



# Preservation of antegrade ejaculation after surgical relief of benign prostatic obstruction is a valid endpoint

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## Abstract

**Purpose** To review the current data on retrograde ejaculation (RE) and ejaculatory dysfunction (EjD) after endoscopic and minimally invasive surgical treatment of benign prostatic obstruction (BPO) and, their perceived impact in the quality of life (QoL) and sexual life of patients and their partners.

**Methods** Narrative review of systematic reviews (SR) assessing comparative rates of RE, EjD or erectile dysfunction (EF) was carried out. Relevant articles on the prevalence of RE, EjD or EF and on their impact in the QoL or sexual life of patients and partners were manually selected based on relevance.

**Results** Twelve SRs reporting on comparisons of different endoscopic/minimally invasive treatments of BPO were found. Data on outcomes varied widely. Overall, after conventional TURP or laser techniques 42–75% of patients present RE. Prostatic incision and ablative procedures present lowest rates of de novo RE or EjD whereas laser adenomectomy and ejaculation preservation procedures preserve antegrade ejaculation in 46–68% of patients. EjDs is associated to LUTS and present in 10% of sexually active men before intervention. It modulates the QoL and sexual life of the couple. In spite of the scarce literature assessing patient's and partner's perception of postoperative EjD, it strongly suggests that both parties value the maintenance of the ejaculatory function.

**Conclusion** Ejaculation-preserving techniques and minimally invasive techniques successfully prevent BPO treatment-induced RE or EjD in 70–100% of the cases. While this is appealing to patients and spouses, technique selection and treatment durability are issues to be discussed with the couple.

**Keywords** Retrograde ejaculation · Benign prostatic obstruction · Ejaculatory dysfunction · Ejaculation preservation · Erectile dysfunction · Sexual health

## Introduction

It is estimated that around half of men suffering severe or medical treatment unresponsive lower urinary tract symptoms (LUTS) will be offered a surgical procedure to relieve benign prostatic obstruction (BPO) [1]. When surgery is indicated, transurethral resection and incision of the prostate (TURP, TUIP) remain the cornerstone for glands > 30 mL and < 30 mL, respectively [2]. Whilst efficacy of the

conventional TURP is proven, a common potentially bothersome side effect, the retrograde ejaculation (RE) occurs in 65.4–86% of the sexually active patients [3, 4].

In the last two decades, multiple endoscopic alternative managements to TURP have developed with the main goal to decrease peri-operative morbidity. Since the seminal work of Allousi describing an ejaculation-preserving (ep)-TURP technique [5], other alternatives to conventional TURP including laser adenomectomy, ablation and prostatic urethral lift (PUL) procedures and prostatic arterial embolization (PAE) aimed to preserve sexual function and antegrade ejaculation (AE) while effective and safely desobstructing [2, 6]. Most of them have been tested in terms of ejaculatory outcomes against the conventional TURP or sham either in observational or RCTs [2, 6].

These efforts may reflect the concern of the Urological community to maintain or improve the health-related quality

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of life (HRQoL) of the patients in need for surgery or the increasing reluctance of patients and partners to conform with the loss of an important component of their sexual life. Considering the consistent association of LUTS and BPO with erectile dysfunction (EF) and ejaculatory dysfunction (EjD) [6, 7], the sexual life of a proportion of those candidates to surgical relieve of obstruction and their partners tends to be fragile and already influencing HRQoL before any kind of surgical or ablative management [7]. Moreover, it is increasingly recognized that RE is one, although not the only of the various conditions that conform the spectrum of the EjD present in the older men [8].

The goals of the present narrative review are to describe the rates of EjD and RE after endoscopic surgery and minimally invasive procedures for BPO and the impact of “de novo onset” of both symptoms in male patients and on the couple’s sexual ambience.

## Materials and methods

A comprehensive review of systematic reviews (SR), with or without meta-analysis, in which ejaculatory function after TURP or any alternative endoscopic/ablative treatment of BPO were described. The following databases were queried for the literature search: PubMed, Embase (Ovid), PsycINFO (Ovid), CINAHL (EBSCO), and Cochrane Central Register of Controlled Trials (CENTRAL).

Following MeSH terms were used: “retrograde ejaculation”, “ejaculation preservation”, “erectile dysfunction”, “benign prostatic hyperplasia”, “ejaculatory dysfunction”, “benign prostatic obstruction”, “transurethral resection of the prostate”, “transurethral incision of the prostate”, “transurethral vaporization of the prostate”, “holmium laser enucleation”, “holmium laser resection of the prostate”, “photoselective vaporization of the prostate”, “thulium laser enucleation of the prostate”, “thulium laser vaporization of the prostate”, “prostatic urethral lift”, “prostatic arterial embolization”, “water vapor thermal ablation”. The terms were pooled using the boolean operator “OR” and filtered as SR.

A search was conducted in August 2020 and updated on 30th November 2020. References were manually reviewed to identify supplementary reviews or studies of interest. Systematic reviews assessing comparative rates of RE or EjD between or among endoscopic/ablative treatments of BPO as primary objective were labeled as specific; those in which RE or EjD were described as secondary objectives were considered non-specific. Only SR in English language were selected.

Data extracted included: authors, year of publication, comparisons between or among techniques, objectives of

the review, quality assessment method, type and number of articles describing RE or EjD and, reported outcomes.

For the purposes of the assessment of impact of surgically BPO-induced RE or EjD in the patient’s and/or partner, original articles were selected based on their relevance, originality, and provision of the necessary information.

## Results

### Rates of ejaculatory dysfunction or retrograde ejaculation

We found 12 SRs with or without meta-analysis that reported on RE, EjDs or sexual outcomes after BPO surgical endoscopic interventions. The reviews encompassed a period of 20 years (from 2001 to 2020) although 9 of them were published from 2015 onwards. Seven SRs focused specifically on the subject of erectile or ejaculatory dysfunctions (EF, EjF) as main objective. Five additional SRs reported on RE rates or EF as secondary outcomes. The main results are described in Table 1 [9–20].

In the seven specific SR, the use of validated questionnaires was irregularly reported varying from scarcely [9–11, 13]; in 1/3 or half of the included studies [14, 15] to in almost all studies in the most recently SR [20]. The most used questionnaires were the IEF (5/15 questions) and the MSHQ-EjD [21, 22].

Comparative outcomes assessment was frequently reported only after intervention, without baseline data on EF or EjF. As such, changes in these functions with respect to preoperative functions measured by validated questionnaires was only consistently reported in the last SR [20]. The number of patients responding to the questionnaires was rarely reported. Overall, there were 14 comparisons between different desobstructive techniques and energy sources in addition to three comparisons of conventional TURP with established desobstructive techniques in ep-mode (ep-TURP, ep-PVP and ep-Holep).

For easiness of comprehension, the different techniques are divided into resection techniques, adenomectomy technique (electro or laser), vaporization (electro or laser), new minimally invasive techniques and ep-techniques of transurethral adenomectomy or vaporization.

### Resection/incision techniques

Studies comparing TURP vs conservative management are contradictory. One study did not report any difference in new onset of EjD at a follow-up of 7.5 months, but others reported TURP resulting in higher prevalence of RE than WW. Both management policies had the same effect on EF

**Table 1** Systematic reviews assessing retrograde ejaculation (RE) or ejaculatory dysfunction (EjD) outcomes after endoscopic treatment of bladder prostate obstruction

Aim	Type study	No studies	RoB	Comparisons	Outcomes	Comments
<b>Specific systematic reviews</b>						
Cacciamani, 2019 [9]	Compare sexual outcomes between preserving techniques and conventional TURP. RCTs	21	Cochrane RoB	HoLEP vs TURP ThuLEP vs TURP Greenlight vs TURP Aquablation vs TURP Urolift vs TURP PAE vs TURP	HoLEP vs TURP: no difference in RE ThuLEP vs TURP: no difference in RE Green light vs TURP: no difference RE Aquablation vs TURP: anejaculation aquablation 10% vs TURP 36% Urolift vs TURP: no differences in changes in MSHQ-EjD at 2 years PAE vs TURP: no significant differences in RE	Data sparse and heterogeneous Aquablation better EjD profile than conventional TURP
Marra, 2016 [10]	Explore sexual side effects of the most common surgical procedures for LUTS. RCTs	42	NR	TURP vs Nd-YAG laser vs WW HoLRP vs TURP Thulium laser vs TURP PVP vs TURP HoLEP vs TURP TUEVP vs TURP TUMT vs TURP/ others TUIP vs TURP Urolift vs sham	TURP vs Nd-YAG laser vs WW: new-onset EjD 62% TURP, 65% Nd-YAG laser, 42% WW HoLRP vs TURP: similar rates EjD Thulium laser vs TURP: RE 52% Thulium laser vs 62.8% TURP PVP vs TURP: RE in PVP 41.9% vs 61% in TURP HoLEP vs TURP: RE in HoLEP 76.3% vs 75.3% in TURP TUEVP vs TURP: RE in 56.3% TUEVP vs 70.3% TURP TUMT vs TURP: RE in TUMT 20.4–24% vs TURP 50–69% TUIP vs TURP: RE TUIP 21% vs TURP 73% Urolift® vs sham: no differences in pre- and postoperative sexual bother and EjD across first 12 months	TURP vs Nd-YAG laser vs WW: EjD worsened in all 3 arms (no differences) Only 10 studies baseline EjF measured Definitions regarding EjD not standardized Rates of EjD or RE among studies comparing same techniques varied

Table 1 (continued)

Aim	Type study	No studies	RoB	Comparisons	Outcomes	Comments	
Lebdai, 2018 [11]	Assess efficacy of modified endoscopic surgical techniques and mini-invasive non-ablative techniques in preserving Ejf	RCTs CCs Cohort	15	OCEBM	Standard ablative procedures (TURP, HoLEP, PVP, ThuLEP, TUIP) Ejaculation-preserving techniques (EP-TURP, EP-PVP, EP-HoLEP) Minimally invasive non-ablative techniques	Monopolar vs bipolar-TURP: RE in M-TURP 50% vs 36% in B-TURP HoLEP vs TURP: EjD HoLEP 74% vs TURP 70% HoLEP at baseline 10.7% no ejaculation, post-intervention no ejaculation 70.3% (normal semen volume at baseline 29.4% vs 8.7% at 12 months). Pain/discomfort by ejaculation 73.7% at baseline to 91.3% at 12 months) PVP (Greenlight XPS laser) vs TURP: similar EjD rate (67.1 PVP vs 65.1% TURP) ThuLEP vs TURP: EjD 55% in ThuLEP vs 65% in TURP TUIP vs TURP: EjD TUIP 21% vs TURP 73% EP-TURP preserves AE in 65.7% (others 80–91%) vs 28.6% TURP. EP-PVP preserves AE in 56–95%, in 30.6–45% diminished ejaculation, in 13.4% no ejaculation EP-HoLEP vs conventional HoLEP: AE 46% in ep-HoleP vs 27% conventional HoLEP PUL: (MSHQ-EjD) significant improvement first year. Afterwards decreases. IIEF remains stable up to 5 years PUL vs TURP: 100% preservation ejaculation vs 34% in TURP at 2 years PAE vs TURP: IIEF decrease in TURP, stable in PAE Rezūm <sup>®</sup> , stable IIEF and MSHQ-EjD at 3 years Aquablation <sup>®</sup> vs TURP: RE 10% Aquablation vs TURP 36%	Insufficient data on non-ablative techniques For PUL and Aquablation level 1b evidence on Ejf preservation EP-PVP and EP-TURP preserve ejaculation EP and ablative techniques reasonable options to preserve ejaculation Heterogeneous assessment of ejaculation function Patient selection necessary for non-ablative techniques Data regarding mid- and long-term for ablative techniques is still lacking
Liu, 2020 [15]	To investigate the impact on erectile function (EF) and ejaculation of EEP and TURP	RCTs	10	Cochrane RoB	HoLEP PKEP ThuLEP As comparator in all of them TURP/ PKRP/B-TURP	EEP and TURP: mean difference in IIEF score no significant differences at 3 years. EEP significantly higher IIEF scores than TURP at 4 years. No differences in RE between EEP and TURP at 2 years Same pattern for HoLEP vs TURP with better scores for HoLEP at 4 years PKEP vs TURP: no differences in IIEF scores up to 5 years. RE 59% for PKEP vs 62.8% for TURP EEP and HoLEP higher IIEF-5 scores than TURP at long term	

Table 1 (continued)

Aim	Type study	No studies	RoB	Comparisons	Outcomes	Comments
Zong, 2012 [13]	RCTs	12	Cochrane RoB	TURP vs WW TURP vs TUEVP TURP vs HLT	TURP vs WW: ED present in 70% TURP and 67% in WW before treatment. After TURP (at 7.5 months) ED present in 55%, and in 72% of WW ED worsen in 19% after TURP and 21% after WW. RE present in 70% before TURP and 64% in WW. After TURP present in 83% and in 73% of WW TURP vs TUEVP TURP baseline 51.3% ED and 46% RE TUEVP at baseline 45% ED and 46.8% RE No difference in de novo Ejf TUEVP greater effect on ED than TURP TUR vs HLT: effect of TURP and HLT on male EF and Ejf were similar. At 24 months, ED decreased from 53.3 to 51.6% on TURP and from 51.6 to 48.3% in HLT. Complete postoperative RE significantly higher than at baseline in both groups. No difference between groups (both 78.3% both) at 24 months	Detailed information on preoperative rates ED and Ejf or RE Contradictory effects on ED in different reports comparing TURP vs WW TURP may cause pain or discomfort at ejaculation
Friebe, 2010 [14]	RCT Cohorts	33	NR	Ho-Laser vs TURP KTP Laser vs TURP KTP (2 cohort studies) Thulium vs TURP Nd-YAG vs TURP TUMT TUNA TEAP (Compared to TURP or sham operation)	Ho-Laser vs TURP: decreased EF Holmium laser 7.5% vs TURP 7.7% Increased EF 7.1% Holmium laser vs 6.2% after TURP Ejf (RE or decreased ejaculates) 50-96% after HoL 50-86% TURP KTP laser vs TURP: Ejf 17.2-49.9% for KTP laser and 9.1-56.7% for TURP (no differences) Thu-laser vs TURP: RE Thu-laser 55% vs 65% TURP Nd:YAG laser vs TURP: ED decrease Nd:YAG laser 15.4% vs TURP 14.8%. Nd:YAG laser lesser Ejf than TURP TUMT vs TURP: decreased EF in TUMT 8.7% vs TURP 19.3%. Ejf TUMT 17.8% vs TURP 42.7% TUNA vs TURP: decreased EF in TUNA 5.8% vs TURP 18.2% Ejf TUNA 5.6% vs TURP 39.7%	In cohort studies KTP trend to decrease the rate of RE up to 2 years No studies on HIFU Mixed RCT with cohorts Overall few articles using validated questionnaires for Ejf or EF

Table 1 (continued)

Aim	Type study	No studies	RoB	Comparisons	Outcomes	Comments
Lokeshwar, 2020 [20]	Explore the sexual side effects (emphasis in EjD) of novel minimally invasive surgical procedures for BPH-related LUTS	RCTs Cohorts	40 (19 trials)	NR	PUL Water Vapor Thermal ablation (Rezūm®) Aquablation PAE	Rezūm®: insignificant changes in MSHQ-EjD scores at 24 months (declined by 14.2% and 18% at 3 and 4 years). Insignificant changes in IIEF-EF score for the first 3 years but decline at 4th year MSHQ-bother score declines up to 4 years PUL: significant increase in MSHQ-EjD compared with baseline up to 4 years MSHQ-EjD bother decreased for all follow-up times. IIEF no changes from baseline up to 2 years PUL vs TURP: changes from baseline significant in the MSHQ-EjD and were significantly different when compared with TURP up to 2 years (increase by 2.8% in PUL and decrease in TURP by 55%). No differences in changes in MSHQ-EjD bother and IIEF from baseline (not different from TURP) PAE vs TURP: no difference in IIEF changes across the follow-up. IIEF in PAE better than baseline at 1 year (cohort study). RE in TURP 100% RE vs 0% in PAE. Decrease in ejaculate volume 6.7–13.3% in PAE Aquablation vs TURP: anejaculation rate Aquablation 10% vs TURP 36%. Decrease MSHQ-EjD Aquablation 33% vs TURP 56% IIEF scores stable after Aquablation, decreased in TURP in sexually active men. In prostates > 80 gr, EjD in 19% of sexually active (81% maintained AE)
Non-specific systematic reviews *						
Yang, 2001 [19]	Effectiveness of TUIP and TURP for BPO	RCTs	5	Pettiti and Schulz	TUIP vs TURP	RE in TUIP 21% vs TURP 73% Pooled difference estimated 0.12 (statistically significant)
Lai, 2019 [12]	Efficacy and safety of PVP and TURP in BPH	RCTs CCs Cohorts	4	OCEBM/Jadad/Newcastle–Ottawa	TURP vs PVP	No significant difference in IIEF at 3, 6 or 12 months Lower IIEF at 24 months for PVP than for TURP

Table 1 (continued)

Aim	Type study	No studies	RoB	Comparisons	Outcomes	Comments
Cornu, 2015 [16] Gathering all the level of evidence (LE) I information available about transurethral procedures for surgical management of LUTS/BPO, by focusing on commercially available and emerging techniques	RCTs	18	Jadad	HoLEP vs M-TURP PVP vs HoLEP M-TURP vs B-TURP PKEP vs OP PKEP vs B-TURP Thulium laser vs M-TURP	HoLEP vs M-TURP: both associated to a decrease in orgasmic function due to EjD. No significant effects on erection. Loss of ejaculation: 78% of patients in both groups. In RCT, HoLEP RE between 70 and 88% PVP vs HoLEP: loss of ejaculation PVP 22% vs HoLEP 88% PVP vs M-TURP: no differences in IIEF/DAN-PSSsex. Absence of ED in both techniques RE in PVP 30–34.7% vs M-TURP 60.5–65% Ejaculation-subscore DAN-PSSsex in 38% PVP vs 61.5% in M-TURP M-TURP vs B-TURP: IIEF variations at 12 months similar in both groups (28.2% improved and 17% worsened) PKEP vs OP or B-TURP or M-TURP: PKEP high rate of RE (59–64.7%) By IIEF-5 no impact on EF, no differences between arms Thulium laser vs M-TURP: no negative effect on EF. RE Thulium laser 55% (no different from TURP)	50% of the manuscripts did not specify basal EF or rate of sexually active men Lack of standardization in the assessment of ejaculation Limited interpretation results (meta-analysis not possible) Favorable profile of PVP regarding sexual outcomes Non inferiority of B-TURP vs M-TURP regarding sexual function

Table 1 (continued)

Aim	Type study	No studies	RoB	Comparisons	Outcomes	Comments
Sun, 2018 [18]	Compare efficacy and safety of different transurethral procedures for BPH (Network meta-analysis)	RCTs	NR	Cochrane RoB/Jadad	m-TURP Bipolar (plasmakinetic and electrovaporization) Thulium laser Greenlight laser TURIs Nd:YAG Diode laser KTP/Nd:YAG Interstitial laser Modalities: Enucleation, resection and vaporization	TmLEP lowest rates of occurrence of ED KTP/Nd:YAG laser the highest rates of RE RE rate in patients treated by HoLEP and common in m-TURP
DeCao, 2015 [17]	Assessment of the TMLRP technique in comparison with either TURP or TUPKP	RCTs CCs	5	Jadad/Newcastle-Ottawa	TmLRP TUPKP TURP	No significant difference in the rate of RE between TMLRP and TURP (OR 0.79) 10 studies of low quality

*HoLEP* Holmium laser enucleation of the prostate, *TURP* transurethral resection of the prostate, *ThuLEP* Thulium laser enucleation of the prostate, *PAE* prostatic arterial embolization, *WW* watchful waiting, *HoLRP* Holmium laser resection of the prostate, *PVP* Photoselective vaporization of the prostate, *TUEVP* transurethral electrovaporization of the prostate, *TUMT* transurethral microwave therapy, *TUIP* transurethral incision of the prostate, *EP* ejaculation preserving, *PKEP* plasma kinetic enucleation of the prostate, *PKRP* plasma kinetic resection of the prostate, *HLT* Holmium laser treatment, *Ho* Holmium laser, *KTP* potassium titanyl phosphate laser, *Nd-YAG* Neodymium:yttrium-aluminum-garnet laser, *TUNA* transurethral needle ablation, *TEAP* transurethral ethanol ablation of the prostate, *PUL* prostatic urethral lift (Urolift®), *M-TURP* monopolar transurethral resection of the prostate, *B-TURP* bipolar transurethral resection of the prostate, *OP* open prostatectomy, *TUR* is bipolar transurethral resection in saline, *TmLRP* Thulium laser resection of the prostate, *TmLEP* Thulium laser enucleation of the prostate, *TUPKP* transurethral plasmakinetic resection of the prostate, *ThuLRP* thulium laser resection of the prostate, *RE* retrograde ejaculation, *MSHQ-EjD* Male Sexual helath Questionnaire-erectile dysfunction domain, *EjD* Ejaculation dysfunction, *AE* antegrade ejaculation, *IIEF* international index of erectile function, *EFP* Endoscopic enucleation of prostate, *ED* erectile dysfunction, *EF* erectile function, *DAN-PSS* sex Danish prostatic symptom score sexual items, *OCEBM* Oxford Centre for evidence-based medicine criteria, *RCTs* randomized control trials, *CCs* case-control studies, *NR* not reported

\*Only number of studies reporting on EjD or RE

(ED worsen in 19% after TURP and 21% after WW). TUIP clearly showed lower RE rate than TURP (21% vs 73%).

No differences were found between mono- and bipolar-TURP (including PKEP) regarding IIEF scores (RE 50% vs 36%).

### Adenomectomy techniques

The most referred comparison was HoLEP vs TURP. Both procedures showed similar decrease in EF (7.5% vs 7.7%) and RE/EjD (50–96% vs 50–86%). At long-term (4 years) better IIEF scores were seen after HoLEP (7.1% vs 6.2%). Further, Thulep did not differ from TURP when RE was considered (55% vs 65%).

### Vaporization techniques

532 nm wavelength Green light laser vaporization exhibits similar rates of RE (65.5%) than conventional TURP, although some authors reported a somewhat lower but still considerable RE rate (41.9% vs 61% for TURP). New onset of EjD and RE rates (65% vs 62%) or ED worsening (15.4% vs 14.8%) did not differ between Nd:YAG laser and conventional TURP.

The RE rate is lower for TUEVP than for TURP in some reports (56.3% vs 70.3%). However, when baseline assessment is performed, the difference in “de novo” EjD rate between the two treatments disappears. Still, ED seems to improve in higher degree after TUEVP.

### New minimally invasive techniques

Lower rates of anejaculation and RE are observed when comparing Aquablation (Robotic assisted TURP) vs TURP. After Aquablation, 81% of sexually active men maintain AE and IIEF score remains stable while it decreases after TURP.

Prostatic urethral lift (PUL) shows significant improvement in MSHQ-EjD scores across the first year when compared to conventional TURP. There are no changes in the IIEF scores across second and third years and, at long term (4 years), no differences in MSHQ-EjD are seen between the two treatments.

Convective water vapor thermal therapy (WAVE) results in insignificant changes in MSHQ-EjD and IIEF-EF scores up to 2 years. However, both scores decline at 3rd and 4th years (14.2% and 18%, respectively). RE outcomes were conflicting regarding the comparison of PAE vs TURP. Apparently, PAE present lower rates of RE (0% vs 100% in TURP), lesser decrease of the ejaculate volume (in 13.3% of patients) and better IIEF scores than TURP.

### Ejaculation-preserving techniques

Overall, all the ep-techniques (TURP, PVP, HoLEP) results in higher rates of AE, in the range of 45–60% and even higher [11] than their conventional counterparts (Table 1).

Comparison between TUMT and TUNA vs TURP shows a benefit for both alternatives in terms of EF and EjF. Nevertheless, the current indications of these modalities are limited.

### Patient's and partner's perception and values regarding ejaculatory dysfunction or retrograde ejaculation

To be able to position the importance of EjD and RE, the position of the patient on changes in these parameters is crucial. If there is no perceived benefit of preservation, why should one aim to preserve? A recent survey using non-validated questionnaires highlights the importance of maintaining the sexual function when BPO surgery is considered. Overall maintenance of erectile and ejaculatory functions was an important preoperative consideration regardless of the age (95% for erectile and 92% for ejaculation functions). While the importance of sexual preservation decreased for patients aged > 70 years, still 66% and 62% of them attributed great importance to maintaining erectile and ejaculatory functions, respectively [23].

### Aging male and sexual function

A cross-sectional analysis in 988 men screened for a testosterone trial using MSHQ-EjF and IIEF questionnaires and, showed a high prevalence and associated distress of EjDs. In this population (mean age of 52 year), 88% of the individuals experienced more than one symptom of EjD, more prevalently in black race [24]. Overall, 68.2% of men were moderately, very or extremely bothered by EjDs. The most prevalent of the EjDs were PEVR, decreased force of ejaculation (DFE) and DE in 88%, 81% and 62% of men, followed by anejaculation in 37%. IIEF questionnaire evidenced that 33.3% of men were dissatisfied with the sexual intercourse and, 19.3% were not enjoying it. PEVR and DFE were associated with age, with men aged 60–70 years having a three-fold times odds than men < 40 years. Anejaculation and DE did not increase with age and none of the EjDs was associated to testosterone levels [24].

### Male LUTS and sexual function

Several epidemiological studies address the strong association between male LUTS and ED/EjD [6]. In the multinational survey of the aging male (MSAM), approximately 40% of men between 50 and 79 years of age experience some

form of EjDs. Specifically, among the 5999 men with LUTS suggestive of BPO in the ALF-LIFE Study, the prevalence of decreased ejaculation (DE), perceived ejaculate volume reduction (PEVR) and dry ejaculation were 78%, 74.4% and 31–40%, respectively [7, 25, 26].

In the CLaSP pragmatic randomized trial, 70% of men with LUTS in each of the three arms (TURP, Nd:YAG laser resection and conservative treatment) were already affected by ED and EjD at baseline, and this increased with age. LUTS severity was the strongest predictor of EjD and of bother because of EjD. EjD was considered a problem by 35.6, 51.6 and 64.1% of men with mild, moderate and severe LUTS [27]. Others have reported that leaking urine during sexual activities was the most frequently reported bothering symptom by 82% of participants [28]. Pain or discomfort during ejaculation is less common than ED but follows the same age-increasing pattern. Overall, 33–43% of men reported that their sex-life was spoiled by LUTS and there was a correlation between the QoL item of the IPSS and sex-life spoiled. Men affected by multiple LUTS had more severe ED and frequent EjDs, namely premature ejaculation [29], while dry ejaculation was observed in 67.4% of those treated by surgery [27]. Interestingly, the rates of ejaculatory pain decreased postoperatively in men undergoing TURP or Nd:YAG laser resection [30]. In addition, a recent study in men with LUTS supports the preoperative correlation between anxiety and EjD, both appraised by validated questionnaires. This correlation disappeared after HoLEP treatment [31].

Another report assessed the PEVR after HoLEP (91 patients) within the last 3 months after surgery, and showed that 76.9% of the patients reported a total loss of ejaculation, 18.7% a decrease in ejaculate volume and in only 4.4%, no changes were observed when compared before surgery. Decreased orgasmic intensity was present in 52.8%. Among the patients who reported a total loss or PEVR, 18.4% responded “feel better” or “it is not a problem”, 73.6% felt “disappointed but able to tolerate owing to improvement in voiding symptoms” and 8% were “dissatisfied and want to reverse the situation” [32].

### Male sexual function and partner satisfaction

At least four studies report on the partner's HRQoL of patients suffering from LUTS [33–36]. In a study of 50 couples in which males were evaluated for surgical management, a non-validated though structured questionnaire showed that 28% of women reported sleep disturbances and 30% disruption of their social life, both positively related to male IPSS and negatively to symptom duration. Wives reported psychological burden in 66% of the cases, positively related to their age, couple age difference and marriage duration) and

48% of women felt their sex-life was inadequate (moderately or severely affected) [33].

In a similar Korean study, practically all spouses (98%) of men with LUTS suffered one or more inconveniences that affected in some degree their HRQoL. Sleep disturbances were significantly correlated with the nocturnal increased frequency of the men. Furthermore, 62% of wives experienced fatigue, 79% embarrassment, 69% were concerned about the possibility of their husbands having cancer and 81% were afraid of their husband surgery. Overall, sexual life was deteriorated in 58% of spouses and their HRQoL perception correlated well with the husbands QoL. Thirty-six percent of spouses said they will feel most dissatisfied, unhappy or terrible, if they had to spend the rest of their lives with their husbands' voiding symptoms [34].

In line with these studies, although 55% of the 125 spouses of US men diagnosed with LUTS responded that their's husband LUTS had “no effect” on their life, when asked about the impact on specific aspects of the relationship, they reported more frequently that their husbands to feel strains in the relationship as isolation, avoidance or lack of communication. Most specially these women resented the lack of intimacy in their marriage [35].

Regarding female perception on the male ejaculation, a recent cross-sectional survey showed that half of the 240 respondents considered it “very important” that the partner ejaculated during intercourse, with older women considering it more important than younger women [37]. Although no relationship was found between partner ejaculation and female orgasm, 22.6% of women experienced a more intense orgasm when the partner ejaculated during the vaginal intercourse and almost one every six reported it as more intense depending on the intensity of ejaculation/orgasm of the partner. Regarding male ejaculation and female sexual functioning, women that experienced a more intense orgasm when the male ejaculated, when the ejaculation was more intense and, when the ejaculate quantity was higher reported better life-long orgasmic function and sexual satisfaction. Of note, a significant association was found between female desire and more intense orgasms depending on the partner's ejaculate volume [37]. In spite of the different demographic characteristics of the participants when compared with the female partners of men suffering from RE after BPO surgery, the data strongly suggest that perceived ejaculate volume may play an important role also in the female sexual satisfaction.

## Discussion

The comparative data hereby presented show a significant higher rate of EjD or RE after conventional TURP/laser treatment than after different endoscopic ejaculation-preserving

modifications or minimally invasive treatments of BPO. TUIP and minimally invasive ablation techniques result in the lowest RE rates at short–mid-term but. Regarding patient's and partners perception, EjD spectrum is already prominent before BPO surgery and bothersome in more than half of the patients. ED and EjDs are a source of sexual and overall unsatisfaction in both partners, though spouses seem to tolerate it better than the patients.

Retrograde ejaculation is already present in around 15% of males before surgical management but generally ill described in opposition to other EjDs.

Overall, post-surgery RE and EjDs data are still subject to multiple biases. In spite of abundance of randomized comparisons between different technologies and techniques, data regarding “de novo” EjDs or RE after BPO endoscopic relieve are hampered by the lack of standardization of outcomes definitions, heterogeneity of the populations and methods, the scarce use of adequate qualitative measurement tools (validated questionnaires) and, in most of the cases, the patent absence of preoperative assessment of the ED or EjDs masks the true “de novo” EjDs attributable to treatment. Moreover, in most of the studies, sexual outcomes are either secondary or “ad hoc” justifying the scarcity of high level of evidence in these SRs focusing on sexual-related outcomes after BPO intervention.

Most of these SRs have been published in the last lustrum, outlining the awareness on ejaculatory and EF in parallel with new ejaculation preservation techniques and the need for a proper frame to assess the impact of surgically induced RE in patients with BPO. This frame includes the acknowledgement that RE is only one of the components of EjD, that encompasses multiple ejaculatory and orgasmic symptoms, including delayed ejaculation, anejaculation, painful ejaculation, and decreased strength and volume of ejaculate or decreased feelings of pleasure during ejaculation. Of note, these symptoms are frequently combined, with to 15% and 30% of men presenting perceived RE and decrease of the ejaculate volume, respectively, already before intervention [38]. In turn, EjDs are associated to ED in 55–75% of men with moderate or severe LUTS [39, 40]. Furthermore, all EjDs are associated to distress and bothersome and even when not associated to ED, impact substantially intercourse satisfaction and sexual enjoyment deteriorating QoL and inducing anxiety and depression [7, 11, 24, 25, 41].

It is easy to understand that in spite of the functional urinary improvement, any intervention that increases pre-existent or results in “de novo” EjDs will not fulfill all the expectations of the patient. Notwithstanding, preserving ejaculation techniques or new alternatives may not be indicated in all the patients (e.g., large prostates or very low Qmax), durability is not yet characterized, and urinary and sexual effectiveness decrease at long term [11]. Eventually degree of satisfaction is a matter of trade and will depend

on personal values, couple expectations and socio-cultural values overpowering the improvement in urinary symptoms in the small percentage of patients that would like to reverse the situation [32]. Besides these considerations, RE impairs the physiological procreation function, which may be highly relevant in the functioning and well-being of some couples.

In contrast to a reasonable body of evidence on the repercussion of EjDs in the QoL of the male suffering from LUTS, its role in the female partner has been clearly neglected. We found few but relevant reports exploring the impact of male LUTS in the spouse and none referring specifically to the impact of post-surgical RE in the females. The couple sexuality is dyadic and includes not only male of female sexual dysfunctions but their impact in each one of the partners as well as how they interact or modulate other spheres of life and on the relationship. Spouses are bothered and suffer by their husbands' LUTS and accompanied erectile or EjDs. A considerable percentage of the wives' experience sleep disturbances and 2/3 of them feel psychological burdened. Their QoL is affected by the symptoms of the husband, more than 50% of wives consider their sexual life inadequate and they resented the lack of intimacy and the strains in the relationship more frequently than men.

While some studies report a postoperative decrease in perceived ejaculate volume in 18% of the sexually active men [32, 38] and a considerable decrease in the orgasmic intensity [32], there is practically no information on the effect of these symptoms in the sexual life of the partner. Only a recent survey stresses the importance of the male ejaculation under the female point of view. Nearly half of the participant women considered male ejaculation very important during sexual intercourse with higher prevalence in older women and another 17.4% of responders experienced a more intensive orgasm when the male ejaculation was more intense and the perceived ejaculate volume higher. In the absence of data on what could be considered the “index couple”, we cannot despise the efforts to preserve AE when surgical prostatic desobstruction is indicated.

The manuscript has several limitations. It was decided to perform a narrative comprehensive review instead of an umbrella review of the SR. While umbrella reviews are becoming widely used as a means to provide one of the highest levels of evidence in medical knowledge, the topic has different inherent problems including: the presence of multiple comparisons focusing on specific techniques, lack of standardized definitions in outcomes used across the different reports, the heterogeneity of the population included in the different SR's, the lack of standard questionnaires to evaluate the use of EF as surrogate in several reports, the systematic lack or absence of reporting on baseline evaluation of ejaculatory function, the heterogeneity in methodology and meta-analysis and the apparent intrinsic link

between BPO, LUTS, erectile dysfunction and EjD that may confound the outcomes.

In conclusion, a considerable degree of EjDs is already present in men with moderate or severe LUTS candidates for endoscopic surgery. Overall, EjDs may cause patient's and partner distress and sexual dissatisfaction. Preservation of AE is feasible and available data suggest that the rate of EjD or RE after conventional TURP/laser treatment is significantly higher than after different endoscopic ejaculation-preserving modifications or minimally invasive treatments of BPO. The psychological effects and the impact of "de novo" EjDs/RE on the QoL and sexual life of the couple are badly and insufficiently described. Focus on appropriate measurement of changes from pre-to post-surgery and on dyadic instead of individual assessment will definitely address the question of to whom it is worth to offer an ejaculation-preserving technique.

**Author contributions** GC: data collection, design and writing of the manuscript. MPL: data collection, design and writing of the manuscript. SG: conception and design of the article and critical review. SA: conception and design of the article and critical review. JdR: conception and design of the article and critical review.

## Declarations

**Conflict of interest** None of the authors declares any conflict of interest for the present work.

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