



Hypochlorous Acid And Secondary Intention Healing Of Fournier's Gangrene: Results Of A Prospective Clinical Assessment

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The optimal management of Fournier's gangrene requires a multidisciplinary approach, integrating pharmacological and surgical interventions. The standard post-debridement treatment typically involves negative pressure therapy, sometimes combined with an instillation procedure, to prepare for surgical reconstruction or tertiary closure. However, this approach may be challenged in certain contexts, particularly in patients with physiological or logistical constraints.

To explore an innovative alternative, we assessed the use of hypochlorous acid (VASHE[®], Urgo Medical, 2025)¹ in a series of cases. This broad-spectrum antimicrobial solution, which is non-cytotoxic, stands out for its ease of use and its application requiring

only a single health-care provider. Our analysis of multiple clinical cases demonstrated the feasibility of second-intention healing following extensive surgical debridement of the genital and perineal region. Moreover, the results suggest a positive impact in terms of cost savings, time savings for nursing staff, simplification of material procurement and improved accessibility, particularly in outpatient settings. This prospective clinical assessment was conducted over two years and included a cohort of five patients hospitalized for Fournier's gangrene at CHU de Québec – Université Laval between 2022 and 2024. Regular photographic follow-ups documented the progression and healing of the wounds.

Introduction

Fournier's gangrene is defined as an acute necrotizing fasciitis of the genital region, characterized by a rapid progression and a frequently poor prognosis, with a mortality rate approaching 40%.² First described by Alfred Fournier in 1883,³ this rare condition predominantly affects males, with an incidence of approximately 1.6 cases per 100,000 per year in the United States,⁴ primarily among individuals aged 50 to 79 years,⁶ with a male-to-female ratio of about 10:1.⁶ While less common, cases have also been reported in pediatric patients, particularly those aged 0 to 3 months.⁷ Pathogenically, this polymicrobial infection—involving both anaerobic and aerobic bacteria—originates in the skin tissues before progressing to deeper structures. The rapid expansion of inflammation induces tissue ischemia, ultimately leading to necrosis of soft tissues and fascia. Comorbidities such as diabetes, immunosuppression or obesity significantly contribute to disease development and aggravation. Given the clinical similarities to other infections, such as cellulitis, a rigorous diagnostic evaluation is essential. Early treatment with intravenous antibiotics combined with prompt surgical debridement remains crucial to improving patient prognosis. Additionally, post-operative management, particularly wound healing follow-up, represents a major challenge due to the complexity of lesions and the often fragile condition of affected patients.

Negative pressure therapy (NPT) has been established as the gold standard for managing post-surgical wounds following debridement in Fournier's gangrene cases.⁸ However, alternative treatments documented in the literature include medical-grade honey,⁹ biological debridement using maggots, hyperbaric oxygen therapy¹⁰ and various surgical reconstruction techniques, such as grafts and flaps.¹¹ Additionally, antimicrobial solutions, including Dakin's Solution™, iodine and chlorhexidine, have been used for wound irrigation, although their cytotoxic effects on regenerating tissue remain a concern.^{12,13}

The present clinical evaluation highlights the potential of hypochlorous acid as a promising alternative for wound management by secondary

intention in Fournier's gangrene, particularly in cases where conventional approaches face limitations due to logistical, physiological or financial constraints. The non-cytotoxic properties of hypochlorous acid, combined with its broad-spectrum antimicrobial activity and ability to disrupt biofilms, position it as a viable therapeutic option when primary closure or reconstruction is not feasible. Furthermore, its ease of application and capacity for patient-administered wound care in outpatient settings enhance accessibility while optimizing health-care resources.

Materials And Methods

This prospective observational study was conducted over two years at CHU de Québec – Université Laval and involved a series of consecutive clinical cases of Fournier's gangrene presenting post-debridement wounds. No formal clinical research protocol was developed, as the study reflects our routine clinical practice.

The experimental treatment was based on the application of hypochlorous acid solution. Following debridement, non-woven gauzes impregnated with the solution and wrung out were applied directly to the wound bed to maintain controlled moisture and promote hypergranulation, angiogenesis and epithelialization. A secondary non-occlusive dressing composed of abdominal compresses was subsequently applied. Care was provided one to two times daily by nursing staff during hospitalization, then continued as self-care post-discharge.

The total treatment duration ranged from 30 to 84 days, leading to complete second-intention healing in five of the six cases, while one patient required scrotal reconstruction using an anterolateral thigh flap.

The solution was chosen due to its demonstrated antimicrobial efficacy (99.9% elimination rate) against a broad spectrum of microorganisms, including gram-positive and gram-negative strains—such as methicillin-resistant *Staphylococcus aureus* (MRSA) and *Pseudomonas aeruginosa*—as well as its ability to reduce *Clostridium difficile* endospores. This therapeutic strategy was considered in a clinical context where the scarcity of literature on Fournier's

gangrene limits the recruitment of large cohorts for randomized studies.

We describe below the clinical outcomes observed in a series of five patients.

This version enhances scientific clarity and precision while ensuring accessibility for a medical readership.

Case 1

Patient Profile: A 70-year-old male with a past medical history of hypertension, osteoporosis, benign prostatic hyperplasia and IgGκ lymphoplasmacytic lymphoma. Initially hospitalized for a bone marrow allograft, he developed perianal erythema extending to the medial half of his left buttock during his stay. Within 24 hours, the clinical picture rapidly progressed to marked scrotal swelling with intensification of the erythema and escalating pain that necessitated regular administration of analgesics.

Clinical Evolution and Initial Management: Twenty-four hours after symptom onset, a CT scan (TAC TAP) revealed the presence of a perianal fistula without an associated abscess, as well as scrotal cellulitis without any fluid collection. Seven days post-allograft, against a background of febrile neutropenia and skin sepsis secondary to an ano-rectal fistula, the patient was transferred to the intensive care unit. The initial surgical approach was conservative, consisting of close observation and continuation of antibiotic therapy, as there were no strong clinical indications of necrotizing fasciitis.

Surgical Intervention and Local Treatment: Once laboratory parameters stabilized and scrotal drainage was deemed necessary, a perineal surgical debridement was performed, which confirmed the diagnosis of Fournier's gangrene. Pus cultures identified the following microorganisms:

- *Pseudomonas aeruginosa*
- *Enterococcus faecalis*
- *Enterococcus faecium*
- *Bacteroides thetaiotaomicron* (belonging to the *B. fragilis* group).

A single debridement was sufficient. Initially, a conservative regimen utilizing a chlorhexidine-

impregnated interface was instituted for 35 days. Thereafter, care was transferred to the enterostomal therapy team which implemented the application of moist dressings saturated with a hypochlorous acid solution (VASHE®). Administered over a total period of 42 days, this treatment achieved complete second-intention healing without the need for surgical reconstruction or skin grafting. Furthermore, the self-management of dressings reduced direct physical contact and minimized the risk of secondary infections in the context of the patient's immunosuppressed status.

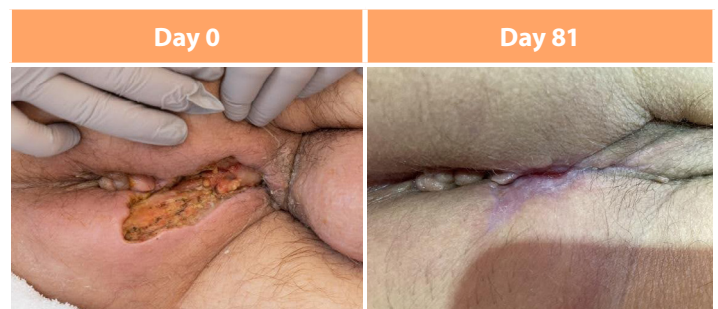


Figure 1: Case 1

Case 2

Patient Profile: A 48-year-old male with a history of type 2 diabetes mellitus, hypertension and dyslipidemia, compounded by poor personal hygiene and malnutrition. He presented to the emergency department with scrotal edema that emerged six days after he self-drained a perineal nodule adjacent to the anus. The edema rapidly evolved into scrotal induration, and the patient reported a febrile episode on the night preceding his admission.

Clinical Evolution and Initial Management: The emergency physician's examination revealed pronounced scrotal erythema, accompanied by edema and induration, yet no evidence of necrosis, palpable mass, discharge or urinary symptoms. Based on the strong clinical suspicion of Fournier's gangrene, the patient was admitted and underwent surgical debridement within 24 hours of evaluation by the urologist. Pus cultures subsequently identified the following pathogens:

- *Streptococcus agalactiae* (Group B)
- *Anaerococcus vaginalis*

- *Peptostreptococcus anaerobius*
- *Staphylococcus anaerobius*
- *Staphylococcus capitis*.

Surgical Intervention and Local Treatment: Over a 21-day period, four surgical debridements and nine operating room-based negative pressure therapy (NPT) sessions. These repeated interventions were necessitated by technical difficulties with achieving an adequate seal on the device and the requirement to maintain an extended gynecological positioning, precluding bedside procedures. Given the multiple unsuccessful attempts at NPT, we proposed an alternative treatment strategy as a moist dressings saturated with the hypochlorous acid solution.

Outpatient Follow-Up: Eager to resume a normal lifestyle, the patient was trained in self-care and transitioned to this conservative treatment regimen. After 55 days of hospitalization, he was discharged home. Outpatient follow-ups conducted at two and six weeks post-discharge confirmed complete wound closure by second-intention healing, achieved after a total of 86 days of therapy.



Figure 2: Case 2

Case 3

Patient Profile: A 68-year-old male with a history of hypothyroidism, gastroesophageal reflux disease, dyslipidemia, hypertension, hemorrhoids and cigarette smoking. Socially, the patient is vulnerable—living alone in subsidized housing without familial support—and has been unable to work for several years due to chronic arthritic conditions.

Clinical Evolution and Initial Management: The patient presented to the emergency department with progressive perianal edema accompanied by an erythema extending to the scrotum. Upon admission, the enterostomal therapy team promptly addressed his concerns—particularly his anxiety regarding a potential cancer diagnosis. Subsequent clinical examinations, complemented by imaging studies, confirmed the diagnosis of Fournier's gangrene. Although a urology consultation was sought and the potentially lethal nature of the condition was explained, the patient refused surgical debridement while consenting to receive targeted antibiotic therapy. Pus cultures isolated the following microorganisms:

- *Streptococcus mitis*
- *Escherichia coli*
- *Klebsiella pneumoniae*
- *Actinomyces odontolyticus*
- *Streptococcus constellatus*
- *Staphylococcus epidermidis*.

Therapeutic Management: In the absence of surgical intervention, the primary objectives were to decrease the microbial burden, reduce odour and promote autolytic debridement. The treatment strategy involved applying a moist dressing saturated with a hypochlorous acid solution. Remarkably, after only seven days of treatment, the wound demonstrated complete resolution of necrosis with the establishment of 100% healthy granulation tissue. The patient was then transitioned to a self-care regimen, ultimately achieving complete secondary-intention wound healing without the need for reconstructive surgery or skin grafting.

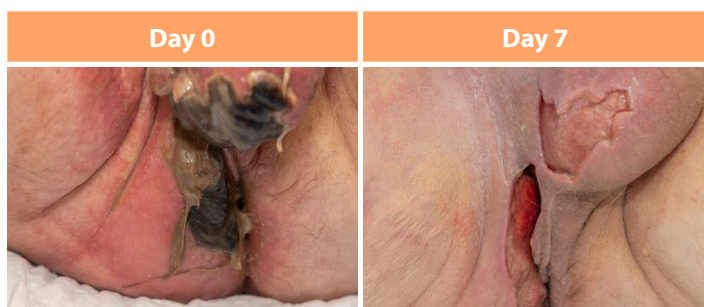


Figure 3: Case 3

Case 4

Patient Profile: A 68-year-old male with a history of smoking, type 2 diabetes mellitus, obesity and sleep apnea. His medical records are further notable for paraplegia (from the D8 level since 2008 following a postoperative complication of a disc herniation), a diversion colostomy (since 2019 due to a chronic pressure injury) and an indwelling catheter (since 2020) for neurogenic bladder management. Additionally, he benefits from an intrathecal baclofen pump to control musculoskeletal spasticity.

Clinical Evolution and Initial Management: Physical examination revealed subcutaneous emphysema within the scrotum. On the day of admission, an initial surgical debridement was performed collaboratively by the general surgery and urology teams. The diagnosis of Fournier's gangrene affecting the left hemiscrotum was established, with a suspected urethro-scrotal fistula as the underlying cause. Initially, a moist dressing impregnated with PHMB (polyhexamethylene biguanide) was applied, and targeted intravenous antibiotics were initiated following microbial isolation. The organisms identified were:

- *Streptococcus dysgalactiae*
- *Streptococcus anginosus*
- *Enterococcus faecalis*
- *Proteus penneri*
- *Bacteroides fragilis*.

Rationale for Abandoning Negative Pressure Therapy (NPT): The use of NPT was contraindicated due to the presence of a urethral fistula (a contraindication as per INESSS guidelines) and significant technical challenges. In particular, intense muscular spasms prevented the maintenance of an aseptic

gynecological position necessary for effective NPT application.

Surgical Intervention and Local Treatment: Four surgical intervention were required. We began a hypochlorous acid wet dressing to facilitate care and encourage a return home as soon as possible at the patient's request. The patient was discharged after 14 days of hospitalization. Home-based follow-up, supervised by the local CLSC, continued for an additional 39 days, during which complete secondary-intention wound healing was achieved, despite the patient's inability to independently manage his wound care.

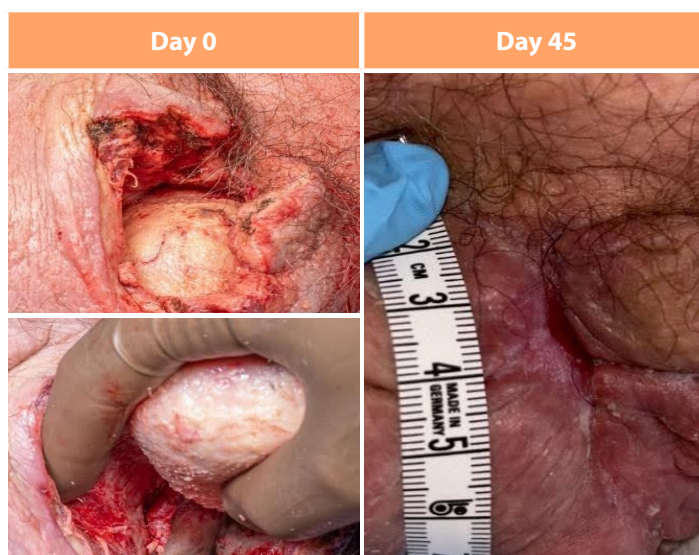


Figure 4: Case 4

Case 5

Patient Profile: A 44-year-old male with a history of moderate-to-severe traumatic brain injury sustained at age 18. Despite his work incapacity, he remains functionally independent for activities of daily living. His medical record is further complicated by psychiatric disorders, polytoxicomania (involving PCP, cocaine, THC and alcohol) and HIV positivity since 2010.

Clinical Evolution and Initial Management: The patient presented to the emergency department after a fall down the stairs, complaining of localized coccygeal pain. Radiography revealed only a slight displacement of the coccygeal bones, without evidence of fracture. However, within the following

24 hours, he developed a marked increase in redness along with scrotal edema. Clinical examination revealed:

- Pronounced erythema and edema
- Testicular and penile pain
- Palpable subcutaneous emphysema in the left groin
- Suprapubic induration extending toward the right abdominal and inguinal wall.

An extensive debridement of necrotic tissues was performed, including a scrotoectomy that exposed both the spongy and cavernous bodies. A moist dressing impregnated with PHMB was applied, after

which the patient was transferred to the intensive care unit.

Intraoperative cultures yielded the following microorganisms:

- *Streptococcus anginosus*
- *Escherichia coli*
- *Actinomyces turicensis*
- *Bacteroides fragilis*
- *Peptoniphilus asaccharolyticus*.

Initial Management and Surgical Interventions: Three debridements and a revision of the PHMB-based NPT were performed. After that, a multidisciplinary consultation (involving urology, anesthesia and intensive care) highlighted significant challenges—marked agitation, severe pain and a recurrent need for propofol and fentanyl boluses at each dressing change. We transitioned to hypochlorous acid-moistened dressings once a day. The benefits was important : reducing analgesic burden, lessening the dressing-related pain and simplifying the procedure. After discharge and outpatient follow-up via the local CLSC, he underwent a pedicled anterolateral thigh flap graft on day 45.

Discussion

Fournier’s gangrene is a rapidly disseminating polymicrobial infection characterized by a synergistic interaction between aerobic and anaerobic bacteria, with common pathogens including *Escherichia coli* and various *streptococci*.⁵ The clinical presentation can sometimes mimic cellulitis, underscoring the importance of early and accurate diagnosis—especially in light of the condition’s mortality rate, which approaches 40%.⁵

In this series of cases, the diagnosis was made clinically at the presentation of the patient in the emergency department, confirmed with appropriate imaging and culture results and subsequently addressed with surgical debridement. Initially, negative pressure therapy (NPT) was used post-debridement in three of the five cases. However, technical difficulties—such as seal loss in anatomically complex regions, excessive pain during dressing changes and the repeated need for narcotics



Figure 5: Case 5

and sedatives—as well as organizational constraints (limited access to the operating room, nursing staff shortages, and material resource limitations) prompted the investigation of alternative therapeutic approaches.

The interdisciplinary adoption of moist dressings with hypochlorous acid (VASHE®) was driven by its broad-spectrum antimicrobial properties, non-cytotoxic profile, ability to disrupt biofilm formation and facilitation of accelerated wound healing. These cases support that this strategy can reduce the frequency of invasive interventions while significantly enhancing patient comfort through decreased pain and sedation requirements during dressing changes.

These preliminary findings suggest that a combined strategy—initial aggressive surgical debridement followed by conservative management with hypochlorous acid–based moist dressings—may represent an appropriate alternative to conventional protocols in the management of Fournier’s gangrene, particularly under clinical and organizational constraints.

Complementary Perspectives

Comparative Analyses: A detailed comparative study between conventional NPT and the hypochlorous acid moist dressing approach (evaluated both clinically and in terms of overall costs) could help better define the indications and limitations of each modality.

Mechanistic Insights: Investigating the cellular and biochemical mechanisms by which hypochlorous acid accelerates hypergranulation may enrich our understanding and guide the development of future therapeutic strategies.

Quality of Life and Psychological Impact: Assessing patient quality of life and the psychological impact—especially in patients who decline surgical interventions—represents a promising research project to optimize a comprehensive, multidisciplinary care approach.

Such lines of inquiry pave the way for prospective randomized studies that will be essential to definitely establish the efficacy and safety of hypochlorous acid in the management of this devastating condition

Advantages of the Hypochlorous Acid–Moistened Dressing Approach in the Management Of Fournier’s Gangrene When NPT Is Not Possible

1. *Ease of Application:* In the setting where negative pressure (NPT) requires experienced nursing staff to ensure adequate sealing due to the difficult anatomical location of Fournier’s gangrene wounds—the application of a hypochlorous acid–impregnated moist dressing is markedly simpler. This technique is intuitive enough to be self-administered by patients, particularly after discharge, without the need for advanced technical skills.

2. *Reduction in Dressing Change Time:* Data indicate that performing a dressing change with NPT generally requires approximately 50 to 60 minutes, even when executed by specialized teams. In contrast, the procedure for changing a moist dressing using a hypochlorous acid solution takes around 10 minutes. This significant time saving can enhance workflow efficiency on an institutional level and reduce the workload for nursing teams.

3. *Optimization of Personnel Deployment:* The setup and change of NPT necessitate the involvement of at least two experienced nurses, often supported by one or two health-care aides (to facilitate proper “gynecological” positioning and ensure asepsis). Conversely, hypochlorous acid–moistened dressings can be applied by a single nurse—or even self-administered by the patient—which is particularly advantageous during periods of staffing shortages, as witnessed in the post-pandemic context.

4. *Decreased Use of Sedatives and Opioids / Pain Management:* Repeated dressing changes with Negative Pressure Wound Therapy in sensitive perineal and inguinal regions often induce stress, pain and agitation, thereby requiring frequent administration of anxiolytics, narcotics and sedatives. Although NPWT is not systematically associated with severe pain, the patient’s experience may vary depending on the location and size of the wound, the patient’s sensitivity, the level of pressure applied, the condition of the tissues and particularly during dressing changes.¹⁴

Pain associated with NPWT is generally most significant during dressing changes. The anatomical location of wounds associated with Fournier’s Gangrene involves a particularly sensitive area that is often difficult to dress. This frequently necessitates the use of stronger adhesives and adjunctive accessories to improve sealing (e.g., stoma paste or protective rings), thereby increasing the body surface area exposed to adhesive materials.

Pain management in our cohort primarily relied on the administration of narcotic analgesics prior to dressing changes, either subcutaneously or orally, while taking into account the timing of dressing replacement and the peak onset of action of the medication administered. In two cases, pain was omnipresent and became a significant factor contributing to the decision to modify the treatment approach in order to relieve the patient and reduce the use of opioids and anxiolytics associated with dressing changes. Another patient presented with paralysis, which prevented an adequate assessment of pain. In the remaining cases, pain was not considered a determining factor in treatment decision-making.

In contrast, the hypochlorous acid dressing approach minimizes or even eliminates the need for these pharmacological agents, as patient reports frequently describe the procedure as virtually painless, with only minor discomfort during genital manipulation.

5. Enhanced Patient Experience and Autonomy: Empowering patients to manage their own care is a cornerstone of this approach. Enabling self-administration during outpatient follow-up facilitates a quicker return to normal activities, improves quality of life and reinforces patient engagement in their recovery process.

6. Cost and Resource Utilization Comparison: Economic and operative time data—collected in varied settings such as CHU de Québec – Université Laval and CIUSSS de la Capitale Nationale—underscore the advantages of the hypochlorous acid dressing method when compared with various NPT modalities.

Overall Impact On Management

- **Cost and Resource Reduction:** Switching from NPT to hypochlorous acid–moistened dressings leads to a substantial decrease in per-change cost and diminishes the time allocated by health-care personnel. This reallocation of resources can improve overall care efficiency.
- **Enhanced Quality of Care and Patient Comfort:** The reduced need for sedation—consequently allowing for a gradual discontinuation of narcotics—lowers the morbidity associated with dressing changes. Patients report greater comfort and tolerance, factors which are essential for optimal wound healing and treatment adherence.

Table 1: Comparative Table Example (Data for a Community Hospital):

Therapeutic Modality	Total Cost per Change (CAD)	Nursing Time (minutes)	Required Personnel	Number of Changes per Week
Hypochlorous acid–moistened dressing (VASHE® 118 mL + 4x4 gauzes)	\$56.91	~10* (or 0 minutes if self-administered in outpatient settings)	1 (or self-administered)	7
NPT (e.g., Renasys black sponge & PHMB)	\$279.81	50 (average)	2	3

* The indicated time for the hypochlorous acid dressing may vary by setting: in a hospital, minimal assistance (approximately 10 minutes) might be needed; in an outpatient setting, self-administration can eliminate direct nurse involvement.

Alternative NPT options, such as Renasys PHMB™-based NPT and 3M™ instillation, have total costs of approximately \$255.00 CAD and \$1473.00 CAD per change, respectively, requiring considerably more time and personnel.

- *Potential Intraoperative Benefit:* Due to its non-cytotoxic characteristics and its ability to penetrate tissues to disrupt established biofilm structures, further exploring the perioperative use of hypochlorous acid—during debridement and wound irrigation—may reduce the number of successive debridements required, thereby optimizing surgical management.

Study Limitations

- *Small Cohort Size:* The rarity of Fournier's gangrene limits the number of cases, making it difficult to conduct a randomized study.
- *Non-Comparative Evaluation:* The study is non-comparative; outcomes might differ when comparing with other antimicrobial agents that were not evaluated.
- *Need for Prospective Trials:* Prospective, randomized studies are needed to confirm these preliminary results and to refine the indications for this treatment approach.

Conclusion

Our case series documents that the use of hypochlorous acid–moistened dressings results in rapid wound healing, a significant reduction in costs and a marked improvement in patient quality of life, and can be a good alternative to the usual procedure like NPT. Complete secondary-intention wound closure was obtained on average within 50 days. Based on these findings, we continue to recommend and utilize this approach for managing Fournier's gangrene, particularly in scenarios with organizational constraints or during periods of specialized resource scarcity.

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References

1. Urgo Medical. Vashe wound solution with pure hypochlorous acid [Internet]. 2025 [cited 2025 Feb 20].
2. Joury A, Mahendra A, Alshehri M, Downing A. Extensive necrotizing fasciitis from Fournier's gangrene. *Urol Case Rep.* 2019 Jun 9;26:100943. DOI: 10.1016/j.eucr.2019.100943.
3. Fournier J. Gangrène foudroyante de la verge. *Sem Med.* 1883;3:345.
4. Gadler T, Huey S, Hunt K. Recognizing Fournier's gangrene in the emergency department. *Adv Emerg Nurs J.* 2019 Jan/Mar;41(1):33-38. DOI: 10.1097/TME.0000000000000221.
5. Sorensen MD, Krieger JN, Rivara FP, Broghammer JA, Klein MB, Mack CD, et al. Fournier's Gangrene: population based epidemiology and outcomes. *J Urol.* 2009 May;181(5):2120-6. DOI: 10.1016/j.juro.2009.01.034.
6. Suleimanov V, Al Hawaj K, Al Rebh FN, Naser H, Al Noaim S. A challenging case of Fournier's gangrene with multiple complications. *Cureus.* 2023 Oct 31;15(10):e48036. doi: 10.7759/cureus.48036.
7. Bakalli I, Heta S, Kola E, Celaj E. Fournier gangrene in an infant, complicated with severe sepsis and liver dysfunction: A case report. *World J Clin Cases.* 2023 Oct 26;11(30):7398-7402. DOI: 10.12998/wjcc.v11.i30.7398.
8. Ozkan OF, Koksall N, Altinli E, Celik A, Uzun MA, Cıkman O, et al. Fournier's gangrene current approaches. *Int Wound J.* 2016 Oct;13(5):713-6. DOI: 10.1111/iwj.12357.
9. de Groot T, Janssen T, Faro D, Cremers NAJ, Chowdhary A, Meis JF. Antifungal activity of a medical-grade honey formulation against *Candida auris*. *J Fungi (Basel).* 2021 Jan 13;7(1):50. DOI: 10.3390/jof7010050.
10. Tanaka T, Minami A, Uchida J, Nakatani T. Potential of hyperbaric oxygen in urological diseases. *Int J Urol.* 2019 Sep;26(9):860-867. DOI: 10.1111/iju.14015.
11. Insua-Pereira I, Ferreira PC, Teixeira S, Barreiro D, Silva Á. Fournier's gangrene: a review of reconstructive options. *Cent European J Urol.* 2020;73(1):74-79. DOI: 10.5173/cej.2020.0060.
12. Koch GE, Abbasi B, Agoubi L, Breyer BN, Clark N, Dick BP, et al. Multidisciplinary management in Fournier's gangrene. *Curr Probl Surg.* 2024 Jul;61(7):101499. DOI: 10.1016/j.cpsurg.2024.101499.
13. Ortega-Peña S, Hidalgo-González C, Robson MC, Kröttsch E. In vitro microbicidal, anti-biofilm and cytotoxic effects of different commercial antiseptics. *Int Wound J.* 2017 Jun;14(3):470-479. DOI: 10.1111/iwj.12625.
14. Shi J, Gao Y, Tian J, Li J, Xu J, Mei F, et al. Negative pressure wound therapy for treating pressure ulcers. *Cochrane Database Syst Rev.* 2023 May 26;5(5):CD011334. DOI: 10.1002/14651858.CD011334.pub3.