Percutaneous kidney stone removal — history, anatomy and statistical analysis of a group of patients

J P van der Merwe
BMedSc (Hons), MB ChB
C S de Vries
MMedRad (D)
Department of Diagnostic Radiology
University of the Free State
Bloemfontein

History

Rupel and Brown removed the first kidney stone by surgical nephrostomy tract in 1941. A percutaneous tract was developed by Ferntröm and Johnson (1976) with the specific aim of removing the kidney stone via the mature tract. In the latter part of 1970, Smith and co-workers developed reliable methods for percutaneous entrance to the pelvis and ureter, and started removing renal pelvic and ureter stones. Rathert and Aiken removed selective stones via a mature percutaneous tract during the same time.[1,2]

Anatomy

It is necessary to understand the infundibular and calix anatomy, as well as the position and orientation of the kidney inside the body before a percutaneous kidney stone removal is performed.

According to Kaye and Reinke,[3] Brödel (1901) described the anatomy as follows: 'the posterior calyces point to a line just a little posterior to the lateral convex border of the kidney, while the anterior calyces are directed straight forward into the convex anterior region of the organ'.

Brödel's illustrations indicate that the anterior calices project ± 70° from the coronal plane of the kidney, while the posterior calices are longer and are projected ± 20° posterior to the coronal plane (Fig. 1).

Hodson's model indicates that the posterior calices project to the mid posterior part of the kidney and the anterior calices are longer and are projected just anterior to the convex lateral renal margin (Fig. 1). On a standard excretory urogram the anterior row calices are usually viewed peripherally from the side as cup-like structures. The posterior rows are viewed more medially end-on as round concentrations of contrast medium (Fig. 2).[3]

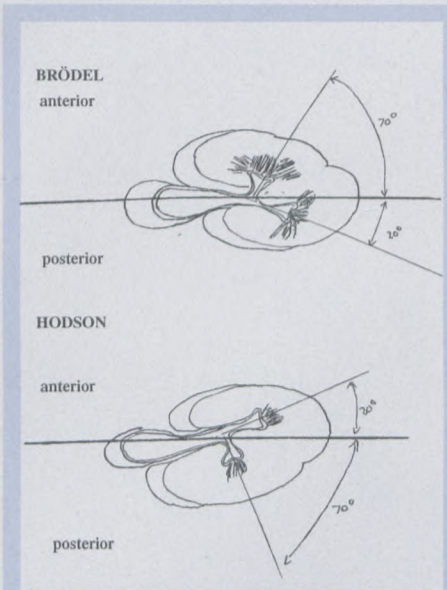

Fig. 1. Models of kidney anatomy.

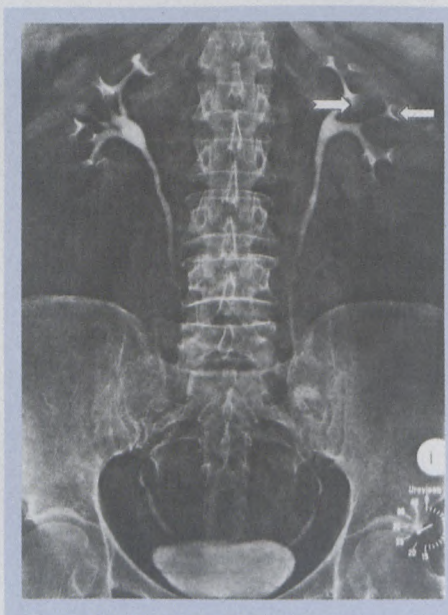

Fig. 2. Position of anterior and posterior calices (← anterior calices, → posterior calices).

In the case of a Brödel type of kidney the posterior calices are viewed more laterally as cup-like structures, while the anterior calices are situated more medially and are viewed as round concentrations of contrast medium.

Kaye and Rienke[3] studied the renal anatomy of a number of patients using computerised tomography (CT) scans and concluded that the right kidney resembled mostly a Brödel type and the left kidney resembled more a Hodson type.

Statistical analysis

The statistical analysis is for data collected during the period 1998 - 2001 in the Intervention Unit of the Diagnostic Radiology Department, University of the Free State.

Eighty-five cases were treated. The patients' ages ranged from 11 to 79 years (average 48 years), 58.5% were male and 41.5% were female. The percentage of patients treated per year is as follows: 18.8% in 1998, 16.5% in 1999, 25.9% in 2000 and 38.8% in 2001.

Kidney stones were present in one kidney in 97.6% of the patients and bilaterally in 2.4% of the patients. One kidney stone was present in 68.3% of the patients and more than one kidney stone in 31.7% of the patients.

The kidney stones were situated in the posterior calix system in all patients except one, where it was situated in the anterior calix system. The position of the kidney stones in the posterior calix system was as follows: 8.8% in the top section, 8.8% in the mid section and 42.5% in the lower section. The kidney stones of only one patient were present intraparenchymally. Kidney stones were situated in the pelvis in 35% of the cases and in the ureter in 15% of the cases.

More than half (58.8%) of the stones were successfully removed, 23.4% were removed incompletely in a single treatment, and 18.8% of the stones could not be removed. Incomplete stone removal was as a result of intraoperative bleeding, extravasation, multiple stones which could not be reached with a single tract, transference of stones to unreachable calices and small residual fragments smaller than 3 mm.

Wong[4] reported a success rate of 97% after the following technique refinements: (*i*) single stadium percutaneous nephrostomy in theatre; (*ii*) use of a flexible endoscope to judge the entire pelvic-calix system; and (*iii*) liberal use of secondary percutaneous kidney stone removal to ensure a stone-free status.

Conclusions

Percutaneous kidney stone removal is conducted with a high success rate, minimal morbidity and is the procedure of choice for kidney stone removal in most patients as well as children.[5,6]

References

1. Ramakumar S, Segura JW. Renal calculi percutaneous management. *Urol Clin North Am* 2000; **27:** 617-622.
2. Segura JW. Endourology. *J Urol* 1984; **132:** 1079-1084.
3. Kaye KW, Reinke DB. Detailed caliceal anatomy for endourology. *J Urol* 1984; **132:** 1085-1088.
4. Wong MY. Evolving technique of percutaneous nephrolithotomy in a developing country: Singapore General Hospital Experience. *J Endourol* 1998; **12:** 397-401.
5. Badaway H, Salama A, Eissa M, Kotb E, Moro H, Shoukiri I. Percutaneous management of renal calculi: experience with percutaneous nephrolithotomy in 60 children. *J Urol* 1999; **162:** 1710-1713.
6. Maheshwarz PN, Andondken M, Hegde S, Bansal M. Bilateral single session percutane nephrolithotomy: a feasible and safe treatment. *J Endourol* 2000; **14:** 285-287.