International Scholars Journals

African Journal of Medicine and Surgery ISSN 2756-3324 Vol. 11 (4), pp. 001-005, April, 2024. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Full Length Research Paper

Open Prostatectomy for the Treatment of Extensive Benign Prostatic Hyperplasia

Long Zhi, He Le-Ye*, Zhang Yi-Chuan, Huang Kai, Shi Xuan-Yan, Sun Xiao-Hui and Peng Dong-Yi

Department of Urology, The Third Xiangya Hospital, Central South University, Changsha, Hunan 410013, PR China.

Accepted 25 January, 2024

The objective of this study is to assess the efficacy and safety of open surgical intervention for large volume (> 150 ml) benign prostatic hyperplasia while summarizing our clinical findings. From January 2001 to September 2010, surgeries were performed on 15 patients diagnosed with significant volume benign prostatic hyperplasia. The average age of these individuals was 71.8 ± 6.1 years. The average prostate volume measured 217.2 ± 90.6 ml (range: 150.1 to 471.7 ml). Follow-up assessments occurred at one, three, six, and twelve months post-surgery. Evaluation metrics included maximum urinary flow rate (Qmax), international prostate symptom score (IPSS), and quality of life (QoL). The findings are as follows: the average weight of the excised glands was 201.3 ± 87.5 g; the average surgical duration was 65 ± 20.4 min; and mean hemoglobin loss during surgery was 1.4 ± 1.3 g/dl. A single case of blood transfusion occurred. Post-catheter removal, all patients were able to urinate independently. One month post-surgery, Qmax improved to 21.5 ± 4.6 ml/s (P < 0.001), while IPSS and QoL scores decreased to 7.3 ± 2.5 and 2.4 ± 0.3 (P < 0.05), respectively. All patients with lower urinary tract symptoms showed significant improvement by the 12-month follow-up. Two patients experienced mild incontinence initially; however, their symptoms resolved within three months. In conclusion, open suprapubic transvesical prostatectomy proves to be a safe and effective option for treating patients with large volume benign prostatic hyperplasia, with adequate preoperative preparation being crucial for ensuring patient safety and minimizing postoperative complications.

Key words: Benign prostatic hyperplasia, huge volume prostate, surgical treatment.

INTRODUCTION

Benign prostatic hyperplasia (BPH) is characterized by a chronic, age-related, progressive disease in which prostate volume increases each year. The average annual increase after 30 years of age is approximately 1 to 2%. For some patients, the prostate volume can increase to 100 ml or more (Jacobsen et al., 2001), which is generally regarded as huge volume BPH. According to reported literature thus far, the largest prostate with huge volume BPH reached 2,410 g (Medina et al., 1997). Clinically, when large volume BPH becomes huge volume BPH, surgical treatment can be a challenging task. BPH is a serious socio-economic burden on the society.

The surgical treatment of BPH has changed drastically over time. About 30 years ago, open surgery was the most common surgical procedure. Afterwards, open surgery has been replaced gradually because of the development of endoscopic techniques. Transurethral resection of the prostate (TURP) is considered to be the "gold standard" treatment option of BPH (Zwergel et al., 1998). Although, some new and more minimally invasive techniques have been used to treat BPH in the past 10 years, for example, laser treatment, plasma vaporization, or laparoscopy, none of these has replaced TURP. However, TURP still incurs risks for heavy bleeding and associated TURP syndrome for large volume BPH (greater than 80 cm^3).

*Corresponding author. E-mail: leyehe@csu.edu.cn. Tel: 86-731-88618028. Fax: 86-731-88618028.

Table 1. Patients' demographic and preoperative data.

Parameter	Mean±SD (Range)
No. Patients	15
Age (years)	71.8±6.1 (59-83)
History (Months)	79.5±62.3 (5-240)
Urinary tract infection	9 (60%)
Retention	3 (20%)
Hematuria	2(13.3)
Cystolith	4 (26.7%)
Inguinal hernia	2 (13.3%)
Comorbidity	
Hypertension	4 (26.7%)
Heart disease	3 (20.0%)
Diabetes	1 (6.7%)
Chronic bronchitis	1 (6.7%)
Cerebral infarction	1 (6.7%)
Thrombocytopenia	1 (6.7%)
tPSA (ng/ml)	7.6±4.5 (1.2-43.7)
Vpro(ml)	217.2±90.6 (150.1-471.7)
150-200	8 (53.3%)
201-300	4 (26.7%)
>300	3 (20.0%)
PVR (ml)	206.3±180.9 (27-802)
Q_{max} (ml/s)	4.8±3.7 (1.2-12.4)
IPSS	27.5±7.1 (10-35)
QoL	5.3±0.8 (3-6)

tPSA: total prostatic special antigen; PVR:post-void residual urine; Vpro: volume of prostate Qmax: maximum urinary flow rate; IPSS: International Prostate Symptom Score; QoL: Quality of life.

European Association Urology guidelines recommend that TURP be applied during BPH treatment for prostate volumes in the 35 to 80 ml range, according to A-level evidence (Madersbacher et al., 2004). Based on the current clinical evidence, open surgery seems to be a reasonable choice for such cases of BPH patients with prostate volumes more than 80 ml.

Prostate volume is an important factor that affects the treatment of BPH (Protogerou et al., 2010). However, no standard in the literature is available regarding what prostate volume is defined as large or huge. In addition, the usefulness of related surgical experience is limited. In this study, we report the open surgical treatment of 15 patients with huge volume prostates, with specifically defining a volume of more than 150 cm^3 as a huge volume prostate.

METHODS

Between January 2001 and September 2010, 920 BPH patients were treated at our hospital. Of these patients, 15 had prostate volumes more than 150 ml (150.1 to 471.7 ml). The clinical data of all of the patients were assessed, including the following: medical history, international prostate symptom score (IPSS), quality of life (QoL), digital rectal examination, tPSA level, hemoglobin (Hb) level, maximum urinary flow rate (Q_{max}), prostate volume, post-void residual urine (PVR), and number of patients with complications and comorbidities. The clinical data of all of the patients are shown in Table 1.

Transrectal ultrasound (TRUS) was used, and the prostate volume was calculated (Chenven et al., 2001). Prostate cancer was excluded by a TRUS-guided prostate biopsy for 12 cases of tPSA > 4 ng/ml. All of the patients were assessed before operation by anesthesiologists to confirm them to be able to tolerate operation. Patients received a suprapubic transvesical prostatectomy under epidural (six cases) or general anesthesia (nine cases) (Meier et al., 1995).

During operations, glands were often removed in two or three portions due to their huge volumes, and the tips of the urethra close to the prostate were cut. Prostate fossa was examined and obvious bleeding sites were treated by electrocoagulation or sutured into a figure-eight configuration with absorbable sutures.

Prostatic fossa was given transverse-fold sutures, depending on the circumstances. At the bladder-prostate junction, 2 to 0 absorbable sutures were used as continuous-lock sutures from the 3:00 to 9:00 position. The 12:00 position often required figure-eight sutures to narrow the opening of the urethra. F20 Foley catheter was indwelled into the urinary tract, and the bladder neck was continuously compressed for 12 to 24 h, while a mushroom-shaped F28 bladder drainage tube was placed for cystostomy.

Catheters were removed after operation, and the patients were discharged from the hospital. Follow-up was performed regularly at1,3, 6, and 12 months after operation, at which time IPSS, QoL, and Q_{max} were assessed. All of these data were recorded and differences were analyzed by the student *t* test (univariate analysis), and $P < 0.05$ was considered to be statistically significant.

Table 2. Operative data.

Parameter	Mean±SD (Range)
Operative time (min)	65±20.4 (55-100)
Weight enucleated (g)	201.3±87.5 (145-450)
Hemoglobin loss (g/dL)	1.4±1.3 (0.2-6)
Blood transfusions (n)	1(6.7%)
Irrigation time (days)	1.8±0.4 (1-3)
Catheter time (days)	9.5±2.5 (8-12)
Postoperative hospital stay (days)	10.7±2.2 (9-12)

RESULTS

It is observed that the prostate was obviously protruding into the bladder in the operations. Ten cases had prostates with prominent protrusions, and three cases had prostates protruding into the anterior 2/3 of the bladder. Throughout the perioperative period, all of the patients were stable. The clinical data are shown in Table 2. The prostate tissue samples were weighed after the operations, with the heaviest weighing 450 g.

After pathological examinations of the specimens, prostate cancer was confirmed to be absent for all of the patients. After removing the catheters, the patients could urinate on their own. All of the patients completed their

Table 3. Preoperative and postoperative parameters (Mean±SD).

Parameter	Preoperative	1 Month	3 Months	6 Months	12 Months
Q_{max}	4.8±3.7 (1.2-12.4)	21.5±4.6 (11-45)	23.4±4.8 (6-47)	22.3±5.0 (9-38)	22.7±4.2 (10-38)
IPSS	27.5±7.1 (10-35)	7.3±2.5 (3-20)	6.6±3.0 (3-21)	5.4±2.6 (2-19)	4.9±1.8 (3-12)
QoL	5.3±0.8 (3-6)	2.4±0.3 (0-4)	2.1±0.4 (0-3)	2.5±0.3 (0-4)	2.6±0.5 (0-3)

Q_{max}: Maximum urinary flow rate; IPSS: International Prostate Symptom Score; QoL: Quality of life.

follow-ups, during which the one-, three-, six-, and twelve-month follow-ups indicated that Q_{max}, IPSS, and QoL showed significant improvement compared with their preoperative scores (P <0.05) and remained stable (Table 3). The two patients with mild urinary incontinence after extubation were counseled to strengthen their pelvic floor muscles, and the symptoms disappeared after three months.

DISCUSSION

BPH is one of the most common urinary system diseases in old men and an age-related, progressive disease that is an inevitable result of male aging. A normal adult male prostate weighs about 20 g. From the age of 40, the prostate begins to increase in size, significantly accelerating at 60 to 70 years of age. Enlarged prostates usually weigh 40 to 100 g, and a few prostates weigh more than 200 g. Weights of more than 500 g are very rare (Jacobsen et al., 2001; Medina et al., 1997; Tolley et al., 1987; Yonou et al., 1999).

Weight and volume of the prostate are important factors that affect treatment choice (Protogerou et al., 2010). However, there is currently no standard definition of prostate volume for treatment selection. Based on our experience, we used the TRUS method to measure prostate size (Chenven et al., 2001). We classified a prostate volume of less than 50 ml as small, 50 to 99 ml as medium, 100 to 149 ml as large, and more than 150 ml as huge. According to the aforementioned standards, a huge prostate accounted for 1.6% (15/920) of the BPH cases that underwent urological treatment at our hospital. Because of recent advances in drug development in the last 20 years and minimally invasive treatments in clinical applications, traditional open surgical treatment of BPH has been performed less frequently. However, open prostatectomy remains the primary choice at most medical institutions that treat BPH patients with large-size prostates (Suer et al., 2008; Thiel et al., 2009; Varkarakis et al., 2004).

Traditional reports in the literature have stated that prostates larger than 100 g are suitable for open surgery (Tubaro et al., 2001; Mearini et al., 1998; Serretta et al., 2002). Nevertheless, TURP is inappropriate due to a number of problems. For example, transurethral surgery requires more time, its removal efficiency is less than that of open surgery, and it incurs more surgical risk and complications (Ou et al., 2010).

However, this weight limit has been challenged by some experts (Suer et al., 2008; Thiel et al., 2009; Liu et al., 2010). Because of recent advances of surgical technologies, BPH patients with prostates weighing 100 g or more are usually subjected to treatments with new technologies, such as holmium laser enucleation of the prostate (Krambeck et al., 2010), transurethral plasmakinetic vaporization prostatectomy (Liu et al., 2010), and laparoscopic prostatectomy surgery (Levinson et al., 2008; Mariano et al., 2006). These new technologies have been proven effective and may provide great promise for the future. However, data on using these new technologies for treatment of huge volume BPH are limited, and their long-term effects require further evaluation.

Additionally, using these new technologies also have equipment-based and technical limitations, because it is difficult for most medical units to adopt these new technologies. Therefore, we advocate the choice of open surgery for huge volume defined as volume greater than 150 ml. Despite a longer hospital stay, slower postoperative recovery, affecting the appearance of the patient's lower abdomen, open surgery has a high efficacy and a low recurrence rate.

In addition, the complications of open surgery are not more severe than other methods (Suer et al., 2008). Moreover, open surgery can facilitate the treatment of bladder stones, bladder diverticula, prostate middle-lobe hypertrophy, and inguinal hernias (Protogerou et al., 2010). Based on these advantages and our own experience in the clinic, we believe that suprapubic prostatectomy is a very safe and effective treatment for huge volume BPH.

Although open surgery is an ideal method that is often used to treat huge volume BPH, the glands may compress the adjacent organs due to the enormous volume. Open surgery may be very challenging when coupled with a rich blood supply and venous engorgement. Bleeding is the most important perioperative complication and is a major factor that can threaten patients. If the operation and treatment are improperly performed, more serious complications may result.

In this study, one patient had perioperative blood loss of 800 m. We believe that the following measures help patients safely undergo the perioperative period:

(1) Routine blood preparation should be performed before operation.
(2) The procedure for opening the loose fatty tissue on the bladder surface, which is suffused with veins, should be performed gently.
(3) Making a bladder incision should begin at the top, only after the puncture has been confirmed. The largest case in this group involved 2/3 of the bladder wall being protruded by the prostate. If a surgical error occurs when the prostate tissue is cut, it will cause more bleeding, and more time will be required to stop the bleeding.
(4) After the bladder outlet mucosa has been cut open, electric coagulation knife should be used to deeply cut into the prostate capsule. The sites with obvious bleeding can be electrically coagulated, which can reduce continuous bleeding after prostate removal.
(5) Avoid damaging the capsule to reduce hemorrhaging in the prostate fossa. It is important to properly locate the surface of the prostate capsule and the gland. The finger should be close to the gland during blunt dissection, and a combination of blunt and sharp instruments should be used in cases of adhesion.
(6) Rapid removal of the prostate is necessary to reduce the continuous bleeding time and to begin the process to stop the bleeding as soon as possible. Meanwhile, a sterile gauze pad should be immediately applied after gland removal. At this time, the determination can be made whether the gland removal was complete. Any residual portion of the gland should be removed after removing the gauze pad, and any obvious bleeding sites can be sutured with absorbable sutures.
(7) The prostate fossa generally requires two stitches due to the huge prostate volume. This will help stop the bleeding and reduces the prostate fossa volume for easy wound healing and postoperative voiding (O'Conor, 1982).
(8) Many authors advocate suturing the bladder neck at the 5:00 and 7:00 during bladder neck reconstruction positions (Tolley et al., 1987), which is insufficient for huge prostatectomy bladder neck reconstruction. Prostate blood supply is not limited to these two sites during this operation (Clegg, 1955), and suturing from the 3:00 position to the 9:00 position is necessary. However, the bladder neck should not be stitched too tightly to avoid a postoperative bladder neck contracture.
(9) Continuously compressing the bladder neck using the balloon catheter is an effective means for preventing re-bleeding after surgery (Shahapurkar et al., 2009).

The protection of adjacent organs and tissue structures during the surgery has attracted close attention.

(1) Excessive force should be avoided when pulling the gland to prevent damage to the urethral sphincter and reduce the incidence of postoperative incontinence. Scissors should be placed close to the prostate when cutting the tip of the prostatic urethra, in order to avoid damaging the tip of the prostatic urethra with the fingers. There were two cases in this article of mild incontinence after surgery. The principal cause may have been local inflammatory edema, sphincter stimulation, closure mechanism failure, bladder instability, decreased bladder compliance, or long-term compression from a huge gland, which results in the over-stretching of the external sphincter. Incontinence itself is not caused by damage to the sphincter, and long-term pelvic floor muscle exercises can restore continence.
(2) The ureteral orifices should be discerned before suturing the bladder neck. If the bilateral ureteral orifice locations cannot be confirmed during surgery, treatment can be supplemented with an intravenous injection of methylene blue or a retrograde ureteral catheter.
(3) Fingers should be close to the gland surface when separating from below the prostate, thus avoiding injury the rectal wall; and rough tearing should be avoided when the glands are not fully stripped. In cases of adhesion between the prostate and the surrounding tissue, the left fingers can penetrate deep into the rectum and raise the prostate; separation can then be performed under the guidance of the left hand.

Huge volume BPH is relatively rarely seen in clinical situations. Surgical treatment should be seriously considered as a treatment option due to its enormous volume, rich blood supply, and adjacent organs being shifted by the pressure. Adequate preoperative preparation, precise surgical techniques, and strict postoperative observation can reduce the incidence of postoperative complications and ensure patient safety during the perioperative period. Regardless of the continuous innovations in endoscopic technology, we still believe that open surgery is a safe and effective method for treatment of huge volume BPH.

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