Original Article

Monopolar Transurethral Resection of the Prostate Using Water as the Irrigation Fluid: Our Initial Experience

Emmanuel A. Jeje, Taiwo O. Alabi[1], Rufus W. Ojewola, Moses A. Ogunjimi, Kehinde H. Tijani, Gabriel K. Asiyanbi[2]

Departments of Surgery and [2]Anaesthesia, College of Medicine of University of Lagos, Idi-Araba, Lagos, Nigeria / Lagos University Teaching Hospital, Idi-Araba, Lagos, [1]Department of Surgery, Urology Unit, Federal Medical Centre, Lagos, Nigeria

Abstract

Background: Monopolar transurethral resection of the prostate (M-TURP) has been the gold standard of surgical intervention in patients with benign prostatic hyperplasia with the indication for surgery. This can be achieved using varieties of irrigation fluids. **Objectives:** To document our experience with M-TURP using water as irrigation fluid in 123 consecutive patients. **Materials and Methods:** A retrospective study of all patients who had M-TURP with water as irrigation fluid was performed between January 2017 and July 2019. Information retrieved from theatre records and case notes includes patient's socio-demographic data, indications for surgery, intra-operative findings, the volume of resected chips and irrigation fluid used, post-operative complications and patient's satisfaction with the outcome of the procedure. These data were analysed using SPSS version 23. **Results:** Data from 123 patients were analysed and presented. The age range was 44–96 years with a mean of 69 years. Prostate volume ranges from 13.9 to 276.00 mls with a mean of 95.69 mls while resected prostate volume ranges from 2.0 to 158.0 mls with a mean of 56.68 mls. Volume of the sterile water used as irrigation fluid ranged from 5.0 L to 174.0 L with a mean of 68.7 L. Mean reduction in International Prostate Symptoms Score, improvement in Q-max and reduction in post-void residual urine were 22.1, 16.9 and 141.6 mls, respectively. Transfusion rate was 6.5% while the duration of admission ranges from 1 to 6 days, with a mean of 2.5 days. The overall complication rate was 26.0%. Ninety-six percent were satisfied with the outcome. **Conclusion:** M-TURP using water as irrigation fluid is safe and is as good as using the more rather expensive glycine or normal saline in bipolar TURP.

Keywords: Prostatic enlargement, TURP, water

Introduction

Benign prostatic obstruction is a common disease affecting men in our environment.[1] Many patients in our environment still require surgical intervention despite the wide use of various medical treatment options. The main surgical option usually employed in our environment is open prostatectomy most probably due either to huge prostates commonly encountered in our practice or lack of facility for endoscopic treatment in many centres.[2] Monopolar transurethral resection of the prostrate (M-TURP) has been the gold standard for a long time. Bipolar transurethral resection of the prostrate (B-TURP) which was designed to addressed the drawback of M-TURP has not demonstrated superiority over it in terms of outcome and complications save transurethral resection syndrome (TURS) and clot retention.[3]

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M-TURP using blended current provides excellent haemostasis during resection of the prostate. The irrigation fluids for monopolar resection are; 1.5% glycine, 5% dextrose water, sterile water, 3% mannitol, sorbitol, etc., The cheapest of all these is water. The justification for a cheap irrigation fluid in our environment is the poverty of resources as well as large prostates requiring longer resection time and the large volume of irrigation fluid. The use of water as irrigation fluid was initially discouraged due to the fear of intravascular translocation, consequent haemolysis and renal failure.[4,5] Recently, published data

Address for correspondence: Dr. Rufus W. Ojewola, Department of Surgery, College of Medicine of University of Lagos, Lagos University Teaching Hospital, PMB 12003, Idi-Araba, Surulere, Lagos, Nigeria.
E-mail: rojewola@unilag.edu.ng

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however showed that water is safe as irrigation fluid during TURP.[6]

The aim of this study is to present our experience with transurethral resection of prostates using water as irrigation fluid.

Materials and Methods

This is a retrospective review of all patients who had M-TURP from January 2017 to July 2019. All procedures were done after an established indication following clinical, laboratory and radiological assessment of the patients. Assessment of patient's fitness for surgery, namely, normal cardiovascular and renal functions, as well as informed consent, were also undertaken. Prostate volume estimation was carried out in all cases using transrectal ultrasound. Sterile urine was ensured or at the least sensitivity profile obtained where sterile urine was not achievable.

Procedures were carried out mostly under subarachnoid or spinal block with or without opioids. Epidural was used in patients with long phallus and very rarely general anaesthesia. All patients were positioned in modified Lloyd-Davis position. Meatotomy was done when necessary. Initial cystoscopy was done using a 22F cystoscope sheath, dilatation with Lister urethral bougies was then subsequently done only when indicated. Prostatic resection was performed using a 26F continuous flow resectoscope by Karl Storz, and an electrosurgical unit by Valley lab using a blended current set at 120 cut and 60 coagulation**.** A good height of about 80 cm of irrigation fluid above the patient was ensured. The resection protocol was to core out the innermost part of the prostate from the bladder neck to slightly above the verumontanum and then subsequently resect the next layers circumferentially following the onion skin pattern making sure not to reach the capsule in any part of the prostate earlier than others. The areas around the verumontanum were resected toward the end of the procedure. In small prostrates (usually <40 mls), the roof is usually left unresected. Meticulous haemostasis was always ensured.[7] The inflow channel was usually opened to about 50%–60% while the outflow channel was always fully opened. Regular palpation of the suprapubic region for bladder distension and immediate decompression was always done. Administration of 20 mg frusemide intravenously was done for every 1 h of resection time. For small and moderately enlarged prostates, omega signs were demonstrated to show satisfactory resection as shown in Figure 1.[8] Prostatic chips were evacuated using Ellik evacuator and the volume of the chips was usually measured using the water displacement technique. All chips were sent for histopathological analysis. The picture of the resected prostatic chip is shown in Figure 2. A 3-way, size 20 silicon catheter was then passed over 0.035 nitinol guidewire. Post-operative bladder irrigation with normal saline was done only when indicated. Patients were followed up for a minimum of 6 months.

Data were retrieved on patient's biodata, prostate volume, indications, intra-operative findings, duration of resection, volume of resected chips, volume of irrigation fluid used during resection, post-operative complications and patient's satisfaction with the outcome of the procedure and then entered into SPSS version 23 and then analysed.

Results

A total of 123 patients had complete data out of 129 cases done over the study period. One hundred and twenty-one have M-TURP for BPH, while 12 had channel M-TURP for acute urinary retention caused by prostate cancer. The age range was 44–96 years with a mean of 69.12 ± 9.92 standard deviation (SD) The age distribution is shown in Figure 3.

The prostate-specific antigen ranges from 0.1 to 3,402 with a mean of 44.30 ± 311.35. Prostate volume ranges from 13.90 to 276.00 mls with a mean of 95.69 ± 58.58. Mean pre-operative haemoglobin was 11.9 mg/dl with ranges of 10.1–14.9. The range of International Prostate Symptoms Score (IPSS) before surgery was 18–33 with a mean of 25.8 ± 7.9. Peak flow rate (Qmax) before surgery was 6.6 ± 1.7 with a range of 2.3–3.4 while post-void residual urine volume (PVR) before surgery was 164 ± 1.7 with a range of 45–262 mls. Indications for surgery are depicted in Table 1.

The distribution of anaesthesia for our procedures are: Epidural 60 (48.8%), Spinal + fentanyl additive 39 (31.7%), Spinal without any additive 23 (18.7%) and general 1 (0.8%). Pre-operative urethral dilatation was required only in 11 (8.9%) of the patients. The intra-operative findings include normal findings other than enlarged prostrate in 60 (48.8), trabeculations in 44 (35.8%) and others as depicted in Table 2.

The volume of the resected prostate ranges from 2.0 to 158.0 mls with a mean of 56.68 ± 33.46 SD The volume of the resected chips calculated as a percentage of the total

Table 1: Indications for transurethral resection of the prostrate

Indications	Frequency, *n* (%)
Recurrent AUR	81 (65.9)
Severe LUTS unresponsive to medical therapy	34 (27)
Haematuria of prostatic origin	6 (4.9)
Bladder stone	2 (1.6)
Total	123

AUR: Acute urinary retention, LUTS: Lower urinary tract symptom

Table 2: Additional intra-operative findings

Intra-operative findings	Frequency, *n* (%)
Normal	60 (48.8)
Trabeculations	44 (35.8)
Diverticulum	10 (8.1)
Bladder stone	7 (5.7)
Trabeculation + bladder stone	1 (0.8)
Diverticulum + bladder stone	1 (0.8)
Total	123

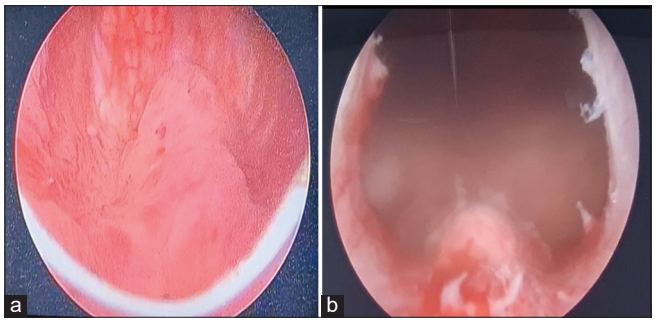

Figure 1: (a) showing appearance of the bladder neck before TURP showing complete obstruction of the bladder neck and (b) demonstrating the "Omega sign" after TURP in the same patient

Figure 2: Resected prostatic chips

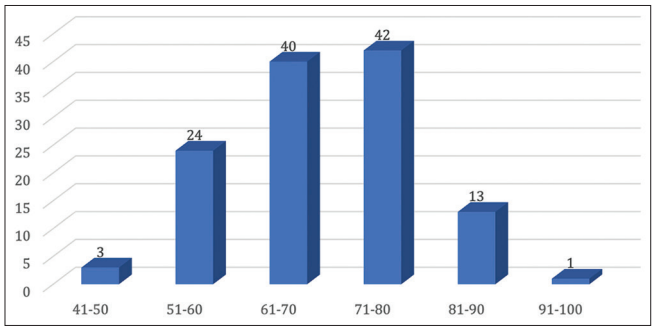

Figure 3: Age distribution of patients

prostate volume ranges from 14.4% to 91.3% with the mean percentage resected chip being 59.2% ± %11.2. The volume of the sterile water used as irrigation fluid ranged from 5.0 L to 174.0 L with a mean of 68.7 + 35.1. Duration of resection ranges from 20 min to 397 min with a mean of 131.3 ± 58.7.

Subjective assessment of outcome was carried out using IPSS while Qmax and PVR were used for objective assessment of outcome. Following surgery, range of IPSS was 5–0 with a mean of 2.9 ± 2.0 which translates to mean reduction in IPSS of 22.1 ± 3.7 with percentage reduction of 86.4%. Qmax after surgery was 21.8 ± 7.8 with mean improvement in peak urinary flow rate of 16.9 ± 7.7 which translates to an improvement of 84.7% while PVR after surgery was 24.6 ± 7.8 with mean reduction in PVR of 141.6 ± 99.3 with a reduction of 91.2%.

Altogether, there were 37 complications which occurred in 32 patients with overall complication rate of 26.0%. The most common morbidity was bleeding complications in 14 (11.4%) patients. Treatment offered for this are; re-catheterisation and continuous bladder irrigation in 4 (3.3%), transfusion in 8 (6.5%), administration of antibiotics/tranexamic acid in 2 (1.6%) or endoscopic fulguration of bleeding points in 1 (0.8%). Significant bleeding requiring re-admission occurred in 5 (4.1%) of these patients with duration of admission ranging from 1 to 6 days, with a mean of 2.5 ± 0.7. Ninety-one (74.0%) patients did not report any complications following the surgery and throughout the follow-up period. There was one mortality from disseminated intravascular coagulopathy. Other complications reported are as depicted in Table 3 classified according to the Clavien-Dindo grading system.

Majority of our patients, 118 (96%) were satisfied with the procedure. The assessment of the overall satisfaction of the patient with the outcome of the procedure is as depicted in Figure 4.

Discussion

Benign prostatic hyperplasia is one of the most common diseases in ageing men with increasing incidence with age.[9] While many are asymptomatic, a significant percentage will manifest clinical evidence of this disease and/or its complications. Asymptomatic men require no treatment while symptomatic ones require lifestyle changes, medical or surgical treatments. While lifestyle changes may suffice in patients with mild symptom, pharmacological treatment is recommended for moderate and severe symptoms. Surgical treatment, which can be open or endoscopic, is usually reserved for those with complications associated with benign prostatic obstruction and those with failed medical treatment.

In this study, the age range of patients requiring surgical intervention for bladder outlet obstruction due to benign prostate enlargement in our study was 44–96 years with a mean of 69 years with the peak age incidence in the eight-decade of life. The mean age incidence in our review is similar to the previous studies on the transurethral resection of the prostate.[2,10,11] The mean prostate volume in this study of 96.69 mls is higher than the mean prostate volume reported in studies among Caucasian and Asian populations.[12,13] The wide range of prostate-specific antigens ranging from 0.1 to 3,402.00 with a mean of 44.30 ng/ml was due to the inclusion of twelve prostate cancer patients requiring channel TURP in this study.

Medical therapy and subsequent trial of voiding without catheter (TWOC) is the first-line treatment for uncomplicated urinary retention due to prostatic enlargement in our practice. The surgical option is reserved for those who fail to respond to the initial medical therapy. This explains why the most

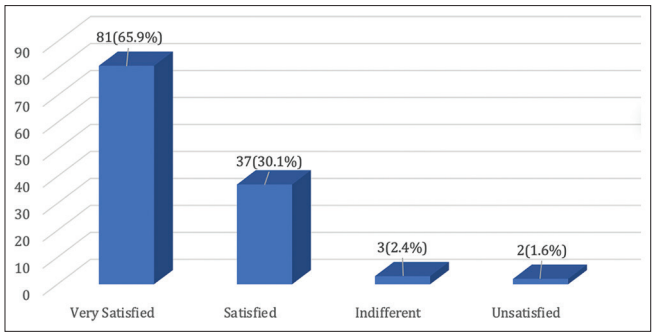

Figure 4: Overall satisfaction with the outcome of the procedure

common indication in our practice is recurrent urinary retention. A similar finding was documented by Alhasan *et al*.[2]

Our preferred anaesthesia for huge prostate (prostate volume greater ≥80 mls) which we commonly encounter in our practice is epidural anaesthesia. It offers little penile tumescence and prolonged effect required in resection of huge prostate. Spinal anesthesia + fentanyl used in 39 patients with intermediate-sized prostate (30–79 mls) offers similar effect to an epidural in terms of reduced penile tumescence and prolonged anaesthesia. We observed that spinal anaesthesia produces rigid erection, this is usually a problem in patients with huge prostate, especially median lobe component, this makes getting into the bladder sometimes challenging. Hence, spinal anaesthesia without additive is usually the choice of anaesthesia for small prostates. Other researchers have however documented excellent results with use of caudal block for TURP.[14]

In patients with co-existing bladder stones, our protocol is to treat the bladder stones endoscopically with litholapaxy or laser stone fragmentation before proceeding to treat the prostate except in very huge prostate (especially with huge median lobe) where it is usually difficult to have adequate access to the bladder let alone the bladder stone. The prostate is first resected, the stone which then drops into the prostatic fossa can then be easily fragmented. This was the case in two of these patients. This however may not be feasible in patients with large calculi who may require cystolithotomy after successful TURP as demonstrated by Ali *et al*.[15] in Kano, Northern Nigeria.

Minimal prostate resection between 5 and 7 O' clock from the bladder neck to the verumontanum is our protocol for small prostates (<30 mls), this explains why as little as 2.0 ml (14.4%) of prostatic tissue was resected in our series. A strip of tissue is also usually left untouched between 10 and 2'O clock for prostate volume between 30 and 50 mls. This in our opinion is responsible for the reduction in the complication of bladder neck stenosis in our series. Circumferential resection from the bladder neck to the verumontanum is done only in prostate volume above 50 mls. Following a thorough circumferential resection at the apical region around the verumontanum, a scope positioned at the just below the membranous urethral shows a classical 'Omega sign' usually in prostates between 50 and 80 mls, especially with prominent median lobe. The

Table 3: Post-operative complications according to Clavien-Dindo classification

Grade	Complication	*n* (%)
1	Reactionary haematuria/haemorrhage	2 (1.6)
	Secondary haematuria	4 (3.3)
	Failed trial of voiding without catheter that resolved spontaneously	5 (4.1)
	Stress incontinence	3 (2.4)
	Sepsis	1 (0.8)
2	Primary haemorrhage	2 (1.6)
	Significant reactionary haematuria/haemorrhage	4 (3.3)
	Significant secondary haematuria	2 (1.6)
	Orchitis	4 (3.3)
	Urge incontinence	4 (3.3)
	New onset ED	1 (0.8)
3	Bladder beck stenosis	2 (1.6)
	Urethral stricture	1 (0.8)
	Total incontinence	1 (0.8)
4	Nil	
5	Mortality from disseminated intravascular coagulation	1 (0.8)
	Total	37

ED: Erectile dysfunction

huge lateral lobes prolapsing below the verumontanum make it impossible to describe this sign in huge prostate >80 mls. This 'Omega sign' typifies adequacy of apical resection and is synonymous with the satisfactory urinary stream which many patients describe as jet-like, in our practice. In addition, resection demonstrates this sign with sparing of the incidence of stress urinary incontinence following TURP.[16,17]

The previous series where water was used as the irrigation fluid during TURP, their mean prostate volume was by far smaller than in our series.[18,19] Expectedly so, their duration of resection was shorter than ours, ditto the volume of resected chips as well as the volume of irrigation fluid. The use water as the irrigation fluid is an attractive option because it is the cheapest irrigation fluid (water [0.17 dollars/L] versus normal saline [1.2 dollars/L] vs. glycine [12 dollars/L]) against the backdrop of large prostates in our environment requiring long duration of resection with the attendant large volume of irrigation fluid.

It is reassuring that about three-quarters of our patients have a jet-like urinary stream with satisfactory outcomes without any significant complications. Reactionary haematuria which occurred in 6.5% of our patients is usually caused by; (1) difficulty in getting the urethral catheter in, due to entrapment within the prostatic fossa with subsequent provoked bleeding. This happened at the early series, we were able to prevent this by subsequently passing our catheters over a 0.032 nitinol glide wire, (2) capsular perforation and (3) restoration of blood pressure after the subarachnoid/epidural anaesthesia wears off.

The overall complication rate of 26.0% in our study is comparable to other studies locally and abroad.[2,11,20] Insignificant secondary haematuria is not uncommon following TURP, however, significant bleeding requiring re-admission

for re-catheterisation and continuous bladder irrigation, transfusion, administration of antibiotics/tranexamic acid or endoscopic fulguration of bleeding points occurred in 4.1%. Causes of this include constipation and urinary tract infection. The rate of urinary retention in our study is also comparable to previous studies.[13,21] All of them were managed conservatively by urethral re-catheterisation for 7–14 days, they all voided satisfactorily thereafter without need for second resection nor long term use of alpha-blockers.

Incidences of urethral stricture (0.8%) and bladder neck stenosis (1.6%) in our series are low compared to previous similar publications.[13,22] In our experience, previous in-dwelling urethral catheters which is common in our practice cause urethral dilatation similar to what happens with ureteric dilatation with DJ pre-stenting before ureteroscopy, hence this group of patients does not require urethral calibration. Previously un-catheterised patients have a narrow urethral which requires calibration because our resectoscope size is 26F. We do not routinely use Otis urethrotome in our practice. Our calibration is done with serial lister bougies. We usually leave the urethral catheters for about 3–5 days.

One patient has total urinary incontinence which resolved for 6 months with Kegel's exercise and medications, this as well as other forms of incontinence are comparable with previous studies despite our careful apical resection.[23,24] The transfusion rate (6.5%) in our series is modest and comparable with previous studies despite prolonged resection time in huge bleeding prostates.[11,13] The use of blended current and meticulous fulguration of the prostatic fossa after the procedure ensured that bladder irrigation is not required in majority, 88.6% of our patients.

The incidence of erectile dysfunction (ED) in this study is similar to reports in previous studies.[25-28] However, proper pre-operative as well as post-operative assessment of ED using International index for Erectile Function 5 was not done in this series. Furthermore, many patients in our series are either not sexually active due to in-dwelling catheters, partner issues or ED which they have lived with long before the surgery. There was no incidence of clinical TURS even in prolonged resection in our series. The only mortality in this series was due to disseminated intravascular coagulopathy from severe sepsis on post-operative day 5 in an 69-year-old man with diabetic retinopathy.

The mean reduction in IPSS of 22.1 is comparable to previous study by Taylor and Jaffe[23] but mean improvement in peak urinary flow rate (Q-max) of 16.9 mls/sec is higher than reported in their study. This might be due to large average resected prostate volume as well as meticulous apical resection in our series. The mean reduction in PVR urine of in this study is also comparable to report by Taylor and Jaffe.[23]

Overall satisfaction of our patients at 6 months post-operative was impressive (96%) and similar to that reported by Alhasan *et al*.,[2] the early post-operative irritative symptoms have settled in them by then.

Conclusion

Our study showed that resection of huge prostates commonly encountered in our practice can be also be done safely over a longer period of resection using sterile water. With careful resection and intra-operative monitoring, complications from this procedure using water as the irrigation fluid are comparable to even the bipolar resection. We recommend periodical use of intravenous frusemide with prolonged duration of resection. A large-scale randomised study with intra-operative measurement of serum electrolyte and fluid absorption is required to further corroborate these findings.

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Conflicts of interest

There are no conflicts of interest.

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