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Case Report

The Surgical Approach for Obtaining Abdominal Wall Closure in Renal Transplant Recipients with Temporary or Permanent Loss of Fascial Integrity Following Emergency Reoperative Surgery

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Abstract

A range of corrective surgical procedures may be required in adult renal transplant recipients who sustain loss of integrity of the abdominal wall in the first month postoperatively. Where this involves the fascia, such as in acute fascial dehiscence or in renal allograft compartment syndrome, more sophisticated reconstructive procedures may also be required, particularly in the setting of surgical site infection. There is limited data on the use of prosthetic or biologic mesh for this type of scenario, where urgent reoperative surgery is required. Three cases are described where placement of prosthetic mesh was combined with negative pressure wound therapy in order to achieve complete healing of the abdominal wall.

Keywords

Surgery; renal transplantation; prosthetic mesh; wound management; negative pressure wound therapy

1. Introduction

Abdominal wall complications are reported to occur in 3%-19% of renal transplant recipients post operatively [1-8]. The major risk factors for wound related complications in post renal transplant recipients include obesity (BMI >30kg/m^2), diabetes, increasing age and use of immunosuppressive drug therapy, including mycophenolate mofetil [1]. There is considerable morbidity and mortality associated with the postoperative open abdominal wall in combination with a surgical repair of wound dehiscence [9]. In the setting of deep fascial wound dehiscence, potential surgical management options include operative repair with either primary closure of the abdominal wall or the use of prosthetic mesh in reinforcement of fascial closure, or if fascial closure is not possible [6, 10]. At times, more sophisticated abdominal wall reconstruction procedures may be required in complex cases [11].

Tension free repair of the abdominal wall may also be required in the setting of acute renal allograft compartment syndrome (RACS) where reoperative surgery is required [12-14]. RACS encompasses a spectrum of clinical scenarios where acute renal allograft dysfunction supervenes secondary to the development of increased pressure in the retroperitoneal compartment resulting in allograft ischaemia [12]. Treatment options for RACS include intra-peritonealisation of the allograft, permanent fasciotomy with subcutaneous placement of the allograft and closure of the skin incision [12], or tension free closure of the abdominal wall using prosthetic mesh at the level of the fascia [13, 15].

However the complications of utilising mesh in repair of the abdominal wall, particularly in the setting of a contaminated or infected surgical site, can include infection, fistula formation and mesh extrusion or hernia recurrence [11, 16, 17]. This has led to the use of biologic mesh to gain fascial closure, when surgical site infection has coexisted with fascial dehiscence [10, 18]. More recently Negative Pressure Wound Therapy (NPWT), has been used to facilitate abdominal wall healing in non-immunosuppressed patients who have had problems with abdominal wall integrity following surgical procedures where mesh was used [17, 19, 20].

Recently we have been faced with renal allograft recipients where a lack of fascial integrity of the abdominal wall has become evident during emergency reoperative surgery in the setting of bacterial contamination and/or infection. The goals of management of the acute post-operative open abdominal wall are to reduce short terms risks, such as wound-related sepsis and mortality and morbidity, and long term complications, such as incisional hernia formation. We also consider the added complexity of managing the abdominal wall in RACS. Hence, we have undertaken a mesh repair of the fascia and then immediately deployed NPWT, as described in the following cases.

Ethics approval was obtained by the Sydney Local Health District Ethics Review Committee (RPA Zone). Each patient provided consent for inclusion in this research paper.

2. Case Description

We describe three cases in which the recipients all underwent a renal transplant in the iliac fossa using a Gibson incision and were treated with standard immunosuppression according to the unit protocol [21]. Table 1 summarises the demographics and clinical characteristics of the three cases. Reoperative surgery was required for either fascial dehiscence (Case 1 and Case 3) or RACS

(Case 2) within 30 days post-transplant. A mesh repair was indicated due to an inability to successfully close the fascia in each case. The RACS syndrome in Case 2 was partly due to acute rejection supervening in a critically ill recipient requiring inotropic support. It was discovered during reoperative surgery, that there was limited additional space in the retroperitoneum, along with a suspected infection. The acute rejection was confirmed on analysis of the allograft biopsy performed during the surgery and was an additional factor in the decision to not close the fascia due to the allograft being swollen. This recipient then required additional treatment with pulse methylprednisolone therapy and anti-thymocyte globulin.

As infection was clinically suspected at the time of surgery in each case, the appropriate cultures were taken and empirical antibiotics were prescribed. The antibiotic therapy was then tailored according to the microbial sensitivities once available, and in conjunction with infectious disease consultation. All surgical wounds underwent a thorough washout with sterile normal saline, tissue debridement and repair of the abdominal wall in the operating theatre. With primary repair of the fascia not being possible, prosthetic mesh, polypropylene (Prolene, Ethicon Inc., Cincinnati, Ohio) or polyglactin (Vicryl, Ethicon Inc., Cincinnati, Ohio) mesh, was inserted in the preperitoneal plane of the abdominal wall with a minimum of 2cm of mesh underlying the fascia in two cases (Case 1 and Case2). The fascial edges were approximated at the apices of the wound only with 1 nylon, with preperitoneal mesh used to bridge the remainder of the fascial defect. The preperitoneal mesh was secured laterally to the fascia at the edges of the defect, and medially it was secured anterior to the rectus sheath, with a combination of interrupted 2/0 prolene and 1 nylon sutures. Onlay biologic mesh (Surgisis Biodesign Tissue Graft, Cook Medical, Bloomington, Indiana) was used to reinforce the abdominal wall fascia in Case 3. The abdominal fascia was closed with interrupted 1 nylon, and the onlay mesh was secured to the fascia with interrupted 2/0 prolene, with a 4cm overlap. The NPWT foam was then placed anterior to the mesh, and then immediately deployed at the end of the operative procedure. The management of the NPWT was according to our unit protocol [22]. An appropriately sized tapered piece of black polyurethane foam was inserted over the abdominal wall defect and covered with an occlusive dressing, with the pressure setting maintained at continuous negative pressure of 125mmHg (Vacuum Assisted Closure, V.A.C Therapy KCI Licensing Inc., San Antonio, Texas). The dressings were changed twice a week, initially on the ward and then in the outpatient clinic, and wounds were reviewed by the surgical team during each change. The NPWT was ceased when the surgical site had healed sufficiently for either delayed primary closure, or healing by secondary intention with simple surgical dressings.

Reoperative surgery was required in two of the three cases. In Case 2 a second look procedure was performed 3 days following the insertion of the mesh, by which stage the wound had improved clinically and was then washed out with normal saline. As the abdominal wall appeared clean and there were no concerns with respect to the mesh remaining in situ, the skin of the abdominal wall was closed and the NPWT ceased. However, recrudescence of infection in the superficial abdominal wall mandated removal of the skin sutures and redeployment of the NPWT a week later at the bedside. The clinical course of Case 2 subsequently remained uncomplicated. In Case 3, after there were signs of further infection in the abdominal wall 11 days following insertion of the mesh, a reoperative procedure was required to remove the biologic mesh, which appeared to be disintegrating, and replace it with a Vicryl mesh. The NPWT was then placed anterior to the Vicryl mesh and continued until delayed primary closure was achieved.

Table 1 Demographics and features of the renal allograft recipients.

	Case 1	**Case 2**	**Case 3**
Age/Gender	55/ Male	56/ Female	56/ Male
Cause of Renal Failure	Diabetic Nephropathy	Diabetic Nephropathy	Diabetic and Hypertensive Nephropathy
Smoker	No	No	No
Body Mass Index (BMI) kg/m^2	36.9	35	29
Donor	Deceased (DBD)	Living	Deceased (DBD)
Indication for reoperation (days post -transplant)	Fascial dehiscence (day 16)	RACS (day 3)	Fascial dehiscence (day 24)
Infection present (organism cultured)	Yes (Corynebacterium jeikeium)	Yes (Pseudomonas aeruginosa, Corynebacterium, Group B streptococcus, Enterococcus species, Citrobacter)	Yes (Alpha haemolytic streptococcus and Enterococcus faecalis)
Antibiotics given (empirical/targeted)	Cefazolin	Tazocin/ Cefepime	Ampicillin/Tazocin and Augmentin duo forte
Type of mesh inserted	Polypropylene	Polyglactin	Biologic (Surgisis)
NPWT (black foam) placed over mesh	Yes	Yes	Yes
Secondary surgical procedures	Nil	Yes, closure of abdominal wall	Yes, reinforcement with onlay Vicryl mesh secured with 2/0 Prolene sutures.
Third Surgical procedures	Nil	Nil (reapplication of NPWT on the ward)	Yes, debridement and closure of abdominal wall
Duration NPWT	73 days	55 days	55 days
Time to healing of abdominal wall post transplant	89 days	72 days	114 days
Hernia recurrence on clinical assessment (time of last follow up)	Nil (8 months)	Nil (36 months)	Nil (28 months)

Overall, management of the NPWT in conjunction with synthetic mesh was complicated by problems with the abdominal wall requiring further intervention in two out of the three cases, however it facilitated complete healing of the abdominal wall in all three. Dressing changes were performed every 3-4 days with the abdominal wall being inspected by a member of the surgical service on each occasion. In one of the cases (Case 3), concerns over efficacy of the NPWT prompted that a third reoperative procedure be performed 43 days following the second reoperative procedure to remove excess inflammatory scar tissue from the subcutaneous tissue layer. As the mesh was well healed into the abdominal wall, delayed primary closure of the skin was performed at that stage and the abdominal wall healed without further incident. All patients were followed up in the outpatient clinic and assessed clinically for any abdominal wall complication, at the time of last follow up, no patients had a clinically apparent incisional hernia.

3. Discussion

Obtaining tension free, abdominal wall closure in the context of an infected surgical site in renal transplant recipients is challenging and not well described in the literature. We have described the technique of using mesh repair combined with NPWT for three cases in which abdominal wall integrity has been lost. This was secondary to complete fascial dehiscence in either overweight or obese recipients or where the abdominal wall could not be closed primarily due to the risk of increased retroperitoneal compartment pressures in the setting of RACS.

In an era where renal transplantation is increasingly being performed on recipients with a BMI over 30kg/m^2 [4], it can be expected that at times difficult scenarios will arise, including in the more challenging subgroup who sustain loss of fascial integrity within the spectrum of abdominal wall complications that are seen in practice. Our three cases were diabetic, over the age of 50 years and had an average BMI of 33.6kg/m^2. Therefore they were more likely to have an increased rate of surgical site complications as seen in individuals with these risk factors, within this particular BMI range of overweight, obese and morbidly obese [1, 23].

Traditionally, the insertion of prosthetic mesh into a contaminated surgical field was not recommended, due to the risk of ongoing mesh infection. However synthetic mesh has been used successfully in the repair of contaminated or infected abdominal wall hernias in transplant recipients [6], as well as in non-transplant patients requiring reconstruction of an infected abdominal wall also with mesh [24, 25].

Given NPWT has been used to salvage infected mesh in the context of incisional hernia repair of the abdominal wall, including in the presence of polypropylene and polyglactin mesh [17, 19, 20, 26]; the technique of combining mesh repair with NPWT was then felt to be a feasible approach when a similar scenario arose in a renal allograft recipient. Moreover, both Case 1 and Case 3 illustrate that it may be possible to combine the use of prosthetic mesh and NPWT in achieving wound healing for an infected surgical fascial dehiscence. Although in Case 3 the abdominal wall fascia was repaired initially with biologic mesh and then managed with NPWT, subsequently this required revision with Vicryl mesh with the NPWT being continued.

Although the approach of using biologic mesh combined with NPWT has been described for managing abdominal wall complications in renal allograft recipients, in only one case was the mesh inserted into the abdominal wall at the transplant surgical site, and this was once the allograft had been removed for complications [18]. The difference in our three cases, was that the renal

allograft remained in situ and the aim was to achieve abdominal wall healing despite the presence of mesh and hence also preserve the allograft.

In other settings, closure of the open abdomen following laparotomy has been facilitated via placement of a permanent onlay mesh as a form of mesh mediated fascial traction, combined with negative pressure wound therapy [27]. This has been shown to improve fascial closure rates, as well as reduce incisional hernia rates with minimal incidence of mesh infection or prolonged wound healing [27]. A similar approach was adopted for Case 2 who had developed RACS, where not only was infection diagnosed clinically and confirmed with positive cultures, but the allograft was also initially swollen due to acute rejection. Therefore, the deep and superficial abdominal wall layers could not be closed primarily without tension and potentially risk increasing compartment pressures. This differs from previous reports, where mesh hood fascial closure techniques have been used in renal allograft recipients with RACS [13, 15]. Furthermore, in these other reported cases, where there was no abdominal wall contamination or infection, the superficial layers were immediately closed over the implanted mesh.

The use of biological mesh in dirty, contaminated and clean-contaminated wounds has been described [28-30], including in a systematic review [31]. Moreover, the reported infection and hernia recurrence rates are highly variable, and mesh explanation although reported, was not common [31]. Up to now, there have been a handful of reports which describe biologic mesh being used in the management of complex abdominal wall issues in adult renal transplant recipients [10, 18, 32]. In Case 3 biologic mesh made from porcine small intestinal submucosa was used according to surgeon preference. However, this case was complicated by surgical site infection and mesh disintegration, requiring debridement and reinforcement with a Vicryl mesh. Hence it is possible that the infection which was present in the abdominal wall at the time that the biologic mesh was inserted, then contributed to the breakdown of the mesh [18, 33]. Currently there is limited evidence for the utility of biologic mesh versus synthetic mesh in the setting of infection or contamination in the abdominal wall following other types of surgery [24, 25, 34]. Until there is more evidence for favourable outcomes with the use of biologic mesh in this setting [35], we believe that it remains a less favoured option compared to using other synthetic meshes, such as polypropylene or polyglactin mesh. Furthermore, whilst the use of polypropylene synthetic mesh is generally considered contra-indicated in contaminated wounds, it was a successful strategy for achieving wound healing in combination with NPWT in Case 1.

The management algorithm proposed by some centres for infected abdominal hernias in renal transplant recipients include a temporary repair with a prosthetic mesh until the abdominal wall appears healthy, followed by definitive repair with reconstruction of the fascia using a tensor fascia lata graft [11]. Due to the emergency nature of the surgery required in each of our three cases, it was not practical to undertake component separation of the abdominal wall along with a complex reconstruction. This approach would have involved far more major surgery, and following the initial success with our first case of combining mesh repair with NPWT, we elected to continue this approach of using NPWT to achieve wound healing.

Although the combination of abdominal wall repair with prosthetic mesh and NPWT can be a successful strategy for some adult recipients with infected abdominal wall dehiscence or RACS to achieve wound healing, this case series is limited by its small size, and the use of mesh was different between cases. The duration of wound healing ranged from 72 to 114 days, which, in conjunction with the financial cost of the NPWT dressing and clinical resources required, adds

considerable burden to the postoperative care of these patients [36]. Furthermore, the long term outcomes of abdominal wall hernia recurrence remain unknown, and there continues to be limited published data on the effectiveness of NPWT for achieving wound healing despite its wide spread use in clinical practice [36, 37]. Factors such as the type of mesh used (biologic versus synthetic), the degree of contamination, and the extent of loss of abdominal wall integrity should be examined in future studies in order to develop a better management algorithm for this subset of renal transplant recipients with complex, infected abdominal wall defects.

In conclusion, these complex cases indicate it is possible to undertake a prosthetic mesh repair of the deep fascia in renal allograft recipients in whom abdominal wall infection is also suspected at the time of surgery, and then immediately deploy NPWT in order to achieve wound healing. However, a significant degree of caution and vigilance is required, as the possibility of further procedures being required remains high. Consideration also needs to be given to using a conventional type of prosthetic mesh in light of potential unforeseen issues with biologic mesh.

Abbreviations

BMI: Body Mass Index; DBD: Donation after brain death; NPWT: Negative Pressure Wound Therapy; RACS: Renal Allograft Compartment Syndrome.

Author Contributions

Dr Susanna Lam assisted in the collection of data and preparation of the manuscript. Dr Jerome Laurence assisted in the preparation of manuscript. Dr Deborah Verran assisted in the preparation of the manuscript.

Competing Interests

The authors have declared that no competing interests exist.

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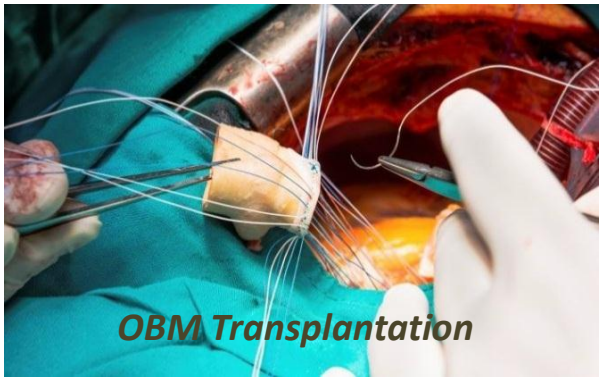

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