

Running Title: Perioperative outcomes of concomitant HoLEP and inguinal hernioplasty

**Perioperative Outcomes of Inguinal Hernioplasty along with Holmium Laser
Enucleation of the Prostate (HoLEP)**

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Abstract

Purpose: Inguinal hernias and benign prostatic hyperplasia (BPH) can coexist in about one fifth of patients undergoing BPH surgery. There is scarce evidence about performing laser enucleation along with open inguinal hernia repair. Our goal is to describe the perioperative outcomes of performing both surgeries in the same operating session compared to doing HoLEP alone.

Materials and Methods: A retrospective analysis of patients undergoing HoLEP and hernioplasty with mesh in the same anesthetic time (group B) at an academic center was conducted. They were compared to a randomly picked control group of patients submitted to HoLEP alone (group A). Preoperative, operative and postoperative features were compared among both groups.

Results: 107 patients submitted to HoLEP alone were compared to 29 combined approach patients (HoLEP + hernia repair). Patients in group A were found to be older and had larger prostates. Group B showed a significant longer operative time. Length of stay and duration of catheter was comparable among groups. In multivariate analysis, the combined approach was not associated to a higher complication rate.

Conclusions: Performing benign prostatic hyperplasia surgery with HoLEP in conjunction with open inguinal hernioplasty is not related to a higher length of stay or a significantly increased risk of morbidity.

Benign prostatic hyperplasia (BPH) and inguinal hernia are common pathologies, both of which increase their frequency in the elderly subjects.⁽¹⁾ Given the global population aging, encountering both entities in the same patient is fairly common. Moreover, traditional literature estimates the prevalence of inguinal hernias in patients undergoing surgery for BPH to be around 15-25 %.⁽²⁾ Several case series have reported both open simple prostatectomy and transurethral resection of the prostate (TUR-P) conducted along with inguinal hernia repair, these reports have shown acceptable morbidity rates.⁽³⁾ Also, the advent of new technologies has improved long-term outcomes and has decreased morbidity from endoscopic prostate surgery. Holmium laser enucleation (HoLEP) has become the gold standard treatment for large adenomas and has relevant hemostatic advantages over traditional TUR-P.^(4,5) There is a lack of literature reporting the execution of HoLEP in conjunction with inguinal hernioplasty. This investigation aims to show a University Hospital experience in the concomitant performance of HoLEP and inguinal hernioplasty, with a focus on perioperative morbidity. We postulated that both procedures can be carried out with a comparable morbidity and thus could be considered an eventual standard in the surgical management of this type of patients.

Materials and Methods

A retrospective study was conducted including patients who underwent surgery for BPH alongside unilateral inguinal hernia surgery between 2008 and 2020 at an academic hospital in Chile. Inclusion criteria comprise all patients who underwent BPH surgery in the form of HoLEP and a concomitant open hernia repair (group A), this was compared to a random control group of patients who underwent HoLEP alone. Roughly a 1:3 proportion (HoLEP + hernia: HoLEP) was achieved. Patients with other surgical techniques for BPH or laparoscopic hernia repair were excluded. Data was collected from the institutional electronic records, with the approval of the ethical review board.

Pre-surgical variables were collected such as age, the presence of hypertension / diabetes, ASA score, and the use of anticoagulation or antiplatelet therapy. Perioperative variables included surgical time, blood transfusion rate, grams of resected tissue, length of stay, days of catheterization, etc. Finally, a thorough search for complications and readmissions in the first 30 days after surgery was performed; these were classified by

Clavien-Dindo. Medical complications and the ones related to the BPH surgery were counted, whereas complication inherent to hernia repair like hematoma were not, with the purpose of making a fair comparison. Following institutional protocols, all patients were asked to suspend clopidogrel at least five days before surgery and to keep aspirin in case of high thromboembolic risk. Patients on coumarins or novel anticoagulants were asked to stop them for 72 hours prior surgery. Time for restart of anticoagulation was dependent on surgeon's discretion. They were asked to have a negative urine culture prior to the intervention. Surgeries were conducted under general anesthesia; hernia repair was carried out firstly, using the Lichtenstein technique with a prolene mesh. After that, enucleation was carried out using a Storz® laser resectoscope, and a 550 um holmium laser fiber (Lumenis Pulse 120H ®) set at 1.5-2 J and 35-45 Hz. A Piranha® (Wolf) morcelator was utilized for extraction. A 22 Fr dufour catheter with bladder irrigation was installed upon the end of the surgery. Depending on hematuria and treating urologist criteria, the catheter was removed on postoperative day 1 or 2, unless the patient was assessed to be at a higher risk for a failed trial of void, in which case patients were discharged with the catheter for an in-office trial of void.

Significant hematuria was defined as either the necessity of bed-side clot evacuation or hematuria that lengthened hospital stay for more than two days due to irrigation requirement. This complication was classified as Clavien-Dindo grade I unless the patient required revision in the operating room. All variables were compared between both groups. Categorical variables were analyzed with Chi-square test and continuous variables with Mann Whitney U test (non-parametric). Multivariate analysis was performed with binary logistic regression. Statistical analysis was conducted with IBM SPSS Statistics v25 (Armonk, NY: IBM Corp) and significance was set at $p < 0.05$.

Results

By January 2021, 758 HoLEP had been carried out in our center. One hundred and thirty-six patients were included in this research: 107 in Group A (HoLEP) and 29 in Group B

(HoLEP+hernia repair). Preoperative characteristics are described in Table 1. Patients in group A were found to be older ($p: <0.01$) compared to those submitted to a combined surgery, also they had greater prostate size ($p: <0.01$), a higher rate of diabetes ($p: .03$), and more patients had an indwelling catheter prior surgery ($p: .04$). Perisurgical outcomes are depicted in Table 2. There was a significant difference in surgical time ($p: <0.01$), adding roughly 1.5 hours for patients undergoing both surgeries. The resected prostate tissue was larger in group A ($p: <0.01$). Despite these differences, the length of stay and the days of postoperative indwelling catheter were comparable. Regarding postoperative results (Table 3), a higher rate of complication was observed in group B which was not statistically significant (20.7% vs 13.1%, $p: .14$). There were no differences in transfusion requirement ($p: .27$), readmissions at 30 days ($p: .19$), urinary tract infection ($p: .29$), significant hematuria ($p: .63$), length of stay ($p: .47$) and postoperative days with indwelling catheter ($p: .36$). There were no complications Clavien-Dindo III or greater in either group. In order to assess the risk for more complications that the combined surgery could impose, a multivariate analysis was performed (Table: 4). Adjusting for age and operative time the combined approach did not seem to impose a significant higher risk.

Discussion

Benign prostatic hyperplasia is a common condition that affects about 80% of men over their 70s.⁽⁶⁾ Enucleation of the prostate has become a widespread option for the treatment of any gland size. For many, HoLEP is considered the gold standard treatment of prostates over 80 grams.⁽⁷⁾ Additionally, inguinal hernias are a fairly common problem which is present in 5-10% of the global population, making hernioplasty one of the most frequent procedures performed worldwide.^(8,9) Even though the coexistence of these pathologies is not rare, especially in the setting of an aging population, is it still unclear whether their joint occurrence is a fortuitous event or they have a causeeffect relationship.⁽¹⁰⁾ Previous literature has shown no greater morbidity associated with performing inguinal hernioplasty alongside with a TUR-p surgery, even taking into account the risk of mesh infection, which seems negligible in some reports.^(11,12) In the last decade there

has been a lack of publications regarding the combination of hernioplasty with newer technologies to treat BPH. To our knowledge, this report might be the first one to compare the surgical results and morbidity of patients who undergo HoLEP and inguinal hernioplasty in the same operating room session. Although we lack a formal cost analysis, taking into account our patients' bills, there is at least a 20% reduction in the billing figure when conducting both surgeries in a single session compared to doing them in two different occasions, possibly making it a cost-effective approach. In our center, most urologists have gone through general surgery residency prior to their urology training. This allows the same surgeon to carry out both procedures and avoids the necessity of coordination with another team.

Thus, a retrospective comparison was made, analyzing 29 patients who underwent both surgeries, and comparing them with 107 HoLEP patients. The results of this report must be looked at over the fact that both groups have some differences. Patients who underwent the combined surgery were younger and consequently had a smaller prostate size. Additionally, patients in the control group had a higher rate of previous indwelling catheters, which could be a sign of a more advanced stage of their disease. This divergence could be explained by the surgeon's preference to select fitter patients to undergo both procedures. The difference between the operative time of both approaches is mostly secondary to the hernia repair itself and some additional time related to position changing skin preparation, and sterile draping. Taking into account this likely selection bias, we could not find that carrying out both procedures leads to more morbidity even after adjusting for confounders variables.. Furthermore, adding the second surgery did not affect length of stay nor readmissions, which also could add to cost-efficiency of this approach.

One of the limitations of this research is its retrospective nature, which makes its accuracy dependent on the reported clinical records. As already mentioned, both groups differed on their baseline characteristics. Also, even though our center has a broad experience in HoLEP; the number of patients submitted to both procedures is low, which reduces the statistical power of the results.

Conclusion

Performing benign prostatic hyperplasia surgery with HoLEP in conjunction with open inguinal hernioplasty is not related to a higher length of stay or a significantly increased risk of morbidity. Centers in which this approach is feasible could take this strategy in consideration.

Accepted

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Table 1: Preoperative characteristics

Characteristics	Total (n=136)	HOLEP (n=107)	HOLEP + hernia (n= 29)	p- value
Age (years)*	72 (67-77)	72.5 (68-77)	65.5 (58.5-72.5)	<0.01
DM	29 (21.3%)	27 (25.25%)	2 (6.9%)	.03
HTA	73 (53.6%)	56 (52.3%)	17 (59%)	.54
ASA				
I	25	20 (18.7%)	5 (17%)	.85
II	98	78 (72.9%)	20 (69%)	.67

III	9	7 (6.5%)	2 (6.9%)	.94
Use of anti-aggregant	24 (17.6%)	17 (15.8%)	7 (24%)	.30
Use of anti-coagulant	14 (10.2%)	13 (12.1%)	1 (3%)	.17
Preoperative PSA (ng/dl)*	3.2 (0.8-5.5)	3 (0.7-5.3)	3.8 (1.3-6.3)	.53
Prostate volume (ml)*	84.5 (62-109)	89.5 (65-117)	73.5 (56-88)	<0.01
Preoperative indwelling catheter	39 (28.67%)	35 (33%)	4 (14%)	.04

* Median (Q1-Q3)

p-values were calculated with Chi-square for categorical variables and U Mann-Whitney for numeric variables.

Table 2: Perioperative results

Characteristics	Total (n=136)	HOLEP (n=107)	HOLEP + hernia (n= 29)	p-value
Operating time* (min)	120 (100-180)	120 (90-180)	217.5 (180-242)	<0.01
Red blood cell transfusion rate	1 (0.7%)	1 (0.9%)	0	.27
Days of postoperative hospitalization*	3 (2-4)	3 (2-4)	3(2-4)	.47
Resected volume (ml)*	40 (26-60)	43 (30-64)	26 (16-41)	<0.01
Discharged with catheter	26 (19.1%)	24(22.4%)	2 (7%)	.06
Days of postoperative catheterization*	3 (2-4)	3 (2-4)	3 (2-3)	.36

*Median (Q1-Q3)

p-values were calculated with Chi-square for categorical variables and U Mann-Whitney for numeric variables.

Table 3: Comparison of 30-day complication rate

Results	Total (n=136)	HOLEP (n=107)	HOLEP + hernia (n= 29)	p-value
Complication rate	20 (14.7%)	14 (13.1%)	6 (20.7%)	.30
Complication \geq III	0	0	0	
Detail according to Grade:				
Grade I-Delirium				
- Hematuria	3 (2.2%)	3 (2.8%)	0	.36
-Arrhythmia	7 (5.1%)	5 (4.6%)	2 (6.8%)	.63
-PolyuriaGrade II	1 (0.7%)	0	1 (3.4%)	.05
- UTI	1 (0.7%)	1 (0.9%)	0	.60
	12 (8.8%)	8 (7.4%)	4 (13.7%)	.29
30-day re-admission	6 (4.4%)	6 (5.6%)	0	.19

Table 4; Multivariate analysis of predictors for 30-day complications.

Variable	OR	95% CI	P-value
Surgery			
HoLEP	Ref.		
HoLEP+Hernia	2.9	0.6-14	0.18
Age (years)	1.06	0.98-1.14	0.10
Operative time (min)	0.99	0.99-1.00	0.84