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Immediate percutaneous drainage compared with surgical drainage of renal abscess

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Abstract
Purpose To compare immediate percutaneous drainage of renal abscess via ultrasonographic guidance to surgical drainage.
Procedures This was a retrospective cross-sectional study of 27 patients (mean age of 59.37 ± 12.25 years) with renal abscesses. Immediate percutaneous catheter drainage was performed in patients with pus-containing cavities greater than 3 cm who consented in the emergency section ($n = 12$). Other patients underwent surgical drainage ($n = 11$). Both groups were also treated with empirical antibiotic therapy. Four patients were treated exclusively with antibiotics and were excluded from the analysis.
Findings Abscess size on computer tomography (CT) was similar between the percutaneous catheter drainage (PCD) patients and open surgical drainage patients (7.47 ± 1.75 cm vs. 8.67 ± 1.87 cm; $P = 0.13$). There was no significant difference in mean duration of hospitalization (PCD, 19.5 ± 10.5 days; surgical drainage, 14.55 ± 4.52 days. $P = 0.15$). Larger abscess size and higher C-reactive protein levels were important prognostic factors in both groups. Microbiological analysis revealed *Escherichia coli* and *Klebsiella pneumoniae* in most abscesses.
Conclusions Patients treated with percutaneous drainage for renal abscess had outcomes comparable to those treated with surgical drainage.

Keywords Renal abscess · Percutaneous catheter drainage · Surgical drainage

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Introduction

Renal abscesses have been associated with significant mortality ranging from 39 to 56%, despite aggressive surgical drainage [1, 2]. With the availability of computed tomography (CT) scanning for percutaneous drainage procedures in renal abscess, mortality has been reduced to 12% [3]. Siegel et al reported that small perinephric abscesses (less than 3 cm) may resolve with antibiotic treatment alone [4]. In one study, they demonstrated the opportunity to avoid aggressive interventional or surgical treatment of perirenal abscesses of 5 cm diameter or less, which can completely regress after at least 4 weeks of anti-

biotic therapy [5]. Either percutaneous catheter or surgical drainage may be indicated in the case of large pus-containing cavities [6] and the cure rate after treatment with routine antibiotics plus percutaneous drainage has had the most favorable outcome of renal abscesses [7].

We studied the difference in clinical outcomes between immediate sonography-guided percutaneous drainage of renal abscess upon patient arrival at the emergency room and surgical drainage after admission. In each case, we analyzed patient characteristics, abscess location and origin, predisposing factors, clinical presentation, microbiology, treatment, and outcome.

Materials and methods

Patients with renal abscess treated at Changhua Christian Hospital from January 2000 to December 2004 were enrolled. Patients were identified by a computer-assisted search. We analyzed patient characteristics, abscess location and origin, predisposing factors, clinical presentation, microbiology, radiographic findings, treatment, and outcome. Patients were excluded if data were incomplete.

The diagnosis of renal abscess was confirmed via the combination of CT scan and microbiologic study. We treated small renal abscesses of size less than 3 cm with antibiotic treatment alone and drainage was recommended to patients with pus-containing cavities greater than 3 cm. Immediate percutaneous catheter drainage was performed for patients with pus-containing cavities greater than 3 cm who consented in the emergency section. Percutaneous catheter drainage was performed with a Toshiba Sonolayer SSA 250A real-time ultrasound unit and an 8-French pigtail nephrostomy catheter placed into the abscess cavity. The procedure was conducted as follows: The patient was placed in a prone or prone-oblique position; the punctured side was elevated. The region was evaluated with renal sonography and the site marked. This region was then prepared (e.g., cleansed with iodine solution) and draped in the usual manner. Under local anesthesia with 2% lidocaine, an 18-gauge needle was passed percutaneously into the abscess cavity under ultrasound guidance. Once the abscess was located with a thin needle, aspiration was attempted using an 18-gauge needle. Without consent for immediate percutaneous catheter drainage, we performed surgical drainage for these in-patients who had pus-containing cavities greater than 3 cm.

Age, white blood cell count, C-reactive protein level (CRP; normal range ≤ 1 mg/l), presence of systemic inflammatory response syndrome (SIRS) or multiple organ dysfunction syndromes (MODS), predisposing factors, abscess size and bacteriological factors were all analyzed. Predisposing factors included renal calculi, urinary tract infection, diabetes mellitus, liver disease and end stage renal disease. Abscess size was the area calculated according to CT scan. The latent period between diagnosis and treatment was also recorded. We also assessed the duration of hospitalization and outcomes between the two groups. The definition of SIRS and MODS was adapted from the American College of Chest Physicians (ACCP) and the Society of Critical Care Medicine (SCCM) ''Consensus Conference'' in 1991[8].

The non-parametric test was the statistical method used in our study for comparing the two groups. A P value < 0.05 was considered significant.

Results

A total of 27 patients (Table 1), 19 women and 8 men, with a mean age of 59.37 ± 12.25 years-old (range 39–84) were diagnosed as having renal abscess from January 2000 to December 2004. The most common underlying diseases were diabetes mellitus and nephrolithiasis. The most common complaints (Table 1) were fever (70%), flank pain (44.4%), nausea (40.7%), abdominal pain (33.3%), and lower urinary tract symptoms (22.2%). In total, 26 patients (96.3%) had SIRS and 4 patients (14.8%) had MODS.

The most frequent microorganisms (Table 2) yielded on culture were *Escherichia coli* and *Klebsiella pneumoniae*. Other organisms were *Proteus*, *Enterococcus*, *Salmonella*, *Staphylococcus aureus*, *Enterobacter*, and *Mycobacterium tuberculosis*.

Table 1 Patient characteristics

	Number of patients (%)
Patient demographics	
Male	8 (29.6)
Female	19 (70.4)
Right	14 (52)
Left	13 (48)
Bilateral	0 (0)
Age (years)	
Younger than 20	0 (0)
20–30	0 (0)
31–40	3 (11.1)
41–50	6 (22.2)
Older than 50	18 (66.7)
Predisposing factors	
Renal calculi	14 (52)
Urinary tract infection	20 (74.1)
Trauma	0 (0)
Diabetes mellitus	21 (77.8)
Malignancy	0 (0)
HIV/Intravenous drug abuse	0 (0)
Liver disease	3 (11.1)
End stage renal disease	1 (3.7)
Risk factor	
0	0 (0)
1	2 (7.4)
2	10 (37)
3 or more	15 (55.6)
Symptoms, sign, laboratory data	
Fever	19 (70)
Nausea/vomiting	11 (40.7)
Flank pain	12 (44.4)
Abdominal pain	9 (33.3)
Urinary symptoms	6 (22.2)
White blood cell count (/ul)	
<10000	3 (11.1)
10000–19999	14 (51.9)
20000 or greater	10 (37)
Pyuria greater than 2 WBC/HPF	19 (70)
Hematuria greater than 2 RBC/HPF	10 (37)
SIRS	26 (96.3)
MODS	5 (14.8)

SIRS, systemic inflammatory response syndrome; MODS, multiple organ dysfunction syndrome; CRP, C-reactive protein; WBC, White blood cell; RBC, red blood cell; HPF, high power field

Table 2 Microbiological data and results of imaging studies

	Total No.	No. Positive[b] (%)	No. Specificity[c] (%)
Microbiological data			
Urine	24	14 (58)	7 (50)
Escherichia coli		10	
Klebsiella pneumoniae		2	
Other[a]		2	
Blood	27	15 (55.6)	9 (60)
Escherichia coli		9	
Klebsiella pneumoniae		5	
Other[a]		1	
Pus	27	24 (88.9)	
Escherichia coli		11	
Klebsiella pneumoniae		9	
Other[a]		4	
Results of imaging studies			
Film of the kidneys, ureter and bladder	14	3 (21)	
Ultrasound	21	18 (86)	
CT scan	27	27 (100)	

No., number

[a]Other organisms included *Proteus*, *Enterococcus*, *Salmonella*, *Staphyloccous aureus*, *Enterobacter* and *Mycobacterium tuberculosis*

[b]Positive findings on imaging studies included nephrolithiasis, perinephric air or hydronephrosis

[c]The pathogens identified via urine or blood cultures similar to the pathogen via pus culture

Computer Tomography had the best diagnostic accuracy (100%) for detecting renal abscess (Table 2); while for plain abdominal radiography and ultrasonography diagnostic accuracy was only 21 and 86%, respectively. Right and left kidneys were affected with equal frequency, with 14 patients having left sided abscesses and 13 patients right. There was no instance of bilateral renal abscess.

All patients were treated with intravenous antibiotics for a mean duration of 11 days (Table 3). Of all patients 12 (52.1%) had a combination of antibiotic therapy and percutaneous abscess drainage and 11 (47.9%) patients had a combination of antibiotic therapy and surgical drainage. The mean duration of hospitalization in patients who received percutaneous catheter drainage was 19.5 ± 10.5 days, and in patients who received open surgical drainage was 12.86 ± 6.2 days (Table 3). There was no significant difference between the two groups ($P = 0.1480$). In the PCD group, two patients accepted nephrectomy; one patient accepted nephrectomy in the surgical group. The mean CRP level in PCD (mean: 136.7 ± 63.7 mg/l) patients who died of multiple organ failure was

Table 3 Comparison of hospital stays and clinical outcome between percutaneous catheter drainage and surgical drainage

	No. patients	No. Nephrectomy	No. Dead	Hospital days[b]
Antibiotics alone	1	0	0	12
Antibiotics + Nephrostomy[a]	12	2	1	19.5 ± 10.5
Antibiotics + Surgical drainage	11	1	1	14.55 ± 4.52
Total	23	3	2	

No., number

[a]Percutaneous nephrostomy

[b]Data are presented as mean ± SD

200 mg/l and in the surgical drainage group (mean: 176.7 ± 70.3 mg/l) was 206 mg/l.

Mean abscess size on CT (Table 4) in patients who received percutaneous catheter drainage was 7.467 ± 1.754 cm and in patients who received open surgical drainage was 8.671 ± 1.869 cm, which was not significantly different ($P = 0.1259$). There was no significant difference in mean age between percutaneous drainage and surgical drainage population. White blood cell counts, C-reactive protein level, severity index (patients who fulfilled SIRS or MODS criteria) and numbers of predisposing factors between the two groups also were not significantly different (Table 4).

Discussion

In our study, percutaneous drainage or surgical drainage in patients with similar clinical characters upon arrival at the emergency division had comparable outcomes, such as duration of hospitalization and survival. We demonstrated that larger abscess size and higher CRP levels appeared to determine prognosis in patients with renal abscess. Some authors have pointed out that complete drainage of purulent collections remains the most important principle in successful outcomes of larger abscesses, which can typically be achieved percutaneously [9]. Outcome variables have included abscess size, daily drainage volume and location, presence of a gastrointestinal fistula, age, bacteriologic factors, and pulse rate, body temperature, and leukocyte count [9].

The advantages of percutaneous abscess drainage include simple, rapid performance; feasibility of bedside intensive care unit (ICU) performance; safety; avoidance of general anesthesia; and well-documented efficacy [10] Hutchison et al. also noted that early recognition of renal abscess and prompt drainage, either percutaneously or

Table 4 Comparison of clinical pictures between percutaneous catheter drainage and surgical drainage

	PCD[a]	Surgical drainage	*P* value
Case Number	12	11	
Age (years)[b]	58.92 ± 14.59	60.86 ± 8.38	0.7034
WBC count (/ul)[b]	16833.33 ± 6426.98	17045.45 ± 7332.44	0.9418
CRP level (mg/dl)[b]	13.67 ± 6.37	17.67 ± 7.03	0.1669
SIRS No.	12	11	
MODS No.	2	1	
Predisposing factors[c], No.[b]	2.92 ± 1.08	2.14 ± 0.90	0.0752
Mean abscess size (cm)[b]	7.467 ± 1.754	8.671 ± 1.869	0.1259

WBC, white blood cell; CRP, C-reactive protein; SIRS, systemic inflammatory response syndrome; MODS, multiple organ dysfunction syndrome, No., Number

[a]Percutaneous catheter drainage

[b]Data are presented as mean ± SD

[c]Include renal calculi, urinary tract infection, diabetes mellitus, liver disease and end stage renal disease

surgically, in combination with appropriate antibiotic coverage, should dramatically reduce morbidity and mortality from this infection [11]. Several investigators advocated using a catheter greater than 8.3-French for adequate percutaneous abscess drainage [12, 13]. In our series, we used an 8-French pigtail nephrostomy catheter for percutaneous abscess drainage. Despite, bacteria with more resistant strains (data not shown) and more patients with multiple organ dysfunction syndromes, patients treated with percutaneous drainage for renal abscess still had outcomes comparable to those treated with surgical drainage.

As previously reported, [14] we found that diabetes mellitus and nephrolithiasis were the leading underlying diseases in patients with renal abscess.

In conclusion that based on retrospective and non-randomized analysis, renal abscess may present a variable clinical picture and percutaneous drainage was done on all who consented. Both percutaneous drainage and surgical drainage for renal abscesses had a favorable outcome.

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