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Management Of Ureteric Calculi: The Pendulum Swings

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Summary

Extracorporeal shock wave lithotripsy (ESWL) for treatment of ureteral calculi has gained wide popularity because of its non-invasive and ambulatory nature. The success rate using the Dornier MFL 5000 is about 77%, but retreatment is often required and stone clearance is gradual. Ureteroscopic lithotripsy (URSL) used to be performed as an in-patient procedure. With the introduction of Holmium laser and establishment of day surgery service, out-patient URSL carries a success rate of 93% and offers immediate stone clearance. It is an attractive alternative for low surgical risk patients as a primary treatment modality. (HK Pract 1997;19:583-590)

摘要

體外聲波碎石術(ESWL)因為屬於非侵入性療法而且病人毋須住院，故得以廣泛應用。使用Dornier MFL 5000型體外碎石機時，手術成功率約77%，但輸尿管結石清除較慢而且經常需多次治療。以往，病人需要住院施行輸尿管鏡取石術(URSL)。引用Holmium激光治療機及建立日診手術服務後，門診病人輸尿管鏡取石術成功率達到93%，而且是即時清除結石。對低危險性外科病人，URSL是另一種很值得注意的療法。

Introduction

The introduction of extracorporeal shock wave lithotripsy (ESWL) has revolutionized the treatment of urinary stone disease.¹ Its use has been

extended to in situ treatment of ureteric stones with reasonable success rates.^{2,3} Essentially, it is a non-invasive therapy which can be performed on an out-patient basis (**Table 1**). However, the fragmented stone takes time to pass,

for a period of up to three months. Retreatment is also frequently required to enhance the success rate. And there remains some stones which fail the ESWL therapy and where endoscopic procedure would be indicated.⁴⁻⁶ On

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Table 1: Available treatment modalities for ureteric calculi in order of invasiveness

Nature	Modality	Anaesthesia
Conservative	Await spontaneous passage	not applicable
Non-invasive	Extracorporeal shock wave lithotripsy	IV sedation
Minimally invasive	Ureteroscopic lithotripsy	SA/GA
	Percutaneous nephrolithotripsy	GA
Minimally invasive, combined modality	Ureteroscopic manipulation, followed by Extracorporeal shock wave lithotripsy	SA/GA
Minimal access surgery	Laparoscopic ureterolithotomy	GA
Invasive	Open ureterolithotomy	GA

IV = intravenous; SA = spinal anaesthesia; GA = general anaesthesia

the other hand, there has been major technological advances for intracorporeal lithotripsy including the development of small calibre semi-rigid ureteroscopes, and powerful yet safe lithotripsy mechanism such as Holmium laser.⁷⁻¹¹ In fact, out-patient ureteroscopic lithotripsy has been practised worldwide and regarded as a viable alternative treatment modality to ESWL, in view of its ambulatory nature and minimal associated morbidity.^{12,13} This treatment modality meets the increasing demand for a highly successful therapy for ureteric calculi which can offer rapid stone clearance with minimal morbidity.

Extracorporeal shock wave lithotripsy

The high success rate of ESWL for renal stones leaves very little room for controversy. With the advance in

technology, including localization modalities and shock wave delivery systems, the use of in situ ESWL (no operative manipulation of stone) has been extended to the treatment of ureteric calculi at all levels. The Dornier MFL 5000 was the first lithotripter introduced to the public service in 1991. The machine delivers a spark-induced shock wave focused by an ellipsoid. Its variable power generator can deliver a wide range of shock wave energies enabling the fragmentation of stones under minimal analgesia. A dual stone localization system (fluoroscopy and ultrasonography) is available and the unit's design as a multi-purpose table allows its various urological procedures to be performed. In the year 1996, two more lithotriptors were installed in other public hospitals under the Hospital Authority, the waiting time for elective treatment has since been reduced dramatically.

ESWL success rates

The Dornier MFL 5000 lithotripter was introduced into the market in 1988. Watson and associates first reported a success rate of 72% for single session treatment and 81% for retreatment using this model in 1993.¹⁴ In the year 1994, Ehreth and associates reported success rates of 67% for renal and upper ureteric calculi and 83% for middle and lower ureteric stones respectively.¹⁵ In this institute, we reported a success rate of 77% (retreatment rate 16%) based on our initial review of 124 patients.¹⁶ Sixty two percent of patients required intravenous injection of sedatives or opioid analgesia for pain control during the procedure.

In another review of 251 patients suffering from ureteric stones from 1991 to 1994 where 184 patients received ESWL, an overall success rate of 77% was again noted.¹⁷ An average of 1.23 sessions was required for each patient. Stone size was found to affect the outcome significantly: for stones of size ≤ 10 mm, the success rate was 86%; whereas for stones > 10 mm in size, a success rate of 66% was recorded. It must be noted, that only 70% of the patients received ESWL as the primary treatment. The common reasons for choosing other modalities included bilateral ureteric calculi, presence of major obstruction, giant stone size and anticipated difficult stone localization for ESWL. Thus, while many patients benefit from ESWL as an ambulatory and non-invasive treatment for their ureteric calculi, there are a significant number of others who will require endoscopic intervention either as a primary

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therapeutic option or as an auxiliary procedure to failed ESWL.

Out-patient ureteroscopic laser lithotripsy

In this hospital and many other hospitals in Hong Kong, ureteroscopic lithotripsy used to be performed as in-patient procedures. In a previous study comparing URSL and ESWL, we

reported a mean hospital stay of 3.7 days for patients undergoing URSL.¹⁸ At the time of the study, the intracorporeal lithotripsy mechanism was limited to ultrasonic lithotriptor and electrohydraulic lithotriptor, which could result in inadvertent perforation of the ureter. It was most natural that more patients opted for ESWL despite a much longer waiting time for the procedure during the study period. In fact, our treatment guidelines in 1995

were to offer ESWL as primary treatment modality for most patients. The frequency of various treatment modalities employed by our institution in the 90's are shown in **Figure 1**. Since 1996, the Holmium: YAG laser has been available in our institution. In the same year, the Day Surgery Centre was opened, and ureteroscopic lithotripsy (URSL) was arranged as an out-patient procedure. The logistics for arrangement of out-patient URSL is shown in **Table 2**.

Figure 1: Number of patients undergoing various treatment modalities for ureteric calculi in the 90's

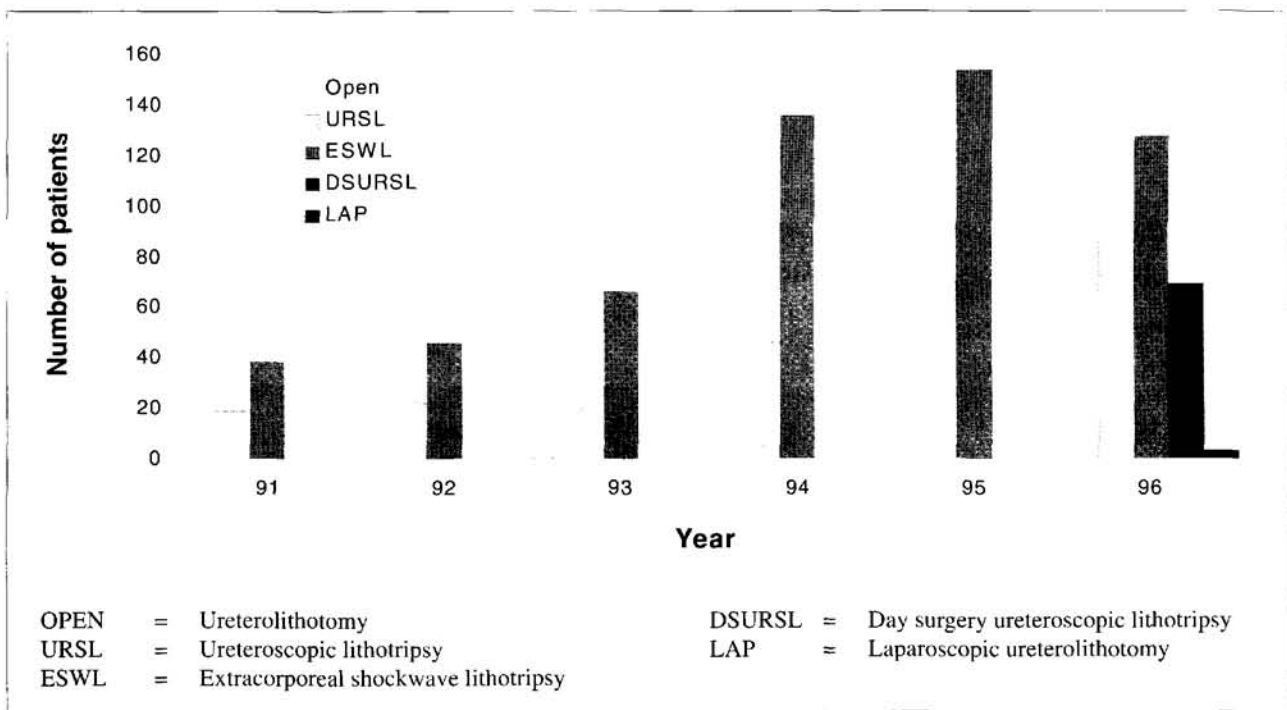


Table 2: Ambulatory ureteroscopic lithotripsy logistics

- Consent to out-patient ureteroscopic laser lithotripsy
- Attendance at pre-operative assessment clinic to be seen by urologist and anaesthetist
- Operation performed in the morning session to allow ample time for recovery
- Patient accompanied by adult upon discharge, responsible adult to take care of patient subsequently
- Access telephone number for inquiries
- Telephone follow up on post-operative day 1 and day 3

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Holmium: YAG laser

The Holmium: YAG laser (Versa Pulse select; Coherent, Palo Alto, CA) produces light of wavelength 2124 nm, which is delivered in a pulsatile manner and has tissue penetration of less than 0.5 mm. The Holmium device is a true thermal laser and acts by superheating water, thus creating a microscopic vaporization bubble at the tip of a quartz fibre. The bubble collapse as well as surface ablation produce erosion plus mechanical disruption powerful enough to vaporize and fragment all types of calculi, while its thermal effect can be localized to an area a few millimeters from the fibre tip as long as continuous irrigation is applied. The risk of intra-luminal trauma is therefore very low. In short, it allows powerful stone fragmentation in a very safe manner.⁷⁻¹¹

URSL results

Erhard and Bagley reported their preliminary results of the urological applications of the Holmium laser in 1995, laser lithotripsy was commented to be highly successful and extremely safe.⁹ In the same year, Matsuoka *et al* reported a success rate of 87% in 38 procedures.¹⁰ In 1996, Glasso reported a remarkably high success rate of 97% in 34 patients.¹¹ In this institution, from January 1996 to March 1997, 48 male and 36 female with mean age of 47.9 (range, 21-76), and ASA (American Society of Anaesthetist) status I or II underwent ureteroscopic lithotripsy under general anaesthesia for their ureteric calculi using Holmium laser and semi-rigid ureteroscopes as an out-patient procedure. Twenty-one upper, 18 middle and 45 lower ureteric stones were treated, the mean stone burden

measured 12.0 mm (5-45). The mean operative time was 60 minutes (15-150). Complete clearance was achieved in 78 patients (92.9%). All patients were discharged on the day of operation. The complication rate was 7.1% (6/84). This included 5 unscheduled readmissions (fever – 2 patients; pain – 2 patients; stent migration – 1 patient) and 1 stricture formation which resolved with endoscopic intervention.

Reasons for high success rate

1. The breakthrough was largely related to the instalment of the Holmium: YAG laser, which can provide unsurpassed stone fragmentation in an extremely safe and controlled manner.¹⁹ The Holmium laser can be used with a small calibre semi-rigid ureteroscope, which further

Table 3: Extracorporeal shock wave lithotripsy (ESWL) and ureteroscopic laser lithotripsy (URSL) – a brief comparison

	ESWL	URSL
Patient selection	all patients	low surgical risk patients
Clearance of stone	gradual, up to 3 months	immediate
Success rate (in our institution)	77%; significantly lower if stone >10 mm	93% for mean stone size of 12 mm (range 5 – 45)
Retreatment	frequently required; not regarded as failure	not desirable; regarded as failure
Follow up visits & x-ray	multiple until clearance	limited
Choice of treatment	primary treatment	primary treatment and auxiliary to failed ESWL

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Key messages

1. Extracorporeal shock wave lithotripsy (ESWL) is suitable for treatment of most ureteric stones with a reasonable success rate. However, retreatment is often necessary and stone clearance is slow.
2. With the use of newer semi-rigid ureteroscopes and laser device, Ureteroscopic lithotripsy (URSL) provides a higher success rate with immediate stone clearance. In selected patients it can be performed on a day basis with minimal morbidity.

reduces the trauma to the ureter during the ureteroscopic manipulation. Thus, once the infrastructure of The Day Surgery Centre was established, we have been much more liberal to offer out-patient URSL to our patients who have a low surgical risk, as an alternative treatment to ESWL.

2. The fibre-optic semi-rigid ureteroscopes are easy to handle and allow very good vision. They have been refined to allow direct access of the ureter without the need of pre-operative stent insertion or balloon dilatation immediately prior to the ureteroscopy. They are also rather durable and allow certain degree of torque thus enhancing access to the upper ureter even in male patients. URSL can therefore be offered to all levels of stones, irrespective of the gender.
3. The liberal use of internal stenting has also been significant in allowing the procedure to be conducted as an out-patient procedure. The current stent insertion rate of 77% is much higher than our previous stent insertion rate of 47%, where many of which were in fact external

stents that had necessitated in-hospital stay post-operatively. The availability of flexible cystoscopes has also rendered removal of an internal stent a simple procedure that causes minimal discomfort, if any. Erhard *et al* reported similar experience of switching from external stents to internal stents and promoting the procedure to be conducted on out-patient basis.²⁰

URSL as an out-patient procedure

Kelly demonstrated in his series that laser lithotripsy could be performed in a significant number of patients as a day case procedure.²¹ In his series, 6.7% of his patients required admission on the day of surgery, including three patients admitted for pain control and one patient admitted following perforation of the ureter. Boline had 90% of his patients discharged the same day, 96% within 23 hours while 4% required hospital admission.¹³ All our patients were discharged on the day of surgery, our readmission rate of 6.0% is acceptable in a day surgery setting. Our results have led to a major revision of the policy in this institution. In 1995,

ureteroscopic lithotripsy was performed as an in-patient procedure, and in the years 1996 and 1997, ureteroscopic lithotripsy became an out-patient procedure in the Day Surgery Centre in about 40% and 70% of cases respectively.

Recommendations

With these results, we would not be hesitant to recommend ureteroscopic laser lithotripsy even in those patients whose stones had been previously considered by us to be difficult for ureteroscopic lithotripsy. URSL using the Holmium laser is a highly successful out-patient procedure, associated with a low complication rate and recommended as an ambulatory, minimally invasive treatment alternative in low risk patients (Table 3). While we consider URSL as attractive a treatment modality as ESWL, it is important that patients should be allowed a free choice of the treatment options.

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