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Original Research Article

A Prospective Study to Compare the Safety, Efficacy and Short Term Outcome of TURP (Transurethral Resection of Prostate) and ThuLEP (Thulium Laser Enucleation of Prostate)

Pankaj Trivedi[1], Vishwas Baheti[2], Vaibhav Lakhanpal[3]

[1,2]Associate Professor, Department of Urology, Geetanjali Medical College and Hospital, Udaipur, Rajasthan

[3]Senior Resident, Department of Neurosurgery, Dayanand Medical College and Hospital, Ludhiana, Punjab

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Corresponding Author: Dr. Pankaj Trivedi

Conflict of interest: Nil

Abstract:

Background: Transurethral resection of prostate (TURP) has been the gold standard for the surgical management of BPH but has complication like bleeding and dilutional hyponatremia which can progress to transurethral resection syndrome (TURS). Thulium laser enucleation of prostate (ThuLEP) provides a bloodless field with minimal energy exposure of pericapsular tissue. The present study aimed to compare the safety, efficacy and clinical outcomes between ThuLEP and TURP for treating symptomatic benign prostatic hyperplasia.

Methods: Total 57 patients were included in this study of which 27 underwent ThuLEP and 30 underwent TURP. All patients underwent thorough preoperative evaluation and were assessed during the perioperative period and on 3 months follow up.

Results: The operative time in ThuLEP group was significantly more as compared to TURP group (96.29 ± 23.72 min vs 65.00 ± 19.02 min). ThuLEP had significantly lower mean volume of irrigation fluid used in the immediate post-operative period, duration for which irrigation was run, time to clearance of hematuria, catheterisation time and post- operative stay. Fall in hemoglobin and serum sodium levels was also found lower in ThuLEP group.On 3 month follow up, there was improvement in all three functional parameters (Qmax, PVR and IPSS) in both groups and were comparable in both the groups.

Conclusion: ThuLEP is as safe and efficacious procedure as TURP which has long been considered the gold standard for the surgical treatment of BPH. Thus, ThuLEP can be considered as a genuine alternative to TURP in present times.

Keywords: Benign Prostatic Hyperplasia, Thulium Laser, Transurethral Resection Of Prostate, Thulium Laser Enucleation Of Prostate.

Introduction

Benign prostatic hyperplasia (BPH) is a condition affecting men over the age of 40, resulting in the enlargement of the prostate gland [1,2]. It manifests clinically with a set of bothersome lower urinary tract symptoms (LUTS) [3]. Surgery is recommended for patients who have BPH related refractory urinary retention, recurrent urinary tract infections (UTIs), recurrent hematuria, renal insufficiency, or with BPH refractory to other therapies [4,5].

Transurethral resection of prostate (TURP) has been the gold standard for the surgical management of BPH [6]. The advent of newer technologies in diathermy and visual scopes has lowered the complication rate considerably. However, a few limitations are associated with TURP such as bleeding and dilutional hyponatremia which can progress to transurethral resection syndrome (TURS) [7,8]. Recent advancements in technology led to the advent of therapeutic lasers in prostatic surgery. The Nd-YAG laser was the first laser to be used in BPH surgery but has since been abandoned due to the extreme depth of penetration causing a large amount of prostate tissue sloughing [9].

Thulium laser enucleation of prostate (ThuLEP) was performed in 2010 by Hermann who used the thulium laser to enucleate the prostate adenoma from the capsule using blunt dissection while also coagulating the bleeding capsular vessels thus establishing a bloodless field with minimal energy exposure of pericapsular tissue [10]. Laser

techniques offer many advantages such as the complete removal of transition zone regardless of size of prostate thereby providing maximum efficacy with minimum side effects. Thulium laser is proclaimed to be the safest and most effective laser when compared to Nd-YAG and holmium lasers in term of blood loss, the speed and versatility of prostatic resection. However, the cost of treatment is considerable and the learning curve is steep [11]. Therefore this study is designed to determine the safety and efficacy of ThuLEP and compare post -operative and peri- operative parameter with TURP.

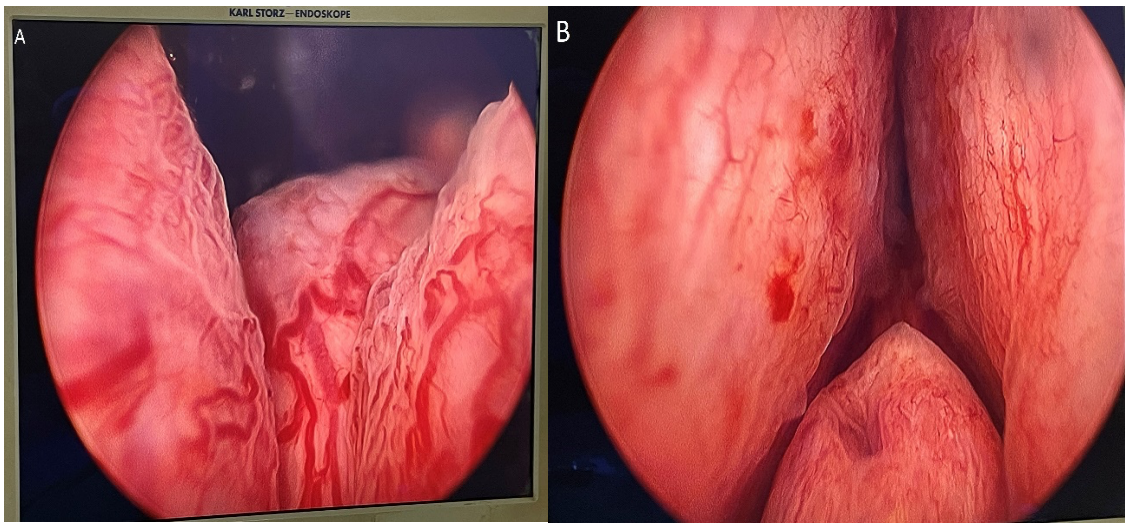
Materials and Methods

After obtaining approval by the Institutional Ethics Committee, patients were included in present study who was admitted in urology department of our hospital from January 2020 to June 2021. Patients age less than 85 years, patients with LUTS due to BPH with indications of surgical intervention, failure of medical therapy, recurrent UTI due to BPH, recurrent hematuria due to BPH, recurrent failed catheter free trials, maximum urinary flow rate (Qmax) < 10ml/s were included in this study.

Exclusion Criteria was mild symptoms (IPSS<8) well managed with medical treatment, prostate volume < 20cc and >100cc as measured by USG whole abdomen, urethral stricture, neurogenic bladder, huge retentive bladder diverticulum, previous prostatic surgeries, previous or subsequent biopsy proven diagnosis of prostatic carcinoma. Patients were divided into two groups: Group A comprised of patients undergoing ThuLEP and Group B comprised of patients undergoing TURP.

Complete clinical history and informed consent was taken from all patients. Preoperative IPSS was recorded for all patients. Complete systematic examination of the patients including genital and rectal examination and co-morbid conditions like Hypertension and Diabetes Mellitus were documented. Complete hemogram, renal function tests with electrolytes (sodium, potassium), coagulation parameters, blood grouping and typing, complete urine analysis, urine culture and sensitivity were done in the preoperative period. Ultrasonogram of KUB region for prostatic volumes and post void residues was done. Uroflowmetry was done for appropriate patients.

TURP was performed using Shalya Vista Monopolar diathermy system and glycine (1.5 %) was used as an irrigation fluid for the entire procedure. The opening of the procedure was started with resection of the median lobe starting at the 6 o'clock position and resection was continued on the left lateral lobe upto the 3 o'clock position and the right lateral lobe upto the 9 o'clock position following the surgical capsule as the depth of resection. Lateral lobes begin to fall into the fossa as they were resected, making subsequent resection easier. Residual tissue present at the apex of the gland was carefully resected all around sparing the distal most margin of the verumontanum so as to not injure the external urethral sphincter. Simultaneous hemostasis was done throughout the procedure. After achieving careful hemostasis, a 20 Fr three-way foleys catheter was carefully placed into the bladder with 40 cc fluid placed in the balloon to avoid the catheter balloon falling into the excavated prostatic fossa. The Foleys catheter was placed on gentle traction by fixing it to the anterior abdominal wall with adhesive tape and was released later in wards based on residual hematuria. Continuous bladder irrigation (CBI) was used with normal saline as per the level of hematuria. (Figure 1)



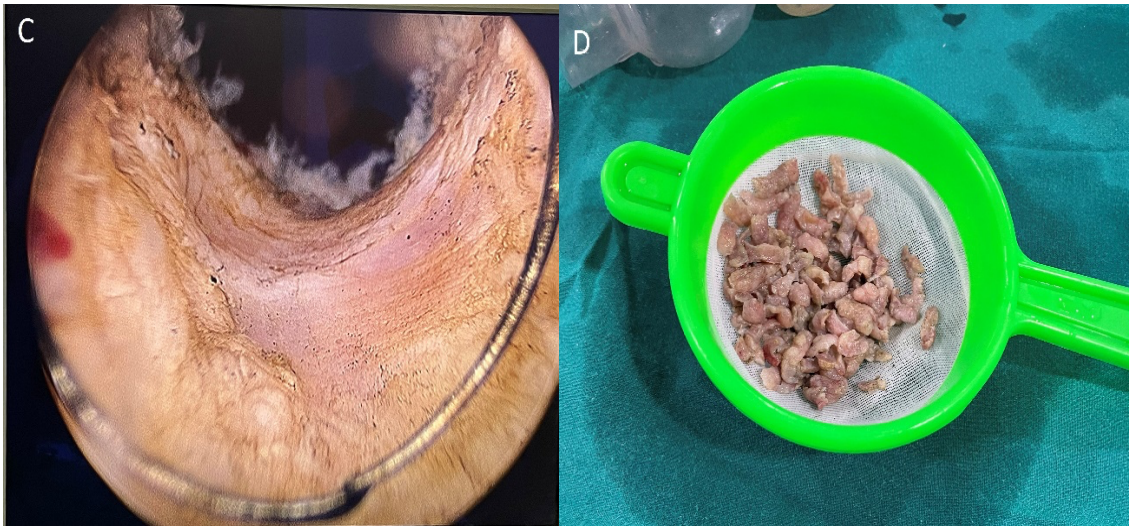
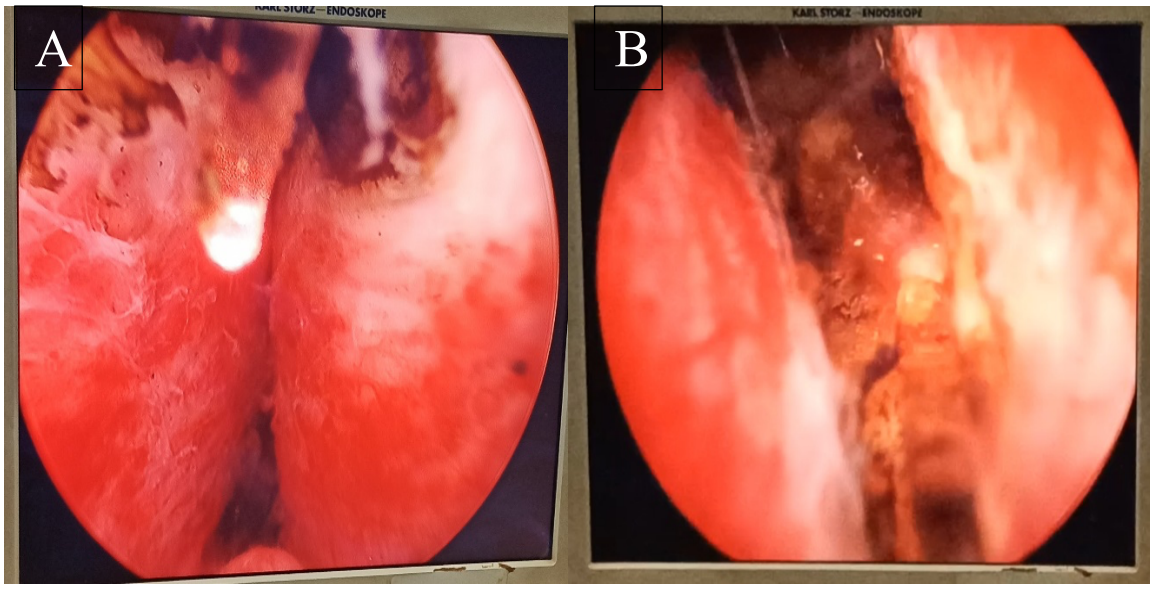


Figure 1: A) Trilobar enlargement of the prostate B) Verumontanum demarcating the distal extent of resection C) Monopolar loop resecting prostatic adenoma D) Prostatic chips

ThuLEP was performed using 150 W CyberTM Thulium laser device surgical laser (Quanta System, Italy), a re-usable 600 um laser fibre (Quanta system, optical fiber).

The procedure commenced with a bladder neck incision at the lateral aspect of the median lobe on both sides using the thulium laser fiber at 60W setting which were then carried down to the surgical capsule. The incisions were lengthened distally until just proximal to the verumontanum and were joined. The median lobe was lifted in a retrograde fashion upto the bladder neck. The surgical capsule was followed as the median lobe was lifted off the capsule which was enucleated and advanced into the bladder. Large adenoma pieces were removed using the Richard Wolf morcellator for which a dedicated scope with a 5-mm working channel was used. Continuous wave form energy of 60W – 120W was used for cutting and hemostasis was achieved using a defocused LASER beam at 25W to coagulate any bleeding.

A 20 Fr three-way foleys catheter was carefully placed into the bladder at the end of the procedure with 40 cc fluid placed in the balloon to avoid the catheter balloon falling into the excavated prostatic fossa with gentle traction and continuous bladder irrigation (CBI) was used with normal saline. (Figure 2)



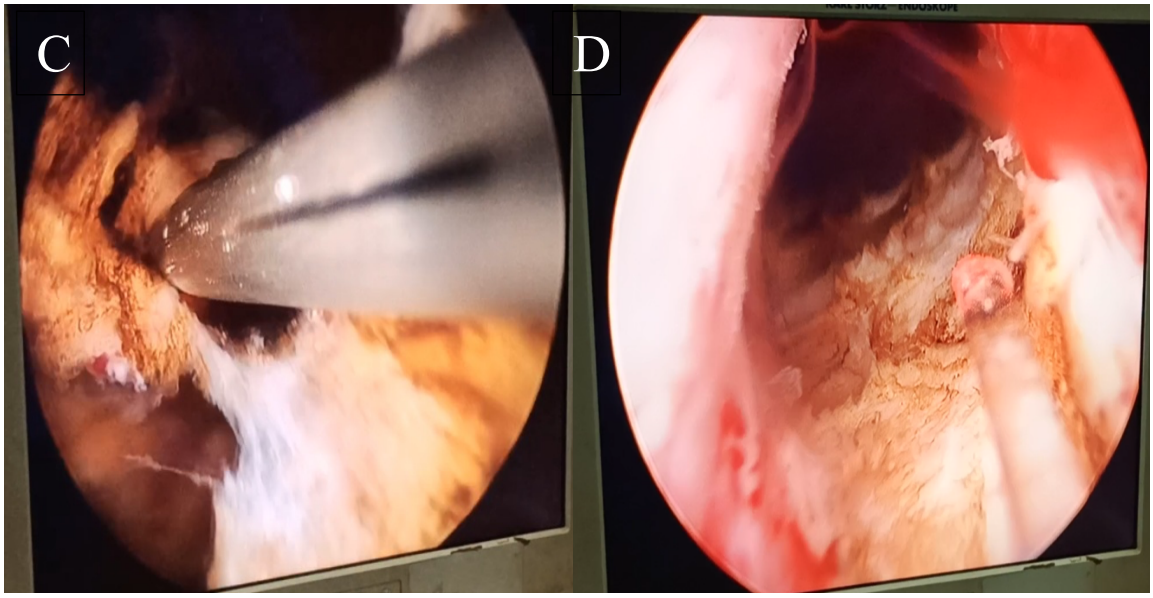


Figure 2: A) Prostatic adenoma with trilobar enlargement B) Creation of the tunnel C) Enucleation of the right lateral lobe D) Wide prostatic fossa after enucleation

After the procedure, specimens were packed properly and sent to pathology department for histopathological examination. Postoperatively all patients were given intravenous antibiotics and monitored for haematuria and any change in vital parameters. Normal saline was used intra-operatively and post-operatively. Blood was drawn and sent for haemoglobin, pack cell volume (PCV) and serum sodium evaluation in the immediate post- operative period.

The operative time of all procedures were calculated from the period of induction of anesthesia to the removal of resectoscope sheath for TURP and completion of morcellation for ThuLEP.

Time to clearance of hematuria was noted and irrigation was continued until evening evaluation as a protocol and continued after that if deemed necessary. Catheter was removed once urine was completely clear and after irrigation had been stopped for at least 12 hours. Changes in preoperative and postoperative parameters like haemoglobin, pack cell volume, sodium and intraoperative complication (capsular perforation and excessive bleeding) were recorded. Catheterization time and hospital stay time was also recorded. Patients were reviewed with postoperative Uroflowmetry, PVR on ultrasonogram and IPSS, upon 3 month follow up and postoperative complications like clot retention, blood transfusion, failure to void, incontinence, urethral stricture, bladder neck stenosis, urinary tract infection, and retreatment for prostate were recorded.

Statistical analysis:

Data was collected and entered into the Statistical Package for Social Sciences (IBM SPSS-23, New York, United States). The quantitative data were presented as mean, SDs, and ranges while qualitative variables were presented as number and percentages. The comparison between groups regarding qualitative data was done using the $\chi 2$ test while comparison between two independent groups with quantitative data was done using the independent t test. P value less than 0.05 was considered statistically significant, and less than 0.01 was considered highly significant.

Results:

A total 57 patients were included in this study and 27 out of 57 patients underwent ThuLEP and 30 patients underwent TURP. The preoperative parameters (age, volume, Qmax, post void residue, serum PSA, hemoglobin, packed cell volume, Sodium, IPSS) were found to be comparable in both the groups. (Table 1)

Table 1: Preoperative parameters in both the groups

Preoperative Variables	Group	Mean	SD	P value
Age (yrs)	ThuLEP	70.778	9.018	0.262
	TURP	68.267	7.705	
Volume (g)	ThuLEP	53.00	15.432	0.270
	TURP	49.533	6.847	
Qmax (ml/s)*	ThuLEP	8.152	0.981	0.453
	TURP	8.368	0.887	

PVR (ml)*	ThuLEP	134.286	45.670	0.963
	TURP	132.636	46.038	
S. PSA (ng/ml)	ThuLEP	2.116	1.376	0.894
	TURP	2.064	1.541	
Hb (g%)	ThuLEP	12.311	1.864	0.805
	TURP	12.187	1.922	
PCV (%)	ThuLEP	36.741	2.536	0.809
	TURP	36.567	2.837	
Sodium (meq/L)	ThuLEP	135.667	3.658	0.316
	TURP	136.700	4.018	
IPSS	ThuLEP	25.407	3.846	0.297
	TURP	24.300	4.070	

***Group concerned without indwelling catheter**

Preoperatively symptoms like indwelling catheters due to acute urinary retention, predominantly storage (irritative) LUTS and predominantly voiding (obstructive) LUTS in both the groups and found to be statistically insignificant (p = 0.911). (Table 2)

Table 2: Preoperative symptoms on admission in both the groups

	Indwelling Catheter N (%)	Predominantly storage LUTS N (%)	Predominantly voiding LUTS N (%)	Total N (%)
ThuLEP	6 (22.2%)	8 (29.7%)	13 (48.1%)	27 (100.0%)
TURP	8 (26.7%)	9 (30.0%)	13 (43.3%)	30 (100.0%)
p value	0.911			

Operative time in ThuLEP was found to be longer as compared to TURP (96.29 ± 23.72 minutes vs 65.00 ± 19.02 minutes (p< 0.001).

However, ThuLEP had significantly lower mean volume of irrigation fluid used in the immediate post- operative period (1666.67 ± 168.70 ml vs 3480.0 ± 320.99 ml (p< 0.001), duration for which irrigation was run (8.15 ± 1.2 hours vs 18.0 ± 1.34 hours, (p<0.001), time to clearance of hematuria (1.33 ± 0.78 hours vs 4.53 ± 1.48 hours), catheterisation time. (31.96 ± 3.2 hours vs 40.67 ± 3.25 hours, (p< 0.001) and post-operative stay (2.52 ± 0.7 days vs 3.17 ± 0.79 days (p = 0.002).

Fall in hemoglobin and serum sodium levels was significantly high in TURP as compared to ThuLEP group (p< 0.001). (Table 3)

Table 3: Intra and early post-operative outcomes in both the group

	Group	Mean	SD	P value
Duration of surgery (min)	ThuLEP	96.296	23.721	<0.001
	TURP	65.000	19.028	
Irrigation volume (ml)	ThuLEP	1666.667	168.705	<0.001
	TURP	3480.00	320.990	
Irrigation duration (hours)	ThuLEP	8.148	1.199	<0.001
	TURP	18.00	1.339	
Hematuria clearance (Hours)	ThuLEP	1.333	0.784	<0.001
	TURP	4.533	1.479	
Catheter removal time (Hours)	ThuLEP	31.963	3.119	<0.001
	TURP	40.667	3.252	
Post-operative stay (Days)	ThuLEP	2.519	0.700	0.002
	TURP	3.167	0.791	
Fall in sodium	ThuLEP	1.000	1.754	0.001
	TURP	3.467	3.093	
Fall in Hb	ThuLEP	0.441	0.309	0.006
	TURP	0.653	0.252	
Fall in PCV	ThuLEP	1.444	1.050	0.324
	TURP	1.933	2.348	

On 3 month follow up, there was improvement in all three functional parameters (Qmax, PVR and IPSS) in both groups and was found to be comparable (p>0.05). (Table 4)

Table 4: Comparison of functional outcomes in both the groups

	Group	Mean	SD	P value
Qmax improvement	ThuLEP	10.562	1.878	0.551
	TURP	10.191	2.156	
PVR improvement	ThuLEP	120.571	50.907	0.996
	TURP	118.500	46.259	
IPSS improvement	ThuLEP	18.704	4.858	0.285
	TURP	17.400	4.256	

4 patients (14.8%) in the ThuLEP group and 3 patients (10.0%) in the TURP group developed storage LUTS in the perioperative period. One patient (3.7%) in ThuLEP group developed a soft mucosal short segment stricture (0.5mm) in the bulbar urethra 1 month after surgery for which an internal urethrotomy was performed. 2 patients (6.7%) in TURP group developed UTIs. (Table 5)

Table 5: Complications in both the groups

	Complications N (%)				Total
	None	Storage LUTS	Stricture	UTIs	
ThuLEP	22 (81.5%)	4 (14.8%)	1 (3.7%)	0	27 (100.0%)
TURP	25 (83.3%)	3 (10.0%)	0	2 (6.7%)	30 (100.0%)

Discussion:

Over the last decade, TURP vs ThuLEP have been a subject of big debate. In present study, the mean operative time was found to be significantly longer in ThuLEP as compared to TURP. This finding was corroborated with Swiniarski et al [12] study; who also found mean operative time for ThuLEP was 102.2 minutes and for TURP was 74.5 minutes. Similar results were also reported by Wani et al [13], Enikeev et al [14] and Zhu et al [15] et al studies. The longer operative time in ThuLEP is due to the fact that it is a relatively new procedure which has only been practiced over the last decade. Experienced surgeons have thus inevitably performed more TURPs in their practice than ThuLEP which may still be on the learning curve. The time of surgery in ThuLEP is also slightly elongated due to the time taken by morcellation as well as a slightly higher volume of prostatic tissue.

In present study that hematuria cleared much faster in patients undergoing ThuLEP and subsequently the amount of irrigation fluid used post operatively and the duration for which it was run also found lower as compared to the TURP group. The mean duration for catheter removal post operatively was significantly lower for ThuLEP as compared to TURP. Our results were comparable with Wani et al [13], Enikeev et al [14], and Xia et al [16] studies; who also reported a shorter catheterization time(days) in ThuLEP group as compared to TURP group (1.4 vs 2.4, 1.5 vs 3.4 , 1.90 vs 3.57) respectively.

Patients undergoing ThuLEP had a significantly lesser mean operative stay as compared to TURP. This finding was similar to studies by Enikeev et al [14] study; who also found less hospitalisation time for patients undergoing ThuLEP (3.4 days vs 4.7 days). Wani et al [13] and Jaiswal et al [17] studies also reported a less hospitalisation time for ThuLEP as compared to TURP (2.8 vs 4.9 , 2.51 vs 3.03) respectively.

Whilst there is a variation amongst studies with regards to the duration of catheterization, there is consistency in the observation that patients that underwent ThuLEP had a much shorter time of post-operative catheterization than those undergoing TURP. The duration of catheterization depends on the amount of post-operative bleeding. The study carried out by Hermann et al [10] suggested that thulium laser has enhanced Coagulative properties owing to its continuous nature of energy dissipation and thus provides better hemostasis and shortens catheterization time. The enucleation technique, in which there is complete removal of prostatic tissue along the capsule, offer the advantages of decreased post-operative bleeding, less hematuria, early stoppage of post-operative irrigation and subsequently earlier removal of catheterfavour earlier discharge and are ultimately more cost effective. Also, TURP often needs a longer duration of catheterization due to edema of the prostate bed after monopolar surgery and a higher rate of hemorrhage.

In the ThuLEP group, mean hemoglobin levels dropped was found to be significantly less as compared to TURP group. Our findings corroborate with those of Enikeev et al [14] study; who reported a less hemoglobin drop in ThuLEP (1.01 g% vs 1.8 g%). Similarly Swiniarski et al [12], Wani et al [13] and Xia et al [16] studies also reported a less hemoglobin loss in ThuLEP group as compared to TURP (0.95 g% vs 1.81 g%, 0.92 g% vs1.46 g%, 0.95 g% vs2.0 g% respectively).

This is due to the enhanced coagulative properties of the thulium laser providing improved vaporization and ensuring smoother soft tissue incisions.

The shallow depth of penetration of Thulium laser (0.25mm) as well as the rapid vaporization, improved spatial beam quality and precise tissue incisions compared to other lasers also causes minimal thermal damage to surrounding tissues further reducing the intraoperative blood loss [13]. Xia et al [16] study noted that the thulium laser achieves excellent hemostasis and ensures a bloodless field and allows a clear view of the prostate allowing the adenomatous tissue to be dissected off the prostatic capsule more precisely as compared to standard resection. Also, the residual adenomatous tissue is minimal which also contributes to decreased post-operative bleeding.

During endoscopic prostatic surgeries, the wide network of venous plexuses might be opened up. This occurs more commonly in TURP due to resection upto the capsule with thinning of the capsule. Excessive absorption of irrigation fluid through these sinuses can cause fluid overload and overwhelm the circulatory system causing dilutional hyponatremia as well as a fall in haematocrit (PCV).

Elsakka et al [18] study found the fall in PCV in two groups of patients undergoing bipolar vaporization of prostate and monopolar TURP. They noticed a marked fall in PCV in the monopolar TURP group from 42.9% to 38.2%. However there was no statistical significance differences on comparing the fall in PCV in both groups in present study, which stressing the importance of careful resection so as to not expose any venous sinuses and to limit the amount of irrigation fluid used to a minimum.

The drop in sodium levels were significantly more in TURP than ThuLEP. Our findings match those of Xia et al [16] study; who reported a sodium fall of 0.38 meq/L in ThuLEP group and 4.40 meq/L in TURP group. Enikeev et al [15] study reported a fall in sodium of 1.1 meq/L in ThuLEP group and 4.1 meq/L in TURP group. This is furthermore evidence of the favourable safety profile of ThuLEP when compared to the gold standard TURP. Absorption of irrigation fluid through the prostatic venous sinuses may lead to dilutional hyponatremia (TUR syndrome).

The use of glycine as an irrigation fluid in TURP predisposes to shift in the serum sodium levels. ThuLEP uses physiological saline as an irrigation fluid and this decreases the amount of sodium loss. In a meta-analysis done by Zhu et al [15], they reported zero cases of TUR syndrome out of 186 patients undergoing ThuLEP. In a meta-analysis done by Zhang et al [19], there were only 3 reported cases of TUR syndrome all of which were in the TURP group. However, in our study there were no incidents of TUR syndrome.

Upon follow up, the rise in Qmax was found to be significant in both the groups but the difference between both the groups was not significant. The findings of our study share similarities with those of Enikeev et al [14] study; who found a comparable improvement in Qmax when comparing the two procedures. Swiniarski et al [12] study noted that the Qmax improved from 7.73 ml/s before surgery to 23.0 ml/s three months after surgery in patients undergoing ThuLEP and Qmax improved from 8.57 ml/s before surgery to 26.04 ml/s three months after surgery in patients undergoing TURP.

The mean difference between the preoperative PVR and PVR on three month follow up was found to be comparable in both the groups which was corroborate with Swiniarski et al [12] and Enikeev et al [14] studies. A fall in post void residue on follow up is an objective marker signifying the improvement in the voiding parameters due to the release of obstruction at the bladder outlet due to the enlarged prostate gland. A similar improvement in PVR when comparing ThuLEP with TURP exemplifies the fact that the efficacy of ThuLEP matches that of TURP.

Upon follow up, the IPSS went down significantly from a mean preoperative value in both the groups but the difference between both the groups was comparable which was similar to Swiniarski et al [12] and Enikeev et al [14] studies; who reported a comparable IPSS fall in both groups. With regards to the post-operative complications, 3.7% patients in ThuLEP group developed a soft mucosal short segment stricture was asymptomatic with a normal uroflowmetry. 6.7% patients developed two episodes of urinary tract infections (UTIs) after surgery in TURP group.

Both these patients were diabetics. Upon follow up after 3 months, all patients had complete symptomatic relief. The complication rates observed in present study were comparable to Swiniarski et al [12] and Enikeev et al [14] studies.

Conclusion:

The present study concluded that the duration of irrigation, catheterization, hospitalisation and changes in peri-operative blood parameters are in favour of ThuLEP. ThuLEP is better in terms of intraoperative blood loss however when it comes to the operative time, TURP holds the edge. Both procedures are comparable in post-operative voiding parameters, symptom alleviation and overall patient satisfaction. Thus ThuLEP is as safe and efficacious a procedure as TURP which has long been considered the gold standard for the surgical treatment of BPH can be considered as a genuine alternative to TURP in present times.

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