

How can I get a renal access if I do not have an ultrasound and cannot opacify the collecting system? Another use of the hydrophilic guide wire

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Abstract: It is well-known that fluoroscopic guidance is the most commonly used imaging technique for percutaneous access to the kidney. However, we might encounter difficulties when attempting to establish the limits of the collecting system for a percutaneous puncture, especially in places where the use of ultrasound guidance in the operating room is limited. We aim to describe the use of a hydrophilic guide wire to delimit the collecting system when this becomes difficult with conventional techniques.

Keywords: hydrophilic guide wire, renal access, percutaneous nephrolithotomy

Received: 24 January 2019; revised manuscript accepted: 15 July 2019.

Introduction

One of the fundamental steps in percutaneous nephrolithotomy (PCNL), and, for many urologists, the one with the highest complexity, is percutaneous renal access. From a purely technical point of view, this includes puncturing the collecting system and dilating the percutaneous tract. Thus, access to the kidney is the mainstay of the technique to successfully develop nephrolithotomy.¹

A knowledge of renal anatomy, the ability to perform the puncture within the operating room, and the management of the various complications that this access might have, demands the presence of a urologist.

There are different ways to obtain renal access. Worldwide, fluoroscopic guidance is the most commonly used imaging technique for percutaneous access to the kidney. The reasons are the wide availability of C-arms as well as the experience of urologists with this imaging modality. Even for nonexperienced urologists, there are techniques for easier prone puncture, such as

that by Cansino and colleagues, who perform a perpendicular puncture of the selected calyx with a 20G spinal needle under fluoroscopy control, followed by the introduction of an 18G needle, aiming to bring both tips of the two needles together, achieving a safe and easy approach to the selected calyx.²

Regarding the use of ultrasound to help reach calyx selected for the puncture, in developing countries there is lack of training on ultrasound-guided pyelography and limited access to ultrasound imaging in the operating room.

Scanner-guided biopsy could allow a more accurate puncture, and has been attempted by other experts in the field,³ but the availability of this practice and radiation exposure are issues that cannot be overlooked.² Other described techniques are carried out under endoscopic control, laparoscopy, or magnetic resonance imaging, or even through the application of new technologies (robotics, augmented reality, electromagnetic navigation),^{4,5} but again, limited access to these techniques represents a problem in daily use.

Ther Adv Urol

2019, Vol. 11: 1–6

DOI: 10.1177/
1756287219868603

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For more difficult cases, Wirth and colleagues achieved a 67% rate of ureteral stent insertion using a combined antegrade/retrograde technique consisting of antegrade guide wire insertion followed by retrograde ureteral stenting.⁶

A blind technique, without any imaging guidance, using the lumbar notch to guide percutaneous access that is bounded by the latissimus dorsi muscle and the 12th rib in the superior, by the sacrospinalis and the quadratus lumborum muscles in the medial, and by the transverses abdominis and the external oblique muscles laterally, has also been described.⁷ This technique has proven safe in clinical trials,⁸ but translating it into daily practice might be challenging.

In this context, we might encounter difficulties when attempting to establish the limits of the collecting system for a percutaneous puncture, especially in developing countries. Our objective was to describe how, using a hydrophilic guide wire, we can delimit the collecting system when this becomes difficult using conventional techniques.

Materials

We used the 0.035-inch Roadrunner[®] PC Guide Wire by Cook Medical[®] (Bloomington, IN, USA) for this technique. Besides the hydrophilic coating, it has an angled radiopaque tip that favors fluoroscopic control. The nitinol core gives resilience and flexibility, and the medium-sized width allows easy passage through catheters and cannulas.

Surgical technique

Since 1994, we have performed over 4000 PCNLs. During this period, we found that around 3% of cases required unconventional maneuvers to achieve renal access, usually related to several conditions such as urinary diversion; reconstructive ureteral surgery; inability to catheterize the ureter due to edema, ectopic location, meatal false tract and ureterocele; ureteral obstruction; severe hydronephrosis; obstructed hydrocalyces; impacted ureteral pelvic junction stone; extravasation of contrast medium, possibly due to injection at high pressures or multiple puncture attempts; and urethral stricture. If any of these conditions are identified, we proceed with the following techniques described for the following scenarios.

Scenario 1: extravasation of the contrast medium

We observe with some frequency that forcible injection of contrast medium, or multiple attempts of puncture, can produce extravasation. In such situations, access can become a product of chance rather than a planned maneuver. Often, the surgeon stops the procedure. In these cases, we have found that it is possible to ascend the guide wire through the ureteral catheter into the selected calyx. The radiopaque tip of the guide wire delineates the calyx, and makes it possible to direct the puncture needle using that reference (Figure 1).

Scenario 2: failure in the opacification of the collecting system

In some instances, a catheter is not able to ascend for opacification of the collecting system, either due to obstruction, urinary diversion, or inability to identify the ureter in a severely inflamed bladder. One option is to practice the puncture on the stone and then delineate the collecting system, so we can confirm that the puncture obtained is safe and appropriate for the removal of the stone (Figure 2).

Scenario 3: dilation of the collecting system

In collecting systems with severe dilatation, it might happen that the opacification demands massive amounts of contrast medium. It is also not convenient to overdilate the renal pelvis with the latter (Figure 3).

Scenario 4: incomplete pyelography

There are situations in which opacification of the collecting system is not completely achieved, leaving some calyces unseen. In such cases, a puncture directed to the unseen calyx, which is usually dilated, could complete the pyelography (Figure 4).

Complications

Even though it is possible to solve the situations described with this novel approach, we have identified a complication, which is knotting of the guide wire when rolling a large segment of the guide wire into the collecting system (Figure 5).

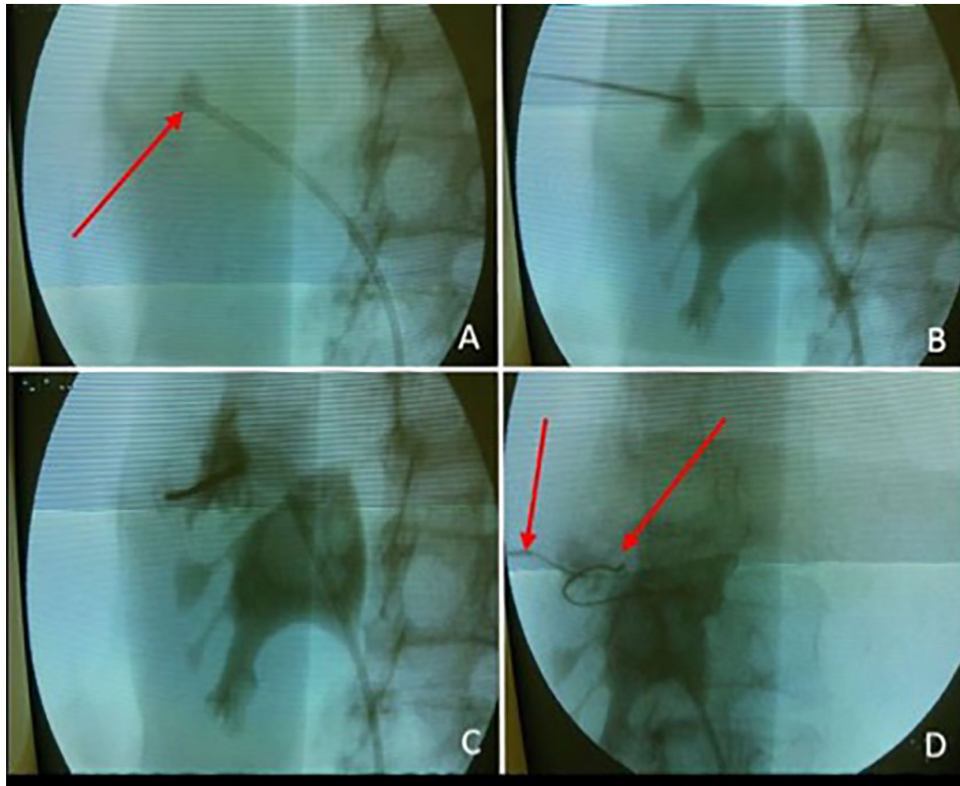


Figure 1. (A) A 10 mm upper pole stone was observed (red arrow). Two sessions of extracorporeal lithotripsy and a flexible ureterorenoscopy had failed. (B) Pyelography with an attempt of puncture. (C) Extravasation produced after the puncture. (D) The radiopaque tip of the guide wire ascending through the ureteral catheter delimits the selected calyx and allows puncture (red arrows).

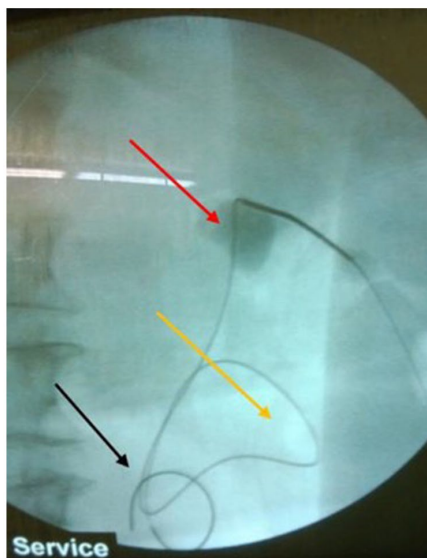


Figure 2. In this case, the catheter could not be ascended; the puncture was performed on the stone located in the upper calyx (red arrow). The advanced guide wire clearly shows the renal pelvis (black arrow) and the lower calyx (yellow arrow).

Comments

The scenarios described above may have an easy solution as long as there is an ultrasound and professionals trained in ultrasound-guided renal puncture in the operating room. Both the ultrasound and trained personnel are uncommon in developing countries. Therefore, the aforementioned maneuvers to access the collecting system might be the solution.

Most renal calyces in which this technique is used are dilated; thus, directing the needle inside the calyces using the anatomical references described in the literature is not difficult. Once inside the collecting system, delimitation of the latter with contrast medium can be performed. However, we have seen how this is accompanied by extravasation, and possibly the need to postpone the surgery. The guide wire solves this situation by delineating the collecting system.

We consider this is not a technique to practice without having good experience in Endourology.

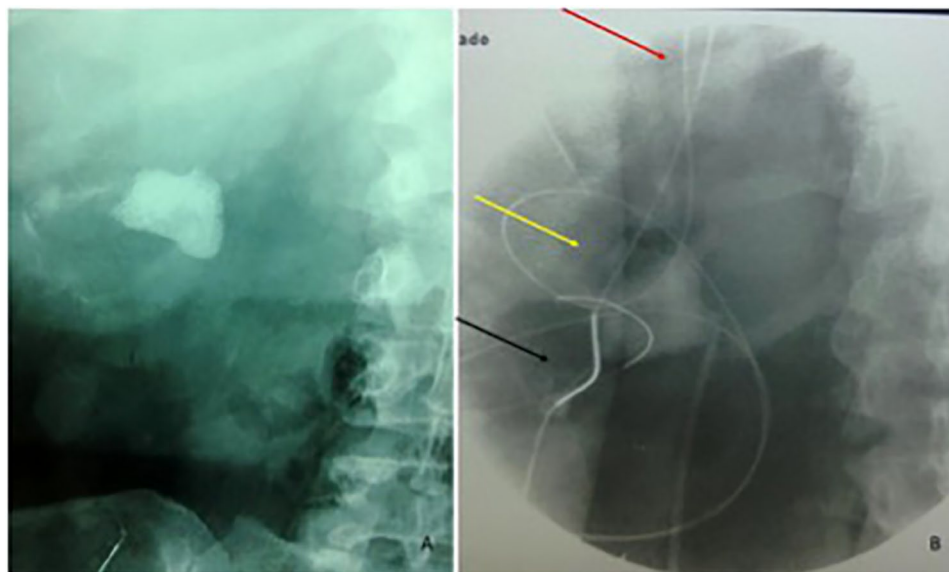


Figure 3. (A) The abdominal X-ray shows a pyelic stone. (B) During the pyelography, severe obstruction is noted, and the injection of contrast medium through the ureteral catheter does not succeed in opacifying the kidney. The kidney is punctured on the lateral contour of the stone and the guide wire is advanced delineating the collecting system. The arrows indicate the calyces: upper (red), mid (yellow) and lower (black). Then, with another needle, the calyx of choice will be punctured.



Figure 4. (A) It is clear how the contrast medium does not opacify the superior calyx, and the pyelography is completed with the guide wire, winding itself on that calyx. (B) and (C) The image shows how the tract is achieved with a dilation technique in a single step on the nonopacified calyx.

The anatomical references should be known to make localization punctures, to be sure the tract is inside the collecting system, and to make a correlation between preoperative images (i.e. noncontrast CT scan) and pyelography images.

Although we have documented this technique using the Roadrunner[®] PC Guide Wire, which has the ideal characteristics to practice these

maneuvers, the manufacturer does not recommend the passage of the guide wire through a metal cannula. This can be solved by changing the metal cannula for a plastic one.

Conclusion

Percutaneous renal access using a hydrophilic guide wire to delineate the pyelocalyceal system is an inexpensive and easy-to-implement

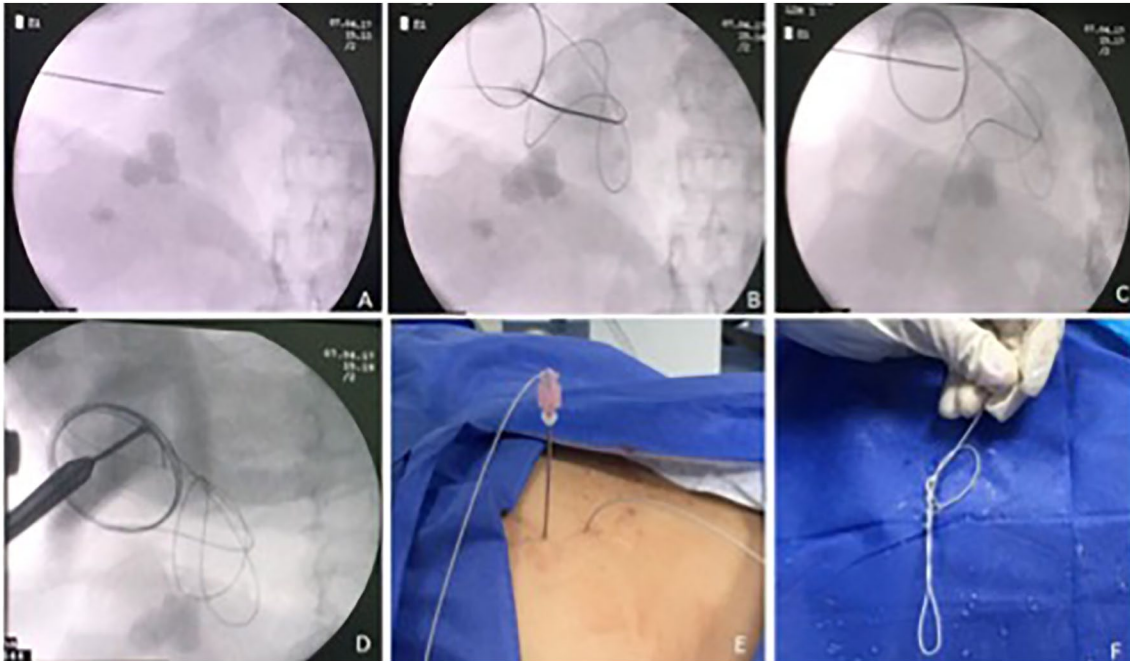


Figure 5. (A) In the case shown, it was not possible to ascend a catheter for pyelography. We decided to make a localization puncture at the crossing of the 12th rib, with a horizontal line traced following the axis of the transverse process of L1. (B) The guide wire was rolled into the collecting system, delineating the upper calyx and part of the renal pelvis. (C) With the upper calyx demarcated by the guide wire, a second puncture was performed. (D) Dilation of the tract was performed in one step. (E) Removal the first guide wire (which is not contained in the needle cannula) was impossible due to knotting. (F) Endoscopic view; the knot in the guide wire impedes its removal.

strategy. We presented situations in which the image of pyelography is not easy to obtain and how to solve them. Pyelography with a hydrophilic guide wire is a novel technique that can be added to the armamentarium of experienced endourologists to resolve cases in which renal access is complex.

Funding

The author(s) received no financial support for the research, authorship, and publication of this article.

Conflict of interest statement

Adolfo Serrano and Carlos Gustavo Trujillo declare to be speakers of Cook Urological®/V.J and Cardiosistemas Colombia®, but have not received any direct or indirect commercial financial incentive associated with publishing the manuscript.

Ethical considerations

This case report follows the Helsinki Declaration and was evaluated and approved by the Institutional

Research Ethics Committee (approval number CCEI-8309-2017, October 18th 2017).

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