

Open adenomectomy: past, present and future

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Purpose of review

Open surgery has been the gold standard for the treatment of benign, symptomatic, large volume prostatic hyperplasia. Recent data series, however, have demonstrated that a minimally invasive approach can be used for the treatment of this pathology while duplicating the results of the open technique. This review will describe the different surgical techniques that have been used through the last century for the treatment of benign prostatic hyperplasia, highlighting the advantages and disadvantages of each approach.

Recent findings

Surgical management for symptomatic benign prostatic hyperplasia has made a journey from an open approach to robotic surgery. Modifications of the gold standard transurethral resection have been incorporated into clinical practice and include bipolar transurethral resection as well as holmium laser resection and potassium titanyl phosphate laser vaporization. Minimally invasive ablative techniques have also been popularized and include transurethral needle ablation and thermotherapy. Most recently, laparoscopy has demonstrated to be a feasible, safe, reproducible technique that can create similar outcomes to an open technique whilst maintaining the advantages of a minimally invasive approach. Although the future will see greater use of robotics, larger series are needed to prove the advantages of this technology.

Summary

Minimally invasive approaches for the treatment of symptomatic benign giant prostatic hyperplasia are replacing open surgery, which has been the gold standard for the surgical treatment of this pathology, duplicating its results with a lower morbidity. Recently we have seen a growing amount of experience treating this disease state with laparoscopic/robotics and the advantages it provides may permit the popularization of this technique.

Keywords

benign prostatic hyperplasia, laparoscopy, prostate, simple prostatectomy

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Introduction

Open surgery has traditionally been the treatment of choice for benign, symptomatic, large size prostatomegaly [1]. More than 2000 years ago, surgeons began using a median perineal incision for the removal of bladder calculi and in the first century of the classical era, surgeons used a semielliptical incision in this same perineal location for partial removal of the prostate. Although there are infrequent records documenting its use for a few hundred years, this perineal approach continued to be applied until 1894 when Eugene Fuller performed the first suprapubic prostatectomy. It was not until 1912, however, that the procedure was popularized as a result of Peter Freyer reporting his results with this technique, which consisted of the enucleation of the hyperthrophic prostatic adenoma through an extraperitoneal incision of the lower anterior

bladder wall. The next transition in surgical approach for treating benign prostatic hyperplasia (BPH) occurred over 30 years later, in 1945, when the retropubic simple prostatectomy was first described by Terence Millin [2]. Through his experience with 20 patients he reported a technique by which he achieved complete enucleation of the prostate adenoma through a transverse capsulotomy incision on the anterior surface of the prostate gland. Subsequently, transurethral endoscopic techniques have virtually replaced the open approach in the surgical management of the majority of cases of BPH [3–5]. Modifications of the gold standard transurethral resection have been incorporated into clinical practice and include bipolar transurethral resection as well as holmium laser resection and potassium titanyl phosphate (KTP) laser vaporization. Minimally invasive ablative techniques have also been popularized and include transurethral needle ablation and thermotherapy.

Technique

The choice of what technique to use in the treatment of BPH depends on a number of factors, the first of which is prostate size. Transurethral incision of prostate is efficacious for glands up to 30 cm³ in size [6] with transurethral resection of the prostate (TURP) accepted as the long-established gold standard surgical procedure for medium-sized adenomas. Minimally invasive techniques have also been developed in an effort to offer outpatient alternatives to the traditional TURP for these medium sized glands. These techniques include microwave ablation of the prostate and interstitial laser coagulation and effect symptomatic improvement by causing coagulative necrosis with secondary ablation. Persistence of the irritative symptoms due to the presence of residual, heat-damage prostate tissue occurs more frequently after these minimally invasive procedures [7] and these symptoms as well as the longer postoperative catheterization times, more unpredictable outcomes, and high reoperation rates have restricted the use of these techniques [8–12].

Transurethral resection of the prostate

TURP remains the gold standard for the surgical treatment of the medium sized prostate with obstructive symptoms. Chen *et al.* [13] showed that the reduction of the prostate volume after TURP proportionally correlates to the rates of American Urology Association symptom score improvement. Operative morbidity of TURP, however, increases when performed for prostatic adenomas larger than 45 g, in procedures lasting more than 90 min, in patients older than 80 years, and in patients with a history of acute urinary retention [7,14]. The transurethral resection syndrome of dilutional hyponatremia is also unique to this procedure and does not occur with open prostatectomy. Newer transurethral techniques have been devised and developed to excise the largest possible amount of prostatic tissue while minimizing the likelihood of hyponatremia. Bipolar electrocautery TURP (saline TURP) uses normal saline as an irrigant instead of glycine and is not only a safe alternative to TURP, but is also technically no different from traditional monopolar TURP. Initial data suggest that the use of this bipolar technology is both safe and effective and offers some advantages over monopolar TURP with respect to the reduction of TUR-syndrome, less conductive trauma (i.e. tissue charring), cheaper irrigation solution, and a shorter catheterization time [15–19].

Holmium laser

The use of the holmium laser for TURP offers similar advantages to the bipolar TURP [20,21]. Using this technique, the adenoma is precisely dissected from the surgical capsule in the cleavage plane between the adenoma and the capsule in a retrograde fashion. Hemostasis is achieved

at the bleeding points based on the wavelength of the laser beam. The resected fragments are then deposited in the bladder, from where they are finally extracted with a transurethral morcellator [20–24].

The results of randomized prospective studies that compared transurethral prostate enucleation using holmium laser to open transvesical prostate adenomectomy showed a similarly significant improvement in the maximum urinary flow rate, reduction in the volume of residual urine, as well as a similar American Urology Association symptom score improvement. Although surgical time was significantly longer in the case of the holmium group, measures including blood loss, length of catheterization, and hospital stay were significantly less. The volume of extracted tissue was similar in both groups [13,22–25].

If we accept that improvement in obstructive symptoms is directly related to the amount of tissue removed it is interesting to read studies like that of Roehrborn *et al.* [1] who showed in a cooperative study on the guidelines for the diagnosis and treatment of benign prostatic hyper trophy, that the average weight of resected tissue for TURP was only 22 g. Furthermore, in a study by Gilling *et al.* [21] comparing TURP and holmium laser prostate resection, the estimated resected specimen weight was 15.5 and 21.7 g, respectively. Comparing the volume of resected tissue using these two endoscopic techniques with open simple prostatectomy, it is clear that open prostatectomy achieves a far more complete removal of the prostatic adenoma via both the suprapubic or retropubic approaches. A meta-analysis of the literature concluded that open prostatectomy is the most effective method for improving the symptoms of an obstruction caused by massively enlarged BPH, despite being a more invasive and more expensive procedure. Unlike TURP, which is a procedure unable to extract large enough volumes in the case of large prostates [26], open prostatectomy is deemed most effective due to that fact that the obstruction is corrected by completely removing this oversized adenoma [7,26]. Although the holmium laser has been employed for ‘giant’ prostatomegaly, even in excess of 100 g [22,25], at many centers, open prostatectomy remains the technique of choice for the majority of patients with this sort of massively enlarged BPH [6,27,28].

Open prostatectomy

In general glands larger than 80–100 g are better managed with open simple retropubic or suprapubic prostatectomy, especially in the presence of coexisting pathology, such as a large vesical diverticulum, large/multiple bladder calculi, or severe hip ankylosis contraindicating a lithotomy position [27]. The advantages of the retropubic technique over the suprapubic approach include improved anatomic

prostatic exposure, direct visualization of the adenoma during enucleation to ensure complete removal and direct visualization of the prostate fossa after enucleation for hemorrhage control, precise division of the prostatic urethra optimizing preservation of urinary continence, and minimal or no surgical trauma to the bladder. The most important advantage of the suprapubic approach over the retropubic approach is that it allows a better visualization of the bladder neck and ureteral orifices and is, therefore, indicated in patients with the following characteristics: enlarged, protuberant, median prostatic lobe; concomitant symptomatic bladder diverticulum; large bladder calculus; obesity. The benefits of the perineal approach are the ability to avoid the retropubic space which can be useful when there is a history of prior retropubic surgery; the ability to treat clinically significant prostatic abscess and prostatic cysts; and less postoperative pain [29]. Bernie and Schmidt [30] described their experiences with simple perineal prostatectomy concluding that, compared with the transvesical and retropubic operations, patients clinically recovered more rapidly, had fewer analgesic requirements and a shorter hospital stay. There is, however, a significant lack of information that can be found in the recent literature regarding this technique.

Laparoscopic approach

As surgeons continue to expand the use of laparoscopic surgery in urology there have been centers exploring techniques and measuring outcomes using a laparoscopic approach to simple prostatectomy. Indeed a laparoscopic approach to many procedures has produced proven benefits including lower morbidity, limited pain, shorter hospital stay, and earlier return to normal working activities. Thus, laparoscopic simple prostatectomy has the potential to combine the advantages of a minimally invasive technique with the favorable results of open surgery.

Mariano *et al.* [31] first reported using a laparoscopic approach for simple prostatectomy performed in a patient with BPH. In this case report, a longitudinal vesicocapsular incision was performed to extract a 120 g prostate adenoma with a total of four hemostatic sutures used for vascular control. This same author further described a series of 60 patients treated with laparoscopic prostatectomy for large BPH with a median prostate weight of 144.5 ± 41.74 g using the same longitudinal incision [32]. Baumert *et al.* [33] also reported their experience with laparoscopic simple prostatectomy in 20 patients. Van Velthoven *et al.* [34] reported their initial experience with laparoscopic extraperitoneal Millin's prostatectomy in 18 patients with a slightly different technique. Their technique included hemostatic control of lateral venous vesicoprostatic pedicles, transverse anterior incision of the prostate capsule, adenoma enucleation using the harmonic scalpel and reconstruction of the posterior bladder neck and prostate capsule. Advantages of the technique proposed by van Velthoven include its preperitoneal approach, the relatively short operative time (2.4 h), and limited blood loss (192 ml). Recently, Sotelo *et al.* [35,36] described their technique for laparoscopic simple retropubic prostatectomy in 17 patients with symptomatic significant prostatomegaly (≥ 60 g on transrectal ultrasonography; mean 93 g). This same author then described an extraperitoneal technique for laparoscopic simple prostatectomy in 71 patients. Blood loss for this series was 275 ml, operative time 140.6 min, and average specimen weight was 65 g. The average specimen weight of the excised prostate in this series was equal to 84.86% of the gland weight estimated on preoperative transrectal ultrasonography. In the technique described by Sotelo a five-port approach was used. The steps in this technique included a transverse cystotomy just proximal to the prostate-vesical junction, retraction of the median lobe with a Carter–Thomason device (Fig. 1),

Figure 1 Retraction of the median lobe with a Carter–Thomason device

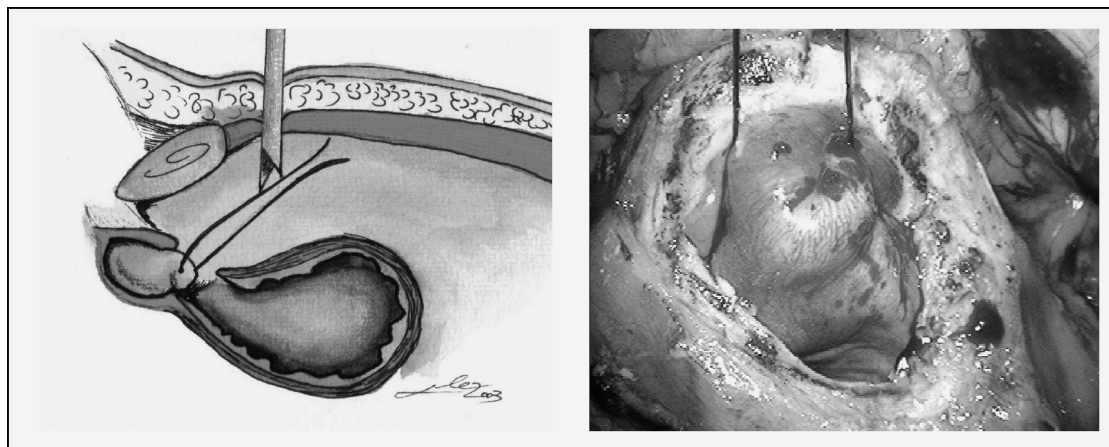
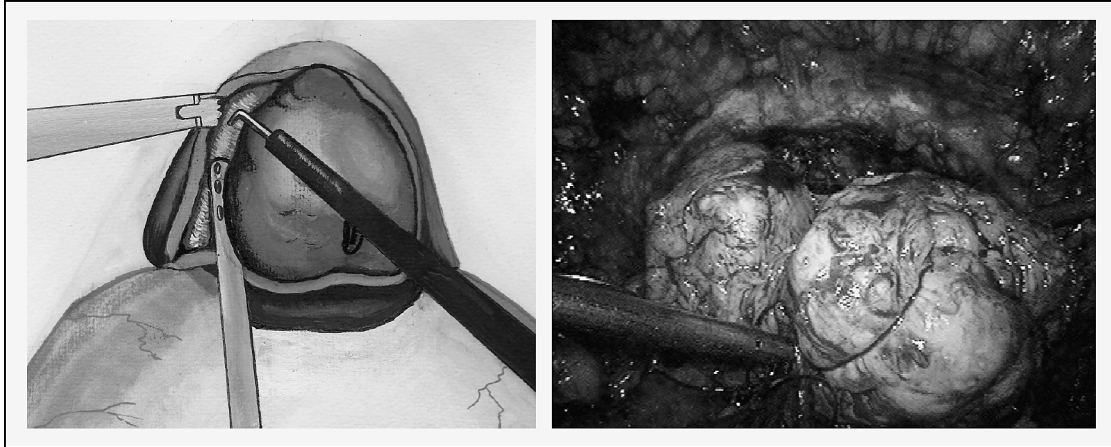


Figure 2 Enucleation of adenoma

development of the subcapsular plane (Fig. 2), enucleation assisted by a prostatic knife (Fig. 3), urethral incision, trigonization of the prostatic fossa (Fig. 4), and suture–repair of the cystostomy. This technique facilitates adenoma enucleation in the correct plane while reducing the potential for hemorrhage, which is most likely to occur from either the capsulotomy incision or the prostatic fossa. During this laparoscopic procedure, the capsulotomy incision is eliminated, diminishing the bleeding that can come from the capsular veins. To reduce potential bleeding from the prostatic fossa, the perforating vessels were controlled laparoscopically by ultrasonic scalpel (Fig. 5). Given the visual clarity and magnification afforded by the laparoscope and the tamponade effect of pneumoperitoneum, these hemostatic steps were able to be achieved with speed and precision [29,37].

Porpligia *et al.* [38] reported a comparative study evaluating open and laparoscopic extraperitoneal approaches for simple prostatectomy using the Millin technique in 40 patients divided into these two groups. The extraperitoneal laparoscopic group in this series had better hemostasis, likely due to a more careful dissection of adenoma and the gas pressure acting in a small space, but there was no improvement in catheterization time. The same author then described the same technique in another 30 patients with a mean operative time of 103.6 min, blood loss 351 ml, and a catheterization time of 6.3 days; a total of 142 cases have been described in the literature [39].

Several maneuvers have been described to facilitate the enucleation of the adenoma during laparoscopic simple prostatectomy. Nijinou Ngninkeu *et al.* initially described, in 15 patients, an extraperitoneal laparoscopic

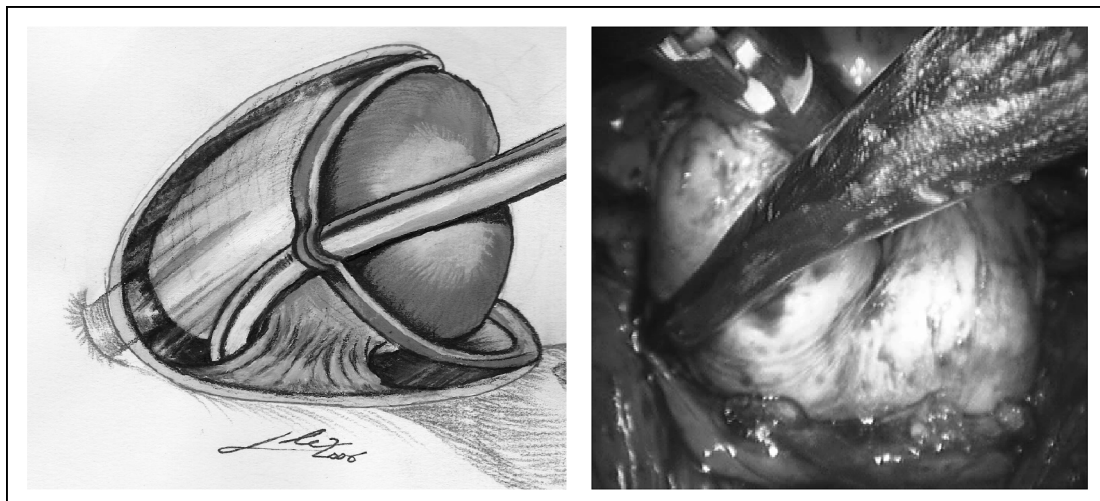
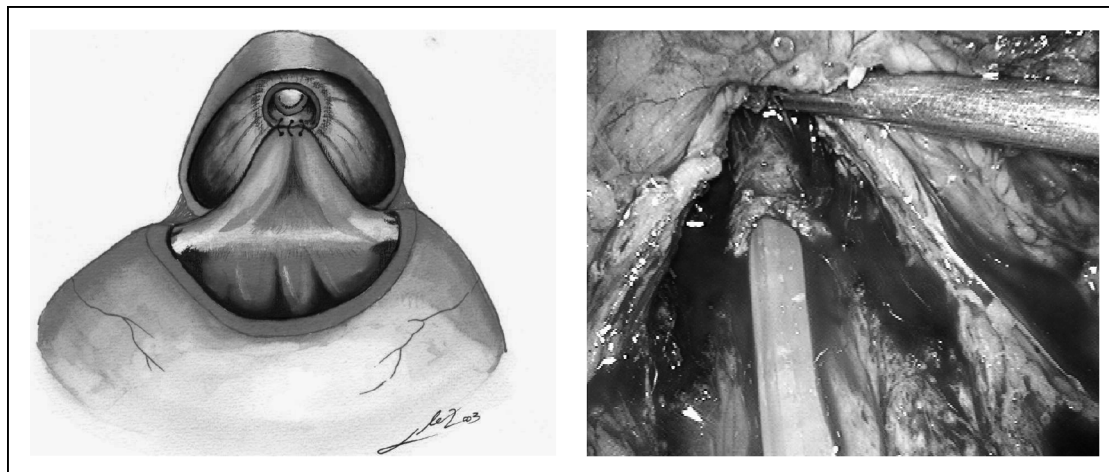
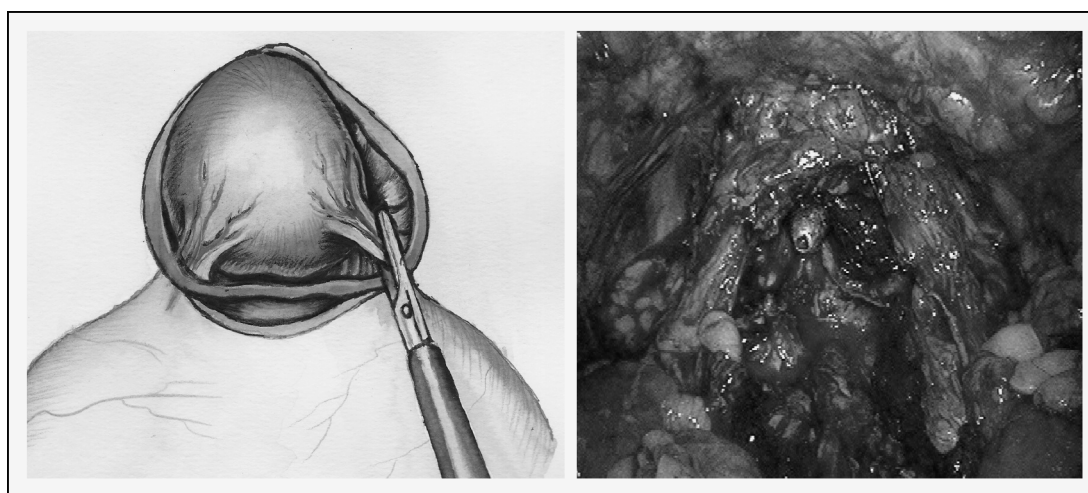
Figure 3 The enucleation is more easy assisted by a prostatic knife

Figure 4 Trigonization of the prostatic fossa

prostatic adenomectomy assisted by the index finger inserted through the abdominal wall for digital enucleation of the adenoma. This same group then reported their results with this technique in 75 patients [40,41]. Lufuma *et al.* [42] described the finger assisted laparoscopic retro-pubic technique in 100 patients for the treatment of large adenoma concluding that in the hands of an experienced laparoscopic team, this technique for large BPH is a feasible, reproducible approach with minimal intraoperative hemorrhage (250 ml), a low postoperative complication rate, and a shorter convalescence period than open surgery. Nadler *et al.* [43] described using a fan retractor and laparoscopic shears to enucleate the adenoma. Sotelo and Garcia [44] used the 'Sotelo prostatotome', a device similar to a curette or an osteotome that facilitates the enucleation of the adenoma during laparoscopic simple

prostatectomy (Fig. 3). Its metallic, curvilinear tip with a sharp cold knife on the distal side of the forceps is used to divide the adherence between the adenoma and its capsule during circumferential dissection of the gland [44]. Unlike open surgery, the surgeon does not insert the index finger in the open capsule in this technique nor are any intravesical retractors placed, thus decreasing the risk of capsular trauma and potential capsular avulsion [31–34,43].

Compared to open surgery, all laparoscopic techniques have limitations, including a steep learning curve and the requirement of significant laparoscopic expertise. In addition, despite the outcomes reported in the prior series, a paper by Barret *et al.* [45] evaluated the morbidity of laparoscopic versus open simple prostatectomy for the

Figure 5 Hemostasia

The hemostasia was made with ultrasonic scapel directly under the subcapsular vessels, with special care in 5 and 7 h, and an additional hemostatic stitch could be placed directly inside the internal capsular side.

treatment of BPH and found that there was no significant difference between the two groups in terms of estimated blood loss, transfusion rate, perioperative complications, and duration of postoperative catheter irrigation. Operative time was significantly longer in the laparoscopic simple prostatectomy but the duration of catheterization, postoperative morphine requirement, and hospital stay were all significantly lower in the laparoscopic group. Despite the longer operative time, the laparoscopic simple prostatectomy offers not only these documented clinical advantages but also allows for simultaneous minimally invasive procedures such as laparoscopic hernioplasty [45].

Robotics

The future, however, is in robotics. We have performed six laparoscopic simple prostatectomies using a robot-assisted transperitoneal approach. In this series, blood loss was 381 ml, operative time 195 min, average specimen weight was 50.56 g, hospital stay 1.3 days, the drain was removed after an average of 3.5 days and catheterization for 7.5 days. One patient required blood transfusion secondary to an injury of the epigastric artery. The average reported Qmax postoperatively was 55.5 ml/s. Excision of only lateral prostatic lobes was performed in one patient who did not have a median lobe. In this patient preservation of the prostatic urethra was achieved necessitating only a suture repair of the longitudinal capsular incision. The robotic system offers the surgeon advantages including three-dimensional vision, six degrees of freedom in the instrument's movements (compared with four degrees for laparoscopic prostatectomy), and downscaling of movements (i.e., modulation of the amplitude of surgical motions by up to five-times). It is the authors' belief that robotics will allow the surgeon greater precision and vision for laparoscopic simple prostatectomy and will permit the popularization of this useful resource [46].

Conclusion

Open retropubic or suprapubic prostatectomy for symptomatic BPH and very large prostates continues to be the gold standard in most centers. The inherent challenges of the laparoscopic technique include acquisition of skill required for advanced reconstructive pelvic laparoscopy and subsequently, the learning curve specific to the procedure so that the adenoma is removed in its entirety as would be the case with open surgery.

As the different centers of excellence achieve this goal, the results of open surgery will be duplicated with the advantages of a minimally invasive approach. In the reported series by Mariano, van Velthoven, Porgiglia, Baumert, and Sotelo, there is a cumulative experience of more than 800 patients using a laparoscopic technique for simple prostatectomy. In these authors' hands the laparoscopic technique is feasible, safe, and reproducible.

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