1110-5704
African Journal of Urology

Vol. 9, No. 3, 2003
133-137

PERCUTANEOUS CALYCEAL IRRIGATION FOR SMALL CALYCEAL CALCULI DURING PERCUTANEOUS NEPHROLITHOTOMY

P.N. MAHESHWARI, M.G. ANDANKAR, N. TRIVEDI, R.JAIN AND V.P. PARMARO
Departments of Urology and Surgery, R.G. Stone Urological Research Institute, Mumbai, India

Objectives: Percutaneous nephrolithotomy performed for the management of complex renal calculi is a challenging endourological procedure. In complex situations multiple tracks and Y tracks may be needed to achieve complete stone clearance. These maneuvers carry a risk of complications, especially bleeding. This study was carried out to evaluate the efficacy of the use of percutaneous calyceal irrigation (PCI) for small calyceal calculi during percutaneous nephrolithotomy.

Patients and Methods: Fifty patients, in whom percutaneous calyceal irrigation (PCI) was attempted were retrospectively evaluated.

Results: Complete stone clearance was achieved with the help of PCI in 62% of renal units. There were no complications attributable to PCI.

Conclusion: Our results encourage the use of PCI as a simple technique for clearance of small calyceal calculi thus preventing the need for a second track or Y track.

Key Words: renal calculus, staghorn calculus, calyceal calculus, kidney stone, percutaneous nephrolithotomy.

INTRODUCTION

Percutaneous nephrolithotomy (PNL) is primarily done for the management of large and complex renal calculi. The initial PNL track is chosen in a way to provide access to the maximal stone load. In complex situations, it is frequently observed that there are small calculi in calyces that are not accessible through the primary track. The options available here are either to leave these calculi for extracorporeal shockwave lithotripsy (ESWL), or to plan additional percutaneous tracks.

ESWL, however, adds to the treatment cost and has a variable success rate, while multiple tracks increase the risk of complications of PNL, especially bleeding.

We herein describe a technique of intraoperative percutaneous calyceal irrigation using fluoroscopic and endoscopic guide. This helps to increase the stone clearance rate during PNL without the need of additional tracks.

PATIENTS AND METHODS

The technique of percutaneous calyceal irrigation (PCI) is primarily used for small calyceal calculi and for the fragments that get pushed into the calyces during intracorporeal lithotripsy. For obvious reasons, this technique would succeed in those cases where the calculus diameter is smaller than or equal to the diameter of the calyceal infundibulum.

Percutaneous calyceal irrigation (PCI) is employed at the end of maximal calculus debulking through the primary PNL track. The patient's intravenous urography is studied before starting PCI to know the direction of the calyx in relation to the renal pelvis and the primary track. The stone-bearing calyx is punctured with an initial puncture needle using biplanar fluoroscopy. The direction of the needle puncture is chosen so as to be in line with the infundibulum. This helps in generating a proper force to push the calculus in the right direction. The Amplatz sheath is left in the primary track while percutaneous calyceal

Table 1: Percentage of Successful PCI Attempts

No. of Calyces Attempted	No. of Patients	Total PCI Attempts	Successful Attempts	Success Percentage
One calyx	37	37	24	64.86%
Two calyces	11	22	17	77.27%
Three calyces	2	6	4	66.66%
Total	50	65	45	69.23%

Table 2: Calculus Clearance Achieved by PCI

No. of Calyces Attempted	No. of Patients	Complete Clearance		Partial Clearance		Failure	
		No.	%	No.	%	No.	%
One calyx	37	24	64.8%	6	16.2%	7	18.9%
Two calyces	11	6	54.5%	3	27.3%	2	18.1%
Three calyces	2	1	50.0%	1	50.0%	0	

irrigation is performed. This prevents the generation of high intrapelvic pressures during forceful irrigation.

The position of the needle tip is confirmed by the use of biplanar fluoroscopy. One milliliter of dilute contrast (Iodixanol; one in five dilution) is flushed into the needle to confirm the position of the needle. If the needle tip is not in the desired place, the puncture is attempted again. As diluted contrast is used in very small amounts extravasation of the contrast does not interfere with the further procedure.

It is important to check the position of the Amplatz sheath during contrast injection. The Amplatz sheath should not block the neck of the calyceal infundibulum. If so, the sheath is withdrawn until a free flow from the calyx is possible.

Once the position of the needle tip and Amplatz sheath is satisfactory, 10-ml normal saline is injected through the needle with sustained pressure. The position of the stones is monitored fluoroscopically. The calyx is flushed with saline two to three times. The position of the needle tip and the angle of the needle may need to be altered so that the effluent forces open the mouth of the calyx. Subtle changes in the direction and angle of the Amplatz sheath would be beneficial (Fig.1). Those fragments of the calculus that get pushed out of the calyx are removed with a nephrosope.

One should avoid pushing the calculus directly into the renal pelvis with the needle. This carries the risk of bleeding and trauma to the renal parenchyma. If the calculus cannot be flushed into the pelvis, the procedure is abandoned and the calculus is treated either by additional track PNL or ESWL.

We have utilized this technique of PCI during PNL over the last five years. For this study, we have retrospectively analyzed the last fifty PNL procedures (Tables 1, 2) where PCI was attempted. In each patient one to three calyces were punctured for PCI depend-ing on the residual calyceal calculi.

RESULTS

Complete calculus clearance from the targeted calyx was achieved in 45 of the 65

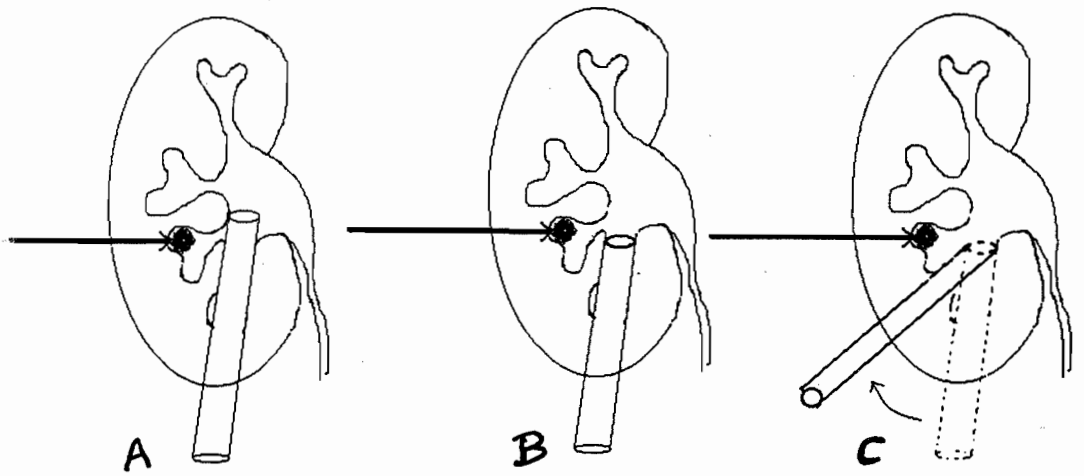

Fig. 1: A: Needle is inserted in the line of the caliceal infundibulum. **B:** Amplatz sheath is withdrawn to get a free effluent from the calyx. **C**: Angle of the Amplatz sheath is altered to further open the caliceal infundibulum.

calyces (69.2%) helping complete stone clearance in 31 of the 50 patients (62%). In ten patients a partial stone clearance could be achieved with partial clearance being defined as failure to remove calculus fragments from one of the multiple calyces attempted, or failure to remove all the fragments from the calyx. PCI failed completely in nine patients (18%) and in 20 attempts out of 65 (30.8%). In those 19 patients in whom complete stone clearance could not be achieved, additional tracks for PNL were made in 14, while ESWL for residual fragments was done for the other five.

Apart from failure of calculus clearance there were no complications attributable to PCI. PCI was found successful and safe in these selected patients.

DISCUSSION

The management of calyceal calculi has changed dramatically during the past 20 years. Minimally invasive techniques have virtually replaced open surgical stone removal. Even large and complex calculi are treated effectively with these minimally invasive techniques. Percutaneous nephrolithotomy has an established place in these situations.

Complete clearance of large and complex calculi is a challenging endourological problem. A clear preoperative understanding of the renal anatomy aids the urologist in dealing more effectively with these patients and in limiting the surgical complications[1]. Anatomy is studied by a pre-operative intravenous urogram and intraoperative retrograde pyelogram.

The management of calyceal calculi entails the use of many endourological "tricks". Lange et al. described in detail the various techniques for the 'less accessible calyceal stones' [2]. They advocate an aggressive approach for PNL. The various options are multiple tracks[3], Y tracks[4], intrarenal diathermy cutting[4], supracostal punctures[5], mini percutaneous tracks[6] or staged procedures. Although they are considered safe, these maneuvers carry a risk of bleeding, infection, septicaemia and renal trauma.

Many of these maneuvers can be avoided by the use of a flexible nephroscope and intracorporeal holmium lithotripsy. Although this method is valuable in reaching inac-cessible areas, it requires considerable skill and experience[2]. The cost of these instruments is also an important factor. The flexible nephro-scope was not used in this study in view of the unavailability of this instrument.

In the absence of a flexible nephroscope, PCI has a prominent role during PNL in complex renal calculi. Besides increasing the stone-free rates, it reduces the need for multiple or Y tracks thus reducing the morbidity of PNL.

Ahlawat and Dalela[7] described the technique of 'intra-operative percutaneous calyceal irrigation' in 1993. Our technique differs from theirs in a few ways. We strongly advocate confirmation of the position of the needle tip prior to calyceal irrigation which is accomplished by injection of diluted contrast. This is important, as it is not unusual to find the fluoroscopically guided 'properly placed' needle tip either in the renal parenchyma or in some blood vessel. If a very small amount of diluted contrast is used, even if extravasation occurs, it does not hamper the further procedure.

Apart from irrigation, there are reports of the use of needle pressures and guide wires to push the calculi into the renal pelvis[1,7]. We have not found these blind techniques successful and they frequently result in bleeding.

The major advantage of the use of calyceal irrigation is to avoid trauma to the renal parenchyma in the process of making a full sized track to remove a residual stone. This does not significantly increase the morbidity of percutaneous nephrolithotomy. If this technique fails, alternative strategies can be brought in.

In conclusion, our study has shown that PCI is a simple technique to be used for the clearance of small calyceal calculi, thus preventing the need for a second track or a Y track.

REFERENCES

1. Bush WH, Brannen GE. Percutaneous removal of caliceal calculi. *AJR* 1985, 144:139-142.

2. Lange PH, Reddy PK, Hulbert JC *et al.* Percutaneous removal of caliceal and other "inaccessible" stones: instruments and techniques. *J Urol* 1984, 132:439-442.

3. Lang EK, Glorioso LW. Multiple percutaneous access routes to multiple calculi, calculi in caliceal diverticula and staghorn calculi. *Radiology* 1986, 158:211-214.

4. Reddy PK, Lange PH, Hulbert JC *et al.* Percutaneous removal of caliceal and other "inaccessible" stones: results. *J Urol* 1984, 132:443-447.

5. Maheshwari PN, Andankar M, Hegde S, Bansal M. Supracostal approach for PCNL. *BJU Int* 2000, 85 (published on the website www.bjui.org)

6. Chan DY, Jarrett TW. Mini-percutaneous nephrolithotomy. *J Endourol* 2000, 14:269-272; discussion 272-273.

7. Ahlawat R, Dalela D. Intra-operative percutaneous caliceal irrigation – a technique for clearing caliceal residue during percutaneous surgery. *Br J Urol* 1993, 72:990.

Editorial Comment:

The authors report their experience with percutaneous irrigation for small residual calyceal calculi as an adjunct to percutaneous nephrolithotomy. The presumed advantage of this technique is clearing small calculi obviating the need for tract dilatation. While flexible percutaneous nephroscopy and stone basketting or Holmium lithotripsy would be ideal for such residual stones, stone irrigation might be an acceptable alternative where flexible instruments are not available.

However not all residual stones are small enough to be irrigated out, and may therefore require tract dilatation. A major disadvantage of this technique is the sudden increase of the intrapelvic pressure during forced irrigation and the dissemination of microorganisms from infected stones. Fluid absorption may result in both infective and non-infective pyrexia,[1] and adequate preoperative control of urinary infection is always imperative. Although renal intra-pelvic pressure generally remains low during percutaneous nephrolithotomy,[2] elevated pressure can occur with incomplete nephroscopy sheath positioning within the collecting system and endoscopy through an infundibular narrowing. Postoperative fever correlates significantly with infected stones.[3] Therefore, we concur with the authors that gentile irrigation of small amounts of fluid should be used.

Stone irrigation is not new, in fact it was used during the early days of percutaneous stone surgery.[4] The Amplatz sheath was initially designed as a hollow cylinder with a flush straight tip. It was not until we encountered problems irrigating out small stone fragments that the Amplatz sheath tip was cut at an angle in order to prevent the pelvic wall from collapsing and obstructing the lumen during suction-irrigation maneuvers. However we stopped performing this type of irrigation after one patient developed septicaemia presumably from bacterial dissemination during irrigation.

If used judicially for the appropriate stone this technique of stone irrigation may save the patient an additional percutaneous tract and possibly limit morbidity.

References:
1- Kukreja RA, Desai MR, Sabnis RB, Patel SH. Fluid absorption during percutaneous nephrolithotomy: does it matter? J Endourol 2002;16(4):221-4
2- Saltzman B, Khasidy LR, Smith AD. Measurement of renal pelvis pressures during endourologic procedures. Urology 1987 Nov;30(5):472-4
3- Troxel SA, Low RK. Renal intrapelvic pressure during percutaneous nephrolithotomy and its correlation with the development of postoperative fever. J Urol 2002;168:1348-51
4- Smith AD, Lee WJ. Percutaneous stone removal procedures including irrigation. Urol Clin North Am 1983;10(4):719-27

RESUME

Le Traitement de Petit Calcul Caliciel Pendant une Nephrolithotomie Percutanée par Irrigation

Objectifs: La nephrolithotomie percutanée réalisée pour le traitement de calcul rénal complexe est un procédé endo-urologique provocant. Dans des situations complexes les voies multiples et les voies en Y peuvent être nécessaires pour nettoyer le rein de ses calculs. Ces manoeuvres éxposent à un risque de complications plus important en particulier le saignement. Cette étude a été effectuée pour évaluer l'efficacité de l'irrigation calicielle percutanée (PCI) pour petit calcul caliciel pendant une nephrolithotomie percutanée. **Patients et méthodes** :Cinquante patients, chez qui l'irrigation calicielle percutanée (PCI) a été essayée ont été rétrospectivement évalués. **Résultats**: Le nettoyage lithiasique complet du rein a été réalisé à l'aide du PCI dans les unités rénales dans 62%. Il n'y avait aucune complication attribuable au PCI. **Conclusion**: Nos résultats encouragent à l'utilisation du PCI comme technique simple pour débarrasser le rein de petits calculs caliciels évitant de ce fait le recourt à une deuxième voie de ponction ou à une voie en Y.

All correspondence to be sent to:

Pankaj N. Maheshwari
Chief Urologist, R.G. Stone Urological Research Institute
15, Panchsheel, Sir J J Hospital
Byculla, Mumbai 400 008
India

maheshwaripn@hotmail.com; pankajnm@netscape.net