Endoscopic Combined Intrarenal Surgery (ECIRS)

22

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22.1 Introduction

Percutaneous Nephrolithotomy (PCNL) has undergone various advances and modifications since it was first introduced in 1976 [1]. Since its inception, PCNL is commonly being done in prone position all over the world. There have been several advances in optics, nephroscope designs, puncture techniques and miniaturization of instruments in the past few decades resulting in better stone clearance and reduction in patient morbidity. The morbidity of PCNL is attributed to the puncturing and dilatation of the renal parenchyma which at times can lead to bleeding and also significant pain in the postoperative period. Moreover, the prone position is also responsible for the difficulty to access airway and ventilation faced by the anaesthesiologists [2]. Prone positioning is time-consuming and requires more personnel in the theatre [3].

In the year 1990, Valdivia presented his work on PCNL in the supine position for the first time in world literature. It took more than two decades for a more widespread acceptance of the supine position for PCNL after various modifications in patient positioning. With the advent of the supine position and the Galdakao-modified supine Valdivia (GMSV) position [4, 5], the simultaneous access to the kidney both from below and above became less cumbersome. This has evolved beautifully in the technique of Endoscopic Combined Intrarenal Surgery (ECIRS) [6].

ECIRS is a very versatile technique wherein PCNL is combined with flexible ureteroscopy to achieve maximal stone clearance in minimal time duration. The disadvantages of additional time for prone positioning and restricted or no access from below are transformed to advantages in the supine position. ECIRS not only helps in the reduction of the number of access tracts, but also in complete clearance of large stone bulk in a single session in a short time thereby reducing the chances of bleeding [7].

22.2 Evolution of Mini ECIRS

Performing PCNL in the prone position gives us a large surface area for obtaining access. It is not so in the supine position, wherein there is a small window to obtain access. The advances in miniaturization of access tract with the advent of mini PCNL have been very fruitful as the smaller sheaths can be easily guided into the pelvicalyceal system (PCS) even from a small window as

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is available in the supine position [8]. Traditionally, ECIRS has been performed with flexible ureteroscopy from below using the modern flexible scopes and a standard PCNL (>20 F) for the percutaneous tract. Flexible ureteroscopy helps to assess the pelvicalyceal system anatomy, stone size, location and its configuration before making the renal access. Furthermore, the renal access can be guided under vision making a perfect papillary puncture through the papilla. In mini ECIRS, the renal access tract is small (<20F) which can be easily created from the limited window available. The dilation process can be a single step in all cases of mini PCNL thereby minimizing the time to create the tract. Most of the stone fragmentation is done through the nephroscope and the renal tract is used for egress of the fragments. There is minimal chance of raised intra-pelvic pressure as the renal tract offers a low-pressure outlet [9].

22.3 Indications

The various indications of mini ECIRS include the following situations.

1. Partial staghorn stone with secondary stones in other calyces.
2. Large bulk impacted upper ureteric stones.
3. Multiple stones in various calyces.
4. Stone at PUJ with suspected PUJ obstruction.
5. Large compound/multiple necrosed detached papilla in the PCS.

22.4 Armamentarium

Mini ECIRS is a versatile technique but it needs more armamentarium than conventional PCNL or flexible ureteroscopy. It requires

(i) Standard or large operation theatre to accommodate two operating teams simultaneously.
(ii) Two Endourology operating teams (2 Urologists and 2 Operating assistants).
(iii) Two camera units.
(iv) Fluoroscopy unit.
(v) Ultrasonogram.
(vi) Flexible ureteroscopy with its accessories.
(vii) Mini PERC nephroscope set.
(viii) Lithotripsy devices (LASER/Pneumatic/Trilogy).

This enormous amount of armamentarium needs planning to avoid clutter in the operating room. Positioning of endoscopy and fluoroscopy monitors should be in such a way that both the renal and ureteral surgeons should have direct visual access to their corresponding monitors as well as the fluoroscopy screen. There are various schemes described for the accommodation of the equipment. We prefer to arrange this equipment as shown in Fig. 22.1.

22.5 Technical Considerations

22.5.1 Anaesthesia

Traditionally PCNL has been done under general anaesthesia in the prone position for several decades. Restricted access to the upper airway, changes in the key cardio respiratory parameters and neurological damages are some of the well-known complications of the prone position. Supine position eliminates most of these disadvantages and access to the upper airway is readily available to the anaesthetist. The safety of PCNL under regional anaesthesia is well established in many recent studies [10, 11]. Mini ECIRS can be safely performed under regional or general anaesthesia depending on the preference of the operating team, stone burden, patient's comorbidities and patient's choice.

22.5.2 Positioning

The standard Galdakao-Modified Supine Valdivia (GMSV) position works very well for all cases of ECIRS giving excellent access to renal as well as the ureteric surgeon [6]. The patient is positioned under anaesthesia at the edge of the table with the ipsilateral side tilted 15 to 20 degrees to the

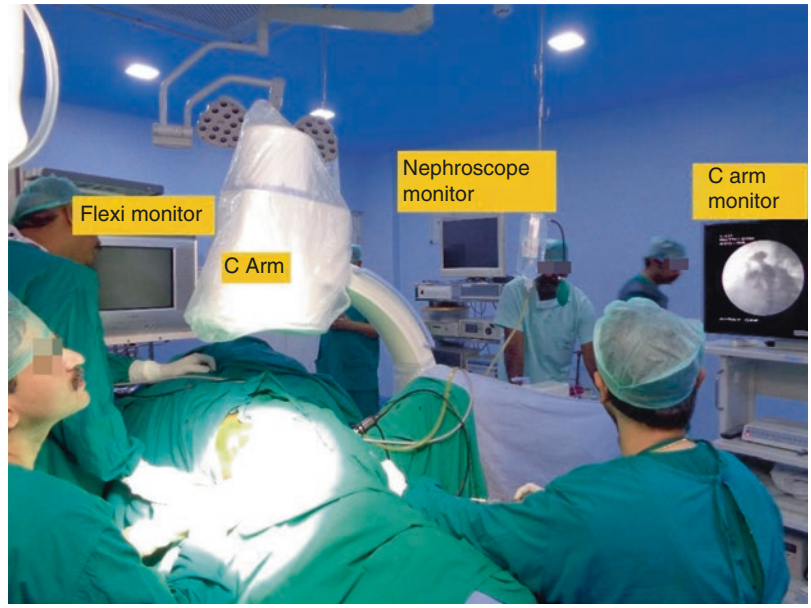

Fig. 22.1 Operation room set-up. Note the endoscopy and fluoroscopy monitor positions

opposite side. The ipsilateral knee is extended and the contralateral thigh flexed and abducted. The ipsilateral hand is rested over the thorax appropriately while the contralateral hand is extended for easy access to the anaesthesia team. This position gives the renal surgeon comfortable access to the kidney percutaneously allowing simultaneous retrograde access to the ureteric surgeon. Retrograde access to the contralateral unit is also possible in this position to perform simultaneous bilateral endoscopic surgery [12]. At times the angulation can be difficult to negotiate a rigid ureteroscope into the upper ureter due to the pushing effect by the renal surgeon but the same renal tract can be used to push the kidney cranially to straighten the ureter.

22.5.3 Retrograde Access

The initial access is almost always retrograde in a mini ECIRS procedure [13]. The upper ureter is visualized directly using a 6/7.5-Fr semi-rigid ureteroscope (Wolf™; Richard Wolf GmBH, Knittlingen, Germany) which paves the way for the insertion of a suitable Ureteral Access sheath (UAS). The initial rigid ureteroscopy assesses the ureter for any strictures or any stones which might have been missed. It also assesses the ureteric orifice and may obviate the dilation of the orifice with a balloon if required to allow placement of suitable UAS (11/13-Fr or 13/15-Fr). A smaller UAS always suffices as the aim is to facilitate passage of the flexible scope and not retrieval of stone fragments which is usually done via renal access.

The flexible scope is used to create a roadmap of the whole PCS and access the calyces for a suitable puncture site for renal access. The flexible scope can be used to direct the renal access for a completely end vision guided puncture [13].

We have been using mini ECIRS for the treatment of large upper ureteric stones which are always in the dilemma group on the selection of suitable modality. The rigid ureteroscope works very well in this setting as it can be used to fragment and disimpact the stone and renal access can be used to clear the fragments.

22.5.4 Renal Access

The renal access is created mostly using ultrasonography for the initial puncture. The access can also be guided with the help of flexible scope which visualizes the target calyx and can fine-tune

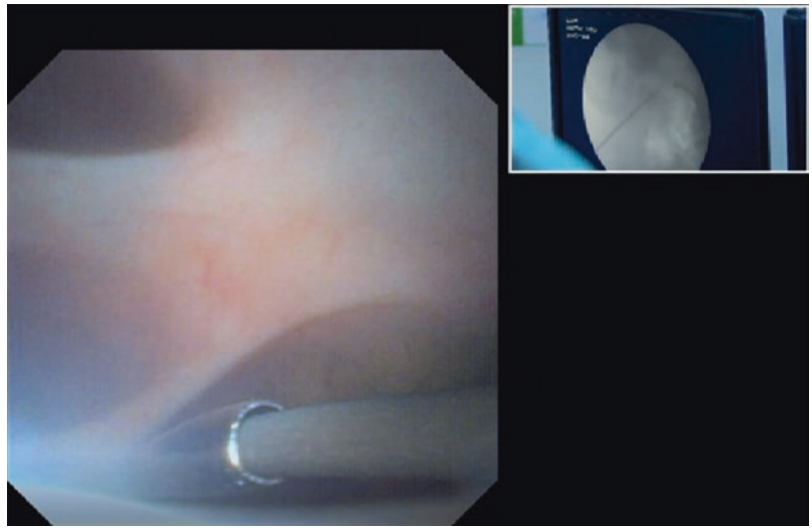

Fig. 22.2 Endovision assisted renal puncture. The flexible scope will guide the puncture through desired calyx

the entry of the puncture needle (Fig. 22.2). With the needle in place, a hydrophilic Terumo guide wire can be passed into the system down the ureter followed by a single step dilator. Mostly the inferior or middle calyx is used to create the renal access followed by insertion of a 16 or 18F renal access sheath depending on the stone burden. As the damage to the flexible scope is significantly higher for lower polar stones especially when the infundibulopelvic angle is less than or equal to 60 degrees [14], it is prudent to clear the lower calyceal stone burden with the percutaneous access. The renal access quickly clears the turbid urine or clot formed following which both the scopes can work in tandem to clear the stone. The nephroscope used in this access can be a standard 12–15F scope.

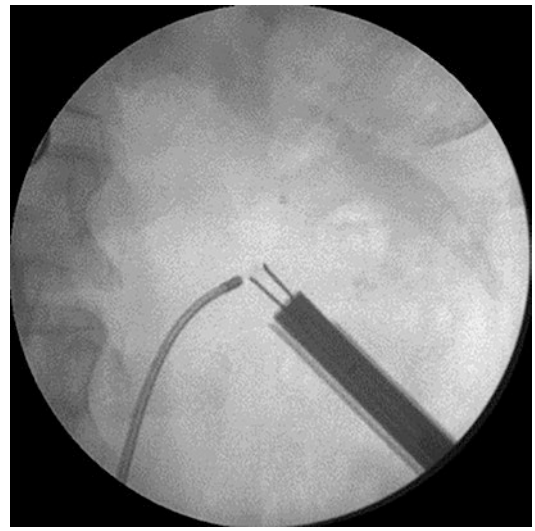

Fig. 22.3 Passing the ball technique. The stone fragment is passed from the flexible ureteroscope to the nephroscope which will be removed through the percutaneous tract

22.5.5 Stone Fragmentation and Retrieval

Most of the times, renal access is used for fragmentation and retrieval of stone fragments. Laser energy (VersaPulse PowerSuite 100 W Lumenis, San Jose, CA, USA) or a Swiss mini LithoClast probe (EMS Electro Medical Systems SA, Nyon, Switzerland) can be utilized for stone fragmentation with the mini nephroscope. The stone fragments are curated to a size appropriate to pass through the renal access sheath. The flexible scope is used just to collect any peripherally lying stones and to deliver them to the nephroscope using 1.5-Fr tipless nitinol baskets (NCircle/Ngage; Cook Medical) by the technique of "Passing the ball" (Fig. 22.3). Sometimes for an impacted calyceal stone inaccessible by nephroscope, the flexible scope is used to fragment the stone and wash it out of the calyx which can then be picked up by the nephroscope and cleared through the percutaneous tract.

22.5.6 Exit Strategy

Once all stone fragments have been cleared, both scopes are used to relook into the PCS to clear any leftover fragments and clots. Flexible ureteroscopy is very helpful in identifying any residual fragments in the calyx of nephroscope entry as well as in any of its parallel calyx. A nephrostomy tube is seldom required following mini PCNL [15]. Nephrostomy tube (8–14 Fr) insertion is required rarely in complicated cases having uncontrolled bleeding, prolonged operating time of more than 2 hours, perforation of the renal pelvis and the presence of residual stones. A double J stent is inserted routinely and removed after 10–14 days. In some uncomplicated cases, a 5/6 Fr Ureteric catheter is left in situ and is removed on the first postoperative day. It is also possible to be totally tubeless following uncomplicated mini ECIRS when the stone burden and the operating time are less without any excessive bleeding and/or pelvis perforation.

22.6 Follow-up

Plain radiograph of the KUB region is done after 24–48 h to confirm stone clearance. Ultrasonogram is a good modality for follow-up following mini ECIRS without any radiation exposure. But the artefact created by the indwelling double J stent may be misleading in some cases. Follow-up computed tomography is rarely required unless they are radiolucent stones.

22.7 Complications

The complications following mini ECIRS may be related to either flexible ureteroscopy or mini-PCNL or both. Fever and urosepsis are the most dreadful complications of flexible ureteroscopy which are less frequent in mini ECIRS owing to less intrarenal pressure during the procedure. With the advent of miniaturization of flexible scopes and hence the small size of ureteric access sheath used, ureteric injury due to access sheath use is uncommon in the current era. Bleeding, drop in haemoglobin, blood transfusion and pelvic perforation are statistically less in miniPCNL when compared to conventional PCNL [16].

22.8 Conclusion

Mini ECIRS is a versatile endourology technique for complex upper tract stones. It has the advantage of maximal stone clearance with minimal nephron loss. The overall stone free rate is comparable to conventional PCNL with reduced risk of bleeding and other complications. The need for two operating teams with various equipment may be a rate limiting step in the widespread adaptation of mini ECIRS.

22.9 Future Considerations

With the recent widespread adaptation of mini PCNL and ECIRS, there is a compelling need for more RCTs in this topic.

References

1. Fernstroem I, Johansson B. Percutaneous pyelolithotomy, a new extraction technique. Scand J Urol Nephrol. 1976;10:257–9.
2. Ibarluzea G, Scoffone CM, Cracco CM, et al. Supine Valdivia and modified lithotomy position for simultaneous anterograde and retrograde endourological access. BJU Int. 2007;100:233–6.
3. Valdivia Urı'a JG, Valle GJ, Villarroya S. Why is percutaneous nephroscopy still performed with patient prone? J Endourol. 1990;4:269–72.
4. Valdivia Urıa JG, Valle GJ, Lopez Lopez JA, et al. Technique and complications of percutaneous nephroscopy: experience with 557 patients in the supine position. J Urol. 1998;160:1975–8.
5. Shoma AM, Erakay I, El-Kenawy MR, El-Kappany HA. Percutaneous nephrolithotomy in the supine position. Technical aspects and functional outcome compared with the prone technique. Urology. 2002;60:388–92.
6. Scoffone CM, Cracco CM, Cossu M, Grande S, Poggio M, Scarpa RM. Endoscopic combined intrarenal surgery in Galdakao-modified supine Valdivia position: a new standard for percutaneous nephrolithotomy? Eur Urol. 2008;54:1393–403.
7. Scoffone CM, Cracco CM, Poggio M, Scarpa RM. Endoscopic combined intrarenal surgery for

high burden renal stones. Arch Ital UrolAndrol. 2010;82:41–2.
8. Ruhayel Y, Tepeler A, Dabestani S, et al. Tract sizes in miniaturized percutaneous nephrolithotomy: a systematic review from the European Association of Urology. Urolithiasis Guidelines Panel. Eur Urol. 2017;72:220–35. https://doi.org/10.1016/j.eururo.2017.01.046.
9. Doizi S, Uzan A, Keller EX, et al. Comparison of intrapelvic pressures during flexible ureteroscopy, mini-percutaneous nephrolithotomy, standard percutaneous nephrolithotomy, and endoscopic combined intrarenal surgery in a kidney model. World J Urol. 2020;39(7):2709–17.
10. Movasseghi G, Hassani V, Mohaghegh MR, Safaeian R, Safari S, Zamani MM, Nabizadeh R. Comparison between spinal and general anesthesia in percutaneous nephrolithotomy. Anesthesiol Pain Med. 2014;4(1):e13871.
11. Cicek T, Gonulalan U, Dogan R, Kosan M, Istanbulluoglu O, Gonen M, Ozturk B, Ozkardes H. Spinal anesthesia is an efficient and safe anesthetic method for percutaneous nephrolithotomy. Urology. 2014;83(1):50–5.
12. Giusti G, Proietti S, Rodríguez-Socarrás ME, Eisner BH, Saitta G, Mantica G, Villa L, Salonia A, Montorsi F, Gaboardi F. Simultaneous bilateral endoscopic surgery (SBES) for patients with bilateral upper tract urolithiasis: technique and outcomes. Eur Urol. 2018;74(6):810–5.
13. Cracco CM, Scoffone CM. Endoscopic combined intrarenal surgery (ECIRS)-tips and tricks to improve outcomes: a systematic review. Turk J Urol. 2020;46(Suppl 1):S46.
14. Ozimek T, Cordes J, Wiessmeyer JR, Schneider MH, Hupe MC, Gilbert N, Merseburger AS, Kramer MW. Steep infundibulopelvic angle as a new risk factor for flexible ureteroscope damage and complicated postoperative course. J Endourol. 2018;32(7):597–602.
15. Lahme S. Miniaturisation of PCNL. Urolithiasis. 2018 Feb;46(1):99–106.
16. Huusmann S, Nagele U, Herrmann TR. Miniaturization of percutaneous nephrolithotomy smaller, but better? Curr Opin Urol. 2017;27(2):161–9.