Efficiency and cost of treating proximal ureteral stones: shock wave lithotripsy versus ureteroscopy plus holmium:yttrium-aluminum-garnet laser

Parker B D, Frederick R W, Reilly T P, Lowry P S, Bird E T

Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
Two treatments for proximal ureteral stones were examined, extracorporeal shock wave lithotripsy (ESWL) and ureteroscopy (URS) with laser lithotripsy.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised patients with radiopaque, solitary stones located between the ureteropelvic junction and sacroiliac joint. Patients with obstructing stones were eligible only if they had undergone stenting before definitive treatment.

Setting
The setting was a hospital. The economic study was carried out in the USA.

Dates to which data relate
The effectiveness and resource use data were gathered from January 1997 to June 2001. The price year was not reported.

Source of effectiveness data
The effectiveness evidence was derived from a single study.

Link between effectiveness and cost data
The costing was carried out retrospectively on the same sample of patients as that used in the effectiveness study.

Study sample
Power calculations were not reported. Patients were identified at the authors' institution from January 1997 to June 2001. An overall sample of 220 eligible patients was identified. The patients were stratified into those with stones less than 1 cm and those with stones 1 cm or greater. In the sub-group of patients with a stone size <1 cm, there were 81 patients (73% men) in the URS group and 73 patients (77% men) in the ESWL group. The mean ages were 44 (+/- 15) years (URS group) and 50 (+/- 17) years (ESWL group), respectively. In the sub-group of patients with a stone size >=1 cm, there were 28 patients (64% men) in the URS group and 38 patients (74% men) in the ESWL group. The
mean ages were 48 (+/- 16) years (URS group) and 55 (+/- 15) years (ESWL group), respectively.

**Study design**
This was a retrospective cohort study that was carried out at a single institution, the Scott and White Memorial Hospital in Temple (TX), USA. The treatment modality was determined by patient or surgeon preference. Eight different urologists performed all procedures. The length of follow-up was 6 months. No patient was lost to the follow-up assessment. No blinding of the outcome assessment was carried out.

**Analysis of effectiveness**
All of the patients included in the initial study sample were accounted for in the clinical study. The outcome measures used in the analysis of effectiveness were:

- success rate (determined by the following criteria: asymptomatic, stone-free by kidney-ureter-bladder radiography, without evidence of obstruction according to either ultrasonography or intravenous urography, when deemed necessary by the individual surgeon);
- additional, ancillary procedures;
- total procedures;
- efficiency (in relation to percentage stone-free, percentage of retreatment and percentage of auxiliary procedures; formula given);
- office visits;
- minor complications (required no intervention or hospitalisation); and
- major complications (required hospitalisation or additional intervention).

The study groups appear to have been comparable at baseline in terms of age and gender distribution.

**Effectiveness results**
In the sub-group of patients with stone size <1 cm, the success rate was 90% with URS and 60% with ESWL, (p<0.0001). In the sub-group of patients with stone size >/=1 cm, the success rate was 93% with URS and 45% with ESWL, (p<0.0001).

When considering all patients, 9% of URS patients required secondary procedures to render them stone-free (URS only in 8% and URS plus ESWL in 1%) versus 45% of ESWL patients (single additional ESWL in 14%, two subsequent ESWL procedures in 2%, URS only in 23%, and additional ESWL plus URS in 6%).

In the sub-group of patients with stone size <1 cm, the number of additional ancillary procedures was 21 with URS and 71 with ESWL. In the sub-group of patients with stone size >/=1 cm, the number of additional ancillary procedures was 11 with URS and 43 with ESWL.

In the sub-group of patients with stone size <1 cm, the total number of procedures was 102 with URS and 144 with ESWL. In the sub-group of patients with stone size >/= 1 cm, the total number of procedures was 39 with URS and 80 with ESWL.

In the sub-group of patients with stone size <1 cm, the efficiency quotient was 0.72 with URS and 0.46 with ESWL. In the sub-group of patients with stone size >/= 1 cm, the efficiency quotient was 0.72 with URS and 0.46 with ESWL.

In the sub-group of patients with stone size <1 cm, the mean number of office visits was 1.3 (+/- 0.7) (range: 0 - 4) with URS and 2.2 (+/- 1.3) (range: 1 - 7) with ESWL. In the sub-group of patients with stone size >/= 1 cm, the mean...
number of office visits was 1.6 (+/- 0.9) (range: 1 - 5) with URS and 2.7 (+/- 1.1) (range: 1 - 5) with ESWL, (p<0.001).

No statistically significant difference in the frequency of minor or major complications was observed.

Clinical conclusions
The effectiveness analysis showed that the success rate and efficiency quotient of URS were higher than for ESWL.

Measure of benefits used in the economic analysis
The health outcomes were left disaggregated and no summary benefit measure was used in the economic evaluation. In effect, a cost-consequences analysis was carried out.

Direct costs
Discounting was not relevant since the costs were incurred during a 6-month period. The unit costs were not presented separately from the quantities of resources used. The health services included in the economic evaluation were the initial procedure, subsequent procedures, radiographs and office visits. All further procedures needed to render the patient stone-free at 6 months occurred in the 6-month follow-up period. The cost/resource boundary of an HMO was used in the cost analysis. The costs and resource use data were estimated using the billing statements of the same patients as those included in the clinical study. The price year was not reported.

Statistical analysis of costs
Statistical analyses were carried out to test the statistical significance of differences in the costs.

Indirect Costs
The indirect costs were not considered in the economic evaluation.

Currency
US dollars ($).

Sensitivity analysis
Sensitivity analyses were not carried out.

Estimated benefits used in the economic analysis
See the 'Effectiveness Results' section.

Cost results
In the sub-group of patients with stone size <1 cm, the mean charges for initial treatment were $7,600 (+/- 3,000) with URS and $9,400 (+/- 2,200) with ESWL, (p<0.0001). In the sub-group of patients with stone size >1 cm, the mean charges for initial treatment were $7,500 (+/- 3,500) with URS and $9,700 (+/- 2,600) with ESWL, (p<0.001).

In the sub-group of patients with stone size <1 cm, the mean total charges were $9,200 (+/- 4,400) with URS and $14,900 (+/- 7,600) with ESWL, (p<0.0001). In the sub-group of patients with stone size >1 cm, the mean total charges were $10,000 (+/- 7,100) with URS and $16,900 (+/- 7,000) with ESWL, (p<0.0001).

Synthesis of costs and benefits
A synthesis of the costs and benefits was not relevant since a cost-consequences analysis was carried out.
Authors’ conclusions
Ureteroscopy (URS) with holmium:yttrium-aluminum-garnet (Ho:YAG) laser lithotripsy for the treatment of proximal ureteral stones was more effective and more efficient than extracorporeal shock wave lithotripsy (ESWL).

CRD COMMENTARY - Selection of comparators
The authors provided a justification for their choice of the comparators, with ESWL being the recommended treatment and URS the new intervention. You should decide whether they are valid comparators in your own setting.

Validity of estimate of measure of effectiveness
The effectiveness evidence came from a retrospective study. Owing to the lack of random allocation of the interventions, the impact of selection bias and confounding factors cannot be ruled out, although age and gender distributions were quite comparable at baseline. There was no evidence that the sample size was appropriate. No patient was lost to the follow-up assessment because only patients with complete data were considered. The evidence came from a single institution, thus caution is required when extrapolating the results of the analysis to other groups of patients. These issues tend to limit the internal validity of the study. The authors noted that the main weakness of their study was the retrospective, non-randomised, patient-driven design. It was further stressed that a prospective, randomised study would be difficult to design.

Validity of estimate of measure of benefit
No summary benefit measure was used in the analysis because a cost-consequences analysis was conducted. Please refer to the comments in the 'Validity of estimate of measure of effectiveness' field (above).

Validity of estimate of costs
A restricted perspective was adopted in the analysis of the costs and charges were used to derive the cost estimates. The authors stated that charges rather than costs were relevant for an HMO. Accordingly, the costs were derived from billing statements. Details on the unit costs and the quantities of resources used were not provided. The price year was not reported, which makes reflation exercises in other settings difficult. The cost estimates were specific to the study setting and sensitivity analyses were not performed.

Other issues
The authors stated that their findings were comparable with those from other studies. However, the issue of the generalisability of the study results to other settings was not addressed and sensitivity analyses were not carried out. This reduces the external validity of the analysis. The study referred to patients requiring treatment for the treatment of proximal ureteral stones and this was reflected in the authors’ conclusions.

Implications of the study
The study results supported the use of URS for the treatment of proximal ureteral stones.

Source of funding
None stated.

Bibliographic details
Other publications of related interest