ESWL-Induced Renal Damage –
An Experimental Study

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Introduction

Since the clinical introduction of extracorporeal shock wave lithotripsy for the treatment of urolithiasis in 1980, approximately 200,000 treatments have been performed in the world (Eisenberger et al. 1977; Chaussy et al. 1978). The number of shock waves given in one single treatment varies in different urological departments and the relation of renal damage to treatment parameters is not known. Only a few authors published subcapsular hematomas in some cases and there are very few experimental studies in animals.

We examined the kind and size of ESWL-induced renal damage in dependence of the number and the pressure of given shock waves and tried to find clues to those damages in clinical examinations.

Materials and Methods

In 1985, we studied the effect of extracorporeally induced shock waves on the kidneys of healthy pigs using a Dornier kidney lithotriptor HM3.

Both kidneys of each individual animal were treated with an equal number of shock waves keeping the generator voltage constant. The groups were as follows: A – untreated control, B – 5,000 shock waves, 25 kV generator voltage, C – 2,500 shock waves, 25 kV generator voltage, D – 2,500 shock waves, 17 kV generator voltage, E – 1,400 shock waves, 17 kV generator voltage. 24 h after ESWL the left kidney was removed and histologically examined in order to judge the severity and localization of the renal damage. The animals living with the remaining shock wave treated right kidney were followed up for a period of 6 weeks, when the second kidney was removed and morphologically examined to show the healing and remaining defects.

We performed screening examinations of the electrolytes sodium and potassium, and of creatinine and urea before ESWL, 24 h after ESWL, before the first kidney was removed, 1 week, 3 weeks and 6 weeks after ESWL. In addition, we performed intravenous pyelograms and renovasograms 24 hours and 6 weeks after ESWL.

The control group was treated in the same way as all other groups including anesthesia but no shock waves were applied.

We used young healthy pigs of about 25 kg bodyweight. The animals were fixed in a special holding device of the lithotripter. We performed intravenous anesthesia

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with Pentobarbital. Shock wave localization and focusing was done via 2 X-ray devices. In order to picture the pelvi-calyceal system we infused contrast-medium, 4 ml of 30% Peritrast per kg bodyweight.

**Results**

All kidneys that were removed 24h after ESWL revealed perirenal hematomas. There was no quantitative correlation with the number of shock waves or the generator voltage for perirenal hematoma.

The shock wave treatment resulted in significant morphological alterations. The most severe injuries were found in the center of the focus sharply demarcated towards intact kidney structures. All kidneys exhibited peripelvic and subcapsular hematomas, parenchymatous necrosis of the cortex and the medulla and fresh hemor-