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'Minimum-incision' endoscopically assisted transvesical prostatectomy: Surgical technique and early outcomes

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Abstract **Objective:** To describe the surgical technique and report the early outcomes of a 'minimum-incision' endoscopically assisted transvesical prostatectomy (MEATP) for managing benign prostatic obstruction secondary to a large (> 80 g) prostate.

Patients and methods: In a prospective feasibility trial, 60 men with large benign prostates underwent MEATP. The baseline and postoperative evaluation included the International Prostate Symptom Score (IPSS), a measurement of maximum urinary flow rate (Q_{max}), and the postvoid residual (PVR) urine volume. The adenoma was enucleated digitally through a 3-cm suprapubic skin incision, and haemostasis was completed with endoscopic coagulation of the prostatic fossa. Perioperative complications were recorded and stratified according to the modified Clavien–Dindo score.

Results: The mean (SD, range) prostate weight estimated by ultrasonography was 102.9 (15.4, 80–160) g, the operative duration was 52 (8, 40–65) min, the haemoglobin loss was 2.1 (1, 0.4–5) g/dL, the catheterisation time was 5.2 (1.3, 4–9) days, and the hospital stay was 6.2 (1.4, 5–10) days. There were 21 complications recorded in 16 (27%) patients, and most (86%) were of grades 1 and 2. The most frequent complications were bleeding requiring a blood transfusion (8%), and prolonged drainage (5%). There was a significant improvement at 3 months after surgery in the IPSS (8.6 vs. 21.6,

$P < 0.001$), Q_{max} (19.5 vs. 7.7, $P < 0.001$), and PVR (15.8 vs. 83.9 mL, $P < 0.001$).

Conclusion: MEATP is feasible, safe and effective. Comparative studies and long-term data are required to determine its role in the surgical treatment of large-volume BPH.

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Introduction

TURP has been considered for many decades as the standard surgical treatment for benign prostatic obstruction (BPO). However, TURP is associated with a high incidence of complications in patients with prostates of > 80 g [1,2]. To circumvent the high perioperative morbidity and costs associated with TURP, many minimally invasive treatments were introduced. Unfortunately, most of them did not provide a better alternative for large-volume BPH [1]. Despite the high efficacy and durability of holmium laser enucleation of the prostate (HoLEP) in treating BPH of all sizes, this procedure failed to gain widespread acceptance as it has a long learning curve and significant financial cost [3,4]. More recently, a laparoscopic transvesical approach was proposed by Sotelo et al. [5]. The procedure was feasible, and provided an adequate relief of BPO and an early convalescence, but it carried a high risk of complications, a prolonged operative duration and a long learning curve. Traditionally, simple open prostatectomy (OP) was considered the treatment of choice for prostate adenomas too large for a safe transurethral resection. This role was recently challenged by the development of minimally invasive ablative surgical procedures [6].

The objective of the present trial was to describe our experience with 'minimum-incision' endoscopically assisted transvesical prostatectomy (MEATP) for large (> 80 g) prostates causing symptomatic or complicated BPH, and to report the clinical success and complications encountered.

Patients and methods

Between March 2010 and August 2013, 60 consecutive patients with symptomatic or complicated large-volume (> 80 g) BPH were selected to undergo MEATP, after approval by the ethics committee and after obtaining written informed consent from the participants. Exclusion criteria included any previous suprapubic or transurethral surgery, morbid obesity (a body mass index of > 40 kg/m^2), prostate cancer and voiding dysfunction not related to BPH. The preoperative evaluation included the IPSS, a DRE, urine analysis and culture, and routine laboratory studies including measurements of serum creatinine and serum PSA levels. Patients were also evaluated by measuring the maximum urinary flow rate (Q_{max}), and by abdominal ultrasonography and TRUS, with an estimation of the postvoid residual (PVR) urine volume and total prostate weight.

Surgical procedure

Access to the urinary bladder was obtained as previously described [7–9]. MEATP was performed under regional anaesthesia with the patient in a low lithotomy position with a slight Trendelenberg tilt. After preliminary cystoscopy, the bladder was filled with normal saline. A midline skin incision of ≈3-cm was made ≈4 cm above the upper border of the symphysis pubis. The rectus fascia was incised vertically for 5–7 cm and the rectus muscles retracted laterally. By using finger dissection, the bladder was cleared of perivesical fat and the peritoneum was pushed superiorly. Two stay sutures were placed lateral to the proposed site of the cystostomy and, when possible, another suture was placed at the vesico-prostatic junction to prevent distal extension of the incision. The bladder was opened sharply, and the adenoma enucleated digitally (Fig. 1). The correct plane between the adenoma and the surgical capsule was developed with the index finger and enucleation was completed until only the urethral attachment remained, which was divided bluntly. Pulling on the adenoma towards the bladder was not used, to avoid traction injury to the external urethral sphincter. The left-hand index finger was placed in the rectum to facilitate adenoma enucleation, by pushing the prostate upward.

After removing the adenoma a 24-F three-way urethral catheter was inserted with its balloon inflated to the maximum volume, and subjected to traction. The cystostomy was closed in two layers and the catheter was then deflated and removed. A 24-F resectoscope was introduced through the urethra to coagulate bleeding vessels at the bladder neck and prostatic fossa, by using a loop electrode. Particular attention was directed towards the control of arterial bleeding at the 5 and 7 o'clock positions. Electrocautery was used sparingly to avoid coagulating the ureteric orifice. Any irrigation fluid that leaked through the suture line of the cystostomy was removed using suction. For the transvesical endoscopic approach, the cystostomy was partly closed to allow a passage for the insertion of the resectoscope assembled with an endocamera. The bleeding vessels were electroco-

Figure 1 The skin incision used for access to remove large prostatic adenomas.

agulated under videoscopic guidance. After confirming haemostasis, the urethral catheter was placed in the bladder with its balloon inflated to 40–50 mL, according to prostate size, and the cystostomy closed completely. A suprapubic tube was inserted when the adequacy of haemostasis was questionable. An extraperitoneal pelvic drain was placed in all cases. The incision was closed using a running suture for the rectus fascia and interrupted sutures for the skin. Continuous bladder irrigation and temporary catheter traction were routinely instituted. A high level of experience with OP and transurethral surgery is required for this type of surgery. All surgical procedures were done by two surgeons (T.M.E., S.A.A.) working as a team with the other surgeons.

The catheter was removed after the resolution of gross haematuria and the cessation of drainage. The patient was discharged after confirming satisfactory voiding. The operative duration was recorded but excludes the time required for anaesthesia and patient positioning. The open enucleation time was defined as beginning with the preliminary cystoscopy and ending when the skin incision was closed, excluding the time of endoscopic haemostasis. The time elapsed from inserting the resectoscope until its removal was the endoscopic haemostasis time. The total operative duration was calculated as the sum of both open enucleation time and endoscopic haemostasis time. The enucleated prostate weight, haemoglobin loss and haematocrit deficit, catheterisation time and postoperative hospital stay were recorded. Postoperative pain was assessed on the first day after MEATP and at discharge, and included a visual analogue pain scale (VAPS) and the patient's requirement for narcotic use [10]. The VAPS is an 11-point numerical rating scale from 'no pain' to 'worst pain imaginable' (0 = no pain, 1–3 = mild pain, 4–6 = moderate pain, 7–10 = severe pain).

Perioperative complications were recorded and stratified according to the modified Clavien–Dindo score [11]. The serum PSA level was measured at 1 month after MEATP to estimate the mean decrease in the total prostate volume. The IPSS, Q_{max} and PVR estimates were repeated at 1 and 3 months after surgery.

The results were analysed statistically, with continuous variables expressed as the mean (SD, range), but age and the follow-up period were not normally distributed, and are described by the median (range). Data before and after surgery were compared using Student's t-test for paired data. The comparative analysis between the transurethral and transvesical endoscopic haemostasis groups was done using Student's t-test for unpaired data and Fisher's exact test, as appropriate. In all tests, $P < 0.05$ was considered to indicate statistical significance and all statistical tests were two-sided.

Results

In all, 60 men with symptomatic or complicated large-volume BPH successfully underwent MEATP with no need for conversion to standard surgery. The indications for surgery in these patients were severe obstructive symptoms refractory to medical treatment in 43 (72%), recurrent acute urinary retention in eight (13%), chronic urinary retention in five (8%), and vesical calculi in four (7%). Table 1 lists the patients' demographics, operative and early postoperative variables. The median (range) age of the patients was 69 (60–84) years. Digital rectal assistance to complete the enucleation of the adenoma was used in all cases. The mean (range) baseline serum PSA level was 5.8 (2.1–13.8) ng/mL, whilst the mean serum PSA level at 1 month after surgery was 1.1 (0.3–2.8) ng/mL, implying removal of 81% of the total prostate weight. The mean operative duration, including both the open enucleation time and endoscopic haemostasis time, was 52 min. The mean haemoglobin level and haematocrit, immediately after surgery, showed a highly significant decrease ($P < 0.001$) from the baseline value. According to the approach used for endoscopic haemostasis, 38 (63%) patients underwent transurethral and 22 (37%) transvesical endoscopic haemostasis (Table 2). The transvesical approach required video-assisted endoscopy. A suprapubic tube was placed in eight (13%) of the patients. The mean endoscopic haemostasis time was significantly longer in the transurethral approach than the transvesical approach ($P = 0.021$). Both approaches were equally effective in achieving haemostasis. The mean haemoglobin loss and haematocrit deficit were slightly greater with the transvesical approach (2.2 vs. 2.0; $P = 0.524$, and 6.2 vs. 5.8; $P = 0.708$, respectively), but these differences were not statistically significant.

Table 3 shows the complications and treatments; 21 complications were recorded in 16 (27%) patients, and most were grade 1 (12 of 21; 57%) or grade 2 (six of 21; 29%). Grade 3 and grade 4 comprised 14% of complications. There were no fatal complications. The most frequent complications were bleeding requiring a blood

Table 1 Variables assessed in 60 patients treated by MEATP.

Variable	Mean (SD, range)
Body mass index (kg/m^2)	28.4 (5.6, 20–39.4)
PSA (ng/mL)	5.8 (3.2, 2.1–13.8)
Creatinine (mg/dL)	1.29 (0.3, 1.01–2.8)
TRUS estimated total prostate weight (g)	102.9 (15.4, 80–160)
Enucleated prostate weight (g)	84.9 (13.2, 64–134)
Operative duration (min)	52.3 (8.3, 40–65)
Haemoglobin loss (g/dL)	2.1 (1, 0.4–5)
Haematocrit deficit (%)	5.9 (3.4, 2–15.9)
VAPS at discharge	1.9 (1.3, 0–5)
Catheterisation time (days)	5.2 (1.3, 4–9)
Hospital stay (days)	6.2 (1.4, 5–10)

transfusion (8%), and prolonged drainage (5%), managed by continued catheter drainage. One patient developed intraperitoneal extravasation due to an inadvertent peritonotomy during the procedure. A peritoneal drain was placed under local anaesthesia during ultrasonographic monitoring. The drain was removed after 3 days, and the patient recovered uneventfully. Over a median follow-up of 5 (3–9) months none of the patients had incontinence or bladder-neck contracture.

The IPSS, Q_{max} and PVR were significantly improved at 1 month after surgery ($P < 0.001$), and continued to improve during the subsequent follow-up (Table 4). At 3 months after surgery the IPSS had improved by 60%, the Q_{max} had increased by 153%, and the PVR decreased by 81%. All patients with acute urinary retention voided spontaneously after removal of the catheter. Among the patients with chronic urinary retention, two could not void and were treated with re-catheterisation for 5 and 7 days. A histopathological examination of the enucleated tissue revealed glandular and stromal hyperplasia in all patients, associated with chronic prostatitis in 11 (18%) and prostatic intraepithelial neoplasia in one (1.7%).

Discussion

Despite the availability of many therapeutic methods for managing BPO, the surgical treatment of patients with large-volume BPH remains challenging. For these patients OP provides the highest probability of a subjective and objective improvement and the lowest failure

Table 2 A comparison of operative variables according to the approach used for endoscopic haemostasis.

Mean (SD, range) variable	Transurethral	Transvesical	P
Patient, n (%)	38 (63)	22 (37)	
TRUS-estimated total prostate weight (g)	102.3 (14.4, 80–120)	104.1 (17.3, 80–160)	0.662[a]
Open enucleation time (min)	37.1 (6.7, 24–52)	36.3 (8.9, 24–55)	0.673[a]
Endoscopic haemostasis time (min)	14.7 (1.9, 12–20)	13.3 (2.6, 10–16)	0.021[a]
Preop haemoglobin (g/dL)	12.6 (1.1, 10.5–14.5)	12.9 (0.7, 11.5–14)	0.295[a]
Postop haemoglobin (g/dL)	10.5 (1.2, 8–13.6)	10.6 (0.9, 9–12.1)	0.732[a]
Haemoglobin loss (g/dL)	2 (1, 0.4–5)	2.2 (1, 0.4–4.5)	0.524[a]
Preop haematocrit (%)	41.2 (2.3, 37.5–46.7)	42.5 (3, 37.4–46.5)	0.063[a]
Postop haematocrit (%)	35.5 (4, 29.4–42.5)	36.3 (4.7, 28.9–42.5)	0.490[a]
Haematocrit deficit (%)	5.8 (2.8, 2–11.1)	6.2 (4.3, 2–15.9)	0.708[a]
Suprapubic tubes, n (%)	5 (13)	3 (14)	1[b]
Blood transfusions, n (%)	3 (8)	2 (9)	1[b]

[a] Student's t-test for unpaired data.
[b] Fisher's exact test.

Table 3 Perioperative complications categorised according to the modified Clavien–Dindo score.

Grade	Complication (n patients,%)	Management
1	Urinary retention after catheter removal (2, 3)	Bedside catheterisation
	Clot retention (2, 3)	Bladder irrigation, temporary catheter traction
	Transient elevation of serum creatinine (2, 3)	Fluid balance
	Prolonged drainage (3, 5)	Continued catheterisation
	Fever < 38.5 °C (2, 3)	Antipyretics
	Catheter malfunction (1, 2)	Bedside catheter change
2	Haemorrhage/haematuria (5, 8)	Blood transfusion
	Fever > 38.5 °C/bacteraemia (1, 2)	Parenteral antibiotics
3a	Intraperitoneal extravasation (1, 2)	Percutaneous drainage under local anaesthesia
3b	Haematuria/clot retention (1, 2)	Endoscopic evacuation and coagulation
4a	Myocardial infarction (1, 2)	Managed in the intensive care unit
4b	None	
5	None	

Table 4 Variables assessed at baseline and 1 and 3 months after MEATP.

Variable	Mean (SD, range)	P^*	$P^\dagger$
IPSS			
Baseline	21.6 (7.1, 12–35)		
1 month	10.9 (3.6, 7–20)	< 0.001	
3 months	8.6 (3.3, 5–18)	< 0.001	0.001
Q_{max} *(mL/s)*			
Baseline	7.7 (3.9, 0–12)		
1 month	18.6 (2.3, 15–22)	< 0.001	
3 months	19.5 (1.6, 17–23)	< 0.001	0.005
PVR (mL)			
Baseline	83.9 (32.2, 50–195)		
1 month	22.3 (11.4, 15–85)	< 0.001	
3 months	15.8 (8.1, 10–40)	< 0.001	< 0.001

* 1 and 3 months vs. baseline.
† 3 months vs. 1 month.

rate, but it also has the highest perioperative morbidity [1,12]. Recently, many trials have been reported of surgical procedures that combine the advantages of OP whilst simultaneously reducing its disadvantages. Desai et al. [8] used a novel minimally invasive treatment termed single-port transvesical enucleation of the prostate (STEP). However, the procedure is still being developed and its role in the current surgical options for BPH remains to be determined [9]. Similarly, Portogerou et al. [7] proposed a minimally invasive modification of OP based on digital enucleation through a 3-cm skin incision. The main disadvantage was a high incidence of perioperative bleeding, as they relied only on catheter traction to control bleeding after the enucleation. In the present trial we sought to minimise blood loss during the procedure by applying endoscopic haemostasis. Transurethral or transvesical endoscopic coagulation of bleeding vessels at the bladder neck and prostatic fossa was readily feasible and effective.

Several technical points of MEATP should be considered. The aforementioned patient positioning during the procedure enabled safe access to the urinary bladder, digital rectal assistance during enucleation, and endoscopy through the transurethral and transvesical routes. The skin incision should be placed ≈4 cm above the symphysis pubis to render the prostate more accessible for enucleation. A generous fascial incision that extends inferiorly to the symphysis pubis is a prerequisite for adequate bladder exposure and successful enucleation. Digital rectal assistance is required to facilitate enucleation of the prostate adenoma, particularly at the apex. In addition, complete removal of the adenoma can be verified by palpating the intervening tissues between the right-hand index finger placed in the prostatic fossa through the wound, and the left-hand index finger placed in the rectum. Endoscopic haemostasis of the prostatic fossa after finger enucleation is not an easy task, and requires experience and good endoscopic facilities. The main concern is to control arterial bleeding, whilst venous bleeding can be controlled with traction on the Foley catheter. Electrocautery should be used sparingly, particularly at the area of the bladder neck, to avoid coagulation of the ureteric orifice, development of postoperative irritative symptoms, ischaemic damage of the bladder neck with subsequent bladder neck contracture, and to avoid the possibility of delayed haemorrhage due to eschar separation.

The modified Clavien–Dindo score was used previously when reporting complications in relation to prostatic surgery for BPH [13–15]. Mamoulakis et al. [13] evaluated the applicability of the score in a cohort of 198 men with BPH treated by TURP. In all, 44 complications were reported in 31 (15.6%) of the patients, with most of the complications (88.6%) ranked as grades 1 and 2. They concluded that the adoption of the modified Clavien–Dindo score for grading complications was relatively simple, not time-consuming, and straightforward. Elshal et al. [14] treated 163 patients with transvesical OP. They reported 106 complications in 69 (42.3%) patients; 91 were low-grade (grade ⩽2) complications and 15 were high-grade (grade ⩾3). Perioperative bleeding requiring a blood transfusion, reported in 24.5% of patients, was the commonest low-grade complication.

MEATP resulted in an expeditious and complete removal of the adenomatous tissues. The operative duration was substantially less than for OP, HoLEP, STEP and robotic-STEP [3,9,16]. Removal of 81% of the preoperatively estimated total prostate weight was comparable with the results of standard OP [3]. Postoperative pain, as assessed with VAPS and narcotic use, was mild, and controlled with simple analgesics. In all, 21 complications were reported in 16 patients, with an overall perioperative morbidity rate of 27%. According to the modified Clavien–Dindo score, the complications were low-grade in 18 (30%) patients, and high-grade in three (5%; Table 3). The use of endoscopic haemostasis during the procedure minimised the blood loss, resulting in an 8% transfusion rate (four patients required a blood transfusion with 1 unit, and one needed 2 units). The overall rate of blood transfusion during OP, TURP, STEP, and HoLEP was cited as 23%, < 10%, 15%, and 0–0.5%, respectively [3,4,12,16,17]. Portogerou et al. [7] reported on a minimally invasive alternative for large prostates. They treated 169 patients with a mean (range) prostate size of 101 (85–144) mL, by transvesical prostatectomy performed through a 3-cm incision. Bleeding after enucleation was managed with the balloon of a Couvelaire catheter that was placed in the bladder, inflated if necessary up to 140 mL, and subjected to traction during the hours after surgery. The mean (range) operative duration was 24 (15–36) min. The catheter was removed on the third day after surgery in 155 (94%) patients, and the hospital stay was 3–10 days.

Of the 169 patients, 69 (41.8%), 27 (16.3%) and 19 (11.5%) required a blood transfusion with 1, 2 and 3 units, respectively.

The results of the present trial show a pronounced improvement in patients' symptoms and voiding function immediately after catheter removal, followed by a significant improvement during the subsequent follow-up period. These results are consistent with those previously reported for HoLEP, laparoscopic and open enucleation of the prostate [4,7,12,16]. The postoperative hospital stay reported in the studies of surgical treatments for BPO is influenced by perioperative complications, catheterisation time and discharge policies. In the present trial most patients were discharged after removal of the catheter. The postoperative stay was 6 days, in contrast to 8, 7 and 3 days for patients treated with OP, STEP and HoLEP, respectively [3,14,18]. The relative disadvantages of MEATP in comparison to HoLEP are the higher rate of blood transfusion, and longer catheterisation time and hospital stay. Nevertheless, a surgeon familiar with OP and transurethral surgery can perform the procedure safely and expeditiously using equipment already available in most urological operating theatres.

The present study was designed to test the feasibility of MEATP, but its main limitation was the exclusion of a control group. Moreover, the inclusion of relatively few patients and a follow-up of only 5 months were other limitations. A precise assessment of MEATP requires controlled randomisation of a larger study group over an extended follow-up period to better evaluate both the early and long-term outcomes.

In conclusion, MEATP was technically feasible, safe and effective. The adoption of endoscopic haemostasis during MEATP was required to control bleeding after enucleation. Further studies, including a prospective comparison with standard OP, and long-term data from a larger cohort of patients, are needed before the procedure can be considered an alternative to other methods currently available for the surgical treatment of large-volume BPH.

Conflict of interest

No conflict of interest.

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None.

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