The use of radiologically guided embolisation to treat haematuria in patients with renal cell carcinoma and transitional cell carcinoma

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Introduction
Percutaneous embolisation performed by interventional radiologists is a safe and effective method for the treatment of haemorrhage in many clinical scenarios. Common uses for this technique include the embolisation of bleeding abdominal viscera post trauma, the embolisation of bronchial arteries to treat haemoptysis and the embolisation of mesenteric vessels to stop gastrointestinal haemorrhage.

Haematuria is a common symptom that can be caused by a wide variety of underlying pathology. Although there are many symptomatic and curative treatment options for patients with haematuria (both surgical and non-surgical) it can be frequently difficult to successfully stop the bleeding. This is particularly the case in patients with neoplastic disease, who may be poor surgical candidates, or have bulky, extensive local disease. This article assesses the use of percutaneous embolisation techniques for the treatment of intractable haematuria in the setting of the two most common renal tract malignancies, renal cell carcinoma and transitional cell carcinoma.

Renal cell carcinoma
Renal cell carcinoma (RCC) accounts for approximately 85% of malignant renal neoplasms and is the eighth most common malignancy overall. Its incidence is twice as high in males as in females. 25% have evidence of local spread at presentation while up to 30% have metastatic disease.

Treatment of the primary tumour is by surgical removal. Adjuvant treatment is not routinely undertaken. Treatment of patients with metastatic disease is challenging. Five-year survival can be as low as 13%. These tumours respond poorly to conventional chemotherapy and until recently, survival rates in these patients had plateaued. However, more recently with the addition of multiple targeted agents, for example tyrosine kinase inhibitors and mammalian target of rapamycin (mTOR) inhibitors, there have been improvements in survival and quality of life in the metastatic setting. Even in patients with metastatic disease, cytoreductive surgery is advocated to reduce both local tumour effects and paraneoplastic phenomena.

The most common local symptoms of RCC are haematuria and flank pain. Haematuria can be the presenting symptom in up to 68% of patients with RCC. It can also cause significant morbidity in those with known disease. In patients with haematuria and unresectable disease or in those with significant medical co-morbidities, the use of percutaneous renal artery embolisation can be of considerable use. Several investigators have demonstrated rates of cessation of haematuria varying from 68-92% in patients with RCC treated with embolisation. Repeat embolisation is rarely necessary but when required, it may be due to collateral vessel recruitment. Maxwell et al report a rate of repeat embolisation for recurrent haematuria of 8%.

In our institution, prophylactic IV antibiotic (Rocephin [ceftriaxone] 1 gm, Roche Pharmaceuticals) is administered to all patients one hour before the procedure. Conscious sedation is maintained throughout the procedure using IV midazolam (Hypnovel, Roche Pharmaceuticals) and propofol (Sublimaze, Janssen-Claig). Under local anaesthesia arterial access is obtained via a right femoral artery approach and a 5-French vascular sheath is inserted. A 5-French multi end-hole catheter (Omniflush, AngioDynamics) is used to obtain a nonselective aortic arteriogram to identify the renal arteries. A hydrophilic polymer-coated 0.035-inch angled guidewire (Radiofocus, Terumo) is used to position a 5-French Cobra catheter (Cordis) in the renal artery and selective arteriography is performed.

Once the renal artery has been accessed, a choice of embolisation material must be made. In general terms the aim is to embolise the arterial bed, most commonly using particles, although other embolisation materials such as ethanol and lipiodol have been successfully used. Historically, polyvinyl alcohol (PVA) had been the most commonly used agent. Spherical particles such as trisacryl gelatin (Embosphere, Biosphere Compatibles) have become widely accepted in recent years as an alternative agent. They penetrate the arterial bed more successfully than PVA and are less likely to clump within vessels. In our institution we use Embospheres in this setting and have had success both for palliating haematuria and for reducing tumour bulk prior to surgery. After embolisation of the tumour bed, further embolisation with gelfoam slurry or coil embolisation of the renal artery may be undertaken.

As with patients undergoing embolisation for transitional cell carcinoma (TCC), post embolisation syndrome (PES) is the most frequent complication. Other complications are rare (5%) but can result from vascular access, non-target embolisation, renal pseudoaneurysm formation and haemorrhage due to damage of the renal vasculature.

Many patients with resectable RCC now undergo partial nephrectomy rather than complete nephrectomy, particularly in the setting of impaired renal function or a solitary kidney. Haematuria is the most common early complication following partial nephrectomy, being reported in up to 5% of patients, and often due to pseudoaneurysm formation. Embolisation is an attractive nephron saving treatment option. In this clinical scenario specific distal embolisation can be performed, typically using coils or glue, that can be delivered via a microcatheter that allows superselective arterial access.

Transitional cell carcinoma
Bladder carcinoma accounts for up to 8% of malignant disease in men and 3% in women, with TCC accounting for 90%. Patients most commonly present with painless haema-
An embolisation material in these patients. It is simple to use, rapid to deploy and does not preclude further embolisation if symptoms recur. In addition, it is also extremely cost effective relative to other embolics and has a low side effect profile. Its success as an embolic agent stems from the inherently disorganised and proliferative vascular supply of the tumour bed within the bladder. As a result of this disorganised anatomy, it is often technically difficult to isolate a feeding artery that would benefit from coil embolisation, and in our experience malignancy will quickly parasitise adjacent vessels to reconstitute its vascular supply. Because gelfoam is deployed as a liquid "slurry", it can embolise deep into the vascular bed in a manner not possible with coils. It is also known that gelfoam powders frequently lead to permanent occlusion due to the small size (approx 50 micrometer) of the particles and the distal level of occlusion that they achieve.

The most common reported complication after pelvic embolisation is PES, with an incidence ranging from 0-65% in the series that was reviewed. Other less common reported complications included distal limb emboli (2%), skin necrosis (<1%), gastric ischemia (<1%) and Brown-Sequard syndrome. Jenkins et al also reported one death from gram negative sepsis and advocate the use of prophylactic antibiotics. While not described in any of these series, bladder infarction is also a recognised complication of internal iliac artery embolisation. DeBerardinis et al described the use of superselective embolisation of the vesical artery for the treatment of haematuria, postulating that its use would result in fewer complications, including reduced rates of PES.

**Conclusion**

Radiologically guided embolisation is a minimally invasive, effective and economic technique for treating haematuria in patients with RCC or TCC. Although it does not influence the long term course of the disease, it provides both prompt and sustained cessation of haemorrhage. Superselective embolisation in these patients is likely to result in a reduced incidence of side effects.

**References available on request from**
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**FIGURE 1**

Angiography of the aorta and iliac vessels demonstrating neovascularisation involving the vesical arteries bilaterally.
FIGURE 2
Selective catheterisation of the right vesical artery reveals the extent of underlying neovascularisation in the tumour bed.

FIGURE 3
Following embolisation, selective angiography demonstrates that flow to the previously identified area of neovascularisation has ceased.