

Comparison of the efficiency and complications of Lumenis and Wolf morcellators after holmium laser enucleation of the prostate

Pankaj N. Maheshwari*, Vinayak G. Wagaskar¹, Reeta P. Maheshwari

Department of Urology, Fortis Hospital Mulund, ¹Department of Urology, Kokilaben Dhirubhai Ambani Hospital, Mumbai, Maharashtra, India

*E-mail: dr.maheshwaripn@gmail.com; maheshwaripn@hotmail.com

ABSTRACT

Introduction: Holmium laser enucleation of the prostate (HoLEP) is a recognized option for the surgical management of benign prostatic hyperplasia. While the laser parameters and enucleation techniques have been widely studied, the morcellation techniques still remain under-evaluated. The current study evaluates the two commonly used morcellation devices for their *in vivo* efficiency and patient safety.

Materials and Methods: A total of 222 patients who underwent HoLEP at two medical centres between January 2011 to December 2013 by a single surgeon were included. Of these 222 patients, the Richard Wolf Piranha Morcellation System, Germany (WM), was used on 140 patients, while on the remaining 82, the Lumenis® VersaCut™ Morcellator, Yokneam, Israel (LM), was used. These devices were compared for safety parameters such as the incidence of bladder mucosal injury, deep muscle injury, bladder perforation, and bleeding requiring electrocoagulation. The morcellation efficiency (ME) defined as the ratio of the weight of morcellated tissue in grams to the time required for morcellation in minutes was also compared.

Results: The incidence of bladder mucosal injury, deep muscle injury, and bleeding requiring electrocoagulation was statistically significantly lower for the WM than the LM. None of the patients had a full-thickness bladder perforation with either of the morcellators. The ME was higher for the LM. In eight patients, hard, smooth rounded adenomatous nodules could not be morcellated by the WM and had to be crushed by a stone grasping forceps before morcellation.

Conclusions: While the LM is a faster morcellator, WM has a better safety profile.

INTRODUCTION

Holmium laser enucleation of the prostate (HoLEP) is a minimally invasive alternative to transurethral resection of the prostate (TURP) and open prostatectomy in men with benign prostatic hyperplasia. The improvement in the lower urinary tract symptoms (LUTS) after HoLEP are immediate, objective, and comparable to those after TURP.^[1-3] The standard steps of HoLEP are identification of the prostatic capsule by bladder neck incisions, enucleation of the median and lateral lobes, and

then morcellation of the lobes to remove the enucleated adenoma from the urinary bladder.^[4] Transurethral morcellation of enucleated lobes has made it possible to perform single-stage procedures for larger prostatic adenomas.^[5]

Although morcellation is safe, it has a potential for severe complications.^[6] The complications can be in the form of bleeding due to bladder mucosal bites or bladder wall injury, leading to bladder perforation. Morcellation can also be time-consuming depending on the amount of prostate tissue enucleated. Occasionally, there may be difficulty to catch

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the smooth round tissue nodules that keep on bouncing off the blade during morcellation.

The two commonly used morcellators are the Richard Wolf Piranha morcellation system, Germany (WM), and the Lumenis® VersaCut™ Morcellator, Yokneam, Israel (LM). The basic design of the morcellation apparatus has a suction and a cutting blade. The suction holds the tissue on the cutting edge and aspirates out the morcellated tissue from the bladder, while the moving blade cuts the adenomatous tissue into small pieces. The efficiency and complications of the morcellator depend on the suction pressure and the cutting mechanism. The stronger the suction pressure, the better is the grasp on the tissue for cutting, and faster is the morcellation. The drawback of stronger suction is a higher risk of engaging the bladder mucosa in the morcellator blade increasing the risk of bladder mucosal injury. The speed of morcellation and the risk to bladder mucosa would also be directly proportional to the size of the cutting aperture.

This study was planned to compare the two commonly used morcellators for their efficiency and risk of complications.

MATERIALS AND METHODS

This is a retrospective analysis of prospectively collected data of a total of 222 patients who underwent HoLEP at two medical centers between January 2011 to December 2013. The detailed demographics, intraoperative findings, procedural issues, postoperative outcomes, and the follow-up data were collected as a routine for all HoLEP patients and entered into an Excel spreadsheet. The operative details such as the morcellation time, weight of the morcellated tissue removed, and bladder mucosal injury if any were recorded. The assistant weighed the morcellated tissue on a weighing scale and time was calculated by a stopwatch. Consent for documenting these details and utilizing it for scientific research was obtained from all patients preoperatively.

The same surgeon performed all the procedure at both the centers. One center had access to the Richard Wolf Piranha morcellation system (WM) where 140 patients were treated. The other center had the Lumenis® VersaCut™ Morcellator (LM) where the remaining 82 patients were managed.

Standard technique of morcellation was utilized. After enucleation and hemostasis by holmium laser, the resectoscope was replaced by a morcelloscope, and the transurethral morcellator was inserted in the bladder. The bladder was optimally filled with dual irrigation. The tissue was caught by the suction mode of morcellator, and the morcellation was performed once the adenoma was held away from the bladder wall. The suction and morcellation

speeds were kept at a medium level. All throughout the procedure, care was taken to avoid injury to the bladder wall. The irrigation and the suction speeds were reduced when only small amounts of adenoma tissue remained that was difficult to catch or kept bouncing off the cutting edge. The time for morcellation in minutes and the weight of the enucleated tissue in grams were recorded at the end of the morcellation.

These patients were compared for safety parameters such as the incidence of bladder mucosal injury, deep muscle injury, bladder perforation, and bleeding requiring electrocoagulation. Mucosal injury was defined as entrapment of the bladder mucosa in the morcellation blade. When the bite was deep enough to expose the detrusor muscle, it was called as deep muscle injury. Bladder perforation was defined as a full-thickness injury exposing the perivesical fat.

After the bladder wall injury, minor bleeding was observed and managed by bladder irrigation. If significant, bleeding was controlled by coagulation using defocused holmium laser beam or by electrocoagulation.

The two morcellators were also compared for their morcellation efficiency (ME). The ME was defined as the ratio of weight of morcellated tissue in grams to the time required for morcellation in minutes. Higher the ME, better is the speed of morcellation.

Statistical analysis

A statistical analysis of the data was performed by a two-sample z-test of proportions. Null hypothesis was used to calculate the significance level. Statistical significance was assumed for $P < 0.05$.

RESULTS

Bladder mucosal injury was recorded with both the morcellators (WM: 11 patients [7.8%], LM: 23 patients [28%]), but the risk was statistically significantly higher with the LM [Table 1]. Most of these injuries did not require any treatment. Bleeding either stopped spontaneously or could be controlled by defocusing the holmium laser beam. In some patients, where the bleeding could not be controlled by holmium laser, electrocautery was used for hemostasis (WM: 8 patients [5.7%], LM: 11 patients [13.4%]). Thus, the WM was found to be safer than the LM in overall risk of bladder mucosal injury.

None of the patients in the WM group had a deep muscle injury, whereas it was recorded in three patients in the LM group. All these injuries were treated conservatively by prolonging the Foley catheter dwell time by 2 days. No patient in either group had a full-thickness bladder perforation.

The WM had difficulty in morcellating small, round hard nodules that remained after the major bulk of adenoma was morcellated in eight patients. Such difficulty was not recorded in the LM group. This difference in failed morcellation between the two groups was statistically significant [Table 2]. The suction of WM was unable to grasp these smooth nodules and they kept bouncing off the cutting edge. They had to be crushed by a stone grasping forceps and made irregular, before morcellation.

The two groups were comparable for the weight of the morcellated tissue; WM: 12-140g (mean 68g) and LM: 14-130g (mean 74g). The morcellation time was shorter for LM (1.5-22 min, mean 9.8 min) as compared to WM (2.2-36 min, mean 14.5 min). The ME of the LM was higher than the WM (8.4 g/min vs. 4.7 g/min) so more tissue could be morcellated per minute of morcellation time with LM as compared to WM [Table 2].

DISCUSSION

Independent of the prostate size, HoLEP has proved to be equivalent to TURP for the management of BPH with fewer re-operations in multiple randomized controlled studies with long-term follow-up data.^[6] HoLEP needs a transurethral device to evacuate the large enucleated tissue pieces from the bladder. The use of mechanical morcellators has helped reduce the overall operative time by reducing tissue evacuation time, and therefore, has resulted in increased mean tissue retrieval rates (grams per minute) for the complete procedure.^[7]

Bladder mucosal injury is a definite possibility during morcellation. Awareness of the risk and proper precautions during morcellation can reduce this risk. The risk is higher when the bladder is inadequately full or the vision is suboptimal due to bleeding. We had mucosal entrapment and injury leading to hematuria with both the morcellators (WM – 7.8%; LM – 28%). Some of these patients required electrocoagulation for hemostasis (WM – 5.7%; LM – 13.4%). Significant injury with deep muscle bites occurred in three patients with the LM. Tan and Gilling^[3] reported a 9.3% rate of bladder mucosal injury in 43 patients who underwent HoLEP for >100g prostate followed by morcellation with the LM. Hettiarachchi *et al.*^[4] performed HoLEP in 18 patients with prostate >100 g with LM without any complications.

Full-thickness bladder perforation is theoretically possible during morcellation, but has never been reported in the literature. Ishikawa *et al.*^[5] performed HoLEP in 140 patients with LM and did not have any bladder perforation during morcellation. Similarly in the present study, none of the patients had a full-thickness bladder perforation with either of the morcellators.

To the authors knowledge, there is only one study in the literature that has compared these two morcellators *in vivo*.^[8] El Tayeb *et al.* found that the morcellation rates of the two morcellators (LM and WM) were comparable, but the WM had a significantly higher cost per patient. Cost analysis was not performed in the present study. They also noted that WM had a more complicated design, making it less user-friendly for the operating room staff; the authors concur with this observation.

Hard, smooth rounded adenomatous nodules that remain after the major bulk of morcellation is completed are a difficult proposition. They keep on bouncing off the morcellation blade making morcellation difficult. These “crazy balls” need to be crushed or broken into an irregular shape before they can be morcellated. This problem was faced in eight patients (5.7%) with the WM but not with the LM. Vavassori *et al.*^[1] performed HoLEP in 330 patients combined with mechanical morcellation with LM. They concluded that reduced ME was due to lower performance of the blades and potential tissue resistance due to the presence of small fibrotic spheres. It is mandatory to keep at least two spares of new sharp blades available to avoid “crazy ball effect” of tissue spheres against sheath of the morcellator.

Cornu *et al.*^[7] performed *in vitro* comparison between WM and LM in terms of aspiration power, morcellation power, and visual control of the cutting part of the morcellator. They used baked chicken meat tissue for morcellation. Aspiration power for WM was 49 s/L and for LM was 45 s/L; morcellation power evaluation showed that 5 g of tissue could be morcellated within 2 min by WM compared to 12 g of tissue within 2 min by LM. The cutting part of the WM was under visual control throughout the procedure, whereas the distal part of cutting device of LM was partly

Table 1: Complications

Morcellator	Richard Wolf Piranha Morcellation System	Lumenis® VersaCut™ Morcellator	P
n	140	82	
Bladder mucosal injury (%)	11 (7.85)	23 (28)	0.00025
Deep muscle injury	0	3 (3.66)	0.0113
Hematuria requiring electrocoagulation (%)	8 (5.71)	11 (13.41)	0.0239

Table 2: Morcellation efficiency

Morcellator	Richard Wolf Piranha Morcellation system	Lumenis® VersaCut™ Morcellator	P
Weight of enucleated tissue (g)	12-140	14-130	
Time for morcellation (min)	2.2-36	1.5-22	
Morcellation efficiency (g/min)	4.7	8.4	
Failed morcellation (%)	8 (5.71)	0	0.0138

out-of-vision control. This could explain the higher risk of bladder mucosal entrapment and subsequent injury with the LM.

ME has been a matter of debate. Vavassori *et al.*^[1] observed a mean morcellation time of 17.3 ± 14.5 min and a ME of 2.3 ± 1.5 gm/min. Ishikawa *et al.*^[5] performed HoLEP in 140 patients with LM. They observed a mean morcellation time of 9.9 min and a ME of 6.7 gm/min. Elzayat and Elhilali^[9] performed a retrospective analysis of 118 patients who underwent HoLEP with LM. The mean morcellation time was 12.1 ± 11 min and the mean resected tissue weight was 30 ± 19 g. In their study, weight of the tissue was underestimated because a significant amount of tissue was vaporized in this process. Tan and Gilling^[3] observed a mean morcellation time of 16.1 min with a ME of 4.2 g/min.

There is a tendency to ask the trainee colleague to perform morcellation as their first step to learn HoLEP. Monitoring and mentoring this training is essential. Achieving good hemostasis before beginning morcellation is crucial. It is vital to keep the bladder optimally full during the morcellation.^[10] It is important to monitor the suction and the cutting speed. Do not try to chase very small pieces, a practice that increases the risk of bladder injury. These small pieces can be grasped with a forceps and removed through the morcelloscope.

CONCLUSIONS

Morcellation is a vital part of the procedure of HoLEP. Both WM and LM work well for morcellation. Bladder wall injury is a definite possibility during morcellation. Awareness and proper care are important while performing this very important step. The WM is slower but safer, while the LM is faster but carries a marginally higher risk to bladder mucosa.

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