Functional assessment of the reconstructed urinary tract

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Reconstruction of the urinary tract is increasingly advanced. However, we need to be able to follow up patients with the appropriate parameters to make sure surgery is successful in the short, medium and long term. This article aims to consider these parameters and the framework by which the reconstructed urinary tract can be assessed.

Reconstructive surgery represents the beginning of a contract between a surgeon and a patient. Not every patient will need to be followed up regularly for life – in some cases, e.g., distal hypospadias, this would completely overload any healthcare system. Some will need lifelong, regular follow-up, but all should know how to access the right care if they need it following surgery. If patients are to be followed up, meaningful parameters to follow are needed so that we know whether the surgery is successful.

Most of the measures used are based on ‘normal’ subjects and used to measure progressive disease. Reconstructive surgeons use these functional measures as a means of gauging surgical outcomes, and this seems to have been reasonable so far. If nothing else, if the same assay is used to measure any particular function, once a baseline is established the recognition of change from baseline can be used to decide upon further investigation or intervention.

URETHRA

The mainstays to investigate the outcome of urethral surgery are urinary flow rates and the urethrogram.

Preoperative flow rates are part of the diagnostic pathway in stricture disease. Maximum flow rate has traditionally been used as the most significant measure, with a flow rate of 10ml/s or below suggesting likely obstruction. This has been validated through evaluation of the flow rate in normal urethras, with benign prostatic enlargement being the cause of obstruction when identified.1 The turbulent flow and loss of corpus spongiosum associated with either a stricture or urethroplasty do not seem to significantly affect the ability to interpret the flow rate in this setting. The question...
of whether the length of the repair affects interpretation does not seem to have been evaluated. Indeed, it would be difficult to do so, although the relationship between tube length, radius and flow would make it interesting. Additionally, as yet, there is no understanding as to whether the flow rate remains representative with a congenitally abnormal urethra, eg hypospadias, epispadias or urethral valves.

In rating surgeons, the BAUS database for urethroplasty examines complications and flow rates as the principle outcome measures. Good quality urethrography would be expected as part of the evaluation, at least if there were concerns around a reduced flow rate or other symptoms such as urinary tract infections.

**BLADDER**

There is no standardisation for the follow-up of a reconstructed bladder. However, as the vast majority of follow-ups are based on the use of bowel, this has been taken as the focus of this section. The potential complications are well documented and include stones (Figure 1), mucous, UTIs, metabolic changes and malignant change. The author has a defined protocol for measuring annual bloods to examine renal function, bicarbonate, chloride and vitamin B12. These are coupled with annual ultrasound and five-yearly formal glomerular filtration rate measurement. Changes in emptying or continence need video urodynamics, and new symptoms such as infections, haematuria or pain necessitate cystoscopy.

It would be negligent to allow a decline in vitamin B12 and subsequent subacute degeneration of the cord. B12 levels should be routinely checked to avoid the serious consequences of a deficiency. Other bloods are checked to provide a baseline. In those with a low bicarbonate and an elevated chloride, we would offer bicarbonate supplementation.²³

**KIDNEY**

One of the main objectives in providing a functioning lower urinary tract is to ensure the preservation of renal function. A low-pressure storage reservoir or an incontinent stoma (ileal conduit) are the two standard means by which this is best achieved. In conditions such as posterior urethral valves (Figure 2), there is almost certainly irreversible renal damage in utero.⁴ Substantial damage may occur before the valves are diagnosed, thus the use of vesico-amiotic shunts may not be able to alter the course of renal decline in these patients.

90% of patients born with myelomeningocele have normal kidneys at birth; but historically, 50% had died by the age of 35 years. End-stage renal failure was the documented cause in a quarter of children and nearly a third of adults.⁶ However, a recent series from St George’s Hospital, London, shows a significant improvement, with a mortality rate of 4.4% at a mean age of 20 years – 48% showed normal renal function and only 1.6% had severe renal failure. There were no deaths from renal failure in this cohort study, suggesting that aggressive bladder management can significantly improve the renal outcome for myelomeningocele patients.⁵

Patients with congenital abnormalities of the kidneys and urinary tract (CAKUT) and other patients who have had reconstructive surgery need careful monitoring. In many cases, this will be for life. Many will not suffer deterioration in renal function, but some will. It is important to set up a service that allows regular follow-up and effective screening. One significant marker of renal deterioration is proteinuria. Checking for proteinuria and measuring blood pressure at each clinic visit therefore seems a sensible means by which these patients can be screened. Close working with a nephrologist is also important, as intervention such as the use of ACE inhibitors is effective in slowing the rate at which function declines.⁶ Although they do not prevent end-stage renal failure, there is a clear advantage in delaying the need for dialysis and/or renal transplant.

These patients also need to be monitored for obstruction. Renal function and a baseline ultrasound scan are good for screening; new or worsening hydronephrosis needs review. It is important to ensure that the bladder is empty at the time of the scan. The finding of hydronephrosis can otherwise be misleading, as the dilatation may resolve once the reservoir has drained. In a reconstructed system, a change in renal function needs investigation with a MAG3 renogram. This is often combined with a video cystometrogram (CMG) to rule out a change in reservoir pressure. It is worth noting that some patients have been found to have a volume-dependent renal deterioration – they had safe bladder pressures, but their upper tracts only
drained below a certain reservoir volume – as denoted by combined CMG and MAG3. This means that if the bladder is emptied below their ‘critical volume’, renal failure can be stabilised.

Overall renal function is best measured with a formal chromium EDTA GFR. An eGFR may differ as it has not been validated for use with bowel in the urinary tract. As with all measurements, eGFR can be used with caution, but a formal measure may be more robust.

**SUMMARY**

The patients discussed here represent a wide range of complexity. The more straightforward do not need regular follow-up – they should know what surgery they have had done and how to access help if needed. The more complex patients, such as those with enterocystoplasties, do need regular follow-up. It is important for clinicians looking after these patients to establish a record of baseline function, look carefully for change, and know the limitations of the tests they are using.

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**REFERENCES**