Role of sonography-guided lithotripsy in renal stone with angiomyolipoma

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ABSTRACT

Treatment of angiomyolipoma (AML) of kidney with stone has been challenging for urologists. We present our experience of treating the renal stone in the presence of AML with shockwave lithotripsy (SWL). Position of the patient with respect to the direction of the shockwaves and accurate knowledge of the dimension of the focal zone are critical aspects of SWL. Keeping the AML safely away from the focal zone at all times during the procedure is only possible by usage of real-time ultrasonography in lieu of fluoroscopy.

Key words: Angiomyolipoma with kidney stone, lithotripsy, sonography-guided lithotripsy

INTRODUCTION

Angiomyolipoma (AML) of the kidney is a clonal neoplasm, derived from perivascular epitheloid cells. Most AMLs are asymptomatic and benign. AML is composed of vascular, fat and smooth muscle elements. The most common serious complication of renal AML is hemorrhage, especially aggravated by renal trauma. AML with renal calculus is a challenge for the treating physician because of AML’s vulnerability to bleed. The blood vessels in AML are thick-walled, tortuous and often have angiomatous arrangement. The vessels are devoid of all important elastic tissue and instead have a disorganized adventitial cuff of smooth muscle. This predisposes them to pseudoaneurysm formation and spontaneous hemorrhage even with trivial trauma. Anatomically they are devoid of capsule and may extend through the renal capsule into the perinephric space making free hemorrhage (without tamponade) a serious possibility.[1] We present a case of renal stone with a concurrent AML. In our opinion this is the rare situation, where the presence of AML leads to challenging alteration in the standard therapy of the renal stone. The ultrasound-guided lithotripsy has real-time ability to prevent the shockwaves from traversing the AML at all times. We believe that it is far safer than fluoroscopy guidance.

CASE REPORT

A 54-year-old non-hypertensive and non-diabetic lady presented with flank pain and repeated symptomatic urinary tract infection like fever, dysuria and urgency of micturition. She was treated with culture-based antibiotic therapy for ten days and was advised SWL after culture negativity. On sonography the patient was found to have a 15-mm right renal pelvic stone with mild hydronephrosis. There was an associated 2-cm solid lesion of the kidney. On contrast computed tomography (CT) urography the lesion was confirmed to be AML [Figure 1]. The Hounsfield units (HU) of the stone were 900 HU. In view of past history of recurrent infection and relatively lower Hounsfield units of the stone, we decided to avoid stenting. The AML was posterolateral in the mid-polar region of the kidney. A three-dimensional (3D) reconstruction was done to find out the anatomic co-relation of the AML and renal calculus. Patient was subjected to SWL on Siemens Modularis Vario (Erlangen, Germany) having focal zone of 12.1 mm X 130.4 mm and depth of penetration 140 mm. The imaging modality used was Siemens Sonoline G20, with transducer C5-2, with footprint measuring 6.7 cm which enabled us to have a broader field of view.
Patient position

The therapy head of Siemens Modularis Vario is angulated at 55 degrees hence the natural course of shockwave travel is demonstrated in figure 2a by yellow line; the patient was given supine right lateral tilt of 15 degrees so that the AML lesion was away from the focal zone of the lithotripter. This tilt was accurately achieved by using the ‘head wedge’ as illustrated in Figure 2b. Once the stone was localized behind the crosshair, the distance between the AML lesion and stone was always kept more than 6 mm from the edge of the stone considering the diameter of focal zone as 12.1 mm.

MATERIALS AND METHODS

Patient was well hydrated before the procedure so as to ensure good fragmentation of stone during SWL. Treatment was initiated with energy level of 0.1 for first 100 shockwaves so that vasoconstriction would lead to prevention of kidney tissue injury. Gradually, energy was increased after initial 500 shockwaves and maximum of 3.0 energy was reached by the end of 1000 shockwaves. Stone and AML were continuously monitored by sonography. Clouds of echogenicity were seen in the area of the stone. With every consecutive shockwave these clouds of echogenicity progressed through the collecting system indicating clouding effect which suggests adequate fragmentation at around 2900 shockwaves. As ultrasound machine cannot directly observe cavitation elements, remnant gas bubbles appear as echogenic region. At the end of 3000 shockwaves the treatment was terminated as we never wanted the adverse effects of the cavitation bubble. Patient had indwelling Foley’s catheter for 24 h post SWL to monitor urine output and to watch for hematuria and was discharged one day later. A sonography scan was performed to check for hematoma at the time of discharge. Patient was instructed to avoid strenuous activities for one week. After one week, the patient was screened by X-ray, which was suggestive of good fragmentation with few residual fragments in the upper ureter along the L3-4 vertebrae. Complete stone clearance was confirmed by X-ray Kidney Ureter Bladder (KUB) at the end of the second week by observing these calculi. Sonography done at four weeks confirmed the clearance.

DISCUSSION

To conclusively diagnose AML, many authors have tried fine needle aspiration cytology (FNAC) as well as fine needle aspiration biopsy (FNAB). FNAB is more reliable, however, fraught with the unwanted and often serious complication of hemorrhage. Thus most AMLs are diagnosed based on their CT features. Extrapolating this data of FNAB, we believe that chances of injury to the AML are high during the puncture. Hence we did not consider doing PCNL (Per Cutaneous Nephrolithotomy) in this patient. Though there are authors who have done percutaneous nephrolithotomy in the presence of AML. Kropp had performed percutaneous nephrolithotomy directly through an AML. Eiley DM had performed percutaneous nephrolithotomy with renal AML with the help of 3D CT imaging to achieve accurate renal
puncture and angle during percutaneous nephrolithotomy. However, a second tract was needed and this was done using standard biplanar fluoroscopic technique which traversed an AML. To avoid such a complication it would be worthwhile to consider initial puncture under sonography guidance. However, it is done at very few centers therefore we believe that sonography-guided lithotripsy is very safe in the presence of AML.

Shockwaves consists of steep positive and negative pressure. Positive wave results in tensile stress and negative pressure causes cavitation. Cavitation erosion is especially observed in the anterior and posterior side of the artificial stone in vitro. Cavitation plays important role in stone disintegration after the initial spalling effect have disintegrated the calculus. Cavitation seems to be an important factor of shockwave-induced tissue injury. The collapse of the cavitation bubble is asymmetric, resulting in the emission of a liquid jet that may have significant destructive effects on tissue exposed to SWL. Since cavitation is an undisputed reason for renal tissue injury and cavitation bubble occurs at the entry site of the shockwave rather than exit site, our major concern was to place the AML lesion outside the focal zone of our machine. Considering the fact that the diameter of the focal zone was 12.1 mm, the minimum distance required between the centre of the stone and the AML lesion had to be more than 6 mm at all times during SWL. This can effectively be achieved only by real-time usage of sonography and not fluoroscopy.

In such special cases of concurrent AML and renal stone we strongly suggest USG-guided lithotripsy for its real-time ability to avoid shockwaves traversing the AML. Real-time sonography is able to detect any hemorrhage from AML during the procedure which enables us to stop SWL on time. This detection is not possible with biplanar fluoroscopic SWL. Thus we believe that real-time sonography indeed adds value during such situations.

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