Surgery Illustrated

Surgical Atlas
Holmium Laser Enucleation of the Prostate (HoLEP)

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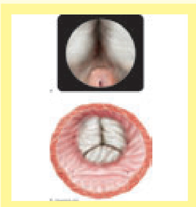
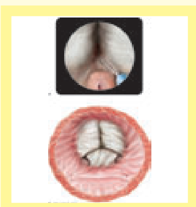
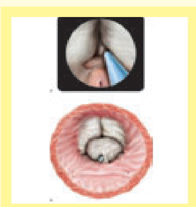
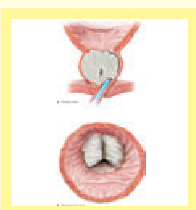
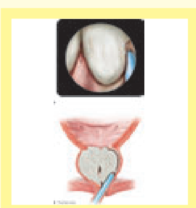






INTRODUCTION

Holmium laser enucleation of the prostate (HoLEP) has been used for over 10 years and is generally done in a similar manner by all of its practitioners. It developed gradually from ablative and resectional techniques using the high-powered (>60 W) holmium laser because of the desire for increased efficiency. The expanding adenoma in BPH creates a natural tissue plane which can be exploited surgically both during open prostatectomy and endoscopic (HoLEP) surgery. Increasing experience with Holmium Prostatectomy led to increased use of this plane in a retrograde direction, the development of a viable transurethral soft-tissue morcellator enabled entire anatomical lobes to then be safely liberated [1].

The evidence base for HoLEP is extensive, with eight published randomized trials, including four comparing HoLEP with TURP [2–5] and two comparing the HoLEP with open prostatectomy [6,7]. Each of the major issues concerning prostatic surgery has been covered in other publications, including durability, with data for >6 years [8].

The current technique initially involves division of the prostate into its three anatomical lobes in most cases. Each lobe is then enucleated in a retrograde fashion, creating the same defect as is achieved with open prostatectomy. After haemostasis, a transurethral morcellator is used to extract the tissue.

INDICATIONS AND PATIENT SELECTION

The ideal patient for this technique has symptomatic BOO due to BPH, regardless of the size of the prostate. The largest adenoma retrieved at our institution is 1.1 kg! The anatomical configuration of the prostate is irrelevant, as an enlarged median lobe is particularly ideally suited to this technique.

Aspirin and anticoagulants are generally stopped 5–7 days before the procedure, although it is possible to perform the procedure on these patients if cessation of their drugs is not possible [9].

The usual indications for TURP also apply to HoLEP, i.e. recurrent infections, significant haematuria of prostatic origin, hydronephrosis and bladder calculi due to prostatic obstruction. Although some fluid is absorbed [10], as the irrigating fluid is saline there is no risk of hyponatraemia or TUR syndrome with this technique. This, combined with the enhanced haemostasis, make it suitable for virtually any patient who is capable of undergoing anaesthesia.

PREOPERATIVE PREPARATION

All patients have a sample of urine analysed, PSA level and urinary flow rate measured, a symptom score assessment and the prostate volume measured by abdominal ultrasonography (US) or TRUS before surgery. The US measurement is obtained to aid in planning the theatre schedule. Urodynamics is only used if there is some uncertainty involving the diagnosis of BO. Flexible cystoscopy is done if a urethral stricture is suspected or in the evaluation of haematuria. Patients in urinary retention usually have abdominal US to estimate prostate size and examine the upper tracts.

Either general or regional anaesthesia can be used and a single dose of i.v. gentamicin is given in uncomplicated cases. Pneumatic calf stimulation is used in every case, as are below-knee support stockings.

The lithotomy position is used, with the hips flexed to 90°; this allows free rotation of the resectoscope, which is necessary to follow the plane of enucleation. The well-lubricated urethra is dilated up to 28 F as the laser continuous-flow resectoscope is 26 F.

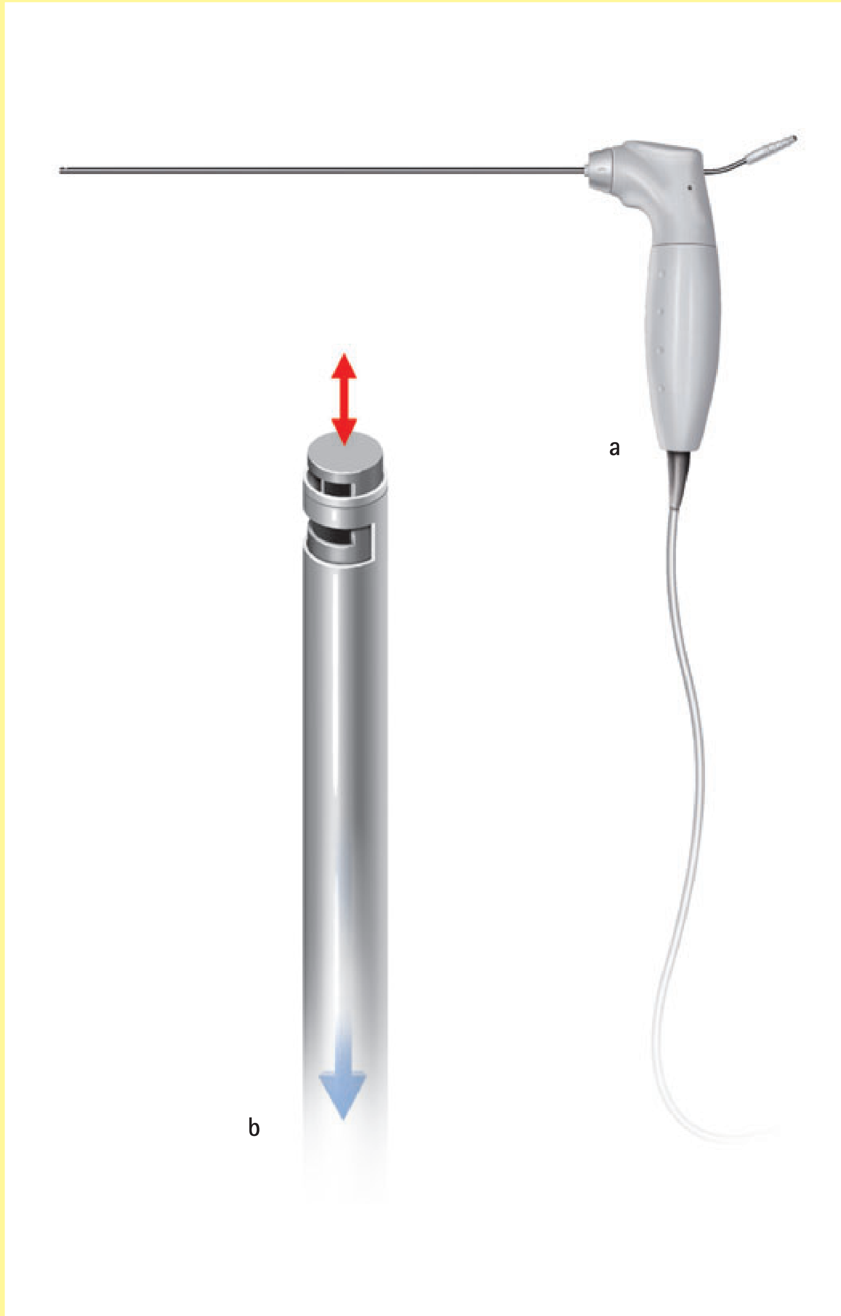
EQUIPMENT

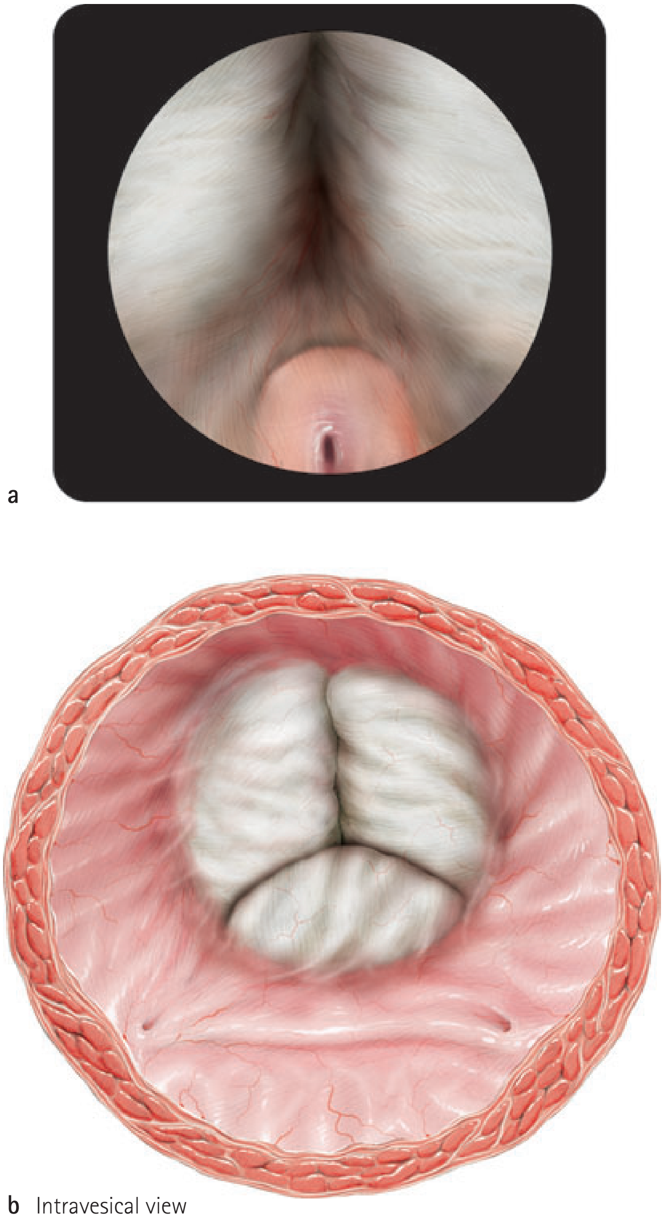
A high-powered holmium laser (>60 W) is necessary, with 100 W preferred (Lumenis, Yokneam, Israel). A 550 μm laser fibre is passed through an Interlink injection port (Baxter, Deerfield, IL, USA), and a 6 F ureteric catheter. The laser resectoscope is a 26 F continuous-flow instrument with a dedicated inner sheath (27040 XAL) incorporating a stabilizing guide (Storz, Tuttlingen, Germany). A 30° telescope (27005 BA), long bridge (27068 CD) and endoscopic camera are necessary.

Alternatively, a combined laser-bridge and inner sheath (A21500A) passed through a 27 F outer sheath can be used (Olympus, Hamburg, Germany).

Figure 1

A morcellator consisting of a mechanical hand-piece, 5-mm reciprocating blades, a two-stage foot-pedal and controller box (VersaCut, Lumenis) is used. This is passed down a long Storz nephroscope (27293 AA) which is connected to the outer sheath by an adapter (27040 LB). A single or double inflow is used to keep the bladder distended during morcellation.





a

b Intravesical view

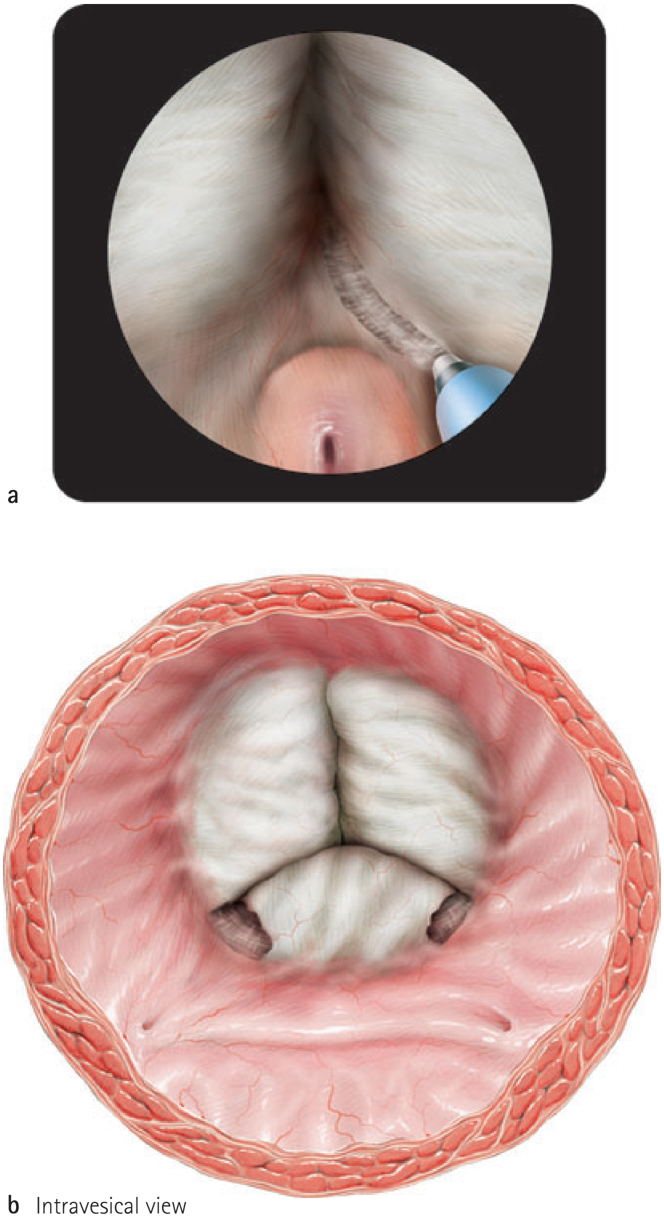
PROCEDURE

Figure 2

Preliminary cystoscopy is used to ascertain the size and configuration of the prostate, and to assess the patient for other pathology such as bladder calculi.

Figure 3

Bilateral bladder neck incisions are then made, extending from the ureteric orifices to the verumontanum. These are deepened down to the level of the surgical capsule, which can be clearly identified as a smooth fibrous layer. It is important to create incisions with cleanly defined edges to aid in their identification, particularly when the lobes are large. If no median lobe is present, a single incision can be made at the 6 o'clock position. Throughout the procedure, haemostasis is obtained using the defocused laser as each of the bleeding vessels is encountered.



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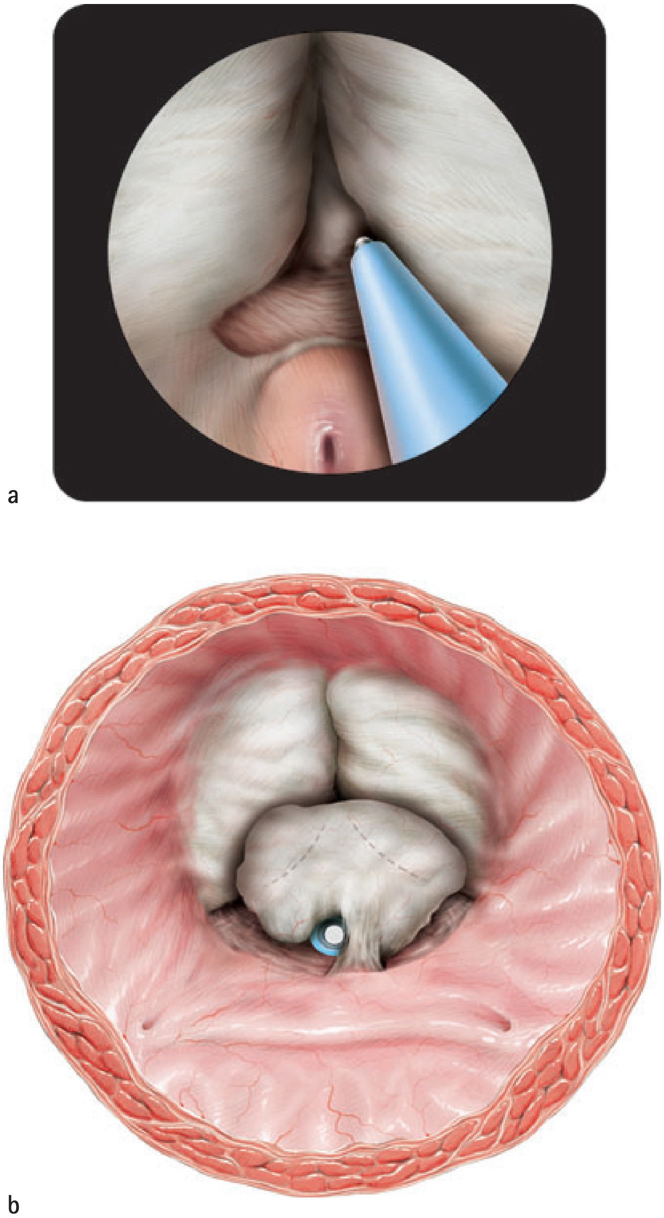
b Intravesical view



a

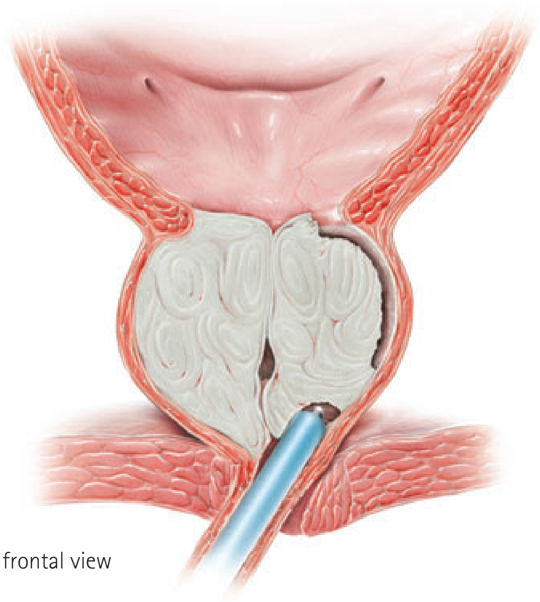
b

Figure 4

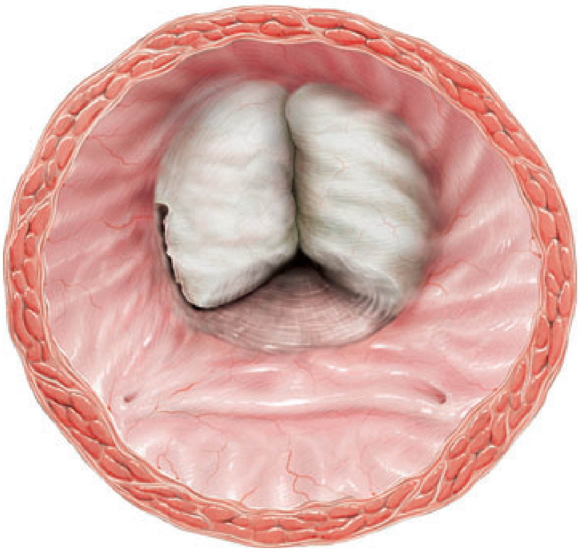
Once the incisions are complete, the median lobe is enucleated starting at the verumontanum. The incisions are connected just above the verumontanum and the fibres connecting the median lobe to the capsule are divided, working side-to-side between the incisions. The beak of the resectoscope is used to elevate the lobe and provide counter-traction while working beneath it. The lobe is disconnected at the bladder neck and placed in the bladder for later morcellation.

Figures 5 and 6

The lateral lobes are each enucleated in several distinct steps. First, the distal bladder neck incision is extended out inferolaterally and then continued upwards at the level of the verumontanum to find the surgical plane and to begin to define the apex.



a frontal view



b Intravesical view

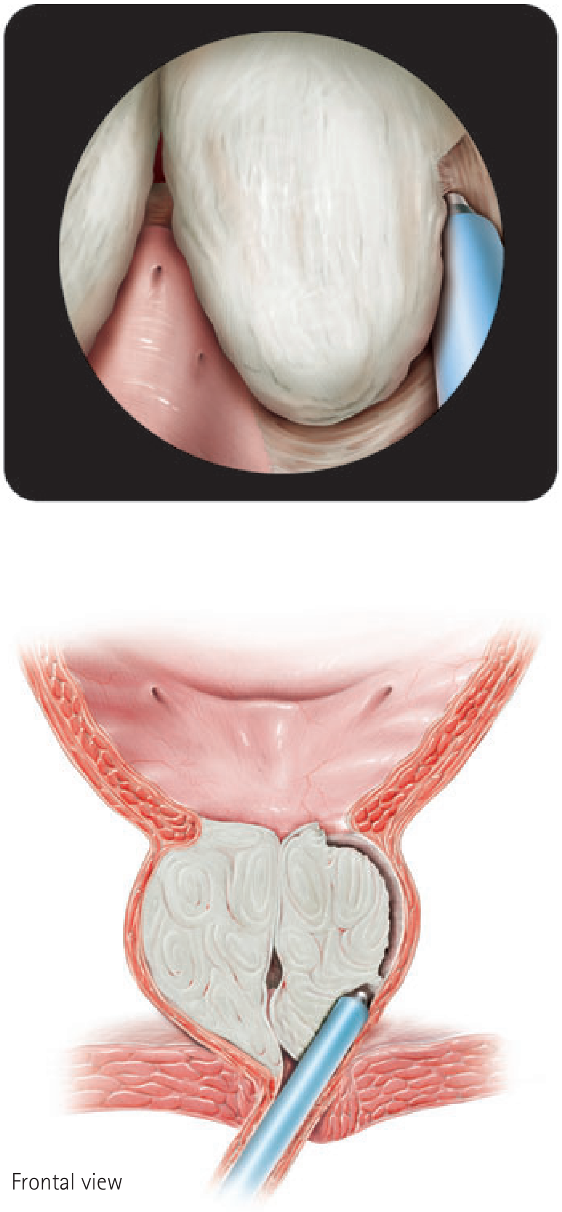
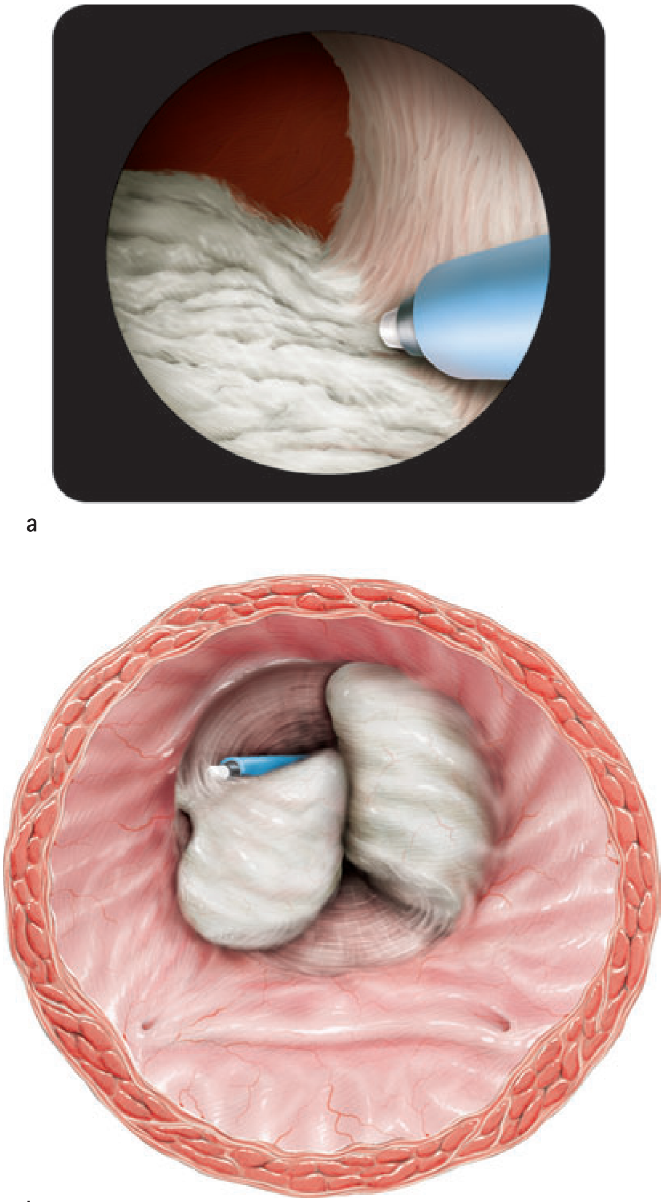

a
b Frontal view

Figure 7

The lower margin of the lobe is released commencing at the apex, and the apical incision is continued up to the 2 o'clock position. On occasion, the entire lobe can be enucleated from below. The beak of the resectoscope supports and manipulates the lateral lobe allowing the plane to be exposed. Next, the bladder neck is incised at the 12 o'clock position. This releases the upper aspect of both lobes. The incision is deepened and extended laterally and distally to the level of the verumontanum. The lobe is then peeled down off the capsule and this is progressively extended distally over the length of the lobe.



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b Intravesical view

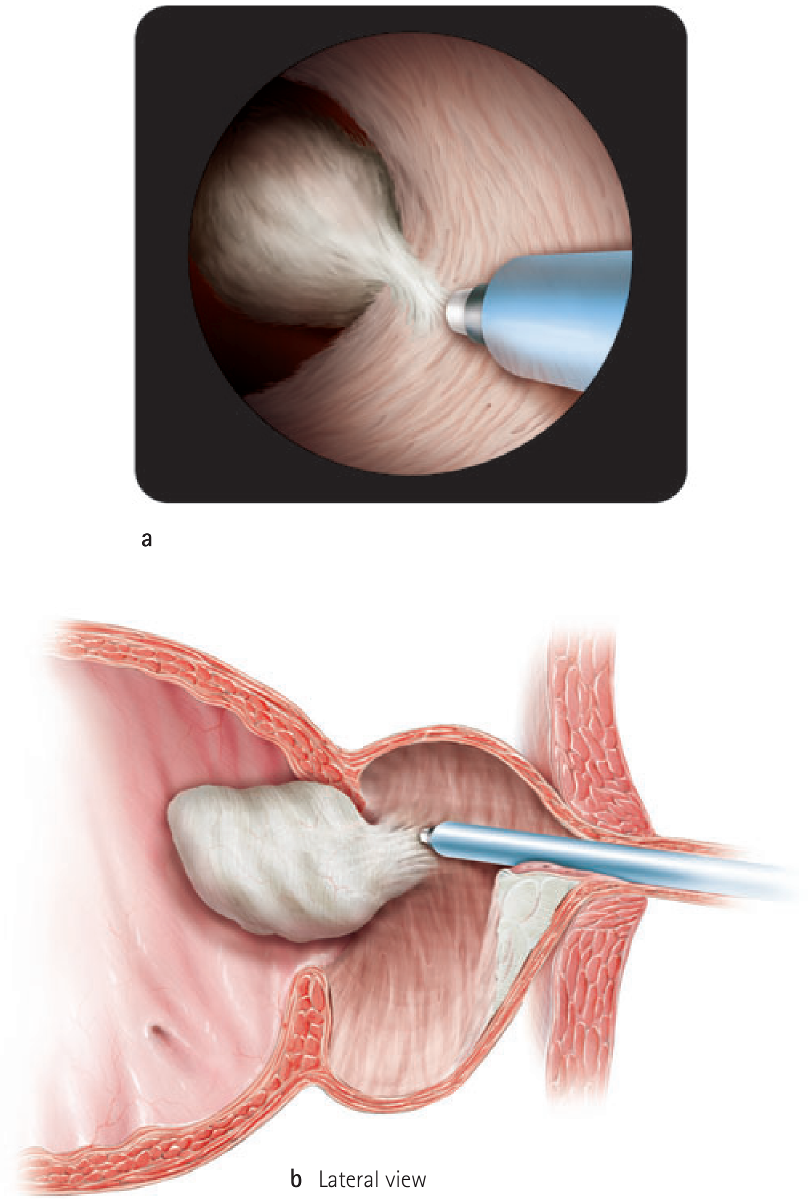


Figure 8

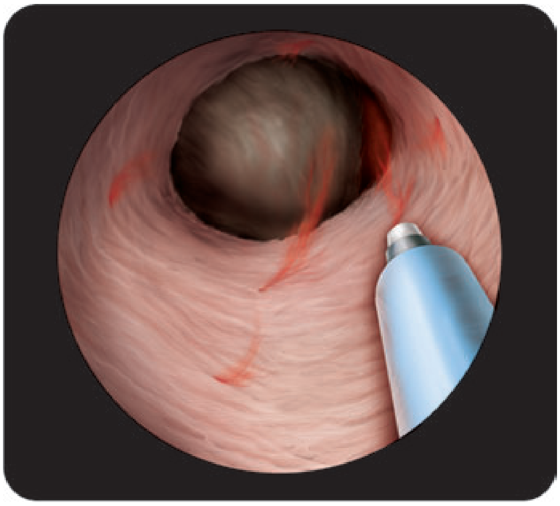
The upper and lower incisions are connected at the apex and the lateral lobe is enucleated in the capsular plane, working from the upper to lower incisions in a manner analogous to the median lobe enucleation. The lobe is released into the bladder and haemostasis is obtained by individually coagulating each bleeding vessel with the defocused beam.

Figure 9a

Once each of the lobes has been placed in the bladder the prostatic fossa is further inspected and any remaining bleeding dealt with. The bladder is decompressed and a final attempt at haemostasis is made, to allow the best possible view for morcellation.

Figure 9b

For morcellation, the inner sheath is replaced by the long nephroscope (Storz) and adapter. The 5 mm blade-set is passed down the instrument channel. Once the bladder is fully distended the suction is activated by the foot-pedal to grasp the fragment, and then morcellation commences. Care is taken to keep good tissue contact, and the bladder distension, to avoid mucosal injury. Small fragments which are resistant to further morcellation can be grasped using a grasping loop (Storz).



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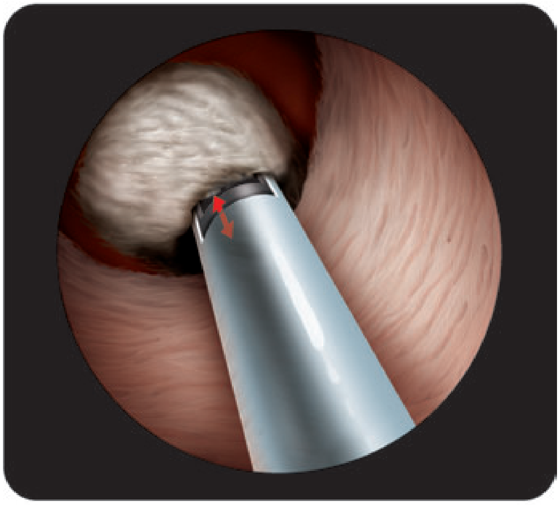

b

POSTOPERATIVE CARE

About 5% of patients require continuous irrigation for a short time after surgery. Typically, patients have their catheters removed at 06.00 hours the morning after and can be discharged from hospital once they have successfully voided at least twice. No further antibiotics are given. The re-catheterization rate is 5–10%, as it is with TURP. A further trial of catheter removal is done on the following morning, which is almost always successful. No specific restrictions on patient activities are necessary once any bleeding has ceased.

FROM SURGEON TO SURGEON

Large prostates are difficult to master, but the principles of enucleation are the same as with smaller glands. Extra time should be taken with the bladder neck incisions in these cases, as the enucleation between them is relatively straightforward because the surgical plane is very well developed. Excellent haemostasis is a crucial part of successful morcellation. Massive glands (>200 g) might require a cystotomy to remove the fragments. Small prostates (<30 g) are better treated with a bladder neck incision, as the surgical plane is poorly developed. HoLEP can still be used but it is more difficult than in prostates of 40–60 g.

Occasionally the length of the urethra is excessive due to either penile or prostatic bulk. Significant pressure needs to be applied initially until the bladder neck is incised and then the median lobe can be enucleated with no difficulty.

Things to make life easier include, most importantly, properly structured training with adequate mentoring for the initial cases. Dedicated instruments are also essential for the correct performance of HoLEP (see above). A second inflow during morcellation will ensure good visibility and will keep the bladder well distended. Grasping forceps used in percutaneous surgery can also be used for extracting smaller residual fragments.

Bladder perforation and significant extravasation are the most challenging intraoperative problems faced with this technique. In these cases, the procedure is terminated and a catheter placed. The patient can be discharged from the hospital with the catheter *in situ* once comfortable, and the procedure completed at a later date.

A backup strategy for intraoperative difficulties is to revert to the resectoscope. This can be done at any point during the case, to resect the prostate, to help haemostasis or to resect fragments, particularly if there are any issues with the morcellator. This gives surgeons who are new to the procedure confidence when tackling their first cases. A further backup strategy which is sometimes invaluable is to 'come back later'. If morcellation is difficult or there are patient concerns, the procedure can be completed at a later date when the prostate lobes are soft and morcellate very easily, and there is no bleeding.

REFERENCES

1 **Gilling PJ, Kennett K, Das AK, Thompson D, Fraundorfer MR.** Holmium laser enucleation of the prostate (HoLEP) combined with transurethral tissue morcellation: an update on the early clinical experience. *J Endourol* 1998; **12**: 457–9
2 **Tan AHH, Gilling PJ, Kennett KM, Frampton C, Westenberg AM, Fraundorfer MR.** A randomized trial comparing holmium laser enucleation of the prostate with transurethral resection of the prostate for the treatment of bladder outlet obstruction secondary to benign prostatic hyperplasia in large glands (40–200 grams). *J Urol* 2003; **170**: 1270–4
3 **Kuntz RM, Ahyai S, Lehrich K, Fayad A.** Transurethral holmium laser enucleation of the prostate versus transurethral electrocautery resection of the prostate: a randomized prospective trial in 200 patients. *J Urol* 2004; **172**: 1012–6
4 **Montorsi F, Naspro R, Salonia A *et al.*** Holmium laser enucleation versus transurethral resection of the prostate: results from a 2-center prospective randomized trial in patients with obstructive benign prostatic hyperplasia. *J Urol* 2004; **172**: 1926–9
5 **Gupta N, Sivaramakrishna, Kumar R, Dogra PN, Seth A.** Comparison of standard transurethral resection, transurethral vapour resection and holmium laser enucleation of the prostate for managing benign prostatic hyperplasia of >40 g. *BJU Int* 2006; **97**: 85–9
6 **Kuntz RM, Lehrich K.** Transurethral holmium enucleation versus transvesical open enucleation for prostate adenoma greater than 100 gm. A randomized prospective trial of 120 patients. *J Urol* 2002; **168**: 1465–9
7 **Naspro R, Suardi N, Salonia A *et al.*** Holmium laser enucleation of the prostate versus open prostatectomy for prostates >70 g: 24-month follow-up. *Eur Urol* 2006; **50**: 563–8
8 **Gilling PJ, Aho T, Frampton CM *et al.*** Holmium laser enucleation of the prostate: results at 6 years. *Eur Urol* 2007 Apr 23; [Epub ahead of print]
9 **Elzayat E, Habib E, Elhilali M.** Holmium laser enucleation of the prostate in patients on anticoagulant therapy or with bleeding disorders. *J Urol* 2006; **175**: 1428–32
10 **Shah HN, Kausik V, Hegde S *et al.*** Evaluation of fluid absorption during holmium laser enucleation of prostate by breath ethanol technique. *J Urol* 2006; **175**: 537–40

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Abbreviations: **HoLEP**, holmium laser enucleation of the prostate; **US**, ultrasonography.