Original Article

Learning Transurethral Resection of the Prostate: A Comparison of the Weight of Resected Specimen to the Weight of Enucleated Specimen in Open Prostatectomy

II Nnabugwu, FO Ugwumba, EI Udeh, OF Ozoemena

Department of Surgery, College of Medicine, University of Nigeria Enugu Campus, Enugu State, Nigeria

ABSTRACT

Background: Minimally invasive procedures in the surgical management of benign prostate enlargement (BPE) are of limited use in the resource-poor settings due to nonavailability of the requisite facilities and skills. It has been observed that teaching uroendoscopy inclusive of transurethral resection of the prostate (TURP) can be challenging in the resource-poor settings where the traditional master-apprentice (Halstedian) approach has remained the prevalent training technique. **Patients and Methods**: We aimed in this retrospective study to assess completeness of resection in TURP by comparing the proportion of prostate tissue resected to the proportion enucleated in open retropubic prostatectomy (ORP). We included all BPE patients on urethral catheter managed in the first 18 months after Halstedian training in TURP. The analysis was done using SPSS® 20 and VassarStats® online software. **Results:** Twenty patients' files for TURP and twenty-eight patients' files for ORP met the inclusion criteria. Patients in the 2 treatment arms were similar in age ($P = 0.22$), body mass index ($P = 0.45$), proportion of prostate tissue extirpated ($P = 0.38$), and International Prostate Symptom Score 12-month postprocedure ($P = 0.06$). However, larger prostates were treated with ORP ($P < 0.0005$). The correlation of the weight of resected specimen to preoperative prostate volume (PV) ($r = 0.78$; $P < 0.001$) was similar to that of enucleated specimen to preoperative PV ($r = 0.89$; $P < 0.001$). Similarly, the proportion of extirpated specimen correlated positively with the preoperative PVs for both TURP ($r = 0.23$; $P = 0.33$) and ORP ($r = 0.292$; $P = 0.13$), with no evidence of any difference between the 2 correlation values ($P = 0.84$). **Conclusion:** With appropriate patient selection, especially as a newly trained Surgeon, resections in TURP are as complete as enucleations in ORP.

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KEYWORDS: *Correlation, enucleated weight, Halstedian approach, learning trans-urethral resection of the prostate, resected weight, retropubic prostatectomy*

INTRODUCTION

Minimally invasive procedures in the surgical management of benign prostate enlargement (BPE) are of limited use in resource-poor settings due to nonavailability of the requisite facilities and skills. Of the various minimally invasive procedures, transurethral resection of the prostate (TURP) is usually the procedure of choice in centers where minimally invasive procedures are possible.[1]

It has been observed that teaching uroendoscopy inclusive of TURP can be challenging[2,3] especially in resource-poor settings where the traditional master-apprentice (Halstedian) approach has remained the prevalent training technique.[4] This is in contradistinction

Address for correspondence: Dr. II Nnabugwu, Department of Surgery, College of Medicine, University of Nigeria Enugu Campus, Enugu State, Nigeria. E-mail: ikenna.nnabugwu@unn.edu.ng

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to the approach in the more advanced economies where various training models and virtual reality simulators are routinely used.[5-9] To improve the learning curve and to reduce the risk of "side effects" on patients in the Halstedian approach, the training eyepiece and later, the use of video-resection facilities were introduced.

Beyond training, however, desirable outcomes in every surgical procedure improve while undesirable outcomes decline with practice. Technically, the quality of surgical care provided improves with the number of such surgical conditions handled by the Surgeon.[10,11]

Relief of infravesical obstruction is the primary objective of surgical treatment of BPE and this is usually achieved through extirpation of the obstructing prostate mass.[12] In open retropubic prostatectomy (ORP) for BPE, the obstructing adenoma which forms a proportion of the entire prostate volume (PV) assessed preoperatively is enucleated bluntly[13] and completely *en masse* along a recognized cleavage plane leaving the nonobstructing compressed peripheral prostate tissue to maintain continuity of the urinary tract. Complete enucleation of the adenoma is usually obvious.

On the other hand, in TURP, resection of the prostate adenoma is done piecemeal up until the typical fibers of the "prostate capsule" which signifies the compressed peripheral prostate tissue is revealed. This achieves similar extirpation of the obstructing mass of prostate tissue with improvement in symptoms as well.[14] Since resection is piecemeal down to the capsule, residual prostate adenoma may be left *in situ* inadvertently by the less experienced, or glaringly by any Surgeon once continuing resection is perceived to pose increasing risk to the patient's safety.

It is not unusual in our setting to have patients consent for surgical interventions in BPE only when their quality of life has been significantly impaired by indwelling urethral catheterization[15,16] and/or other complications of "neglected" long-standing bladder outlet obstruction. Resuming voiding without urethral catheter, reduction in the International Prostate Symptom Score (IPSS), improvement in uroflowmetry parameters, as well as the proportion of prostate tissue extirpated (PPE) (with respect to the preoperative ultrasonographic estimate of PV) are objective outcome indicators of adequacy of resection and relief of bladder outlet obstruction due to BPE, and can be used singly or in combinations as indices of extent of relief of infravesical obstruction.[17,18]

In this study, we retrospectively assessed the proportions of prostate tissue resected through TURP by a single Surgeon after a typical Halstedian approach to training in TURP[4] and compared it to the proportions of prostate tissue enucleated in ORP for BPE within the same period.

Patients and Methods

The case files of all the patients who had TURP or ORP for BPE from July 2013 to September 2014 were retrieved for analysis. All patients included in the study had an abdominopelvic ultrasonographic assessment of the PV obtained preoperatively from one of two radiologists using the same ultrasound machine (Sonoace-X8 Medison Ultrasound®), and a histological confirmation of nodular hyperplasia of the resected or enucleated prostate tissue postoperatively. Only those patients whose lower urinary tract symptoms (LUTS) culminated in urethral catheterization before giving consent for surgical management were selected for this analysis. We however excluded those who had developed urinary bladder calculi and diverticula before the presentation.

From the case files that met the inclusion criteria, the following information were extracted: the age of patient; weight and height of patient from which body mass index (BMI) was derived; the abdominopelvic ultrasonographic estimation of the PV preoperatively; the weight of extirpated (resected or enucleated) specimen; the type of surgical procedure done (TURP or ORP); need for recatheterization in the first postoperative year; and the IPSS at 12-month postsurgery (IPSS-12).

Using Statistical Package for Social Sciences (SPSS® Inc., Chicago, IL, USA) version 20, we compared the means of age, BMI, preoperative volume of prostate, PPE by TURP or ORP, and the IPSS-12 of the patients that had TURP against those that had ORP. We used Pearson Correlation and Linear Regression analyses to evaluate the relationship between weight of specimen and PV on the one hand and PPE and PV on the other hand for TURP and ORP. VassarStats® online statistical software was used to estimate the difference between the correlations. Statistical significance was set at $P < 0.05$.

Results

Forty-eight patients' case files met the inclusion criteria. Of these, 20 had TURP while 28 had ORP. The means of patients' age, BMI, PV, and PPE for the 2 treatment groups (TURP and ORP) are shown in Table 1. The median values of PV for the 2 treatment groups are 77.7 cm^3 (interquartile range [IQR] 65.1–89.1 cm^3) for TURP and 130.7 cm^3 (87.9–191.3) for ORP. The IPSS at 1 year postoperative period (IPSS-12) was available for 14 of the 20 TURP patients and 17 of the 28 ORP patients with the means as shown in Table 1.

Table 1 shows there is no significant difference in the age, BMI, PPE, and IPSS-12 of patients treated with TURP and those treated with ORP. However, as

Table 1: Comparison of the mean age of patients, body mass index prostate volume percentage of prostate tissue extirpated and International Prostate Symptom Score 12-month postsurgery within the 2 procedures

Type of procedure	Mean age of patients (years)	Mean BMI (kg/m²)	Mean PV (cm³)	Mean PPE (%)	Mean IPSS-12
TURP	66.1±8.6	22.8±4.0	72.3±22.7	57.3±16.7	5.0±1.9
ORP	69.1±8.3	23.6±3.6	150.2±86.8	62.0±21.5	3.9±1.5
P	0.22	0.45	<0.0005	0.38	0.06

TURP=Transurethral resection of the prostate; ORP=Open retropubic prostatectomy; BMI=Body mass index; PV=Prostate volume; PPE=Proportion of prostate extirpated; IPSS=International Prostate Symptom Score

Table 2: The correlation between the weight of prostate tissue specimen in transurethral resection of the prostate and open retropubic prostatectomy, and the preoperative prostate volume

	PV (cm³)		WTS (g)		Pearson correlation	*P*
	Minimum	Maximum	Minimum	Maximum		
TURP	19.3	104.1	3.8	63.9	0.78	<0.001
ORP	30.6	336.0	8.7	289.5	0.89	<0.001

Minimum=Minimum value in the distribution; Maximum=Maximum value in the distribution; PV=Prostate volume; WTS=Weight of tissue specimen; TURP=Trans-urethral resection of the prostate; ORP=Open retropubic prostatectomy

Table 3: The analysis of correlation between the proportion of prostate extirpated and the preoperative prostate volume in transurethral resection of the prostate and open retropubic prostatectomy

	PV (cm³)		PPE (%)		Pearson correlation	*P*
	Minimum	Maximum	Minimum	Maximum		
TURP	19.3	104.1	23.6	79.0	0.231	0.33
ORP	30.6	336.0	17.4	9.4	0.292	0.13

Minimum=Minimum value in the distribution; Maximum=Maximum value in the distribution; PV=Prostate volume; TURP=Transurethral resection of the prostate; ORP=Open retropubic prostatectomy; PPE=Proportion of prostate extirpated;

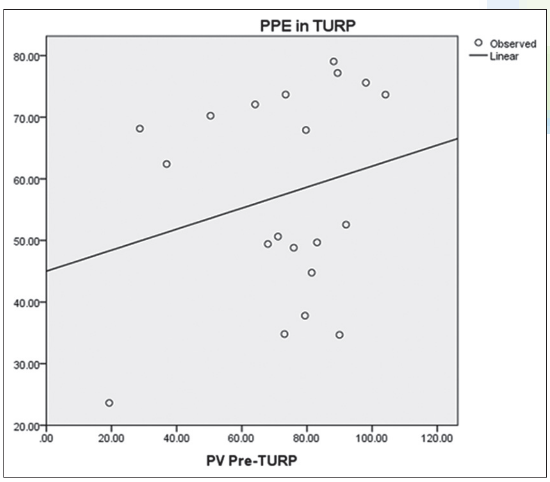

Figure 1: Regression curve of proportion of the prostate tissue extirpated and the preoperative prostate volume for transurethral resection of the prostate group

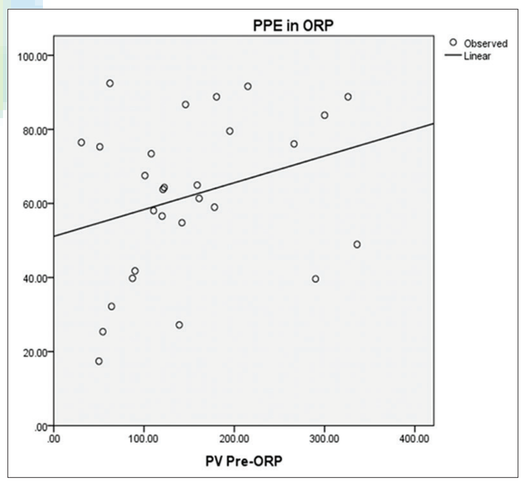

Figure 2: Regression curve of the proportion of prostate tissue extirpated and the preoperative prostate volume for open retropubic prostatectomy group

expected, patients with higher PVs had ORP as the surgical procedure of choice ($P < 0.0005$).

Using TURP, 3.8–63.9 g of tissue was resected with a mean of 35.3 ± 16.1 g and a median of 30.7 g (IQR 25.3–45.1 g). The mean proportion of prostate tissue resected assuming a specific gravity of 1 g/cm³ for the prostate is 57.3 ± 16.7% of the preoperative volume (in cm³) of the prostate as estimated by abdominopelvic ultrasonography. With respect to ORP, 8.7–289.5 g of prostate adenoma was enucleated with a mean of 98.4 ± 72.3 g and a median of 78.3 g (IQR 38.0–148.0 g). The enucleated adenoma constituted a mean proportion of 62.0% ± 21.5% of the preoperative PV assuming a specific gravity of 1 g/cm³ for prostate tissue.

Table 2 clearly reveals that the weights of enucleated adenoma and resected prostate tissue very strongly correlate with the corresponding preoperative PVs.

The correlation between the proportion of prostate extirpated by resection or enucleation and the preoperative PVs within the respective treatment arms is shown in Table 3 as well as Figures 1 and 2. There is no evidence that there is any difference between the correlation values for weight of extirpated specimen versus preoperative PV ($P = 0.23$), and PPE versus preoperative PV ($P = 0.84$) for the two procedures TURP and ORP using VassarStats® online statistical software.

The regression curves of the PPE and PV for TURP and ORP are shown in supplementary [Figures 1 and 2].

Discussion

Completeness of prostate adenoma resection is one of the concerns in TURP. In our setting where medical bills are borne by individual households through direct out-of-pocket payment,[19] it will be more cost-effective to aim to achieve complete resection in one theater session. To achieve this using a monopolar continuous-flow resectoscope as in our setting, proper patient selection with respect to the preoperative PV is important. Smaller PVs requiring surgical management are better managed by monopolar TURP while larger prostates are better managed by ORP in the absence of minimally invasive techniques for such large PVs. This sorting criterion ensures that significant residual prostate adenoma with persistent LUTS does not become the outcome of TURP sessions. In open prostatectomy, however, the completeness of enucleation is rarely in doubt in so far as enucleation is bluntly done along the cleavage plane.

This retrospective appraisal of our monopolar TURP sessions in the first 18 months after training by the Halstedian approach,[4] focuses on completeness of resection of the prostate adenoma in the subset of patients whose LUTS progressed to recurrent acute urinary retention requiring indwelling urethral catheterization in the absence of any other possible explanation.

The mean age of the TURP patients from this study was 66.1 ± 8.6 years which is similar to Kyei *et al*. in Ghana,[16] Yamaçake *et al*. in Brazil[11] and many other studies elsewhere.[20-22] Similarly, the mean BMI of these TURP patients was 22.8 ± 4.0Kg/m^2 which is akin to the findings of Wu *et al*. in Shanghai,[22] but lower than the findings of Harraz *et al*. in Egypt.[21] There is no evidence from this study [Table 1] of any significant difference in age ($P = 0.22$) and BMI ($P = 0.45$) between the patients who had TURP and those that had ORP.

However, expectedly smaller volume prostates were assigned to TURP whereas larger volume prostates were assigned to ORP ($P < 0.001$). This was to ensure completeness of resection in one session with little or no risk of transurethral resection syndrome as a consequence of prolonged monopolar resection, or significant residual adenoma with symptoms requiring recatheterization and completion TURP or prostatectomy in the early postoperative period.[23] The mean preoperative volume of prostates that had TURP was 72.3 ± 22.7 cm^3 while the mean preoperative volume of prostates that had ORP was 150.2 ± 86.6 cm^3. These preoperative PVs are greater than the volumes in the study from Ghana,[16] where the mean preoperative PV of TURP group of patients was 40.1 ± 16.2 ml, and the corresponding value for open prostatectomy group of patients was 64.2 ± 28.7 ml.

Alhasan *et al*.[15] in northern Nigeria, resected a mean prostate tissue of 59.8 ± 27.8 g, which is greater than the mean weight of resected prostate tissue in this study (35.3 ± 16.1 g), but which may have been from much bigger prostate glands since the mean preoperative volume of the prostate glands in their study was not documented. In open simple prostatectomy (retropubic or transvesical), the obstructing adenoma is undoubtedly completely enucleated, and from our study, the median weight of enucleated adenoma was 78.3 g (IQR 38.0–148.0 g) constituting a mean 62.0% ± 21.5% of the preoperative PV. This mean proportion of prostate tissue enucleated by ORP is similar to the mean proportion of prostate tissue of 57.3% ±16.7% resected by TURP ($P = 0.38$) [Table 1]. In other words, the completeness of resection by TURP in our selected group of patients was comparable to completeness achieved by enucleation. In a series of 51 TURP patients from Malaysia,[24] a mean 26.6 g of prostate tissue constituting 59.1% of preoperative PV was resected to achieve a mean postoperative IPSS of 6.5.

The weight of resected prostate tissue is a function of the preoperative volume of the prostate as well as the speed (a function of the expertise and experience of the surgeon) and duration of resection. Table 2 shows a very strong positive correlation between the weight of resected prostate tissue and the corresponding preoperative volume of prostate ($r = 0.78$; $P < 0.001$), which does not differ significantly ($P = 0.23$) from the correlation of weight of enucleated prostate adenoma and the preoperative PV ($r = 0.89$; $P < 0.001$). Similarly, the weak positive correlation between the preoperative estimates of the PV and the proportion of the prostate extirpated by resection in TURP ($r = 0.23$; $P = 0.33$) approximates that obtained by enucleation in ORP ($r = 0.29$; $P = 0.13$) as displayed in Table 3 and supplementary Figures 1 and 2, with the difference in their correlation estimates being highly insignificant ($P = 0.83$). There was no recatheterization or retreatment in the first postoperative year in either group, unlike the observation of 7.1% recatheterization rate and 8.8% retreatment rates reported by Geavlete *et al.*,[25] although our series is rather small. Either procedure achieved significant and durable relief of LUTS to an IPSS <7 by the first postoperative year. While the TURP group had a mean IPSS of 5.0 ± 1.9, the ORP had a mean IPSS of 3.9 ± 1.5 in the first postoperative year (P = 0.06). In their meta-analysis, Wang *et al*. obtained a mean IPSS of 4.94 (95%CI) 12 months postoperatively,[26] while in their retrospective analysis of procedures done, Erturhan *et al*. obtained an IPSS of 4.80 ± 0.77 by the 1st year after TURP.[27]

Therefore, in the practice of a newly trained Surgeon in our low-income setting with such limitations as the absence of practice sessions in skills laboratories and prevalent direct out-of-pocket payment for needed medical services, appropriate patient selection plays a significant role in achieving desired treatment goals of relieving infravesical obstruction and improving quality of life of patients. Obviously, as the speed of resection improves and/or with the deployment of other minimally invasive techniques for larger prostate glands such as bipolar resection techniques, such larger prostate glands can be extirpated using minimally invasive techniques with successful complete resection of the obstructing prostate adenoma.

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Conflicts of interest

There are no conflicts of interest.

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