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Original Research Article

Shockwave lithotripsy for urolithiasis: a 12-month analysis of referral data to a metropolitan Australian Hospital

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ABSTRACT

Background: Extracorporeal shockwave lithotripsy (SWL) is still an important option in the treatment of renal tract stones. SWL is not without its limitations and alternatives should be considered. This study investigates the referral data to a new SWL planning meeting to identify reasons why SWL was not offered.
Methods: A review of 12 months of data prospectively collected at a weekly stone meeting was supplemented with a retrospective chart analysis to identify the source of all referrals for SWL. The principal reason for diverting a patient to other stone management was noted.
Results: 142 patients (median age 52 years) were referred for SWL over the 12-month period. SWL was not recommended in 40 (28.2%) patients. SWL was most commonly contraindicated due to excessive stone size±position (32.5%), anatomical complexity (25.0%) and radiolucency on x-ray (10.0%). The majority of patients who were diverted away from SWL were referred from an emergency department (32.5%) and the general urology clinics (20.0%).
Conclusions: A significant portion of patients referred for SWL prove unsuitable for this method of stone clearance. This highlights an educational gap amongst clinicians regarding the indications and more importantly contraindications for SWL. Only 6.3% of total referrals originated from general practice suggesting a lack of awareness of the process of direct referral for SWL. Improving this with guidelines will relieve demand in outpatient clinics and help streamline patient care.

Keywords: Lithotripsy, Nephrolithiasis, Referral, Shockwave, Urolithiasis

INTRODUCTION

Extracorporeal shockwave lithotripsy (SWL) remains an important option in the treatment of both renal and ureteric stones. It has been demonstrated to be equivalent to percutaneous nephrolithotomy and ureteroscopy in the management of intermediate-sized upper renal tract calculi.[1] Chan et al demonstrated that SWL was an excellent choice for rapid and non-invasive treatment of solitary lower pole stones between 10-20 mm.[2] The efficacy and fiscal efficiency for the treatment of smaller (1-10 mm) had previously been demonstrated.[3,4]

There remain a number of stones that are not suitable for treatment with SWL. In deciding appropriate treatment it is important to consider the size and density of the stone on imaging, the anatomical complexity including location of the stone, the presence of renal artery or abdominal aortic aneurysms, and whether a female could be

pregnant.[5] It is important to identify whether a patient is suitable for SWL early to facilitate prompt management.

A new metropolitan based lithotripsy service was established in December 2014 utilising a Storz Medical (Switzerland) SLK inline lithotripter. Uniquely for Australia all adult patients are treated without general anaesthesia in a dedicated unit within the diagnostic imaging department. To streamline the patient, journey any doctor, including general practitioners, can complete a referral for SWL (either paper or online). A weekly stone meeting reviews the referrals and appropriate imaging with those cases felt suitable being booked directly for treatment. If SWL is felt to be inappropriate the patient is reviewed in a dedicated stone clinic to discuss treatment options.

This study reviews the referrals to the service to better understand which doctors are referring and to assess what proportion of referrals are deemed appropriate. We would hope to encourage more use of the streamlined referral.

METHODS

All patients referred to the SWL service at a metropolitan Melbourne (Australia) hospital network (Monash Health) between 1st December 2017 and 30th November 2018 were included. The location of the original stone that was referred for treatment with SWL are noted in Table 1. Patients referred for repeat treatment of the same stone or its fragments were excluded.

The dedicated referral for SWL can be completed by any doctor either online or on paper. The required information includes radiological details of the stone, patients' general health and any relevant investigations which have been ordered (for example, urine microscopy/culture or X-ray kidney/ureter/bladder (KUB) or CT KUB).

Each referral is reviewed at a weekly stone meeting attended by several urologists with significant experience in stone management to discuss whether SWL is appropriate.

For a 12-month period an additional form was completed prospectively by the team to record source of referral and the decision to either book SWL, advise no treatment at all or review the patient in the stone clinic. If patients were diverted away from SWL then the reason for this and the suggested alternative treatment were also recorded.

Despite meticulous documentation by a specifically assigned staff member, data was sometimes incomplete. A retrospective medical chart analysis was performed to supplement data obtained from the stone meetings.

Data on the characteristics of the stones including quantity, size and location were obtained from the referral form and confirmed by accessing radiological reports from X-rays or CT KUB available on the hospital system. External radiology was accessed via online portals in a few instances were no images were available on the hospital system.

Percentages and measures of central tendency were calculated using IBM SPSS statistics standard (version 23).

RESULTS

A total of 142 patients were referred to the stone planning meeting. There were 98 (69.0%) males and 44 (31%) with a median age of 52 years (range 22.7 - 82.5).

Details on stone characteristics and referral source are contained in Tables 1 and 2. The majority of stones (87.4%) were ≤10 mm and the largest referral base was from private consultant rooms (32.3%). Disappointingly only 10.0% of referrals were directly from general practitioners.

Table 1: The stone characteristics across the entire cohort patients (n=142).

Stone characteristics		Number (%)
Number of stone (s)	0	1 (0.7)
	1	86 (60.6)
	2	33 (23.2)
	3	10 (7.0)
	>3	10 (7.0)
Size of stone (s) (largest diameter measured in mm)	0.1 - 5.0	40 (28.2)
	>5.1 - 10.0	84 (59.2)
	>10.1 - 15.0	15 (10.6)
	15.1 - 20.0	3 (2.1)
	>20.0	0 (0.0)
Location of stone (s)	Upper pole	20 (14.1)
	Mid pole	15 (10.6)
	Lower pole	64 (45.1)
	Renal pelvis	8 (5.6)
	Proximal ureteric	13 (9.2)
	Middle ureteric	11 (7.7)
	Distal ureteric	10 (7.0)

Table 2: Source of all extracorporeal SWL referrals.

Source of referrals	Number (%)
Private consultant offices	46 (32.3)
Outpatient clinic	38 (26.8)
Emergency department	28 (10.7)
Inpatient ward	11 (7.7)
General practice	9 (6.3)
Other	10 (7.0)

A total of 40/142 (28.2%) patients were diverted from SWL to other forms of stone management. Thirteen of the 40 (32.5%) were rejected due to stone size or a

combination of size and position e.g. 10 mm lower pole stone, while 10 (25.0%) were rejected due to the complexity of the anatomy involved (Figure 1). Six (15%) patients were rejected as the stones could not be seen on a plain KUB and the majority of the stone localisation with the SLK inline lithotripter depends on image intensification. These stones are also more likely to be uric acid and could be considered for dissolution therapy. Four of the 40 (10%) patients did not have stones.

Those that were rejected as a consequence of exceeding the size criteria for SWL were mostly recommended for ureterorenoscopy (76.9%). A smaller proportion (23.1%) were diverted to percutaneous nephrolithotomy. A similar trend was observed in patients rejected due to anatomical complexity: 70.0% were directed to ureterorenoscopy and 30% to percutaneous nephrolithotomy.

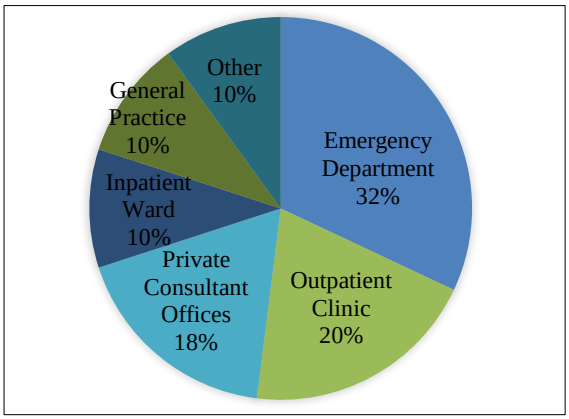

Figure 1: The source of rejected extracorporeal SWL referrals.

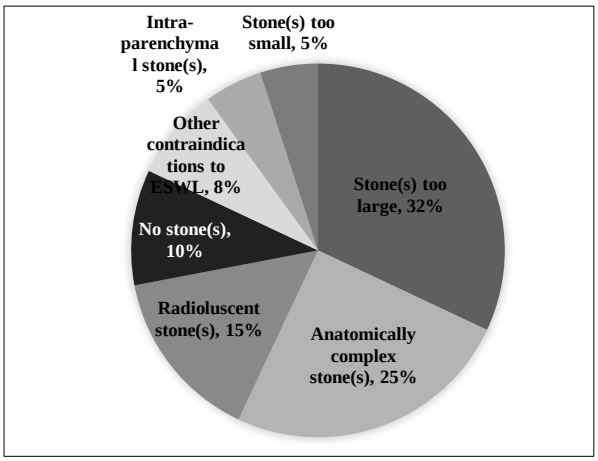

Figure 2: The reason for rejection of extracorporeal SWL.

The largest number (13/40) of patients diverted away from SWL were referred from the emergency department. The main reason was due to large stone size (8/13). The next largest source of inappropriate referrals stemmed from the outpatient clinic (8/40). Similarly, the most common reason for rejection in this group was because of large stone size (4/8). Those rejected from private consultant offices (7/40) were largely due to their complexity (2/7) (Figures 1 and 2).

DISCUSSION

The practice of medicine has gradually shifted toward specialist care. An important duty of a doctor in this modern climate is in referring patients to other specialists when patient care requires their expertise. Three distinct attributes that contribute toward referral appropriateness are necessity, quality and destination.[6] The paradox lies in knowing enough about the specialty to make an appropriate referral whilst acknowledging that assistance may be required in the patient's management. As a result, referrals can be difficult and inappropriate referrals can lead to delays in patient care.

The results of this study demonstrate the difficulty in making an appropriate referral with almost a third of patients specifically referred for SWL being deemed inappropriate and diverted to other forms of stone management. The most common reasons were stone size, anatomical complexity and radiolucency. The referral process in the health network involves the completion of a lithotripsy consultation form which is submitted either via fax/post or online. Whilst the process is logistically simple, the challenge is to ensure an appropriate referral. Two major contributing factors that may prevent this are the lack of clear protocols and the general lack of knowledge amongst clinicians regarding SWL.

Currently there are only very superficial referral protocols within the hospital repository and popular clinical guidelines such as UpToDate (UpToDate, Inc. Waltham, MA). These clinical practice assistance tools focus on stone size greater than 20mm and an anatomically complex renal collecting system as contraindications but do not provide in depth guidance regarding which cases are most suitable for SWL. There is a dearth of material on other important contraindications. The widely quoted stone treatment guidelines do not go into any technical details about suitability for SWL.[7]

Patients with any ureteric anatomical abnormalities that hinder the passage of stone fragments such as ureteric stricture should be excluded.[8] There should also be consideration of stone morphology as it is widely accepted that stones with an upper diameter of 20mm and a surface area of 115-180mm^2 are most suitable for management with SWL. However, stones that demonstrate density greater than 1000 Hounsfield Units show poor results.[9] For stones within the kidney, SWL is not recommended for lower calyx stones exceeding 15mm as gravity and dependence results in poor fragment clearance.8 Previous stone analysis can be valuable information as stones composed of calcium oxalate-monohydrate, brushite and cystine can be shockwave

resistant due their hardness, though this information is not always available.[10]

It is well recognised that ureteric calculi at all ureteric levels can be adequately treated with SWL alone and the number of referrals for ureteric lithotripsy in this study was disappointing.[11] A renewed enthusiasm for treating ureteric stones may be generated by the recently published NICE guidance.[12]

The most common source of inappropriate referrals was the emergency department (32.0%) mostly in terms of their necessity and their quality. This could be a product of time pressure, variable degrees of clinical knowledge and inexperience in management of urolithiasis within the emergency department. SWL is a highly specialised management option for stones and clear guidelines need to be available for junior doctors (who tend make up a majority of the Emergency Department workforce) and other specialists. Urologists are also encouraged to educate junior doctors in both an informal and formal capacity.

The proportion of SWL referrals originating from general practice was disappointingly small (6.3%) despite repeated efforts to advertise the service to general practitioners (GPs). The SWL service readily accepts direct referrals from GPs in an attempt to expedite patient care but does mark a significant change from previous clinical practice. The difficulty getting GPs to use the dedicated SWL referral pathway unfortunately delays treatment and adds a further burden on already overstretched outpatient clinics.

There were a small number of referrals for SWL where no stone was present. These patients had been assessed with ultrasound scans which are notoriously unreliable in accurately diagnosing stones.[13] it was believed that all patients presenting with stone disease should have a CT scan to confirm diagnosis but are aware that the ease of obtaining such scans does lead to unnecessary exposure to ionising radiation.[14] Patient education regarding the risks of this exposure is important so that patients can inform doctors about their stone history and detail previous CT scans.

CONCLUSION

SWL is a minimally invasive and efficacious management option for a wide range of urinary tract stones. For patients to fully benefit from SWL an appropriate referral needs to be submitted. Currently a high proportion of patients are diverted to other forms of stone management leading to delays in treatment. Authors recommend that local SWL referral protocols are devised to ensure better use of the service when available.

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