# THE SUCCESS RATE OF NEW GENERATION ELECTROMAGNETIC LITHOTRIPSY DEVICE IN CHILDHOOD URINARY TRACT STONES

## Original Article

# ÇOCUKLARDA ÜRİNER SİSTEM TAŞ HASTALIĞI TEDAVİSİNDE YENİ JENERASYON ELEKTROMAGNETİK TAŞ KIRMA CİHAZININ BAŞARI ORANI

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**ABSTRACT**

Urinary tract stone disease in childhood is as frequent as in adults. Diagnosis and treatment of urinary tract stone disease in the pediatric age group was not different from that in adult age. Extracorporeal shock wave lithotripsy is known to be safe in adults, but concerns about high-energy pulse can affect the development of kidney injury in children. New generation ESWL devices had the opportunity of lower radiation exposure with better fluoroscopic focusing, and even no radiation exposure with ultrasonographic visualization. We retrospectively evaluated our results of ESWL treatment in children with urinary tract stones.

**Key words:** *Pediatrics; shock wave lithotripsy; urinary stones.*

**ÖZET**

Üriner sistem taş hastalığı erişkinlerde olduğu gibi çocukluk yaş grubunda sıkça karşılaşılan bir hastalıktır. Çocuk yaş grubunda üriner sistem taş hastalığının tanı ve tedavisi erişkin yaş grubundan ayrılmamaktadır. ESWL yetişkinlerde güvenli olduğu bilinmektedir, ancak çocuklarda yüksek enerjili darbe olumsuz böbrek gelişimini etkileyebilir endişesi olmuştur. Pediatrik hastalara uyumlu, yeni jenerasyon taş kırma makinelerinin kullanıma girmesi, daha iyi floroskopik odaklama ile daha az radyasyona maruz kalma ve ultrasonik görüntüleme yöntemlerinin devreye girmesi ile radyasyon maruziyeti tamamen ortadan kalkmıştır. Biz de kliniğimizde çocuk hastalarda uyguladığımız ESWL sonuçlarını retrospektif olarak araştırdık.

**Anahtar kelimeler:** *Çocuk; şok dalga litotripsi; üriner sistem taşları.*

## INTRODUCTION

Urinary tract stone disease is frequently encountered in every period of childhood. The frequency has been reported as 1-5% in developed countries, and 5-15% in

developing countries. Nowadays, the actual incidence of urolithiasis in children may be higher than the previous prevalence reported (1). Children in hot, arid and dry climates have a higher prevalence. Urinary stone disease is endemic in Turkey, Pakistan and in regions with similar climates. Pediatric stone disease is a serious problem in our country (2). Etiological factors are anatomical defects (30.4%), urinary tract infection (31.5%), metabolic disorders (26.1%) and idiopathic causes (3).

Today, patients in the pediatric age group are treated either with extracorporeal shock wave lithotripsy (ESWL), ureteroscopy (URS), retrograde intrarenal surgery (RIRS) and percutaneous/mini-percutaneous nephrolithotomy (PNL).

We retrospectively evaluated our results of ESWL treatment in children with urinary tract stones.

## MATERIAL AND METHODS

Between January 2007 and December 2011, a total of 56 children (37 male and 19 female) who underwent ESWL with the diagnosis of urinary tract calculi were enrolled to the study. All patients were diagnosed either with ultrasonography (USG) or KUB. Stone size was measured as the longest axis of the stone.

The device used for ESWL was the new generation SLK electromagnetic Storz Medical Modulith device. Both ultrasound and fluoroscopic X-ray focusing systems has been used on this device. Because of convenience, efficiency and security Reasons, mostly ultrasonic focusing system was used. Prior to the ESWL, patients with known urinary tract infection were treated with antibiotics according to the results of the pre-ESWL urine culture and urine culture was repeated if necessary. No anesthesia required in 17 children older than 12 years, other patients received 2-2.5 mg / kg fentanyl or 0.15 mg / kg midazolam intravenously prior to ESWL. General anesthesia was needed in 8 children who could not tolerate the procedure because of the pain. After the procedure, patients who received no-anesthesia were discharged immediately, and patients undergoing general anesthesia were discharged after 4-6 hours. The interval between ESWL sessions was at least one week. All children were evaluated with routine plain radiographs, USG, urinalysis, and stone analysis at the first month after the last session of ESWL treatment. The presence of residual stone fragments smaller than 2 mm was considered to be stone free.

## RESULTS

Mean age of the patients was 7.5 years (range 3 months to 16 years). Stones were located in the ureter in 8 of 56 patients, and 48 patients in the kidney. Four of the ureteral stones were located in the left ureter (2 distal and 2 proximal) and 4 of them were located in the right ureter (1 middle, 3 proximal). Mean stone size of the ureteral stones were 6.7±1.5 mm (range from 4 to 8 mm). A total of 22 patients had more than one stone. There were 24 stones in the renal pelvis of 21 pediatrics. Furthermore, 3 had bilateral renal calculi and 6 had three stones. Mean stone size of the renal stones was 11.2 mm±7.6mm (range from 4 to 27 mm). Mean follow up period 72±22 months (range from 3 to 120 months).

Average number of shock waves applied for each ESWL session was 2769 (range from 700 to 7000). The average energy used for stone fragmentation was 45.3 kV. Average number of sessions was 1.5 (range from 1 to 3).

Stone free rate for ureteral stones were 87.5% and 72% for renal stones. The fragmented renal pelvis stones were cleared in most of the patients after one month. However, in 5 patients with renal stones, stone path was occurred. We implanted DJ stent in 3 of these patients and cleared the stones by using URS in two patients. After ESWL treatment, all

patients were discharged on the same day except 2 patients who had febrile urinary tract infection (3.5%). Two patients were hospitalized for 3 days and parenteral antibiotherapy was administrated. Minor complications like hematuria occured in 30 patients (53.5%). None of the patients had skin ecchymosis. Complications like hypertension, proteinuria, or persistent renal damage have not been detected in any patients.

## DISCUSSION

Pediatric urinary stones are rare but have lifelong consequences. Because children have a small body size and delicate tissues, and because the use of general anesthesia is likely, treatment for pediatric stone disease requires thoughtful consideration and individualized therapy. ESWL for pediatric urinary stones was first introduced by Newman et al. (5) in 1986, numerous reports have demonstrated the efficacy and safety of ESWL in the pediatric population (6,7). ESWL is now considered a first-line treatment for pediatric stone disease because of its minimal invasiveness and high success rate (8,9).

In addition to its noninvasive nature, ESWL has other advantages in the treatment of pediatric urinary stones. For younger patients, stones seem to be more susceptible to shockwaves because of the short indwelling time. The pediatric ureter is more elastic, more distensible, and shorter, which facilitates the passage of stone fragments and compensates for the narrower lumen. The small body volume of children allows the shockwaves to be transmitted with minimal energy loss. However, the application of many ESWL sessions is a burden to pediatric patients because of the likely use of general anesthesia during the procedure and the increased susceptibility of children to radiation exposure.

Many reports confirm ESWL) can be performed in children with no suspicion of long-term morbidity of the kidney (10-12). Calyceal or renal stones with a stone diameter of up to 2 cm are an ideal indication for ESWL. More effective disintegration of even larger stones, together with swifter and uncomplicated discharge of larger fragments, can be achieved in children by ESWL. In short and medium-term follow-up of cases, we did not report any permanent kidney damage.

Stone-free rates of 67-93 % in short-term and 57-92 % in long-term followup studies have been reported (13-15). Consequently, ESWL can be indicated in children with a larger stone volume, and the placement of a ureteral stent before or after ESWL is generally unnecessary (9,15-17). The mean number of shock waves for each treatment is about 1,800 and 2,000 (up to 4,000 if needed) and the mean power set varies between 14 and 21 kV. The use of ultrasonography and digital fluoroscopy has significantly decreased the radiation exposure and it has been shown that children are exposed to significantly lower doses of radiation compared to adults (12).

Early concerns about possible damage to the growing kidneys in children treated with ESWL have not been validated in long-term follow-up studies. However, potential damage of the gonadal tissue in the ovaries caused by shock waves is still a controversial subject. Vieweg et al. specifically studied female fertility afterESWL of distal ureteric stone and found no case of infertility.

A general recurrence rate of 2-44 % has been reported for children after ESWL; the residual stone growth is between 23 and 33 % (12,14, 17). In contrast, the recurrence rate in adults is only between 8 and 10 %, and the residual stone growth averages 22 %. Complex aetiology, a high rate of metabolism disturbances, anatomical changes, and urinary tract infection, are given as reasons for the higher rate of residual stone growth in children.

Furthermore, success rates and complications vary according to the type of equipment used. After the procedure, complications such as pain, fever, skin ecchymosis, hematuria occur in about 20% of cases. Stone path requiring additional treatment with ureteral obstruction is rare (15,16). 53.5% of our cases had minor complications. Stone path occurred in 5 of the patients. Three of these patients were treated with double J stent implantation and two needed additional treatment procedures. Our complication rate was also lower.

## CONCLUSION

ESWL is considered as first-line treatment option for the majority of the patients with benefits such as less need for anesthesia and lower complication rates. Successful results can be obtained for stones smaller than 20 mm. ESWl shoul also be used in pediatric age as effective and safe method.

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