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ARTICLE

HypnoVR® in minimally invasive surgical techniques (MISTs) for lower urinary tract symptoms (LUTS): a safe, sedation-reducing tool improving patient experience

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Background: *Minimally invasive surgical techniques (MISTs) are becoming an increasingly popular outpatient treatment option for lower urinary tract symptoms. Although generally well-tolerated, MISTs may cause periprocedural discomfort. Virtual reality devices (VRDs) have been shown to reduce patient-reported pain during several procedures. This study aims to evaluate whether the use of VRD during MISTs could improve perioperative endovenous sedation needs of a VRD during MISTs in a case-control design.*

Methods: *We retrospectively analyzed patient data from MISTs performed between January 2024 and July 2025 at a single referral center (ASST Grande Ospedale Metropolitano Niguarda, Milan, Italy). Procedures were conducted with or without a VRD (HypnoVR®, Strasbourg, France), based on patient preference and device availability. Patients were grouped into MISTs without VRD (group 1) and MISTs with VRD (group 2). Periprocedural data, endovenous sedation needs, Visual Analogue Scale (VAS) score for pain, use of additional painkiller drugs after the procedure, and complication rate have been addressed.*

Results: *Twenty-one procedures with VRD and 66 control procedures were analyzed. Groups were comparable in age, prostate volume, PSA, indwelling catheter presence, and type of MIST. Median (IQR) prostate volume was 41 (30–56) mL in group 1 and 36 (30–45) mL in group 2. MIST distribution was similar, though iTIND procedures were more frequent with VRD. Endovenous sedation rate was higher in group 1 (86.4 vs. 38.1%, $p < 0.001$). Median (IQR) VAS scores were 2 (1–2) in group 1 and 1.5 (1–2.75) in group 2. No VRD-related side effects or procedure interruptions occurred.*

Conclusion: *This is the first study demonstrating the safety, feasibility, and tolerability of VRD use during MISTs. Although VRD did not significantly reduce pain scores, it markedly decreased endovenous sedation use, potentially facilitating faster recovery and discharge. VRD may be considered for patients undergoing MISTs where available.*

Key Words: Pain control, minimally invasive surgical techniques, outpatient surgery, virtual reality, lower urinary tract symptoms (LUTS)

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Introduction

Minimally invasive surgical techniques (MISTs) for benign prostatic obstruction (BPO) are various treatment options designed to relieve Lower Urinary Tract Symptoms (LUTS) while minimizing procedural trauma, improving recovery time, reducing postoperative patient morbidity, and lowering the risk of sexual side effects compared with traditional approaches.[1,2]

After their introduction in clinical practice, MISTs, such as Prostatic Urethral Lift (Urolift), Water Vapor Therapy (Rezum), and Temporary Implantable Nitinol Device (iTIND), are usually performed using local anesthesia with or without a light sedation,[3–7] as one of the several advantages of these procedures is the outpatient or same-day discharge setting[8] with reduced pain and rare complications.[9]

Although MISTs are generally well tolerated, anxiety and pain significantly influence patient experience during the procedure, sometimes reducing compliance and satisfaction. Although available studies rarely report intraoperative complications, pain-related movement can result in suboptimal clinical outcomes due to the difficulty of delivering treatment correctly. Additionally, procedure-related anxiety before and during urological procedures is usually high and can further increase patient discomfort.[10]

In recent years, virtual reality devices (VRDs) have shown promising potential for pain relief and anxiety reduction across multiple clinical and surgical settings, including urological procedures.[11–14] In a previous non-controlled pilot study, Łuczak et al. demonstrated that VRD use during cystoscopy could effectively alleviate pain and anxiety, but, on the other hand, could also cause moderate nausea.[15] Hence, the present study aims to evaluate the safety and efficacy of a VRD during MISTs for BPO in a case-control study.

Materials and Methods

Study population

This case-control study included all patients who underwent MISTs from January 2024 to July 2025 at a single referral center (ASST Grande Ospedale Metropolitano Niguarda, Milan, Italy). For BPH-related LUTS during the period of the study, the center could offer iTIND, Urolift, Rezum, TURP, Holep, and robot-assisted simple prostatectomy. Each patient was preoperatively evaluated with prostate-specific antigen (PSA), uroflowmetry with post-void residual volume (PVR), transrectal ultrasound (TRUS), and flexible cystoscopy, and right after being counseled regarding the benefits, success rates, and possible complications of both MISTs and traditional treatments. Two urologists with MIST expertise made the final choice of a MIST technique according to the patient's expectations and exam results. Patients who received pelvic radiotherapy or had active urinary tract infections before the treatment were excluded from this study.

The study was reviewed by the local ethics committee (Comitato Etico Territoriale Lombardia) and formally deemed exempt from ethical approval because of the anonymous database design. All patients provided written informed consent with guarantees of confidentiality.

Variables of interest and study endpoints

For each patient, the following variables were collected: age at surgery, prostate-specific antigen (PSA), body mass index (BMI), prostate volume measured with TRUS or magnetic resonance imaging (MRI), and the presence of an indwelling catheter. During the procedure, the following variables were investigated: the duration of the surgery, the need for endovenous sedation, the maximal pain level reported by the patient during the procedure, measured with the visual analog scale (VAS), and the rate of intraoperative complications. According to patient preference and device availability, several procedures were performed using a VRD (HypnoVR®, Strasbourg, France). Patients who underwent the procedure without VRD were enrolled in a case-control study (group 1: MISTs without VRD, and group 2: MISTs with VRD).

The primary end point of this study was to evaluate whether the use of VRD during MISTs could improve perioperative endovenous sedation needs. Secondary outcomes measured were pain levels and the influence on immediate postoperative outcomes, such as painkiller drug usage and the length of stay in the hospital.

Anaesthesia and pain management strategies

All the procedures have been performed in local anaesthesia (LA), with our established protocol.[9] Briefly, LA was performed by experienced urologists; no anesthesiologists were present during the procedure. All the patients received a local administration of two anaesthetic gels in the urethra 20 min before the procedure. A team nurse obtained 18-gauge venous access to administer antibiotic prophylaxis and, if needed, venous sedation. In addition to the gel injection, patients undergoing the

FIGURE 1. One of the scenarios that the patients can experience during the procedure

Rezum procedure received Transurethral Intraprostatic Anaesthesia (TUIA), with the Schelin Catheter (SC) (ProstaLund AB®, Lund, Sweden) into the prostatic lobes.[5] Patients in group 2 who underwent MIST with the VRD used the HypnoVR device—an ergonomic virtual reality headset designed for medical use. The headset immerses patients in relaxing virtual environments through a combination of visual and auditory stimulation. It offers six 3D videos depicting tranquil settings, such as calm beaches or snowing forests (Figure 1), accompanied by tailored music, hypnotic voiceovers (available in several languages and in both male and female versions), and guided instructions for controlled breathing and heart rate regulation. The immersive experience was not supervised by any health care professional; however, a nurse was at the side of the patient for all the duration of the procedure. The device was placed on patients lying on the cystoscopy bed, and activation occurred approximately 5 to 10 min before the MIST procedure, remaining in use until completion. Prior to the intervention, a urologist explained the device operation and provided training. All patients were instructed to report if they felt pain >6 on the VAS during the treatment. The urologist investigated the peak pain level reported by the patient at the end of the procedure. Once the patient was at ease with its use, they were allowed to choose their preferred virtual scenario and narration. The need for endovenous sedation using midazolam 1 to 3 mg was defined before the beginning of the procedure, if the patient declared a very high anxiety level or during the procedure if the patient reported a VAS score > 6. Patient satisfaction in the VRD group was assessed by asking patients whether they would choose to use the virtual reality device again if they were to undergo a similar procedure in the future.

Statistical analysis

The statistical analysis was performed using IBM SPSS (Version 24; IBM Corp., Armonk, NY, USA). Data were summarized using the median and interquartile range (IQR) and absolute and relative frequencies for continuous and categorical variables. Mann-Whitney and Pearson chi-squared tests were used for comparison where appropriate. Patient characteristics were compared between patients with and without ICs. All tests were two-sided, with a significance level set at $p < 0.05$.

Results

A total of 87 patients undergoing MISTs for BPH-related LUTS were included in the analysis, of whom 21 (24.1%) underwent the procedure with VRD and 66 (75.9%) without VRD. Baseline characteristics were comparable between the two groups. No significant differences were observed in age (54 [51–63] vs. 62 [52–67] years, $p = 0.061$), prostate volume (36 [30–45] vs. 41 [30–56] mL, $p = 0.35$), PSA levels (0.66 [0.43–0.91] vs. 0.76 [0.47–1.29] ng/mL, $p = 0.33$) or presence of an indwelling catheter (14.6% vs. 7.6%,

TABLE 1. **Intraoperative data stratified by virtual reality device (VRD)**

Characteristic	No VRD group, n = 66	VRD group, n = 21	*p*-value
Age (years), median (IQR)	62 (52–67)	54 (51–63)	0.061
Prostate size (mm), median (IQR)	41 (30–56)	36 (30–45)	0.35
PSA level (ng/mL), median (IQR)	0.76 (0.47–1.29)	0.66 (0.43–0.91)	0.33
Indwelling catheter, n (%)	5 (7.6%)	3 (14.6%)	0.107
Type of MISTs, n (%)			0.32
Urolift	20 (30.3%)	4 (19.0%)	
Rezum	26 (39.4%)	7 (33.3%)	
iTIND	20 (30.3%)	10 (47.6%)	
Surgery duration (minutes), median (IQR)	20 (15–26.25)	20 (15–25)	0.70
Endovenous sedation, n (%)	57 (86.4%)	8 (38.1%)	<0.001
Visual Analogue Score during procedure, median (IQR)	2 (1–2)	1.5 (1–2.75)	0.90
Intraoperative Complications, n (%)	3 (4.5%)	1 (4.8%)	0.90
Additional painkillers, n (%)	12 (18.1%)	3 (14.2%)	0.90
Same-day discharge, n (%)	47 (83.9%)	18 (90%)	0.70
Length of stay (hours), median (IQR)	6 (4–7)	5 (4–7.25)	0.70

Note. Abbreviations: IQR, interquartile range; PSA, prostate-specific antigen; MIST, minimally invasive surgical technique.

$p = 0.107$). The distribution of MISTs did not differ significantly between groups ($p = 0.32$), although a higher proportion of iTIND procedures was observed in the VRD group (47.6% vs. 30.3%).

Intraoperative outcomes are summarized in Table 1. Median operative time was similar between patients treated with and without VRD (20 [15–25] vs. 20 [15–26.25] minutes, $p = 0.70$). The requirement for endovenous sedation was significantly lower in the VRD group compared with controls (38.1% vs. 86.4%, $p < 0.001$). Intraoperative pain levels were comparable between the two cohorts, with a median VAS score of 1.5 (1–2.75) in the VRD group and 2 (1–2) in the non-VRD group ($p = 0.90$). No VRD-related adverse events, intolerance, or procedure interruptions were reported.

Peri- and postoperative outcomes did not differ between groups. The rate of intraoperative complications was low and comparable (4.8% vs. 4.5%, $p = 0.90$). The need for postoperative analgesics was similar in both groups (14.2% vs. 18.1%, $p = 0.90$). Same-day discharge rates were high and comparable (90% vs. 83.9%, $p = 0.70$). Median length of stay was 5 (4–7.25) hours in the VRD cohort and 6 (4–7) hours in the control group ($p = 0.70$). In the VRD group 18 (85.7%) of the patients stated that they would use the VRD again for a similar procedure.

Discussion

This case-control study is the first to evaluate the impact of a VRD (HypnoVR®, Strasbourg, France) on patient experience and perioperative parameters during MISTs for the treatment of benign prostatic hyperplasia (BPH). The main finding of this study is that VRD use significantly reduced the need for endovenous sedation without increasing pain or complications. Patients who underwent the procedure with the aid of VRD reported comparable pain scores and postoperative outcomes compared with controls, yet sedation was required in less than half of the cases. Importantly, no VRD-related adverse events or procedural interruptions were recorded, confirming the safety and feasibility of this technology during MISTs performed under local anaesthesia. To our knowledge, this is the first study specifically assessing the role of a VRD in the context of office-based or day-case minimally invasive BPH treatments.

The clinical implications of these findings are noteworthy. While MISTs are generally well tolerated, anxiety and pain during the procedure can negatively affect intraoperative patient cooperation, satisfaction, and overall experience. In some cases, excessive anxiety or movement may compromise the precision of device deployment or thermal delivery, potentially impacting clinical outcomes. By reducing the need for pharmacological sedation, VRD use may help clinicians to achieve a more stable and controlled operating environment. Furthermore,

decreased reliance on sedatives (e.g., midazolam) reduces the need for anaesthetic monitoring, allowing the procedure to remain safely within the local anaesthesia framework. This could simplify logistics, improve patient turnover, and expand access to MISTs in outpatient or ambulatory settings. The immersive and hypnotic properties of HypnoVR®—combining visual, auditory, and guided breathing stimuli—appear to create a state of focused relaxation that counteracts procedural discomfort and anxiety, enabling patients to tolerate treatment with minimal pharmacologic support.

These results align with an expanding body of literature demonstrating the benefits of virtual reality for pain and anxiety management in urology and other surgical fields. Early evidence showed that VR distraction could significantly reduce pain and distress during cystoscopy.[15–18] Similarly, randomized trials confirmed the positive impact of VR in transrectal prostate biopsy procedures, improving patient comfort and lowering anxiety scores.[19–21] Dings et al.[22] reported analogous findings in vasectomy, demonstrating that video or VR glasses effectively alleviated procedure-related discomfort. More recently, studies focusing on HypnoVR® specifically have highlighted its utility in functional urological surgery under local anesthesia and in extracorporeal shockwave lithotripsy, reporting high patient satisfaction and reduced stress perception.[14,23] A recent review by Perucchini et al.[24] concluded that VR constitutes a safe, well-tolerated adjunct to anesthesia during urological procedures, capable of enhancing patient experience while minimizing sedation requirements. Our findings extend these observations to the field of MISTs for BPH, supporting the hypothesis that VRD integration may improve tolerance and streamline these outpatient interventions.

The potential mechanisms underlying VRD's anxiolytic and analgesic effects are multifactorial. Immersive visual and auditory stimuli can divert patients' attention away from procedural sensations, engaging cortical areas responsible for emotion and perception rather than pain processing. In addition, guided breathing and hypnotic voice components may activate parasympathetic pathways, promoting calmness and reducing stress-related sympathetic activation. This dual distraction–relaxation model has been proposed to explain the observed reductions in both subjective pain and objective physiological stress markers.[11,12] Within the context of MISTs, these effects are particularly advantageous, as patients remain awake and aware throughout the procedure. Reducing stress perception not only enhances comfort but may also reduce involuntary movements, supporting optimal device placement and procedural precision.

The use of virtual reality during prostate biopsy is consistently associated with significant reductions in procedural anxiety and a decreased need for sedative medication, while pain scores often remain unchanged or only modestly reduced. These findings, confirming our results, suggest that the main benefit of VR lies in its anxiolytic effect rather than direct analgesia, improving patient comfort and tolerance of the procedure and allowing biopsies to be performed with less or no sedation, without compromising pain control.[25]

The adoption of VRDs, such as HypnoVR®, could also help refine patient pathways in office-based urology. By minimizing the need for sedatives, VRD-assisted MISTs can be safely managed with simpler postoperative monitoring and faster discharge. This aligns with the broader healthcare trend toward ambulatory surgery, where patient safety, satisfaction, and operational efficiency are all key metrics of success. In this study, the use of VRD did not prolong surgical duration or hospital stay, indicating that its integration into the operative workflow is practical and does not interfere with efficiency. Furthermore, the absence of adverse events reinforces its safety profile, providing reassurance to clinicians regarding its implementation in routine clinical practice.

Despite these promising findings, certain limitations should be acknowledged. The main limitation of this study is the relatively small sample size, particularly in the VRD group, which may limit the statistical power to detect subtle differences in pain or postoperative recovery variables. The non-randomized case–control design inherently introduces selection bias, as the decision to use VRD was driven by device availability and patient preference. While this reflects real-world clinical practice, it nonetheless substantially limits causal inference and the ability to draw definitive conclusions regarding treatment effects. A higher proportion of iTIND procedures was observed in the VRD group. Because of the small sample size, we were unable to perform stratified analyses by MIST type or adjust for IV sedation requirements, which may represent a confounding factor in our conclusions. Although baseline characteristics were similar between groups, unmeasured factors such as preoperative anxiety levels could have influenced outcomes. Furthermore, subjective measures such as the visual analog scale are inherently variable and may not fully capture the multidimensional nature of pain and anxiety. Another limitation is the absence of standardized anxiety assessment tools (e.g., STAI, APAIS). Since the primary mechanism of VR-based

hypnosis is expected to be anxiolysis rather than pure analgesia, the lack of validated anxiety measures limits both a detailed assessment of the psychological benefits of VRD and the ability to mechanistically interpret the observed reduction in sedation. Finally, the study did not evaluate long-term outcomes, cost-effectiveness, or patient-reported satisfaction in a structured manner. Future randomized controlled trials involving larger cohorts and standardized psychometric evaluations are warranted to confirm these findings, investigate more appropriately the effectiveness of the device in reducing pain, and clarify which patient subgroups would benefit most from VR-assisted anaesthesia.

Conclusions

In conclusion, this study demonstrates that integrating a VRD into MISTs for BPH is safe, feasible, and associated with a significant reduction in sedation requirements without compromising pain control or procedural efficiency. The immersive environment provided by VRD supports patient relaxation and comfort, reducing the need for pharmacologic interventions and enhancing tolerance during office-based urological surgery. These results reinforce the growing role of digital technologies in procedural pain management and highlight VRD as a valuable adjunct in achieving patient-centered minimally invasive urological care.

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Author Contributions

The authors confirm their contribution to the paper as follows: study conception and design: Alberto Olivero, Silvia Secco, Sofia Giudici, Alberto Caviglia; data collection: Marco Nizzardo, Alberto Quistini, Andrea Grasso, Erika Palagonia, Marco Colombo, Elio Mazzone, Ofir Maltzman; analysis and interpretation of results: Alberto Olivero, Alberto Caviglia, Stefano Tappero, Paolo Dell'Oglio, Antonio Galfano, Aldo Massimo Bocciardi; draft manuscript preparation: Alberto Olivero, Sofia Giudici, Silvia Secco. All the authors reviewed and approved the final version of the manuscript.

Availability of Data and Materials

Data is available on request from the authors.

Ethics Approval

The study was reviewed by the local ethics committee (Comitato Etico Territoriale Lombardia) and formally deemed exempt from ethical approval because of the anonymous database design.

Informed Consent

All patients provided written informed consent with guarantees of confidentiality.

Conflicts of Interest

The authors declare no conflict of interest.

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