Super-selective Renal Artery Angiography And Embolization As Treatment For Late Severe Bleeding Emanating From Nephrostomy Insertion: A Case Report And Review Of The Literature.

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Abstract

“Background”
Percutaneous nephrostomy is a well established procedure for the management of obstruction of the upper urinary tract. The complication rate is low when the procedure is undertaken by an experienced interventional radiologist. Severe bleeding emanating from nephrostomy insertion may occur early or late. Prior to the development of interventional radiology severe bleeding from a branch of a renal vessel was treated by partial nephrectomy or nephrectomy.

“Case Report”
A 64-years-old man was admitted with haematuria and was catheterised. Flexible cystoscopy revealed a tumour in the left side of the bladder. Excretory urography confirmed a filling defect in the left side of the bladder and a left sided hydroureteronephrosis. He developed a stroke therefore his bladder tumour resection was postponed whilst being managed by the physicians. His renal function subsequently became impaired and ultrasound scan showed bilateral hydronephrosis. Bilateral nephrostomies were inserted and the renal function improved. Two weeks pursuant to the nephrostomy insertion he developed severe haematuria with a drop in haemoglobin of 4 g/dL. Selective renal angiography confirmed a pseudo-aneurysm of the descending branch of the left renal artery which was successfully embolized with four coils and the bleeding stopped.

“Conclusions”
Severe bleeding from the kidney after insertion of nephrostomy is rare and this can occur late. Selective renal angiography to establish the source of bleeding followed by super-selective embolization of the source of bleeding is safe and effective.

It is recommended that every radiology department should have an interventional radiologist who is capable of performing renal angiography and embolization.

Key Words:
Haematuria; bladder tumour; nephrostomy; selective renal angiography; super-selective embolization; late severe bleeding:

Introduction

Percutaneous nephrostomy, or nephropyelostomy, is an interventional procedure which is mainly used to decompress the renal collecting system. Since Goodwin and associates' published a report of the first series involving this procedure in 1955, percutaneous nephrostomy insertion has become the prime procedure for the temporary drainage of obstructed upper renal tract in the developed world due to the development of interventional radiology.

Major complications associated with percutaneous nephrostomy tube insertion include: bleeding, sepsis, and injury to adjacent organ(s). Massive haemorrhage requiring blood transfusion, surgery or embolization is rare but this can occur early around the time of the procedure or late. Excessive haemorrhage associated with percutaneous nephrostomy insertion can be worrying to the patient, the urologist as well as the interventional radiologist.

A case is reported of a 64-years-old man who developed massive haematuria through his nephrostomy tube two weeks after insertion of the nephrostomy. The investigation and management of the bleeding as well as literature regarding nephrostomy associated bleeding has been reviewed.

Case Report

A 64-years-old man was admitted via accident and emergency Department when he was found collapsed
at home. He had apparently had frank haematuria. His general examination was unremarkable. His pulse rate was 76 per minute and his blood pressure was 160/100 mm Hg. His abdominal examination was also unremarkable. His initial investigations were reported as follows:

- Full blood count (Haemoglobin 14.0 g/dl, [normal range 13.0 – 18.0 g/dl]) white blood cell count 8.7 x 10^9/L [normal range 4.0 – 11.0 x 10^9/L], platelets 229 x 10^9/L [normal range 150-450 x 10^9/L]).
- Serum urea and electrolytes (normal).
- Serum glucose and coagulation screen were normal.

He was catheterised with a 22-french three way catheter and blood clots washed out. He was given intravenous fluids and he subsequently had flexible cystoscopy which revealed a tumour in the base of the bladder this was more confined mainly to the left side of the bladder. He was listed to undergo trans-urethral resection of the bladder tumour. However, he developed a stroke in the ward with weakness of both upper limbs and blindness. CT scan and Magnetic Resonance Imaging scan of his head confirmed multiple infarcts affecting the occipital region bilaterally; the right frontal region. In view of this his operation was postponed and his medical management was taken over by the physicians. He had an excretyory urography which revealed: normal right upper renal tract, left hydronephrosis and hydro-ureter down to the level of the vesico-ureteric junction and a filling defect on the left side of the bladder wall (see illustration 1).

Whilst under the physicians his serum urea and electrolytes were normal, however, two weeks later his serum urea and creatinine were noted to be elevated (creatinine 605 umol/L; urea 24.5 mmol/L). An ultrasound scan of his renal tract revealed mild to moderate bilateral hydronephrosis with preserved cortex (see illustration 2). In view of the ultrasound scan findings and impaired renal function bilateral nephrostomies were inserted and the renal function reasonably improved within four days (serum creatinine and urea levels dropped to 117umol/L and 6.1mmol/L respectively). He remained well after the nephrostomy insertion and then had a CT scan which revealed bilateral lymph-adenopathy involving the para-aortic, common iliac and external iliac group of lymph nodes and evidence of mild ascitis.

His nephrostomy urine remained clear until the fourteenth day post nephrostomy insertion, when it was noted that the left nephrostomy tube started to drain frank haematuria. His haemoglobin dropped to 6.9 gm/dl (his haemoglobin was 10.1 gm/dl prior to the onset of bleeding). He continued to bleed and was therefore given intravenous fluids and four units of blood.

Urgent renal artery angiography was performed which revealed a pseudo-aneurysm of the descending branch of the left renal artery (see illustration 3) and this was super-selectively embolized using four coils (see illustrations 4 and 5). There was no complication associated with the embolization. The haematuria settled immediately after the embolization procedure and thus open surgery was avoided. He recovered enough from his stroke to be able to undergo cystoscopy and resection of his bladder tumour histology of which was consistent with high grade (grade III) papillary carcinoma with adenocarcinoma component with muscle-invasion of at least pT2a at least and with lympho-vascular invasion. He lived for four months without any further bleed but eventually died as a result of his tumour.

**Discussion**

Martin and associates\(^2\) reported that they treated 808 patients with renal calculi by percutaneous nephrolithotomy (PCNL) between 1984 and 1998. They reported that 8 patients (1%) of the 808 patients, developed severe bleeding following PCNL and they were treated by hyper-selective embolization. They also reported that renal arteriography had shown arterio-venous fistula in 3 patients, pseudo-aneurysm in 4 patients, and both arterio-venous fistula and pseudo-aneurysm in 1 patient. Embolization allowed definitive treatment of these lesions in 7 out of the 8 patients. The patient with failure of embolization required a partial nephrectomy to stop the bleeding.

In this study it was noted that patients with normal renal function did not suffer significant change in the serum creatinine after treatment. Martin and associates\(^2\) reported that all the patients who had PCNL + embolization, with the exception of one patient, had maintained normal blood pressure. They concluded that in their opinion hyper-selective embolization is the least invasive and best treatment for massive haemorrhage after PCNL.

Peene and associates\(^2\) reported renal bleeding of iatrogenic origin in 3 patients with massive haematuria. Even though per-cutaneous nephrostomy was the initial injury in all cases, the angiographic was variable. All the three cases were successfully managed by using different techniques; coil in one case; detachable balloon in the second case; polyvinyl alcohol particle in the third case. Peene and associates\(^2\) reported that the symptoms regressed in all three patients and thus avoiding surgical intervention.
Lee and associates\(^4\) stated that:

- Urologists will continue to rely on percutaneous nephrostomy and PCNL to treat renal pelvis stone, but a clear understanding of its associated bleeding risks and management is mandatory.
- Although most patients with bleeding post nephrostomy can be managed conservatively, a subset of patients will require endovascular embolization for vascular control.
- Clinically significant bleeding can be treated conservatively in a majority of cases with tamponade nephrostomy tubes with or without transfusions. Arterial haemorrhage, pseudo-aneurysms and arterio-venous fistulas however, require prompt intervention with angiographic embolization.

El-Nahas and associates\(^5\) identified risk factors predicting severe bleeding due to percutaneous nephrolithotomy. They retrospectively reviewed computerized data on 2,909 patients who underwent a total of 3,878 percutaneous nephrolithotomy procedures between January 1995 and December 2005. Data on patients who experienced severe bleeding requiring angiographic renal embolization were compared with those of other patients using univariate analyses. They tested the characteristics of patients, kidneys and stones, together with details of the operative procedure and surgeons’ experience. They found that severe bleeding was a complication in a total of 39 procedures (1%), in 25 males and 14 females, with a mean age of 50.7 +/- 12.6 years. Associated morbidity included shock in 6 patients and perirenal haematoma in 4 patients. El-Nahas and associates\(^6\) also stated that renal angiography revealed pseudo-aneurysm in 20 patients, arterio-venous fistula in 9 patients, both pseudo-aneurysm and arterio-venous fistula in 8 patients, and arterial laceration in 2 patients. Bleeding could be controlled with super-selective embolization in 36 patients (92.3%). Follow-up was available on 33 patients (mean follow-up 21 +/- 15 months). Renal function was stable in all patients except 3 who had post embolization increase in serum creatinine, of whom, all had solitary kidney and not required renal replacement therapy. El-Nahas and associates\(^5\) observed that significant risk factors for severe bleeding were:

- Upper calyceal puncture,
- Solitary kidney,
- Multiple punctures,
- Inexperienced surgeon.

They concluded that percutaneous nephrolithotomy should be performed by an experienced endourologists in patients at risk for severe bleeding such as those with solitary kidney or staghorn calculus.

Konishi and associates\(^6\) reported a case of renal pseudo-aneurysm which occurred as a complication of percutaneous nephrolithotomy (PCNL) for right renal staghorn calculi. They reported a 59-year-old man who previously had left nephrectomy due to renal staghorn calculi and right pyelolithotomy due to renal staghorn calculi who was admitted for treatment of recurrent right renal staghorn calculi on March 29, 1990. The patient’s laboratory data on admission revealed no significant abnormality except for mild elevation of blood glucose (16 mg / dl). Pseudomonas aeruginosa 10\(^6\) CFU / ml were cultured in his urine. Pre-operative plain abdominal X-ray showed right partial staghorn calculi extending to the lower calyx and pelvis. Three sessions of PCNL were performed. Two nephrostomy tubes were placed in the upper and middle calyces at the first session. Although all calculi were removed completely, massive renal bleeding with bladder tamponade occurred, a number of times post-operatively and blood transfusion was necessary. Renal angiography was performed, and it demonstrated renal pseudo-aneurysm at the upper nephrostomy tract. At the same time the pseudo-aneurysm was treated by super-selective embolization with an absorbable gelatine sponge.

Percutaneous nephrostomy is a well established procedure for the management of urinary obstruction. Farrell and associates\(^1\) reported that the complication rate is low when performed by experienced operators. Recognised complications emanating from insertion of percutaneous nephrostomies include: pain, haemorrhage, infection, puncture of nearby structures and catheter displacement. Stables and co-workers\(^8\) in a review of 1207 percutaneous nephrostomies (PCNs), reported an overall significant complication rate of 4%. Haemorrhage occurred in 1.3%, with 0.2% being fatal.

Kehinde and co-workers\(^9\) reported the main complications in their review of 127 PCNs as catheter displacement (18%) and blockade 12%, with haemorrhage causing catheter blockage in 5%. It has been stated that the complication rates vary widely depending upon the technique and the type of catheter used (7). It has also been reported that higher complication rates may occur when PCN is carried out as an emergency\(^10\).

Chalmers and associates\(^11\) reported their United Kingdom audit of 3262 nephrostomy cases carried out over a 29 month period (between August 2004 and December 2006) involving 285 hospitals. They reported an overall technical success rate of 98% and a complication rate of 6.3%. Indications for the nephrostomies in this audit include:
Ureteric obstruction in 2899 cases
- Suspected ureteric obstruction in 195 cases
- Ureteric obstruction was absent in 6 cases, mainly trauma and iatrogenic fistula.

Of those with ureteric obstruction pelvicalyceal dilatation was moderate or severe in 2088 cases, mild in 665 cases and absent in 41 cases. In this United Kingdom audit the indications for the nephrostomies include:
- Benign stricture 268
- Calculi in 608
- Malignancy 1638
- Trauma 29
- Indication not known in 441
- Other 265

With regard to complications Chalmers and associates\textsuperscript{11} reported the following:
- No complications in 3034 cases
- Catheter displacement/malposition
- Minor haemorrhage in 62 cases
- Major haemorrhage in 5 cases
- Septicaemia in 31 cases
- Urinoma in 6 cases
- Pneumothorax in 2 cases
- Other 62

Mensah and associates\textsuperscript{12} stated that in a third world country like Ghana, percutaneous nephrostomy insertion is not readily available or affordable. It would appear that the non availability of nephrostomy service in the third world is related to the paucity of radiologist in the third world and the fact that the few available radiologists are inundated with diagnostic radiology services. However, as soon as a radiologist in the third world trains in interventional radiology he or she can train other radiologists in order to make interventional radiology service develop in the third world.

This patient was not fit to undergo a general anaesthesia for nephrectomy or partial nephrectomy to stop his bleeding at the time of his post-nephrostomy insertion bleeding. The availability of an interventional radiologist who could perform the angiography and embolization has been of tremendous help in that the embolization procedure was associated with minimum risk and morbidity. As a result of a successful embolization procedure a major surgical procedure has been avoided. The patient is alive 3 months after the embolization procedure was carried out.

Conclusions

The ensuing conclusions would be drawn from the experience gained in the management of this case:
- Severe haemorrhage, even though uncommon, can occur late after insertion of nephrostomy.
- The availability of a well trained interventional radiologist who would perform super-selective renal artery angiography and embolization of any identified cause of severe bleeding emanating from nephrostomy insertion would help avoid nephrectomy or partial nephrectomy, which are associated with higher morbidity and mortality.
- Super-selective embolization of a bleeding vessel from the kidney is an effective way of managing severe post nephrostomy insertion bleeding from the kidney.
- If an interventional radiologist is available then renal angiography and embolization should be the first choice of approach to the management of severe bleeding from the kidney post nephrostomy insertion rather than open or laparoscopic partial or total nephrectomy.

References


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Illustrations

Illustration 1

Illustration 1:
Excretory Urography showing filling defect in the bladder and mild left sided hydrenephrosis

Illustration 2

Illustration 2: Ultra-sound scan showing evidence of hydrenephrosis
Illustration 3

Illustration 3: Super-selective Renal Angiography Showing the Pseudo-aneurysm – The source of bleeding which was embolized. (It also shows the angiographic catheter and the nephrostomy tube)

Illustration 4

Illustration 4: Post-Embolization picture with coil in-situ
Illustration 5

Illustration 5: Post-Embolization Angiography showing coil in-situ and new nephrostomy tube in-situ and obliteration of pseudo-aneurysm and no bleeding from the descending branch of the left renal artery
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