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Incisional hernia repair after kidney transplantation in a tertiary high-volume center: outcomes from a 10-year retrospective cohort study

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Abstract

Background and aim Incisional hernia (IH) after Kidney Transplantation (KT) is a challenging complication due to both technical reasons and patients' complexity. Data regarding outcomes of hernia repair in KT recipients are uncertain, since the biggest part of previous papers focused on risk factors for incisional hernia occurrence and not on its outcomes. Aim of the study was to focus on risk factors for incisional hernia recurrence after surgical repair in KT recipients.

Methods Data regarding all consecutive patients undergoing kidney transplantations from January 2011 until September 2020 in Montpellier University Hospital were retrospectively collected from a single institutional database.

Results After a median follow-up of 48 months ($IQR_{25\text{-}75}$ 31–59), data from 1546 consecutive KT were collected. 83 patients underwent 99 incisional hernia surgeries after KT, with 14 patients that had one recurrence (14.4%) and 2 patients that experienced two recurrences (2.4%). Total recurrence rate was 16.8%. At univariate analysis, the only factor associated with an incisional hernia recurrence was having undergone to at least one previous abdominal surgery other than KT (p value 0.002). Overall morbidity was 15% ($n = 15$), with most of complications classified as mild (59%). No mortality related to incisional hernia repair occurred.

Conclusion IHs after KT represent an important condition. Its surgical management is challenging due to its anatomical complexity and patient's status. This is the largest sample size in the literature of patients treated for IH after KT and it shows that a previous surgery other than the KT is a risk factor for hernia recurrence after surgical repair, without regarding surgical technique or other comorbidity and therapeutical factors.

Keywords Kidney transplantation · Incisional hernia · Hernia recurrence

Introduction

Incisional hernia is one of the most common complications following abdominal surgery, with an estimated incidence of 8–20 percent [1, 2]. It accounts for a considerable economic cost and for patients' quality of life [3], because of worse outcomes when compared with primary hernia repair [4–6].

Different risk factors can predispose patients to incisional hernias, as obesity, diabetes, advanced age, malnutrition, smoking habit [7–9]. However, the rates of incisional hernia in kidney transplant (KT) patients are reported to be lower than for other abdominal surgeries, with an incidence between 3 and 7 percent [10, 11], probably due to the different incision that can be used (oblique, para-medial, the so-called 'hockey stick' or para-rectal incisions), depending on surgeons' experience and on the extra-peritoneal access.

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From these kinds of accesses, a lateral hernia of the abdominal wall can occur. Lateral hernias represent a big technical difficulty for surgical repair because of the presence of *loci minoris resistenciae,* as well as of the proximity of costal margins and iliac bones, resulting in a difficult prosthetic mesh positioning and fixation. Different techniques have been described for this kind of surgical repairs with acceptable results, such as intraperitoneal underlay or onlay technique, retro-muscular sub-lay, posterior component separation using a transversus abdominis muscle release (TAR) [12–15].

Furthermore, KT recipients have an increased risk of postoperative infectious complications, given their immunosuppressive regime, as well as the high prevalence of diabetes, malnutrition, end-stage renal disease, and other complex comorbidity [16–18]. Surgical-site infection (SSI) is itself a risk for incisional hernia.

Real incidence and outcomes of hernia repair in renal transplant recipients are uncertain.

Because of all the aforementioned reasons that testify the complex nature of KT population, as well as of the paucity of data in literature concerning this frequent and potentially dangerous complication, we report the largest single tertiary center experience in incisional hernia repair after kidney transplantation on 83 patients, from 1546 KT recipients. The aim of our study was to assess the risk factors for the outcomes of incisional hernia repair after KT.

Materials and methods

Patients and data selection

Data regarding all consecutive patients undergoing kidney transplantations from January 2011 until September 2020 in Montpellier University Hospital were retrospectively collected from an institutional database. Among them, we searched patients who developed an incisional hernia based on the presence of the specific hospital discharge code. All patients who had undergone KT and developed IH during the designated period were included in the study.

Data regarding comorbidities, etiology of the end-stage kidney disease, smoking history and postoperative outcomes were collected. We compared data regarding surgical-site recurrence and other complications according to the aforementioned factors, including operative technique, the type of mesh used and immunosuppressive drug regimen.

Post-operative complications were classified according to Clavien–Dindo [19].

The study has been conducted according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines of the EQUATOR network [20] and has been reported in line with the STROCSS criteria [21].

All patients gave their informed consent and the study has been approved by the Institutional Review Board.

Statistical analysis

The categorical data were described by frequencies and percentages, whereas continuous data by mean ± standard deviation (SD) or median ± interquartile range (IQR) depending on whether or not they have a normal distribution. Categorical variables were compared using the χ^2 test or Fischer exact test, while the distribution of continuous variables were compared by applying Student's *t* test or Mann–Whitney test, when appropriated.

The primary endpoint was the recurrence after incisional hernia repair in our setting of patients. Secondary outcomes were postoperative complications, length of stay (LOS), surgical-site infections (SSI). Univariate and multivariate analyses were performed with a *p* value set to 0.05, via logistic regression. The statistical analysis was conducted using the SPSS software (version 26.0).

Technical aspects and management of kidney transplantation

All the analyzed patients underwent KT for their end-stage renal disease through a lombotomic access, the so-called Gibson incision. All transplant surgeons belong to the same team, guaranteeing the same surgical technique. All the grafts came from cadaveric deceased donors. Post-operative management was carried out in the Intensive Care Unit for kidney transplanted patients of Montpellier University hospital. Follow-up for all patients was performed by the Nephrology Unit of our institution. If any surgical complications or issues were found, the patients were addressed to our transplantation unit.

Results

Patients characteristics

Data from 1546 consecutive kidney transplantations performed between January 2011 and September 2020 at Montpellier University Hospital were retrospectively collected. After a median follow-up of 67.5 months ($IQR_{25\text{-}75}$ 33–100), 93 patients (6%) were found to have developed an incisional hernia. Among them, 83 patients (5.3%) underwent surgical IH repair, while 10 patients refused surgery because they didn't experienced any symptoms or for other reasons. Data from the operated patients were further analyzed to evaluate the outcomes (Fig. 1).

Mean age was 58.5 (± 10.2), with 58 female patients and 25 male. Mean BMI was 25.98 (± 4.96). All patients' characteristics are shown in Table 1.

Kidney transplantation

The main indications to KT were diabetes and polycystic kidney disease, as showed in Table 1. All patients underwent standard immunosuppressive protocol of our institution, that consists of an induction therapy with biological agents (IL2-RA) or T-cell-depleting antibodies (TDAs) and a maintenance immunosuppression consisting of a calcineurin inhibitor (CNI) and an anti-proliferative agent, with or without corticosteroids in low and medium immunological risk KT recipients. Everolimus and Corticosteroids were interrupted before surgery. Furthermore, 42 patients (50.6%) were dialyzed at the time of hernia surgery, but this showed no correlation with the outcomes. All data regarding KT are showed in Table 1.

Incisional hernia repair

From January 2011 until September 2020, 83 KT recipients underwent surgery for an IH, while in the same period a total of 1935 patients were treated for an IH at our institution. All the included patients had a lateral hernia because of the type of incision used. 16 patients underwent a herniorrhaphy without prosthesis because of surgeon's or patient's choice (16.1%), while in 25 procedures was used a resorbable mesh (25.3%) and in 58 interventions was placed a non-resorbable mesh (58.6%). An intra-peritoneal positioning of the mesh was performed in 23 cases (30.2%), while it was retromuscular in 41 patients (53.8%) and pre-peritoneal in 19 patients (25%).

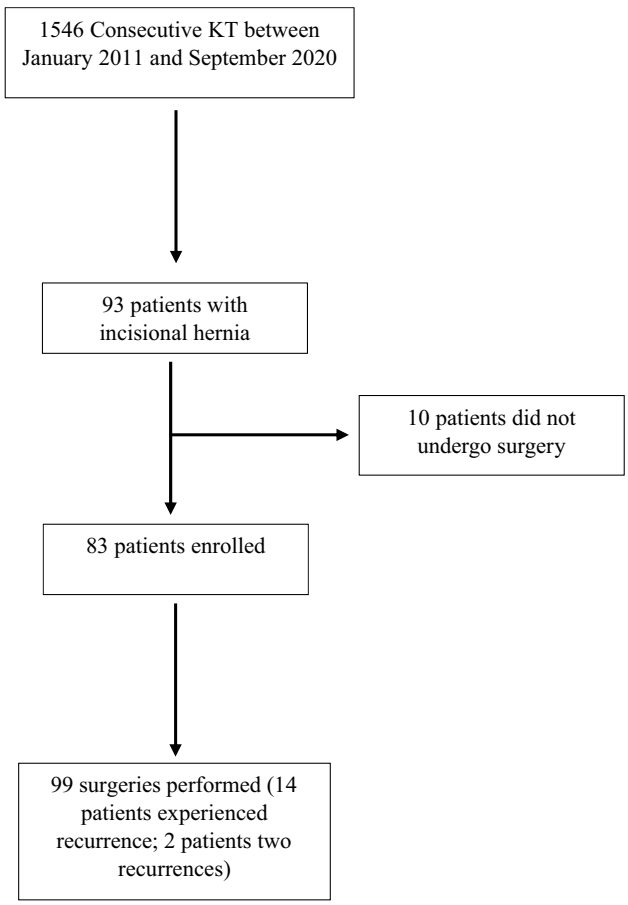

Fig. 1 Study flow-chart. *KT* kidney transplantation

Table 1 Patients 'characteristics

Total patients	83
Mean age (SD)	58.5 (± 10.2)
Sex, Female (%)	58 (69.8)
Mean BMI (SD)	25.98 (± 4.96)
Smoke history (%)	13 (15.6)
Dialysis	32 (38.5)
Cause of end-stage renal disease (%)	
Diabetes	26 (31.4)
Polycystic kidney disease	17 (20.5)
Hypertension	5 (6)
Others	35 (42.1)
Complications after KT (%)	31 (37.3)
Transplant rejection (%)	32 (38.5)
Immunosuppressive therapy (%)	70 (84.3)
Tacrolimus + MMF	45 (64.3)
Tacrolimus	10 (14.2)
MMF	13 (18.5)
Cyclosporine	1 (1.4)
Azathioprine	1 (1.4)
Previous abdominal Wall defect history (%)	64 (77.1)
Other laparotomic abdominal surgery before RT (%)	25 (30.1)
Appendectomy	14 (15.6)
Cholecystectomy	8 (9.6)
Colectomy	4 (4.8)
Other	3 (3.6)

SD Standard deviation, *BMI* body mass index, *MMF* Mofetil mycophenolate, *KT* Kidney transplantation

Surgical outcomes

After a median follow-up of 48 months (IQR_{25-75} 31–59), 83 patients underwent 99 surgeries for IH after KT, with 14 patients that had one recurrence (14.4%) and 2 patients that experienced two recurrences (2.4%). Overall morbidity was 15% ($n = 15$) with most of complications not needing specific therapy (59%). In this kind of patients, specific operative risks are: intestinal injury, SSI and ureteral injury of the transplanted kidney. Between them, we experienced 4 SSI, no ureteral and bowel injuries. Only 1 patient underwent

Table 2 Surgical outcomes of incisional hernia repair

Total number of surgeries for incisional hernia repair after RT	99
Median length of stay (IQR_{25-75})	5 (4–8)
Surgical technique (%)	
Direct herniorrhaphy	16 (16)
Resorbable Mesh	25 (25)
Non-absorbable Mesh	58 (58)
Mesh positioning	
Intra-peritoneal	23 (30.2)
Retro-muscular	41 (53.8)
Pre-peritoneal	19 (25)
Post-operative complications (%)	15 (15.1)
Clavien–Dindo I	9 (59)
Clavien–Dindo II	3 (27)
Clavien–Dindo III	1 (7)
Clavie–Dindo IV	1 (7)
Incisional hernia recurrence (%)	14 (14)
Surgical-site infections (%)	4 (4)
Chronic pain (%)	3 (3)

RT Renal transplantation, *IQR* Interquartile range

surgery because of a complication (7%), specifically prosthesis infection that needed its removal, and one another patients who experienced a transient respiratory distress (7%). Median length of stay was 5 days (IQR_{25-75} 4–8). All the surgical outcomes are reported in Table 2.

Recurrence

Recurrence was clinically investigated and confirmed by CT scan. Total recurrence rate was 16.8%. After univariate analysis, the only factor associated with an incisional hernia recurrence was having undergone to at least one previous abdominal surgery other than both KT and abdominal wall surgery (p value 0.002). In particular, we considered all the surgeries that involved an opening of the abdominal cavity by a laparotomic incision. Diabetes, dialysis, immunosuppressive therapy, mesh positioning and previous abdominal wall defect history were not associated to recurrence (Table 3). A multivariable analysis was not performed to determine predictive factors for recurrence after surgical repair because there were no other significative factors associated with it.

Discussion

To our knowledge, the present study involves the largest sample size in the literature of patients treated for IH after KT. Our results on 83 patients show an incidence of IH of 6% and a recurrence rate after surgical treatment in this type of patients of 16.8% ($n = 14$). The only factor statistically associated with a recurrence, at univariate analysis, was a previous surgical abdominal intervention in addition to the transplant itself (p value 0.002).

We do not have data regarding the exact type of previous incision, but only laparotomic surgeries were considered in our paper. Specifically, 12 patients had undergone an appendectomy, 2 an appendectomy and a bowel resection, 6 patients a cholecystectomy, 2 a cholecystectomy and a colic resection, 4 a colic resection and 3 patients had been operated for another emergency condition. Thus, 4 patients had undergone more than one previous surgery.

IH after KT must be considered a complex surgical complication, for both technical and outcomes aspects. From the procedural point of view, different factors must be considered: the proximity of bone prominences that limits an adequate mesh overlap, as well as the presence of the allograft and the ureteral anastomosis performed to the bladder in a heterotopic situation (superficial). Talking about results, immunosuppressive therapy, together with diabetes and a long-term dialysis history, provides another challenge with both the use of prosthetic mesh (risk of infection) or direct herniorrhaphy (tissue fragility).

IH rate after kidney transplantation was 6 percent, a figure that is somehow in line with the previous literature on this topic, confirming the lower incidence than after midline laparotomy [22, 23]. Therefore, although transplant patients have on average more comorbidities, the incidence is confirmed to be lower than general population.

The type of incision probably plays a fundamental role in the development of IH. Furthermore, this type of considerations on the close connection between site and type of incision and herniogenesis, could be closely linked to the main result of our study, namely the correlation between having been subjected to previous surgeries other than renal transplantation and recurrence after incisional hernia repair. In fact, the high risk of IH after midline incision, transversal incision and laparotomic abdominal surgery which somehow weakens the muscles of the anterior abdominal wall is well known. The Gibson incision, used to perform KT in all patients in our study, is more respectful of the muscles of the anterior wall, as well as their vascularity. A previous abdominal surgery history did not influence the choice of transplant site.

In our large retrospective study, we focused on factors predisposing for hernia recurrence after surgical repair in this cohort of patients, differently from the biggest part of the previous studies on IH that focused on risk factors for incisional hernia occurrence. From the analysis of data regarding the risk factors for recurrence after surgery for incisional hernia in KT patients, very interesting results have emerged. The use of immunosuppressive drugs, and in particular Mycophenolate Mofetil (MMF)

Table 3 Univariate analysis for incisional hernia recurrence

	Recurrence	No-recurrence	Univariate analysis *p* value
Total	**14**	**69**	
Mean age	59.7	58.3	0.67
Sex, Female	6	25	0.56
BMI > 30	1	4	0.81
Smoke habit	3	10	0.48
Diabetes	3	23	0.18
Dialysis	3	29	0.90
Surgical technique			
Direct repair	3	13	0.78
Mesh	11	56	0.96
Mesh positioning			
Intra-peritoneal	4	19	0.27
Retro-muscular	14	27	0.13
Pre-peritoneal	4	14	0.32
Surgical-site infections	1	3	0.69
Immunosuppressive therapy	10	60	0.19
Tacrolimus + MMF	9	36	0.15
Tacrolimus	1	9	0.23
MMF	2	13	0.20
Previous abdominal wall defect history	12	69	0.14
Previous laparotomic abdominal surgery other than KT	9	16	**0.002**

Bold the significative *p*-value (< 0.05)

BMI body mass index, *MMF* Mofetil mycophenolate, *KT* Kidney transplantation

for post-transplant immunosuppressive therapy, had been shown in previous studies to be somehow related with the development of incisional hernia [17, 24, 25]. But this is not true for its recurrence after surgery, since neither MMF nor immunosuppressive therapy at all was statistically correlated to recurrence in our results. The same can be said for obesity (BMI > 30), diabetes, smoking and surgical-site infections, which are considered risk factors for developing incisional hernia after abdominal surgery [8, 26], but in our study, they are not statistically associated with the surgical outcomes in terms of recurrence. Finally, also dialysis at time of surgery was not shown to be statistically associated with recurrence.

Regarding complications of incisional hernia surgery in KT patients, we would have expected a greater risk of complications due to comorbidities and frailty of patients, as already showed in literature for dialysis before transplant, post-transplant immunosuppression and a higher prevalence of obesity, diabetes, chronic obstructive pulmonary disease and hypertension [27–29]. On the other hand, a total complication rate of 15%, all of which below grade III according to Clavien–Dindo, confirms that abdominal wall surgery can be considered safe even in a similar cohort of patients when performed in high-volume centers. However, we are convinced that it is a specialized surgery that must be performed in highly experienced centers. The low rate of SSI (4%) and chronic pain (3%) are also somewhat reassuring when considering these types of patients.

Finally, interestingly the risk of recurrence was not influenced by the use of prostheses, just as the use of a "synthetic" mesh in these immunocompromised patients did not lead to an increased rate of infectious complications. These results, like recurrences, could always be related to the type of incision. The mesh positioning technique also showed no statistical correlation with the development of a recurrence. Further studies with a prospective design and a multivariate analysis are needed confirm such a data. The lack of a multivariate analysis was due to the small number of events (14) that would have exposed us to the risk of overfitting of the model.

Our study has some limitations. First, the retrospective and monocentric nature which gives less power in the statistical analysis of the outcomes. Second, the lack of data regarding the size of hernial defects, which we know to be related to outcomes in abdominal wall surgery [30, 31]. Unfortunately, such data were not available for all patients in our database because not all the patients underwent a CT scan before surgery.

At the same time, we can underline as strengths of our study the number of KT recipients who underwent surgery of the incisional hernia after transplantation, which is the highest in the literature. The monocentric design ensures the same type of surgical and follow-up technique (same surgical team), as well as medical therapy, in the considered patients, reducing confounding factors.

We can conclude that the incidence of incisional hernia in kidney transplant patients is confirmed to be lower than in other types of abdominal surgery. Surgical treatment of this condition has good outcomes when performed in experienced centers with high volumes. The recurrence of incisional hernia after surgery is influenced by the patient's abdominal surgical history.

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Declarations

Conflict of interest The authors declare that they have no conflict of interest.

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