A systematic review of the clinical efficacy and effectiveness of the holmium:YAG laser in urology

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Authors' objectives
To provide a systematic assessment of the clinical efficacy and effectiveness of the Holmium:YAG (Ho:YAG) laser in urology.

Searching
MEDLINE, HealthStar, the Cochrane Library and Current Contents were searched from 1980 to July 1998. Search terms included 'Ho:YAG laser', 'laser surgery', 'urology', 'lithotripsy' and 'BPH'. Studies in English, French and Spanish were included. Additional articles were identified by searching the references of retrieved studies. Direct contact with researchers in the area was initiated when appropriate.

Study selection
Study designs of evaluations included in the review
Original studies that addressed the clinical efficacy of the Ho:Yag laser.

Specific interventions included in the review
Ho:YAG laser treatment.

Participants included in the review
Patients with the following surgical indications: 1. General urology, including condyloma acuminatum, urinary and urethral strictures, other unspecified outlet obstructions, and superficial bladder carcinoma. 2. Urinary lithotripsy. 3. Benign prostatic hyperplasia (BPH).

Outcomes assessed in the review
1. General urology: proportion disease free, no recurrence, success of treatment and number of restrictures.
2. Urinary lithotripsy: x-ray of remaining fragments, passable fragments, stone-free, fragment size, operative duration.
3. BPH: AUA score, peak urinary flow rate, post void urine volume, duration of surgery, perceived symptoms, urodynamic assessment, tissue resected, length of hospital stay, nursing time.

Side effects were considered for all participant groups.

How were decisions on the relevance of primary studies made?
The authors do not state how the papers were selected for the review, or how many of the reviewers performed the selection.

Assessment of study quality
Study design, sample size, data analysis used, precision of results, pertinence and validity of outcome variables and the validity and reliability of measurement methods used were assessed. The authors do not state how papers were assessed for validity, or how many of the reviewers performed the validity assessment.

Data extraction
The authors do not state how the data were extracted for the review, or how many of the reviewers performed the data extraction.
Methods of synthesis
How were the studies combined?
Efficacy, effectiveness and complication rates were examined to assess the magnitude of the effect. Where appropriate (same clinical indication, similar study design, outcome measures and measurement methods) effectiveness ratings were summarised.

How were differences between studies investigated?
The authors do not state how differences between the studies were investigated.

Results of the review
Twenty-seven studies: 25 clinical series and 2 RCTs.

1. General urology (n=4 clinical series).
The studies did not provide detailed information on the outcome measures used or on the specific effectiveness rates obtained. However, according to the authors the Ho:YAG laser seemed to be successful in the treatment of the conditions investigated (superficial bladder carcinoma, renal carcinoma, condylomata accuminata, urteric and urethral strictures, PUJ obstructions, and bladder neck contractures), with no significant side effects.

2. Urinary lithroscopy (n=2 clinical series + 12 single case series).
The number of participants included in the case series ranged from 3-160, only 2 studies reported precise outcome measures. These series showed the Ho:YAG laser to be effective at fragmenting >80% of all types of urinary stones, with the risk of developing side effects in approximately 5% of patients. Two studies compared the performance of Ho:YAG laser with other therapies (dye laser or EHL), these studies used fragmentation rate as the outcome measure. The Ho:YAG laser seemed to be more effective than EHL in the shore term, both rates were similar in the long-term.

3. BPH (n=6 clinical series, 2 RCTs).
One study investigated Ho:YAG laser in combination with Nd:YAG (combined endoscopic ablation of the prostate, CELPA, a standard coagulative procedure performed initially with the Nd:YAG laser and followed by ablation using the holmium laser). Two series assessed Ho:YAG laser ablation of the prostate, the final 3 used Ho:YAG laser resection of the prostate. The results of these series suggest that the Ho:YAG laser may be effective in relieving BPH symptoms, a seen by reduction in the IPSS or AUA score at 3 months follow up. The peak urinary flow was increase and post void residual urine volume was decreased. The results appear to be more favourable for the laser when using resection techniques. The reported side-effects were scarce and of low severity. One RCT compared the clinical efficacy of the Ho:YAG laser with the Nd:YAG laser. After one year follow-up both outcome measures (AUA score and peak urinary flow) were slightly better for the Ho:YAG laser, however the duration of catheterisation was significantly less for the Ho:YAG laser than for the VLAP group. The second RCT compared the clinical efficacy of the Ho:YAG laser in resecting prostatic tissue compared with TURP. At 6 month follow-up Ho:YAG laser producer similar or slightly better short-term outcomes than TURP, with fewer side effects. Some preoperative variables, e.g. length of stay and nursing time also appear to favour the Ho:YAG laser.

Authors’ conclusions
The scientific evidence on the use of the Ho:YAG laser in urology remains sparse and restricted, especially for lithotripsy and general urology, to small clinical series whose methodological limitations preclude firm conclusions about effectiveness. Evidence for the treatment of BPH is more robust, but still scarce and limited to short-term outcomes. However, almost all the available studies, support the hypothesis that the Ho:YAG laser may be an effective and safe instrument in treating urological indications.

CRD commentary
A reasonable review of the area. A thorough literature search was undertaken, however limiting the review to published studies and on language of publication may have resulted in important studies being missed and the results may be
subject to publication bias. The authors state that a validity assessment was carried out, however, the results of this are not presented. The majority of studies included in the review were clinical series which do not have a control group and are subject to bias. Individual study details were only provided for the clinical series looking at general urology, for the other surgical indications individual study data was not presented which makes it difficult to assess whether the results presented follow from the primary data. A narrative synthesis is presented and results are stratified on intervention type which appears appropriate in view of the data presented. The authors conclusions are supported by the data presented.

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

**Practice:** Clinical decisions about the use of this laser in urology will necessarily differ according to the specific details of the condition treated, and whether the laser is already available or has yet to be acquired.

**Research:** The authors state that information on the long-term outcome of treatment with Ho:YAG laser would be of interest. The hypothesis that Ho:Yag laser may be an effective and safe instrument in treating urological indications is in need of further confirmation. More good quality research is needed to determine with greater certainty the clinical effectiveness of the Ho:YAG laser in the three urological specialities. This should include further evidence in outcomes not yet considered, e.g. patients' preferences and perceived quality of life after therapy, perioperative factors and costs associated with treatment, and thus provide information on the effectiveness and efficiency of the Ho:YAG laser.

**Bibliographic details**


**PubMedID**

10444114

**Original Paper URL**


**Indexing Status**

Subject indexing assigned by NLM

**MeSH**

Holmium; Humans; Laser Therapy; Lithotripsy, Laser; Male; Prostatectomy /methods; Prostatic Hyperplasia /therapy; Radioisotopes; Urinary Calculi /therapy; Urologic Diseases /therapy; Yttrium

**AccessionNumber**

11999004093

**Date bibliographic record published**

31/10/2000

**Date abstract record published**

31/10/2000

**Record Status**

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