Endoscopic Transvesical Adenomectomy of the Prostate, a New Minimal Invasive Approach for Large Benign Prostate Hyperplasia. A Description of the Technique and the Results of the First 40 Patients

Wouter M.H. van der Sanden, Laurent M.C.L. Fossion, and Kevin de Laet

OBJECTIVE The objective of this study is to present the results in the first 40 patients treated with a new minimal invasive technique in the treatment of large-volume benign prostate hyperplasia: the endoscopic transvesical adenomectomy of the prostate (ETAP).

PATIENTS AND METHODS From 2014 to 2016 we performed the ETAP in 40 patients with large volume benign prostate hyperplasia (>80 cc). The mean volume on ultrasound was 117 cc. The mean baseline Qmax was 8.1 ml/s and the International Prostate Symptom Score was 20.5. Seventeen patients (43%) had a urinary retention preoperatively. A cystotomy through a small infraumbilical incision was performed and a camera port was placed through the bladder dome. A pneumovesicum was created and 2 instrument ports were placed into the bladder. The prostate was transected and removed in 1 piece through the umbilical incision.

RESULTS The operation was completed in all 40 patients, without need for conversion. The mean operation time was 102 minutes with a mean blood loss of 185 ml. The average hospital stay was 5 days. There were no grade V complications and 1 grade IV complication. The transfusion rate was 2.5%. After the procedure, all 40 patients were able to void spontaneous. The Qmax increased to 21.2 ml/s (+13.1 ml/s) and the International Prostate Symptom Score decreased to 7.5 (−13 pts).

CONCLUSION This study shows that the ETAP is a feasible, safe, and truly minimal invasive procedure. The functional outcomes are promising as well. We believe the ETAP is good alternative to open surgery. UROLOGY 125: 174−178, 2019. © 2019 Elsevier Inc.

Large volume benign prostate hyperplasia (BPH) is defined by the European Association of Urology as >80 gram and can be treated in a variety of ways.[1] The golden standard for treatment of large BPH is still the open adenomectomy according to Hryntschak/Freyer or Millin, as described in 1945 and 1951 respectively.[2,3] Open adenomectomy has been proven an effective treatment with significant morbidity.[4] Recent technical advances have made new, minimal invasive, and techniques possible. In 1993 laser surgery has shown up, but still this remains an expensive technique and is not widely available.[5] In 2002 the first laparoscopic simple prostatectomy was performed, followed by robotic transperitoneal simple prostatectomy. Both laparoscopic and robotic techniques are expensive, technically demanding, and time consuming[5-9] and therefore not widely spread throughout the urological community.

The Endoscopic Transperitoneal Adenomectomy of the Prostate (ETAP) was developed in our centre. We wanted to develop a new technique with the presumed advantages of minimal invasive surgery, in familiar anatomy, the possibility to perform it with standard and low-cost laparoscopic instruments. There is no clear consensus about which of these minimal invasive techniques is the best treatment, mainly due to a lack of long-term results. We have chosen the name ETAP to avoid

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From the Department of Urology, Maxima Medical Center, Veldhoven, the Netherlands

Address correspondence to: *Wouter M.H. van der Sanden, M.D., Maxima Medical Center, Department of Urology, PO Box 7777, 5500MB Veldhoven, the Netherlands. E-mails: wouter_vd_sanden@hotmail.com; l.fossion@mmc.nl; l.fossion@mmc.nl*

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misinterpretation with both techniques of laparoscopic simple and radical prostatectomy, because we perform endoscopy, as we directly look inside an organ and throughout the abdomen.

The goal of our study is to describe the ETAP technique and present the results of the first patients in our centre.

PATIENT AND METHODS

Patients

Forty consecutive patients with lower urinary tract symptoms (LUTS) due to BPH larger than 80 gram, measured by transrectal ultrasound of the prostate, were included in the study. Prostate cancer was excluded by PSA-level measurement and a digital rectal examination and, if necessary with prostate-biopsies. Informed consent was given by all patients after an explanation of the procedure, possible complications, and alternative treatment options. No patients were excluded regarding the European Association of Urology guidelines inclusion criteria for the golden standard. All procedures were performed after discussing treatment alternatives and obtaining informed consent.

Data

Patients were included from March 2014 to November 2016. A prospective data collection was done with regard to pre-, per- and postoperative data. Data analysis was performed in a retrospective manner. Data were gathered from the electronic patient files and collected in an Excel (Microsoft) database. Preoperative data included: age, BMI, prostate volume, PSA, International Prostate Symptom Score (IPSS), Qmax, and post-void residu (PVR). Perioperative data included: estimated blood loss, operating time, complications, and transfusion rate. Postoperative data included: hospital stay, catheterization time, resected specimen weight, Qmax, and PVR. The IPSS was assessed preoperatively and 6 months after surgery. Complications were registered using the Clavien-Dindo-Classification.[10]

Technique

All patients were treated in a single-center general hospital, by a single urologist with extensive laparoscopic experience having performed over 1000 laparoscopic procedures.

The patient is positioned in a dorsal decubitus position with his legs slightly spread to allow a rectal examination if needed during the operation. All patients undergo general anesthesia. The lower abdomen is disinfected and covered with sterile drapes. A 16 Ch catheter is placed in the bladder, which is filled with 300 mL water to make the identification of the bladder safe. The incision and trocar placement is displayed in Supplementary Figure 1. A small midline incision of 2 cm is made at 2-3 cm below the umbilicus. Through this incision a cystotomy of the bladder dome is performed and a 10 mm camera cannula trocar is placed into the bladder. A purse string suture is placed to ensure air tightness after insufflation of the bladder with CO_2 at 12 mm Hg. Now the camera is introduced and both lateral 5 mm balloon trocars (Applied medical) are placed under direct vision in a transcutaneous and transvesical way. Both balloons are insufflated to prevent collapsing of the bladder during the procedure and dislocation of the trocar. The camera is then fixed in the Endoboy camera holder.

We use 3 laparoscopic instruments: a bipolar grasper for the left-hand port, and a harmonic scalpel (Ultracision from Johnson & Johnson) and suction device (Elephant suction from Johnson & Johnson) for the right-hand port.

The adenomectomy starts with the incision of the bladder mucosa 1 cm above the trigonum and ureteral orifices. The enucleation of the adenoma is initiated at the dorsal plane. The bladder mucosa is incised in a circumferential way and the enucleation is continued at both lateral lobes and ends at the ventral part. The attachments between the adenoma and the capsula are progressively transected with the harmonic scalpel. At the apex, the urethra and the bladder catheter are identified. The urethra is transected and the adenoma can be dropped in an endobag, which is introduced through the camera port. The capsula of the prostate is inspected and hemostasis of the prostate bed is performed using bipolar coagulation. If by accident a capsular lesion is made, it can easily be sutured with a V-lock suture. A Dufour bladder catheter of 22 Ch is introduced under direct vision and the balloon is filled with 30-50 mL water. The endobag is removed through the cystotomy incision and sent in for pathology. The cystotomy can be closed in 2 layers (mucosa and serosa) or with a purse string suture. Through one of both 5 mm ports, a drain is placed prevesicaly in the Retzius space. The fascia, subcutis, and skin are closed. In Figure 1 and Supplementary Figures 2 and 3, the procedure is depicted and explained step-by-step.

Follow-up

The drain is removed at day 1 if no urinary leakage occurs. The catheter is standard removed after 7-10 days. Bladder irrigation is continued until the urine is clear. The first day postoperative, all patients received a blood test: hemoglobin, creatinine, leukocytes, and CRP. Patients visited our outpatient clinic after 3 and 6 months for further follow-up, including a new IPSS-score and uroflowmetry.

RESULTS

Between March 2014 and November 2016, a total of 40 patients underwent an ETAP. As displayed in Table 1, the average age was 71 years, with a mean BMI of 26.9. Preoperative TRUS estimation of prostate volume showed a mean volume of 117 ml, the mean PSA was 8.0 ug/l and patients indicated a mean IPSS of 20.7. Out of the 40, patients 17 (43%) had a catheter preoperatively due to urinary retention. The average Q-max of the remaining 23 patients was 8.1 ml/s with a mean PVR of 77 cc. Out of 40 patients, 38 (95%) used a 5α-reductase inhibitor, an α-blocker or a combination therapy preoperatively.

Average operating time was 102 minutes and estimated blood loss was 184 ml. In seven (17.5%) cases a small perforation in the prostate-capsule occurred and in 1 (2.5%) case a small bladder defect occurred, all corrected with a V-lock suture. These patients did not have any problems in the postoperative follow-up. There was no perioperative transfusion or conversion needed. Postoperatively the catheter was removed after a mean of 9 days. Patients stayed an average 5 days in the hospital.

In Table 2 the functional outcomes are displayed. After removal of the catheter, all patients were able to urinate again. The average Qmax improved from 7.9 ml/s preoperatively to 21.2 ml/s postoperatively. The mean IPSS score decreased from 20.7 before the procedure to 7.5 after the procedure. The mean volume of the enucleated prostate adenoma was 85 grams in the pathology report.

All complications were registered according to the Clavien-Dindo classification, as displayed in Table 3. Postoperatively no

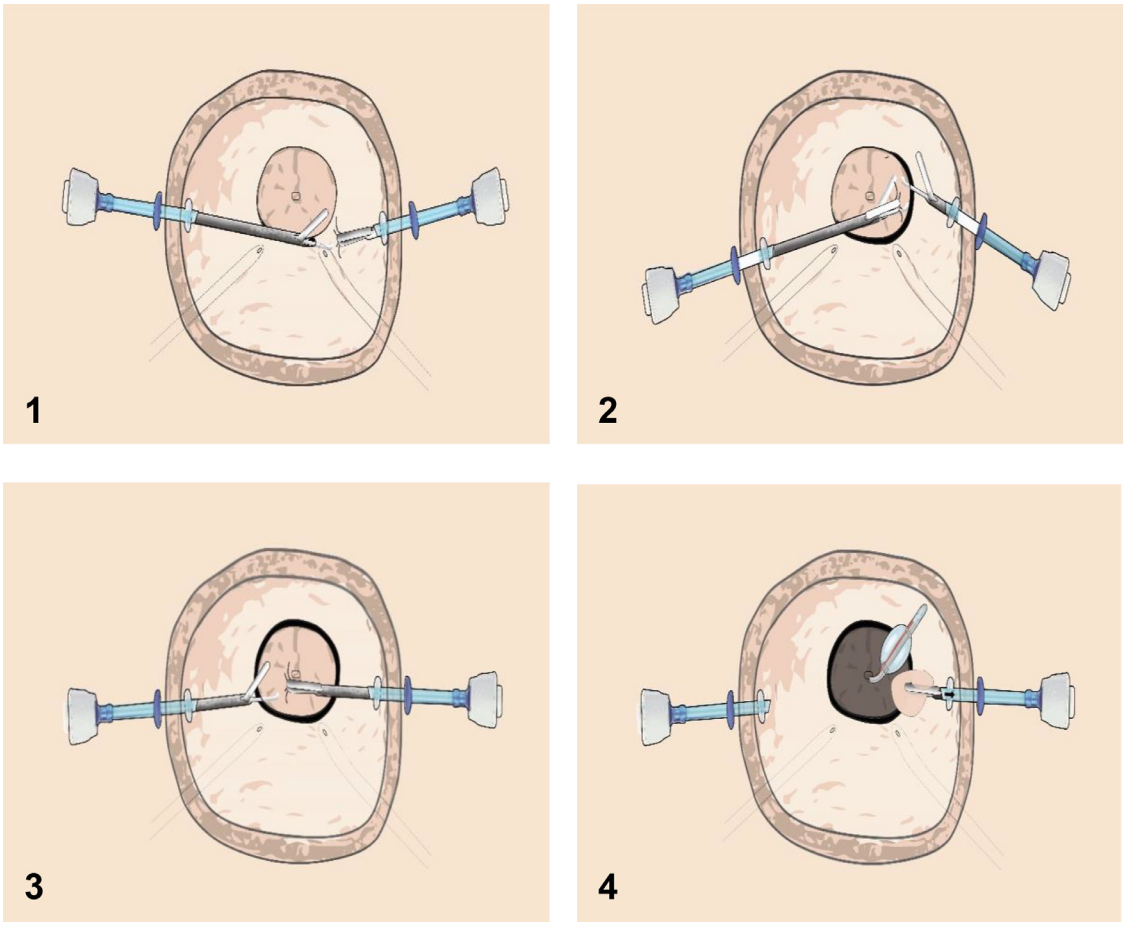

Figure 1. Step-by-step procedure. 1. Incision of the bladder mucosa above the trigonum and ureteral orifices. 2. Incision in a circumferential way on both lateral lobes. 3. Incision of the ventral part. 4. Identification of the urethra at the apex and completion of the transection. (Color version available online.)

patients suffered from wound complications. Eight (20%) of the 40 patients suffered from urinary tract infection after catheter removal and required antibiotics. Two (5%) of them developed an urosepsis and were readmitted for intravenous antibiotics. Two (5%) of the 40 patients suffered from a persisting severe hematuria and required an endoscopic revision and TUR coagulation in the operation room. Four (10%) patients suffered from a bleeding after discharge from the hospital and were readmitted for continuous irrigation of the bladder. None of them needed blood transfusion however. One (2.5%) patient in our series suffered a severe complication. He underwent an endoscopic revision because of persisting hematuria and a blood transfusion was required. After the procedure he developed a TUR-syndrome, and because of his cardiac history he was transferred to the intensive care unit. There he developed necrosis of a part of the glans penis, most likely due to persisting traction of the bladder catheter and edema. He finally underwent a debridement and skin graft.

Table 1. Baseline and perioperative data

Variable	Mean (±SD) or n (%)
Age (years)	71 (±7.1)
Body mass index (kg/m^2)	26.9 (±3.5)
Prostate volume in TRUS (gr)	117 (±32.3)
PSA (ng/l)	8.0 (±6.2)
IPSS	20.5 (±6.1)
Urinary retention (n)	17 (43%)
Qmax (ml/s)	8.1 (±3.2)
PVR (ml)*	77.1 (±68.7)
Perioperative	
Conversion to open (n)	0 (0%)
Blood loss (ml)	184.1 (±153.1)
Operation time (min)	102 (±31.0)
Hospital stay (days)	5.2 (±4.8)
Days with catheter	9.4 (±3.9)
Prostate volume (gr)	85.2 (±30.1)

IPSS, International prostate symptom score; PVR, post void residu; TRUS, Transrectal ultrasound.
* Exclude the 17 patients who were in retention.

There was a mean follow-up of 14 months. In this longer follow-up, 9 (22.5%) patients had stress urinary incontinence, all of them were referred for pelvic floor training which improved the incontinence. Only 2 (5%) of them suffered from persisting urinary incontinence. Three (7.5%) patients needed a bladder neck incision due to bladder neck sclerosis. One patient (2.5%) suffered from a recto-vesical fistula and was referred to an academic hospital for a fistula closure.

DISCUSSION

Open adenomectomy of the prostate or HoLEP is the recommended surgical treatment options for patients with moderate to severe LUTS in men with prostate size

Table 2. Functional outcomes

Outcome	Preoperatively	Postoperatively	
Urinary retention (n)	17 (43%)	0 (0%)	*p <0.001*
Qmax (ml/s)	8.1 ± 3.2	21.2 ± 9.5	*p <0.001*
PVR (ml)	77.1 ± 68.7	50.4 ± 32.1	p 0.12
IPSS	20.5 ± 6.1	7.5 ± 3.3	*p <0.001*

IPSS, International prostate symptom score; PVR, postvoid residu.

>80 mL. The HoLEP procedure shows good and promising results; however, it is not widely available because of the cost of laser surgery and the steep learning curve, and thus the open adenomectomy is still the most performed procedure. But open simple prostatectomy leads to significant complications as bleeding, long hospital stay, and catheterization time. To overcome these disadvantages, a new minimal invasive technique was developed in our center, with a similar approach as the open prostatectomy according to Hryntschak, clear vision, good vascular control, easiness to learn, and the use of standard laparoscopic instruments are the presumed advantages of this technique.

The ETAP was successfully preformed in all 40 patients, without conversion to the open approach. There were no severe complications during surgery. Postoperatively patients remained an average of 5 days in the hospital and had a urethral catheter for an average of 9 days. With the further development of and experience with the technique the admission stay and days with catheter is decreasing. Postoperatively 4 patients had a bleeding, which required transurethral coagulation. Of them 1 required blood transfusion as mentioned above. The transfusion rate of our study was 2.5%, which is much lower than the average 7%-14% transfusion rate in the open adenomectomy.[4,11,12]

In the longer follow-up, 3 patients required a bladder neck incision due to bladder neck obstruction; this is comparable to the number occurring in the open adenomectomy.[11] One patient had a vesico-rectal fistula with recurrent urinary tract infections. He was referred to an academic hospital for operative closure of the fistula.

The procedure shows promising functional outcomes with a significant decrease in the IPSS-score (−13 points) and an increase in Qmax (+13.1 ml/s). All of the patients who had an urinary retention preoperatively were able to void spontaneous after surgery. These numbers are comparable to open surgery and HoLEP.[4,12-16] Nine patients suffered from incontinence after the procedure. Seven of them showed improvement after standard pelvic floor therapy.

The cost issues are not directly calculated in this study. We presume this technique is not less cost-effective then the most current treatment options. We only use simple laparoscopic tools, so there is no need for investment in new technical material. The hospital stay and operation time are comparable to most treatment options. We presume it is more cost-effective than robotic approaches, due to the higher costs of adoption of robotics in urological surgery.

Other minimal invasive adenomectomy techniques have been described. Mariano et al were the first, in 2002, to describe the laparoscopic adenomectomy of the prostate.[17] Using a transperitoneal route with 5 trocars the capsule of the prostate and bladder-neck are opened. Van Velthoven et al followed in 2004 with a laparoscopic modification of the technique as described by Millin.[18] In 2005 Sotelo et al described a series of 17 patients that were treated with an endoscopic extraperitoneal technique.[19] Rey et al presented 10 cases of the so-called "hand assisted laparoscopy."[20] Retrospective studies comparing open techniques with laparoscopic or endoscopic techniques show the common advantages of minimally invasive surgery; less blood loss, shorter hospitalization, less days with catheter, less urinary tract infections, and similar percentages of postoperative haematuria are seen in the laparoscopic series.[21] Functional outcome after 1 year is similar.[22] A recent study of Xie et al compared the endoscopic procedure with the conventional TUR-P in large prostates. They showed a shorter hospitalization, less days with catheter and less complications with a better functional result after 1 year of follow-up, in favour of the endoscopic procedure. The overall blood loss was more in the endoscopic procedure compared to the conventional TUR-P.[23]

In 2008 and 2010 Desai et al described a transvesical single port adenectomy of the prostate.[24,25] They operated 34 cases with this new technique, with promising functional outcomes. There were some major complications in this study, including 1 death and 1 bowel injury. The procedure had a transfusion rate of 15% and a conversion rate of 12%. Fareed et al described the same technique in

Table 3. Complications

Grade		Complication	*N* < 90 days	*N* > 90 days
Low grade	Grade I	Stress incontinency	7 (17.5%)	2 (5%)
	Grade II	Urinary tract infection	8 (20%)	-
		Haematuria after discharge	4 (10%)	-
High grade	Grade III	Haematuria and need for TUR-coagulation	2 (5%)	-
		Bladder neck obstruction	-	3 (7.5%)
		Recto-vesical fistula		1 (2.5%)
	Grade IV	Haematuria, TUR-coagulation, TUR-syndrome with ICU-admission and partial glans necrosis	1 (2.5%)	-

2012, robot assisted.[26] They also had high-grade complications in 44% of the patients and a long mean operation time of almost 4 hours.

These studies showed the benefit of a transvesical approach, which stimulated us to create our new technique. The main benefit of this transvesical approach is the direct access to the bladder with less surgical trauma. There is no need for peritoneal violation or tissue dissection, and therefore no risk of injury to adjacent organs or tissue. The inflation of the bladder also provides tamponade of venous channels and therefore helps in reducing intraoperative bleeding, which is often the case in open surgery or transperitoneal laparoscopy. The final benefit of the transvesical approach is the excellent exposure of the prostate capsula after the enucleation, which is helpful in creating adequate haemostasis.

This study has a few limitations. It is a single-center, single-surgeon study. There was also no formal power analysis preformed, therefore it is not sure a sample size of 40 patients is sufficient. There is also no control group, therefore a comparative analysis vs other treatment options is lacking. In the future, a multicenter randomized controlled trial is necessary to further evaluate the technique.

In conclusion, this study suggests the ETAP is a technical feasible alternative to open surgery for the treatment of large BPH, with presumed less perioperative morbidity. This study shows promising functional outcomes. A prospective, multicentric comparison with other surgical methods in a larger group of patients and a longer follow-up is necessary to determine its place in the treatment of large BPH.

SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found, in the online version, at https://doi.org/10.1016/j.urology.2018.12.031.

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