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# The role of early nephrostomy in the management of patients with hyperkalaemia and renal failure due to ureteric obstruction

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## ABSTRACT

**Objective:** To assess the outcomes of early percutaneous nephrostomy in obstructed hydronephrosis and hyperkalaemia from ureteric obstruction.

**Methods:** Patients were diagnosed with hyperkalaemia with serum potassium >5.0 mmol/L and hyperkalaemia was graded as mild (5.0–6.0 mmol/L), moderate (6.1–7.0 mmol/L) or severe (>7.1 mmol/L). Data on age, sex, clinical presentation, presence of concurrent disease, creatinine, potassium, haemoglobin concentration, time interval in doing the nephrostomy since their first presentation, any pre-nephrostomy medical correction of hyperkalaemia and complications were collected.

**Results:** A total of 61 patients (40 males and 21 females) with mean age of 69.7 years (ranged 35 to 94 years) underwent 69 procedures. Prior to the nephrostomy, the serum potassium was mildly elevated in 42 cases, moderately elevated in 17 cases and severely elevated in 10 cases. The overall mean level of potassium before intervention was 6.1 mmol/L (range: 5.1 mmol/L–9.3 mmol/L). Forty (58%) had nephrostomy without prior medical treatment of the hyperkalaemia. The mean serum potassium in these patients was 5.6 mmol/L (range: 5.1 mmol/L–7.5 mmol/L). Twentynine (42%) had medical treatment of the hyperkalaemia prior to nephrostomy. The mean potassium level in these patients was reduced from 6.7 mmol/L (range 5.4 mmol/L–9.3 mmol/L) before medical treatment to 5.8 mmol/L (4.0 mmol/L–7.4 mmol/L). Five patients (7%) had complications from percutaneous nephrostomy including temporary atrial fibrillation in 3 patients and transient pyrexia in 2 patients.

**Conclusions:** Percutaneous nephrostomy as the initial management for hyperkalaemia from ureteric obstruction is a safe procedure with acceptable complication rates.

## 1. Introduction

Hyperkalaemia is a common feature of acute kidney injury of any cause. Percutaneous nephrostomy (PCN) under local anaesthesia or retrograde ureteric stenting under general anaesthesia are effective treatments to relieve renal impairment due to ureteric obstruction[1]. Pre-procedural hyperkalaemia is often a cause of concern for anaesthetic and radiological staff due to the associated risk

of dysrhythmia and sudden death. Decompression of the ureteric obstruction either by PCN or retrograde ureteric stent usually improves renal function or hyperkalaemia with a low morbidity[2,3]. Retrograde ureteric stent insertion in patients with malignant ureteric obstruction carries a higher failure rate compared to PCN; furthermore the majority of patients will need a general anaesthetic which may be challenging when complicated with hyperkalaemia[4].

There are no specific guidelines on management of patients with hyperkalaemia due to ureteric obstruction. Wide variation in management exists in some patients undergoing dialysis, having infusion of dextrose/insulin, inhaling salbutamol or terbutaline and receiving oral/rectal calcium resonium, and most patients having a

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combination of the above. Once the potassium is normalised, decompression of the ureter is achieved by either PCN or ureteric stenting. A handful of case reports, however, have suggested that early nephrostomy can help normalise the renal function and correct the potassium. Furthermore, no added morbidity has been reported following early nephrostomy. Whilst, as these case reports suggested, there are no large case series reported in the literature to verify the encouraging outcome. We hypothesised that an early nephrostomy in this group of patients without prior additional medical correction is effective without added morbidity. In order to test this hypothesis, we analysed our results with specific aims: 1. to assess the outcome of early nephrostomy in patients with ureteric obstruction, in particular the morbidity and outcome in terms of renal function and correction of hyperkalaemia; 2. to compare the outcomes of patients with and without medical treatment prior to hyperkalaemia. In some cases, medical management was commenced to prevent further increase in serum potassium whilst waiting nephrostomy and in others because intervention in a hyperkalaemic state was clinically considered hazardous in an unwell patient and drainage was delayed to allow for correction.

## 2. Materials and methods

We investigated the outcomes of patients who underwent nephrostomy for hyperkalaemia with renal failure secondary to ureteric obstruction between January 2003 and December 2008 at a single centre. Hyperkalaemia was defined as serum potassium greater than 5.0 mmol/L and graded as mild (5.0 mmol/L–6.0 mmol/L), moderate (6.1 mmol/L–7.0 mmol/L) or severe (>7.1 mmol/L). Data was extracted from the radiology information system, biochemistry database, medical, interventional radiology and nursing notes and entered into a pre-designed data extraction sheets. Patients with no records available were excluded from the study. An experienced radiologist (AT) or registrar under supervision performed all procedures.

**Table 1**

Pre and post nephrostomy potassium, creatinine and WBC count.

Parameters	n	Minimum	Maximum	Mean	SD
Age (years)	69	35.0	94.0	69.7	13.1
Pre nephrostomy K (all) (mmol/L)	69	5.1	9.3	6.1	0.8
Pre-nephrostomy K, no MM (mmol/L)	40	5.1	7.5	5.6	0.5
Pre-nephrostomy K, pre MM (mmol/L)	29	5.4	9.3	6.7	0.8
Pre-nephrostomy K, post MM (mmol/L)	29	4.0	7.4	5.8	
Pre-nephrostomy creatinine	69	62.0	1602.0	553.5	320.0
Pre-nephrostomy WBC	63	3.1	26.9	10.7	5.3
Post-nephrostomy K (next day)	69	3.4	7.1	4.8	0.7
Post-nephrostomy creatinine	68	68.0	1002.0	223.4	175.6

MM: Medical management; K: Potassium; WBC: White blood cell count.

Following parameters were recorded for each patient: age, sex, clinical presentation, presence of concurrent disease, creatinine, potassium, haemoglobin concentration, time interval in doing the nephrostomy since their first presentation to the hospital, any pre-nephrostomy medical correction of hyperkalaemia and complications. The success of the procedure was defined as resolution of hyperkalaemia and improvement in renal function.

## 3. Results

During our study period, a total of 61 patients, 40 males and 21 female, with mean age of 69.7 years (range 35 to 94 years) underwent 69 procedures (Figures 1–3). All patients had hyperkalaemia and hydronephrosis due to ureteric obstruction. Pre-nephrostomy hydronephrosis was unilateral in 37 cases, bilateral in 27 cases, with one transplant kidney. In four patients the biochemistry failed to improve after unilateral nephrostomy and a subsequent contralateral nephrostomy was necessary.

The underlying cause was malignant ureteric obstruction in 46 patients, obstruction from ureteric calculi in 8 patients, pyonephrosis in 4 patients and obstruction from a combination of retroperitoneal fibrosis and/or inflammatory aortic aneurysm in the remaining three patients. Prior to the nephrostomy, the serum potassium was mildly elevated in 42 cases, moderately elevated in 17 cases and severely elevated in 10 cases. The overall mean potassium before intervention was 6.1 mmol/L (range: 5.1 mmol/L–9.3 mmol/L) (Table 1).

Twenty-nine (42%) had medical treatment of the hyperkalaemia prior to nephrostomy. This was to prevent further increase in serum potassium whilst waiting for a nephrostomy because intervention in a hyperkalaemic state was considered hazardous and drainage was delayed to allow correction (Figures 1a and 1b). Of these 29 cases, the mean potassium level was reduced from 6.7 mmol/L (range 5.4 mmol/L–9.3 mmol/L) before medical treatment to 5.8 mmol/L (4.0 mmol/L–7.4 mmol/L) with a mean reduction of 0.9 mmol/L (range: 0.8 mmol/L–4.2 mmol/L) (Figure 3).

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