Incidence, Risk Factors, and Management of Incisional Hernias After Kidney Transplant: A 20-Year Single Center Experience

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ABSTRACT

Background. Incisional hernias (IH) constitute a complication after kidney transplant (KT). Patients may be particularly at risk because of comorbidities and immunosuppression. The study aim was to assess the incidence, risk factors, and treatment of IH in patients undergoing KT.

Methods. This retrospective cohort study included consecutive patients who underwent KT between January 1998 and December 2018. Patient demographics, comorbidities, perioperative parameters, and IH repair characteristics were assessed. Postoperative outcomes included morbidity, mortality, need for reoperation, and length of stay (LOS). Patients who developed IH were compared with those who did not develop one.

Results. Forty-seven patients (6.4%) developed an IH after a median delay of 14 months (IQR, 6-52 months) in 737 KTs. On uni- and multivariate analyses, body mass index (odds ratio [OR], 1.080; $P = .020$), pulmonary diseases (OR, 2.415; $P = .012$), postoperative lymphoceles (OR, 2.362; $P = .018$), and LOS (OR, 1.013; $P = .044$) were independent risk factors. Thirty-eight patients (81%) underwent operative IH repair, and 37 (97%) were treated with a mesh. The median LOS was 8 days (IQR, 6-11 days). Three patients (8%) developed surgical site infections, and 2 patients (5%) presented hematomas requiring surgical revision. After IH repair, 3 patients (8%) had a recurrence.

Conclusions. The incidence of IH after KT seems rather low. Overweight, pulmonary comorbidities, lymphoceles, and LOS were identified as independent risk factors. Strategies focusing on the modifiable patient-related risk factors and early detection and treatment of lymphoceles may help to decrease the risk of IH formation after KT.

INCISIONAL hernias (IHs) are one of the most frequent postoperative complications after abdominal surgery, with an incidence between 2% and 20%, depending on the type of intervention and length of follow-up [1,2]. Patients with IH can present with various symptoms such as pain, discomfort, cosmetic complaints, or incarceration. These hernias can therefore have a physical and psychological impact on the patient and generate considerable costs.

After abdominal organ transplant, patients are of particular concern as they are placed on immunosuppressive medications, which may increase the risk of IH formation because of an associated impairment in wound healing [1,3]. The most commonly used maintenance treatments, such as mycophenolate mofetil and steroids, as well as sirolimus and everolimus, have an antiproliferative effect and may impair fibroblasts growth. These drugs also interfere with the production of vascular endothelial growth factor and therefore impede local angiogenesis and tissue repair mechanisms [4−6]. Kidney transplant (KT) recipients are also exposed to prolonged periods of dialysis and often harbor complex comorbidities, which may in turn increase the risk of developing an IH [7]. Previous studies have analyzed the

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incidence of IH formation after KT, and estimates range from 1% to 18% [1,6−9].

Regarding the treatment of IH, the use of a permanent prosthetic mesh has been described as the gold standard [1,6]. However, this may be a challenging intervention, potentially predisposing the patient to complications, such as seroma, hematoma, and mesh infection. In addition, mesh placement makes the iliac fossa less accessible for future transplant removal or KT [1]. For these reasons, the decision to reoperate on transplant recipients is not always straightforward [10].

The aim of the present study was to assess the incidence, time to onset, risk factors, and management of IH after KT.

MATERIALS AND METHODS

Patients and Outcomes

This retrospective cohort study included consecutive patients who underwent KT between January 1998 and December 2018 at the Department of Visceral Surgery, Lausanne University Hospital (CHUV), Lausanne, Switzerland. Patients who received a second (contralateral) transplant were considered as new cases at risk for developing IH. Multivisceral transplant recipients and pediatric patients (<18 years) were excluded. Patient demographics, comorbidities, perioperative parameters, and IH repair characteristics were assessed. The postoperative outcomes included morbidity, mortality, need for reoperation, and length of stay (LOS). Surgical site infections (SSIs) included superficial incisional, deep incisional, and organ-space infections [11]. A lymphocele was defined as a symptomatic fluid collection adjacent to the kidney allograft found during ultrasonography or computed tomography scan [12]. Symptoms included graft dysfunction, ureteric obstruction, leg swelling, or lower abdominal pain. A hematoma was defined as any clinical or radiologic collection of blood below the skin or surrounding the kidney allograft.

Incisional hernias were diagnosed in the outpatient clinic or emergency department. An IH was defined as any abdominal wall gap with or without a bulge in the area of the transplant incision, palpable by clinical examination or diagnosed by imaging when there was a doubt. Eviscerations and kidney paratransplant hernias (internal hernia) were excluded. Patients who developed IH were compared with those who did not develop one.

Surgical Technique

A pararectal approach using a crescent-shaped suprainguinal incision ("hockey stick") was used to access the retroperitoneal space. The inferior epigastric vessels were divided. In male recipients, the spermatic cord was preserved. The graft was placed in the retroperitoneal space. After vascular anastomoses on external iliac vessels, the kidney was reperfused and the ureter anastomosed to the bladder. Ureteral catheter placement was left to the surgeon's discretion. Running sutures (1 cm per stitch advancements), using looped size 1 polydioxanone threads, started on both ends of the incision to meet in the center. Perigraft and subcutaneous drain placement was left to the surgeon's discretion. In case of IH repair, a synthetic polypropylene mesh was used in intraperitoneal, sublay, or onlay position.

Immunosuppression and Graft Function

Standard immunosuppressive therapy consisted of basiliximab induction followed by tacrolimus, mycophenolate mofetil, and corticosteroids maintenance therapy. Thymoglobulin was administered according to the recipient's immunologic risk or in the context of delayed graft function. Some patients received cyclosporine or azathioprine as calcineurin inhibitor and antiproliferative immunosuppressant, respectively. The steroids were gradually tapered during the first year after KT. No patients received sirolimus or everolimus in their immunosuppressive regimen during the first 3 months after KT. Acute rejection was defined as any antibody- or T cell−mediated rejection episode confirmed by tissue biopsy results within the first 3 postoperative months. All KT recipients were regularly followed up at the Transplantation Center, CHUV or by an affiliated nephrologist.

Statistical Analysis

The continuous variables were expressed as mean (SD) or median (IQR) and compared with Mann−Whitney U test or Student t test according to their distribution (Shapiro−Wilk test). The categorical variables were expressed as the frequency and percentage and compared between groups with Pearson χ^2 or Fisher exact test, where appropriate. The cumulative incidence function assessed the incidence of the hernia occurrence over time [13]. All statistical tests were 2-sided, and .05 indicated significance. Variables with P values $\leq$ .05 were entered in a multivariable logistic regression to provide adjusted estimations of the odds ratio (OR). Analyses were performed with SPSS 27.0 (SPSS Inc, Chicago, Ill, United States).

Ethics

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board of the Lausanne University Hospital CHUV (CER-VD protocol no. 2020-00677).

RESULTS

A total of 737 KT recipients were included (699 patients, of whom 38 underwent a second transplant). Median follow-up was 8.0 years (IQR, 4.5-12.6 years), and 63 patients (9.0%) died during follow-up. Forty-seven patients (6.4%) developed an incisional hernia after a median time of 14 months (IQR, 6-52 months). The time to the development of the IH is presented in Fig 1. The cumulative incidence was 10% at 20 years.

Patients with am IH presented a significantly higher body mass index (BMI; calculated as weight in kilograms divided by height in meters squared) (26.8 vs 24.7, P = .003), a higher rate

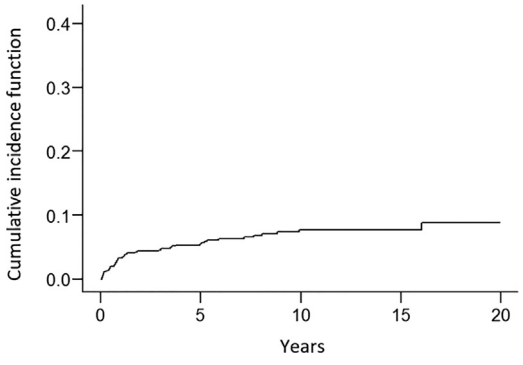

Fig 1. Development of incisional hernia after kidney transplant.

Table 1. Demographics, Surgical Details, and Outcomes

Variable	With Incisional Hernia (n = 47)	Without Incisional Hernia (n = 690)	*P* Value
Age, mean (SD), y	55 (11)	49 (15)	.056
BMI, mean (SD)	26.8 (4.9)	24.7 (4.5)	.003*
Male sex, No. (%)	12 (26)	234 (34)	.267
Cardiovascular disease, No. (%)	17 (36)	217 (32)	.631
Pulmonary disease, No. (%)	16 (34)	89 (13)	< .001*
Diabetes, No. (%)	9 (19)	106 (15)	.537
Active smoking, No. (%)	14 (30)	148 (22)	.211
Active alcohol use, No. (%)	1 (2)	42 (6)	.352
Anticoagulation therapy, No. (%)	8 (17)	70 (10)	.150
Hemodialysis, No. (%)	33 (70)	453 (66)	.754
Peritoneal dialysis, No. (%)	8 (17)	119 (17)	> .99
ADPKD, No. (%)	4 (9)	105 (15)	.290
Previous midline incision, No. (%)	15 (32)	192 (28)	.620
Previous Pfannenstiel incision, No. (%)	6 (13)	52 (8)	.259
Past hernia repair history, No. (%)	7 (15)	38 (6)	.021*
Living donor, No. (%)	13 (28)	276 (40)	.092
Left-side implantation, No. (%)	18 (38)	162 (24)	.037*
Operative time, mean (SD), min	180 (61)	173 (77)	.426
Complication, No. (%)	44 (94)	572 (83)	.157
Mortality, No. (%)	0 (0)	7 (1)	> .99
Lymphocele, No. (%)	14 (30)	78 (11)	.001*
Hematoma, No. (%)	10 (21)	77 (11)	.061
Surgical site infection, No. (%)	3 (6)	16 (2)	.120
Surgical revision, No. (%)	12 (26)	102 (15)	.065
Length of stay, median (IQR), d	17 (12-30)	13 (10-18)	< .001*
Acute rejection, No. (%)	7 (15)	73 (11)	.344

* Significant *P* values (≤ .05).
ADPKD, autosomal dominant polycystic kidney disease; BMI, body mass index.

of pulmonary comorbidities (34% vs 13%, $P < .001$), and a past history of hernia repair (15% vs 6%, $P = .021$) (Table 1). There were no differences in age, sex, and nonpulmonary comorbidities. Smoking (30% vs 22%, $P = .211$) and alcohol consumption (2% vs 6%, $P = .352$) were comparable between the 2 groups, as well as the rate of preoperative hemodialysis (70% vs 66%, $P = .754$) and peritoneal dialysis (17% vs 17%, $P > .99$).

The rate of living donors was comparable (28% vs 40%, $P = .092$) in the 2 groups (Table 1). From a surgical point of view, patients with IH had more left-side implantation (38% vs 25%, $P = .037$). Postoperatively, overall complications (94% vs 83%, $P = .159$) and mortality (0% vs 1%, $P > .99$) were comparable. The rate of postoperative lymphoceles was higher in the patients with IH (30% vs 11%, $P = .001$). The median LOS was significantly longer for patients with IH than for patients without IH (17 vs 13 days, $P < .001$).

On multivariate analysis, BMI (OR, 1.080; 95% CI, 1.012−1.152; $P = .020$), pulmonary diseases (OR, 2.415; 95% CI, 1.218-4.790; $P = .012$), lymphoceles (OR, 2.362; 95% CI, 1.157-4.882; $P = .018$), and LOS (OR, 1.013; 95% CI, 1.000-1.025; $P = .044$) were independently associated with the development of IH (Table 2).

Thirty-eight patients (81%) underwent operative repair, of whom 2 (5%) required emergency repair. Thirty-seven patients (97%) underwent a mesh repair. The mean (SD) operative time was 138 (45) minutes. The median postoperative LOS was 8 days (IQR, 6-11 days), and 21 patients (55%) developed

Table 2. Multivariable Risk Factor Analyses

Variable	OR †	95% CI	*P* value
BMI[§]	1.085	1.017-1.157	.013*
Pulmonary disease	2.135	1.058-4.307	.034*
Past hernia repair history	2.203	0.879-5.523	.092
Left-side implantation	1.712	0.898-3.265	.103
Lymphocele	2.340	1.149-4.764	.019*
Length of stay	1.013	1.000-1.025	.044*

BMI, body mass index; OR, odds ratio.
* Significant *P* values (≤ .05).

complications, mostly medical complications (42%). Three patients (8%) developed a surgical site infection, and 2 patients (5%) presented hematomas, for which both underwent surgical revision. No mortality related to IH repair was observed. After repair, 3 patients (8%) presented a recurrence.

DISCUSSION

Incisional hernias were infrequent after KT (6.4%). Overweight, pulmonary comorbidities, lymphoceles, and LOS were identified as risk factors. The IH repairs generated additional LOS and complications.

Incisional hernias have been associated with a significant reduction in health-related quality of life through their impact on occupation, activities of daily living, mobility, and psychological well-being [6,14,15]. In the present study, 6.4% of patients developed an IH after a median of 14 months. A

retrospective study on 1564 KTs showed similarly that 3.2% of KT recipients presented a postoperative IH after a median time of 16 months. [1] Several retrospective studies showed that the incidence of IH after KT ranged between 1% and 7%, and the median time to IH development ranged between 48 days and 59 months [1,7−9]. More than half of IHs appear within 6 months after surgery, and 75% appear within 2 years [16]. However, regarding IH, these incidences were probably often underestimated because the studies have not considered loss of follow-ups and because some of the patients who were operated on just before the end of the study period did not have time to develop IH during follow-up. In the present study, the cumulative incidence was measured over a long period of 20 years. One study on KT also found a comparable cumulative incidence at 10 years (4.4%) [1]. These incidences seem lower compared with other abdominal wall incisions, particularly midline incisions (up to 20%). This may be related to the anatomic location of the iliac incision in KT and the transfascial and transmuscular approach perpendicular to the tension lines of the abdomen [1].

It has been stated that KT recipients are at higher risk for IH as a consequence of long-term uremia, tissue wasting, and higher prevalence of obesity, diabetes, and chronic pulmonary diseases [16,17]. A retrospective study provided an overview of IH formation after abdominal organ transplant, including 2247 KT [3]. Surgical site infections were strongly associated with IH formation. Regarding patient comorbidities, age older than 50 years, BMI > 30, concurrent abdominal wall hernia, female sex, and history of smoking have also been recognized as independent risk factors [1,7−9]. From a surgical point of view, deceased donor grafts, reoperation through the same incision, duration of the KT procedure, and local postoperative complications, in particular lymphoceles, hematomas, and SSI, were all previously recognized as risk factors for IH formation [1,3,7−9]. Several studies have suggested that SSI was a strong predictor of IH in KT recipients, with a hazard ratio up to 28.8, probably in part because of the local bacterial proliferation that triggers an immune response that impairs collagen synthesis [3,6,18]. An SSI was not confirmed as a risk factor in the present study. In comparison, 4 other risk factors were identified: overweight, pulmonary comorbidities, postoperative lymphoceles, and prolonged LOS. The 2 preoperative modifiable factors should be considered when evaluating patients for enrollment on a KT waiting list. Preoperative weight reduction could benefit graft survival, decrease LOS, and prevent wound infection and IH [1,16,17]. Regarding prolonged LOS, a previous study confirmed a significant difference between patients with and without IH (9.3 vs 7.4 days, P = .001) [10]. The cause-effect relationship cannot, however, be established on the basis of these results. Another retrospective study on 45 patients showed that postoperative lymphoceles were significantly associated with an increased risk of IH after KT (OR, 4.39) [19]. One hypothesis is that the lymphocele contributes to a delay in wound healing by producing a mechanical stress on the suture lines. The volume of the lymphocele and its treatment was not assessed in the present study, but it has been previously stated that the treatment strategy (no treatment, drainage, or marsupialization) had no influence on IH development [19].

Few studies have investigated the different incidences of IH in KT on the basis of the type of incision [6]. A meta-analysis found that IH rates were not significantly different between oblique, paramedian, and hockey-stick incisions [5]. No technical aspect of the incision closure has currently been studied either. According to the guidelines of the European Hernia Society on abdominal wall closure, small-bite sutures are suggested for fascia closure after midline incisions, with a running suture length to wound length ratio of at least 4:1 [1,20]. This has to be investigated in iliac fossa incisions. The use of a prophylactic mesh implantation in KT recipients with modifiable and nonmodifiable preoperative risk factors is currently not recommended because of the lack of robust evidence, but it should be explored in future prospective studies, especially in patients identified at higher risk for IH. Obesity and history of recent smoking have been proposed as selection criteria for prophylactic mesh use [20−22]. However, most surgeons are reluctant to place a mesh near a kidney graft for fear of infections, wound dehiscence, and interference with post-transplant follow-up, including graft biopsy, postoperative sonography, or re-exploration of the iliac fossa [6].

Operative repair of the IH was performed in the vast majority of patients (81%) in the present study. In comparison, another retrospective study on IH after KT showed that about half of the patients were operated on, while the rest were observed [1]. Almost 1 in 4 patients underwent IH repair without mesh, contrary to our study where 97% of patients benefited from a mesh implantation. Furthermore, 35% required emergency repair because of small-bowel incarceration, and overall, the IH recurred in 23% of patients [1]. This appears to be much higher than the emergency and recurrence rates in the present study. One potential explanation could be that, in view of the fragility of these polymorbid and immunosuppressed patients, the preferred attitude was a straightforward IH repair instead of a nonoperative treatment. Even if the absolute risk of incarceration in patients with IH is unknown, estimates as low as 1% have been described [23]. This has to be weighed in the balance of risks and benefits of a surgical intervention. Based on the existing literature, there is currently no consensus on the optimal management for patients with IH, with the alternatives ranging from nonoperative treatments (weight loss, abdominal binder) for patients unsuitable for surgery to surgical treatment [6]. In case of repair, the use of a mesh is recommended because patients treated with primary direct suture repair have a higher rate of recurrence (47%) than those treated with mesh repair (29%) [24]. There is also no consensus on the optimal positioning of the mesh.

This study has several limitations beyond its retrospective design that need to be discussed. The number of IH (n = 47) was relatively small, and the correlation with KT and clinical outcomes should be interpreted with caution. Other aspects that could have an impact on KT and IH, such as the details of the immunosuppressive treatment (type and dosage over time after KT), donor type and characteristics, delayed graft function, and nutritional parameters, were not taken into consideration. They could potentially represent confounding factors, which were not adjusted in the analysis. In addition, IH symptoms were not

recorded. The diagnosis of IH was made clinically and/or by imaging, but the number of small and asymptomatic IH could be underestimated. Some patients who developed IH may have been treated in another hospital, and details of the mesh implantation were not assessed. However, this study unravels several independent risk factors for the development of IH, as well as describes the treatment and outcome in a well-defined consecutive population over a period of 20 years.

CONCLUSIONS

With approximately 1 in 15 patients developing IH after KT, its incidence seems rather low. Overweight, pulmonary comorbidities, lymphoceles, and LOS were identified as independent risk factors. Strategies focusing on the modifiable patient-related risk factors and early detection and treatment of lymphoceles may help to decrease the risk of IH formation after KT.

DATA AVAILABILITY

Data will be made available on request.

DISCLOSURE

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

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