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Guidelines

EAU Guidelines on Laser Technologies

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EAU Guidelines Panel on Lasers, Technologies

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Abstract

Context: The European Association of Urology (EAU) Guidelines Office has set up a guideline working panel to analyse the scientific evidence published in the world literature on lasers in urologic practice.
Objective: Review the physical background and physiologic and technical aspects of the use of lasers in urology, as well as current clinical results from these new and evolving technologies, together with recommendations for the application of lasers in urology. The primary objective of this structured presentation of the current evidence base in this area is to assist clinicians in making informed choices regarding the use of lasers in their practice.
Evidence acquisition: Structured literature searches using an expert consultant were designed for each section of this document. Searches were carried out in the Cochrane Database of Systematic Reviews, the Cochrane Central Register of Controlled Trials, and Medline and Embase on the Dialog/DataStar platform. The controlled terminology of the respective databases was used, and both Medical Subject Headings and EMTREE were analysed for relevant entry terms. One Cochrane review was identified.
Evidence synthesis: Depending on the date of publication, the evidence for different laser treatments is heterogeneous. The available evidence allows treatments to be classified as safe alternatives for the treatment of bladder outlet obstruction in different clinical scenarios, such as refractory urinary retention, anticoagulation, and antiplatelet medication. Laser treatment for bladder cancer should only be used in a clinical trial setting or for patients who are not suitable for conventional treatment due to comorbidities or other complications. For the treatment of urinary stones and retrograde endoureterotomy, lasers provide a standard tool to augment the endourologic procedure.
Conclusions: In benign prostatic obstruction (BPO), laser vaporisation, resection, or enucleation are alternative treatment options. The standard treatment for BPO remains transurethral resection of the prostate for small to moderate size prostates and open prostatectomy for large prostates. Laser energy is an optimal treatment method for disintegrating urinary stones. The use of lasers to treat bladder tumours and in laparoscopy remains investigational.

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1. Introduction

This document presents a synthesis of the European Association of Urology (EAU) guidelines on laser technologies published in 2011 [1]. The aim of this document is to supplement the information included in other EAU organ-specific guidelines, with a focus on technical considerations.

The application of lasers in treating urologic disorders has gained widespread clinical acceptance in multiple surgical indications, such as stones, benign prostatic obstruction (BPO), benign prostatic enlargement (BPE), bladder cancer, kidney cancer, urothelial tumours, strictures, and so on. In some therapeutic areas, lasers have become the primary method of treatment. This document addresses bladder outlet obstruction (BOO), BPE, bladder cancer, laser-assisted nephrectomy, laparoscopic nerve-sparing radical nephrectomy (LNSRP), renal tumours, ureteral stricture, ureteropelvic junction (UPJ) obstruction, upper urinary tract stones, and tumours.

These clinical guidelines present the best evidence available to the Guideline Working Panel, but particularly in the field of lasers, where technological advances are so rapid, many technologies are quickly superseded and not available for long-term study. The primary objective of this structured presentation of the current evidence base in this area is to assist clinicians in making informed choices regarding the use of lasers in their practice. However, although the aim is to help with decision making, simply following guideline recommendations can never replace clinical expertise in making treatment decisions. The individual circumstances and the personal values and preferences of both the physician and the patient are integral aspects of the process. This makes it difficult to establish an evidence-based discussion of the topic and also means these guidelines will need reevaluating and updating within a short time.

The acronym LASER stands for "light amplification by stimulated emission of radiation." Laser radiation is simply directed light with a narrow bandwidth. This is synonymous with a single colour and applies to all regions of the invisible and visible electromagnetic spectrum [2].

2. Methodology

Structured searches were carried out in the Cochrane Database of Systematic Reviews, the Cochrane Central Register of Controlled Trials, and Medline and Embase on the Dialog/DataStar platform. The search strategies covered the last 25 yr for Medline and for Embase (since 1974). A separate literature search for cost effectiveness was carried out and yielded seven unique publications. Papers were assigned a level of evidence (LE), and recommendations were graded (grade of recommendation [GR]) following the system currently used by the EAU Guidelines Office.

3. Laser-based treatments for bladder outlet obstruction and benign prostatic enlargement

BOO and BPE can be treated with a range of different laser systems and applications. Laser treatment is regarded as an alternative to transurethral resection of the prostate (TURP). The different systems produce different qualitative and quantitative effects in tissue, such as coagulation, vaporisation, or resection and enucleation via incision. The goal is to achieve similar efficacy parameters, with the same improvements in symptoms and quality of life but with less morbidity and shorter hospitalisation times in comparison with TURP [2].

4. Contemporary laser systems

Following the first generation of laser-based treatments for BOO and BPE, four groups of laser systems are currently used:

- Potassium titanyl phosphate (KTP):neodymium (Nd):yttrium-aluminium-garnet (YAG) (second harmonic generation [SHG]) and LBO (lithium borate):Nd:YAG (SHG) lasers
- Diode lasers (various)
- Holmium (Ho):YAG lasers
- Thulium (Tm):YAG lasers.

All of these contemporary (and historical) laser systems for the treatment of BOO and BPE use a physiologic sodium 0.9% solution for irrigation. This eliminates the risk of hypotonic hypervolaemic TURP syndrome, which has been reported in 1.4% of patients in large TURP series [3].

It should be noted that the term *green light laser* should be avoided when discussing lasers in this setting because "green light" refers to a particular feature of a group of lasers (eg, both KTP photoselective vaporisation of the prostate [PVP] and lithium borate [LBO] PVP emit green light).

4.1. Potassium titanyl phosphate lasers and lithium borate lasers

4.1.1. Urodynamic results and symptom reduction (Table 1)

In 1998, Malek et al. [4] showed that PVP using a 60-W KTP laser was both feasible and safe. Since then, most laser therapy trials up to 2010 have used 80-W KTP lasers. There are only limited data on the higher powered 120-W LBO laser. Almost 10 yr after the clinical introduction of 532-nm lasers, two randomised controlled trials (RCTs) were published that compared 80-W KTP with TURP with follow-up periods of up to 12 mo [5,6].

One RCT showed equivalent results to TURP [4] after 1 yr of follow-up; another nonrandomised two-centre study reported equivocal results [7]. In contrast, a second RCT clearly showed that TURP resulted in greater urodynamic improvement (maximum flow rate [Q_{max}]) than the KTP PVP [6]. Another study comparing KTP PVP with open prostatectomy (OP) showed equivalence in Q_{max} improvement, postvoid residual (PVR), and symptom score reduction after an 18-mo follow-up period [8]. KTP PVP laser was associated with a higher retreatment rate in larger prostates >80 ml in comparison with prostates <80 ml after a 12-mo follow-up [9].

An RCT that compared PVP using LBO lasers with TURP showed no significant differences between the two groups