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Ultrasound-guided percutaneous nephrolithotomy: total free versus partial fluoroscopy

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Background

- Percutaneous nephrolithotomy (PCNL) is the primary and most effective treatment for large and complex renal calculi.
- Puncture, dilation and fragmentation are three crucial steps. Among which, puncture and dilation can substantially affect the final results of PCNL.







Background

- Optimal percutaneous renal access to the pelvicaliceal system is traditionally performed in the prone position with fluoroscopy guidance.
- However, long-term X-ray exposure may cause deleterious effects for both patients and hospital staff. This is why ultrasound-guided PCNL has recently gained popularity.







Background

- Ultrasound-guided access can display the kidney in a stereoscopic image and allow the avoidance of adjacent and visceral injury.
- Major drawback of ultrasound-guided PCNL is the powerlessness to control the dilation. Limited researches about a small number of patients and non-comparable PCNL studies were performed about total real-time ultrasound guidance.
- To our knowledge, there was no study about the comparison of total versus partial real-time ultrasound-guided PCNL.







Purpose

• To provide a comprehensive analysis about safety and efficacy of fluoroscopy-free total ultrasound-guided percutaneous nephrolithotomy (TUPN) versus ultrasound with fluoroscopy-guided percutaneous nephrolithotomy (UFPN).







Patients and Methods

- 377 patients who underwent ultrasound-guided PCNL were consecutively reviewed.
- TUPN was defined as both puncture and dilation were realtime monitored by ultrasound.
- UFPN meant that only the puncture was real-time guided by ultrasound while the dilation was operated by X-ray.
- The decision of guidance methods depended on the operator and all the operations were performed in the same operating room.































Results

• Groups were comparable in baseline characteristics. Fifty percent of patients were Guy's score III-IV and over half of the patients were mild or none of hydronephrosis.





Parameters	Group A(TUPN, n=185)	Group B(UFPN, =192)	p value	
M/F ratio, n	98:87	101:91	0.94	
Mean age, yr(range)	42.7 (21-72)	43.5 (20-72)	0.65	
Mean BMI, kg/m ²	25.3 (20-31)	25.6 (21-31)	0.52	
ASA physical status, n(%)				
Class 1	93 (50.3)	79 (41.2)		
Class 2	78 (42.1)	98 (51.0)	0.19	
Class 3	14 (7.2)	15 (7.8)		
Left/right side, n	91:94	99:93	0.64	
Guy's stone score, n(%)				
I	21 (11.4)	19 (9.9)		
п	35 (18.9)	41 (21.4)	0.90	
III	98 (53.0)	98 (51.0)		
IV	31 (16.7)	34 (17.7)		
Mean maximum stone diameter, cm(range)	4.6 (1.6-12)	4.3 (1.7-11.2)	0.33	
Degree of hydronephrosis, n(%)				
None	53 (28.6)	56 (29.2)		
Mild	44 (23.8)	62 (32.3)	0.24	
Moderate	65 (35.1)	55 (28.6)		
Severe	23 (12.5)	19 (9.9)		
History of surgery, n(%)	13 (7.0)	12 (6.3)	0.76	
PCNL=percutaneous nephrolithotomy; TUPN=total ultrasound-guided percutaneous nephrolithotomy; UFPN=ultrasound and fluoroscopy-guided percutaneous nephrolithotomy; M=male; F=female; BMI=body mass index; ASA=American				

Table 1 Patient characteristics of ultrasound-guided PCNL

nephrolithotomy; M=male; F=female; BMI=body n society of anesthesiologists



Results

- All renal punctures were successfully performed.
- The primary successful rates of dilation were more than 95% in both groups.
- Two or more accesses were established in 33 patients (17.8%) in TUPN group and 25 patients (13%) in UFPN group (p=0.20).
- Post-operative instant stone free rates were 88.6% and 90.1%, TUPN versus UFPN, respectively, p=0.65.







Tuble 2 Intraoperative parameters of an abound galace Ferre					
Parameters	Group A(TUPN, n=185)	Group B(UFPN, n=192)	p value		
Successful rate of puncture, n(%)	185 (100)	192 (100)			
Primary successful rate of dilation, n(%)	176 (95.1)	184 (95.8)	0.74		
Repetitively successful rate of dilation, n(%)	8 (4.3)	7 (3.6)	0.74		
Third successful rate of dilation, n(%)	1 (0.5)	1 (0.5)	0.98		
No. of access, n(%)					
One tract	152 (82.2)	167 (87.0)	0.20		
Two or more	33 (17.8)	25 (13.0)			
Mean operating time, min(range)	58.3 (46-135)	61.8 (42-139)	0.53		
Post-operative instant stone free rate, n(%)	164 (88.6)	173 (90.1)	0.65		
Post-operative hospitalization time, d(range)	5.8 (4-10)	6.1 (4-12)	0.65		

Table 2 Intraoperative parameters of ultrasound-guided PCNL

PCNL=percutaneous nephrolithotomy; TUPN=total ultrasound-guided percutaneous nephrolithotomy; UFPN= ultrasound and fluoroscopy-guided percutaneous nephrolithotomy







Results

• Most of the complications were minor and there were no differences in Clavien-Dindo complications in both groups. Mean operating time and hospitalization were comparable.







Parameters	Group A(TUPN, n=185)	Group B(UFPN, n=192)	p value	
Complications, n(%)				
Clavien grade 1				
Transient fever	15 (8.1)	13 (6.8)	0.62	
Clavien grade 2				
Blood transfusion	3 (1.6)	4 (2.1)	0.74	
Infections requiring additional	11 (5.9)	12 (6 3)	0.90	
antibiotics	11 (5.5)	12 (0.5)	0.50	
Clavien grade 3				
Perioperative bleeding requiring	1 (0.5)	1 (0.5)	0.98	
superselective embolisation				
Clavien grade 4				
Requiring ICU-management	1 (0.5)	1 (0.5)	0.98	
Clavien grade 5				
Death of a patient	0	0		
PCNL=percutaneous nephrolithotomy: TUPN=total ultrasound-guided percutaneous				

PCNL=percutaneous nephrolithotomy; TUPN=total ultrasound-guided percutaneous nephrolithotomy; UFPN= ultrasound and fluoroscopy-guided percutaneous nephrolithotomy; ICU= intensive care unit







Conclusions

- Our findings show that fluoroscopy-free total ultrasoundguided PCNL represents an alternatively safe and efficient approach for the treatment of renal stones.
- Further study will be required to evaluate fluoroscopy-free TUPN in various clinical settings.







Thanks !



