

Laparoscopic vs. open transcapsular adenectomy (Millin): a comparative study of perioperative outcomes and complications

Gonçalo Mendes, Alexandra Rocha, Bernardo Lobão Teixeira, Mariana Madanelo, Sofia Mesquita, Miguel Monteiro, Avelino Fraga, Diogo Nunes-Carneiro, João Cabral, Frederico Teves

Department of Urology, Centro Hospitalar Universitário de Santo António, Porto, Portugal

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Corresponding author

Gonçalo Grilo Mendes
Centro Hospitalar
Universitário
de Santo António
Department of Urology
Largo do Prof. Abel Salazar
4099-001 Porto, Portugal
goncalo.grilomendes@gmail.com

Introduction Laparoscopic adenectomy for prostates larger than 80 mL is still a topic of debate.

The purpose of this study is to evaluate the perioperative outcomes and complications between open Millin (OM) and laparoscopic Millin (LM) adenectomy.

Material and methods Perioperative data and complications were retrospectively collected from patients submitted to Millin procedure from August 2019 to August 2022 in a tertiary centre, and OM and LM were compared. Complications were classified according to Clavien-Dindo classification.

Results A total of 205 patients were identified, 125 in the OM group and 80 in the LM group. Baseline characteristics were similar between the groups. Mean total blood loss (194 ± 210 vs 477 ± 389 mL, $p < 0.001$), mean haemoglobin drop (1.40 ± 1.16 vs 2.62 ± 1.42 g/dL, $p < 0.001$), duration of catheterisation (4.63 ± 1.39 vs 5.37 ± 1.99 days, $p = 0.004$), and hospital stay (4.59 ± 1.72 vs 5.82 ± 3.36 days, $p = 0.003$) were significantly lower in the laparoscopic group. The mean operative time was longer in the laparoscopic group (109.9 ± 33.4 vs 68.7 ± 18.0 min, $p < 0.001$). The overall complication rate was significantly lower in the laparoscopic group (18.8% vs 36.8%; $p = 0.012$), and this difference was maintained only in Clavien-Dindo groups I (3.8% vs 13.6%; $p = 0.018$) and II (12.5% vs 21.6%; $p = 0.049$). Regarding individual complications, patients in the LM group had significantly less haematuria (1.3% vs 8.8%, $p = 0.031$), wound infections (0% vs 4.8%, $p = 0.047$), and blood transfusions (0% vs 6.4%, $p = 0.024$).

Conclusions Laparoscopic Millin adenectomy is a safe technique, with less intraoperative blood loss, shorter length of hospital stay and catheterisation time, and fewer complications, including a lower transfusion rate, than its open counterpart.

Key Words: simple prostatectomy <> laparoscopy <> Millin <> adenectomy

INTRODUCTION

Benign prostatic hyperplasia (BPH) is the most common cause of lower urinary tract symptoms (LUTS) in men over 50 years of age [1]. For prostates larger than 80 mL, the recommended surgical treatment is either adenectomy (simple prostatectomy) or transurethral anatomical enucleation of the prostate adenoma [2]. Among the techniques developed for simple pros-

tatectomy, the retropubic transcapsular technique, described by Terence Millin in 1947, is commonly performed [3]. Laparoscopic adenectomy was first described by Mariano et al. in 2002 [4], and since then several studies have demonstrated the feasibility and safety of laparoscopic simple prostatectomy in these patients [5–12]. Still, there are not enough well-designed studies to make recommendations for laparoscopic approaches, and the published studies

often compare different techniques of adenomectomy, either in the laparoscopic or open routes [10].

The aim of our study was to evaluate the perioperative outcomes and complications between open Millin (OM) and laparoscopic Millin (LM) adenomectomy.

MATERIAL AND METHODS

We retrospectively collected data regarding perioperative outcomes and complications from all patients submitted to Millin procedure from August 2019 to August 2022 at a tertiary centre in Portugal, and OM and LM were compared. Data were obtained from clinical records. The variables analysed were length of hospital stay, length of catheter duration, estimated blood loss, drop in haemoglobin levels, operative time, need for blood transfusion, and complications. Baseline characteristics were also analysed, such as age, prostate volume on transabdominal ultrasonography, prostate-specific antigen (PSA) value before surgery, specimen weight, and uroflow rate pre-operatively and at 6 months post-operatively. Questionnaires regarding LUTS and quality of life were not available for most patients and therefore were not analysed. Complications were classified according to Clavien-Dindo classification at 30 days postoperatively. Statistical analysis was performed using Student's *t* test, the chi-square test, Fischer's exact test, and multinomial regression. The study was approved by the Ethics Committee of our centre. Indications for the Millin procedure were recurrent urinary retention, recurrent urinary tract infection (UTI), macroscopic haematuria due to BPH, dilatation of the upper tract due to BPH, with or without renal insufficiency, and persistent bothersome LUTS despite medical treatment, in patients with prostatic volume >80 mL. The surgical procedures in both groups were performed by the same group of surgeons, with varying degrees of experience but all dedicated to prostatic surgery. The procedure used in the OM group was a standard transcapsular retropubic adenomectomy. For the LM group, an extraperitoneal approach was used. Five ports were placed, including a 12-mm port at the umbilicus for the lens, a 12-mm port at the left anterior superior iliac crest, and three 5-mm ports, one at the right anterior superior iliac crest and 2 between the umbilicus and the anterior superior iliac crests on both sides. Pneumoextraperitoneum was created at a pressure of 12 mmHg. Dissection of the Retzius space was performed, with no need for opening of the endopelvic fascia. A transverse incision was made in the prostatic capsule, and the adenoma was enucleated using bipolar forceps and a harmonic scalpel. Haemostasis of the capsule was achieved using bi-

polar diathermy. Trigonisation was performed, securing the trigone to the posterior capsule. Closure of the prostatic capsule was done using a 2-0 barbed suture in a running fashion.

RESULTS

A total of 205 patients were obtained, 125 patients in the OM group and 80 patients in the LM group. Patient demographics and perioperative data are presented in Table 1. Baseline characteristics were similar between groups, meaning there were no significant differences in patient age, PSA, prostate volume, pre- and postoperative uroflow rate, and specimen weight between the laparoscopic and open groups. Regarding perioperative outcomes, the LM group showed superior outcomes compared to the OM group. Mean estimated blood loss was 194 ±210 mL in the LM group, compared to 477 ±389 mL in the open group (*p* <0.001). The mean haemoglobin drop of the LM group was 1.40 ±1.16 g/dL vs 2.62 ±1.42 in the OM group, also significantly less (*p* <0.001). Duration of catheterisation (4.63 ±1.39 vs 5.37 ±1.99 days, *p* = 0.004) and hospital stay (4.59 ±1.72 vs 5.82 ±3.36 days, *p* = 0.003) were significantly shorter with the laparoscopic approach. Operative time was significantly longer in the LM group, at 109.9 ±33.4 minutes vs 68.7 ±18.0 min in the open approach (*p* <0.001). The overall complication rate was significantly lower in the LM group. The laparoscopic group had a total of 18.8% of complications vs 36.8% in the OM group, which translated to an odds ratio

Table 1. Patient demographics and perioperative data

| | Laparoscopic Millin adenomectomy (mean ±SD) | Open Millin adenomectomy (mean ±SD) | <i>p</i> value |
|--------------------------------|---|-------------------------------------|----------------|
| Age (years) | 68.7 ±7.6 | 70.4 ±7.6 | 0.124 |
| Prostate volume (gr) [min–max] | 115.9 ±43.4 [82–350] | 109.4 ±34.7 [80–265] | 0.264 |
| PSA (ng/mL) | 5.45 ±4.05 | 5.43 ±4.73 | 0.982 |
| Specimen weight (gr) | 55.1 ±30.3 | 56.7 ±33.6 | 0.713 |
| Preoperative Qmax (mL/s) | 8.58 ±3.21 | 8.70 ±3.69 | 0.872 |
| Postoperative Qmax (mL/s) | 21.82 ±12.54 | 18.91 ±8.34 | 0.313 |
| Blood loss (mL) | 194 ±210 | 477 ±389 | <0.001 |
| Hb drop (g/dL) | 1.40 ±1.16 | 2.62 ±1.42 | <0.001 |
| Catheterisation time (days) | 4.63 ±1.39 | 5.37 ±1.99 | 0.004 |
| Length of hospital stay (days) | 4.59 ±1.72 | 5.82 ±3.36 | 0.003 |
| Operative time (min) | 109.9 ±33.4 | 68.7 ±18.0 | <0.001 |

Hb – haemoglobin; PSA – prostate-specific antigen; SD – standard deviation

Table 2. Comparison between laparoscopic and open approach for prostate adenomectomy. Complications grouped by Clavien-Dindo grade

| Clavien-Dindo | Laparoscopic Millin n, (%) | Open Millin n, (%) | OR (CI 95%) | p value | Complications |
|---------------|----------------------------|--------------------|------------------|---------|--|
| I | 3 (3.8%) | 17 (13.6%) | 0.21 (0.06–0.76) | 0.018 | Urinary retention, haematuria, wound haemorrhage, wound dehiscence |
| II | 10 (12.5%) | 27 (21.6%) | 0.45 (0.20–0.99) | 0.049 | UTI, wound infection, blood transfusion |
| ≥III | 2 (2.5%) | 2 (1.6%) | 1.22 (0.17–8.87) | 0.847 | Reintervention, pelvic haematoma, myocardial infarction |
| Total | 15 (18.8%) | 46 (36.8%) | 0.43 (0.22–0.83) | 0.012 | |

CI – confidence interval; OR – odds ratio; UTI – urinary tract infection

Table 3. Comparison between laparoscopic and open approach for prostate adenomectomy. Individual complications

| | Laparoscopic Millin n = 80 | Open Millin n = 125 | Clavien-Dindo | p value |
|-------------------------|----------------------------|---------------------|---------------|---------|
| Urinary retention | 2 (2.5%) | 5 (4%) | I | 0.707 |
| Haematuria | 1 (1.3%) | 11 (8.8%) | I | 0.031 |
| Wound haemorrhage | 0 (0%) | 1 (0.8%) | I | 1.000 |
| Wound dehiscence | 0 (0%) | 3 (2.4%) | I | 0.283 |
| Urinary tract infection | 10 (12.5%) | 18 (14.4%) | II | 0.699 |
| Wound infection | 0 (0%) | 6 (4.8%) | II | 0.047 |
| Blood transfusion | 0 (0%) | 8 (6.4%) | II | 0.024 |
| Reintervention | 1 (1.3%) | 1 (0.8%) | IIIb | 1.000 |
| Pelvic hematoma | 0 (0%) | 1 (0.8%) | IVa | 1.000 |
| Myocardial infarction | 1 (1.3%) | 0 (0%) | V | 0.390 |

(OR) of 0.43, favouring the laparoscopic approach (95% CI: 0.22 to 0.83; $p = 0.012$). When analysing by grade of complications, the difference between groups was maintained in Clavien-Dindo groups I and II (minor complications). The LM group had a total of 3.8% Clavien-Dindo I complications, while the OM group had 13.6% complications of this grade (OR: 0.21; 95% CI: 0.06 to 0.76; $p = 0.018$), and the LM group had also fewer Clavien-Dindo II complications, at 12.5% vs 21.6% in the OM group (OR: 0.45; 95% CI: 0.20 to 0.99; $p = 0.049$). Both approaches were similar with respect to major complications, i.e., Clavien-Dindo groups ≥III complications were similar between both groups (2.5% for LM vs 1.6% for OM; OR: 1.22; 95% CI: 0.17 to 8.87; $p = 0.847$) (Table 2). When analysing each complication alone, the laparoscopic approach had significantly fewer haematuria, wound infections, and blood transfusions. Only one patient (1.3%) in the laparoscopic group presented with haematuria, against 11 (8.8%) in the OM group ($p = 0.031$). No patient in the LM group presented with wound infection, while 6 (4.8%) had this complication in the OM group ($p = 0.047$). Also, no patient required blood transfusion in the LM group, while

8 (6.4%) patients in the open group needed transfusion ($p = 0.024$). There was one reintervention in each group, both patients because of severe bleeding with the need for endoscopic control in the operating room (Table 3).

DISCUSSION

Laparoscopic simple prostatectomy for large prostates remains a topic of debate. There is an increasing body of evidence favouring minimally invasive approaches for adenomectomy with respect to open approaches [4–17]. There are comparative series between minimally invasive approaches and open approaches for adenomectomy, demonstrating better perioperative outcomes with similar functional outcomes [7–9, 11], although many studies compare different approaches in either the minimally invasive or open routes. Still, the lack of high-quality evidence prevents its recommendation [2], despite its high adoption [12, 14]. Furthermore, the role of enucleation of the prostate has also been widely recognised, with many studies demonstrating its efficacy and safety with a favourable peri-operative

profile compared to open prostatectomy or minimally invasive simple prostatectomy [18, 19, 20]. In our study, we focused on comparing purely Millin approaches, by either open or laparoscopic approaches; we demonstrated that LM offers a better perioperative profile than OM, with less estimated blood loss and a smaller drop in haemoglobin levels, as well as shorter catheterisation time and length of hospital stay; we also demonstrated fewer complications in the LM group, with fewer overall complications, fewer minor complications, and, on an individual level, fewer haematuria and wound infections and a lower transfusion rate.

Porpiglia et al. [8] presented the first comparative analysis between laparoscopic and open adenectomy, with only the Millin approach in both groups, demonstrating less bleeding with the laparoscopic approach. Baumert et al. [7], in a series of 60 patients, demonstrated less blood loss, shorter irrigation time, and shorter time of catheterisation and hospital stay in the laparoscopic group. In this study, both the transvesical and transcapsular technique were used in the laparoscopic arm, which were compared to the transvesical approach in the open group. McCullough et al. [9] published the largest comparative study, with 280 patients, demonstrating similar results as the previous authors, with better perioperative outcomes in the laparoscopic approach. Moreover, these authors offered an insight into complications between both groups, demonstrating fewer urinary tract infections and sepsis in the laparoscopic group. It is worth noting, however, that the enucleation of the adenoma in the laparoscopic approach was done in a hand-assisted manner, using the index finger through the suprapubic port. More recently, Garcia-Segui et al. [11], in a comparative series between open and laparoscopic adenectomy by the Millin approach, observed better perioperative outcomes with fewer complications and a lower transfusion rate in the laparoscopic group. Regarding operative time, only Porpiglia et al. [8] reported no differences between the open and laparoscopic approaches, while the other authors observed a longer operative time in the laparoscopic approach [7, 9, 11].

Asimakopoulos et al. [12] performed a critical analysis of the literature on laparoscopic prostatectomy. After reviewing 14 case series and 3 comparative studies, with a total of 626 patients, they concluded that the laparoscopic approach had less bleeding, a shorter hospital stay, and a shorter catheterisation time, at the expense of a prolonged surgical time.

Since the introduction of the robotic simple prostatectomy in 2008 [13], more comparative studies between minimally invasive and open techniques

emerged, which is in line with the greater adoption of these minimally invasive techniques [14, 15]. Pavan et al. [16] compared robotic and laparoscopic simple prostatectomy and concluded that they were equally effective but differing in rate of complications, which was higher in the robotic approach, and estimated blood loss, which was higher in the laparoscopic approach. Autorino et al. [17] published the largest multicentric study on minimally invasive simple prostatectomy, encompassing 23 centres across North America, South America, and Europe, and enrolling 1330 patients, of whom 843 were treated by a laparoscopic approach and 487 by a robotic approach. They concluded that minimally invasive approaches can be safely and effectively performed in a variety of centres with different expertise and technology, obtaining good functional and perioperative outcomes with a low rate of complications. Lucca et al. [10], in a systematic review and meta-analysis of 27 observational studies on minimally invasive simple prostatectomy (including laparoscopic and robotic surgery), which included 764 patients, observed better perioperative outcomes in the minimally invasive arm, with a similar complication profile when compared to the open arm.

The optimal surgery for BPH should involve the complete removal of the adenoma to achieve enduring functional outcomes. This should be achieved through minimally invasive procedures that result in minimal morbidity, shorter hospital stays, and reduced catheter time [12]. In that sense, endoscopic enucleation of the prostate (EEP) gathers all these characteristics, which is why it is replacing adenectomy as the gold-standard for BPH surgical treatment [2]. The overall better perioperative profile renders it an advantageous surgical tool, with shorter hospital and catheter times compared to minimally invasive prostatectomy [19, 21, 22, 23]; shorter operative times were also found in some comparative studies [19, 21, 23]; complication rates, however, appear to be similar in comparative studies [22, 23]. Li et al. [20], in a meta-analysis comparing minimally invasive prostatectomy and EEP, found that EEP demonstrated shorter operative time, lesser haemoglobin drop, and shorter catheterisation and hospitalisation times. Meanwhile, complications and blood transfusions were similar between groups. More recently, Kowalewski et al. [24], in another meta-analysis comparing robotic simple prostatectomy and EEP, demonstrated that haemoglobin drop, rate of blood transfusions, catheterisation time, and length of hospital stay were significantly lower in EEP, while operative time and complications were similar between groups. Despite its obvious advantages, it is also worth noting that

EEP requires specific surgical materials, which is not the case for minimally invasive simple prostatectomy. Moreover, the learning curve might be longer for EEP than for minimally invasive simple prostatectomy [20].

Our study focuses on one technique to simple prostatectomy, by the Millin technique, and compares the laparoscopic and open approaches of this technique. We concluded that LM offers better perioperative outcomes, namely less estimated blood loss and a smaller drop in haemoglobin levels, as well as a shorter catheterisation time and length of hospital stay, as was noted by other authors [7, 8, 9, 11]. We focused also on the blood transfusion rate, which was also significantly lower in LM, a finding only observed by Garcia-Segui et al. [11]. Operative time, on the other hand, was significantly longer with the laparoscopic approach, in line with other authors' findings [7, 9, 11]. Finally, we also focused on complications, demonstrating fewer overall complications for LM, fewer minor complications (Clavien-Dindo grades I and II), and, on an individual level, fewer haematuria and less wound infections, besides the lower rate of blood transfusion already mentioned. Comparisons of complication rates between both techniques are not often found in the literature, with only a few authors demonstrating fewer complications with laparoscopic approaches [9, 11].

Nevertheless, our study has limitations. The retrospective design carries intrinsic biases, and underestimation of complications is a possible risk. Also, this study does not offer a comparison with other gold-standard techniques, namely enucleation of the prostate. Despite the perioperative advantages that enucleation offers in comparison to minimally invasive simple prostatectomy [21, 24], it requires specific surgical material and a long learning curve. Therefore, in centres with experience in laparoscopy, laparoscopic simple adenomectomy remains a viable alternative to the open approach [12, 25].

CONCLUSIONS

Laparoscopic Millin transcapsular adenomectomy is a safe and effective alternative to its open counterpart, with less bleeding, shorter catheterisation time, shorter length of hospital stay, and fewer complications, namely fewer haematuria, wound infections, blood transfusions. On the other hand, this does come at the expense of longer operative time. Further studies, mainly prospective, randomised studies, are needed to further validate these findings.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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