



Letter

Super-mini percutaneous nephrolithotomy



Dear editor,

The first extraction of a renal calculi through a percutaneous nephrostomy (PCNL) was described in 1976 by Fernström and Johansson [1]. Through the collaboration of urology and interventional radiology, several innovations were later made to improve what we know today as PCNL [2].

Ever since PCNL was introduced, the basic concepts for stone treatment with a nephroscope were the need for good visualization, a method to fragment larger stones, and a mechanical means to remove the fragments. Initially we started with a 30-French instrument to meet those goals; the concept was to have a large enough channel to remove 1 cm stone fragments. This decision was arbitrary at the time, and not evidence based.

The size of standard PCNL was one of its major disadvantages compared to other emerging technologies such as flexible ureteroscopes and retrograde intrarenal surgery (RIRS). As popular as RIRS was, it had numerous problems, including challenging stone locations, large burden stones and fragment clearance, the need for dilation or pre-stenting, and the associated ureteral injury. Financially, RIRS is also the more expensive procedure, due to its flexible ureteroscopes and equipment wear out, making it a less available option in a global view.

Another drawback of PCNL has always been its relatively higher complication rate, compared to other treatment options. Some of the complications tend to be related to the nephrostomy tract size and its placement accuracy [3]. Perhaps this change in sizes was the most dramatic one in modern endourology practice [4]. Over the course of time, light sources, optics and imaging technology at the tip of the scope have all improved drastically, which made it feasible for scopes to become smaller. Subsequently several smaller PCNL techniques have emerged, minimally invasive PCNL (mini-PCNL), ultra-mini PCNL (UMP), and micro-PCNL [5–7].

Studies have shown that mini-PCNL can achieve the same stone free rates as the standard PCNL, while keeping

all of its smaller size advantages [8]. When the smaller UMP and micro-PCNL were introduced, they suffered from decreased visualization, but both techniques' main problem was fragment clearance; UMP either utilizes pressurized irrigation or leaves the stones *in situ*, and micro-PCNL would always leave fragments *in situ* for spontaneous passage [7]. The new thulium fiber lasers seem to be able to fragment stones into tiny fragments easy to irrigate and suction even with smaller scopes and sheaths, perhaps partially solving this problem in the future.

The most recent advancement is the super-mini PCNL (SMP) that uses an 8.0-French nephroscope and a specially designed irrigation-suction sheath with a built in handle [7]. The new SMP generation modification of the technique was developed to overcome the limited irrigation problem [9], using the same nephroscope and an innovative sheath that provides an inflow irrigation through a special channel in the sheath itself, thus providing continuous irrigation without sacrificing one of the working channels.

SMP also provides a new “negative pressure” stone clearance mechanism, which uses the hydrodynamic properties of how its irrigation system works. This simultaneously overcomes the disadvantages of both UMP and micro-PCNL, while also maintaining low intra renal pressure during the procedure.

A recent multicenter study for the treatment of 1–2 cm lower pole calculi compares SMP to RIRS, demonstrating superior stone free rate with SMP and similar complication rates [10]. This places SMP in a unique position, bridging the gap between what we used to conceive as standard PCNL, and RIRS surgery. SMP may have its own role in future guidelines for nephrolithiasis, especially if we incorporate economic considerations as well.

Despite its advantages, SMP still suffers from having a smaller tract size with the inherent limitation to visualization and operative time. To our knowledge, SMP is yet to be widely tested for larger stones or staghorn calculi, making standard PCNL the better option for those patients.

Endourology is a field heavily reliant and affected by technological advancement. With today's technology, smaller PCNL actually gives you more maneuverability, the same ability to fragment stones and various methods for clearing fragments. SMP is at the forefront of minimizing PCNL procedures without sacrificing any of its advantages.

Still, to my opinion, this should be limited to stones less than 2.5 cm in size at the current era.

Author contributions

Study concept and design: Arthur Smith.

Data acquisition: Arthur Smith, Tareq Aro.

Data analysis: Tareq Aro.

Drafting of manuscript: Tareq Aro.

Critical revision of the manuscript: Arthur Smith, Tareq Aro.

Conflicts of interest

The authors declare no conflict of interest.

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