Original Article

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Flexible Cystoscopy Patient Experience: Comparative Effects of Irrigation Techniques on Comfort and Satisfaction

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Abstract

Aim: Flexible cystoscopy under local anesthesia is frequently associated with pain and discomfort, and irrigation delivery may influence patient experience. The aim of this study was to compare three irrigation techniques with respect to pain, patient satisfaction, and willingness to repeat (WtR) during flexible cystoscopy.

Methods: This single-center retrospective comparative cohort study included 283 men who underwent flexible cystoscopy under local anesthesia between October 2023 and June 2024. Patients were allocated to patient-controlled pressurized irrigation with a sphygmomanometer cuff (Group 1, n=73), operator-controlled manual pressurized irrigation (Group 2, n=126), or non-squeeze irrigation (Group 3, n=84). The primary outcome was intraoperative pain assessed by a 0-10 visual analog scale (VAS). Secondary outcomes were postprocedural VAS, WtR (0-10), satisfaction (5-point Likert scale), and complications. Groups were compared using Kruskal-Wallis and chi-square or Fisher's exact tests (two-sided; $p<0.05$).

Results: Age and body mass index were similar across groups. Intraoperative VAS differed significantly across groups (Group 1: 3.07±1.07; Group 2: 3.64±1.26; Group 3: 4.88±1.58; $p<0.001$), with both pressurized techniques associated with less pain than non-squeeze irrigation. Postprocedural VAS scores were also lower with pressurized irrigation (2.63±0.96 and 2.98±1.32 vs. 3.73±1.20; $p<0.001$). Willingness to repeat was highest in Group 2 and lowest in Group 3 (7.79±1.63 vs. 6.71±1.74; $p<0.001$). Satisfaction was higher in the pressurized groups (4.34±0.58 and 4.30±0.68 vs. 3.71±0.84; $p<0.001$). Complication rates were low and comparable (6.8%, 6.3%, and 3.6%; $p=0.610$).

Conclusion: Pressurized irrigation during flexible cystoscopy under local anesthesia was associated with less pain and greater patient satisfaction than non-squeeze irrigation, without an increase in complications. Operator-controlled pressurization showed a modest advantage in WtR.

Keywords: Cystoscopy, pain, patient satisfaction, irrigation, urology

Introduction

Flexible cystoscopy is one of the most frequently performed diagnostic and follow-up procedures in urologic practice, used for bladder cancer surveillance, evaluation of hematuria, and assessment of lower urinary tract symptoms (1). Although it is generally better tolerated than rigid cystoscopy and can be performed under local anesthesia in an office setting, a considerable proportion of patients still report pain or discomfort—most commonly during passage through the external urethral sphincter—which may negatively affect satisfaction and adherence to follow-up (2-5).

Multiple approaches have been investigated to reduce discomfort during cystoscopy, including pharmacological measures (e.g., intraurethral lidocaine gel) and non-pharmacological interventions (6-8). Pre-procedural strategies, such as adequate patient information and

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scheduling (immediate vs. scheduled cystoscopy), may also affect patient-reported pain and anxiety (9). Beyond these, procedural modifications—such as increasing irrigation pressure—have recently been proposed to facilitate urethral passage and reduce pain (10). In a randomized trial, manual bag-squeeze pressurization significantly lowered visual analog scale (VAS) pain scores compared with non-squeeze irrigation (10); however, this method may be operator-dependent and less standardized in routine practice (5,10). Patient-controlled pressurization using a sphygmomanometer cuff could improve standardization and autonomy; however, no study has directly compared patient-controlled pressurization, operator-controlled manual pressurization, and non-squeeze irrigation and simultaneously incorporated patient-centered outcomes such as satisfaction and willingness to repeat (WtR) the procedure.

We hypothesized that pressurized irrigation would be associated with lower pain scores and higher rates of WtR than with non-pressurized irrigation during flexible cystoscopy performed under local anesthesia. Therefore, this study aimed to compare the effects of the three aforementioned irrigation techniques on pain intensity, patient satisfaction, WtR the procedure, and complication rates during flexible cystoscopy under local anesthesia to identify the optimal irrigation strategy.

Materials and Methods

Study Design and Ethical Approval

This single-center, retrospective, comparative cohort study included 283 men who underwent flexible cystoscopy under local anesthesia from October 2023 to June 2024. Ethical approval was obtained from the University of Health Sciences Türkiye, Umraniye Training and Research Hospital Scientific Research Ethics Committee prior to data collection (approval number: 287, date: 30.09.2024). The study was performed in accordance with the principles of the Declaration of Helsinki.

Patient Selection and Grouping

A total of 283 male patients who met the inclusion criteria and underwent flexible cystoscopy under local anesthesia were enrolled in the study. During the eligibility assessment, 21 patients were excluded due to regular analgesic use (n=7), use of psychiatric medication, or analgesic intake within 24 hours before the procedure (n=10) (Figure 1). The reviewed procedures were performed by various urologists, and the irrigation method was chosen according to each operator's preference. Irrigation was performed by manual bag compression by the urologist, by patient-controlled pressurization using a sphygmomanometer cuff, or by non-squeeze irrigation.

Accordingly, patients were divided into three groups:

- Group 1 (n=73): Patient-controlled pressurized irrigation using a sphygmomanometer cuff,
- Group 2 (n=126): Operator-controlled manual pressurized irrigation,
- Group 3 (n=84): Control group- non-squeeze irrigation (gravity-driven flow).

Inclusion Criteria

Patients were included if they:

- were male and aged ≥18 years,
- had no history of neurological disease,
- had not previously undergone cystoscopy under local anesthesia,
- had complete data for intraoperative VAS pain scores and post-procedural VAS and WtR scores.

Exclusion Criteria

The following were excluded from the study:

- regular use of analgesics,
- use of psychiatric medication,
- intake of any analgesic within 24 hours before the procedure.

Procedure

All procedures were performed under local anesthesia following the same clinical protocol. Each examination was conducted using a flexible cystoscope. Before the procedure, all patients received 10 mL of 2% lidocaine gel for intraurethral anesthesia, followed by a 10-minute waiting period. This approach was consistent with current guideline recommendations and standard clinical practice (5,11). Sterile saline was used as the irrigation solution, and the delivery method depended on the assigned group. The procedure time was recorded as the interval from insertion of the cystoscope into the urethra to its withdrawal.

Primary Endpoint: Pain intensity during the procedure (VAS 0-10).

Secondary Endpoints:

- Post-procedural pain (VAS 0-10)
- Willingness to repeat the procedure (WtR, 0-10 scale)
- Patient satisfaction (5-point Likert scale)
- Presence of complications (hematuria, dysuria, postvoid burning)

Demographic and procedural variables such as age, body mass index (BMI), and procedure duration were also recorded for all patients.

Statistical Analysis

Data were analyzed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Normality of continuous variables was assessed using the Kolmogorov-Smirnov test. Continuous variables were presented as median (interquartile range)

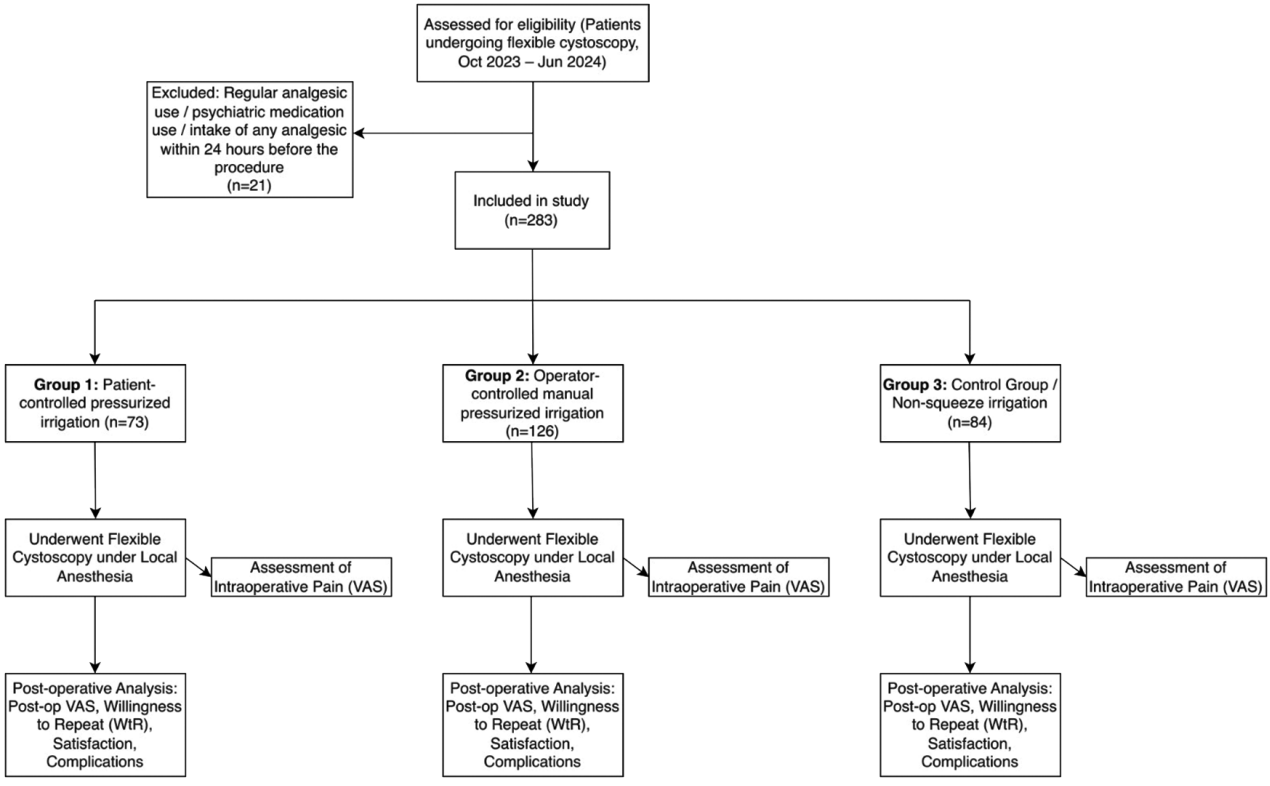

Figure 1. Study flowchart: Comparison of irrigation methods in flexible cystoscopy
VAS: Visual analog scale

or mean ± standard deviation, as appropriate, and were compared among the three groups using the Kruskal-Wallis test. When a significant overall difference was detected, post-hoc pairwise comparisons were performed with Bonferroni-adjusted p-values. Categorical variables are presented as n and compared using the chi-square test or Fisher's exact test, as appropriate. All tests were two-sided, and a p-value <0.05 was considered statistically significant.

Results

Demographic and Clinical Characteristics

Age and BMI were similar across groups (Table 1). Procedure time was longer in the non-squeeze group than in either pressurized group (Group 1 vs. Group 3, p=0.027; Group 2 vs. Group 3, p<0.001), with no difference between the two pressurized groups (Table 1).

Primary Endpoint: Intraoperative Pain

Intraoperative VAS scores differed significantly among the three groups (p<0.001) (Table 2). Post-hoc comparisons showed lower pain scores in both pressurized groups compared with the non-squeeze group (Group 1 vs Group 3, p<0.001; Group 2 vs Group 3, p<0.001), with no difference between Groups 1 and 2 (p=0.235) (Table 2).

Post-Procedural Pain

Post-procedural VAS differed among groups (p<0.001), with no significant difference between the two pressurized groups (p=0.123) (Table 2).

Table 1. Demographic and clinical characteristics

	Group 1 (n=73)	Group 2 (n=126)	Group 3 (n=84)	p-value*
Age, median (IQR)	63 (14)	63 (10)	62 (11)	0.699
BMI (kg/m^2), mean ± SD	26.5±3.1	27.0±3.4	26.2±3.0	0.453
Procedure time (min), median (IQR)	8 (2)	7 (2)	8 (4)	**<0.001**

*Kruskal Wallis test
BMI: Body mass index, SD: Standard deviation, IQR: Interquartile range

Willingness to Repeat the Procedure (WtR)

Willingness to repeat scores differed among groups (p<0.001). Both pressurized groups had higher WtR than the non-squeeze group (Group 2 vs. Group 3, p<0.001; Group 1 vs. Group 3, p=0.016), while Groups 1 and 2 were similar (p=0.743) (Table 2, Figure 2).

Patient Satisfaction

Satisfaction differed among groups (p<0.001).The non-squeeze group reported lower satisfaction than both pressurized groups (each p<0.001), with no difference between Groups 1 and 2 (p=0.999) (Table 2).

Complication Rates

Complication rates were low and comparable across groups (p=0.610; Table 2; Figure 3). No serious adverse events occurred; all complications were mild and transient (temporary hematuria, mild dysuria, or post-void burning).

Discussion

This study is among the first to systematically compare the effects of different irrigation techniques on patient comfort, satisfaction, and safety during flexible cystoscopy under local anesthesia.

Our findings demonstrate that pressurized irrigation methods, whether patient-controlled or operator-controlled, are associated with significantly lower pain scores, higher satisfaction, and greater willingness to undergo repeat procedures than with non-squeeze irrigation. Importantly, complication rates were comparable across the three methods, indicating that pressurized techniques can be safely implemented.

A notable within-study observation was that the irrigation strategy appeared to influence procedural flow and efficiency. Although median procedure times were similar, the distribution differed significantly, with longer and more variable durations in the non-squeeze group. This pattern is consistent with the practical notion that suboptimal flow may impair visualization and necessitate additional maneuvers or intermittent irrigation adjustments, potentially prolonging urethral manipulation. While our retrospective dataset does not allow a formal mediation analysis, the concordant directionality—higher pain, lower satisfaction/WtR, and longer procedure times in the non-squeeze group—supports a plausible mechanical pathway by which improved, steadier irrigation can reduce procedural friction and shorten exposure to discomfort, thereby enhancing overall patient experience.

Pain Management and the Role of Irrigation Pressure

The primary finding of reduced intraoperative pain supports the clinical efficacy of pressurized irrigation. Group 1 (patient-controlled, VAS =3.07) and Group 2 (operator-controlled, VAS =3.64) showed 37-24% lower pain scores

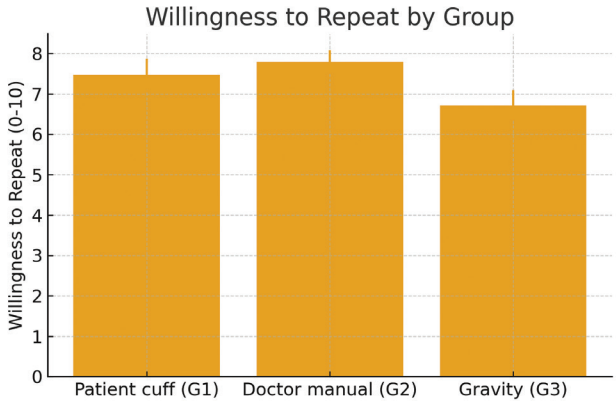

Figure 2. Willingness to repeat scores by group

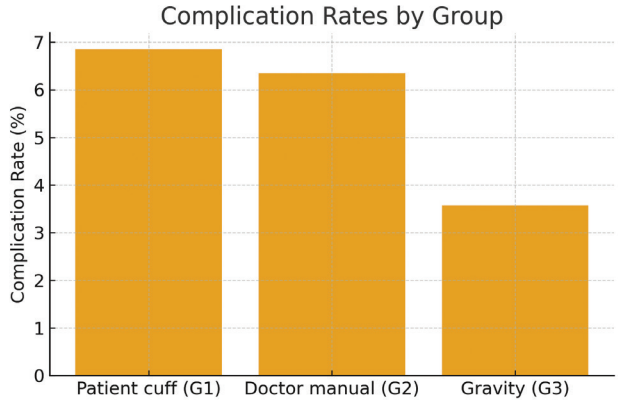

Figure 3. Complication rates by group

Table 2. Outcome measures				
	Group 1 (n=73)	**Group 2 (n=126)**	**Group 3 (n=84)**	**p-value***
VAS (intraoperative)	3.07±1.07	3.64±1.26	4.88±1.58	**<0.001**
VAS (post-procedural)	2.63±0.96	2.98±1.32	3.73±1.20	**<0.001**
WtR (0-10)	7.47±1.78	7.79±1.63	6.71±1.74	**<0.001**
Satisfaction (1-5)	4.34±0.58	4.30±0.68	3.71±0.84	**<0.001**
Complications (%)	6.8	6.3	3.6	0.610

*Kruskal Wallis test, significance values have been adjusted by the Bonferroni correction for multiple tests
VAS: Visual analog scale, WtR: Willingness to repeat

compared with Group 3 (non-squeeze, VAS =4.88). These results are consistent with the randomized controlled trial by Gunendran et al. (10), which reported that manual bag-squeeze irrigation reduced VAS scores from 3 to 1.38. The slightly higher VAS values in our study may be explained by differences in patient demographics, lidocaine dwell times, or operator experience.

The mechanisms by which increased irrigation pressure reduces pain are likely multifactorial. Physiologically, elevated pressure increases bladder hydrodistention and widens the urethra (12).

This expansion minimizes mucosal contact during scope advancement, particularly at the external urethral sphincter, the narrowest and most sensitive region of the urethra (3,13). Taghizadeh et al. (3) showed that up to 70% of pain during cystoscopy occurs as the scope passes through the membranous urethra. Therefore, reducing resistance at this critical segment can substantially improve overall procedural comfort.

From a physical standpoint, Chang et al. (12) emphasized the importance of independently controlling irrigation pressure and flow rate in endoscopic systems. The authors proposed that controlled-pressure systems be considered an alternative for cystoscopy. Our results provide clinical evidence supporting this view, confirming that both patient- and operator-controlled pressurizations are effective.

Patient-controlled vs. Operator-controlled Pressurization

There was no significant difference in pain scores between patient-controlled and operator-controlled groups (p=0.235), indicating no detectable difference in analgesic efficacy; however, this does not establish equivalence. Although not statistically significant, WtR was slightly higher in the operator-controlled group (7.79 vs. 7.47; p=0.743). This may be due to the operator's ability to maintain more consistent, flow-optimized pressure throughout the procedure.

From an implementation perspective, the absence of a significant pain difference between patient- versus operator-controlled pressurization suggests that the key determinant is achieving adequate and sustained irrigation performance rather than who applies the pressure. Accordingly, centers may select the approach that best fits their workflow: patient-controlled pressurization may be attractive in resource-constrained settings by preserving staff time and enhancing perceived patient control, whereas operator-controlled pressurization may facilitate more consistent titration across procedural phases. The modest, not statistically significant, numerical advantage in WtR observed under operator control may reflect greater stability of flow and pressure during critical transitions (e.g., passage through the external sphincter). Prospective studies could standardize and objectively record pressure profiles to clarify whether consistency of pressurization—rather than peak pressure—best explains the patient-centered benefits observed in our cohort. It is also important to avoid over-interpreting the lack of statistical difference between the two pressurized strategies as "true equivalence." Our analysis was not designed as an equivalence or non-inferiority comparison, and adjustment for multiple testing may have reduced the sensitivity for detecting small differences between techniques. Therefore, the most conservative interpretation is that both approaches yield broadly comparable patient-reported comfort in routine practice, while any incremental differences—if present—are likely modest and dependent on how consistently pressure and flow are maintained. Prospective studies with prespecified equivalence margins and objective pressure profiling would be needed to determine whether small differences carry practical relevance.

The patient-controlled technique offers distinct advantages, including enhanced autonomy, psychological reassurance through perceived control (14), and no need for additional personnel. However, individual variations in pain thresholds and anxiety levels may lead to inconsistent applied pressure, thereby limiting standardization. Indeed, Armany et al. (15) proposed using standardized pressure bags (350 mmHg) to minimize such variability.

Conversely, the operator-controlled method allows experienced clinicians to modulate pressure dynamically across procedural stages (e.g., urethral entry, bulbar, prostatic, and bladder neck passages). This adaptability may optimize both visualization and comfort. Nevertheless, as Gunendran et al. (10) noted, manual pressurization introduces inter- and intra-operator variability.

Patient Satisfaction and Willingness to Repeat

Patient satisfaction and WtR are increasingly recognized as key indicators of quality in patient-centered care. In our study, satisfaction scores were high in both pressurized irrigation groups (4.34 and 4.30 out of 5), consistent with prior research (16,17). The lower satisfaction score in the non-squeeze group (3.71) may reflect its higher pain levels and slightly longer procedure times.

Willingness to repeat is particularly relevant in long-term surveillance settings, such as bladder cancer follow-up. Koo et al. (18) highlighted the psychological burden of repeated cystoscopy and its negative impact on compliance. The higher WtR scores observed in our pressurized groups (7.47 and 7.79 out of 10) suggest that these methods may enhance long-term adherence to surveillance protocols.

Similarly, Casteleijn et al. (19) reported that pain during cystoscopy reduces female patients' willingness to return

for future procedures. Our results reinforce the notion that effective pain control improves not only immediate comfort but also future compliance.

Safety Profile and Complications

Complication rates were similar among groups (3.6-6.8%; p=0.610), supporting the safety of pressurized irrigation. All reported events (temporary hematuria, mild dysuria, and post-void burning) were minor and self-limited (20,21).

Theoretically, increased irrigation pressure could pose risks, such as upper urinary tract reflux, bladder perforation, or infection (22,23). However, no serious complications were observed in our series.

Jung and Osther (24) demonstrated that controlled irrigation during flexible ureteroscopy remains within safe pressure thresholds. Given the bladder's larger capacity and urethral valvular mechanisms, it is likely more tolerant of transient pressure elevations compared with the upper urinary tract.

Local Anesthesia and Multimodal Analgesia

All patients received 10 mL of 2% lidocaine gel with a 10-minute dwell time. Although lidocaine gel is widely used, the efficacy of lidocaine gel remains controversial. A meta-analysis by Patel et al. (7) found a statistically significant but clinically minimal benefit compared with that of plain lubricant gel (mean VAS reduction =0.6). Razdan et al. (25) further reported that cooled lidocaine gel (4 °C) improved patient satisfaction.

Our design specifically assessed the additive analgesic effect of irrigation pressure in addition to standard lidocaine anesthesia, aligning with the principles of multimodal pain control. As Xie et al. (13) suggested, combining different analgesic modalities may provide synergistic benefits. Future studies should compare different lidocaine concentrations, dwell times, and combinations of pressurized irrigation techniques.

Non-Pharmacological Approaches

Beyond irrigation pressure, several non-pharmacological methods have been evaluated for cystoscopy-related pain reduction. Several studies have reported that allowing patients to watch the procedure on a monitor reduced patients' discomfort (6,26,27), although Koenig et al. (28) failed to confirm this finding. Distraction techniques, such as listening to music (29-31) or using stress balls (32), show mixed efficacy. However, music may shift attention by recruiting the cingulo-frontal cortex, periaqueductal gray, and posterior thalamus (31).

Unlike these approaches, pressurized irrigation acts through direct physiological mechanisms rather than psychological ones, and its efficacy is therefore less influenced by factors such as anxiety, education, or cultural background. Nevertheless, integrating psychological support or distraction techniques into a multimodal protocol may yield synergistic benefits.

Clinical Implications and Cost-effectiveness

Both pressurized irrigation methods are simple, low-cost, and easy to implement. The patient-controlled technique is labor-efficient, requires no additional personnel, and can be applied with a standard blood pressure cuff or an inexpensive pressure bag. In Armany et al.'s (15) protocol, Infu-Surg standard-pressure infusion bags were shown to be cost-effective and widely available.

The operator-controlled technique typically requires a second staff member (physician, nurse, or technician), but this is already standard practice in most endoscopy units. Overall, the minimal additional cost of pressurized irrigation is likely offset by higher patient satisfaction and potentially reduced complication-related expenses.

Study Limitations

Certain limitations should be acknowledged. Due to its retrospective design, randomization was not possible, introducing a potential selection bias. However, the groups were demographically and clinically comparable, minimizing this risk. Second, the single-center design may limit external validity. Third, irrigation pressure in the operator-controlled group was not objectively measured, and future studies using pressure sensors could standardize this variable. Fourth, pain was assessed using a VAS, a subjective measure influenced by psychological and cultural factors (33,34). Nevertheless, VAS remains the most widely validated tool for cystoscopy-related pain assessment. Lastly, the inclusion of only male patients limits generalizability, as anatomical differences may influence irrigation effects in females. Despite these limitations, this study provides real-world comparative data from a relatively large cohort and evaluates clinically relevant patient-centered outcomes (pain, satisfaction, and WtR) using standardized measures, while reporting low complication rates across all techniques.

Future Directions

Validation through prospective randomized controlled trials. Dose-response studies should be conducted to determine the optimal irrigation pressure, including validation of the proposed 350 mmHg level (10). Evaluation of combinations of pressurized irrigation with pharmacologic and non-pharmacologic analgesic methods. Replication in female cohorts to assess anatomical influences. Assessment of long-term outcomes, such as pain perception and compliance in repeated cystoscopies. Cost-effectiveness analyses identify economically optimal strategies. Comparative evaluations from the operator's perspective included visualization quality and procedural

ease. Investigation of specific patient subgroups (elderly, BPH, urethral stricture) to determine tailored safety and efficacy profiles.

Conclusion

This study demonstrates that pressurized irrigation techniques, whether patient- or operator-controlled, significantly reduce pain and improve satisfaction compared with non-squeeze (gravity-driven) irrigation during flexible cystoscopy under local anesthesia. Both methods exhibit comparable efficacy and safety, with the operator-controlled approach showing a slight advantage in WtR.

These results suggest that integrating pressurized irrigation into routine flexible cystoscopy practice may enhance patient-centered outcomes. The patient-controlled technique, offering autonomy and requiring no additional personnel, presents a practical advantage for clinical implementation. However, prospective randomized studies are warranted to confirm these findings and to determine optimal pressure parameters for routine use.

Ethics

Ethics Committee Approval: Ethical approval was obtained from the University of Health Sciences Türkiye, Umraniye Training and Research Hospital Scientific Research Ethics Committee prior to data collection (approval number: 287, date: 30.09.2024).

Informed Consent: Written consent was obtained from all participants.

Footnotes

Authorship Contributions

Surgical and Medical Practices: A.I., R.S., E.V.K., Concept: M.B., H.S.G., A.T., Design: M.B., A.T., Data Collection or Processing: R.S., M.U.E., E.V.K., Analysis or Interpretation: A.I., M.U.E., Literature Search: M.B., H.S.G., Writing: M.B., H.S.G.

Conflict of interests: The authors declare that they have no conflict of interest related to this study.

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