NEW TECHNIQUES IN THE TREATMENT OF URINARY STONES

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SYNOPSIS

Radical changes in the treatment of urinary stones have occurred in the past 5 years with the introduction of percutanous nephrolithotomy (PCN), extracorporeal shock-waves lithotripsy (ESWL) and ureteroscopy.

PCN was first popularised in the early 1980, whereby a tract is made between the skin and the kidney. A specially designed nephroscope is used to remove the stone in the renal pelvis or upper ureter by forceps, with or without preliminary fragmentation of the stones with ultrasound or electrohydraulic shock waves.

PCN is rapidly superseded by ESWL which is entirely non-invasive. In this procedure patients are immersed in a water-bath and an external source of shock-waves generated, is focussed on the stone causing its disintegration. Patients then passes the stone fragments spontanously. The ideal indication is a "cherry" size stone in the renal pelvis which has a success rate of about 90%. PCN still has a place in patient with a tightly jammed pelvi-ureteric junction stone, and in staghorn stone where it is used to debulk the stone before ESWL. Ureteroscopy with or without the use of Ultrasound disintegration is ideal for treatment of lower ureteric stones. Preliminary dilatation of the uretero-vesical junction is essential and if it can be achieved, the success rate of removing the lower ureteric stone is about 85%. Open surgery would still be indicated for large complicated staghorn and large mid-urteric stones. Small and uncomplicated calyceal and ureteric stones would still be best treated conservatively.

INTRODUCTION

Urinary Stone disease is the commonest problem we encounter in our urological practice. Radical changes in the treatment of urinary stones have occurred in the past 5 years with the introduction of percutaneous nephrolithotomy (PCN) extra-corporeal shock wave lithotripsy (ESWL) and ureteroscopy.

PERCUTANEOUS NEPHROLITHOTOMY (PCN)

Though Fernstrom and Johanson were the first to remove renal calculi through the percutaneous nephrostomy tract in 1976 (1), the procedure was not popular until the early 1980's when new percutaneous nephroscopes and ultrasound lithotripter was introduced (2).

The procedure basically involves first a percutaneous nephrostomy under floroscopy or ultrasound guidance. The nephrostomy tract is then progressively dilated to a size which can accommodate a 26F nephroscope. The nephroscope is then introduced to view the stone using normal saline for irrigation. If the stone is small, it can be grasped with various types of forceps and removed in toto through the nephroscope.

Bigger stones would require preliminary fragmentation with ultrasound lithotripter and either removed with forceps or sucked out through the ultrasound probe. Flexible fibre optic nephroscope can supplement the use of the rigid scope to reach difficult stones in the upper or middle calyx. Electro-hydraulic shock wave electrode can be passed through the flexible nephroscope to disintegrade the stone using the electro-hydraulic lithotripter.

The indications for percutaneous nephrolithotomy are essentially the same as for open surgery, mainly for obstruction and infection. Stone in the pelvis causing moderate to severe hydronephrosis is the easiest to do. Success rate of as high as 96% has been reported by Segura and his associates at the Mayo Clinic (3,4). Complications include extravasation of irrigating fluid, pelvic perforation, infection, and bleeding from nephrostomy tract, but all these are not common. Percutaneous nephrolithotomy is rapidly superceded by extra-corporeal shock wave lithotripsy (ESWL) in the past few years as this procedure (ESWL) is relatively non-invasive. However, currently PCN still has a role in tightly impacted pelvi-ureteric junction stones and in debulking large staghorn stones before ESWL. PCN is also indicated for large and multiple fragments in the upper urinary tract which remain and cause obstruction after ESWL precedure. In our local context in Singapore at the present moment, PCN is still a good alternative for those patients who cannot afford the expense for the ESWL procedure.

EXTRA CORPOREAL SHOCK WAVE LITHOTRIPSY (ESWL)

ESWL was first introduced into clinical use by Chaussy in February 1980 in Germany (5). In this procedure, the patient is immersed in a water bath and an external source of shock waves-generated by means of an electrode and a special generator, is focused on the stone causing its disintegration. The patient then passes the stone fragments spontaneously. Surprisingly only about 16% of patients have severe colic on passage of the fragments (5).

Since the use of the ESWL was approved by Food and Drug Administration of the United States in December 1984 (7), the machine has proliferated all over the world. In December 1985 this lithotripter became available at the American Hospital, private as well as Government and University Urologists have access to the facility.

A new second generation ESWL will soon be available at the National University Hospital. This second generation ESWL does not need an elaborate room for installation as no water bath is required. Ultrasound instead of X-ray is used to localise the stone for disintegration. The new method of shock wave generation using Piezo-ceramic elements eliminate the need for regional or general anaesthesia in this procedure. This is a major advantage and the procedure can thus be repeated more readily, and for small stones, it can even be done on an outpatient basis.

The ideal indication is a renal pelvic stone one to 2.5 cm in diameter. With experience, more difficult stones including upper ureteric stones are treated and the success rate, defined by complete discharge of all stone fragments at 3 months is around 77.4% (6). Renal pelvic stone has a higher success rate than ureteric stone. Ureteric stones especially impacted ones do not disintegrate well because they are not completely surrounded by a liquid medium. Preliminary cystoscopy and retrograde catheterisation to push the stone into the kidney may improve results.

Asymptomatic calyceal stones more than 0.5 cm in diameter especially in the young patient, should be treated as they can cause problems when they migrate down to the ureter and ESWL is not as effective then. Large pelvic stones more than 2.5 cm in diameter and partial staghorn stones can also be treated with ESWL but the complication rate is much higher because of the bulk of the stone fragments which need to be passed. To overcome this problem, several centres have used PCN to debulk the stone first before applying ESWL for the residual stone fragments. In this way, with experience, even large complete staghorn can be treated (7). The complication rate is low. About 10% of patients required auxillary procedures (8) such as ureteral manipulation to facilitate discharge of stones, and percutaneous nephrostomy to provide temporary drainage for infection in an obstructed system which may occur by fragments blocking the ureter. Less than 1% of patients (0.6%) may develop perirenal haematoma requiring blood transfusion but no surgical intervention is necessary for the haematoma (8).

Currently ESWL would be the first treatment of choice in stones which are suitable, estimated to be up to 70 to 80% of patients with renal and upper ureteric stones (8). Recently, with special positioning lower ureteric stones can be treated as well. However, with the availability of the operating ureteroscope our first option for treatment of lower ureteric stone is still transurethral manipulation with or without the use of ultrasound disintegration.

URETEROSCOPY

Transurethral ureteroscopy was first reported by Goodman in 1977 (9) and further developed by Lyon et al (10) using the paediatric cystoscope. It was popularised in the early 1980s when specifically designed ureteroscope by Perez-Castro (11) became available. Apart from diagnosis, the most useful aspect of the rigid ureteroscope has been for the removal of lower ureteric stones.

The procedure essentially involves preliminary dilatation of the uretero-vesical junction with ureteric bougies or ballon catheter. The rigid ureteroscope is then introduced transurethrally and manoeuvred up to the stone under direct vision. If the stone is not too big and judged to be able to pass down the dilated ureter, it is trapped with the wire "Dormia" basket under vision and removed in toto. Bigger or impacted stones would need to be disintegrated with ultrasound before removal by the Dormia basket or forceps (12). Ultrasound is applied to the stone through a special probe attached to a transducer and the ultrasound generator.

Ureteric stones of 0.5 cm to 1 cm in transverse diameter in the lower ureter below the pelvic brim are ideally suitable for ureteroscopic removal. Though attempts had been made to treat upper ureteric stones and even pelvic stones transurethrally the success

rate is low because of the difficulty in manoeuvring the ureteroscope up the ureter.

In a personal series of the first 82 attempts at transurethral ureteroscopic removal of ureteric stones from August 1984 to September 1986, 50 cases were successful, giving a rate of 61%. Of these 24 cases were removed by Dormia basket after ureteric dilatation while the other 26 cases had ultrasound disintegration before removal (13). No serious complications occur except in one patient who developed clot retention due to bleeding around the ureteric orifice from manipulation. False passage, if severe can cause ureteric perforation and avulsion of the ureter, requiring surgical intervention. Uretero-vesical reflux after dilatation of the uretero-vesical junction has not been a problem, however ureteric stricture is a potential complication from this procedure (14). IVU needs to be done to detect this complication usually 3 months after the procedure.

CONCLUSION

With the availability of all these new techniques in the management of urinary stones, we are now confronted with many options for our patients with stone disease. We need to know the benefits, results, and potential complicatins of each procedure to best advise our patients on their particular stone problem. Open surgery would still be indicated for large complicated staghorn stones and large mid-ureteric stones. Small and uncomplicated calyceal and ureteric stones woluld still be best treated conservatively.

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