Day-case holmium laser enucleation of the prostate: feasibility, safety and predictive factors

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ABSTRACT

INTRODUCTION Transurethral resection of the prostate has remained the most common operation for bladder outlet obstruction in the UK, but it is associated with potential morbidity and median two-day length of hospital stay. Holmium laser enucleation of the prostate (HoLEP) provides an alternative procedure. Provision of day-case HoLEP would improve patient care through increased efficiency. We assessed the feasibility and safety of day-case HoLEP and examined predictive factors for increased length of hospital stay.

MATERIALS AND METHODS Patients presenting for HoLEP by a single surgeon from September 2013 to September 2016 were considered for day-case surgery. Patients were discharged following assessment by the operating surgeon and met predetermined discharge criteria. Factors contributing to day-case success were identified.

RESULTS In total, 210 patients (mean age 70.3 ± 8.5 years) underwent HoLEP, with 74 (35.3%) discharged as true day-cases and a further 84 (40.0%) discharged within 23 hours. Readmission rate was 5.5%, with all complications Clavien–Dindo grade I or II. Factors associated with successful day-case operation included low-volume prostates (≤ 40 g) (odds ratio, OR, 3.097, 95% confidence interval, CI, 1.619–5.924, $P = 0.0001$) and morning surgical lists (OR 6.124, 95% CI 2.526–14.845, $p < 0.001$).

DISCUSSION AND CONCLUSION Day-case HoLEP is both feasible and safe, with low readmission rates. Two factors were significantly associated with successful day-case surgery: small volume prostate and morning theatre lists. Addressing these factors through preoperative planning can improve day-case surgery rates and improve bed throughput.

KEYWORDS

Day surgery – Ambulatory surgical procedures – Benign prostatic hyperplasia – Holmium lasers – prostate

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Introduction

Since its introduction over 40 years ago, transurethral resection of the prostate (TURP) has remained the gold standard operation for relief of bladder outflow obstruction secondary to benign prostatic hyperplasia.¹ In the UK, TURP accounts for over 80% of the approximately 22,000 operations performed each year to relieve prostatic obstruction.² While TURP has been very successful, it is still associated with small but significant risks. Early mortality rates range from 0.1% to 0.25% and complications include haemorrhage (transfusion rate 0.4%), clot retention (2%) and urinary tract infection (1.7%).³ This morbidity can result in delayed discharge and increased hospital readmission, and can cause substantial distress to the patient.

Deferment of elective surgery continues to be a major problem. With the introduction of national benchmarks for cancer treatment, hospitals are being placed under increased pressure to meet these targets and benign, elective surgeries such as TURP are typically the first to be delayed. An audit by Ally *et al.*⁴ found nearly 50% of patients

awaiting TURP at a large district general hospital were deferred over a three-month period, with an increase in urological admissions among the patients awaiting surgery. With an aging population, the need for definitive surgery is expected to increase.⁵

Multiple new technologies, including Holmium laser enucleation of the prostate (HoLEP), have been introduced as alternatives to TURP for the management of benign prostatic hyperplasia.⁶ HoLEP has been shown to have equivalent, if not improved, patient outcomes compared with traditional transurethral resection of the prostate. A 2015 meta-analysis demonstrated improvements in International Prostate Symptom Score (IPSS), Qmax and post-void residual (PVR) volumes compared with monopolar TURP.⁶ Immediate complications were lower in HoLEP patients, requiring no blood transfusions compared with monopolar TURP.

Within the NHS, the median length of stay for TURP continues to be two days, despite the introduction of bipolar systems.^{2,7} The provision of day-case surgery would allow for greater patient flow and improve clinical care through increased efficiency. We therefore assessed the feasibility

and safety of day-case HoLEP and examined predictive factors for increased length of hospital stay.

Materials and methods

Following approval by the hospital audit department, hospital record databases were searched using the procedure code for HoLEP. Consecutive patients undergoing HoLEP by a single surgeon (PA) from September 2013 to September 2016 were retrospectively reviewed from a prospectively collected database.

Patients were admitted the day of surgery and underwent HoLEP as originally described by Gilling *et al.* and modified to include the use of a morcellator.^{8,9} Irrigant solution was 0.9% sodium chloride. Operations were performed under general anaesthesia with paralysis; in rare exceptions, spinal anaesthesia was used in patients with severe respiratory comorbidity at the discretion of the anaesthetist. All patients had a three-way 22-French catheter inserted at the end of the procedure with irrigation in the immediate postoperative period.

Patients were assessed by the operating surgeon at the end of the surgical list and were discharged home if they met the following criteria: National Early Warning Score of 0,¹⁰ mobilising, tolerating oral intake, acceptable haematuria and freely draining catheter. Patients who did not meet these criteria, who had prolonged or late anaesthetic recovery or who declined day-case discharge were admitted to a urology ward. All patients were discharged with a catheter in place, with arrangements for its removal at three to five days postoperatively. Patients were given catheter care information and advised to contact the urology department if problems were encountered.

Data, including patient, surgical, and pathological characteristics, were collected retrospectively. The primary endpoint was successful day-case HoLEP. Length of hospital stay was calculated by subtracting the discharge date from the admission (surgery) date. Operative time was defined as surgical time only and did not include anaesthesia time. Factors contributing to failure of day-case surgery were analysed.

Data analysis was performed using SPSS statistical software version 20. The level of statistical significance was set at $P < 0.05$. Patient characteristics were compared using independent t-test for normally distributed, continuous variables, Mann–Whitney U test for non-parametric, continuous variables and chi-square test for categorical variables. Factors contributing to successful day-case surgery were analysed using binary logistic regression analysis.

Results

In total, 210 patients were identified from the hospital database. All patients were operated on with day-case intention and admitted overnight on the basis of failing to meet the aforementioned criteria. Patient, surgical and histological characteristics are shown in Table 1. A total of 74 (35.3%) patients were discharged on the day of surgery as true day-cases, with a further 84 (40.0%) discharged within 23 hours.

The median length of stay for the overall cohort was one night (range 0–11 nights).

From a safety perspective, 4 (5.5%) day-case patients were readmitted within a 28-day period with deep vein thrombosis ($n = 1$), haematuria ($n = 1$), urinary tract infection ($n = 1$) and groin pain of unknown cause ($n = 1$). The patient with haematuria was managed conservatively and patients with deep vein thrombosis and urinary tract infection were managed medically, with anticoagulation and antibiotics, respectively. No cause was found for the patient with groin pain and he was discharged following medical review; the pain was managed symptomatically with analgesia.

Univariate and multivariate binary logistic regression analysis outcomes for factors contributing to successful day-case surgery are shown in Table 2. Three factors: time of surgery (morning surgical list), enucleated weight (≤ 40 g), and operative time (≤ 80 minutes), were significant predictors on univariate analysis. Operative time was excluded from the multivariate analysis as it was not considered to be a preoperative variable and because it correlated significantly with enucleated weight (Spearman correlation, $r = 0.803$, $P < 0.001$), indicating potential collinearity. A scatter plot demonstrating this correlation is shown in Figure 1. On multivariate analysis, surgery on a morning theatre list (OR 6.124, 95% CI 2.526–14.845, $P < 0.001$) and low enucleated weight ≤ 40 g (OR 3.097, 95% CI 1.619–5.924, $P = 0.001$) both remained significant predictors for requirement of hospital admission.

Discussion

Based upon an estimated prevalence of lower urinary tract symptoms of 30%, approximately four million men aged over 40 years are affected in the UK alone.¹¹ A proportion of these men will require surgery for bladder outlet obstruction secondary to benign prostatic hyperplasia, either due to deteriorating symptoms or acute and/or chronic urinary retention.¹² With an aging population, the need for definitive surgery may increase; the provision of more efficient day-case surgery would help to ease this increasing burden.

Our results show that day-case HoLEP is both feasible and safe, with low readmission rates. Treating all patients as potential day-cases, we demonstrate a day-case HoLEP rate of 35.3%. Overall 28-day hospital readmission rate among day-case patients was 5.5%, consisting of two Clavien–Dindo grade I and two grade II complications. In addition, the percentage of patients discharged within 23 hours highlights improvement gains that can be made within our protocol.

Our analysis identified two factors contributing to day-case success: small volume prostates and morning theatre lists. Modification of these variables through simple preoperative planning could further improve our day-case rate. Preoperative prostate volume assessment (e.g. transrectal ultrasound in clinic) would allow selection of appropriate patients. By placing these patients on morning lists, we can probably increase the efficiency of our day-case protocol. We note that enucleated prostatic weight is highly correlated with operative time and may provide further ability to optimise these morning theatre lists.

Table 1 Stratified patient characteristics for patients undergoing holmium laser enucleation of the prostate.

Characteristic	Total (n = 210)	Day-case (n = 74)	Other (n = 136)	P-value
ASA grade: n (%)				0.925
1	30	10	20	
2	150	52	98	
3	26	8	18	
Not documented	4	4	0	
Age (years), mean $\pm$ SD	70.3 $\pm$ 8.5	68.9 $\pm$ 8.1	71.1 $\pm$ 8.7	0.073
Enucleated weight (g), median (range)	41 (1–295)	23 (1–120)	50 (1–295)	< 0.001 ^a
Indication: n (%)				0.123
Lower urinary tract symptoms	90 (42.9)	37 (50.0)	53 (39.0)	
Retention	120 (57.1)	37 (50.0)	83 (61.0)	
Indwelling catheter, n (%)	83 (39.5)	25 (33.8)	58 (42.6)	0.209
Intermittent self-catheterisation, n (%)	19	8 (10.8)	11 (8.1)	0.511
Histology: n (%)				0.665
Benign	168 (80.0)	58 (78.4)	110 (80.9)	
Cancer	42 (20.0)	16 (21.6)	26 (19.1)	
Time of surgery, n (%)				< 0.001 ^a
Morning	136	66	70	
Afternoon	52	7	45	
Not Documented	22	1	21	
Operating time (minutes), median (range)	75.5 (21–284)	61 (21–163)	86 (22–284)	< 0.001 ^a

^a significant P-value < 0.05.

SD, standard deviation; ASA, American Society of Anesthesiologists; ISC ();

Two previous studies have addressed day-case HoLEP. Larner *et al.*¹⁵ published a series of 38 patients. Patients excluded from day surgery included those older than 75 years, American Society of Anesthesiologists (ASA) grade greater than 1 on anticoagulation, with indwelling catheter and/or previous prostate surgery. With no control group, the authors found same-day discharge for HoLEP to be safe within this cohort of fit patients. Despite this healthy patient cohort, the complication rate requiring readmission was 7.9% (3/38 patients), with one paraphimosis, one blocked catheter and one episode of urinary retention.

In a larger study with 184 patients by Cynk *et al.*,¹⁴ the authors demonstrated an overall successful day-case rate of 49.5%, greater than that of our study. Patients were excluded on the basis of medical comorbidity including ASA grade greater than 3 and anticoagulation that could not be stopped, but additionally logistical factors (i.e. greater than one-hour return time to hospital and lack of adult supervision for the first preoperative night). Of patients considered for day-case surgery, 90% were successfully discharged on the day of surgery using a fixed nurse-led discharge protocol.

Multiple factors may contribute to this higher day-case rate. First, the use of fixed nurse-led discharge protocols may improve day-case rates by easing the discharge process.

Within our cohort, the operating surgeon reviewed all patients for discharge, which may have impacted the discharge pathway if this clinical review was delayed. The nurse-led discharge protocol used by Cynk *et al.*¹⁴ had strict criteria, potentially allowing for greater overall efficiency. Additionally, the median prostate size of the Cynk *et al.* cohort was 22 g compared with 41 g in this study. As higher enucleated weight was associated with day-case failure requiring overnight hospital admission, the Cynk *et al.* patient cohort may have been more suited to day-case surgery compared with those in the present study.

At present, HoLEP and other laser operations only account for a small proportion of surgeries for bladder outlet obstruction in the UK.² TURP remains the primary operation for benign prostatic hyperplasia yet, despite a number of small case series showing that day-case TURP is feasible,^{15,16} this procedure has yet to gain widespread adoption. It remains to be seen if these studies can be translated to the wider health service. In fact, in a meta-analysis of randomised trials comparing HoLEP and TURP, HoLEP patients had a mean 1.4-day shorter hospital stay.⁶

Our study benefits from being a large, consecutive patient cohort, with all patients considered as potential day-cases, allowing us to identify reasons for day-case failure.

Table 2 Univariate and multivariate binary logistic regression analysis for factors associated with successful day-case surgery.

Variable	Univariate			Multivariate		
	OR	95% CI	P-value	OR	95% CI	P-value
ASA grade:			0.712			–
> 2	1	–		–	–	
≤ 2	1.182	0.487–2.872		–	–	
Age (years):			0.215	–	–	–
> 70	1	–				
≤ 70	1.434	0.811–2.535				
Enucleated weight:			< 0.001 ^a			0.001 ^a
> 40 g	1	–		1	–	
≤ 40 g	3.164	1.744–5.749		3.097	1.619–5.924	
Indication:			0.124	–	–	–
Retention	1.566	0.884–2.773				
LUTS	–	–				
Indwelling catheter:			0.210	–	–	–
Yes	1	–				
No	1.457	0.808–2.628				
Intermittent self-catheterisation:			0.513	–	–	–
Yes	1	–				
No	0.726	0.278–1.893				
Histology:			0.665	–	–	–
Malignant	1	–				
Benign	0.857	0.426–1.724				
Time of surgery:			< 0.001 ^a			< 0.001 ^a
Afternoon	1	–		1	–	
Morning	6.061	2.554–14.387		6.124	2.526–14.845	
Operative time:			0.002 ^a	–	–	–
> 80 minutes	1	–				
≤ 80 minutes	2.890	1.476–5.660				

^a Significant *P*-value < 0.05.

ASA, American Society of Anesthesiologists; CI, confidence interval; LUTS (lower urinary tract symptoms); OR, odds ratio.

However, we highlight potential limitations. First, we recognise the limitations in the retrospective nature of our study. Second, all cases were performed by a single surgeon, although we note that this reduces variability in operative technique. Furthermore, as previously mentioned, all patients were discharged after review by the operating surgeon. If review was delayed for a given reason (e.g. delayed operating theatre list), this may have impacted the overall discharge pathway in select cases.

While a long-established technique, HoLEP continues to be used in more specialised centres, likely associated with the prolonged learning curve compared to TURP.¹⁷ More recent guidance from the National Institute for Health and Care Excellence (NICE) has recommended that the

procedure is only performed in centres with expertise in the technique, limiting its widespread adoption.¹⁸ Despite this, the safety and feasibility of day-case HoLEP, demonstrated in this and other studies, may aid the adoption of HoLEP into additional centres and may increase its overall use.

Conclusions

Day-case HoLEP is both feasible and safe, with low readmission rates. Two factors were significantly associated with successful day-case procedures: small-volume prostates (≤ 40 g) and morning theatre lists. Addressing these factors through preoperative planning can improve day-case surgery rates and improve bed throughput.

Figure 1 Operative time compared with enucleated weight

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