Systematic review and economic modelling of effectiveness and cost utility of surgical treatments for men with benign prostatic enlargement


CRD summary
This review aimed to evaluate the clinical effectiveness of surgical procedure alternatives to transurethral resection of the prostate for benign prostatic enlargement unresponsive to expectant non-surgical treatments. In the absence of strong evidence favouring newer methods, the authors concluded that the standard of transurethral resection of the prostate remained both clinically and cost-effective. These conclusions appear reliable.

Authors' objectives
To evaluate the clinical effectiveness of surgical procedure alternatives to transurethral resection of the prostate for benign prostatic enlargement unresponsive to expectant non-surgical treatments.

Searching
Thirteen databases (including MEDLINE, EMBASE, BIOSIS Previews, the Cochrane Library, ISI Science Citation Index and CRD databases) were searched for relevant studies published up to March or September 2006. Search terms were reported. In addition, relevant conference proceedings and the reference lists of retrieved studies were searched for further relevant evidence. The search was not restricted by language or publication status.

Study selection
Randomised controlled trials (RCTs) of surgical interventions for treating benign prostatic enlargement were eligible for inclusion in the review.

Surgical interventions incorporated: transurethral resection of the prostate; minimally invasive techniques (including transurethral microwave therapy, transurethral needle ablation, transurethral ethanol ablation of the prostate and transurethral laser coagulation); transurethral incision of the prostate; and tissue ablative procedures (including laser prostatectomy, laser vaporisation, transurethral vaporisation of the prostate, bipolar transurethral vaporisation of the prostate, transurethral vaporisation of the prostate, bipolar transurethral resection of the prostate and bipolar transurethral vaporisation of the prostate).

Trials of men with a clinical diagnosis of benign prostatic enlargement were eligible for inclusion. Outcomes of interest included symptom score using a validated scale, quality of life, urodynamic outcomes, prostate size and complications.

Two reviewers independently assessed studies for inclusion, with any disagreements resolved by discussion or arbitration.

Assessment of study quality
The quality of the included trials was assessed using a 14-point checklist that covered multiple methodological characteristics including: randomisation and allocation concealment; baseline comparability of groups; length of follow-up; and reporting of inclusion criteria, blinding, outcomes and withdrawals.

Two reviewers independently assessed validity, with disagreements resolved by discussion or arbitration.

Data extraction
Data were extracted on the primary outcome (symptom score), secondary outcomes (urodynamic measures), complications, prostate size, and quality of life outcomes. Dichotomous outcomes were calculated as relative risks and continuous outcomes were calculated as mean differences.
Methods of synthesis
Studies were initially pooled using a fixed-effect model: relative risks were combined using the Mantel-Haenszel method, and continuous outcomes using the inverse variance weighted mean difference method. Statistical heterogeneity was assessed using the $\chi^2$ and $I^2$ methods. Where heterogeneity was significant, a random-effects model was applied.

Results of the review
A total of 94 comparisons from 88 randomised controlled trials (RCTs, n=8,494 patients) were included in the review. Sample size ranges from 12 to 234, with most trials including fewer than 100 patients. Studies were generally poorly reported, with over 70% failing to clearly report aspects of randomisation, allocation concealment, blinding, impact of withdrawals, and experience of the operator performed the procedure.

Fourteen different pair wise comparisons were made among the included studies: transurethral microwave therapy, transurethral needle ablation, stents, transurethral ethanol ablation of the prostate, laser coagulation, transurethral incision of the prostate, laser resection, laser vapourisation, bipolar transurethral resection of the prostate, transurethral vapourisation of the prostate, bipolar transurethral vapourisation of the prostate, transurethral vaporesection of the prostate, and bipolar transurethral vaporesection of the prostate were all compared against standard transurethral resection of the prostate. Transurethral microwave therapy was compared against a sham procedure.

Transurethral resection of the prostate appeared to provide a high level of long-term symptom improvement, as well as improvements in quality of life and flow rate.

Minimally invasive procedures generally showed less improvement on the outcomes of symptom improvement and flow rate.

Ablative procedures showed improvements in symptoms and quality of life equivalent to transurethral resection of the prostate.

The only newer procedure to show an improvement over transurethral resection of the prostate was holmium laser enucleation of the prostate, but this was limited to urodynamic outcomes (peak urinary flow rate at 12 months significantly favoured holmium laser enucleation of the prostate, weighted mean difference 1.43 mL/second, 95% confidence interval: 0.92 to 1.93).

Severe blood loss was more common following transurethral resection of the prostate, though acute retention and reoperation were more common for newer procedures, particularly minimally invasive techniques. Lower rates of incontinence were reported for transurethral needle ablation and laser coagulation than for other procedures.

Cost information
A cost-effectiveness model developed alongside the review suggested that minimally-invasive procedures were unlikely to be more cost-effective than transurethral resection of the prostate. The base-case analysis suggested an 80% probability of transurethral vapourisation of the prostate, followed by holmium laser enucleation of the prostate if required, being the cost-effective strategy at a threshold of £20,000 per quality-adjusted life-year. For an average £50,000 per quality-adjusted life-year threshold, transurethral vapourisation of the prostate followed by transurethral resection of the prostate, as required, would be cost-effective, but there was uncertainty around this estimate.

Authors’ conclusions
In the absence of strong evidence favouring newer methods, the standard of transurethral resection of the prostate remained both clinically and cost-effective.

CRD commentary
The review was based on a question clearly defined in terms of the participants, interventions, outcomes and study designs of interest. An extensive range of sources were searched to identify both published and unpublished relevant evidence, without any limitations on language of publication. Validity assessment and synthesis of studies was undertaken using established methods. Extensive details of the included evidence were provided. The authors reported
their attempts to minimise the potential for errors and bias throughout the review process. Their analyses appeared appropriate and were well reported. On this basis, the authors' conclusions appear reliable.

**Implications of the review for practice and research**

**Practice**: The authors stated that the use of minimally invasive technologies is not appropriate until a more effective or less costly technology is available.

**Research**: The authors made several recommendations for future research, including the need for research on how many years of medical treatment are necessary to offset the cost of treatment with a minimally invasive or ablative intervention. They also recommended more research on more cost-effective alternatives to transurethral resection of the prostate and strategies to improve outcomes after transurethral resection of the prostate.

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