Nephroprotective Strategy in Aortic Surgery: A Review of 3 Cases

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Abstract

Urological complications are increasingly well recognised after both open and endovascular abdominal aortic surgery. We report 3 different cases in which patients required combined urology and vascular input, and we outline the nephroprotective strategy required to safely manage such patients. The 3 patients underwent different procedures (open abdominal aortic aneurysm repair, endovascular aneurysm repair (EVAR), and aortobifemoral bypass graft), however, they all required urinary tract attention for an optimal outcome.

Keywords: Aortic Surgery; Ureteric; Stenosis; Vascular; Complication

Introduction

Close liaison between urology and vascular teams is an essential component of modern aortic surgery. The close anatomical relations of the aorta and urinary tract, together with the unique demands placed on the renal tract by aortic surgery, necessitate that safe and effective aortic intervention can only be achieved with an optimised nephroprotective strategy.

The renal tract is vulnerable with both open and endovascular intervention, indeed 33.4% of patients developing chronic renal failure 30 months after aortic aneurysm repair [1]. Open surgery can cause renal risk at the time of renal vein mobilisation and aortic cross-clamping, and the ureter is at risk either by operative misadventure or at a later date by postoperative retroperitoneal fibrosis and perigraft inflammatory reaction [2,3]. Alternatively, the renal tract can be injured during endovascular aneurysm repair (EVAR) by wire-related renal artery dissection, thrombosis, graft malposition, and of course by contrast-induced nephropathy [4,5]. Up to 31% of patients undergoing open repair and up to 37% of patients undergoing EVAR develop a degree of ureteric stenosis [6].

The overall nephroprotective strategy should take into account pre-operative hydration, avoidance of nephrotoxins, careful open or endovascular operative technique, and post-operative surveillance for urological complications with a view to prompt treatment.
We present 3 cases of aortic surgery where close collaboration between urologists and vascular surgeons was fundamental for optimising nephroprotective strategies and providing a good outcome.

**Case Presentation**

The first case we present is of a 65 year old male who attended the emergency department with an abdominal aortic aneurysm rupture. This was repaired through open surgery and the patient had insertion of a bifurcation graft. Following the operation the patient was admitted to ITU where he developed acute renal failure with right sided hydronephrosis. The cause of this was thought to be early perigraft fibrosis. After collaboration with the urologists, it was determined that the patient required insertion of bilateral ureteric stents. On follow up at 9 months the patient’s left ureteric stent was removed and his right was replaced, as shown in **Figure 1**. The patient is alive and well with normal renal function at 3 years follow up.

![Figure 1](image1.png)

**Figure 1.** CT reconstruction illustrating ureteric compression and hydronephrosis of the right collecting system by aorto-bi-iliac aneurysms. Note decompressive pigtail stent in right ureter.

Our second case is a 56 year old male who was being investigated for recurrent UTIs. He was found to have a large staghorn calculus and was incidentally found to have an 8 cm abdominal aortic aneurysm on ultrasound. He was referred to the vascular surgeons who planned to perform an EVAR. This patient had an eGFR of 30ml/min/1.73m² and he required pre-operative antibiotics. This was done to maintain asepsis during the procedure and to prevent graft colonisation by circulating organisms [7]. The input of both urology and vascular clinicians was necessary to safely perform this EVAR. The patient recovered well after his EVAR but continued to have problems related his staghorn calculus. **Figure 2**

![Figure 2](image2.png)

**Figure 2.** Postoperative CT scan showing large staghorn calculus in right kidney, in close approximation with recently deployed aortic endoluminal stent graft (EVAR). Note rim of calcification in aortic wall.

Our last case is an 89 year old male who underwent an aortobifemoral bypass graft. After this operation, the patient is a post-operative CT showing his EVAR graft in-situ along-side his staghorn calculus in his kidney. The urology team kindly followed up this patient and performed percutaneous nephrolithotomy and inserted a right ureteric stent. The patient is alive and well at 18 months with stable renal function.

![Figure 3](image3.png)

**Figure 3.** Postoperative CT angiogram; Showing dilated right renal collecting system as a result of aorto-bifemoral perigraft fibrosis.

Our last case is an 89 year old male who underwent an aortobifemoral bypass graft. After this operation, the patient...
developed a right ureteric stricture in close proximity to his graft due to peri-graft inflammation. Unfortunately, a 7 mm calculus became lodged at this stricture causing hydronephrosis of his right kidney as shown in figure 3. It was not possible to retrieve this calculus by initial ureteroscopy so a 6 Fr stent was placed to allow dilation of the stricture for subsequent stone retrieval. After 6 weeks, the stone was removed by laser lithotripsy and ureteroscopy. The patient is alive and well with stable renal function 3 years after this procedure.

Discussion

The overall nephroprotective strategy required in patients undergoing abdominal aortic surgery is outlined in table 1:

| :Pre-op | Prehydration | Avoidance of nephrotoxins | Consider determination of split renal function | Treat outflow tract obstruction |
| :Intra-op | Divide renal vein (if required) proximal to gonadal vein | Intraoperative monitoring of fluid status (CVP, LIDCO, etc) | Minimise angiographic contrast load | Facilitate intraoperative diuresis | Careful angiographic technique | Avoid ureteric trauma |
| :Post-op | Monitor for EVAR graft proximal migration | Consider ureteric involvement in perigraft fibrosis |

Table 1. Nephroprotective strategy for abdominal aorta surgery.

Nephroprotective planning is a crucial component of successful aortic surgery. Pre-operative renal optimisation is crucial: generous application of ureteric stenting for outflow tract obstruction is invaluable, and nephrotoxic medications should be withheld where possible. Whilst it is important to have a well-planned morphological and anatomical operative plan [8], consideration should also be given to ‘bail-out’ strategy. In difficult aortic neck anatomy it may be necessary to consider adjunctive techniques such as suprarenal clamping or the ‘snorkel’ family of procedures [9] or even renal artery sacrifice in very diseased kidneys (providing the contralateral organ is healthy!).

In the case of endovascular repair consideration should be given to intra-arterial contrast load minimisation. Whilst it is difficult to effect an endovascular repair without contrast, adjunctive techniques such as IVUS or CO₂ angiography can be deployed at certain stages to assist stent placement.

Finally, post-operative monitoring of EVAR grafts is well established [10] and consideration should be given to surveillance of open repairs in certain high risk groups. This is to monitor for graft or stent-graft migration with possible effects on the renal tract.

By taking these considerations into account, and by close partnership between urologists and vascular surgeons, these complex patients can have smoother hospital visits and can expect better outcomes.

Conclusion

Proper planning of aortic surgery necessitates that the urology and vascular teams are integrated in their patients’ management. We have outlined a nephroprotective strategy above which allows effective and safe aortic surgery; reducing the complications to the urinary tract.

Conflict of Interest

None

Illustrations

All figures are required to be printed in black and white

References
