physical, social, and mental aspects.

In conclusion, patients who undergo LT exhibit a high incidence of incisional hernia, which has a considerable impact on HRQoL. Development of incisional hernia was shown to be related to surgical site infection, advanced age and prolonged ICU stay.

INTRODUCTION

Liver transplantation (LT) has evolved from a life-saving operation with high mortality in the 70's and 80's of the past century to a standardized procedure with a reported 1-year survival rate of over 90%, depending on the initial indication.[1,2] During this evolution, focus has shifted from preventing peri-operative mortality and major complications to managing long-term side-effects of immune suppressive therapy and improving quality of life after LT.[3-6]

With improved long-term survival after LT, incisional hernia has become a frequently diagnosed and clinically more relevant complication with incidences varying between 1.7 and 34.3%.[7-16] Incisional hernias form not only an aesthetic problem, but they may also reduce quality of life and can lead to serious morbidity due to incarceration or strangulation.[16-18] Therefore, prevention of this late complication has become increasingly important. Many causative factors for incisional hernias have been identified retrospectively in patients after LT: recipient's age, male sex, body mass index (BMI), indication for transplantation and underlying liver disease, pulmonary complications, wound infections, number of reoperations, immunosuppressive regimen, and incision type.[14,16,19,20]

Traditionally, the classic 'Mercedes Benz star' incision or 'rooftop' incision was used predominantly to perform LT. More recently, smaller incisions like a subcostal incision with or without a mediocranial extension ('J-shaped' or 'hockey-stick' incision) are now preferred, since they have been shown to provide adequate access for LT with presumably less abdominal wall trauma, resulting in a reported lower incidence of incisional hernia.[1,11,21,22]

Prospective data on independent risk factors for the development of incisional hernia after LT are sparse and none have evaluated the impact of incisional hernia after LT on health-related quality of life (HRQoL). The aim of this cross-sectional study was to assess the incidence of clinically detectable incisional hernias, to evaluate risk factors for the development of incisional hernia, and to determine the impact of incisional hernia on HRQoL in patients all of whom underwent LT through a J-shaped incision.

METHODS

A cross-sectional study was performed of patients who underwent LT between January 2004 and November 2010 at the Erasmus University Medical Center. All patients who

underwent LT through a J-shaped incision with a minimum follow-up of 3 months were asked to participate in the study and invited to the outpatient clinic for a physical examination. The medical ethics committee at Erasmus University of Rotterdam approved the study, and written informed consent was obtained from all participants. All patients who participated in the study were examined by an experienced surgeon to assess the incidence of incisional hernias after LT. In each patient, the physical examination was performed in both a supine and erect position, in rest and during the Valsalva maneuver. Incisional hernia was defined as a palpable defect in the abdominal wall of the incision used for LT, performed during the initial study period, resulting in a herniation of abdominal contents. If an incisional hernia was diagnosed, data on hernia location, hernia size and if corrected data on recurrence were collected. If patients underwent repair of an incisional hernia, a flat heavyweight polypropylene mesh was used if gross contamination was not present at the time of correction. This mesh was placed in the pre-peritoneal plane preferably. Antibiotic prophylaxis was administered to prevent infection of the prosthesis.

The J-shaped incision, consisting of a right subcostal incision combined with a mediocranial extension towards the xyphoid, was used primarily to gain access to the abdominal cavity in all cases. Routinely, a table-mounted abdominal wall retractor (Thompson Surgical Instruments, Incorporated, Traverse City, MI, USA) was used during the entire procedure. At completion of the procedure the abdominal wall fascia was closed by a single-layer mass closure technique with a running, slowly absorbable, monofilament suture loop (PDS 0, Ethicon). The skin was closed using intracutaneous running absorbable monofilament sutures (Monocryl 4.0, Ethicon). Thirty minutes preoperatively, a single dose Cefalozine (1500mg) was administered as antibiotic prophylaxis unless another antibiotic regimen was prescribed because of earlier infections in the patient's recent medical history. An additional dose of Metronidazole (500 mg) in case of expected bilioenteric reconstruction. When patients had considerable ascites at the first exposure of the abdominal cavity, passive abdominal drainage was only performed after LT. No T-tubes or stents were used during the biliary reconstruction. All biliary reconstructions were duct-to-duct unless primary sclerosing cholangitis or another disease was present affecting the extrahepatic bile duct. In these patients a bilio-enteric reconstruction was created, using a Roux-en-Y loop. Relaparotomies were always performed through the same incision created during LT. Postoperatively, dual or triple immunosuppressive therapy consisting of low-dose steroids, and Tacrolimus (Prograf, Astellas Pharma) and/or Mycophenolate Mofetil (MMF, CellCept, Roche), was administered for three months. All patients were withdrawn from steroid therapy except those with an underlying immune-regulated liver disease.

Patient characteristics and clinical data were collected prospectively in the search for potential risk factors, including: age, sex, underlying liver disease, cardiovascular diseases (cardiac arrhythmia, ischemic heart disease or other cardiovascular disease), chronic obstructive pulmonary disease (COPD), diabetes mellitus (DM), medical history of other hernia (inguinal-/umbilical hernia/acute dehiscence), Body Mass Index (BMI) at time of LT, Child-Turcotte-Pugh (CTP) score at time of LT, Model of End-stage Liver Disease score based on laboratory findings solely at the time of LT (labMELD), intraoperative presence of ascites, procedure time of LT, intra-operative blood loss, length of hospital stay, length of postoperative intensive care unit (ICU) admission, immunosuppressive regimen (dual or triple), postoperative complications including wound complications, surgical site infection, pneumonia, biopsy-proven acute graft rejection, and number of relaparotomies.

To compare HRQoL among patients with an incisional hernia after LT to those without, patients were asked to fill in quality of life questionnaires, the Short Form (36) Health Survey (SF-36) and the Body Image Questionnaire (BIQ) prior to physical examination.[23-25] The SF-36 consists of 36 items that allow measurement of eight health domains, including: physical functioning, physical role functioning, bodily pain, general health perception, vitality, social functioning, emotional role functioning, and mental health.[25] In addition, physical and mental health are scored with the SF-36 physical component summary and SF-36 mental component summary, respectively. SF-36 scores range from 0 to 100, with higher scores implying a better quality of life.

The BIQ consists of eight items evaluating body image and cosmetics after surgery, and two items evaluating self-confidence.[23-25] The body image scale measures patients' perception of and satisfaction with their own body and it explores patients' attitude towards their bodily appearance (items 1, 2, 3, 4, 5); each item can be awarded 1 to 4 points (1 = "no, not at all" to 4 = "yes, extremely"). The cosmetic scale assesses the degree of satisfaction of the patient with respect to the physical appearance of the scar (items 6–8); item 6 ranges from 1 ("very unsatisfied") to 7 ("very satisfied"), item 7 ranges from 1 ("revolting") to 7 ("beautiful") and item 8 is a scoring scale from 1 to 10, with higher scores implying more satisfaction. Two items (9, 10) evaluate self-confidence of the patient *before* and *after* LT; both items can be awarded 1 to 10 points (1 = "not very confident" to 10 = "very confident").

Statistical analysis

SPSS 17.0 (SPSS Inc., Chicago, IL, USA) was used for statistical analysis. Chi-square test, Mann-Whitney U-test and independent sample t-test were used for categorical, continuous variables and analysis of quality of life. Univariate and multivariate analy-

ses of various factors were performed with logistic regression analysis to determine HRQoL, potential and independent risk factors for the occurrence of incisional hernia. In univariate and multivariate analysis, risk factors were adjusted for length of follow-up; SF-36 components and BIQ questions were adjusted for age and sex. Values were considered statistically significant at p-values less than 0.05.

RESULTS

Of all 201 patients who were transplanted through a J-shaped incision, 140 provided informed consent and were examined. The remaining 61 were deceased (n = 40) or emigrated/refused to participate (n = 21) and could not be included. Patient characteristics and clinical data are set out in table 1. The mean follow-up period was 33 (SD 20) months. Sixty patients (43%) were diagnosed with a clinically detectable incisional hernia after physical examination. Twenty-one of those 60 incisional hernias (35%) were located in the subxyphoidal part of the incision, 18 (30%) were located in the middle part of the incision, and 9 (15%) were located laterally. In 12 patients (20%) the incisional hernia was located at more than one location. The mean diameter of the incisional hernia was 3.4 cm (SD 5.5).

Ten of the 60 patients (17%) who developed an incisional hernia underwent hernia repair during follow-up; eight patients of these ten were operated electively and one patient in an emergency setting due to incarceration of the small bowel after a mean follow-up of 17 months (SD 12). Furthermore, four patients underwent acute dehiscence repair after LT. All four patients developed an incisional hernia after acute dehiscence repair during follow-up; one of these four patients underwent an elective incisional hernia repair 19 months after LT. In all incisional hernia repairs a mesh was used. Two patients developed an infection of the mesh; in both cases the infected mesh had to be removed.

Univariate analysis (adjusted for follow-up duration) demonstrated age (p = 0.02), pre-operative BMI (p = 0.012), ICU stay (p = 0.022), surgical site infection (p = 0.004), and hernia in the medical history (p = 0.036) to be potential risk factors for development of incisional hernia after LT. Sex (p = 0.133), follow-up time (p = 0.076), labMELD score at time of LT (p = 0.423), relaparotomy frequency (p = 0.057), immunosuppressive regimen (p = 0.772), and biopsy-proven acute graft rejection (p = 0.078) were not identified as risk factors for incisional hernia after LT. (Table 2)

Table 1. *Patient characteristics and clinical data.*

Characteristics	*Total (n = 140)*
Sex, (%)	
Male	90 (64)
Female	50 (36)
Age (years), mean (SD)	49 (12)
Body mass index (at LT), mean (SD)	26 (4)
Follow-up (months), mean (SD)	33 (20)
Total # with Liver Disease, (%)	
Hepatitis	41 (29)
Alcoholic	30 (21)
HCC	33 (24)
Cryptogenic	13 (9)
PSC	37 (26)
PBC	5 (4)
Autoimmune	2 (1)
Acute liver failure	20 (14)
Budd-Chiari syndrome	1 (0.7)
Other	10 (7)
Child Pugh Score, (%)	
A	24 (17)
B	57 (41)
C	59 (42)
labMELD, median (range)	15 (6-40)
Preoperative ascites, (%)	93 (66)
Procedure time LT (min), median (range)	441 (254-822)
Blood loss (liter), median (range)	3.2 (0.1-25.0)
Duration hospital stay (days), median (range)	20 (10-77)
Duration ICU stay (days), median (range)	4 (2-70)
Relaparotomy, (%)	53 (38)
Immunosuppressive regimen, (%)	
Dual	29 (21)
Triple	111 (79)
Acute graft rejection, (%)	30 (21)
Surgical site infection, (%)	28 (20)
Diabetes, (%)	45 (32)
Cardiovascular disease, (%)	42 (30)
COPD, (%)	12 (9)
Other hernia in medical history, (%)	47 (34)

LT, liver transplantation; PBC, primary biliary cirrhosis; labMELD, Model of End-stage Liver Disease, only based on laboratory variables; COPD, Chronic obstructive pulmonary disease; Other hernia in medical history includes: inguinal-/umbilical hernia/acute dehiscence.

Table 2. *Univariate analysis: potential risk factors for incisional hernia development.*

	Patients with IH (n = 60)	*Patients without IH (n = 80)*	*p – value**
Follow-up (months), mean (SD)	37 (19)	31 (20)	0.076
Sex, mean (SD)			
Male	43 (72)	47 (59)	0.113
Female	17 (28)	33 (41)	
Age (years), mean (SD)	51 (10)	47 (14)	0.020
Body mass index (at LT), mean (SD)	26 (5)	25 (4)	0.012
labMELD, median (range)	11 (6-40)	11 (6-40)	0.423
Surgical site infection, percentages (%)	19 (32)	9 (11)	0.004
Relaparotomy, percentages (%)	28 (47)	25 (31)	0.057
Duration ICU stay (days), median (range)	5 (2-70)	4 (2-46)	0.022
Immunosuppressive regimen, percentages (%)			
Dual	13 (22)	16 (20)	0.772
Triple	47 (78)	64 (80)	
Acute graft rejection, percentages (%)	8 (13)	22 (28)	0.078
Other hernia, percentages (%)	26 (43)	21 (26)	0.036

**p-values are adjusted for follow-up duration. IH, incisional hernia; LT, liver transplantation; labMELD, Model of End-stage Liver Disease, only based on laboratory variables; Other hernia in medical history includes: inguinal-/umbilical hernia/acute dehiscence.*

Multivariate logistic regression analysis after adjustment for follow-up duration revealed surgical site infection (OR 5.27, 95% CI 1.94 to 14.35; p = 0.001), older age (OR 1.05, 95% CI 1.02 to 1.09; p = 0.003) and prolonged ICU stay (OR 1.54, 95% CI 1.06 to 2.22; p = 0.022) to be independent risk factors for incisional hernia in patients who underwent LT through a J-shaped incision.

A total of 122 patients (87%) completed quality of life questionnaires. Patients with an incisional hernia scored significantly lower (i.e. experienced worse quality of life) on the SF-36 components: physical role functioning (p = 0.026), vitality (p = 0.004), social functioning (p = 0.002), emotional role functioning (p = 0.005), mental health (p = 0.042) and mental component summary (p = 0.001). (Table 3)

Patients with an incisional hernia after LT were significantly less satisfied with the body image (p = 0.016). These patients answered significantly less favorably the item: "*Do you think the surgery has damaged your body?* " (p = 0.007). Patients with an incisional hernia after LT also scored significantly lower on the cosmetic scale (p = 0.033). These patients answered significantly less favorably the item: "*How satisfied are you with your scar?"* (p = 0.036). Within the group of patients with an incisional hernia, no difference in HRQoL was observed with regard to the location of the diagnosed incisional hernia.

Table 3. *Mean SF-36 scores and SD for patients with and without an incisional hernia.*

Short form 36 component	*Patients with IH*			*Patients without IH*				
	N	**Mean**	**SD**	**N**	**Mean**	**SD**	**p - value***	**(p – value)**
Physical functioning	54	65.9	26.2	65	73.2	28.0	0.053	0.204
Role physical	51	43.6	42.4	60	62.9	42.6	**0.026**	**0.020**
Bodily pain	53	72.3	26.7	65	79.2	24.2	0.149	0.113
General health perceptions	54	52.5	23.2	65	58.0	22.8	0.139	0.197
Vitality	54	51.9	22.6	65	63.5	18.9	**0.004**	**0.003**
Social functioning	54	66.9	26.5	66	80.1	23.3	**0.002**	**0.003**
Role emotional	50	68.7	44.9	61	90.7	26.1	**0.005**	**0.003**
Mental health	54	73.5	18.3	65	79.9	17.0	**0.042**	**0.028**
Physical component summary	50	41.4	11.5	59	44.8	10.9	0.138	0.137
Mental component summary	50	48.2	11.7	59	54.9	8.4	**0.001**	**0.001**

** Mann-Whitney U test (univariate); p-values after adjustment for age and gender (multivariate) are shown in parentheses; SF 36, short form 36; SD, standard deviation; IH, incisional hernia.*

Multivariate analysis of SF-36 components, the body image scale and the cosmetic scale, after adjustment for age and gender, did not change the results significantly, except for the body image item: *"Is it difficult to look at yourself naked?"* After adjustment for age and sex, patients with an incisional hernia scored significantly more points (i.e. had more difficulty looking at their body naked, p = 0.016). (Table 4)

Table 4. *Mean BIQ scores with SD for patients with and without an incisional hernia.*

Body image questionnaire		*Patients with IH*			*Patients without IH*				
	Scale	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**p - value***	**(p – value)**
Body image									
Are you less satisfied with your body since the surgery?	1-4	51	1.9	1.1	63	1.6	0.8	0.132	0.055
Do you think the surgery has damaged your body?	1-4	51	2.0	0.8	62	1.6	0.6	**0.007**	**0.003**
Do you feel less attractive as a result of your surgery?	1-4	50	1.7	0.9	63	1.5	0.7	0.237	0.203
Do you feel less feminine/ masculine as a result of your surgery?	1-4	51	1.4	0.8	62	1.2	0.6	0.088	0.121
Is it difficult to look at yourself naked?	1-4	51	1.6	0.9	63	1.3	0.6	0.073	**0.016**
Cosmesis									
On a scale from 1 to 7, how satisfied are you with your scar?	1-7	51	4.5	1.9	63	5.2	1.9	**0.036**	**0.022**
On a scale from 1 to 7, how would you describe your scar?	1-7	51	4.2	1.5	62	4.7	1.4	0.102	0.075
Could you score your own scar on a scale from 1 to 10?	1-10	55	6.1	2.7	75	6.2	3.4	0.268	0.590
Self-confidence									
*How confident were you **before** your operation?*	1-10	54	6.7	2.8	75	5.9	3.4	0.353	0.317
*How confident were you **after** your operation?*	1-10	55	6.0	3.0	76	5.9	3.5	0.501	0.945
Body image scale	5-20	51	16.5	3.6	63	18.0	2.4	**0.016**	**0.009**
Cosmetic scale	3-24	51	15.3	4.9	63	17.1	4.3	**0.033**	**0.016**

*Mann-Whitney U test (univariate); p-values after adjustment for age and gender (multivariate) are shown in parentheses; BIQ, body image questionnaire; SD, standard deviation; IH, incisional hernia.

DISCUSSION

This cross-sectional study shows that patients who undergo LT through a J-shaped incision have a high incidence of incisional hernia and that these patients experience diminished HRQoL compared to those who do not develop an incisional hernia. Furthermore, the presence of an incisional hernia was shown to be related to surgical site infection, older age and prolonged ICU stay. These results underscore the importance of this late complication in patients after LT. Especially, because these patients are often not considered to be at high risk typically for an incisional hernia in contrast to patients with obesity or abdominal aneurysms.[25-31] Poor preoperative nutritional status, long duration of the operation, poor immunologic status due to postoperative immunosuppressive medication and the underlying liver disease in patients undergoing LT could all contribute.

Incisional hernias after LT have been reported with growing incidence in recent years, reflecting improved survival after LT and probably greater awareness of the development of incisional hernias.[11,14-16,21] However, in contrast to the current study, several studies have shown lower incidences of incisional hernia after LT.[12,13,20,22] If incisional hernias are asymptomatic, it is conceivable that patients are often not examined with a specific focus on incisional hernias at the outpatient clinic, which could have led to an underestimation of the incidence in these studies. Furthermore, diagnosing abdominal wall hernias retrospectively solely based on questionnaires have also been shown to be unreliable and follow-up must be done by physical examination.[32] Therefore, all patients included in this study underwent physical examination with a special focus on incisional hernia.

A recent retrospective study also reported a high overall incidence (32.4%) of incisional hernias after LT.[16] The authors identified early use of mammalian target of rapamycin inhibitors as the most important independent risk factor for incisional hernia development after LT. The current study reports an even higher incidence of incisional hernia but without use of this immunosuppressive regimen. In addition to rapamycin, Montalti et al. identified MELD scores higher than or equal to 22 and male sex as independent risk factors for the development of incisional hernia after LT.[16] Whereas, the current study identified surgical site infection, older age and prolonged ICU stay as risk factors related to incisional hernia development after LT, which is more in line with previous studies of risk factors for incisional hernia development after abdominal surgery for other indications.[14,20,22]

In this cross-sectional study, 20% of patients developed surgical site infections. Several studies suggested PSC as risk factor for surgical site infections after LT due to the frequent presence of infected bile and the need for bilioenteric anastomoses in the majority of these transplant patients.[33-35] However, the association between PSC and the presence of surgical site infections could not be found in this study. Infection of the surgical site is already considered to be an important risk factor contributing to the development of incisional hernia in non-transplant patients.[18,36,37] This study provides evidence that surgical site infections are the most important risk factor for the development of incisional hernias in LT patients as well. Negative effects of immunosuppressive therapy after LT on the patient's immune system can further contribute to the high incidence of surgical site infections and therefore the increased incidence of incisional hernia due to disturbed and delayed wound healing in the early postoperative period after LT.[3,14] However, intensity of immunosuppressive therapy could not be verified as an independent risk factor for the development of incisional hernia after LT in the current study.

Aging is also associated with a decline in many functions of the immune system.[38] It has been argued that changes in the immune system may lead to more surgical site infections.[39] Although, the current study found older age to be an independent risk factor for incisional hernia development in patients after LT, changes in the immune system leading to infection in patients of older age are not fully understood.[38,39] This has also been suggested, but not as independent risk factor, in an earlier study by Gomez et al.[19]

Malnutrition, with an incidence of up to 40% of patients in the ICU, is shown to be associated with impaired immune function, impaired ventilatory drive, and weakened respiratory muscles, leading to prolonged need for ventilator support in critically-ill patients.[40] This might explain the association found in the current study between prolonged ICU stay and incisional hernia development after LT. Muller et al. also suggested this association in an earlier report.[1]

Although most incisional hernias in patients included in this study were without symptoms, HRQoL assessed by both SF-36 and BIQ (body image scale *and* cosmetic scale) revealed impaired outcomes for patients with an incisional hernia after LT compared to those without an incisional hernia. Patients with LT and an incisional hernia experienced worse HRQoL as given by the SF-36 components: physical role functioning, vitality, social functioning, emotional role functioning, mental health and mental component summary and were reported to be generally less satisfied according to both the body image scale and the cosmetic scale. The highest impact on HRQoL

according to the SF-36 was observed for the component 'role emotional', which scored 22 points lower on a 0 – 100 scoring scale in the presence of an incisional hernia in patients after LT. Patients suffering from an incisional hernia were reported to be less satisfied with their scar. This negative impact of incisional hernias after LT on HRQoL further underscores the importance of prevention of this complication.

In the current study, only patients operated through a J-shaped incision with a minimum follow-up of 3 months were included. In our institution the J-shaped incision is considered to be the optimal incision since it combines minimal abdominal wall trauma with sufficient access to the abdominal cavity to perform LT safely. The optimal incision to perform an LT however is still a subject of debate.[11,16,22] It is hypothesized that this small incision may also have contributed to the high incidence of incisional hernias in the current study because of increased mechanical strain on the wound due to wound retractors, necessary to provide adequate access.[1] Therefore, conversion of the J-shaped incision into the Mercedes incision may be of additional value in specific cases, such as very obese patients, in order to provide an adequate access but to avoid the wound damage caused by excessive traction. It may also be that in the current study, in contrast to other studies, irrespective of which incision type was used, the higher incidence can be explained by the fact that all incisional hernias were diagnosed and addressed because of the special focus on finding an incisional hernia. This may also have contributed to the high rate of elective incisional hernia repairs in this study. Unfortunately, the optimal incision type, that combines adequate access to the suprahepatic inferior vena cava, liver hilum and both liver lobes with prevention of long-term complications, such as incisional hernias after LT, remains to be determined, just like the optimal closing technique. As reported in this study, 65% of the incisional hernias diagnosed, were located in the subxyphoidal part and in the middle part of the incision. Presumably, in the J-shaped incision, the point of higher tension is at the junction of the subcostal incision with the midline incision. Therefore, it might be advantageous to apply one additional stich using a non-absorbable/absorbable suture in this point in order to reinforce the closing, as a possible measure to decrease the incidence of the incisional hernia using the J-shaped incision. Randomized controlled trials on incision types, closure techniques, and prophylactic mesh use and studies that focus on prevention of surgical site infections are needed to tackle this often underestimated complication after LT.

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