British Journal of Medical and Surgical Urology (2011) 4, 243—247

ELSEVIER

British Journal of
Medical & Surgical
Urology

www.elsevier.com/bjmsu

ORIGINAL ARTICLE

Factors predicting the success of extracorporeal shock wave lithotripsy in the treatment of ureteric calculi

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Received 5 April 2011; received in revised form 2 June 2011; accepted 6 June 2011

KEYWORDS
Lithotripsy;
ESWL;
Ureter;
Stones

Summary
Objective: To evaluate the success of extracorporeal shock wave lithotripsy (ESWL) in the treatment of ureteric calculi and determine the factors which influence outcome.
Patients and methods: A retrospective audit of patients with a single ureteric stone receiving ESWL was performed. Success was defined as complete stone clearance on post-treatment imaging. Patient demographics and stone characteristics were correlated to ESWL outcome.
Results: 108 patients met the inclusion criteria for this study. The mean age of the patients was 52.5 years (range 24—89 years). 80% (86/108) of patients were male. Stone sizes varied from 4 to 19 mm (mean 7.92 mm). The overall ESWL success rate for ureteric stones was 79%. Treatment was more effective for smaller ($p = 0.003$) and more proximally located stones ($p = 0.035$). Stone size correlated with number of treatments required ($p = 0.005$). A JJ stent *in situ* at the time of ESWL reduced the success rate ($p = 0.002$).
Conclusions: Stone size, site in the ureter, and the presence of a JJ stent were predictors of ESWL success. Our study from a District General Hospital in the UK demonstrates that ESWL may be used with high efficacy to treat ureteric stones.

Introduction

Urolithiasis is a major clinical and economic burden for Western health care systems. It is estimated that up to 13% of men and 7% of women present with renal stones in their lifetime and the prevalence is increasing [1]. Stones most commonly affect people

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1875-9742/$ — see front matter
doi:10.1016/j.bjmsu.2011.06.001

between the ages of 20 and 60. Urinary tract stones are a common presentation to hospital emergency departments resulting in overall annual costs in the US of more than $5 billion in 2005 [2]. Whilst many stones will pass spontaneously with or without medical expulsion therapy, others require intervention with ESWL, ureteroscopy or PCNL [3].

Ureteric stones are generally managed with either ureteroscopic extraction or ESWL when intervention is required. Although a relatively safe procedure, ureteroscopy does have some significant potential complications including ureteric stricture and perforation [4—6]. ESWL is an attractive treatment modality offering a minimally invasive and convenient treatment option, delivered in an outpatient setting and resulting in low complication rates [7,8]. However, in contrast to endoscopic and open surgical procedures, patients treated by ESWL are not immediately stone-free. Some patients will require repeat sessions of ESWL and others will have residual fragments that may require auxiliary interventions. Moreover, a small percentage of ureteric stones may not be fragmented by ESWL. Several factors determining the success of ESWL treatment of ureteric stones have been studied. These include the stone site, size, crystal type, degree of obstruction, stone impaction and function of the renal unit [9,10].

The aim of this work is to evaluate the success of ESWL within a district general hospital and to determine prognostic factors which reliably affect the success of ESWL and can be used to guide choices over the appropriate treatment of ureteric stones.

Patients and methods

The data from all patients undergoing extracorporeal shock wave lithotripsy for renal tract calculi within the urology department at the Royal Berkshire Hospital was reviewed over a two and a half year period from September 2007 to March 2010. Study inclusion criteria were radiological evidence of a single ureteric calculus less than 20 mm with no previous intervention to this stone. Patients were excluded if they had multiple stones on imaging or if there was no available post-treatment imaging or documented follow up. After these criteria were met, 108 patients were available for inclusion in this study.

All lithotripsy treatments were performed within the same department on the same lithotripter (a fixed-site Storz Modulith SLX). All lithotripsy was performed by either the same doctor or the departmental radiographer using either ultrasound or fluoroscopic targeting. All data was collected prospectively including patient characteristics (sex and age), stone factors (size and location within the ureter) and presence/absence of double J-Stent. To define stone site the ureter was divided into three areas (i) the pelvi-ureteric junction (PUJ), (ii) upper ureter: between PUJ and sacro-iliac joint and (iii) lower ureter, distal to sacro-iliac joint. Post-treatment imaging, stone-meeting discussions, clinic letters and theatre records were retrospectively reviewed to determine the outcome of each patient. Data over the 30 month period was collated in a database.

Success was defined as complete resolution of the ureteric stone using ESWL treatment alone. This was confirmed with post-treatment imaging using plain KUB X-ray for radio-opaque stones or CTKUB for radio-lucent stones. Imaging was performed two weeks following treatment and was reviewed at the stone meeting. Failure was defined as incomplete clearance of the ureteric stone requiring secondary procedures. Those that failed lithotripsy were listed for ureteroscopy and laser stone fragmentation.

Statistical analysis

Data when presented as mean includes standard error of mean. Where statistical analysis is employed unpaired *t*-tests were used. ANOVA contingency tables and Chi-squared analysis were used to compare the influence two or more variables may have had on a successful outcome. Results were considered significant when $p < 0.05$.

Results

Patient demographics and stone characteristics

There were 108 patients included in the study who received ESWL as a primary treatment modality for ureteric stones at the Harold Hopkins Department of Urology, Royal Berkshire Hospital, Reading, UK, in the study period.

The mean age was 52.5 years (range 24—89 years). There was no statistical difference between mean ages of those patients that received successful lithotripsy (mean age 51.0 years) from those that failed treatment (mean age 57.7 years). Of the 108 patients, 86 (80%) were male and 22 (20%) were female. There was no statistically different rate of success for men (79.1%) compared to women (77.3%) (Table 1).