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Fournier's Gangrene: Assessing the Adequacy of Residual Genital Skin in Post Gangrene Wound Management

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Abstract | **Original Research Article**

Fournier's gangrene is a severe and potentially fatal genito-perineal infection that requires a mitigating radical surgical debridement, which leaves denuded genitalia requiring skin coverage. Restoring pre-gangrene genitalia that is cosmetically acceptable is challenging. Aim is to assess the adequacy of post gangrene residual genital skin in overcoming this challenge. Patients and Methods: A retrospective review of clinical records of all patients with FG managed by Urology department of a tertiary health institution between July 2005 and June 2025 was undertaken. Data retrieved and analysed included personal biodata, etiology, co-morbid factors, clinical presentation, extent of gangrene, treatment and outcome. Results: A total of 60 males were studied. Age range of 24-76 years (mean 47±15) was recorded. Complicated urethral trauma and stricture (16.7%), neglected strangulated inguinoscrotal hernia (11.7%), scrotal boils (8.3%); and Diabetes mellitus (16.7%), HIV infection (10%) were the main etiologic and predisposing factors. Clinically, patients presented with the triad of scrotal swelling, wound and pain in 98.3%, 81.7% and 73% of cases respectively. Staphylococcus aureus was the commonest bacterial isolate in 25% of cases. Mixed infections with proteus, E.coli, klebsiella was observed in 25% of patients. Extent of gangrene consisted of Scrotum only (76.7%), Scrotum and penis (18.3%), penis only, scrotum and perineum, scrotum and anterior abdominal wall in 1.67% patients each. >50% of scrotal surface was involved in 56.67% of cases. Post gangrene wound care included twice daily hypertonic saline sitz baths followed by honey-soaked gauze dressings. Wound coverage by secondary intention was achieved in 80%, and by secondary suturing in 16.67% of cases. Mortality occurred in 2 (3.3%) patients. Conclusion: The post gangrene residual genital skin has immense, innate elasticity and regenerative capacity, which should be utilized for restoring pre-gangrene genitalia.

Keywords: Fournier's gangrene, Post gangrene wound, Residual genital skin, Conservative wound management.

INTRODUCTION

Fournier's Gangrene (FG) is a uro-surgical emergency that epitomizes synergistic polymicrobial infection with proclivity for thrombosis of arterioles in the subcutaneous dermal layers, resulting in progressive necrotizing fasciitis and gangrene of genital and perineal skin [1,2].

It was first reported by Baurienne in 1764 and Hebler in 1848, but described in 1883 by the French Venereologist, Jean Alfred Fournier, after whom the condition is named. His original description which consists, in the main, of hurricane-like features in five healthy young men, idiopathic origin and high mortality rate [3], has largely been surpassed by clear elucidation of predisposing factors and reports of FG in the female gender [4-6]. Polymicrobial synergistic infection is fundamental to the initiation and propagation of fulminant gangrene and sepsis while the cornerstone of management is based on prompt resuscitation with intravenous crystalloids, systemic combination antibiotic therapy and radical surgical debridement [2,7]. After resolution and recovery from the acute phase, a challenging second phase ensues: provision of skin cover for the deformed and denuded genitalia and restoration of pre-gangrene genitalia.

Management of the post gangrene wound (PGW) is determined by extent of the wound, expertise and resource availability, presence of co-morbid conditions which may contraindicate extensive reconstructive procedures, cosmetic acceptability and patient satisfaction [8,9]. Current evidence-based practice espouses the area of defect as a compass to the reconstructive effort: areas of defect less than 50% should be managed by secondary intention or scrotal advancement flaps while defects more than 50% should

engage skin grafting or flap repair [10]. However, some authors advocate conservative healing by secondary intention using simple topical agents, daily saline sitz baths and allowing nature to re-epithelize the denuded genitalia [11-13]. This is predicated on the innate elasticity and rich blood supply of the genital skin [7]. The benefits of this approach include superior cosmetic appearance, patient satisfaction, avoidance of multiple surgical procedures and reduced hospital stay. Topical agents and adjuncts employed for wound care in several studies includes, but not limited to, daily hypertonic saline sitz baths followed by honey dressings, plates and strips made of calcium alginate, hydrogels and polyurethane, two-dimensional cavity foams, vacuum assisted closure (VAC) and negative pressure wound therapy (NPWT) [5,8,11-13]. Consensus of opinion amongst these pundits is that reconstruction should be restricted to patients who fail to heal on conservative measures or have extensive defects [13-15].

This study aims to assess the adequacy of residual genital skin in achieving post gangrene wound closure.

Patients and Methods

A retrospective review of patients with Fournier's gangrene managed in our institution between July 2005 and June 2025 was undertaken. Their clinical records were obtained from ward, theatre and emergency registers; and from these case files were retrieved, data extracted and entered into the study proforma. This information consisted of personal biodata, presenting complaints and duration, etiological and predisposing factors, gangrene site/extent, bacterial isolates from wound, method of wound coverage, duration of hospitalization and outcome. Institutional ethical review approval was obtained and IBM SPSS 25 statistics software was employed in data analysis.

The institutional approach to management of patients with FG include quick and concise history, physical examination, clinical diagnosis, obtain samples for urgent investigations (Full Blood Count, serum electrolytes, urea and creatinine, retroviral screen, fasting blood sugar, wound swab for microscopy, culture and sensitivity) while commencing resuscitation with intravenous crystalloids, intravenous antibiotics (ceftriaxone, metronidazole and a quinolone), preparatory to radical surgical debridement. Post debridement wound care involves twice daily saline sitz baths, followed by honey-soaked gauze dressings. Technique of saline sitz baths requires the patient to sit on a tub containing warm water mixed with table salt to near-saturation point, immersing the wound in the solution for 20-30 minutes. Further debridement is usually minor and carried out by the bedside. Adjunctive procedures such as urethral catheterizations, suprapubic cystostomies are carried out in those with extensive gangrene and urethral strictures/trauma respectively. Within 14-28 days wounds usually exhibit healthy granulation tissue, contraction and re-epithelialization. With financial constraints many are discharged home on twice daily sitz baths and honey dressings regimen. Those who can afford a second procedure undergo secondary suturing with or without scrotal advancement flaps. During outpatient follow-up visits, completeness or otherwise of wound coverage are noted. Those non-compliant with follow-up are contacted on phone.

Results

A total of sixty (60) out of sixty-nine (69) patients with complete information were analysed. All were men aged 24-76 years (mean 47±15) with peak age incidence between 51-60 years, closely followed by those in the 31-40 years bracket (Fig 1). The duration of symptoms before presentation ranged from 1-21 days (mean 7± 5). Majority of the patients were of the low socio-economic class comprising artisans, farmers, traders, students, etc. The common aetiological factors in order of occurrence were neglected, complicated urethral stricture/trauma (16.7%), strangulated inguino-scrotal hernia (11.7%) and improperly treated scrotal boil (8.3%) while diabetes mellitus (16.7%), HIV infection (10%) and congestive cardiac failure (3.3%) constituted the bulk of co-morbid factors. 98.3% of patients presented with scrotal swelling while accompanying scrotal wound with discharge, and pain occurred in 81.7% and 73% of cases respectively (Table 1). Amongst the causative bacterial isolates in this series, staphylococcus aureus (25%), Klebsiella (20%) and E. coli (13.3%) were the commonest. Others were Proteus (11.7%) and Pseudomonas (10%). Mixed cultures with these organisms were noted in 15 (25%) of patients. Anaerobic cultures are not routinely carried out in our institution (Table 2).

In managing the post gangrene wound (PGW), strict adherence to twice daily saturated salt sitz baths followed by honey-soaked gauze dressings as well as minor bed side debridement constituted the cornerstone of wound care. Re-epithelialization is usually noticeable within 2 weeks of management. Wound cover was achieved by secondary intention in 48 (80%) patients, and secondary suturing in 10 (16.7%) patients (see Figs. 2&3). In 46 (76.67%) of patients, gangrene was limited to scrotum only, and those with >50% of scrotum involved healed by second intention in 26 (43.3%) patients and secondary suturing in 7 (11.67%). (Table 3). One of the most extensive gangrene in this series involving scrotum and perineum occurred in a poorly controlled diabetic. Wound cover was successfully achieved by secondary suturing (Fig 3), after attaining glycemic control. We did not skin graft nor use flaps. The resultant skin was cosmetically acceptable to patients and surgeons.

Mortality was recorded in 2 patients (3.3%) in this study. One died of overwhelming sepsis from extensive gangrene affecting the genitalia and anterior

abdominal wall following an infected appendectomy wound while the other died from severe sepsis.

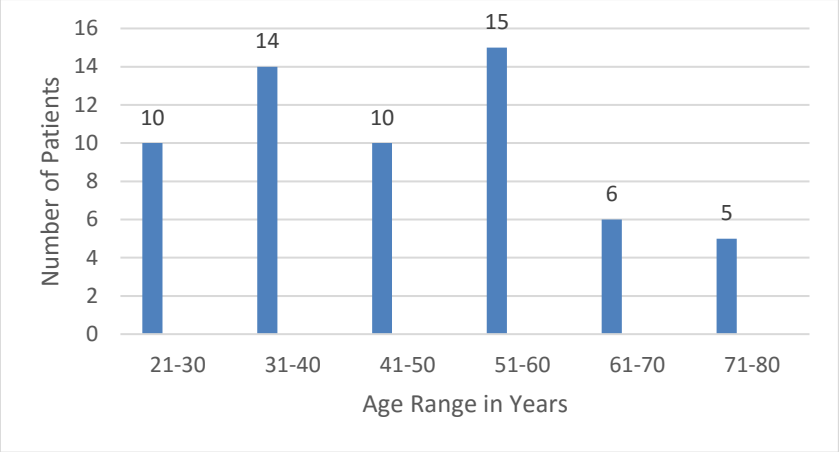


Fig 1: Age Frequency Chart

Table 1: Aetiology, Co-morbid factors and Clinical presentation

S/No.	Aetiological Factor	No. (%)	Co-Morbid Factor	No. (%)	Clinical Presentation	No. (%)
1.	Scrotal itching/Hot balm application	3 (5)	Diabetes Mellitus	10 (16.7)	Fever and chills	12 (20)
2.	Scrotal boil	5(8.3)	HIV Infection	6 (10)	Penile wound	11(18.3)
3.	Urethral trauma/stricture/fistula	10 (16.7)	Congestive cardiac failure	2 (3.3)	Penile Swelling	12 (20)
4.	Strangulated/perforated inguinoscrotal hernia	7 (11.7)	Tropical Splenomegaly syndrome	1 (1.7)	Scrotal swelling	59 (98.3)
5.	Gluteal abscess	1 (1.7)	Alcoholism and heavy smoking	1 (1.7)	Scrotal pain	44 (73)
6.	Shaving injury	1 (1.7)	Prolonged steroid use	1 (1.7)	Scrotal wound/discharge	49(81.7)
7.	Infected herniorrhaphy wound	3 (5)	Drug reaction	1 (1.7)	Inguinoscrotal swelling	7(11.7)
8.	Fistula-in-ano	1 (1.7)	-	-	Perineal wound	1 (1.7)
9.	Infected appendectomy wound	1 (1.7)	-	-	Anterior abdominal wall swelling	1 (1.7)
10.	Skin reaction to plaster	1 (1.7)	-	-	-	-
11.	Unidentifiable	5 (8.3)	-	-	-	-

Table 2: Bacterial Isolates from Wounds

S/No	Organism	Number of Patients (%)
1	Klebsiella	12 (20%)
2	Staphylococcus aureus	15 (25%)
3	Escherichia coli	8 (13.3%)
4	Pseudomonas aeruginosa	6 (10%)
5	Proteus	7 (11.7%)
6	Mixed Infections	15 (25%)

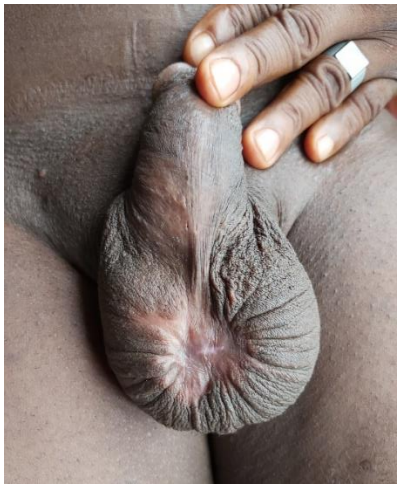
Table 3: Post Gangrene Wound Coverage

Gangrene Area	Number (%)	Wound Coverage	
		Secondary Intention (Number, %)	Secondary Suturing (Number, %)
Scrotum Only < 50% *>50%	46 (76.67%) 12 (20%) 34 (56.67%)	 12 (20%) 26 (43.3%)	 0 7 (11.67%)
Scrotum and Penis	11 (18.3%)	9 (15%)	2 (3.33%)
Scrotum and Perineum	1 (1.67%)	-	1 (1.67%)
Penis Only	1 (1.67%)	1 (1.67%)	-
*Scrotum and Anterior Abdominal Wall	1 (1.67%)	-	-
Total	60 (100%)	48 (80%)	10 (16.67%)

*1mortality each from these groups = 2 (3.4%)

2a) Healing PGW

2b) Same patient at 4 weeks



2c) Completely healed at 10 weeks

Figure 2: Healing by Second Intention

3a) Gangrenous scrotum and perineum

3b) Healing PGW in same patient

3c) Coverage by Secondary Suturing

Figure 3: Healing by Secondary Suturing

DISCUSSION

Fournier's gangrene (FG) is a life threatening uro-genito-vascular emergency of infective origin. Typically, it presents as rapidly spreading necrosis of the skin and superficial fascial layers of the genitalia and perineum. The deeper fascial layers and the testes, due to their disparate blood supply, are usually spared. The original description, by Jean Fournier, of abrupt onset, rapid course, idiopathic origin and high mortality in five healthy young men provides the framework for discussion of advances that have occurred in this field.

Firstly, age and sex incidence reports from several studies has shown that FG affects all ages from infants to the elderly [8]. Females are also affected (M:F ratio of 10:1) [4,6]. The former is corroborated by our study: all 60 patients were males with age range 24-76 years (mean 47 ±15). There were no females in our series. It is probable that they are seen and managed by our gynaecology colleagues, as has been observed by other authors [16,17]. Secondly, modern postulates on the pathogenesis of FG requires a focus and portal of entry for micro-organisms in and around the genitalia as well as systemic immunosuppressive co-morbid factors. Results of this study clearly reflects this theory (Table 2). 10 (16.7%) patients developed FG as a result of complications from urethral trauma, strictures and fistulae. Phenomenally, strangulated and perforated inguino-scrotal hernia were implicated in 7 (11.7%) cases. This is a rare association, with only 9 cases reported in the literature [18-20]. With strangulation of bowel loop within the scrotal sac, there's translocation of bacteria onto the fascial layers leading to obliterative endarteritis, thrombosis of small subcutaneous vessels, necrotising fasciitis and gangrene [1,2]. This calls for timely repair of inguinoscrotal hernias to prevent this grave complication. The renown co-morbid entities,

namely, diabetes mellitus, HIV infection, alcoholism and prolonged steroid use were recorded in this study (see Table 1), as observed by other authors [21,22]. The patient with Tropical Splenomegaly Syndrome (TSS) reported severe scrotal itching which could have caused injury and introduced micro-organisms. This is similar to itching caused by filariasis reported by Ugwumba et al [16]. These co-morbid conditions are known to induce a state of systemic immunosuppression, decreasing host defense mechanisms, thereby fulminant gangrene supervenes [8,23]. The diagnosis of FG is stereotypically clinical in 95% of cases. Investigations are only necessary to determine cause of an episode [24]. In this study all diagnoses were made clinically: the triad of scrotal swelling, pain and wound (blisters, crepitus, gangrenous slough with malodorous feculent discharge) recorded in 98.3%, 81.7% and 73% of cases respectively, represented the commonest symptoms, and is consistent with findings by other workers [16,22,23]. The commonest bacterial isolates from our patient cohort were staphylococcus (25%), klebsiella (20%) and E. coli (13.3%). This is at variance with most series in which E. coli is implicated as the commonest organism [23,25]. Consistent with polymicrobial synergism, 25% of our patients demonstrated mixed infections with above organisms and others.

The management of FG in the acute phase is clearly hinged on the triad of immediate resuscitation with intravenous crystalloid fluids, combination intravenous antibiotics and radical surgical excision of dead and dying tissue. This usually stems the tide of spread of gangrene and patient rallies. The post-debridement wound requires special care to optimize it for reconstruction or spontaneous closure. One of such care involves the employment of twice daily concentrated salt solution sitz baths and honey-soaked gauze dressings. In this study wound cover by secondary intention occurred in 48 (80%) patients while 10 (16.7%) healed by secondary suturing. Previous studies from our region have achieved wound coverage with these two methods in 36.84%, 55.3%, 67.7%, and 100% of cases [17,21-23]. Secondary suturing often involves a second surgical procedure with additional cost on most of our patients who are indigent (artisans, farmers, students, etc), and pay for service 'out of pocket'. This explains why they readily request discharge to continue with wound care at home and achieve spontaneous closure. The impact of this development is that even in those with greater than 50% scrotal involvement, 43.3% of them healed by secondary intention. Though this may contrast with standard of care which recommends use of grafts and flaps, the resultant spontaneous closure and acceptable cometic appearance is incontrovertible and a pleasant delight to patient and surgeon. Furthermore, this underscores the immense elasticity and regenerative capacity, as well as adequacy of residual scroto-genital skin in PGW coverage. Therefore, this method is a useful armamentarium in managing medium to large PGWs in low resource settings.

The properties of honey enhancing wound healing are well documented and includes antibacterial, anti-inflammatory, antioxidant, hyperosmolar activities. It stimulates fibroblast and macrophage activity necessary for tissue repair, while its high concentration of nutrients (glucose, fructose, maltose, sucrose and isomaltose) promotes epithelialization and angiogenesis. Glucose oxidase enzyme in honey converts sugar to gluconic acid and 3% hydrogen peroxide which exert bactericidal effect [25,26]. Synergistically, the role of hypertonic salt solution in wound healing is attributed to its bactericidal, hygroscopic and de-sloughing properties [17].

Use of novel wound care methods such as negative pressure wound therapy (NPWT), vacuum-assisted closure (VAC), hyperbaric oxygen therapy (HBO), plates and strips made of calcium alginate, hydrogels, polyurethane, saline sitz baths and povidone-iodine dressings have been shown to promote healing by second intention [5,12,13,21]. Lauerman et al in a review of 168 patients concluded that even large PGWs, if placed on long term wound care can heal by second intention only, without resort to skin grafts or flaps [15]. In this study wound cover was achieved within 9-12 weeks depending on size of the wound. This is consistent with an earlier report from Lagos [11], while Muchuweti *et al.,* achieved spontaneous closure in 4 weeks [5]. Arguments against conservative wound management are premised on prolonged hospital stay and development of contractures [8,9]. In our practice, we discharge the patients after the acute phase and teach them to self-administer daily saline sitz baths and honey dressings at home. One of the patients with long segment urethral stricture (associated with watering can perineum), and penile only PGW was allowed to heal by second intention. A year later, the regenerated penile skin was successfully used for substitution urethroplasty. The average duration of hospital stay in this study was 28.65 (±11.98) days, and is consistent with published reports by other authors [16-17,21-23].

FG is a potentially fatal condition with racial and regional variability in mortality rates. Studies have shown that mortality rates in FG are higher in caucasians than in blacks. Mortality rate in this study was 3.3%. This is similar to rates of 3.6%, and zero mortality from our sub-region [16,17]. However, mortality rates of 9.6%, 15.79% and 17% have been reported from another region [21-23]. These still fall short of rates of 29.6% and 34% reported from Europe [27,28]. Factors adduced to explain high mortality rates include old age, primary anorectal infections, delayed treatment, higher anatomical extent of gangrene and severe sepsis. The latter two factors unequivocally explain mortality in the two patients in this study.

CONCLUSION

The rapidly spreading necrosis of the genitalia and perineum, and the systemic sepsis encountered in FG

can be aborted by the time-honoured principles of fluid resuscitation, intravenous combination antibiotic therapy and prompt radical surgical debridement of gangrenous parts. Daily hypertonic saline sitz baths and honey dressings de-sloughs, stimulate granulation tissue formation and re-epithelialization in the PGW, which facilitates considerable regeneration of residual genital skin adequate for coverage by either second intention or secondary suturing. Conservative wound management should be considered an excellent method for restoring pre-gangrene genitalia.

REFERENCES

1. Morpurgo E. (2002). Fournier's gangrene. Surg Clin N Am, 82: 1213-24
2. Gurjit Singh, Chawla S. (2004). Aggressiveness — the key to a successful outcome in Fournier's Gangrene. Medical Journal Armed Forces India, 60(2): 142-145
3. Fournier JA. (1883). Gangrene Foudroyante de la verge. Medecin Pratique, 4: 589-97
4. Liang SG, Chen HH, Lin SE, Cheng CL, Lu CC, Hu WH. (2008). Fournier's gangrene in female patients. J Soc Colon Rectal Surgeon (Taiwan), 19: 57-62
5. Muchuweti D, Muguti E, Mungazi SG. (2020). Spontaneous closure of an extensive post-debridement perineal wound in a newly diagnosed diabetic patient presenting with necrotizing fasciitis. Clin Case Rep, 8(6):1044-1047. doi: 10.1002/ccr3.2805. PMID: 32577261; PMCID: PMC7303866.
6. Khalid A, Devakumar S, Huespe I, Kashyap R, Chisti I. (2023). A Comprehensive Literature Review of Fournier's Gangrene in Females. Cureus, 15(5):e38953. doi: 10.7759/cureus.38953. PMID: 37197302; PMCID: PMC10184784.
7. Huayllani MT, Cheema AS, McGuire MJ, Janis JE. (2022). Practical Review of the Current Management of Fournier's Gangrene. Plast Reconstr Surg Glob Open, 10(3):e4191. doi: 10.1097/GOX.0000000000004191. PMID: 35295879; PMCID: PMC8920302.
8. Chennamsetty A, Khourdaji I, Burks F, Killinger KA. (2015). Contemporary diagnosis and management of fournier's gangrene. Ther Adv Urol, 7 (4): 203-215
9. Insua-Pereira I, Ferreira PC, Teixeira S, Barreiro D, Silva Á. (2020). Fournier's gangrene: a review of reconstructive options. Cent European J Urol, 73(1):74-79. doi: 10.5173/ceju.2020.0060. Epub 2019 Dec 31. PMID: 32395328; PMCID: PMC7203772.
10. Carvalho JP, Hazan A, Cavalcanti AG, Favorito LA. (2007). Relation between the area affected by Fournier's gangrene and the type of reconstructive surgery used. A study with 80 patients. Int Braz J Urol, 33(4):510-4. doi: 10.1590/s1677-55382007000400008. PMID: 17767755.
11. Osegbe DN, Akaiso OE, Panchalingam L, Dania F, Harry A, Ashiru B. (1998). Fournier's Gangrene: Infective Gangrene of the Genitalia. Lagos Journal of Surgery, 1 (1): 3-8
12. Jones EG, El-Zawahry AM. (2012). Curative treatment without surgical reconstruction after perineal debridement of Fournier's gangrene. J Wound Ostomy Continence Nurs, 39(1):98-102. doi: 10.1097/WON.0b013e31823fe212. PMID: 22237647.
13. Milanese G, Quaresima L, Dellabella M, Scalise A, Di Benedetto GM, Muzzonigro G, Minardi D. (2015). A conservative approach to perineal Fournier's gangrene. Arch Ital Urol Androl, 87(1):28-32. doi: 10.4081/aiua.2015.1.28. PMID: 25847893.
14. Michael P, Peiris B, Ralph D, Johnson M, Lee WG. (2022). Genital Reconstruction following Fournier's Gangrene. Sex Med Rev, 10(4):800-812. doi: 10.1016/j.sxmr.2022.05.002. PMID: 37051973.
15. Lauerman M, Kolesnik O, Park H, Buchanan LS, Chiu W, Tesoriero RB, Stein D, Scalea T, Henry S. (2018). Definitive Wound Closure Techniques in Fournier's Gangrene. Am Surg, 84(1):86-92. PMID: 29428033.
16. Ugwumba FO, Nnabugwu II, Ozoemena OF. (2012). Fournier's gangrene -- analysis of management and outcome in south-eastern Nigeria. S Afr J Surg, 50(1):16-9. PMID: 22353315.
17. Omisanjo OA, Bioku MJ, Ikuerowo SO, et al. (2014). Clinical characteristics and outcome of management of Fournier's gangrene at the Lagos State University Teaching Hospital, Ikeja, Lagos, Nigeria. Ann Afr Med, 13: 174-178
18. Guzzo JL, Bochicchio GV, Henry S, Keller E, Scalea TM. (2007). Incarcerated inguinal hernia in the presence of Fournier's gangrene: a novel approach to a complex problem. Am Surg, 73(1):93-5. PMID: 17249467.
19. Xiarchos A, Tshijanu F, Chatzigianni E, Xiarchos G, Vorias M, et al. (2021) A Giant Sliding Inguino-Scrotal Hernia Inducing Fournier Gangrene in an Octagenarian Diabetic Patient: A Case Report and Review of Medical Literature. Ann Case Report 6: 616. DOI: 10.29011/2574-7754.100616
20. Halid Melkamu, Fikadu Negash, Biniyam Yohannes, Arop Garang, Leul Mulubrhan, Tsedeke Tullicha. (2024). A neglected case of strangulated right groin hernia presenting with perforated ileum, vanished right testis and necrotizing fasciitis of the right groin: A case report. International Journal of Surgery Case Reports, Volume 116,109425,ISSN 2210-2612.
21. Oyelowo N, Ahmed M, Lawal AT, Sudi A, Adetola Tolani AMM, Fidelis L, Bello A, Maitama HY. (2021). Fournier's gangrene: Presentation and predictors of mortality in Zaria, Nigeria. Ann Afr Med, 20(2):105-110. doi: 10.4103/aam.aam_23_20. PMID: 34213476; PMCID: PMC8378468.
22. Aliyu S, Ibrahim AG, Ali N, Waziri AM. (2013). Fournier's Gangrene as Seen in University of Maiduguri Teaching Hospital. ISRN Urol,

2013:673121. doi: 10.1155/2013/673121. PMID: 23997966; PMCID: PMC3753747.
23. Agwu NP, Mohammad AS, Abdullahi AA, Bashir B, Legbo JN, Mungadi IA. (2020). Pattern and outcome of management of Fournier's gangrene in a resource constraint setting. Urol Ann, 12: 248-53.
24. Eke N. (2002). Fournier's gangrene: a review of 1726 cases. Br J Surg, 87 (6): 718-28
25. Ayse Celik Yilmaz, Dilek Aygin. (2020). Honey dressing in wound treatment: A systematic review. Complementary Therapies in Medicine, 51, 102388, ISSN 0965-22
26. Tashkandi H. (2021). Honey in wound healing: An updated review. Open Life Sci, 16(1):1091-1100. doi: 10.1515/biol-2021-0084. PMID: 34708153; PMCID: PMC8496555.
27. Aridogan IA, Izol V, Abat D, Karsli O, Bayazit Y. (2012). Epidemiological characteristics of Fournier's Gangrene : A report of 71 patients. Urol Int, 89: 457-61.
28. Polo MJ, Sánchez T. (2008). Fournier's gangrene: Study of prognostic factors in 90 patients. Actas Urol Esp, 32:1024-30.