Endovascular treatment of thoracic aortic pathology in renal transplant recipients: early and intermediate-term results

Marcio Da Rocha, Zaki Anas Zarka, Vicente A. Riambau*
Division of Vascular Surgery, Thorax Institute, Hospital Clinic, University of Barcelona, Villarroel 170, 08036 Barcelona, Spain
Received 21 June 2009; received in revised form 31 August 2009; accepted 1 September 2009

Abstract

Endovascular correction of aorta thoracic pathology in renal transplant patients is a challenge. The aim of this study is to review early and intermediate-term results of endovascular repair of thoracic aorta pathology in patients with functioning previous renal transplant. The records of 81 patients submitted to a thoracic endograft between 2003 and 2008 were reviewed. Five patients with six previous renal transplants were submitted to six thoracic endografting. Two were women. The mean age was 55.4 years (range, 43–75 years). There were two patients with type B aortic dissection, one penetrating ulcer, one aneurysm of the aortic arch and one descending thoracic aorta aneurysm. Three patients underwent hybrid procedures: two total supra-aortic transpositions and one partial transposition of visceral trunks. Three patients presented postoperative complications. There were two cases of pneumonia, one acute limb ischemia and a stroke, with an early death. The mean follow-up was 16.2 months (range, 1–40 months). In this period all patients sustained renal function without any related complication. Despite the fact that it is a small series, in our clinical experience, endovascular thoracic aortic surgery can be performed as an alternative to open correction, in high-risk patients with a previous working renal transplant.

© 2009 Published by European Association for Cardio-Thoracic Surgery. All rights reserved.

Keywords: Aneurysm; Endovascular; Aortic aneurysm; Renal transplantation; Renal insufficiency; Hybrid surgery

1. Introduction

The prevalence of end-stage renal disease (ESRD) has increased in the last years throughout the world [1]. Renal transplantation (RT) is the best option of treatment for this serious health problem. Renal replacement increases survival and is done even in patients over 65 years old [2, 3]. Renal transplanted patients (RTP) may develop thoracic aorta disease (Fig. 1) because of associated arteriosclerosis risk factors, or prolonged use of steroid and other immunosuppressant therapy [4]. They may need endovascular repair lifelong. The traditional open surgery of thoracic aorta aneurysms is associated with a high rate of morbidity and mortality, and is performed with aortic cross-clamping.

Nowadays, endovascular surgery of thoracic aorta aneurysms has shown promising results. In this group of patients, with a working renal transplant, it is very important to carefully plan thoracic aorta endografting. The presence of a renal graft imposes some concerns and technical considerations.

There is no reported series in the bibliography about the endovascular treatment of thoracic aorta lesions in renal transplant patients. No previous reports concerning thoracic endografting of RT patients have been found in English peer reviewed bibliography.

Open graft replacement includes aortic cross-clamp as a major technical risk factor for these patients; however, endovascular repair has also a great risk factor, especially in this subgroup of patients: in fact, contrast enhancing agent is used during the procedure and may be necessary in some circumstances in the follow-up period. The objective of this work is to report the early and intermediate term results of endovascular treatment of thoracic aorta diseases in patients with working previous renal transplant, over a period of five years.

2. Methods

The prospective records of the patients who underwent endovascular treatment of thoracic aorta pathologies were retrospectively reviewed, between April 2003 and April 2008. Eighty-two thoracic endograftings were performed in 81 patients. Six endovascular thoracic aorta procedures were performed in five patients with working renal transplant, two females and three males. The mean age was 55.4 years (range, 43–75 years).

These patients were referred to our institution to be evaluated for endovascular correction of thoracic aorta pathology in a context of multiple comorbidities (Table 1). They were deemed risk patients for traditional open surgery. The etiologies of ESRD in this series were glomerulonephritis, followed by polycystic kidney disease, nephroangiosclerosis and ischemic nephropathy (Table 2). Four transplants were from cadaveric donors. One was an auto transplant to the pelvis and the other was of a living related donor, in a patient previously operated for an aorta bifemoral bypass for atherosclerotic obstructive disease.
Fig. 1. Aneurysm of the aortic arch in a patient with renal transplant. Detail of the anastomosis of the renal artery with the right external iliac artery (arrow).

Table 1
Distribution of co-morbidity and grading system for cardiovascular risk according to SVS/ISCVS in five patients [5].

<table>
<thead>
<tr>
<th></th>
<th>None (0)</th>
<th>Mild (1)</th>
<th>Moderate (2)</th>
<th>Severe (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes mellitus</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Tobacco use</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Hypertension</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Hyperlipidemia</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Cardiac status</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Carotid status</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Renal status</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Pulmonary status</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>


Table 2
Etiology of the ESRD in five patients

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glomerulonephritis</td>
<td>2</td>
</tr>
<tr>
<td>Polycystic kidney</td>
<td>1</td>
</tr>
<tr>
<td>Nephroangiosclerosis</td>
<td>1</td>
</tr>
<tr>
<td>Ischemic nephropathy</td>
<td>1</td>
</tr>
</tbody>
</table>

ESRD, end-stage renal disease.

One patient had two renal transplants, the second one nineteen years later. The external iliac artery was the donor artery in five cases, and in one case the renal artery was anastomosed to a branch of a previous aorta bifemoral bypass. All patients were on immunosuppression therapy and continued the medication after surgery. Kidneys transplanted to the iliac vessels were located in the iliac fossa. They were working at the moment of the surgery. The mean RT follow-up of this cohort was 64.5 months (range, 11–205 months). In this series, one patient presented with penetrating aortic ulcer in the descending aorta, another presented with a descending thoracic aortic aneurysm involving celiac trunk, a third had an aortic arch aneurysm (Figs. 1 and 2) involving supra-aortic trunks. Two patients presented type B aortic dissection treated because of persistent pain. In these two cases the dissection did not involve iliac arteries. Four years later one of them required thoracic aorta stenting, to treat a re-entry tear and false lumen, next to the subclavian artery. In three of six patients, hybrid procedure was necessary. Two total supra-aortic transpositions and one partial transposition of the visceral trunks (celiac trunk and superior mesenteric artery) were performed. All hybrid interventions were done in two stages. General anesthesia was used in all six patients, including in the second stage of hybrid intervention. Insertion of the endograft was performed via femoral artery, contra-lateral to the side of the kidney graft, in five instances. In both cases of debranching of the arch, the thoracic endografts were implanted in zone 0 [6]. A temporary iliac conduit, contra-lateral to the renal graft, was necessary in one woman. The Gore TAG (W.L. Gore & Associates, Flagstaff, AZ, USA) endoprosthesis was used in two cases and Relay (Bolton Medical, Sunrise, FL, USA) endograft in four. The mean number of endoprostheses used per patient was 1.5 (range, 1–3). Endograft diameter varied from 26 to 36 mm. Total amount of contrast used ranged from 50 to 110 ml. The follow-up image control was performed with angio-magnetic resonance imaging (MRI). No patients were lost to follow-up.

3. Results

Mean stay in the hospital was 10.2 days (range, 3–18 days). One patient with a descending thoracic aneurysm did not need intensive unit care. The hybrid surgery was performed in two stages, and the endovascular procedure was performed two days after the first part of the hybrid surgery. The mean follow-up of this group was 16.2 months (range, 1–40 months). All patients maintained immunosuppression therapy in the postoperative period. No endoleak, endograft migration or any other related surgical complications were recorded in the follow-up. There was no renal graft loss or late mortality in this period.

3.1. Renal function

In two out of six procedures, patients presented mild renal insufficiency during hospital admission. In the other
four, renal function was normal. The mean preoperative baseline creatinine in the six procedures was 1.52 mg/dl (range, 0.70–2.5).

In the post-surgery period there was mild increase in creatinine in three cases and significant increase in one, that did not need renal replacement therapy. In the other two procedures the renal function was normal. The mean creatinine level after surgery was 2.06 mg/dl (range, 1.00–4.2). In the follow-up period the mean creatinine level was 1.69 mg/dl (range, 1.00–2.4).

3.2. Morbidity

Two patients had pneumonia. One patient presented acute limb ischemia, in the contra-lateral limb to the side of RT, in the first post-surgery day after the visceral trunk transection. This patient underwent a successful thromboembolectomy.

3.3. Mortality

There was one death in the postoperative period. The patient that underwent hybrid procedure because of a re-entry tear in the arch presented stroke and rupture of the ascending. It caused a fatal cardiac tamponade 15 days post-surgery.

4. Discussion

RT is the treatment of choice for ESRD and age is not a contraindication. Patients over the age of 65 years who undergo RT have good quality of life and better survival rate [7]. The prolonged use of steroid and other immunosuppression therapy is associated with the development or worsening several atherosclerotic risk factors, such as hypertension, hypertriglyceridemia and impairment of glucose tolerance [8]. With the growing age and associated risk factors for atherosclerosis, these patients may be up to develop aortic diseases.

The fast development of endovascular technology in the treatment of thoracic aortic dissection or aneurysmal disease, and good results in high-risk patients, have brought some technical challenges, as complex cases sometimes are referred to endovascular treatment [9].

In the last five years, 6.1% of the thoracic aortic endovascular surgeries in our service were performed in patients with a previous renal transplant. They were referred to our institution to be assessed for endovascular procedure.

In these patients the major concern is the preservation of the transplanted kidney and renal function, in a scenario where instrumentation of the arterial tree is necessary with catheters and guide wires, use of contrast medium with its nephrotoxicity risk and induction of hypotension, in some cases, in order to deploy the thoracic endograft. On the other hand, patients with previous RT generally have severe associated co-morbidity. They may need a longer hospitalization period and have higher risk of infection due to the use of immunosuppression therapy.

In the preoperative period careful management is required. Adequate hydration is advised. Use of N-acetylcysteine, strict blood pressure control during the procedure and use of a small amount of low-osmolar contrast media are essential. To solve the need of higher doses of contrast in thoracic endografting, we advise a technique for hybrid procedures of the arch. In the first open part of surgery, we placed a radio-opaque marker that encircles the aorta, showing the surrounding limit to release the endograft. It avoids excessive use of contrast. As in three of six instances it was necessary to perform a hybrid procedure, this strategy was useful in limiting the use of contrast. Instrumentation of the intra-arterial devices must be performed with extreme caution, in order to avoid damaging the iliac arteries. Use of the contra-lateral side of the transplanted kidney to deliver the main body of the endograft is good. There is always the concern raised when manipulating an artery possibly fixed by scarring, of increasing the risk of rupture, dissection or occlusion of the transplanted renal artery. Manipulation of the iliac artery, contralateral to the renal graft, must be performed with caution too, because the patient may require another transplant in the future. Careful selection of material is essential. It is better to use smaller sheaths whenever possible. These facts are helpful not to lose the renal transplant.

In the post-surgery period, careful monitoring of renal function is mandatory, as well as the maintenance of the immunosuppression therapy. In the follow-up control angioresonance is advised (Fig. 2).

Sometimes this subset of patients may be refused open surgery. The endovascular approach may be the only alternative. There is no evidence to support the use of endovascular approach in this group of patients, but the use of endoluminal therapy seems more reasonable. It has good results and it is generally safe in high-risk patients. The morbimortality of this group of patients may reflect the fact that it is a small group. They were submitted to complex aortic endoluminal therapy, and showed serious comorbidities associated with the use of immunosuppression therapy.

Some authors may argue that the deployment of a thoracic endograft in the thoracic aorta is easy [10] but generally, this is not the truth. The existence of diverse pathology affecting the thoracic aorta may determine the use of complex procedures, such as the hybrid approach that is a combination of an open and endovascular procedures. In this report three patients were submitted to a complex aortic procedure, with two total de-branchings of the supra-aortic trunks and one partial visceral re-transposition.

Feezor et al. reported the differences between thoracic endografting and abdominal aorta endovascular repair (EVAR). Thoracic endografting group is composed of a heterogeneous group of patients, with a wider range of pathologies, as aortic dissection, intramural hematoma, penetrating ulcer, aneurysms, pseudoaneurysm and trauma. It was reflected in this cohort. Our patients had a heterogeneous group of diseases and different approaches were necessary. The majority of subjects who undergo EVAR have aneurysms [11].

In conclusion, despite the fact that it is a small series, in our clinical experience, the endovascular thoracic aortic surgery can be performed as an alternative to the open correction in high-risk patients with a previous working renal transplant. All patients sustained their renal function in mid-term follow-up without the need of renal therapy.
replacement or a new transplant. This study adds information about the endovascular management of thoracic aorta diseases in complex contexts.

References


