Urinary fistulae after partial nephrectomy

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OBJECTIVE

To report the risk factors and natural history of urinary fistula (UF) after partial nephrectomy (PN), as their incidence has been reported to be 3–6% in large series of PN but there are few reports of the risk factors associated with the development of UF after PN, and the natural history of UF in a large group of patients.

PATIENTS AND METHODS

This was a retrospective review of 1118 PN at one tertiary-care institution. Most patients had a drain placed in the perinephric space after surgery. Fifty-two patients were identified as having a UF if they had persistent flank drainage for >14 days after surgery, or presented with evidence of a UF after the drain had been removed. Risk

factors for development and the course of the UF are reported.

RESULTS

Fifty-two patients developed a UF after PN (4.4%, 95% confidence interval, CI, 3.5–6.1%). The rate of a persistent urine leak (defined as drain fluid consistent with urine for >2 weeks after surgery) was 4.0 (95% CI 2.9–5.3)%. The overall rate of delayed UF presentation was only 0.4 (0.09–0.9)%. Patients who developed a UF had larger tumours (3.5 vs 2.6 cm, $P = 0.03$), a higher estimated blood loss (400 vs 300 mL, $P < 0.001$), and longer ischaemia time (50 vs 39 min, $P < 0.001$) than patients who did not develop a UF. Differences in tumour histology, laterality, multifocality, type of surgery (laparoscopic vs open), and intraoperative collecting system entry were not statistically different in patients who did or did not develop a UF. Patients with tumours of >2.5 cm were twice as likely to develop a UF than patients with tumours

of <2.5 cm ($P = 0.02$). Most patients were managed conservatively with a percutaneous drain until the UF resolved, if they were asymptomatic. Overall, in 36 patients (69%) the fistula resolved with no intervention, while 16 (31%) required intervention. Stenting was the commonest intervention (15%). No patient required re-operative open surgery.

CONCLUSION

The rate of development of UF after PN is low. Tumour size, blood loss and ischaemia time were all associated with the development of a UF. In most patients with a urine leak immediately after surgery the UF will resolve with no intervention, and can be managed conservatively with patience, in the absence of clinical symptoms.

KEYWORDS

partial nephrectomy, urinary fistula, complications

INTRODUCTION

The use of partial nephrectomy (PN) for treating renal cortical neoplasms is becoming increasingly common and accounts for 90% of surgery in high-volume cancer centres for kidney tumours of <4 cm [1]. This is particularly relevant because evidence shows that patients undergoing PN have equivalent cancer control to those undergoing radical nephrectomy (RN), and have lower overall mortality and cardiovascular morbidity [2]. This has made PN, while often more technically demanding than RN, critical in the treatment of renal cortical tumours.

The price paid for the long-term benefit of nephron-sparing surgery is the greater incidence of short-term procedure-related complications with PN than RN. Urinary

fistula (UF) formation is unique to PN (vs RN) with reported incidence rates of 3–6% [3]. UF can manifest as a drain that cannot be removed after surgery due to persistent drainage of urine from a perinephric drain, or present with a delay after the drain has been removed. While overall rates of complications have been published, factors associated with the formation of UF after PN are not well known. We report the incidence, associated risk factors, and outcomes of UF after PN at one tertiary-care cancer centre.

PATIENTS AND METHODS

After receiving institutional review board approval we identified 1118 consecutive patients treated with PN for a localized renal

cortical neoplasm between 1989 and 2007 via an open or laparoscopic approach. In all, 20 surgeons had performed the PNs. Information was retrospectively reviewed from a prospectively collected database that recorded information and complications in patients treated with PN. Variables collected included age, sex, ischaemia time, laterality, tumour histology, tumour size, surgical approach (open vs laparoscopic), estimated blood loss (EBL), collecting system entry/repair, and multifocality. After PN, externalized drains were typically left in the perinephric space. Drain and serum creatinine values were typically assessed before discharge. If the drain creatinine level was equal to or less than the serum creatinine level, the drain was removed before discharge. If the drain creatinine level was higher than the measured serum creatinine level, the drain

TABLE 1 The baseline patient characteristics

Variable	Median (IQR) or n (%)
Age, years	61 (52–70)
Tumour size, cm	2.6 (2.0–3.7)
Male	725 (65)
Female	393 (35)
Laterality	
Left	558 (50)
Right	557 (50)
Tumour histology	
Clear cell	600 (54)
Papillary	197 (18)
Chromophobe	110 (10)
Oncocytoma	111 (10)
Other	100 (9)
EBL, mL	300 (200–500)
Multifocal*	
No	715 (89)
Yes	92 (11)
Procedure type	
Open	1023 (92)
Laparoscopic	94 (8)

*From 807 patients.

TABLE 2 Risk factors for a UF

Median (IQR) or n (%)	No	Yes	P
No. of patients	1066	52	
Age, years	61 (52–70)	63 (54–72)	0.12
Tumour size, cm	2.6 (2.0–3.6)	3.5 (2.4–4.4)	0.03
Ischaemia time, min	39 (30–48)	50 (38–57)	<0.001
EBL, mL	300 (200–500)	400 (200–1000)	<0.001
Laterality			
Left	532 (50)	26 (51)	
Right	532 (50)	25 (49)	0.02
Multiple tumours	84 (11)	8 (18)	0.3
Collecting system entry			
Yes	509 (49)	19 (37)	
No	530 (51)	33 (63)	0.08
Histology			
Clear cell	572 (54)	28 (54)	
Papillary	190 (18)	7 (13)	
Chromophobe	103 (10)	7 (13)	
Oncocytoma	105 (10)	6 (12)	
Other	96 (8)	4 (8)	0.8

symptoms of a perinephric urinary collection that was confirmed to be urine.

Differences in the means of continuous variables between those with and without a UF were compared using a *t*-test. Differences in categorical variables between those with and without a UF were compared using the chi-square test (or Fisher's exact test when frequency counts were <5). Factors evaluated included age, sex, laterality, tumour histology, tumour size, surgical approach (open vs laparoscopic), EBL and multifocality. Logistic regression was used to assess the likelihood of UF by tumour size (> or <2.5 cm), with $P < 0.05$ considered to indicate statistical significance.

RESULTS

Of the 1118 patients who had a PN, a UF formed in 52 (4.6%, 95% CI 3.5–6.1); Table 1 lists the baseline patient demographics, and Table 2 lists the clinical and pathological factors that were examined relating to the development of a UF. Age, sex, tumour histology, multifocality and type of surgery were not statistically associated with an increased risk of developing a UF. The median tumour size was significantly greater in patients who developed a UF than in those who did not (3.5 vs 2.6 cm, $P = 0.03$). Patients with a tumour of >2.5 cm were twice as likely to develop a UF after PN than those with

a tumour of <2.5 cm. The absolute risk of developing a UF in patients with tumours of >2.5 vs <2.5 cm was 6% vs 3% ($P = 0.03$), respectively. The median EBL was significantly greater in patients who developed a UF than in those who did not (400 vs 300 mL, $P < 0.001$), as was the ischaemia time (50 vs 39 min, $P < 0.001$).

Overall, 48 patients (4.0%, 95% CI 2.9–5.3) developed a UF that was detected by a drain that was left in place for >2 weeks after PN. Four patients (0.4%, 95% CI 0.09–0.9) developed a delayed UF after the drain had been removed. Of the 52 patients who developed a UF, in 36 (69%) it resolved with no further intervention, while 16 (31%) had a secondary intervention. Overall, most patients were managed conservatively with a drain only, and intervention was offered when deemed necessary due to persistence of the UF, symptoms, or patient choice. The median (interquartile range, IQR) time to resolution of the UF overall was 64 (29–96) days. Of the 52 patients with a UF that required intervention, a nephro-ureteric stent was the most common intervention, used in eight (15%); other secondary interventions are listed in Table 3. No patient required open intervention for their UF.

DISCUSSION

The role of PN is expanding in large-volume centres, with the knowledge that patients

TABLE 3 Characteristics and outcomes of UF

Characteristic	n (%)
Prolonged postoperative UF	48 (4)
Delayed UF	4 (0.4)
Spontaneous resolution	36 (69)
Intervention required	16 (31)
Type of intervention (14 patients)	
Stent	8 (15)
Percutaneous drain	2 (4)
Urethral catheter	1 (2)
Stent and drain	1 (2)
Ureteroscopy	1 (2)
Unknown	1 (2)

was left in place at discharge until either the drain output was not measurable or the measured drain creatinine level was below the measured serum creatinine level. UF were identified from overall complications occurring within 90 days of surgery that were captured using a five-grade modified Clavien system used at the Memorial Sloan-Kettering Cancer Center. Patients who were discharged with a drain were considered to have a UF if their drain was not removed within 14 days of surgery. Otherwise, UF were typically identified if patients presented with signs and

who undergo RN have a lower GFR than those who have a PN [2], and there is an association of diminished GFR with increased cardiovascular and all-cause mortality [4]. While the long-term benefits of PN are becoming increasingly clear, it has been shown that the short-term procedure-related complication rate of PN exceeds that of RN. Stephenson *et al.* [3] reported a 9% vs 3% rate of procedure-related complications in patients undergoing PN vs RN, most of which were grade 1 and 2 complications. The rate of UF has been reported to be 2–6% in several large series of patients treated with PN via an open or laparoscopic approach [3,5]. We report our experience with UF in a large contemporary series of patients treated with PN at one tertiary-care cancer centre.

The rate of UF in our series was similar to those in previous reports of complications after PN [3,5,6]. However, to our knowledge, the present is the largest series reporting the risk factors and outcomes of patients with UF after PN, and showed that three factors are significantly associated with the development of a UF, i.e. tumour size, EBL and ischaemia time. Patients with tumours of >2.5 cm were twice as likely to develop a UF. EBL and ischaemia time, which are often considered as surrogates for surgical difficulty, were also significantly associated with the development of a UF. Surprisingly, in our series there was no statistically significant association between documented collecting system entry and repair at the time of PN and development of a UF, although it is possible that there were too few UF events to detect a statistically significant difference.

Over 95% of patients who developed a UF in this series had persistent urine output through a drain that was placed in the perinephric space immediately after PN. Of the patients who developed a UF, there was a delayed presentation in <5%, and the overall rate of a delayed UF relative to all patients was 0.4%. This is important because most drains at our institution are removed before discharge if the analysed drain creatinine

level is the same or lower than that of serum creatinine. The relatively low rate of delayed UF suggests that early drain removal is safe, with minimal risk. These delayed leaks probably represent delayed leaks of previously over-sewn collecting system entries or unrecognized entries to the collecting system at the time of surgery.

Generally, most patients with UF at our institution are managed conservatively with a flank drain until spontaneous resolution of the UF. We feel that subsequent intervention is associated with other potential problems, including exposure to additional anaesthetic agents, operative morbidity, irritative voiding symptoms, and the potential for worsening UF output from retrograde urinary reflux through the stent. In this series, only 30% of the patients with a UF required intervention. The decision to intervene was usually multifactorial and included patient or physician preference. However, as most UF will ultimately heal spontaneously we generally advocate conservative management with good nutrition, balanced meals, rest, and exercise to promote healing.

There are several limitations of the present study. First, as the overall UF rate was low, patients who did not develop a UF were over-represented relative to those who did; this might limit the ability to detect statistical differences between the patient groups, which might be important. Also, our institutional definition of a UF as a drain that cannot be removed immediately after PN was a drain that has not been removed within 2 weeks of surgery. This might vary by institution. Varying this definition could alter the incidence of UF formation.

In conclusion, UF after PN is relatively uncommon, with an incidence rate of <5% in the present patients. Most UF were represented by persistent drains that are left in place after PN, and delayed UF were rare. Tumour size, EBL and ischaemia time were all associated with an increased risk of UF formation, and can be used to counsel patients on their risk of developing this

complication. Most UF are managed conservatively at our institution, and heal spontaneously with no intervention.

CONFLICT OF INTEREST

None declared.

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Abbreviations: UF, urinary fistula(e); PN, partial nephrectomy; RN, radical nephrectomy; IQR, interquartile range; EBL, estimated blood loss.