Management of Stones in Abnormal Situations

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KEYWORDS

• Nephrolithiasis • Pregnancy • Horseshoe kidney • Urinary diversions • Calyceal diverticulum
• Pelvic kidneys • Transplant kidneys • Autosomal dominant polycystic kidney disease

KEY POINTS

- The management of urinary calculi in abnormal situations continues to pose challenges to urologists. Abnormal situations include pregnancy, aberrant anatomy, kidney transplants, calyceal diverticuli, urinary diversions and autosomal dominant polycystic kidney disease.
- A combination of aberrant anatomy, urinary tract infections, and metabolic changes predispose these patients to an increased incidence of stone formation.
- Metabolic evaluation and medical therapy are arguably more important in these patients, as metabolic abnormalities can be rather common.

INTRODUCTION

The management of urinary calculi in abnormal situations continues to pose challenges to urologists. Abnormal situations include pregnancy, aberrant anatomy, kidney transplants, calyceal diverticuli, urinary diversions, and autosomal dominant polycystic kidney disease (ADPKD). A combination of aberrant anatomy, urinary tract infections, and metabolic changes predispose these patients to an increased incidence of stone formation. The aims of treatment are similar to normal situations. That is an attempt at complete clearance of all stone fragments with the least invasive means possible while trying to minimize secondary procedures and complications. Unfortunately, the aberrant anatomy makes access and clearance of these calculi more difficult to accomplish.

Metabolic evaluation and medical therapy are arguably more important in these patients, as metabolic abnormalities can be rather common, as will be discussed later. These changes often lead to progression of remnant stones requiring secondary treatments and increasing morbidity to the patient.

The options for treatment include open procedures, extracorporeal shockwave lithotripsy (ESWL), percutaneous nephrolithotomy (PCNL), laparoscopy, and ureteroscopy. The choice of procedure must take into account difficulties with access and the anatomic configuration of the kidney and stone. In general, our experience is that most if not all urinary calculi can be managed by minimally invasive procedures, obviating the need of open procedures, although we do acknowledge that in the situations of a lack of access to equipment or inexperience, open procedures may be the safer option with better stone-free rates.

HORSESHOE KIDNEYS

Horseshoe kidneys are the most common renal malformation with an incidence of 1 in 400 births. There is also a preponderance toward males with a 2:1 ratio.[1] As the renal units ascend during fetal development there is abnormal fusion of the mesonephric blastemas. This leads to incomplete ascension and also malrotation of the kidneys. The final product is a fused kidney in the shape of

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Urol Clin N Am 40 (2013) 79–97
http://dx.doi.org/10.1016/j.ucl.2012.10.001
0094-0143/13/$ – see front matter

a horseshoe that is limited by the inferior mesenteric artery and lies more caudally (**Fig. 1**). The kidney calyces tend to be posterior and medial and the upper pole calyces lie more cranial and lateral (**Fig. 2**).[2] The ureters have a high insertion and deviate more anteriorly, as they have to cross the renal isthmus (**Fig. 3**). This high insertion and crossing of the renal isthmus may lead to increased incidence of urinary stasis.

Horseshoe kidneys are associated with up to 100% incidence of urinary metabolic abnormalities, 40% recurrent urinary tract infections, and 35% incidence of suboptimal urinary outflow.[3] There is a 20% median incidence of stones in horseshoe kidneys[1] with most in the posterior lower pole calyx and the renal pelvis. Most of these stones are calcium oxalate.

As the innervation of the horseshoe kidney is the same as that of the normal kidney, symptoms of renal colic are similar; however, atypical presentations of vague abdominal pain or emesis may occur owing to the different lie of the kidneys.

The decision of treatment option will have to take into consideration aberrations in anatomy that may include aberrant vasculature, distortions of the renal collecting system, and interposing bowel between skin and kidney. The presence of ureteropelvic junction (UPJ) obstruction should also be determined before treatment, as it will affect outcomes of certain procedures. The options for treatment include ESWL, ureteroscopy, PCNL, laparoscopy, and open surgery.

ESWL

ESWL is the least invasive modality of treatment for horseshoe kidney stones. There are a number of factors that may make shockwave therapy less efficacious. The horseshoe kidney sits lower

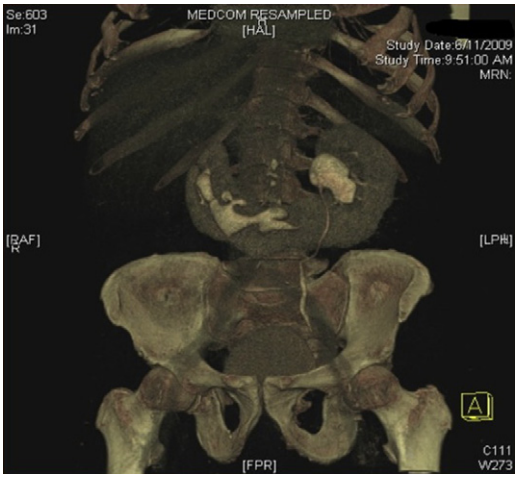

Fig. 1. Horseshoe kidney.

Fig. 2. Horseshoe kidney with stone. Note the access angle is 15° as opposed to the 30° for normal kidneys.

in the abdominal cavity and tends to be more medial. The end result of these changes is that vertebral bodies, transverse processes, bony pelvis, and bowel gas shadows may obscure targeting of the stone. Furthermore, if the stone lies below the pelvic brim, a prone ESWL will have to be attempted and this has a higher chance of traumatizing the overlying bowel.

The second problem is the high insertion and kinking of the ureter as it crosses the renal isthmus. Contrast studies and excretory studies may also need to be done to exclude UPJ obstruction in these kidneys. The net effect is that even if the stones are fragmented, there is poor passage of fragments.

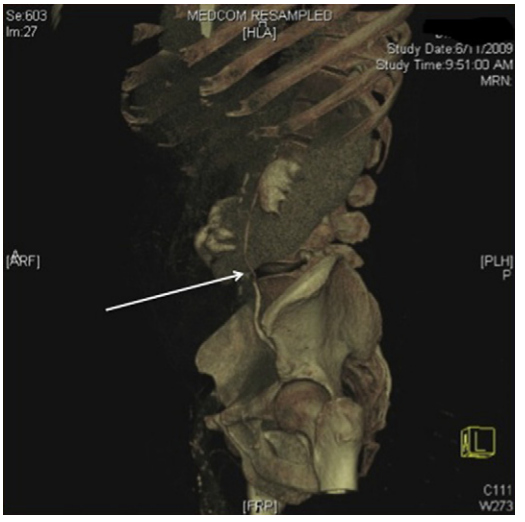

Fig. 3. Anterior deviating ureter with kink over the isthmus.