

The 3-Finger Technique in Establishing Percutaneous Renal Access: A New and Simple Method for Junior Trainees

Iqbal S. Shergill, FRCS,* Mohamed I. Abdulmajed, MBChB,* Sami A. Moussa, FRCR,[†] and Gerald H. Rix, FRCS[‡]

*Department of Urology, Wrexham Maelor Hospital, Betsi Cadwaladr University Health Board, Wrexham, North Wales, United Kingdom; [†]Department of Radiology, Western General Hospital, Edinburgh, United Kingdom; and [‡]Colchester General Hospital, Colchester, United Kingdom

INTRODUCTION AND OBJECTIVES: Urology trainees may lack experience in gaining renal access during percutaneous nephrolithomy (PCNL). Establishing the correct depth of initial percutaneous needle insertion is one of the major obstacles. As such, we have identified an easy technique, which can be performed, to establish correct depth adjustment allowing easier access.

MATERIALS AND METHODS: An initial attempt is made to insert the percutaneous needle into the desired posterior calyx in the antero-posterior (AP) plane. If the needle does not traverse into the desired calyx immediately, it is concluded that the needle track must be too shallow or too deep. The C-arm is then rotated 20 to 30 degrees from the vertical, in the axial plane, towards the operating surgeon and, using the image intensifier, very careful note is made of the end of the needle in this plane, compared with the end of the needle initially in the AP plane, to see if it has moved “medially” or “laterally.” The 3-finger technique is then performed by the surgeon, to establish if the needle path is too deep or too shallow. This technique is currently being performed by trainees under direct consultant supervision with 13 successful cases so far.

RESULTS: The 3-finger technique has been successfully used to demonstrate and teach PCNL access to urology trainees. In all 13 cases, percutaneous renal access was achieved successfully by trainees without immediate or late complications. Also, positive and encouraging feedbacks were received from those trainees, and all expressed willingness to continue using the same new technique in the future.

CONCLUSIONS: Our new technique is cheap, safe, easy to learn and use, and of particular benefit to junior trainees who

are beginning to perform PCNL access. (J Surg 69:550-553. © 2012 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: tips, technique, percutaneous, access

COMPETENCIES: Patient Care, Medical Knowledge, Professionalism, Practice Based Learning and Improvement

INTRODUCTION

Urology trainees (residents) may lack experience in gaining renal access during percutaneous nephrolithomy (PCNL), especially in their early years of training.¹ Establishing the correct depth of initial percutaneous needle insertion is considered one of the major obstacles in achieving this goal. As such, we have identified an easy method—the 3-finger technique—which can be performed with no harm to the patient, to establish correct depth adjustment of the needle, allowing easier access, particularly for junior trainees who are beginning to perform PCNL access. We have used this technique in 13 cases to teach urology trainees, who have then achieved satisfactory percutaneous access.

MATERIALS AND METHODS

According to local protocol and the anatomy on preoperative imaging, an initial attempt is made to insert the percutaneous needle into the desired posterior calyx in the antero-posterior (AP) plane. If the needle does not traverse into the desired calyx immediately, but the approach appears to be correct, it is concluded that the needle track must be too shallow or too deep. The C-arm is then rotated 20 to 30 degrees from the vertical, in the axial plane, towards the operating surgeon and, using the image intensifier, very careful note is made of the end of the needle in this plane, compared with the end of the needle initially in the AP plane, to see if it has moved “medially” or “laterally.” The 3-finger technique is

Correspondence: Inquiries to Mohamed I. Abdulmajed, MBChB, Department of Urology, Wrexham Maelor Hospital, Betsi Cadwaladr University Health Board, Croesnewydd Road, Wrexham, North Wales LL13 7TD, UK; fax: 01978 727149; e-mail: mehmetismat@yahoo.com

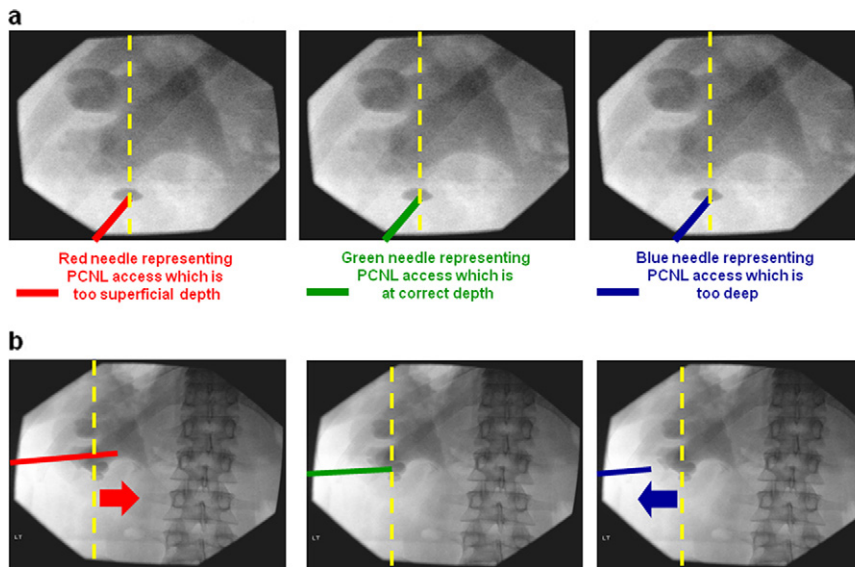


FIGURE 1. C-arm images in AP plane (a, the direction and tips of all 3 access needles appear to be exactly on to the stone in AP plane) and in 20–30 degrees from the vertical plane (b, the tip of the needle which is too superficial, red, appears to move “medially” and the needle which is too deep, blue, appears to move “laterally” in this plane. While, the tip of the needle representing access which is at correct depth, green, does not move at all).

then performed by the surgeon, to establish if the needle path is too deep or too shallow.

In Figure 1, three needle paths on the image intensifier are shown in the AP plane (Figure 1a) and then in the 20 to 30 degrees from the vertical plane (Figure 1b). In the AP plane, all needle paths appear to be in the desired calyx, but, as can be verified in Figures 2 and 3, it is only the green tipped needle that is at the correct depth, whereas the red-tip is too shallow and the blue-tip is too deep. The 3-finger technique is then performed by the surgeon using his/her ring, middle and index fingers, to

establish if the needle path is too deep or too shallow, as is demonstrated in Figure 4.

In Figure 4a, the surgeon is viewing the 3 fingers in the AP direction, exactly simulating the view of the C-arm in the AP plane. It can be seen that the green tipped finger (middle finger) is simulating a needle tip, which is at the correct depth, whereas the red finger tip (index finger) is too shallow and the blue finger tip (ring finger) is too deep. The surgeon then rotates his/her view 20 to 30 degrees from the vertical, in the axial plane, and views the 3 fingers again (Figure 4b). If the initial path is too

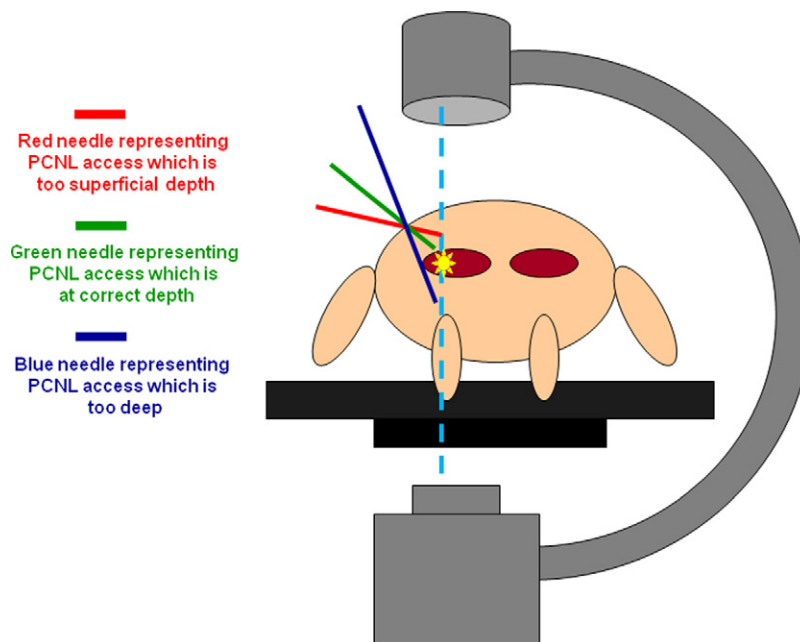


FIGURE 2. Left PCNL access in AP plane.

FIGURE 3. Left PCNL access at 20–30 degrees from the vertical plane.

shallow (red finger tip), the end of the needle moves medially (Figure 4b), and the next pass should then be performed in a deeper plane. If the initial path is too deep (blue), the end of the needle is seen to move laterally (Figure 4b), and the next pass should then be performed in a shallower plane.

This technique is currently being performed by trainees under direct consultant supervision with 13 successful cases so far. After each case, trainees were asked to provide feedback about their experience.

RESULTS

The 3-finger technique has been successfully used to demonstrate and teach PCNL access to urology trainees. In all 13 cases, percutaneous renal access was achieved successfully by trainees without immediate or late complications. Also, positive and encouraging feedbacks were received from those trainees and all expressed willingness to continue using the same new technique on a regular basis.

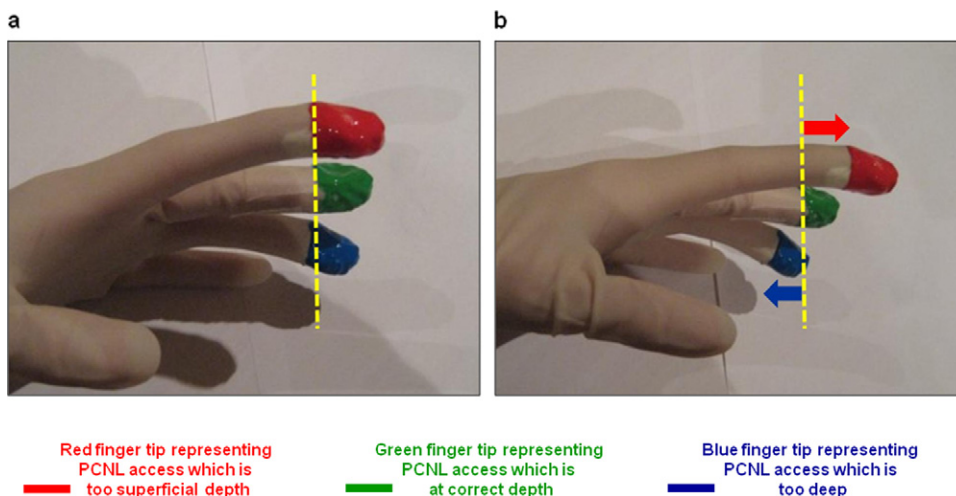


FIGURE 4. Finger Method demonstration in AP plane (a, all 3 finger tips appear to be in the same plane, although the green-tipped finger “middle” is the only one simulating a needle tip which is at correct depth) and in 20–30 degrees from the vertical plane (b, the red-tipped finger “index” which is actually too superficial appears to move “medially” and the blue finger tip “ring” which is actually too deep appears to move “laterally” in this plane while the green-tipped finger “middle” representing access at correct depth does not move at all).

DISCUSSION

The ability to secure a safe and precise percutaneous access is an essential step in performing PCNL, and many techniques to establish renal access have been described in the literature. Ultrasound is suggested as a rapid, accurate, and safe method to establish antegrade renal access before PCNL.² However, the use of ultrasonography for this purpose needs expertise that many trainee urologists do not have readily available. The traditional use of biplanar fluoroscopy with a rotating C-arm to obtain percutaneous renal access in renal surgery is recommended in many published studies.^{3,4} The downside of using fluoroscopic X-ray guidance alone is the requirement of multiple punctures and prolonged operative duration and radiological exposure, especially early in careers of junior trainees. Since 1995, manually positioned^{5,6} and fully automated robots were introduced to assist in providing renal access for PCNL procedure; however, the size and complexity precluded their use in routine clinical practice.⁷ Recently, a new technique using a portable mechanical gantry with a needle guiding device, C-arm fluoroscopy, and a laptop computer containing the software and graphic user interface for selecting the targeted calyx has been established.⁸ Although the last technique is portable, light-weight, and simple to set up and operate, providing accuracy in gaining calyceal access, the cost of manufacturing the gantry and needle positioning mechanism is approximately US\$1500 and, most importantly, it was tested on synthetic and animal models only. The 3-finger technique described in this paper reduces reliance on fluoroscopic screening with no radiation to surgeon's fingers and it is easy to understand and practice. Also, it allows the operating surgeon a short period of focus during potentially stressful time, while he/she evaluates his/her 3 fingers. Importantly, it must be noted that there are a few limitations to the 3-finger technique, including its inapplicability in cases of horseshoe and pelvic kidney. Finally, it is important to clarify the distinction of using this method in the "triangulation technique" for fluoroscopic access, but not the "bull's eye" technique.

CONCLUSIONS

We have identified an easy technique that can be performed, in gaining percutaneous renal access, to establish correct depth adjustment of the needle, allowing easier access. Our technique is cheap, safe, easy to learn and use, and of particular benefit to junior trainees who are beginning to perform PCNL access.

REFERENCES

1. Ko R, Soucy F, Denstedt JD, Razvi H: Percutaneous nephrolithotomy made easier: A practical guide, tips and tricks. *BJU Int.* 2008;101:535-539
2. Virgili G, Vespasiani G, Rosi P, Costantini E, Porena M: Ultrasonically guided access to the kidney. *Arch Ital Urol Nefrol Androl.* 1991;63:41-48
3. Marcovich R, Smith AD. Percutaneous renal access: tips and tricks. *BJU Int.* 2005;95:78-84
4. Miller NL, Matlaga BR, Lingeman JE: Techniques for fluoroscopic percutaneous renal access. *J Urol.* 2007;178:15-23.
5. Potamianos P, Davies BL, Hibberd RD: Intraoperative imaging guidance for keyhole surgery: methodology and calibration. In: Proceedings of the First International Symposium on Medical Robotics and Computer Assisted Surgery. Pittsburgh, PA, 1994;98-104
6. Potamianos P, Davies BL, Hibberd RD: Intraoperative registration for percutaneous surgery. In: Proceedings of the Second International Symposium on Medical Robotics and Computer Assisted Surgery. Baltimore, MD, 1995;156-164
7. Cadeddu JA, Bzostek A, Schreiner S, et al: A robotic system for percutaneous renal access. *J Urol.* 1997;158:1589-1593
8. Zarrabi AD, Conradie JP, Heyns CF, Scheffer C, Schreve K: Development of a computer assisted gantry system for gaining rapid and accurate calyceal access during percutaneous nephrolithotomy. *Int Braz J Urol.* 2010;36:738-746