The New MPCNL (Minimally Invasive Percutaneous Nephrolithotomy) for Treatment of Upper Urinary Tract Stones

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Introduction

The kidney lies deep in the retroperitoneum, but it is in fact only 7-8 cm from the skin surface if we approach it from the back. It makes sense to create a stable track/conduit directly from the skin surface on the back to the pelvicalyceal system for stone removal. This concept formed the basis of the modern day percutaneous nephrolithotomy (PCNL).

Conventionally, a track of 1 cm diameter (Fr 30) is created through which the endoscope is introduced to reach the stones, which are then broken down using mechanical, ultrasound or laser energy of the surgeon’s choice. The stone fragments are then removed with forceps or grasping baskets via the track.

Quest for a Smaller Track

While PCNL represents a great improvement compared to open stone surgery, it is in fact a “penetrating injury” to the kidney and is still associated with significant morbidity like bleeding. The need for creating a Fr 30 track was questioned as it is now clear that a larger size track is associated with more bleeding complications. As the track diameter increases two-fold, the cross sectional area affected by the track increases four-fold, and similarly for the amount of renal parenchyma that can be crushed or damaged. A smaller track with less trauma would be desirable.

In fact, percutaneous stone removal with a smaller track (Fr 12-18), had been reported as early as 1997. The term “minimally invasive percutaneous nephrolithotomy (MPCNL)” was first coined by Lahme et al in Germany in 2001. The challenge lies in the lack of proper endoscopes and equipment. It becomes more difficult to maintain good endoscopic view and even more difficult to remove the stone fragments as the track gets smaller. Therefore, these early reports concluded that MPCNL was technically feasible but should only be used in patients with small stone load less than 2 cm, or as a secondary track in a difficult PCNL, or in paediatric patients.

New Developments in MPCNL Techniques

However, recent reports from the Guangzhou group in China had drawn new interests in the use of MPCNL. Their approach and technique, which they coined as the Chinese MPCNL, was built on their experience on a large number of patients with stone diseases. It had evolved through many years of practice before the technique, equipment and set up are standardised.

The Guangzhou group had recently reported their results of MPCNL performed from year 2001 to 2005. A total of 4760 MPCNL procedures were done in 3610 kidneys. There were 1240 staghorns and 85 ureteric stones. There were 14 transplanted kidneys and 27 cases of horseshoe kidneys. The average operating time was only 78 mins. The stone free rate at post op Day 2 was 89 %. The major complication rate was 0.86%. The mean haemoglobin drop for each MPCNL procedure was 0.88mg/dL. One important feature of this technique was that the puncture was based on pre-op imaging and intra-op tactile feedback, with minimal use of fluoroscopy. That would require a long learning curve.

The new MPCNL procedure was introduced in Hong Kong since 2005. Our local experience also showed that this was feasible even for staghorn stones. It achieved a comparable stone clearance rate and operating time to the standard large track PCNL. In particular, we found that there was less bleeding and less requirement for transfusion. In Hong Kong, the use of fluoroscopic guidance permitted kidney punctures with greater accuracy.

Highlight of the Surgical Technique

The detailed surgical technique had been described elsewhere. Highlight includes:

1) The procedure should be performed very gently.
2) The procedure should be performed using specially designed miniaturised endoscopes and equipment.
3) There is preference for intercostal skin punctures via the 11th rib space.
4) Usually a track of size Fr18 is formed, and a peel-off sheath is used for the track.
5) There is preference for punctures via the posterior middle calyx. This would permit good access of the endoscope to the ureter and different calyces.
6) A slim and compact operating rigid cystoscope or short operating semirigid ureteroscope usually of size Fr 8/9.8 is used.
7) Stone fragmentation can be achieved with a 1mm pneumatic probe (lithoclast) or with holmium laser.
8) Pressurised irrigation at a pressure of 350mmHg is required to maintain good view and for flushing out
Renal Pelvic Pressure

Realising that a renal pelvic pressure exceeding 30mmHg contributes to backflow from the renal pelvis into the bloodstream and thus bacteraemia, the Chinese group in Guangzhou conducted measurements of the renal pelvic pressure during the MPCNL procedure. With a Fr 18 track, they found that the average renal pelvic pressure during the procedure was only 11.68mmHg, and the time for such pressure to exceed 30mmHg was only 10 seconds7. Similar measurements were repeated in Hong Kong also shown reassuring results8.

Conclusion

The new MPCNL can be used in adults and can remove even large staghorn stones. It is less invasive than the standard PCNL with less risks of bleeding. It is particularly suitable in undilated systems and in those with narrow infundibula.

References