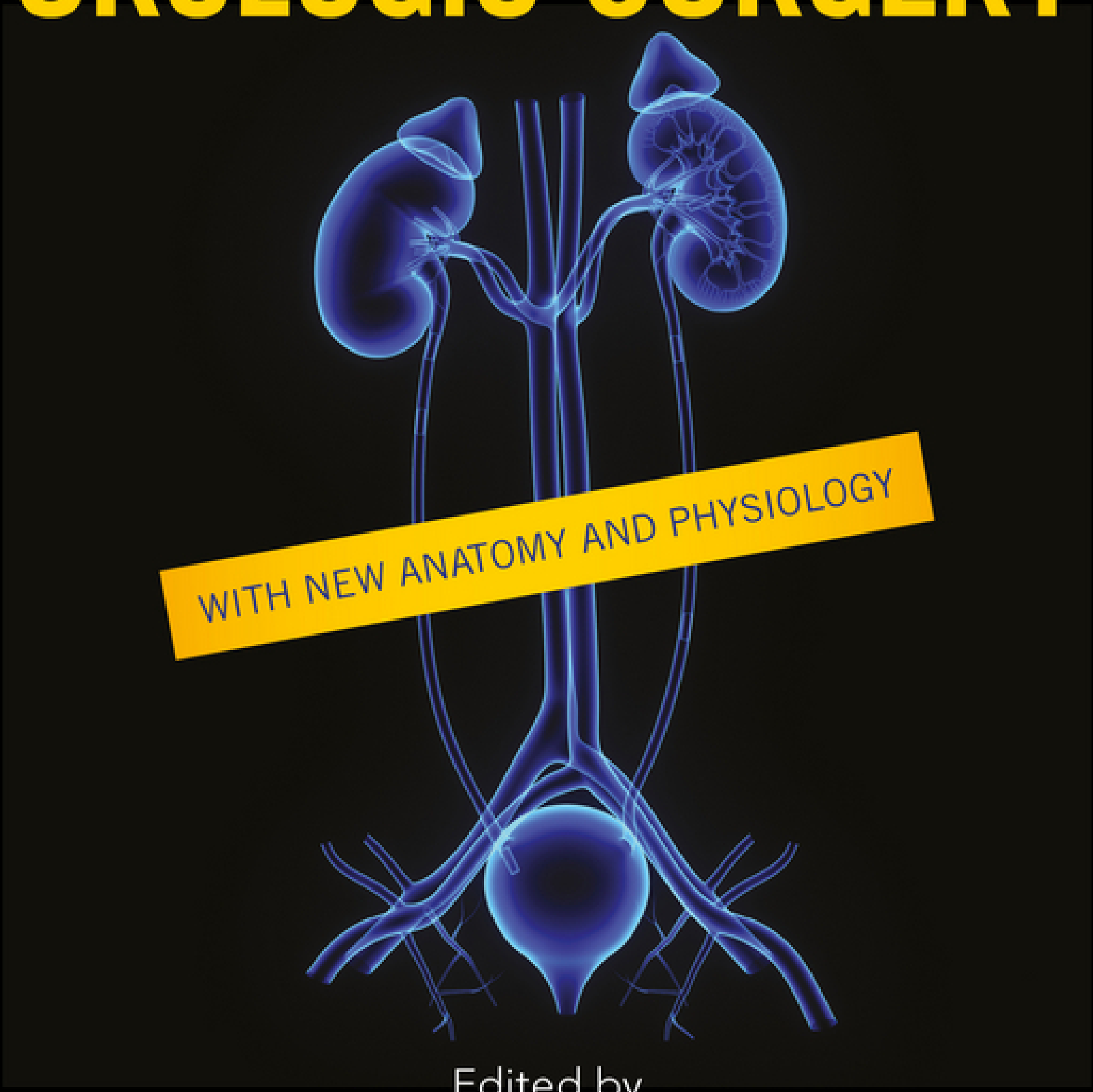
RADIOLOGY AND FOLLOW-UP OF UROLOGIC SURGERY



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Radiology and Follow-up of Urologic Surgery

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Dedicated to our lifelong supporters, Anna Terrington and John Kirkham, and to our contributors.

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The heroes of this book are the contributing authors. Without exception they found the subject to be intriguing because it had not been tackled before. Then, for the same reason, they found that the lack of evidence-based literature made the writing difficult. All have risen to the challenge, giving the benefit of their experience and analysis of the limited literature. We send them all our greatest thanks.

At Wiley, we have had wonderful support from a most comprehensive team. Walter Oliver, in his last days at the company, pushed hard for the project's acceptance. He was followed by James Schultz and now Deidre Barry who have kept it on track.

Yoga Mohanakrishnan sorted out the submission and established order from multiple files and then Manish Luthra and Shobana Ramesh reviewed the technical aspects of text, images and layout. Dr Laurence Errington has provide a most comprehensive index.

The copy editing was done by Jan East. This is a task that requires meticulous attention to detail and great tact. With her encouragement and gentle pressure everything, down to the smallest detail, was prepared for typesetting on time.

No good book can be produced without such tireless help. We are most grateful to all.

Christopher Woodhouse
Alex Kirkham

Introduction

Christopher Woodhouse and Alex Kirkham

The literature in radiology and urology is predominantly orientated to diagnosis and disease management. Although complications and outcomes are included under 'management', the clinician is often left in the dark about anatomical and physiological changes that follow successful treatment. This is particularly true where there has been conservative or reconstructive surgery. We are faced with patients who have a new set of symptoms, images that look different from those seen before treatment and physiology that requires definition of new normal values.

Clinicians are therefore left wondering what is a complication and what an inevitable consequence of the management? What, for example, is the normal appearance of a kidney cancer after radiofrequency ablation (RFA) and what does a local recurrence look like? How does the urine flow down the ureters after a trans-uretero-ureterostomy? What is the new normal appearance of the urinary tract after a cystoplasty?

When we asked our colleagues to contribute chapters, their reactions were consistent. After the usual complaints of being too busy and so on, there was recognition that the subjects were very intriguing and had not been tackled before. Their instructions emphasised that we were not interested in *why* any particular treatment was carried out, or what the figures for outcome were. We needed the 'new normal' and the differences between that and complications. In some conditions the principal changes were radiological, but biochemical and histological findings also change after some reconstructions. With long-term survival after many reconstructive procedures there are some changes that are the consequence of ageing or the initiation of a malignant change. On the basis of the known changes, what should be the follow-up? This last was often the most difficult because it was rare to find any evidence-based follow-up protocols!

Once our contributors had settled down to their work, all admitted to finding it interesting but challenging. One or two, sadly, felt that the whole task was beyond them. Once completed, however, they universally felt that it had been worthwhile and we, the editors, feel that those who did accept the challenge have triumphed and produced excellent texts and illustrations.

It could be asked why these issues have been so little considered in the literature. Anatomical reconstruction could not begin until it became possible to operate for longer than the few minutes that were needed to chop off a leg or some other damaged appendage, and, even more importantly, to have an aseptic field. The first urological reconstruction of this era was the uretero-sigmoidostomy (U-sig). Simon described this operation in 1852 in a paper in *The Lancet*. If one reads beyond the title it is found that it was a report of an operation that was successful but the patient died. Despite this unhappy beginning, the U-sig

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remained the standard urinary diversion until the ileal conduit was developed in 1948. It had many complications and patients were not always continent, but it usually lasted for 10 years before death occurred from something which, at the time, might have appeared unrelated to the original operation.

In the 100 years during which the U-sig was the predominant lower urinary tract reconstruction, there were plenty of ideas for alternatives. Leon Krynski (1896), a Polish surgeon, described a non-refluxing method of implantation of the ureters into the colon virtually identical to the Politano–Leadbetter procedure. In a textbook published in Leipzig in 1909, Verhoogen and Graeuwe, surgeons from Brussels, reviewed the possibilities of continent diversions. They quoted Pawlik (1889) who created a new bladder by diverting the urine into the vagina; continence was achieved by tightening of the introitus and the patient was continent and could void. Verhoogen had made a reservoir from the caecum and drained to skin by the appendix. The accompanying diagram (Figure I.1) showed a system very similar to that used today. The results were not recorded.

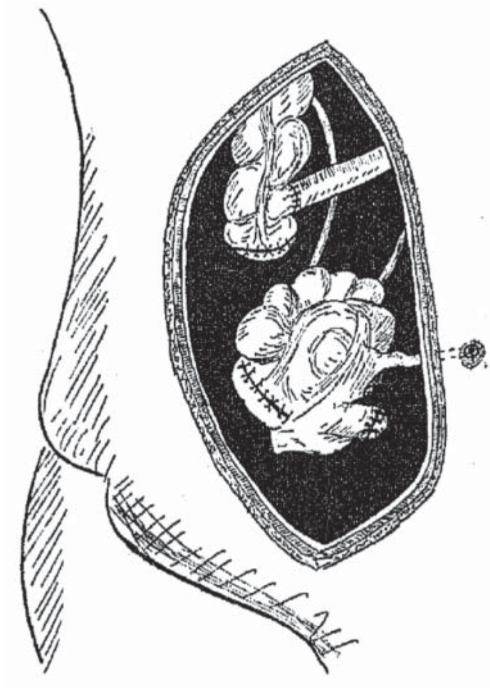

Figure I.1 Diagram taken from *Folio Urologica* edited by James Israel, Leipzig, 1909, pp. 629–679. It shows the construction of a urinary reservoir from caecum and drained by the appendix, attributed to Verhoogan. With thanks to Professor Elmar Gerharz who first drew our attention to this fascinating book.

Clean intermittent catheterisation (CIC) was described by Lapides *et al.* in 1972. It is interesting to note that none of the early reports of bladder reconstructions described how the reservoir was to be emptied. There are anecdotal reports of men keeping catheters in their hat bands, which could be described as dirty self-catheterisation!

In this phase of anatomical reconstruction, Anderson and Hynes (1949) described their procedure for anastomosing the retro-caval ureter to the renal pelvis. This was not then carried out to treat pelvi-ureteric obstruction although it is now. Trendelenberg (1906) designed a bladder reconstruction for exstrophy which allowed the paediatric patient to void, albeit only for a short time before the wound broke open. Dennis-Brown (1936) described his 'buried skin strip' operation for hypospadias which has some similarity to the current Snodgrass procedure. It should be noted that at least 51 'new' operations for hypospadias were described in the twentieth century. Sadove *et al.* (1993) used a vascularised graft of fibula and overlying soft tissue to replace the small or absent penis.

Despite all of these ideas and clinical experiments, it is really only since the 1980s that reconstructive urology has become a major subspecialty and produced the large numbers of long-term survivors from single institutions that are needed for study.

The other criterion for inclusion in this book is 'conservative surgery'. Conservation as a surgical concept generally implies greater difficulty with preservation of blood and nerve supply. At least until the 1960s, cancer was generally treated by radical surgery or radiotherapy, partly because it was known that malignant cells could be found outside the visible mass and partly because there was no other treatment. Later it was recognised that less radical surgery, sometimes augmented by radiotherapy (or, later, chemotherapy), could achieve the same result with less morbidity. Now, conservative surgery is often supplemented by reconstruction and performed with minimal access technology.

There are the same issues with follow-up as there are with reconstructive surgery: what does the conserved organ look like; how does it work; what is a complication and what does a malignant recurrence look like?

The book has a section for each of the organs of the genitourinary tract and the chapters are based on the major diseases and operations that are used. There are copious illustrations, a feature strongly encouraged by the excellent staff at Wiley Blackwell. We are very aware of the difficulties that the contributors have had and the time that they have devoted to their work. We are most grateful to them all and especially for the new light that they have shone on the outcomes of urological surgery beyond the standard survival and complication rates.

1

Subtotal Nephrectomy and Tumour Ablation

David Nicol, Alison Elstob, Christopher Anderson and Graham Munneke

Introduction

With the use of cross-sectional imaging, small renal tumours have been increasingly diagnosed over the past 20 years [1]. During this period, management has become more conservative with a progressive decline in the utilisation of radical nephrectomy. Nephron-sparing approaches have been widely adopted with the objectives of preserving renal function and reducing long-term morbidity. Partial nephrectomy with excision or enucleation of the tumour appears to have equivalent oncological outcomes to more radical surgery. The availability of robotically assisted surgery allows a minimally invasive procedure for partial nephrectomy that many now suggest is the surgical procedure of choice when feasible. Ablative therapies such as radiofrequency ablation (RFA) and cryoablation (CA) are alternatives to partial and radical nephrectomy, particularly for patients who are not suitable surgical candidates. Small renal masses in the short to intermediate term frequently exhibit slow growth and minimal metastatic risk and consequently surveillance is now adopted in patients who are elderly or have significant co-morbidities.

Postoperative and follow-up imaging after radical nephrectomy for small renal tumours is essentially to detect early postoperative complications and the relatively rare events of local recurrence and metastatic disease. The increasingly utilised nephron-sparing approaches have introduced challenges associated with the repeated imaging that is required for these various options. These include investigations of the tumour-bearing kidney for a range of specific complications of the various strategies as well as the possibility of incomplete eradication, tumour recurrence within the remaining parenchyma as well as disease progression. Anatomical distortion of the kidney and evolving changes to masses subjected to ablative treatment or undergoing surveillance management represent specific challenges for the nephron-sparing approaches.

Procedures

Partial Nephrectomy

Surgical excision of small renal tumours is undertaken as either an open operation or, increasingly, with a robotically assisted or laparoscopic approach. Tumours can be enucleated or excised with a margin of surrounding renal parenchyma. Components of the operation include mobilisation of the kidney and identification of the renal mass, isolation of the renal artery, with temporary occlusion/clamping if required, tumour excision and renal repair. The last may, in some cases, require closure of the collecting system in addition to oversewing of the incised parenchyma including divided blood

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vessels required for haemostasis. A ureteric stent can be inserted as a preliminary or during surgery if collecting system repair is required.

Follow-up imaging is required to assess and guide management of early postoperative complications, most often haemorrhage or urinary leakage. Longer term imaging is also required as routine to detect local recurrence either at the site of resection or within the remaining parenchyma.

Early Imaging

This is principally indicated for assessment of clinically recognised or suspected complications of the surgical procedure and to direct their management. Haemorrhage and urinary leakage comprise the principal surgical complications that require imaging.

Haemorrhage Bleeding can arise in the initial postoperative period, usually reflecting an unsecured artery, or days to weeks later as a result of rupture of a pseudo-aneurysm of an intrarenal artery. The events alerting the clinician are signs of blood loss or falling haematocrit as well as flank pain or mass and at times, heavy haematuria. Subtle unexplained drops in haematocrit, which may precede signs of significant bleeding, can also prompt radiological investigation. The principal investigations used are computerised tomographic angiography (CTA) and invasive angiography [2].

CTA – may be required initially to determine the source of blood loss. Intravenous contrast should be employed as this will assist localisation of bleeding. Recommended imaging entails an initial arterial phase after bolus contrast injection with a subsequent portal venous phase approximately 1 minute later [3]. Visualisation of active bleeding based on contrast extravasation is an indication for urgent embolisation (Figure 1.1). Whether CTA is a necessary preliminary to standard angiography, required for embolisation, is debatable. In the context of bleeding following partial nephrectomy from the kidney, CTA may be a redundant investigation increasing contrast media exposure as angiography and embolisation is highly likely to be required. When CTA fails to detect an active source, angiography may also be deemed necessary based on clinical concern and heightened suspicion. In practice it is often used as a rapidly accessible investigation and to confirm whether bleeding is from the kidney itself, from non-renal vessels such as lumbar or intercostal or reflects damage to other organs such as the spleen or liver which may not be evident on selective angiography.

In cases where there are significant concerns regarding contrast and specifically renal dysfunction, ultrasound (US) and magnetic resonance angiography (MRA) are alternative options. Of these, MRA, if available, is the best alternative to CTA in providing detail of the intrarenal circulation

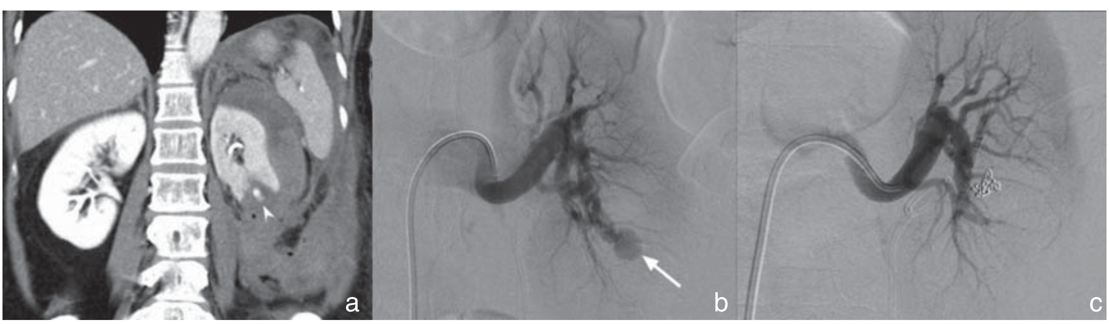

Figure 1.1 Haemorrhage 7 days following left partial nephrectomy with large perinephric haematoma and contrast extravasation on computerised tomography (CT) (a). On subsequent angiography, no sign of active bleeding persisted but a contained lower pole aneurysm was demonstrated (arrow, b) which was successfully treated with gel embolisation (c).