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Correlation of CT stone density and skin-to-surface distance with ESWL efficacy on lower pole kidney stones

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Background: In the last years the optimal first line treatment for small stones in the lower pole of the kidney (<15 mm) is a controversial topic. With the widespread use of fURS in the last years, it became an alternative of ESWL for primary treatment modality for lower pole stones (LPS).

Several factors are known to correlate with ESWL success in these patients. Undoubtedly the main factor is the diameter of the stone, with ESWL showing rapidly decreasing efficacy in LPS with diameter greater than 15 mm. Another important determinant of success of ESWL is the lower pole spatial anatomy, with infundibulopelvic angle greater than 70 degrees, infundibular length less than 30 mm, infundibular width greater than 5 mm, and lower pole ratio (infundibular length/infundibular width) less than 3.5 are prerequisites for 62% successful stone free rate. Patients with LPS bigger than 15 mm or unfavorable lower pole collecting system anatomy are candidates for fURS.

Aim: In the present study we determine the significance of stone CT density and skin to stone distance for ESWL success in LPS, in addition to the abovementioned factors.

Material: Our cohort consists of 45 patients age 37-52 (mean age – 47,4 years), who have undergone ESWL for solitary LPS in the period 7.2010 – 7.2012. Stone size was 4-15 mm (mean diameter 9,8 mm). Stones diameter is <10 mm in 25 patients (55,5 %), 10-12 mm in 17 patients (37,7%), and 12-15 mm in 3 patients (6,6 %). All patients had stone density less than 500 HU and distance from the skin to the surface of the stone less than 12 cm plus favorable lower pole anatomy. The lower pole anatomies, density of the stone and distance from skin have been determined on CT spiral 3D reconstructed images. The control arm consists of 57 patients matched by age, stone size and lower pole anatomy, but with stone density >500 HU and/or skin to stone distance more than 12 cm. All ESWL were performed on Storz Modulith SLX machine with a mean of 3200 waves, energy level 5-7, and frequency 1Hz. Our main variable was stone-free rate after 1 or 2 ESWL procedures.

Results: on follow-up CT after 1 or 2 ESWL procedures stone free rate was observed in 29 (64,4%) patients with favorable prognostic factors, compared with 23 (40,3 %) patients in the group with stone density > 500 HU or skin-to-stone distance >12 cm. Stones greater than 10 mm required more than one session in 62,5% of the cases in our study, compared with 32,1 % in stones <10mm.

Conclusion: The proper selection of patients for ESWL according to stone size and lower pole anatomy is a successful determinant for optimizing the efficacy of lower pole kidney stone free rate. The addition of stone density and skin-to-stone distance further improves the sensitivity of this prognostic model and helps to increase the ESWL efficacy in LPS through improvement in patient selection.