Annals of Medicine and Surgery 33 (2018) 24–31

Contents lists available at ScienceDirect

Annals of Medicine and Surgery

journal homepage: www.elsevier.com/locate/amsu

Review

Optimal surgical management in kidney and pancreas transplantation to minimise wound complications: A systematic review and meta-analysis

Sara Shahrestani[a], Hanh Minh Tran[a], Henry C. Pleass[a,b], Wayne J. Hawthorne[a,b,c,*]

[a] Westmead Clinical School, Sydney Medical School, University of Sydney, NSW, 2145, Australia
[b] The Department of Surgery, Westmead Hospital, Westmead, NSW, 2145, Australia
[c] The Centre for Transplant & Renal Research, The Westmead Institute for Medical Research, Westmead, NSW, 2145, Australia

ARTICLE INFO

Keywords:
Transplant
Hernia
Immunosuppression
Complication
Wound

ABSTRACT

Background: Immunosuppression in transplant patients increases the risk of wound complications. However, an optimal surgical approach to kidney and pancreas transplantation can minimise this risk.
Materials and methods: We performed a systematic review and meta-analysis to examine factors contributing to incisional hernia formation in kidney and pancreas transplant recipients. Bias appraisal of studies was conducted via the Newcastle-Ottawa scale. We considered recipient factors, surgical methods, and complications of repair.
Results: The rate of incisional hernia formation in recipients of kidney and pancreas transplants was 4.4% (CI 95% 2.6–7.3, $p < 0.001$). Age above or below 50 years did not predict hernia formation (Q (1) = 0.09, $p = 0.77$). Body mass index (BMI) above 25 (10.8%, CI 95% 3.2–30.9, $p < 0.001$) increased the risk of an incisional hernia. Mycophenolate mofetil (MMF) use significantly reduced the risk of incisional hernia from 11.9% (CI 95% 4.3–28.7, $p < 0.001$) to 3.8% (CI 95% 2.5–5.7, $p < 0.001$), Q (1) = 4.25, $p = 0.04$. Sirolimus significantly increased the rate of incisional hernia formation from 3.7% (CI 95% 1.7–7.1, $p < 0.001$) to 18.1% (CI 95% 11.7–27, $p < 0.001$), Q (1) = 13.97, $p < 0.001$. While paramedian (4.1% CI 95% 1.7–9.4, $p < 0.001$) and Rutherford-Morrison incisions (5.6% CI 95% 2.5–11.7, $p < 0.001$) were associated with a lower rate of hernia compared to hockey-stick incisions (8.5% CI 95% 3.1–21.2, $p < 0.001$) these differences were not statistically significant (Q (1) = 1.38, $p = 0.71$). Single layered closure (8.1% CI 95% 4.9–12.8, $p < 0.001$) compared to fascial closure (6.1% CI 95% 3.4–10.6, $p < 0.001$) did not determine the rate of hernia formation [Q (1) = 0.55, $p = 0.46$].
Conclusions: Weight reduction and careful immunosuppression selection can reduce the risk of a hernia. Rutherford-Morrison incisions along with single-layered closure represent a safe and effective technique reducing operating time and costs.

1. Introduction

Transplantation remains the gold standard of management for end-stage renal disease and type 1 diabetes [1]. Despite advances in surgical technique and immunosuppressive therapy, fundamental surgical issues are associated with preventable morbidity, hospitalization, readmission, and reoperation [2]. The significant burden related to immunosuppressant use remains a challenging balance between the increased risk of infection and wound complications against the need to prevent rejection in patients [3].

Wound dehiscence and infections are common surgical post-transplant complications [4], and incisional hernia can lead to longer-term complications. Incisional herniation of the abdomen has been linked to significantly reduced quality of life through its impact on occupation, activities of daily living, mobility, perceived pain and psychological well-being [5]. The Global Burden of Disease study, conducted in 2010, reports that the surgical morbidity associated with a hernia resulted in the loss of 792,000 disability-adjusted life years [6].

In transplant recipients, the association between factors thought to precipitate incisional hernia formation have been explored. These factors include increased recipient age or body mass index [7], an immunosuppressive regimen that includes sirolimus or mycophenolate mofetil (MMF) [8], Rutherford-Morrison transplant incision [9] and single layered closure [10]. In this meta-analysis, we aimed to assess

Abbreviations: BMI, Body mass index; CENTRAL, Cochrane register of randomized controlled trials; MMF, Mycophenolate mofetil; PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses; RCT, Randomised controlled trial; SPK, Simultaneous pancreas-kidney transplantation

* Corresponding author. Department of Surgery The University of Sydney at Westmead Hospital, Westmead, NSW, 2145, Australia.
E-mail address: wayneh@med.usyd.edu.au (W.J. Hawthorne).

https://doi.org/10.1016/j.amsu.2018.08.006
Received 6 March 2018; Accepted 13 August 2018

the risk and factors contributing to incisional hernia formation in kidney and pancreas transplant recipients by synthesizing the evidence available in the literature. We also reviewed the evidence for methods of repair to reduce the morbidity associated with this complication.

2. Materials and Methods

2.1. Criteria for considering studies in this review

All studies examined were case reports or retrospective reviews that reported on incisional herniation after kidney alone, kidney and pancreas and pancreas alone transplants abdominal organ transplants (study n = 25). The studies included in the meta-analysis were only the studies reporting incisional or ventral hernias, as these were more likely to be due to the transplantation surgery.

2.2. Primary outcome measures

Event rates of incisional hernia formation reported numerically or as odds ratios in the relevant studies were used for synthesis and analysis. We also examined rates of recurrence of a hernia following repair with herniorrhaphy with resorbable or non-resorbable mesh and laparoscopic techniques.

2.3. Moderating factors

We considered multiple moderating factors in this review. These included recipient factors such as age and BMI. We also considered surgical factors at the time of transplantation such as the type of incision and single-layered or multi-layered closure. The medical factors we examined included whether the immunosuppressive regimen included sirolimus or MMF.

2.4. Search methods for the identification of studies

2.4.1. Initial search

The search strategy followed guidelines outlined in the Cochrane Handbook for Systematic Reviews of Interventions [11] and reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [12].

Electronic databases including MEDLINE via PubMed/, EMBASE and Cochrane register of randomized controlled trials (CENTRAL) were searched using combinations of the terms ‘hernia’ and ‘transplant’ and their variations from inception to May 2017. We mapped terms to MeSH terms. In addition to these electronic searches, we examined each report's citation list for additional studies.

2.4.2. Data collection

The search strategy involved screening titles and abstracts for duplicates and identifying ineligible studies. Using full copies of the papers, two researchers (SS and HT) independently assessed whether studies met the inclusion criteria, and we resolved disagreements through discussion. Relevant statistics were then extracted from the eligible studies and included in the meta-analysis.

Aspects relating to study quality were assessed, using the Newcastle-Ottawa Quality Assessment Scale [13] including how participants were selected, comparability of groups and assessment and follow-up of outcomes. This information is presented in a table describing features of the included studies (see Table 1).

2.5. Statistical analysis

The Comprehensive Meta-Analysis [14] program was used to calculate an overall event rate from the individual event rates within each study. This event rate provides an estimate of the rate of occurrence of an event within a group. Heterogeneity across studies was assessed using the Q-statistic [15]. A significant Q-statistic indicates different effect sizes across studies, indicating potential differences in methodology or study population across studies.

We inspected the funnel plot for symmetry to determine whether any publication bias was present. This technique determines whether there was a significant risk of bias, and controls for that risk by imputing values to correct for the bias [16]. We verified these results against the Begg test [16] to ensure there was no publication bias. We constructed plots utilizing software packages GraphPad Prism [17] and R Statistical Package [18].

3. Results

3.1. Study characteristics

26 relevant articles met our inclusion criteria for systematic review from a total of 3011 articles (see Fig. 1). 22 were retrospective reviews of kidney transplantation, two included simultaneous pancreas-kidney (SPK) transplantation, and one article was pancreas alone transplantation. Two articles were prospective reviews including one randomised controlled trial comparing wound complications in patients receiving sirolimus and tacrolimus [19].

Of the 26 relevant articles, 17,821 recipients of kidney and pancreas transplantation were included in the present review. This included 17,574 kidney transplants, 66 SPK transplants, and 181 pancreas transplants. Of these patients, 2538 had a Rutherford-Morrison incision, 2198 had a hockey-stick incision, 712 had a paramedian incision, 156 had a midline incision. 341 patients had single layered closure, while 4838 had multi-layered closure. 1629 patients received MMF and 2914 did not receive MMF. 1125 patients received sirolimus while 6120 did not. Broggi et al. [10] reported data in the form of an odds ratio rather than raw numbers and these patients have not been included in these numeric descriptors.

3.2. Bias appraisal

The studies included in the present meta-analysis were well reported (see Table 2). Overall, patients from both the hernia and control groups were drawn from transplant populations from hospitals and thus were highly representative. Presence of an incisional hernia was assessed either by a surgeon in theatre, in follow-up clinics or from secure medical records for all papers. However, many studies did not report whether patients had experienced previous hernias or if the hernias were present before the transplant. Outcomes were identified by medical personnel prospectively or found in the medical records for most studies. Follow-up was poorly reported in the studies. There was no statement about attrition rates in many of the retrospective studies, and this should be reported explicitly in all future studies.

3.3. Rate of incisional hernia formation and recipient characteristics

The overall rate of incisional hernia formation in recipients of kidney and pancreas transplants was 4.4% (CI 95% 2.6–7.3, $p < 0.001$), see Fig. 2. We inspected the funnel plot and found no evidence of asymmetry, indicating there was no publication bias. The classic fail-safe N statistic showed an additional 3418 studies would be required to invalidate this result.

We then compared studies based on whether they reported on a mean recipient age of < 50 years or > 50 years. We found incisional hernia occurred in both groups at a similar rate [Q (1) = 0.09, $p = 0.77$], that is 5.6% (CI 95% 2.7–11.4, $p < 0.001$) in < 50 years and 4.7% (CI 95% 1.911.3, $p < 0.001$) in > 50 years groups, see Fig. 3A.

We separated studies based on whether the mean BMI was in the normal range or not. Individuals with a normal BMI had a 4% (CI 95% 0.3–34.5, $p < 0.001$) rate of incisional hernia formation, while those