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GENERAL UROLOGY
Original Article

# Trends in benign prostatic hyperplasia surgery over the years: A multicenter 14-year retrospective study

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## ABSTRACT

**Objective:** The aim of this study is to show the surgical trend over the past 14 years using the data from five major centers in Turkey with accumulated experience in benign prostatic hyperplasia (BPH) surgery.

**Material and methods:** This study included 94,954 patients with low urinary tract symptoms (LUTSs) secondary to BPH. By using electronic databases, we identified 7,163 patients who underwent BPH surgery, including monopolar transurethral prostate resection (M-TURP), bipolar transurethral prostate resection (B-TURP), transurethral incision of the prostate (TUIP), open prostatectomy (OP), and holmium laser enucleation of the prostate (HoLEP) from 2006 to 2019. The years were grouped as 2006-2010, 2011-2015, and 2016-2019.

**Results:** The total number of outpatient treatments for BPH increased by 72.9% from 5,379 in 2006 to 9,302 in 2019. Until 2019, the annual number of surgeries increased from 375 to 937 (increasing 150%). All surgical approaches for BPH, except TUIP, were most frequently performed between the ages of 60 and 69. The rate of surgery including M-TURP, B-TURP, and TUIP was statistically different between 2006 and 2010, 2011 and 2015, and 2016 and 2019 ($P < .001$), except OP ($P = .071$). The highest increase was observed in HoLEP in the first half of the 2010s compared to the second half of the 2010s. The rate of M-TURP decreased from 77.9% to 17.9% from 2016 to 2019.

**Conclusion:** With the aging population, the number of patients diagnosed and treated with BPH is increasing. B-TURP as a resection technique and HoLEP as an enucleation technique replace M-TURP. Healthcare services and government spending should be organized according to these data.

**Keywords:** Benign prostate hyperplasia; bipolar transurethral resection; holmium laser enucleation of the prostate; monopolar transurethral resection.

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## Introduction

The prevalence of benign prostate hyperplasia (BPH) increases with age. In the United States, roundly 70% of men between 60 and 69 years and 80% of men ≥70 years have BPH.[1] The management of low urinary tract symptoms (LUTSs) may include watchful waiting, lifestyle modification, phytotherapy, and medical or surgical treatments.[2] The number of benign prostatic hyperplasia (BPH) surgery procedures has been incessantly increasing worldwide over recent years,[3] for multiple reasons: patients' demand to be able to age in good health without LUTS, increased older patients' awareness and population, and improvement in surgical techniques.

Open prostatectomy (OP), used for substantially enlarged glands (>80 mL), is the oldest surgical treatment for moderate-to-severe LUTS secondary to BPH. Transurethral resection of prostate (TURP) has been considered as the gold standard endoscopic surgical treatment of BPH since the early 20th century.[4] Transurethral incision of the prostate (TUIP),

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bipolar TURP (B-TURP), and holmium laser enucleation of the prostate (HoLEP) are minimally invasive and promising alternative to standard monopolar TURP (M-TURP) for the treatment of BPH. Especially, good functional outcomes of HoLEP similar to OP and TURP with lower perioperative complication rates for any prostate size have popularized this method widely.[5]

According to the Turkish Statistical Institute data, the rate of the total elderly population in Turkey was 8.0% in 2014, rose to 9.1% in 2019. According to population projections, the elderly population ratio is estimated to be 10.2% in 2023, 12.9% in 2030, and 16.3% in 2040.[6] BPH has been a major concern for healthcare providers, as the growing proportion of the elderly population can lead to an increase in the number of BPH surgeries. There are no studies of trends in the use of surgical alternatives for BPH in Turkey.

In this study, the changing rates of surgical treatment methods were applied to BPH patients over the years, and their changes according to age groups were investigated.

## Material and Methods

In the current retrospective study, five Turkish institutions participating in this study were selected from major centers with accumulated experience in surgery for BPH. The following 5 urological centers (geographically; one hospital in Turkey's south, north and east and two hospitals in center of Turkey) took part in the study: University of Ankara, University of Mersin, University of Fırat, University of Ondokuz Mayıs, and Medicana International Ankara Hospital.

This study was approved by the local ethical committee of Ankara University Faculty of Medicine (I5-226-19). Afterward the approval of the ethical committee, we sorted the records of BPH patients in the AVICENNA (version 2), NUCLEUS (version 9), and ENLIL (version 2) electronic databases from the Hospital Data Processing Center for analyzing the trends in surgery for BPH during 14 years in five centers, from 2006 to 2019. The screening was performed with the health practice

**Main Points**

- The number of patients who have undergone surgery for BPH has been increasing from past to present.
- It can be commented that B-TURP is preferred more than M-TURP in transurethral resection prostate surgeries.
- It can be expressed that the future standard endoscopic approach for the prostate will be HoLEP.

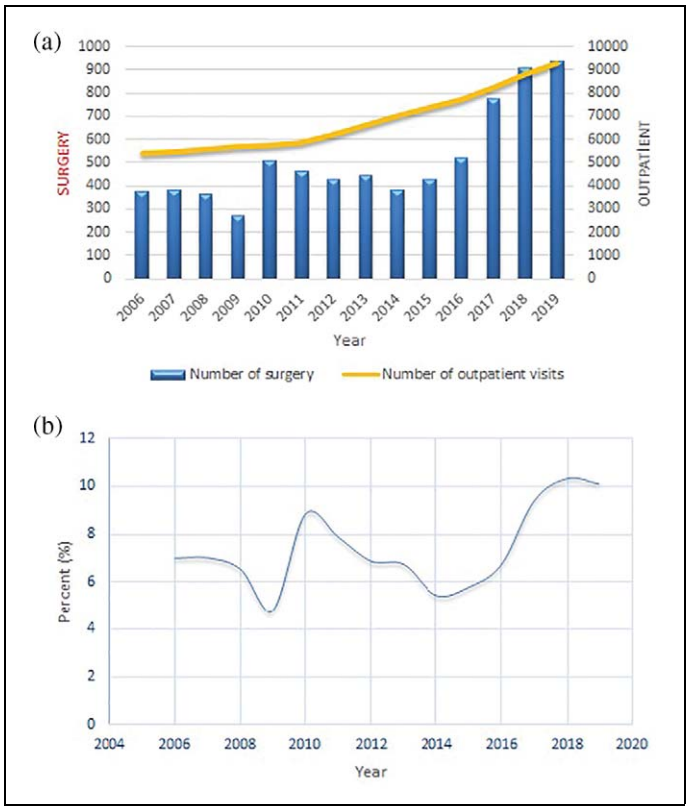


Figure 1. (A) A total number of outpatient visits and operations for benign prostatic hyperplasia during the 14 years in five centers. (B) Surgical rates of patients with outpatient visits for benign prostatic hyperplasia over 14 years at five centers.

statement codes specially assigned to each BPH surgery (OP: 621400, M-TURP: 621390, B-TURP: 621391, TUIP: 621420, HoLEP: 621360). The number of outpatient visits for BPH was identified using the International Classification of Diseases-10 procedure codes for BPH (N40.0). To avoid over counting the number of patients, if multiple claims with the same procedure code or multiple outpatient visits with the same "Republic of Turkey identification number" were found, only the first one was retained. The number of operations (including elaborated analysis of each surgical method) and the yearly changes of surgical incidence in each age group were enrolled.

BPH surgical indication of the patients was determined according to EAU Guidelines, while TUIP was applied to patients with small prostate volume (<30 mL), OP was not performed for patients with prostate volume <80 mL. M-TURP, B-TURP, and HoLEP were performed on patients with prostate volumes of 30-80 mL. In addition, HoLEP was applied for large prostate volume (>80 mL). However, the final decision for the surgical method of BPH was made by the surgeons individually.

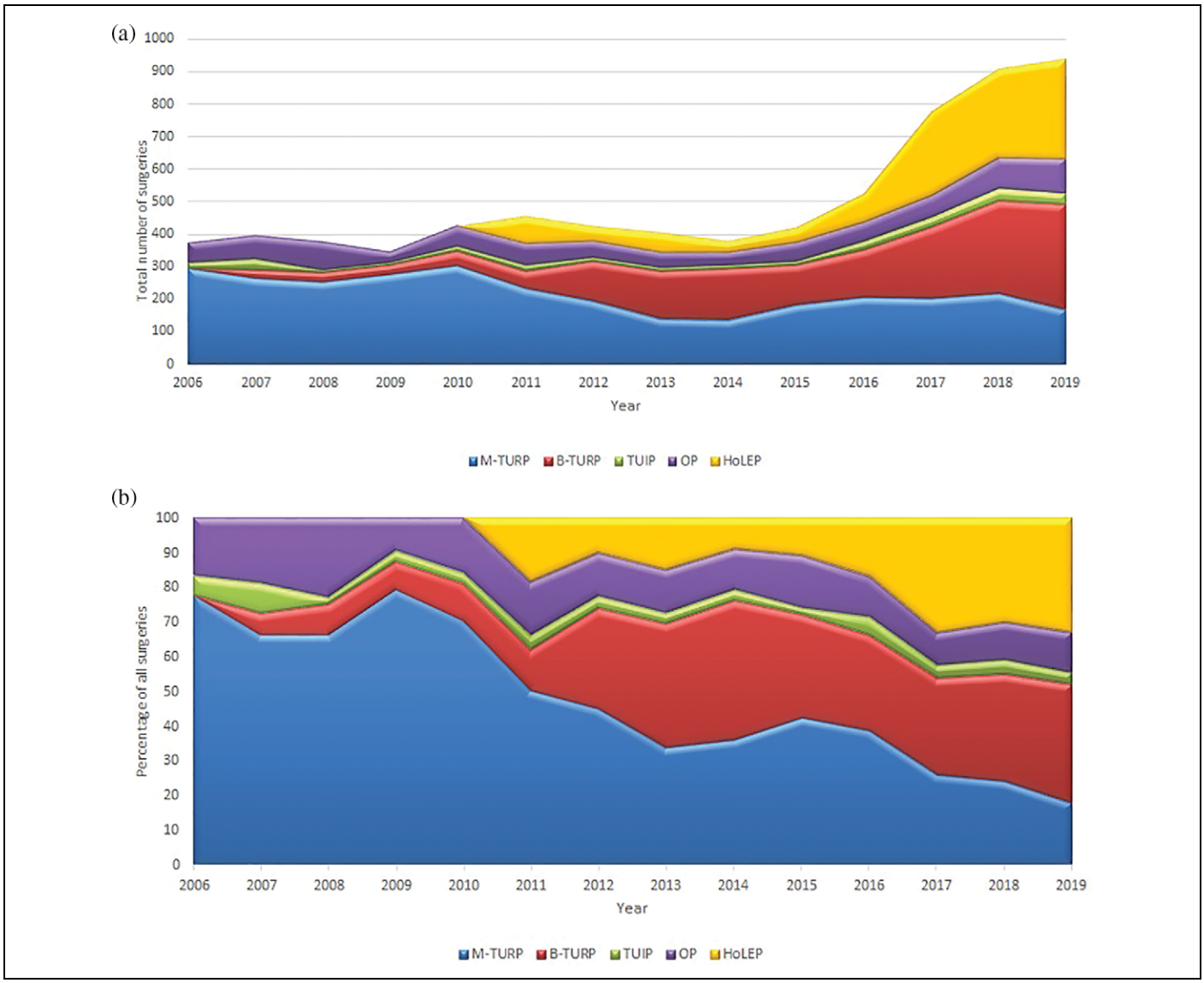


Figure 2. (A) A total number of benign prostatic hyperplasia surgical procedures from 2006 to 2019. (B) Annual rates of benign prostatic hyperplasia surgical procedures from 2006 to 2019. M-TURP: monopolar transurethral prostate resection; B-TURP: bipolar transurethral prostate resection; TUIP: transurethral incision of the prostate; OP: open prostatectomy; HoLEP: holmium laser enucleation of the prostate.

Descriptive statistics is given as mean ± standard deviation or median (minimum – maximum) for quantitative variables and as frequency (percentage) for qualitative variables. The Kruskal–Wallis test was used for quantitative variables in comparison of demographic information, and the Chi-square test was used for qualitative variables in associating patient groups, age groups, and dates. The statistical significance level was accepted as 0.05, and the Statistical Package for the Social Sciences (SPSS) version 22.0 (IBM SPSS Corp.; Armonk, NY, USA) was used for the analysis.

## Results

The total number of outpatients for BPH, between 2006 and 2019, was 94,954. Between 2006 and 2019, it increased by 72.9% from 5,379 to 9,302. From 2006 to 2019, a total of 7,163 patients underwent BPH surgery for the treatment of BPH-related LUTS (Figure 1A). The annual rate of BPH surgery was 7.5%. It decreased between 2010 and 2014 regularly. However, the annual rate of BPH surgery increased from 5.4% in 2014 to 10.1% in 2019 (Figure 1B).

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42.6% of all BPH operations consisted of M-TURP, with a rate that decreased from 77.9% in 2006 to 17.9% in 2019. The proportion of B-TURP, TUIP, OP, and HoLEP was 23.8%, 3.9%, 13.1%, and 16.7% in all BPH surgeries, respectively. Between 2006 and 2019, the minimum and the maximum annual rate of the TUIP approach were 1.9% in 2015 and 8.6% in 2007, respectively. In the same way, the minimum and the maximum annual rates of the OP approach were 9.3% in 2017 and 16.5% in 2006, respectively. Although the HoLEP rate was 16.7% when evaluated over all years, it had increased in the last 3 years and was 31.9% between 2017 and 2019 (Figure 2A and B). M-TURP was the most commonly performed procedure, comprising 71.8% (n = 1,380) and 41.9% (n = 878) of total procedures in 2006-2010 and 2011-2015, respectively. However, 30.7% (n = 966) of surgeries performed in 2016-2019 were B-TURP and 29.4% (n = 924) were HoLEP, and they were the most preferred procedures among these years (Figure 3). The rate of surgery including M-TURP, B-TURP, and TUIP was statistically different between 2006 and 2010, 2011 and 2015, and 2016 and 2019 ($P < .001$), except OP ($P = .071$). In addition, the rate of HoLEP was statistically different between 2011 and 2015 and 2016 and 2019 ($P < .001$).

Due to differences in indications, TUIP and OP were excluded from the evaluation, and M-TURP, B-TURP, and HoLEP were evaluated within themselves. In 2006, the type of BPH surgery most commonly performed was M-TURP (100%). The proportion of M-TURP had decreased to 21.1% by 2019, and the proportion of B-TURP and HoLEP had increased to 40.3% and 38.6% in 2019, respectively. The proportion of B-TURP had increased from 9% in 2007 to 40.3% in 2019 (Figure 4A). Figure 2 shows the fast penetrance of the HoLEP in BPH surgery in 2011. In 2014, the number of HoLEP was only 34, but the number regularly increased and exceeded the number of B-TURP in 2017 (Figure 4B). The proportion of B-TURP and HoLEP was almost similar in 2018 and 2019.

Considering the ages of patients who underwent BPH surgery, all BPH surgical approaches, except TUIP, were most frequently performed between the ages of 60 and 69. The mean age of patients who underwent TUIP was 52.7, and TUIP was most frequently performed in the <50 years age group. With increasing age, the number of patients who underwent TUIP was decreased. Only 6.1% of patients who underwent TUIP were over 80 years old. TUIP was the most commonly performed procedure in the <50 years group, comprising 32.4% of total procedures ($P < .001$), but the most common procedure in other age groups was M-TURP (Figure 5A-C). However, in 2016-2019, B-TURP and HoLEP were the most frequently used procedures in the 60-69, 70-79, and ≥80 age groups (Figure 5D).

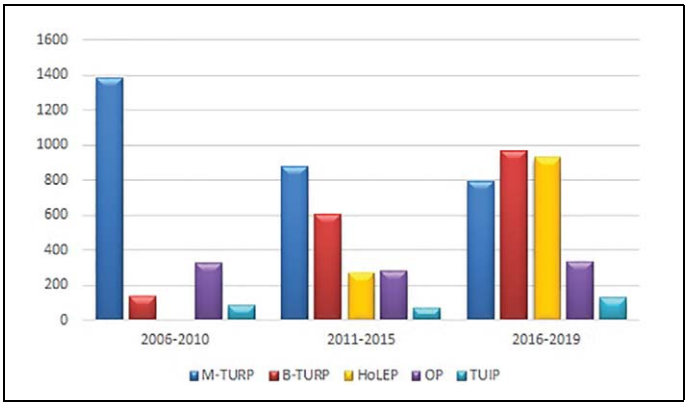


Figure 3. Number of surgeries performed in 2006-2010, 2011-2015, and 2016-2019. M-TURP: monopolar transurethral prostate resection; B-TURP: bipolar transurethral prostate resection; TUIP: transurethral incision of the prostate; OP: open prostatectomy; HoLEP: holmium laser enucleation of the prostate.

## Discussion

BPH is an increasingly common condition in the aging population. LUTS associated with BPH can be bothersome and has a negative impact on a patient's QoL. BPH can cost a lot, so treatment at an appropriate time is important. Treatment of BPH involves not only a reduction of symptom scores but also an improvement in overall QoL and cost-effectiveness. The EAU-Non-Neurogenic Male LUTS Guidelines include indications for surgical intervention including the following conditions secondary to BPH: refractory retention, gross hematuria, urinary tract infections, bladder stones, renal insufficiency, and refractory LUTS, or an unwillingness to use medical therapies.[7]

The relationship between LUTS, BPH, and bladder outlet obstruction is complex. This confusion can cause problems with epidemiologic definitions between studies. Also, socioeconomic, psychosocial, or cultural factors may play an effective role in the reported BPH/LUTS prevalence rates.[8] Although studies are conducted with different methodologies in different populations, the number of men diagnosed with BPH/LUTS in the last decade has been increasing over time.[9] The increasing prevalence of BPH/LUTS may be linked to the global aging population, the increasing lifespan among men, or increasing disease awareness. It has been reported in the literature that the number of BPH-related surgeries has increased.[10,11] In our study, it was shown that both total BPH-related outpatient admissions and the number of surgeries performed for BPH have increased from 2006 to 2019. Because

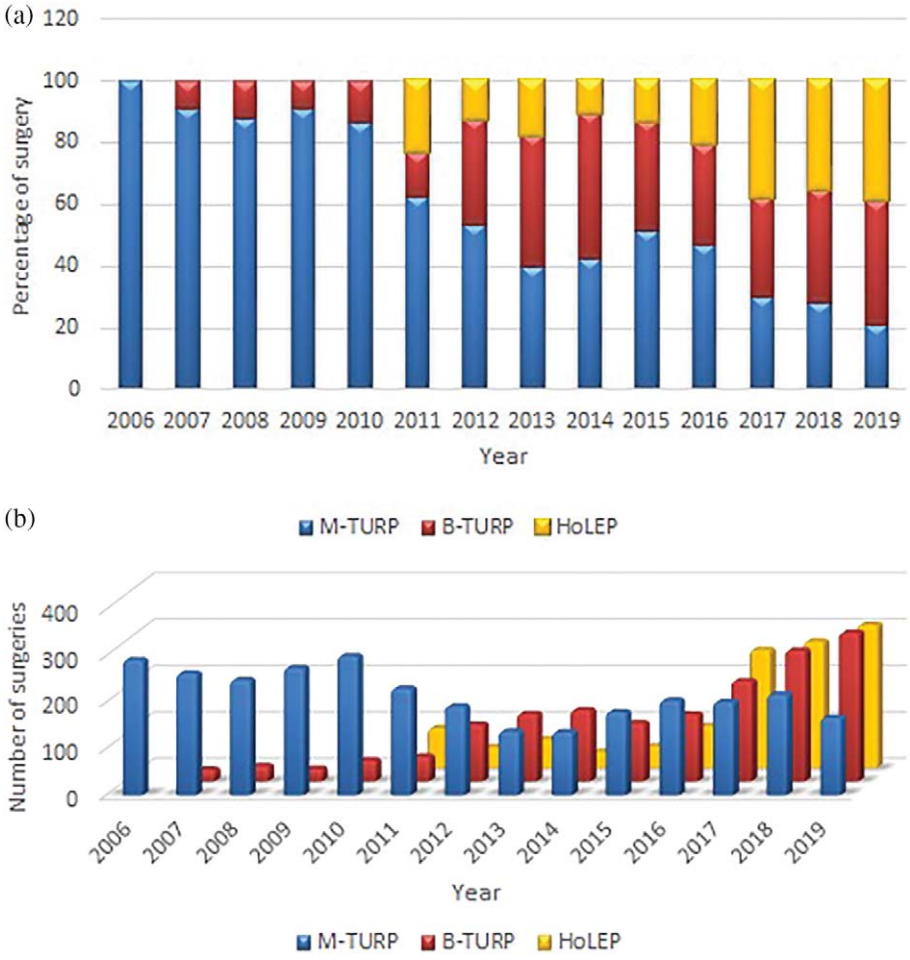


Figure 4. (A) A total number of transurethral surgical procedures except for TUIP from 2006 to 2019. (B) Annual rates of transurethral surgical procedures except for TUIP from 2006 to 2019. M-TURP: monopolar transurethral prostate resection; B-TURP: bipolar transurethral prostate resection; HoLEP: holmium laser enucleation of the prostate.

the number of patients undergoing surgery increased more rapidly than outpatient admission, the rate of patients who underwent surgery also increased. It is possible that patients may be opting for surgery due to anxieties regarding the potential for medical therapy to have unwanted side effects such as erectile dysfunction and retrograde ejaculation. Another reason for the high rate of patients who underwent surgery may be that the institutions participating in this study were selected from major centers with accumulated experience in surgery for BPH so-called referral centers.

For a long time, M-TURP has been the gold standard for surgical treatment for BPH due to its effectiveness and low cost.[2] Although M-TURP is the most common approach throughout this study period, its rate has gradually decreased over the years. The increasing availability of new endoscopic treatment options may be responsible for this decrease. In addition, TURP has some potential risks, such as prolonged catheterization times, long hospital stays, postoperative bleeding, clot retention, and transurethral resection syndrome.[4] For these reasons, similar to our study, the use of M-TURP in most countries has decreased significantly in recent years.[10,12]

Studies comparing M-TURP and B-TURP reported similar and durable long-term efficacy of either procedure.[13,14] However, in M-TURP, systemic absorption of the electrolyte-free irrigation solutions may cause complications such as hyponatremia and TUR syndrome. B-TURP has minimal effects on serum sodium and, thus, minimizes the risk of TUR syndrome compared with M-TURP.[15] Therefore, during the learning period, an appropriate approach especially in large prostates is crucial to reduce postoperative morbidity rates. In our study, we

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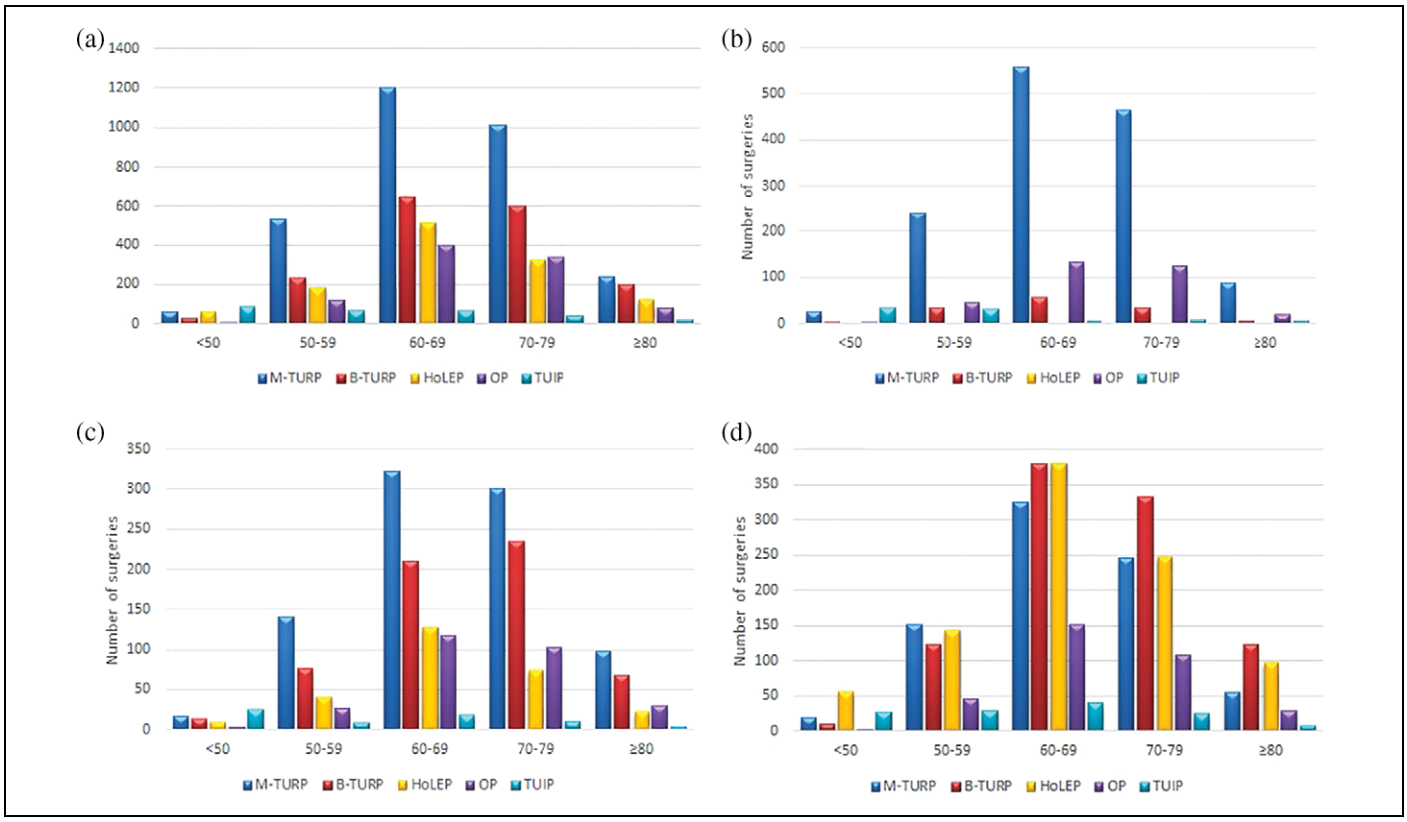


Figure 5. (A) The total number of surgeries by age group from 2006 to 2019. (B) The total number of surgeries by age group from 2006 to 2010. (C) The total number of surgeries by age group from 2011 to 2015. (D) The total number of surgeries by age group from 2016 to 2019. M-TURP: monopolar transurethral prostate resection; B-TURP: bipolar transurethral prostate resection; TUIP: transurethral incision of the prostate; OP: open prostatectomy; HoLEP: holmium laser enucleation of the prostate.

showed that the annual rates of B-TURP had increased over the years. B-TURP, which caught up the number of M-TURP in 2013, increased the difference between with M-TURP after 2017. We think that the fact that the centers participating in this study provide residency training may have led to this result.

Studies report that HoLEP is as effective or even better than another surgical approach.[16,17] When compared with TURP, patients undergoing HoLEP benefit from a shorter hospital LOS, shorter catheterization time, and lower transfusion rates.[16] These benefits have also contributed to the increased number of HoLEP since 2011. Also, it is recommended that for men with large prostates undergo open prostatectomy in an attempt to avoid TUR syndrome. Because HoLEP is a size-independent procedure and TUR syndrome is not seen, contrary to TURP, it can replace the open prostatectomy.[18] However, the main disadvantage of HoLEP is a prolonged learning curve.[19] In large prostates, the learning curve is expected to be even longer. The number of cases required for a surgeon to safely carry out the procedure with satisfactory efficiency, and outcomes may be estimated at 50 cases with the condition of attentive case selection.[20] Nevertheless, HoLEP is a safe approach in large prostates taking antithrombotic, when performed by experienced surgeons.[21] In our study, we confirmed the rapid increase of HoLEP in the last 5 years. It is noteworthy that the HoLEP overtakes M-TURP, despite the high learning curve, the high price of the generator and morcellator. This increase indicates that HoLEP may be the gold standard treatment in the future.

The OP and TUIP indications have not changed over the years. For this reason, their rates remained constant. OP has been used for over a century in clinical practice. However, with the widespread use of HoLEP and the evolution of minimally invasive therapies, its presence will potentially fade. TUIP is used more frequently in men <50 years of age because it is more effective in small prostates and has fewer sexual ejaculation

side effects. TUIP is also indicated in other settings, such as the division of bladder neck contracture following radical prostatectomy. It allows TUIP to be performed in all age groups, although at a low rate.

Recently, more minimally invasive treatment options such as prostate artery embolization and urolift have become widespread in the treatment of BPH.[22,23] Although these surgical options are associated with fewer sexual side effects, long-term studies are needed to evaluate functional outcomes and duration of action compared to other techniques. Although the absence of these surgical procedures in the study may be seen as a limitation, we did not consider it as an important limitation as they are not widely used compared to procedures such as TURP and HoLEP, and their long-term results are still controversial. In the future, as surgical equipment will be more easily accessible for new procedures, more comprehensive studies will be conducted covering all surgical procedures with the possibility of these surgical procedures becoming widespread.

Several limitations in this study should be noted. First, this study did not include clinical data such as prostate volume, PSA, objective voiding parameters ($Q_{max}$, PVR), urinary symptoms (IPSS, QoL), and prior medical treatment. Second, the experience, learning curves, and preferences of the surgeons performing the operations are unknown. Also, existing data do not provide information about the efficacy and safety of the surgeries. Third, data from five major centers were included in this study. The variety of BPH surgery that can be performed was directly dependent on the surgical equipment of these five centers. Minimally invasive surgical therapies procedures (such as prostatic urethral lift, intra-prostatic injections, and aquablation) and other laser treatments (such as greenlight, diode, and thulium) that were not performed in these centers could not be included in the study due to insufficient equipment.

In conclusion, since 2006, the total number of outpatient treatments and surgeries for BPH has been increasing. There is a serious decrease in the rate of M-TURP and a significant increase in the rate of B-TURP and HoLEP. M-TURP, which is accepted as the gold standard for surgical treatment of BPH, is replaced by B-TURP in resection procedures and HoLEP in enucleation procedures. Changing surgical trends for BPH surgical treatment should be followed by healthcare providers, and necessary equipment should be provided to public and university hospitals.

**Ethics Committee Approval:** Ethical committee approval was received from the local ethics committee (I5-226-19).

**Informed Consent:** N/A

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Concept - M.A.İ., F.K., E.A.; Design - M.A.İ., İ.O., E.A.; Supervision - S.C., İ.O., F.K.; Resources - Z.T., R.A., O.Y.; Materials - S.C., İ.O., E.A., O.Y.; Data Collection and/or Processing - Z.T., R.A., E.A., O.Y.; Analysis and/or Interpretation - S.C., R.A., F.K.; Literature Search - S.C., Z.T., R.A.; Writing Manuscript - M.A.İ., İ.O., F.K.; Critical Review - M.A.İ., Z.T., O.Y.

**Conflict of Interest:** The authors have no conflicts of interest to declare.

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