Cost-effectiveness of medical management strategies for nephrolithiasis

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
Six technologies for the long-term management of nephrolithiasis were studied:

- conservative therapy, comprising dietary modification;
- empiric medical therapy, comprising drug and dietary treatment with metabolic evaluation;
- modified simple metabolic evaluation and management (SMEM) followed by appropriate drug treatment;
- SMEM with appropriate drug treatment;
- modified comprehensive metabolic evaluation and management (CMEM) with appropriate drug treatment; and
- CMEM with appropriate drug treatment.

Modified SMEM differed from SMEM in that patients with no metabolic abnormality were treated with potassium citrate rather than with no drug. Modified CMEM differed from CMEM similarly. Hydrochlorothiazide, at a dose of 25 mg/day, was used as one of the drug treatments. Potassium citrate was given as a tablet at a dose of 20 mEq twice daily.

Type of intervention
Treatment (long-term management).

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised patients with idiopathic calcium oxalate nephrolithiasis. Patients with primary hyperparathyroidism, renal tubular acidosis, cystinuria, infection stones, and primary or secondary hyperoxaluria were excluded from the study.

Setting
The setting was secondary care. The economic study was carried out in the USA.

Dates to which data relate
The effectiveness data were taken from literature published between 1963 and 2001. The dates for the unit costs were not reported. The quantities were determined by the decision model at the time of the study.

Source of effectiveness data
The effectiveness data were derived from a review and synthesis of published studies, supplemented, when required,
with some authors' assumptions.

**Modelling**
A decision analytic model using TreeAge Data 3.5 software (Williamstown, MA) was used to estimate the costs and outcomes. A graphical depiction of the model was provided.

**Outcomes assessed in the review**
The outcomes assessed were the stone recurrence rate in first time and repeat stone-formers, the risk of symptomatic events, and surgical intervention. Although the analysis was based on a model, the authors appear to have carried out a systematic review of the literature.

**Study designs and other criteria for inclusion in the review**
The authors searched for articles "addressing the natural history, evaluation, and medical and surgical treatment of renal calculi". They reported that some studies were randomised trials.

**Sources searched to identify primary studies**
The authors searched MEDLINE for English literature published between 1966 to the date of the study.

**Criteria used to ensure the validity of primary studies**
Specific inclusion and exclusion criteria for patients who could be included in the study were identified.

**Methods used to judge relevance and validity, and for extracting data**
Not reported.

**Number of primary studies included**
Thirty-one primary studies were included in the review.

**Methods of combining primary studies**
The authors estimated weighted means from the review to estimate the baseline parameter values. The weighting system might have been based on sample size and length of follow-up, although this was not explicitly stated.

**Investigation of differences between primary studies**
The authors did not discuss differences between the primary studies.

**Results of the review**
With dietary measures alone, the rate of stone recurrence was 0.07 stones per patient per year for first time stone formers and 0.3 stones per patient per year for repeat stone formers.

There was a risk reduction of 81% for potassium citrate alone and a 90% reduction for thiazide plus potassium citrate (associated with SMEM and CMEM treatments).

Fifteen per cent of recurrent stones become symptomatic each year and 55% of symptomatic stones require surgical intervention.
Methods used to derive estimates of effectiveness
The authors used assumptions to supplement their data requirement for the decision model.

Estimates of effectiveness and key assumptions
The following assumptions were made.

Among patients who require surgical intervention, half undergo shockwave lithotripsy and half ureteroscopy.

Simple and comprehensive metabolic evaluations identify specific defects in 70% and 90% of cases, respectively, excluding low urine volume.

All patients treated with empiric medical therapy derive maximal benefit from treatment, even though some may have no metabolic effect.

Patients with no metabolic abnormality on simplified evaluation and who receive no medical treatment carry the same risk of stone recurrence as those maintained on conservative therapy. They benefit from the same risk reduction as those with metabolic abnormalities.

Measure of benefits used in the economic analysis
The authors did not estimate a summary measure of health benefits. Therefore, a cost-consequences analysis was performed.

Direct costs
The authors did not report a perspective (e.g. third-party payer or health care provider) from which the costs were estimated. The authors aimed to estimate the cost of treatment and follow-up taking physician visits, medical evaluation, medication, and emergency room visits and/or surgery for stone recurrences into account. The costs from the local hospital were measured. The decision analytic model was used to estimate the total cost associated with each treatment strategy, thus resource use was determined by the model. The timeframe of the model was not reported, so it is not evident whether discounting of the costs was required. By way of example, the authors considered recurrence but it was unclear whether this was restricted to the year following initial treatment. If the model time horizon extends longer than one year then costs beyond that first year should be discounted. The dates when the cost data were collected were not reported.

Statistical analysis of costs
The costs were treated deterministically.

Indirect Costs
The authors estimated the daily salary to assess whether time lost from work might compensate for additional direct costs between the possible treatments. Daily salary was estimated from the 2001 Census of Population and Housing.

Currency
US dollars ($).

Sensitivity analysis
A one-way sensitivity analysis was carried out to estimate the impact of varying probabilities and costs inputted into the model. This enabled an estimation of the cost threshold at which different levels of risk decrease would achieve cost equivalence between the conservative treatment and each other treatment strategy.
Estimated benefits used in the economic analysis
Not relevant. See the Effectiveness Results' section.

Cost results
For first time stone formers, conservative treatment cost $133, empiric treatment cost $966, modified SMEM cost $1,085, SMEM cost $835, modified CMEM cost $1,170, and CMEM cost $1,087.

For recurrent stone formers, conservative treatment cost $258, empiric treatment cost $990, modified SMEM cost $1,104, SMEM cost $885, modified CMEM cost $1,187, and CMEM cost $1,114.

Synthesis of costs and benefits
Not relevant.

Authors' conclusions
Treatment with dietary measures alone can be justified for first time stone formers, owing to the small associated cost and relatively low recurrence rate. For recurrent stone formers, the authors concluded "since neither cost nor efficacy was improved by a more comprehensive evaluation or by more selective drug treatment... the time consuming comprehensive evaluation should be omitted".

CRD COMMENTARY - Selection of comparators
The authors selected a comprehensive range of treatment alternatives for comparison in their decision model. A valuable background was provided, and this helped to set the scene for the analysis and provide the reader with justification for the alternatives selected. Readers must assess the relevance of these comparators to their own setting.

Validity of estimate of measure of effectiveness
The authors carried out a systematic review of the literature in order to estimate parameter values for input into their model. They carried out a full search of MEDLINE and reported that data from the primary studies were combined using weighted means. These factors add to the validity of the study and provide confidence in the data used to populate the decision model. The authors might have provided further information on the criteria used to ensure the validity of the primary studies. This was referred to indirectly in the study limitations when the authors reported that they assumed that disease severity was comparable among stone prevention trials. The studies might have been categorised according to severity in order to improve the accuracy of their resulting model in respect to treating a specific group of patients.

Validity of estimate of measure of benefit
The authors did not estimate a summary measure of health benefit. The reader is referred to the comments in the 'Validity of estimate of measure of effectiveness' field (above).

Validity of estimate of costs
The costing analysis seems to have been carried out from the perspective of the health care provider, with an adjustment to explore wider impacts on society, although this was not explicitly stated. For instance, the authors focused on the immediate costs of treatment and follow-up. However, it was unclear whether their estimates took all aspects relevant to such a perspective into account. For instance, there was no comment as to whether hospital overheads were included in the unit costs. It may be that the inclusion of overheads would have affected all treatments equally (although this is unlikely in the case of conservative dietary treatment), in which case the relative cost-difference between treatments would remain unchanged. Further exploration would help to clarify these issues. The societal perspective might likewise have been explored further to estimate the full impact of productive time lost because of illness and treatment.
Other issues
The authors were able to compare their own work with that already published. They pointed out some conflicts in the results, but were able to discuss some differences in the underlying methodologies and comparators that helped to explain these. Generalisability, both of the specific results and of the modelling principles, was considered. The authors acknowledged the difficulties in generalising the results presented, citing national and global differences in results, whilst also describing how their decision model could be re-populated with data from other settings. Several limitations to the study were discussed, which focused on the underlying assumptions used to populate the decision model. The reporting of the results was made especially difficult by the number of alternatives considered in this study. Presenting a cost per 1% decrease in stone recurrence relative to conservative therapy might have provided a measure with which to compare the alternatives on an equal basis.

Implications of the study
The authors did not make any recommendations for policy or practice following their study.

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Other publications of related interest

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