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The efficiency of new generation ESWL device at lower calyx urinary stones

Alt kaliks taşlarında yeni nesil ESWL cihazının etkinliği

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ÖZET

Amaç: Bu çalışmanın amacı retrospektif olarak böbrek alt kaliks idrar taşlarının tedavisinde yeni nesil ESWL cihazların etkinliğini araştırmaktır

Metod: Yeni nesil elektromanyetik Storz Medical Modulith SLK ESWL cihazı ile taş tedavisi yapılan 151 hasta retrospektif olarak değerlendirildi. Bu çalışmada Ocak 2009-Şubat 2012 tarihleri arasında Hisar Intercontinental Hastanesi'ne başvuran 94 erkek ve 57 kadın hastanın verileri değerlendirildi. Hastaların yaşları 13-79 (ort:41 yıl) arasında idi. Taşların çapları 7-20 mm (ort:12 mm) arasında idi. Her ESWL seansında 1000-3500 (ort: 2500) şok dalgası uygulanmıştı. Üç aylık süre içinde en az 3 mm ya da daha küçük fragmanlar olduğu durumda tedavi başarılı kabul edilmiştirsunda Mueller-Hinton agarda disk diffüzyon yöntemi ile araştırılmıştır.

Bulgular: Yüz ellibir alt kaliks taşının 133 ünde arınma sağlandı (% 88.1). Kalan 18 taş (% 11.9) başarısız parçalanma ve / veya rezidüel taş nedeniyle fleksibl üreterorenoskopi (URS) ile tedavi edildi. Analjezi 140 (% 92.8) hasta için gerekli oldu. Dört hastaya intravenöz Tramadol (% 2.6) ve 7 hastaya diklofenak (% 4.6) uygulandı. Hiçbir hastaya spinal veya epidural anestezi, sedasyon veya narkotik analjezikler kullanılmadı. Minör komplikasyon olarak 110 hastada (% 72.8) hematüri gözlendi. Majör komplikasyon olarak, bir hastada perirenal hematom, üç hastada taş caddesi (URS gerekli olmuştur) görüldü, ancak genel komplikasyon oranları invazif taş tedavi yöntemlerinden daha düşüktü

Sonuç: Yeni nesil ESWL cihazı ile taş tedavisi 2 cm veya daha küçük olan renal kaliks taşlarınında etkili ve güvenli bulunmuştur.

Anahtar kelimeler: ESWL, alt kaliks, üriner sistem taş hastalığı

ABSTRACT

Aim: To investigate the efficiency of new generation ESWL devices for the treatment of lower calyx urinary stones with data review of previous patients

Method: One hundred fifty one procedures of ESWL performed by new generation electromagnetic Storz Medical Modulith SLK ESWL device were evaluated retrospectively This study contains data from 94 male and 57 female patients whose admitted to Hisar Intercontinental Hospital between January 2009 and February 2012. Ages of patients were between 13-79 (mean: 41year). The diameters of stones were between 7-20 mm (mean 12mm).An average 1000-3500 shock waves (mean: 2500) were used for each ESWL session. The procedure was accepted successful with less than 3 mm or smaller remnant stones within the following 3 months interval.

Results: Hundred thirty-three stones of 151 lower calyx stones (88.1%) were removed. Remaining 18 stones (11.9%) were treated with flexible ureterorenoscopy (URS) due to unsuccessful fragmentation and/or residual stones. No analgesia was required for 140 (92.8%) patients. Intravenous Tramadol was administered to 4 (2.6 %) and intramuscular Diclophenac administered to 7 (4.6%) patients. No spinal or epidural anaesthesia, sedation or narcotic analgesics were used. Haematuria was observed in 110 (72.8%) patients as a minor complication. As major complication, a perianal haematoma was seen in one patient, stone street (which required URS) was developed at three patients, but the complication rates were less than invasive stone treatment methods

Conclusion: New Generation ESWL was found efficient and safe for the treatment of lower calyx stones of 2 cm or less.

Keywords: ESWL, lower calyx, urinary system stones

Figure 1. New generation electromagnetic Storz Medical Modulith SLK extracorporeal shock wave lithotripsy (ESWL) device

Table 1. Clinical characteristics of patients undergoing ESWL

Male/female	94/57
Age	13-79 (mean 41) years
Stone size	7-20 (mean 12) mm
Shock waves	1000-6500 (mean 2500)

INTRODUCTION

Invention of Extracorporeal Shock Wave Lithotripsy (ESWL) was considered as a revolution in the treatment of urinary stone disease and the method became a standard for most of the nephrolithiasis cases. It has been a preferred choice of therapy, also because of its lower complication potential and non-invasive nature (1). However, the efficiency of ESWL for lower pole stones has been discussed for a long time for the lower calyx is particular for its anatomical location. Most important components that affected the success of ESWL are size of the stone, anatomical properties of lower collector system and chemical structure of stones. The main purpose for lithotripsy of lower calyx stones is to get rid of fragments after the therapy(2). The complete removal of stones at lower calyx has lower rate than the stones located in mid or upper kidney or at the other compartments of the urinary tract(3). The optimal results for ESWL are obtained when the stones are located in the renal pelvis and with a size up to 2cm. ESWL treatment can also be used for larger stones but has more adverse effects in this condition. Although cystin and calcium phosphate dihydrate stones (Brushite) are difficult to break up, a major proportion of urinary stones can be treated by ESWL(4). The aim of the present study is to investigate the efficacy of new generation ESWL devices on the lower calyceal stones

METHODS

One hundred fifty one patients admitted to Hisar Intercontinental Hospital with the diagnosis of lower calyx kidney stone including 94 male and 57 female between the dates of January 2009– February 2012 were enrolled to this retrospective study. Ages of patients were among 13-79 (average 41 years). The diameters of stones were between 7-20mm (average 12mm) ESWL was not used in the pregnant, in patients who has urinary tract infections and who has a serious deterioration of the kidney functions. ESWL was indicated with existing symptoms (pain, urinary obstruction), in stones bigger than 6mm with inability for stone passage. No drug was stopped for 5 patients using aspirine, warfarine natrium and clopidogrel. These patients received shocks with number less than 1500 and intensity less than 50. The diagnosis was made with ultrasound, IVP (intravenous pyelogram) and CT scan. CBC, full blood biochemistry, complete urinalysis and urine culture were obtained before ESWL. No, spinal or epidural anaesthesia, sedation or narcotic analgesics were used. Intramuscular Diclophenac sodium was administered when the pain score was 5 out of 10 or more. If the pain still remained, tramadol HCl 2mg /kg administered with intravenous infusion.

New generation electromagnetic Storz Medical Modulith SLK ESWL device was used for entire procedure. In order to ensure confort, efficiency and safe applications; ultrasonic focusing was used. Eighty-one patients had right kidney stone and procedure was applied with prone position for all of them. The remaining 70 patients with left kidney stone, prone position was used for 55 of them having no superimposed stone to 12th rib. For 15 patients with superimposition, slightly sided prone position used for 5 and supine position for 10 patients. One to six sessions of ESWL (average 2) were applied to all cases. The number of shockwaves for every session was 1500-5000 (average 2500) and intensity of shocks were between 45-75 kv. (average 60), Patients rescheduled for follow-up for 10th, 20th, 30th days and 3rd month after the procedure. During follow-up, all patients were controlled using both urinary x-rays and ultrasounds. The interval between sequences was 10 days. All patients had their advice & recommendations concerning prescribed drugs (analgesics, antiseptics), requirements of fluid intake and necessary bed positions. Sportive activities were also recommended

RESULTS

After the 3 months follow-up, 133 patients were stone-free among all 151 patients having lower calyx stones (88.1%).The remaining 8 stones (11.9%) were removed and/or cleaned with flexible ureterorenoscopy (fURS) or percutaneous nephrolithotripsy (PCNL) because of unsuccessful fragmentation and/or existing residual stones. No analgesia was required for 140 (92.8%) patients. Intramuscular diclophenac sodium was administered to 7 (4.6%) patients and intravenous tramadol HCl infusion was administered to 4 (2.6%) patients. Hematuria was observed in 110 (72.8%) patients and considered as a minor complication. No haematuria persisted over 24 hours. Hematuria generally was detected during the first voiding following ESWL and no macroscopic hematuria observed at the later urines. A perianal hematoma was developed at one patient who was under coumadine administration and having a stone with the diameter of 20 mm. The stone street was developed at three patients and these are treated with ureterorenoscopic lithotripsy. CT scans of unsuccessfully treated patients showed infundibular angles >90°. Calyceal neck was extremely narrow at 5 cases and calyceal length was 1 cm or more in 8 patients.

DISCUSSION

ESWL (Extracorporeal Shock Wave Lithotripsy) was brought to medical domain by Chaussy at year 1980 and has a rapid expansion of its usage(1). Main purpose for the treatment of the lower calyx stone is no remaining milimetric fragments because of their 21-26% growing potential even for remnants less than 4 mm of diameter. ESWL is a non-invasive method of therapy and can be applied without anesthesia. It is also known as first line treatment for lower calyx stones up to 1 cm. Long term follow-up of retrograde intra-renal surgery on the basis of residual stones contains a significant advantage but requires general anesthesia (1-3).

Another affecting factor to the success of ESWL for lower calyx stones is anatomical structure of the calyx being subject of many reports. A study done by Günlüsoy et al. with 93 lower calyx stones (only patients with appropriate IVP and isolated lower calyx stones enrolled) showed 70.9 % success, but this rate was later corrected to 89.7 % for the patients having less than 7 ratio for infundibular length in comparison to width. Therefore, it is determined that ESWL is a safe method and has significantly lower side effects and also increased success rates when infundibular angle is larger, size of stones are small and ratio of infundibular length to width is less(4). There are some factors which influence to the success of ESWL such as the nature of the stone, the burden of the stone, anatomical variation of the lower calyx and the type of the lithotriptor used. Most difficult fragmentation can be observed for cystin and calcium oxalate monohydrate stones (5). A study performed by Odaba et al. with 340 patients investigated 77 lower calyceal stones. Two patients showed persistent residual stones, 4 patients has fragmented but no stone free status and this study considered with a success rate of 96 %. This rate decreased to 79% for the stones larger than 2 cm2 .

A separate study by Tas et al., ESWL applied to 171 kidney and ureteral stones. Forteen of them had lower calyceal stones and the success rate was reported as 78.8% (7). In our study, we used intravenous contrast CT scan and or intravenous pyelogram (IVP) for the unsuccessful attempts and detected that stones were larger, infundibulo-pelvic angle was narrow, the length of the the calyx was long and neck of calyx was narrow. The other negative factor is the bigger size of fragments. The smaller is the size of fragments the higher the chance to remove /clean stones. In our study this rule was also confirmed in parallel with previous reports. New generated lithotriptors (electromagnetic, piezoelectric) with less focused geometry and less energy obtain success with more frequent sequences. Danuser et al. applied ESWL to 96 patients with solitary lower calyx stones under epidural anesthesia by HM3 (Dornier Medical Systems) lithotiriptor. After 3 months follow up, 65 of 96 patients has showed successful results (success rate 68%) . Parameters as gender, age, body mass index, stone diameter, stone volume, infundibular wideness, infundibular length , infundibulo-pelvic angle and volume of collector system were also evaluated. It is determined that all above- mentioned factors are important for efficacy of stone removal (8).

In a study performed by Sampaio et al. for 74 lower calyx stones with Lithostar Plus Stone-Breaking device, authors found 75% success with no residual stone when infundibulo-pelvic angle was wider than 90° and 23% when this angle was smaller than 90°. Elbahnasy et al. considered that positive factors for ESWL results are infundibulo-pelvic angle > 70°, infundibular length < 3cm. and infundibular wideness >5cm. If these three factors coexist, the success rate may arise up to 91%, but if none of them exist, this decreases to 50%. In the second circumstances, authors recommend PCNL or fURS (10). ESWL also has complications despite it is minimal invasive nature. One of the major complications is hematoma due to vascular injury. Although this complication has no significant incidence, this rate was reported to be 1-25 %(11). Furthermore, shock waves may hit some adjacent tissues or organs due to breathing movements and can cause damage or injury of these tissues. It has been de-

monstrated renal micro vascular hemorrhage and injury at animal experiments (12). ESWL can be harmful to adjacent tissues such as muscles, stomach, pancreas, spleen, liver or intestines (13). ESWL also may cause bleeding, perforation and cardiac arrhythmias. There is also a very small percentage for developing diabetes or hypertension (14). In our study; with breath holding and online ultrasound method, the stone was always at center of the focus and this side effect minimalized. Uninterrupted ultrasonic observation was also helpful to monitorize possible hematuria. It took time to distinguish between stone fragmentations and haematuria. In our study, microscopic hematuria seen temporarily and disappeared within 12 hours. After the removal of the stones and within long term follow-up there was pain or discomfort at the shooting area. All studied patients were monitorized for ECG, pulse, blood pressure and O2 saturations. No problem encountered in the patients with pacemakers.

In conclusion, ESWL with a new generation with ultrasound focusing is a safe and effective treatment method thus, it must be considered as first choice for the treatment of lower calyceal stones 2 cm or less in diameter.

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