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ARTICLE

Comparison of endoscopic treatment for bladder neck contracture: a single centre study and review of literature

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Objectives: *Nowadays, bladder neck contracture treatment reported is both bladder neck incisions and resection. Also, different energies have been described. This study aimed to describe and compare surgical techniques and energy sources used in Hospital Universitari de Vic.*

Methods: *retrospective study of patients with a diagnosis of bladder neck contracture that required endoscopic surgical treatment between 2000 and 2024. Preoperative, operative, and postoperative characteristics were analysed. At the end of follow-up, the patient's status was asymptomatic, under urethral dilatations, or with a permanent catheter.*

Results: *60 patients were included. Mean age was 71.1 years (SD = 8.95). Previous urologic surgery was open radical prostatectomy (33.3%), laparoscopic radical prostatectomy (6.7%), transurethral resection of the prostate (31.7%), laser prostate vaporization (16.7%), open prostate adenomectomy (6.7%), and transurethral resection of bladder tumour (5.0%). Concomitant urethral stricture was detected in 21.3%. Bladder neck resection was used in 41.7% and bladder neck incisions at 12, 5, and 7 h in 58.3%. No significant difference in success rate was detected ($p = 0.598$). The instrument was monopolar loop (31.7%), Collins (41.7%), cold knife (11.7%), bipolar loop (8.3%), and Holmium laser (6.7%). In 13 patients, a second endoscopic management was performed, and 9 presented success. Median time follow-up was 63 months (IQR: 25–100). Patient's clinical situation was asymptomatic in 71.1%, periodic dilatations in 25% and a permanent catheter in 3.3%. The only risk factor detected for periodic dilatations was urethral stenosis.*

Conclusions: *Endoscopic treatment presents a success rate of 71% at 5 years with no significant difference between bladder neck incisions or resection, nor between previous types of prostate surgery.*

Key Words: bladder neck contracture, vesico-urethral anastomosis stricture, bladder neck incisions, bladder neck resection, periodic dilatations, bladder neck contracture management

Introduction

Due to the improvement of life expectancy and a health care system centered on patients' quality of life, benign prostatic hyperplasia (BPH) and its minimally invasive treatment represent one of the main concerns of urologists in daily practice.

The incidence of bladder neck contracture (BNC) after BPH surgery has been reduced due to the increased use of endoscopic treatment, even in large prostatic glands, with the use of laser enucleation. Moreover, vesico-urethral anastomosis stricture (VUAS) after radical prostatectomy has also diminished due to the introduction of laparoscopic and robotic-assisted procedures.[1] However, the appearance of this complication can still be

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challenging, and its management is heterogeneous as reported in the literature. The two main endoscopic surgeries described are bladder neck incisions and bladder neck resection. Energy sources go from cold knife to monopolar and bipolar energy, and lately, laser incisions have also been introduced.

The aim of this study is to describe the different surgical techniques and energy sources used in our center in the past two decades and to report the results to detect differences between them. This, in order to observe risk factors for treatment failure and try to find the most favorable endoscopic treatment and energy source to standardize BNC endoscopic treatment in the future.

Methods

Study design

A single-center retrospective study in Hospital Universitari de Vic was conducted in accordance with the principles of Good Clinical Practice and the Declaration of Helsinki. The protocol was approved by the Ethics Committee for Research with Medicines of the Institute for Research and Innovation in Life Sciences and Health in Central Catalonia (CEIm IRIS-CC), CEIm Code approval number: 25/065 during statement number 06/2025.

Pateints

Inclusion criteria were patients with a diagnosis of bladder neck contracture that required endoscopic surgical treatment during the period between January 2000 and January 2024, and with a minimum follow-up time of 6 months. Preoperative data, surgical techniques, and postoperative data were collected as follow:

Preoperative data: age, gender, Body Mass Index (BMI), American Society of Anaesthesiologists classification (ASA), use of any anticoagulant therapy, presence of urethral catheter or cystostomy, symptoms at time of diagnosis, and previous urological endoscopic treatment.

Surgical techniques: technique description, type of energy, diameter of the urethral catheter in French (Fr), and days of urethral catheter.

Postoperative data: Clavien-Dindo classification for complications, acute urinary retention, requirement of another treatment for failure after the first surgery and follow-up time.

Surgical techniques

The initial BNC diagnosis was assessed with an ambulatory urethroscopy with a 16 Fr flexible cystonephro videoscope (Device Model Number CYF-VH, OLYMPUS MEDICAL SYSTEMS CORP.). Those cases with an inability to pass through the stricture were scheduled for endoscopic surgery. Two entities were differentiated: bladder neck contracture (BNC) after benign prostate surgery and vesico-urethral anastomosis stricture (VUAS) after radical prostatectomy (both open and laparoscopic). Thus, surgical management of bladder neck contracture was endoscopic in all cases. Different techniques were used depending on the surgeon, including bladder neck incision at 12, 5, and 7 o'clock or bladder neck resection. The energy sources used depended both on surgical tecnique and surgeon preferences. Four sources were reported: laser, monopolar and bipolar energy, or a cold knife. Monopolar and bipolar energy could be applied with a cutting loop or a Collins knife. A urethral catheter was placed at the end of the surgery, and the time to removal depended on the surgeon's decision.

Follow-up

During the follow-up, success was determined as patients reporting comfortable micturition, absence of recurrent urinary tract infections ($\geq$3/year), <150 mL post-voiding volume during uroflowmetry, and no need for further treatment for BNC. Those patients were assessed as "asymptomatic".

At the end of follow-up, the patient's status was classified as asymptomatic, under periodic urethral dilatations, or requiring a permanent catheter (urethral or cystostomy).

Statistical analysis

Finally, SPSS 23 (IBM Corp., Armonk, NY, USA) statistical program was used to analyze the database. An initial descriptive analysis was performed. Then, Chi-Square and Mann-Whitney U tests were used to determine the statistical association between variables. Statistical significance was determined by a p-value < 0.05.

Results

A total of 60 patients with endoscopic management were included. Of those 60 patients, 24 were classified as VUAS and 36 as BNC. Patients' characteristics are described in Table 1. Mean age at BNC diagnosis was 71.1 years (SD = 8.9). The main symptoms leading to diagnosis were: worsening of bladder obstructive symptoms in 40 patients (66.7%), urinary infection in

TABLE 1. **Patient's characteristics (N = 60)**

Variable	Value
Age (years), mean (SD)	71.1 (8.9)
Sex, n (%)	
Male	60 (100.0%)
BMI (kg/m^2), mean (SD)	27.4 (3.7)
ASA level, n (%)	
I	3 (5.0%)
II	35 (58.3%)
III	22 (36.7%)
Anticoagulants use, n (%)	
Yes	6 (10.0%)
No	54 (90.0%)
Previous surgery, n (%)	
Open radical prostatectomy	20 (33.3%)
Laparoscopic radical prostatectomy	4 (6.7%)
Transurethral resection of the prostate (TURP)	19 (31.7%)
Transurethral resection of the bladder (TURB)	3 (5.0%)
Prostate laser vaporization	10 (16.7%)
Open prostate adenomectomy	4 (6.7%)
Main symptom leading to BNC diagnosis, n (%)	
Bladder obstructive symptoms	40 (66.7%)
Urinary infections	5 (8.3%)
Acute urinary retention	11 (18.3%)
Not specified	4 (6.7%)

Note: Abbreviations: IQR, interquartile range; ASA, American Society of Anaesthesiologists; BMI, Body Mass Index; BNC, bladder neck contracture.

5 (8.3%), acute urinary retention in 11 (18.3%), and in 4 (6.7%) patients, it was not specified.

The mean body mass index (BMI) was 27.4 kg/m^2 (SD = 3.7). Previous urologic surgery in the VUAS group (n = 24) was open radical prostatectomy in 20 cases (83.3%) and laparoscopic radical prostatectomy in 4 (16.7%). In the BNC group (n = 36), transurethral resection of the prostate (TURP) was performed in 19 (52.8%), laser prostate vaporization in 10 (27.8%), open prostate adenomectomy in 4 (11.1%), and transurethral resection of bladder tumor (TURB) in 3 (8.3%). In TURB cases, the lesion localization in the bladder was reviewed to be in the bladder neck.

Mean time in months to BNC or VUAS detection since previous surgery was 28.4 (median = 6.7) for open radical prostatectomy, 18.8 (median = 7.8) for laparoscopic radical prostatectomy, 31.5 (median = 19) for open prostate adenomectomy, 54.6 (median = 33.6) for TURP, 25.2 (median = 20.5) for laser prostate vaporization, and 7 (median = 7) for TURB. Time to appearance was shorter in the VUAS group vs. the BNC group ($p = 0.029$).

At the time of BNC or VUAS detection, the presence of concomitant urethral stricture was detected in 13 patients (21.7%). Out of 36 BNC patients, 7 (19.4%) had had previous endoscopic BNC treatment.

The American Society of Anesthesiologists classification (ASA) was I, II, and III in 5.0%, 58.3%, and 36.7%. Use of oral anticoagulant therapy was 10%. Before endoscopic treatment, 3 (5.0%) patients required a urethral catheter, 6 (10.0%) had a cystostomy, and 4 (6.7%) underwent periodic dilatations.

Operative and postoperative information is summarized in Table 2. For the endoscopic procedure, bladder neck resection was used in 41.7% of BNC cases, and bladder neck incision at 12, 5, and 7 o'clock in 58.3%. The instruments used were monopolar loop in 19 cases (31.7%), Collins in 25 (41.7%), cold knife in 7 (11.7%), bipolar loop in 5 (8.3%), and Holmium laser in 4 (6.7%). Urethral catheters 20 and 22 Fr were used in 70% and 30% of cases, respectively. The mean time

TABLE 2. **Operative and postoperative results**

Variable	Total value (n = 60)	BNC value (n = 36)	VUAS value (n = 24)	*p*-value
Surgical technique, n (%)				0.593
Bladder neck incisions 5, 7, 12 h	35 (58.3%)	22 (61.1%)	13 (54.2%)	
Bladder neck resection	25 (41.7%)	14 (38.9%)	11 (45.8%)	
Clavien-Dindo complications, n (%)				0.011*
0 (No complications)	49 (81.7%)	25 (69.4%)	24 (100.0%)	
I	5 (8.3%)	5 (13.9%)	0 (0.0%)	
II	6 (10.0%)	6 (16.7%)	0 (0.0%)	
Acute urinary retention, n (%)				0.675
Yes	6 (10.0%)	3 (8.3%)	3 (12.5%)	
No	55 (91.7%)	33 (91.7%)	21 (87.5%)	
Dilatations' requirement first 12 months, n (%)				0.800
Yes	22 (36.7%)	14 (38.9%)	8 (33.3%)	
No	38 (63.3%)	22 (61.1%)	16 (66.7%)	
Second procedure requirement, n (%)				0.898
Yes	13 (21.7%)	8 (22.2%)	5 (20.8%)	
No	47 (78.3%)	28 (77.8%)	19 (79.2%)	
Concomitant urethral stricture, n (%)				0.210
Yes	13 (21.7%)	10 (27.8%)	3 (12.5%)	
No	47 (78.3%)	26 (72.2%)	21 (87.5%)	
Follow-up time (months), median (IQR)	63 (25–100)	44 (16–76)	68 (58–121)	0.002**
Final clinical situation, n (%)				0.385
Asymptomatic	43 (71.7%)	24 (66.7%)	19 (79.2%)	
Dilatations/Permanent catheter	17 (28.3%)	12 (33.3%)	5 (20.8%)	

Note: *$p < 0.05$, **$p < 0.01$. Abbreviations: IQR, interquartile range; BNC, bladder neck contracture; VUAS, vesico-urethral anastomosis stricture.

of urethral catheter use in days was 13 (median = 12, IQR: 7–19).

Postoperative complications were detected in 11 patients (18.3%). Using the Clavien-Dindo classification, level 1 and 2 complications were detected in 2 and 9 patients, respectively. Nine patients had urinary tract infections requiring antibiotic use, including 3 cases of orchitis and two patients with hematuria. All complications were detected in the BNC group.

During the follow-up, acute urinary retention (AUR) was reported in 6 patients (10%). Mean time to AUR was 5.3 months (median = 3, IQR: 1–11.5). No difference between VUAS/BNC groups was detected ($p = 0.675$). In those patients who failed after surgery, the median time to dilatation requirement was 2 months (IQR: 1–4.25). In 13 patients, a second endoscopic management was performed with a mean time between procedures of 13.9 months (median = 8, IQR: 4–18). Nine out of 13 (69.2%) presented success after the second procedure. Patients with a previous history of endoscopic management of BNC or those who underwent a second endoscopic management for recurrence during the follow-up didn't present statistically significantly worse outcomes than those with only one endoscopic management at the end of follow-up. No significant differences were detected between the BNC and VUAS groups in acute retention event, dilatations requirement during the first 12 months, second endoscopic treatment requirement, or concomitant urethral stricture. However, the BNC group had a significantly greater risk of complications ($p = 0.011$) after endoscopic treatment.

There was no difference in surgical technique preference between the BNC and VUAS groups ($p = 0.593$). Also, no statistical differences were detected in the final patient's clinical situation ($p = 0.598$). regarding whether the endoscopic treatment had been a bladder neck resection or bladder neck incisions.

The types of energy used (cold knife, monopolar, bipolar, or laser) didn't affect the presence of postoperative AUR, the requirement of second BNC surgery, or the final clinical situation.

Those patients diagnosed with urethral stricture during endoscopic management required more frequent use of periodic dilatation ($p = 0.035$), which could be assessed as the only risk factor detected for endoscopic management failure.

Median time of follow-up was 63 months (IQR: 25–100). Follow-up time was longer in VUAS, probably due to its requirement for oncological assessment. The patient's clinical situation at that time was not asymptomatic in 43 patients (71.7%), and periodic dilatations or a permanent catheter in 17 (28.3%). More specifically, 15 patients underwent periodic dilatations, and 2 required a permanent urethral catheter. There were no statistically significant differences between VUAS and BNC groups ($p = 0.385$).

Discussion

Bladder neck contracture is a surgical complication reported in the literature for decades. Its risk factors and management have been analyzed in many studies. The two main treatments considered in the European guidelines are bladder neck resection and hot-knife bladder neck incisions.[2] Even though in European guidelines the current treatment for VUAS is bladder neck incisions and bladder neck ressection or incisions for BNC, our results report no complications for bladder neck resection for VUAS if needed. In our study of 60 cases, no differences were assessed between bladder neck ressection or incisions for the success rate. Incisions were performed with cold knife, monopolar or bipolar Collins knife, and laser. The complication rate was 18% but there were no severe complications (only Clavien-Dindo I and II were reported).

In previous investigations of the field, it has been observed that etiology, incidence, and complexity differ depending on the previous prostatic surgery. Nonetheless, in our study, the patient's clinical outcome wasn't statistically different between patients with different previous surgeries. However, the most prevalent surgery leading to BNC was open radical prostatectomy, despite being a surgery much less frequent than endoscopic BPH management. This is due to the high incidence of VUAS after open radical prostatectomy, which rises up to 30%.[3] Then, it has been described that the incidence of BNC was reduced to 1.4% by the introduction of minimally invasive radical prostatectomy.[1]

In our study, it was significant shorter the time to develop VUAS compared to BNC, probably due to its different etiology of stricure. Moreover, follow-up time was longer in the VUAS group due to the requirement of oncological assessment.

For further investigation, Pansadoro et al.[4] analyzed the prostatic fossa's changes after endoscopic surgery for BPH and described 3 types of sclerosis. Type I: fibrotic tissue includes only the bladder neck. Type II: sclerosis is localized in the middle of the prostatic fossa. Type III: sclerosis included the entire prostatic fossa.

Risk factors for bladder neck contracture

Risk factors related to patients' characteristics: tobacco as the main risk factor, Diabetes Mellitus, age, coronary disease, and previous radiotherapy.[5] These variables have been reported to affect microvascularization, leading to an impact on scar formation.

Risk factors depend on the surgery[6,7]: smaller prostate volume, excessive bladder neck resection, and the use of high energy during the bladder neck resection. Goßler et al.[8] analyzed BNC incidence after TURP in 1300 patients with a detection up to 6.5%. Surgical risk factors were a smaller prostate volume, less resected tissue, a lower PSA level, shorter operative time, reintervention due to hematuria, and postoperative urethral stenosis appearance that required endoscopic urethrotomy. The use of antibiotics prior to surgery was the only protective factor detected. Furthermore, Chen et al.[9] determined that a prostate volume smaller than 42.9 cm^3 presented a higher risk of BNC, either with TURP or enucleation.

Bladder neck contracture after prostatic surgery

In 2017, Cindolo et al.[10] published a systematic review detecting a BNC incidence between 0%–6% after open and laparoscopic radical prostatectomy. After endoscopic procedures, the reported incidence of BNC was 0%–4.9% for TURP, without a difference between monopolar and bipolar energy. In HOLEP cases, the incidence was 0.4%–1.7% and it rose to 7% after prostate ablation with laser Holmium. In patients undergoing Greenlight vaporization, BNC incidence depended on laser characteristics. The results for the different laser models were 0%–9.6%, 0%–7.4%, and 0%–5.9% for 80-W KTP, 120-W HPS, and 180-W XPS systems, respectively. As the incidence of BNC rises in low-volume prostate endoscopic treatment, this review recommends a concomitant bladder neck incision during the procedure. For BNC management, endoscopic bladder neck incision was the first choice in all the studies reported. In 2024, a single-center

retrospective study[11] reported a BNC incidence of 4.7% for TURP and 1.3% for HOLEP.

Sun et al.[12] analyzed BNC incidence after Thulium laser BPH treatment in both resection and enucleation techniques. Incidence after resection was significantly higher (13.6% vs. 1.8%; $p = 0.045$). A recent meta-analysis comparing Greenlight (HPS 120-W) laser vaporization and TURP for BPH treatment[13] didn't detect a statistically significant incidence of urethral stenosis and bladder neck sclerosis.

After radical prostatectomy, Kovell et al.[3] published a BNC incidence of 30% for the open approach. However, it seems to have lowered to 1.4% with technique optimization, with a minimally invasive approach.[1] Risk factors as greater bleeding, urine leak persistence, previous prostatic surgeries, previous local radiation, surgeon's experience, patient's age, BMI, and tobacco, were detected in this revision. Otherwise, the proper exposition of tissues and mucosa approximation avoids stricture of anastomosis. Also, checking for urine leakage during anastomosis prevents BNC appearance. Parihar et al.,[14] in a study with 930 robotic-assisted radical prostatectomies, detected a 1.6% BNC incidence.

Results reported in the literature for endoscopic treatments in bladder neck contracture

In 2022, Nealon et al.[15] reported the efficacy of balloon dilatation and bladder neck incisions with a cold knife in both *de novo* and recurrent BNC in 124 patients. Success rate in a mean follow-up time of 12 months was 82% for one procedure and up to 94% after two procedures.

Also, Furukawa et al.[16] analyzed 25 bladder neck incisions for BNC after TURP or HOLEP. Time to BNC diagnosis was 365 days, and the mean follow-up after BNC treatment was 170 days with a success ratio of 92%.

Similar to the previous studies, Rosenbaum et al.[17] included 60 patients with BNC (54 after TURP and 6 after HOLEP). Endoscopic treatment for BNC was bladder neck resection in 49 cases and bladder neck incisions in 11. No significant differences were detected between the techniques, as also reported in the present study. The overall success rate was 53% but it was significantly higher in HOLEP vs. TURP patients (100% vs. 48%).

The initial management of BNC after radical prostatectomy is also endoscopic incision of the bladder neck, with a success rate detected by Shinchi et al.[18] up to 81% at the first procedure and 93% after up to three attempts.

In consideration of the previous literature and also de present study, it could be encouraged to perform a second procedure after a first failure. In literature, the success rate always improves after the second procedure, and in our study, 9/13 patients presented success after the second procedure. On the other side, the main cause of the lower success rate (71%) in the present study compared to that described in the literature (>90%) could be the longer follow-up time. Most of the studies report a follow-up time of 1 year, instead of 5 years from the present study.

Use of endoscopic injections after bladder neck incisions

Even though the use of injections was not assessed in our study, three treatments are well-reported in the literature.

Mitomycin C (MMC) is a chemotherapy used to diminish fibrosis and scar formation with cellular death.[19] Its use for BNC management has been mostly studied in those patients with failure of an initial endoscopic treatment. Vanni et al.[20] reported a success ratio of 72% after the first procedure and 89% after a second procedure in patients with BNC recurrence. In a multicentric prospective study by Nagpal et al.,[19] cold knife bladder neck incisions with subsequent injections of 0.3–0.4 mg/mL of MMC in each incision were performed in 40 patients with a success rate of 87.5% after a maximum of two procedures. Redshaw et al.[21] described a success rate of 75% in 55 patients after a maximum of 2 attempts. A 7% of severe complications were detected, including: pubic bone osteitis, necrosis of the bladder neck, urethrorectal fistulae, and rapid recurrence of BNC.

Triamcinolone use in bladder neck contracture has been described by Zhang et al.[22] with bladder neck resection and further triamcinolone injection (2 mL, 40 mg/mL in eight points of resection). It included 28 patients with BNC after BPH surgeries and an initial BNC endoscopic treatment failure. Injections were repeated monthly 3 times, and the success rate was 92.9%. In another study, Mann et al.[23] described bladder neck incisions with laser Holmium at 3, 6, 9, and 12 o'clock and triamcinolone injections with a success rate of 83% in 30 patients with BNC after radical prostatectomy.

Betamethasone was described for BNC management by Wu et al.[11] Twenty patients were treated with endoscopic Betamethasone injections after bladder neck incisions, with a BNC recurrence of 35% after the procedure. The mean time of recurrence was 1.8 months.

Limitations

Limitations in this study include the wide period of inclusion time, which leads to the inclusion of a great variability of surgical treatments and the evolution of these surgical techniques. It also comprises the limitations of a retrospective analysis and the only description of endoscopic management. No cases of open, laparoscopic, or robotic approach for reconstruction were included. Also, as described in the discussion, bladder neck incision alone was not compared with incision plus injection treatments such as corticosteroids or Mitomycin C.

Conclusions

The incidence of bladder neck contracture tends to decrease in the last decades due to the introduction of laparoscopy and robotic surgery. The initial management is the endoscopic procedure with bladder neck incision or resection, with no difference between them assessed. The different initial prostate surgeries didn't seem to alter the final patient's status. Only concomitant urethral stricture was detected as a risk factor for endoscopic treatment failure. Finally, in this study, in a mean follow-up time of 5 years, 71.1% of patients didn't require more dilatations or bladder catheter. Of those patients who presented treatment failure, 88% underwent periodic dilatations.

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Author Contributions

Sofia Fontanet: research, data analysis, and elaboration of the manuscript, Julio F. Calderón-Cortéz design of the study and research of the database, Edgar Suquilanda: research of the database, Fernando Gaona: analysis of the data, Alejandro García Navarro: revision of the manuscript. All authors reviewed and approved the final version of the manuscript.

Availability of Data and Materials

The findings of this study are not publicly available due to privacy reasons but are available on request from the corresponding author.

Ethics Approval

This study was performed in accordance with the Declaration of Helsinki. This human study was approved by Ethics Committee for Research with Medicines of the Institute for Research and Innovation in Life Sciences and Health in Central Catalonia (CEIm IRIS-CC), CEIm Code approval number: 25/065 during statement number 06/2025. This study has been granted an exemption from requiring written informed consent due to its retrospective characteristics, with a long length of time included and a pseudonymization of patients' data, and was granted from the same ethical committee (CEIm IRIS-CC approval number 25/065).

Conflicts of Interest

The authors declare no conflicts of interest.

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