UROLOGIA COLOMBIANA

PERMANYER

Check for updates

ORIGINAL ARTICLE

In vitro investigation of the optimal hydrogen peroxide dosage for bladder clots evacuation

Investigación in vitro sobre la dosis óptima de peróxido de hidrógeno para la evacuación de coágulos vesicales

Albert Ciam, Tjahjodjati Romdan, and Zola Wijayanti*

Department of Surgery, Division of Urology, Universitas Padjadjaran; Department of Surgery, Division of Urology, Hasan Sadikin Hospital. Bandung, West Java Indonesia

How to cite this article: Ciam A. et al. *In vitro* investigation of the optimal hydrogen peroxide dosage for bladder clots evacuation. Urol. Colomb. 2026;35(1):21-28. doi: 10.24875/RUC.25000019

Abstract

Objective: *Bladder clot retention after hematuria is a urological emergency. Traditional washout often fails, requiring endoscopic evacuation under general anesthesia - often inaccessible in remote or critical care settings. This study aimed to determine the optimal dose and dwell time of hydrogen peroxide (H_2O_2) for enhancing clot evacuation.* **Method***: In this in vitro study, 24 bladder clot models using 100 g of human blood were randomized into six groups and treated with 0.15%, 0.30%, or 0.60% H_2O_2 or saline. Each model used a 750-mL transparent urinary bag with an 18 Fr Foley catheter. Instillations lasted 30 or 60 s and were repeated until clot clearance. Parameters measured included procedure difficulty, attempts, duration, and fluid volume.* **Results***: All H_2O_2 concentrations improved clot removal. The 0.30% group significantly reduced time and difficulty versus 0.15% ($p < 0.05$). Extending dwell time to 60 s did not enhance outcomes and prolonged the procedure. Although 0.60% was effective, it offered no significant advantage over 0.30%.* **Conclusions***: Instilling 0.30% H_2O_2 for 30 s appears most effective for clot evacuation. Further in vivo studies are recommended.*

Keywords: *Bladder clot. Bladder instillation. Hydrogen peroxide.*

Resumen

Objetivo: *La retención de coágulos vesicales tras hematuria es una emergencia urológica. El lavado tradicional suele fallar, requiriendo evacuación endoscópica bajo anestesia general, a menudo inaccesible en entornos remotos o críticos. Este estudio evaluó la dosis y tiempo óptimos de peróxido de hidrógeno (H_2O_2) para mejorar la evacuación de coágulos.* **Método:** *En este estudio in vitro, se utilizaron 24 modelos de coágulo vesical con 100 g de sangre humana, aleatorizados en seis grupos y tratados con H_2O_2 al 0,15%, 0,30% o 0,60%, o solución salina. Cada modelo empleó una bolsa urinaria transparente de 750 mL con un catéter Foley 18 Fr. Las instilaciones se aplicaron por 30 o 60 segundos y se repitieron hasta la eliminación del coágulo. Se evaluaron dificultad, intentos, duración y volumen utilizado.* **Resultados:** *Todas las concentraciones de H_2O_2 facilitaron la evacuación. El 0,30% redujo significativamente el tiempo y la dificultad en comparación con el 0,15% ($p < 0.05$). Prolongar a 60 segundos no mejoró la eficacia. Aunque el 0,60% fue efectivo, no mostró ventaja significativa sobre el 0,30%.* **Conclusiones:** *La instilación de H_2O_2 al 0,30% durante 30 segundos es la estrategia más eficaz. Se recomiendan estudios in vivo adicionales.*

Palabras clave: *Coágulo vesical. Instilación vesical. Peróxido de hidrógeno.*

***Correspondence:**
Albert Ciam
E-mail: albert12002@mail.unpad.ac.id

Date of reception: 22-04-2025
Date of acceptance: 02-10-2025
DOI: 10.24875/RUC.25000019

Available online: 11-03-2026
Urol. Colomb. 2026;35(1):21-28
www.urologiacolombiana.com

Introduction

Clot retention within the bladder following episodes of significant hematuria constitutes a critical urological emergency[1]. Conventional management strategies involve continuous bladder irrigation with 0.9% (normal saline). However, this traditional approach frequently demonstrates limited effectiveness, often necessitating prolonged and labor-intensive efforts to achieve complete clot evacuation.

Occasionally, in a tenacious and chronic blood clot, intervention with cystoscopy is required for blood clot evacuation in the operating room (OR). Evacuation with an Ellick evacuator or a Toomey syringe has a risk of bladder rupture due to the addition of positive pressure during evacuation in an overdistended bladder[2,3]. Surgical options are also challenging for patients in rural areas with difficult transportation access to main hospitals, in pediatric patients with small urethral calibres, and in those who are not eligible for general anesthesia or spinal anesthesia[4].

Several methods have been modified to prevent open suprapubic clot evacuation and allow conducting in a bedsit with local anesthesia. One of them is intravesical agents and changes in flushing fluid elements such as anti-thrombolytic agents, hydrogen peroxide, chymotrypsin[5,6]. The most frequently used intravesical agent in bladder clot management was hydrogen peroxide, which was first introduced by Warlick et al. The mechanism of hydrogen peroxide remained unclear, but some theories include the inhibition of adenosine phosphate and the oxidizing effect[7]. Until now, there is no standard regimen, with various dosages of hydrogen peroxide varying in several studies.

Unavailable data regarding effective dosage and duration of hydrogen peroxide instillation have been a concern in use for clinical settings. Although no complications have been reported in various studies regarding this method, several studies have reported reactive oxygen species, such as induces chronic cystitis, especially in long-term duration (> 30 min) and harmful complications in animal model[2,7-10].

Hydrogen peroxide offers multiple clinical benefits in bladder clot management. Its application assists in achieving hemostasis during active hemorrhage while simultaneously improving endoscopic visualization of the bladder lumen[2,7]. The solution effectively reduces the cohesive strength of retained clots, making them more amenable to removal[2,7]. This property proves particularly valuable when conventional manual irrigation becomes excessively prolonged or physically demanding for clinicians. Furthermore, as an inexpensive and readily available agent, hydrogen peroxide presents a practical solution for routine clinical use. The current investigation was designed to systematically evaluate the thrombolytic effectiveness of hydrogen peroxide by testing different concentrations and exposure times using an *in vitro* model simulating urinary clot retention.

Materials and methods

In vitro bladder models

This study follows the methods used by Ritch et al. For this experimental investigation, we used an *in vitro* bladder simulation system utilizing a 750 mL transparent urinary drainage leg bag (OneMed, Indonesia, Fig. 1)[11]. The model incorporated a 3-way 24 French Foley catheter (OneMed, Indonesia) connected to the drainage port to replicate clinical conditions. A fresh 100 mL of unpreserved healthy human blood was obtained using an intravenous catheter, which was then connected directly to the urine bag. The blood is stored at room temperature for 24 h to facilitate clot formation. After the clot formation is observed, we proceed to the irrigation procedure.

Procedures

Each batch of the experiment was carried out 4 times to achieve consistent results using Federer's Formula, with a total of 30 models divided into six different groups. The experiment was done utilizing three different concentrations of hydrogen peroxide and one control using normal saline. Dilution of 3% hydrogen peroxide in normal saline is necessary to achieve 0.6%, 0.3%, and 0.15% concentration. The irrigation was done in cycles using 50 mL of irrigation fluid and indwelled for 30 s or 60 s before being pulled back using a 50 mL syringe. The maximum duration of irrigation time was 10 min for each experiment. The number of cycles given to reach a significant loss of clot volume was observed, and the percentage of clot removed was noted. The procedures were done single-blinded without the participant knowing the concentration of the solution.

Primary outcomes were the degree of difficulty, total number of instillations, and total volume of irrigant used. The secondary outcome was the percentage of clots removed. Data analysis the difficulty level of irrigation was numerically standardized and compared across models as follows[11]: (1) No difficulty – complete clot removal was achieved immediately without resistance;

Table 1. Differences in the degree of difficulty, total time, total cycle, and time per cycle between groups

Intervention group	Degree of difficulty	Total time (seconds)	Total cycle (times)	Time per cycle (seconds)
Pure saline water 0.9%	5.00 ± 0.00 5.00 (5.00-5.00)	692.50 ± 20.62 690.00 (670.00-720.00)	10.00 ± 0.00 10.00 (10.00-10.00)	69.25 ± 2.06 69.00 (67.00-72.00)
H_2O_2 0.15% (indwelling 30 s)	4.25 ± 0.50 4.00 (4.00-5.00)	228.50 ± 23.69 228.00 (200.00-258.00)	5.75 ± 0.50 6.00 (5.00-6.00)	39.75 ± 2.36 39.00 (38.00-43.00)
H_2O_2 0.15% (indwelling 60 s	3.50 ± 0.58 3.50 (3.00-4.00)	303.00 ± 46.54 285.00 (270.00-372.00)	5.25 ± 0.50 5.00 (5.00-6.00)	57.50 ± 3.32 57.00 (54.00-62.00)
H_2O_2 0.30% (indwelling 30 s)	2.75 ± 0.96 2.50 (2.00-4.00)	134.5 ± 32.72 128.00 (102.00-180.00)	3.75 ± 0.50 4.00 (3.00-4.00)	35.75 ± 6.24 33.00 (32.00-45.00)
H_2O_2 0.30% (indwelling 60 s)	3.50 ± 1.00 3.00 (3.00-5.00)	177.00 ± 40.97 174.00 (130.00-230.00)	4.50 ± 0.58 4.50 (4.00-5.00)	39.20 ± 6.57 39.15 (32.50-46.00)
H_2O_2 0.60% (indwelling 30 s)	3.25 ± 0.50 3.00 (3.00-4.00)	147.25 ± 25.22 135.25 (133.50-185.00)	3.75 ± 0.96 3.50 (3.00-5.00)	40.14 ± 5.92 40.75 (33.38-45.67)
p value*	0.018	0.001	0.003	0.005

*Kruskal-Wallis.

(2) minimal difficulty – all clots were removed with minimal resistance; (3) moderate difficulty – partial clot removal was possible with slight resistance; (4) significant difficulty – only some clots could be removed, encountering moderate resistance; and (5) severe difficulty – clots could not be fully removed due to an inability to evacuate them through the catheter.

Statistical analysis

The procedural outcomes were recorded in tabular format using Microsoft Excel and analyzed with the Statistical Package for Social Sciences version 26. Continuous variables were expressed as mean ± standard deviation and median (range). Statistical comparisons were conducted using non-parametric methods, specifically the Kruskal-Wallis test, followed by the Mann-Whitney U test for *post hoc* analysis. A $p < 0.05$ was considered statistically significant.

Results

In this study, different concentrations of hydrogen peroxide (H_2O_2) (0.15%, 0.30%, and 0.60%) were used as an irrigation agent for blood clot evacuation in bladder models. The instillation time varied between 30 s and 60 s before the evacuation procedure was attempted. The detailed results are presented in table 1.

The use of H_2O_2 demonstrated superior effectiveness in removing blood clots compared to 0.9% normal saline (Fig. 2). This was evident in the significantly shorter total procedure time, fewer irrigation cycles, and reduced difficulty of clot evacuation in the H_2O_2 groups (Tables 2-5).

Among the tested concentrations, H_2O_2 at 0.15% and 0.30% yield better results than the control, with H_2O_2 at 0.30% at a 30s dwell time yielding the most optimal results, with an average total time of 134.5 ± 32.72 s and 3.75 ± 0.50 irrigation cycles. In addition, this group exhibited the lowest procedural difficulty compared to the other groups.

Increasing the dwell time to 60 s at the same concentration did not result in a significant improvement in clot evacuation efficiency. Similarly, while higher H_2O_2 concentrations (0.60%) enhanced clot removal compared to control, they did not substantially reduce procedural difficulty compared to lower concentrations.

Overall, compared to pure saline irrigation, H_2O_2-assisted irrigation significantly reduced procedure time, the number of irrigation cycles, and the difficulty of blood clot evacuation, with the most effective outcome observed at a 0.30% concentration with a 30s dwell time.

Discussion

The process of hemostasis and blood clot formation in the bladder serves as a crucial physiological defense mechanism. When endothelial cells are injured, they trigger the activation of prothrombin, which is then converted into thrombin. This leads to the transformation of fibrinogen into fibrin, which binds platelets, red blood cells, and

Table 2. Comparison of the degree of difficulty between groups

Study group	Pure saline water 0.9%	H_2O_2 0.15% (indwelling 30 s)	H_2O_2 0.15% (indwelling 60 s)	H_2O_2 0.30% (indwelling 30 s)	H_2O_2 0.30% (indwelling 60 s)	H_2O_2 0.60% (indwelling 30 s)
Pure saline water 0.9%	-	**0.040**	**0.013**	**0.013**	**0.040**	**0.011**
H_2O_2 0.15% (indwelling 30 s)	-	-	0.096	**0.044**	0.169	**0.040**
H_2O_2 0.15% (indwelling 60 s)	-	-	-	0.222	0.739	0.495
H_2O_2 0.30% (indwelling 30 s)	-	-	-	-	0.278	0.350
H_2O_2 0.30% (indwelling 60 s)	-	-	-	-	-	0.850
H_2O_2 0.60% (indwelling 30 s)	-	-	-	-	-	-

Bold: significant results.

Table 3. Comparison of total times (seconds) between groups

Study group	Pure saline water 0.9%	H_2O_2 0.15% (indwelling 30 s)	H_2O_2 0.15% (indwelling 60 s)	H_2O_2 0.30% (indwelling 30 s)	H_2O_2 0.30% (indwelling 60 s)	H_2O_2 0.60% (indwelling 30 s)
Pure saline water 0.9%	-	**0.019**	**0.019**	**0.019**	**0.019**	**0.019**
H_2O_2 0.15% (indwelling 30 s)	-	-	**0.019**	**0.019**	0.144	**0.019**
H_2O_2 0.15% (indwelling 60 s)	-	-	-	**0.019**	**0.019**	**0.019**
H_2O_2 0.30% (indwelling 30 s)	-	-	-	-	0.144	0.144
H_2O_2 0.30% (indwelling 60 s)	-	-	-	-	-	0.559
H_2O_2 0.60% (indwelling 30 s)	-	-	-	-	-	-

Bold: significant results.

Table 4. Comparison of total cycles (times) between groups

Study group	Pure saline water 0.9%	H_2O_2 0.15% (indwelling 30 s)	H_2O_2 0.15% (indwelling 60 s)	H_2O_2 0.30% (indwelling 30 s)	H_2O_2 0.30% (indwelling 60 s)	H_2O_2 0.60% (indwelling 30 s)
Pure saline water 0.9%	-	**0.011**	**0.011**	**0.011**	**0.013**	**0.013**
H_2O_2 0.15% (indwelling 30 s)	-	-	0.186	**0.015**	**0.032**	**0.025**
H_2O_2 0.15% (indwelling 60 s)	-	-	-	**0.015**	0.096	**0.044**
H_2O_2 0.30% (indwelling 30 s)	-	-	-	-	0.096	0.874
H_2O_2 0.30% (indwelling 60 s)	-	-	-	-	-	0.222
H_2O_2 0.60% (indwelling 30 s)	-	-	-	-	-	-

Bold: significant results.

plasma together, forming blood clots. These clots develop when their formation surpasses the ability of urokinase in urine to dissolve them[9]. Currently, there are no established guidelines for managing bladder blood clots in either pediatric or adult patients. Several factors influence the success of manual irrigation, including the type and size of the catheter and the technique used for catheter manipulation. However, manual irrigation is often inefficient, time-consuming, and physically demanding due to the strong adhesive nature of blood clots.

Several methods have been modified to prevent open suprapubic clot evacuation and allow conducting bedside

Table 5. Comparison of times per cycle (seconds) between groups

Study group	Pure saline water 0.9%	H_2O_2 0.15% (indwelling 30 s)	H_2O_2 0.15% (indwelling 60 s)	H_2O_2 0.30% (indwelling 30 s)	H_2O_2 0.30% (indwelling 60 s)	H_2O_2 0.60% (indwelling 30 s)
Pure saline water 0.9%	-	**0.019**	**0.019**	**0.019**	**0.020**	**0.020**
H_2O_2 0.15% (indwelling 30 s)	-	-	**0.019**	0.243	1.000	1.000
H_2O_2 0.15% (indwelling 60 s)	-	-	-	**0.019**	**0.020**	**0.020**
H_2O_2 0.30% (indwelling 30 s)	-	-	-	-	0.245	0.245
H_2O_2 0.30% (indwelling 60 s)	-	-	-	-	-	0.773
H_2O_2 0.60% (indwelling 30 s)	-	-	-	-	-	-

Bold: significant results.

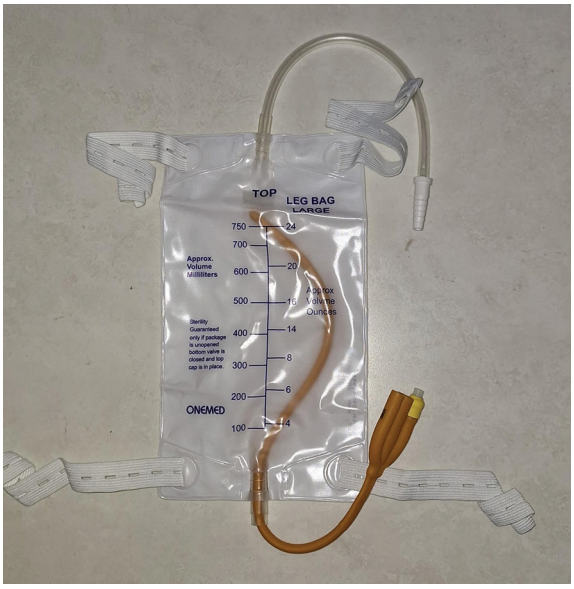

Figure 1. Urine leg bag with the volume of 750 cc and a 20 Fr 3-way Foley Catheter.

with local anesthesia, and have proved to be safe and efficient. Intravesical agents appear to be promising management in chronic bladder clots that can be conducted in bedside settings. Intravesical agents in bladder clot are also beneficial, especially in children, geriatric patients with high comorbidity, and traumatic patients who have difficulty with transurethral instrumentation and anesthesia considerations. Blood clot management agents with the lowest cost, minimal side effects, and availability of substances that could be repeated in multiple cycles with a high success rate have been considered when selecting the best intravesical agent. Despite no reported systemic adverse events, there is limited information regarding the relative safety of intravesical agents due to minimal and inadequate studies[4].

The most frequently used intravesical agent in bladder clot management was hydrogen peroxide, which was first introduced by Warlick et al in the two case series in urological procedures[7]. Kalloo et al. previously reported that the instillation of 3% hydrogen peroxide (H_2O_2) significantly enhanced gastroscopic visualization in both animal and human studies. This improvement was achieved by modifying the properties of blood clots, making them less adherent, more translucent, and easier to remove[11,12]. The mechanism of hydrogen peroxide remained unclear, but some theories include the inhibition of adenosine phosphate and the oxidizing effect[7]. The efficacy of hydrogen peroxide (H_2O_2) in bladder clot evacuation observed in our study aligns with the mechanistic insights provided by Jessop et al., who demonstrated that H_2O_2 induces fibrinolysis in a concentration- and time-dependent manner[13]. Their *in vitro* experiments revealed that H_2O_2 increases fibrin fiber length and diameter while reducing branch point density, resulting in larger pore sizes and a more porous clot structure. These structural changes, driven by oxidative disruption of fibrin cross-linking, weaken the clot's adhesive properties and facilitate its disintegration – a process that correlates with our findings that 0.30% H_2O_2 at a 30 s dwell time optimally balances efficacy and procedural efficiency. Notably, Jessop et al. reported that higher H_2O_2 concentrations (e.g., 3-10%) accelerated fibrinolysis but also emphasized that prolonged exposure (> 30 min) risks tissue toxicity. This mirrors our observation that increasing the concentration to 0.60% or extending dwell time to 60 s did not significantly enhance clot removal compared to 0.30% H_2O_2, suggesting a threshold for clinical utility. The time-dependent effect was further underscored by

Figure 2. Complete evacuation of the blood clot.

their finding that fibrinolysis peaked after 75-90 min *in vitro*, whereas our shorter indwelling times (30-60 s) achieved practical clot evacuation, likely due to the mechanical synergy of irrigation. Together, these studies highlight that low-concentration H_2O_2 with brief dwell times (e.g., 0.30% for 30 s) maximizes fibrinolysis while minimizing potential oxidative damage to the urothelium. Until now, there is no standard regimen with various dosages of hydrogen peroxide used in several studies. Low concentrations of 0.3% and 0.15% hydrogen peroxide mixed with saline solution have been described in a limited number of studies with various indwelling times and total cycle[2,7-9,14].

There are several case reports and case series regarding this topic; however, a bigger population-based study is still limited, as there was only one study in 2020 by Xu et al. involving 31 patients[8]. A bladder irrigation solution was prepared by diluting 3% hydrogen peroxide in a 1:5 ratio with 0.9% normal saline. This solution was introduced into the bladder through a 20-Fr three-way Foley catheter in volumes of 30-50 mL, retained for 3-5 min, and then evacuated. The study demonstrated that using 0.6% hydrogen peroxide over four irrigation cycles significantly improved blood clot removal. Large clots are fragmented into smaller pieces, increasing the efficiency of manual bladder washout over time.

In 2023, Stride et al. reported a case in which a similar 3% hydrogen peroxide solution, diluted in a 1:5 ratio with normal saline, was used[9]. The mixture was instilled via a 20-Fr three-way Foley catheter, retained for 3 min, and then aspirated, with the process repeated for four cycles. After the fourth cycle, the patient experienced abdominal discomfort. An abdominal ultrasound showed a reduction in clot size, and no procedure-related complications were reported[9].

Increasing the concentration of hydrogen peroxide led to a proportional reduction in the number of irrigation cycles required. However, no significant differences were noted in the difficulty of irrigation or the volume of irrigant used. This suggests that in cases of clot retention, combining intravesical hydrogen peroxide instillation with irrigation may be more effective than using sterile water alone. In addition, hydrogen peroxide-assisted manual irrigation could help minimize the need for operative intervention in the cystoscopic suite, potentially reducing associated morbidity.

The use of hydrogen peroxide provides several benefits, including enhancing hemostasis in cases of active bleeding, improving bladder visualization, reducing the adhesive nature of bladder blood clots, and facilitating clot disruption when manual irrigation is inefficient and labor-intensive. In addition, hydrogen peroxide is inexpensive and readily available for daily use[2,8,13,15,16]. Minimizing the need for cystoscopic clot evacuation could potentially avoid a costly and risky emergent trip to the OR if hydrogen peroxide is used to facilitate irrigation. Under Indonesia's current National Health coverage, the cost of OR time for cystoscopy and clot evacuation ranges from approximately $500 to $700. In contrast, the cost of 50 mL of hydrogen peroxide is < $1, highlighting a significant cost difference between

surgical intervention and hydrogen peroxide-assisted irrigation.

Despite all of the advantages, hydrogen peroxide can cause vasoconstriction, thrombus formation from platelet aggregation, free diffusion through vessel walls, and its conversion to water and oxygen to the creation of intraluminal bubbles, which leads to microembolism, thermal injury, and arteriolar spasm. Despite this theoretical consideration, no complication has been reported[2,7]. Dogishi et al. also reported that a chronic cystitis model can be made using 1.5% H_2O_2 solution instilled and indwelled in the rat bladder for 30 min[10]. Histopathological analysis revealed severe tissue damage, including hemorrhage, edema, urothelial denudation, intermittent rupture of the smooth muscle layer, and early infiltration of inflammatory cells such as neutrophils and mast cells. These changes led to rapid but short-term hyperpermeability of the urothelial barrier in the mouse model. Although the initial damage gradually healed, it persisted for an extended period[10]. However, Wu et al. reported no clinically significant histological changes in the antrum and duodenal bulb following hydrogen peroxide therapy, supporting its safety[12].

Uroepithelial stem cells play a crucial role in repair processes. Unlike the epithelia found in the skin or the lining of the gut, which regenerate every 1.5-30 days, the uroepithelium has a slower turnover rate, estimated at approximately 3-6 months. Nevertheless, the uroepithelium exhibits remarkable regenerative abilities, often restoring its integrity within days following significant damage. In contrast to other tissues, uroepithelial stem cells are believed to originate from a single clone, have a slow replication cycle, yet possess a high capacity for regeneration, giving rise to various differentiated cell types[17].

Other intravesical agents, like anti-thrombolytic agents, such as streptokinase and alteplase, have also been used with promising results[6]. These studies concluded that there was a high margin of safety with no evidence of systemic fibrinolytic complications even at higher doses. Chymotrypsin combination with 5% sodium bicarbonate is also used as an intravesical agent[18]. However, the cost-benefit of these products was low, and the availability in overall hospitals is questioned.

Like any *in vitro* study, this research has several limitations. The use of a plastic bladder model does not fully replicate the effectiveness of manual clot evacuation in a compliant structure like the human bladder. In addition, the biomechanical properties, such as elasticity and viscoelasticity, were not accounted for in the models. Enhancements, particularly in hydrodynamic design, are necessary to better simulate turbulent stress. Furthermore, the bladder's capacity should be adjusted according to the physiological limits of the human bladder or scaled proportionally to align with the mechanical-biological characteristics of the dynamic urinary environment.

Despite these limitations, the findings from this study strongly support further investigation into the use of hydrogen peroxide for manual bladder irrigation. While clinical applications have been explored in several studies, the conflicting histopathological findings reported by Dogishi et al. should be validated in an animal model to confirm the safety of low-concentration hydrogen peroxide instillation in the bladder[10]. Nevertheless, these preliminary results suggest that this technique may enhance the effectiveness of bladder irrigation, particularly in cases of persistent clot formation.

Conclusion

This study identifies 0.30% hydrogen peroxide instillation with a 30-s dwell time as the most effective approach for clot evacuation. However, further *in vivo* animal studies and long-term assessments are needed to evaluate its safety, efficacy, and clinical applicability.

Funding

The authors declare that this work was carried out with the authors' own resources.

Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical considerations

Protection of human subjects and animals. The authors declare that the procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation and with the World Medical Association and the Declaration of Helsinki. The procedures were authorized by the Institutional Ethics Committee.

Confidentiality, informed consent, and ethical approval. The authors have followed their institution's confidentiality protocols, obtained informed consent from all patients, and secured approval from the Ethics

Committee. SAGER guidelines have been followed as applicable to the nature of the study.

Declaration on the use of artificial intelligence (AI). The authors declare that no generative artificial intelligence was used in the writing or creation of the content of this manuscript.

References

1. Aydin C, Senturk AB, Akkoc A, Topaktas R, Aydın ZB, Ekici M. Clot retention: our experiences with a simple new technique of evacuation with a thoracic catheter. Cureus. 2019;11:e4329.
2. Bagheri M, Tahmasebi M, Najafi S, Rafsanjani ZJ. Using hydrogen peroxide as a bladder irrigation solution for clot evacuation. J Pharm Care. 2015;3:79-81.
3. Wallad CK, Santoso J, Adi K. The efficacy of nasogastric tube in a large blood clot evacuation during cystoscopy. Indones J Urol. 2016;23: 118-21.
4. Della Corte M, Clemente E, Cerchia E, De Cillis S, Checcucci E, Amparore D, et al. Intravesical agents in the treatment of bladder clots in children. Pediatr Rep. 2023;15:282-92.
5. Bo J, Yangyang Y, Jiayuan L, Siwen D, Yong C, Junbo Y. Evaluation of bladder clots using a nonsurgical treatment. Urology. 2014;83:498-9.
6. Olarte JL, Glover ML, Totapally BR. The use of alteplase for the resolution of an intravesical clot in a neonate receiving extracorporeal membrane oxygenation. ASAIO J. 2001;47:565-8.
7. Warlick CA, Mouli SK, Allaf ME, Wagner AA, Kavoussi LR. Bladder irrigation using hydrogen peroxide for clot evacuation. Urology. 2006;68:1331-2.
8. Xu M, Jin L, Shan Y, Zhu J, Xue B. A simple and effective method for bladder blood clot evacuation using hydrogen peroxide. J Int Med Res. 2020;48:300060520924546.
9. Stride K, Van Jaarsveld N, John V, John J. Hydrogen peroxide bladder irrigation: a simple, safe and effective management option for clot retention. Urol Case Rep. 2023;51:102579.
10. Dogishi K, Okamoto K, Majima T, Konishi-shiotsu S, Homan T, Kodera M, et al. A rat long-lasting cystitis model induced by intravesical injection of hydrogen peroxide. Physiol Rep. 2017;5:e13127.
11. Ritch CR, Ordonez MA, Okhunov Z, Araujo J, Walsh R, Baudin V, et al. Pilot study of alteplase (tissue plasminogen activator) for treatment of urinary clot retention in an *in vitro* model. J Endourol. 2009;23:1353-7.
12. Wu DC, Lu CY, Lu CH, Su YC, Perng DS, Wang WM, et al. Endoscopic hydrogen peroxide spray may facilitate localization of the bleeding site in acute upper gastrointestinal bleeding. Endoscopy. 1999;31:237-41.
13. Jessop ZM, García-Gareta E, Zhang Y, Jovic TH, Badiei N, Sharma V, et al. Role of hydrogen peroxide in intra-operative wound preparation based on an *in vitro* fibrin clot degradation model. JPRAS Open. 2021;29:113-22.
14. Kalloo AN, Canto MI, Wadwa KS, Smith CL, Gislason GT, Pasricha PJ, et al. Clinical usefulness of 3% hydrogen peroxide in acute upper GI bleeding: a pilot study. Gastrointest Endosc. 1999;49:403-5.
15. Nonato MB, Moraes RS, Bandeira Herênio YM, Nunes TF. Management of a giant urinary bladder clot with intravesical thrombolysis. J Vasc Interv Radiol. 2023;34:154-5.
16. Montelongo-Rodríguez FA, Guerra-Catañón CD, Vázquez-Herrera M, Gutiérrez-González A, Gómez-Guerra LS. Inexpensive and combined technique: use of suction tracheal catheter and hydrogen peroxide for the evacuation of intravesical clots. Asian J Urol. 2022;9:99-100.
17. Khandelwal P, Abraham SN, Apodaca G. Cell biology and physiology of the uroepithelium. Am J Physiol Renal Physiol. 2009;297:F1477-501.
18. Bo J, Yangyang Y, Jiayuan L, Siwen D, Yong C, Junbo Y. Evaluation of bladder clots using a nonsurgical treatment. Urology. 2014;83(2):498-499.