

## Research Article

Michele Del Zingaro, Andrea Boni, Jacopo Adolfo Rossi De Vermandois\*, Alessio Paladini, Emanuele Lepri, Pietro Ursi, Roberto Cirocchi, Morena Turco, Gianluca Gaudio, Andrea Nogara, Ettore Mearini

# Fournier's gangrene and intravenous drug abuse: an unusual case report and review of the literature

<https://doi.org/10.1515/med-2019-0114>

received February 9, 2019; accepted July 9, 2019

**Abstract:** Fournier's gangrene is a potentially fatal emergency condition characterized by necrotizing fasciitis and supported by an infection of the external genital, perineal and perianal region, with a rapid and progressive spread from subcutaneous fat tissue to fascial planes.

In this case report, a 52-year-old man, with a history of hepatitis C-virus (HCV)-related chronic liver disease and cocaine use disorder for which he was receiving methadone maintenance therapy, was admitted to the Emergency Department with necrotic tissue involving the external genitalia.

Fournier's gangrene is usually due to compromised host immunity, without a precise cause of bacterial infection; here it is linked to a loco-regional intravenous injection of cocaine. A multimodal approach, including a wide surgical debridement and a postponed skin graft, was needed.

Here we report this case, with a narrative review of the literature.

**Keywords:** Fournier's gangrene; Necrotizing Fasciitis; Surgery; Infection

## 1 Introduction

Fournier's gangrene was described for the first time in 1764 by Baurienne as an idiopathic, necrotizing lethal process in a man affected by gangrene of the genitalia. However, the origin of this clinical condition must be linked to Jean Alfred Fournier who described a series of fatal cases of idiopathic gangrene of the genitalia with a sudden onset in 5 young men in 1883 [1]. Fournier's gangrene is a potentially fatal condition; it is characterized by necrotizing fasciitis and supported by an infection of the external genital, perineal and perianal region, with a rapid and progressive spread from subcutaneous fat tissue to fascial planes [2].

This emergency condition always requires a multimodal approach: antibiotic therapy, surgery followed by intensive care, and oxygen hyperbaric therapy [3].

Because of its rarity, most of the limited knowledge about Fournier's gangrene derives from case reports and retrospective studies with small sample size [4].

Here, in order to improve the knowledge concerning Fournier's gangrene, we describe an unusual case due to injection of cocaine into the superficial dorsal vein of the penis, followed by a comprehensive literature review.

## 2 Material and methods

We performed a narrative review of the literature by searching "Fournier's gangrene", "necrotizing fasciitis" on PubMed and Scopus (Table). Case reports, case series, and reviews were chosen and used to extract data regarding gender, age, comorbidity, pathogens, number of surgical debridements performed, peri-operative outcomes, intra- and post-operative complications, length of hospital stay, and number of hospitalizations in intensive care units. Two authors (AB, AP) independently performed online bibliographic searches to identify titles and abstracts of interest. Full texts of relevant articles were further assessed for inclusion in this study.

---

\*Corresponding author: Jacopo Adolfo Rossi De Vermandois, Department of Surgical and Biomedical Sciences, University of Perugia, Perugia, Italy, E-mail: jacopo.rossi.jr@gmail.com

Michele Del Zingaro, Andrea Boni, Alessio Paladini, Emanuele Lepri, Morena Turco, Gianluca Gaudio, Andrea Nogara, Ettore Mearini, Department of Surgical and Biomedical Sciences, University of Perugia, Perugia, Italy

Pietro Ursi, Department of General Surgery and Surgical Specialties "Paride Stefanini", Sapienza University of Rome, Rome, Italy

Roberto Cirocchi, Division of General Surgery, Department of Surgical and Biochemical Sciences, University of Perugia, Perugia, Italy

Table 1: review of the Literature up-to-date to July 2019

Reference	Year	Gender	N. of cases	Mean age	Surgical debridement	Days of hospital stay	Sepsi / ICU	Hyperbaric oxygen therapy	Pathogen	N. of deaths
Del Zingaro et al. [36]	2019	M	1	76	1	ND	0	0	Pseudomonas putida, Stenotrophomonas maltophilia, Staphylococcus haemolyticus and Staphylococcus Warneri	0
Arora et al. [37]	2019	50M	50	53	1	12.6	ND	ND	Escherichia coli, Staphylococci, Pseudomonas, Bacteroides, Streptococci	12
Ali et al. [38]	2019	M	1	45	1	ND	1	0	ND	0
Mostaghim et al. [39]	2019	M	1	38	1	ND	0	0	Escherichia coli, Enterococcus faecalis, Bacteroides thetaiotaomicron, Streptococcus agalactiae, Clostridium clostridioforme	0
Zhou et al. [40]	2019	M	1	58	1	ND	1	0	ND	0
Aslan et al. [41]	2019	M	1	12	0	8 h	2	0	Pseudomonas aeruginosa	1
Heijkoop et al. [42]	2019	ND	14	ND	6	36	9	0	ND	1
Paone et al. [43]	2019	M	1	72	>1	ND	2	0	ND	0
Lin et al. [44]	2019	118M	118	58	1	ND	ND	ND	ND	17
Akella et al. [45]	2019	M	1	37	1	ND	ND	0	Staphylococcus aureus, Streptococcus, Anaerobic bacteroides	0
Klement et al. [46]	2019	M	1	53	1	ND	1	ND	ND	1
Onder et al. [47]	2019	M	1	64	2	ND	ND	ND	ND	0
Bersoff-Matcha et al. [48]	2019	39M 16F	55	ND	1	ND	9	ND	ND	3
Louro et al. [49]	2019	14M 1F	15	66.9	3.3	46.8	ND	ND	Escherichia coli, MRSA, Streptococcus pyogenes, Enterococcus faecium, Enterococcus cloacae, Klebsiella pneumoniae, Streptococcus epidermidis, Bacteroides fragilis, Corynebacterium, Candida albicans, Aspergillus fumigatus	0

Table 1 continued: review of the Literature up-to-date to July 2019

Reference	Year	Gender	N. of cases	Mean age	Surgical deb- ridement	Days of hos- pital stay	Sepsi / ICU	Hyperbaric oxygen therapy	Pathogen	N. of deaths
Únverdi et al. [50]	2019	13M	13	54.3	1	42	ND	ND	Bacteroides Fragilis, Escherichia coli, Klebsiella spp, Pseudomo- nas aeruginosa Escherichia coli, Enterococcus faecalis, Proteus mirabilis, Klebsiella pneumoniae, Peptostreptococcus, Pseudomonas aeruginosa Fusobacterium varium, Escherichia coli, Bacteroides fragilis	0
Hong-Cheng et al. [51]	2019	56M 4F	60	53	1.17	ND	1	0	Escherichia coli, Enterococcus faecalis, Proteus mirabilis, Klebsiella pneumoniae, Peptostreptococcus, Pseudomonas aeruginosa Fusobacterium varium, Escherichia coli, Bacteroides fragilis	1
Rachana et al. [52]	2019	M	1	50	1	18	0	0	Escherichia coli, Bacteroides fragilis	0
Joury et al. [53]	2019	M	1	51	1	ND	ND	0	MRSA, Edwardsiella tarda, Klebsiella oxytoca, Prevotella	0
Selvi et al. [54]	2019	30M	30	62.9	6	20	9	ND	ND	3
Majdoub et al. [55]	2018	F	1	70	-	-	-	-	Escherichia coli, Bacteroides	1
Hahn et al. [56]	2018	33M 11F	44	54.4	3.3	47	18	ND	Polymicrobial flora (Escherichia coli, Entero- coccus, Staphylococcus, Klebsiella) (7), Monomicrobial flora (Staphylococcus, Esche- richia coli, Klebsiella, Enterococcus, Candida (22)	9
Overholt et al. [57]	2018	M	1	44	2	13	0	0	Escherichia coli, Enterococcus avium, Gemella morbillorum	0
Pehlivanli et al. [58]	2018	19M 4F	23	65.9	6	18	ND	ND	Escherichia coli, Klebsiella, Staphylococci, Enterobacter	5
Kranz et al. [4]	2018	154M	154	62.7	4.2	26.6	104	13	Mixed flora (73), Streptococci (12), Staphylo- cocci (10), Enterococcus (10), Citrobacter (1), Pseudomonas (1), Candida (2)	17
Kobayashii et al. [59]	2018	M	1	68	1	59	1	0	Escherichia coli	0
Pandey et al. [60]	2018	M	1	65	1	ND	ND	ND	ND	ND
Matsuura et al. [61]	2018	M	1	88	ND	ND	ND	0	ND	1
Sen et al. [62]	2018	M	1	47	1	18	0	0	Rhizobium radiobacter	0
Elsaket et al. [63]	2018	43M 1F	44	51	1.33	26	6	ND	Staphylococcus aureus, Acinetobacter, Strep- toccus pyogenes, Proteus mirabilis, ND	5
Heijkoop et al. [64]	2018	ND	14	ND	6	36	8	0	ND	1
Takano et al. [65]	2018	F	1	44	1	ND	ND	0	Streptococcus constellatus, Clostridium ramosum	1

Table 1 continued: review of the Literature up-to-date to July 2019

Reference	Year	Gender	N. of cases	Mean age	Surgical deb- ridement	Days of hos- pitalstay	Sepsi / ICU	Hyperbaric oxygen therapy	Pathogen	N. of deaths
Semenič et al. [66]	2018	M	1	30	2	16	1	0	Escherichia coli, Bacteroides fragilis, Prevotella oralis, Streptococcus anginosus	0
Abbas-Shereef et al. [67]	2018	M	1	71	>1	30	1	0	Pseudomonas aeruginosa, Klebsiella pneumoniae, Candida albicans, Staphylococci, Group A Streptococcus	0
Wetterauer et al. [68]	2018	20M	20	66	4	ND	15	0	Escherichia coli, Klebsiella, Pseudomonas aeruginosa	3
Demir et al. [69]	2018	49M 25F	74	57.6	1.87	23.18	ND	ND	Escherichia coli, Staphylococcus aureus, Streptococci, Enterobacter, Pseudomonas aeruginosa, Bacteroides, Proteus, Clostridium	6
Chen et al. [70]	2018	M	1	29	2	11	1	0	Streptococcus Agalactiae, Staphylococcus haemolyticus, Escherichia coli, peptostreptococci, Prevotella corporis	0
Yuan et al. [71]	2018	M	1	62	1	ND	1	ND	Enterococcus avium, Escherichia coli	ND
Katsimantas et al. [72]	2018	M	1	68	2	17	0	0	Enterococcus faecalis, Streptococcus gordonii, Prevotella melaninogenica	0
Althunayyan et al. [73]	2018	F	1	36	2	31	1	0	Escherichia coli, Acinetobacter baumannii	0
Pittaka et al. [74]	2018	F	1	24	>1	14	ND	ND	ND	0
Taylor et al. [75]	2018	F	1	58	1	ND	1	ND	Bacteroides fragilis, Clostridium ramosum, Gram positive cocci	1
Dos Santos et al. [76]	2018	29M 11F	40	51.7	1.8	19.6	9	ND	ND	9
Fukui et al. [77]	2018	M	1	85	1	104	1	0	Streptococcus dysgalactiae, Escherichia coli, Staphylococci	0
Kuzaka et al. [78]	2018	13M	13	59.6	>1	31.9	0	ND	Enterobacteriaceae, Bacteroides, Parabacteroides, Klebsiella, Staphylococcus, Lactocillus acidophilus, Escherichia coli	0
Goel et al. [79]	2018	M	1	60	1	14	0	0	ND	0
Ghoduoussipour et al. [80]	2018	54M	54	49.3	3.9	37.5	53	ND	ND	3
Tenório et al. [81]	2018	99 M, 25F	124	50.8	ND	21.7	ND	1	Escherichia coli, Proteus, Klebsiella, Pseudomonas, Staphylococci, Enterococcus, Clostridium	32
Weimer et al. [82]	2017	M	1	55	>1	90	1	0	Parabacteroides distasonis, Prevotella melaninogenica, Fusobacterium nucleatum, Bacteroides	0
Wähmann et al. [83]	2017	F	1	46	3	ND	1	ND	Streptococci, Enterobacteria, gram+	0
Wang et al. [84]	2017	M	1	61	1	ND	ND	ND	Klebsiella pneumoniae	0
Yücel et al. [85]	2017	11M, 14F	25	54.3	2.4	21.4	ND	0	ND	1

Table 1 continued: review of the Literature up-to-date to July 2019

Reference	Year	Gender	N. of cases	Mean age	Surgical deb- ridement	Days of hos- pital stay	Sepsi / ICU	Hyperbaric oxygen therapy	Pathogen	N. of deaths
Üreyen et al. [86]	2017	18M, 11F	29	51.5	1.8	11.5	17	ND	Escherichia coli, Acinetobacter, Streptococci, Staphylococcus aureus, Pseudomonas, Klebsiella,	6
Dell'Atti et al. [87]	2017	M	1	75	1	28	1	0	ND	0
Yanaral et al. [88]	2017	54M	54	58.3	1.4	15.3	ND	0	ND	4
Chia et al. [89]	2017	42M, 17F	59	56	>1	19	11	ND	Streptococci, Escherichia coli, Prevotella	9
Kordahi et al. [90]	2017	M	1	57	>1	ND	ND	ND	ND	ND
Hong et al. [91]	2017	18M, 2F	20	61.8	1.55	36.9	15	0	Escherichia coli, Streptococci, Proteus, Klebsiella pneumoniae, Enterococcus faecium, Pseudomonas aeruginosa, Staphylococcus aureus	5
Sanders et al. [92]	2017	M	1	70	2	ND	1	0	Escherichia coli, P. mirabilis	0
Ferretti et al. [93]	2017	19M, 1F	20	56	4	31.7	17	4	ND	3
Kumar et al. [94]	2017	M	1	41	2	15	1	0	Streptococcus anginosus, anaerobes, Gram -	0
Ioannidis et al. [95]	2017	20M, 4F	24	58.9	1	16	18	3	Escherichia coli (11), Klebsiella pneumoniae (3), Pseudomonas aeruginosa (3), Acinetobacter baumannii (2), Proteus mirabilis (2), Providencia stuartii (1)	5
Bocchiotti et al. [96]	2017	M	1	40	3	ND	0	0	Escherichia coli, Streptococcus pyogenes, Prevotella loeschii	0
Choi et al. [97]	2017	F	1	31	1	17	0	0	Streptococcus anginosus, Pseudomonas, Clostridium	0
Sawayama et al. [98]	2017	M	1	66	1	ND	0	0	ND	0
Laureman et al. [99]	2017	12.5M, 43F	168	ND	>1	ND	92	0	Enterococcus faecalis, Klebsiella pneumoniae, Escherichia coli, Clostridium difficile	6
Smith et al. [100]	2017	M	1	50	>1	ND	1	0	ND	0
Baek et al. [101]	2017	F	1	57	1	ND	1	ND	ND	0
Huang [102]	2017	M	1	46	1	ND	1	0	ND	0
Morais et al. [103]	2017	12M, 3F	15	70	ND	32	ND	0	Escherichia coli, Proteus, Staphylococcus aureus, Enterococcus faecalis	4
Okumura et al. [104]	2017	M	1	70	1	39	1	0	Klebsiella pneumoniae, Group G Streptococcus	0
Osburn et al. [105]	2017	ND	165	53.4	1.97	16.6	43	ND	ND	11
Kahn et al. [106]	2017	M	147	52	2.5	19	112	ND	ND	11
Misiakos et al. [107]	2017	47M, 15F	62	63.7	4.8	19.7	32	0	ND	11
Obi [108]	2017	4M	4	34.3	1	17.3	0	0	Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, Proteus mirabilis	0

Table 1 continued: review of the Literature up-to-date to July 2019

Reference	Year	Gender	N. of cases	Mean age	Surgical debridement	Days of hospital stay	Sepsis / ICU	Hyperbaric oxygen therapy	Pathogen	N. of deaths
Pernetti et al. [109]	2016	M	1	70	1	21	1	ND	ND	0
Faria et al. [110]	2016	M	1	46	1	4	1	0	ND	0
Ozkan et al. [111]	2016	7M, 5F	12	62.4	5.7	19.6	ND	0	Polymicrobial flora (6), monomicrobica (6)	0
Yoshino et al. [112]	2016	M	1	64	1	33	1	0	Streptococcus. alpha-emolitic	0
Crowell et al. [113]	2016	M	1	54	3	18	1	0	Rhizopus (zygomycosis)	1
Taken et al. [114]	2016	57M, 8F	65	52.5	2.5	9.2	13	0	Escherichia coli, Streptococcus, Staphylococcus aureus, Enterobacter, Bacteroides, Pseudomonas aeruginosa, Proteus, Clostridium	6
Wanis et al. [115]	2016	M	1	28	1	14	1	0	ND	0
Sheehy et al. [116]	2016	M	1	48	2	ND	1	0	Polymicrobial flora	0
Sarkut et al. [117]	2016	32M, 32F	64	57	3	16.6	ND	ND	ND	18
Sinha et al. [118]	2015	F	1	30	1	ND	1	0	ND	0
Marín et al. [119]	2015	53M, 6F	59	68	ND	24.4	50	ND	ND	15
Chalya et al. [120]	2015	82M, 2F	84	34	ND	28	ND	ND	ND	24
Namkoong et al. [121]	2015	M	1	61	1	ND	1	0	ND	0
Schulz et al. [122]	2015	M	1	59	>1	ND	1	0	ND	0
McCormack et al. [123]	2015	25M	25	56.6	1.4	ND	3	ND	Polymicrobial flora	5
Tarchouli et al. [124]	2015	64M, 8F	72	51	3.2	28.7	17	56	Polymicrobial flora (37), Monomicrobial flora (1)	12
Paonam et al. [125]	2015	M	1	65	1	ND	1	0	Escherichia coli, Enterococcus	0
Oguz et al. [126]	2015	34M, 9F	43	52	>1	ND	43	0	Polymicrobial flora (Escherichia coli 48%)	6
Asahata et al. [127]	2015	M	1	70	1	ND	0	0	Listeria monocytogenes, Escherichia coli	0
Ye et al. [128]	2015	M	1	47	1	21	0	0	Pseudomonas aeruginosa	0
Danesh et al. [129]	2015	8M	8	44	>1	ND	ND	0	Enterococcus, Pseudomonas, Staphylococcus haemolyticus, Proteus, Clostridium	3
Ossibi et al. [130]	2015	M	1	60	1	ND	0	0	ND	0
Mahmoudi et al. [131]	2015	M	1	44	1	ND	1	0	ND	0
Cochetti et al. [132]	2015	2M	2	42.5	0.5	ND	2	1	Staphylococcus warneri	1
Sarmah et al. [133]	2015	M	1	68	1	1	1	0	Bacteroides fragilis	1
Papadimitriou et al. [133]	2015	M	1	56	1	90	1	0	Polymicrobial flora	0
Ozsaker et al. [134]	2015	M	1	69	1	ND	0	0	ND	0
García Marín et al. [135]	2015	53M, 6F	59	68	ND	ND	18	0	ND	15
Toh et al. [136]	2014	M	1	61	6	ND	1	0	Polymicrobial flora	0
Parry et al. [137]	2014	M	1	48	1	ND	0	0	ND	0
Tena et al. [138]	2014	M	1	73	1	55	1	0	Actinomyces funkei, Clostridium hathewayi, Fusobacterium necrophorum	0
Matilsky et al. [139]	2014	M	1	51	4	30	1	0	Polymicrobial flora	0
Lee et al. [129]	2014	3M	3	50.7	ND	ND	ND	ND	ND	ND

Table 1 continued: review of the Literature up-to-date to July 2019

Reference	Year	Gender	N. of cases	Mean age	Surgical deb- ridement	Days of hos- pital stay	Sepsi / ICU	Hyperbaric oxygen therapy	Pathogen	N. of deaths
Di Serafino et al. [140]	2014	M	1	63	1	ND	ND	ND	ND	0
Galukande et al. [141]	2014	2M	2	35.5	2.5	ND	0	0	ND	0
Tattersall et al. [142]	2014	M	1	61	2	47	1	ND	Escherichia coli	0
Omisano et al. [143]	2014	11M	11	51.9	>1	22.7	7	0	Klebsiella (10), Escherichia coli, Pseudomonas aeruginosa, no microbes (1)	0
Rubegni et al. [144]	2014	2M	2	58.5	1	ND	0.5	0	ND	1
Dinc et al. [145]	2014	M	1	51	>1	16	0	0	ND	0
Dayan et al. [146]	2014	M	1	27	>1	ND	0	0	ND	0
Ludolph et al. [147]	2014	3M	3	48.7	>1	ND	0	0	ND	0
Ozkan et al. [148]	2014	7M, 5 F	12	62.4	5.7	19.6	ND	0	Pseudomonas, Acinetobacter, Escherichia coli, Enterococcus, Stafilococcus aureus, Proteus, Corynebacterium, Polymicrobial flora (6)	ND
Shimizu et al. [149]	2014	M	1	74	2	ND	0	0	Proteus vulgaris, Prevotella denticola, Pepto-streptococcus species	ND
Ho et al. [150]	2014	F	1	78	1	14	0	0	ND	1
Aslanidis et al. [151]	2014	F	1	23	>1	ND	1	0	Candida albicans, Staphylococcus epidermidis, Klebsiella pneumoniae	0
D'Arena et al. [152]	2014	M	1	66	1	ND	0	0	ND	0
Perkins et al. [153]	2014	M	1	73	1	ND	0	0	Candida albicans	0
Sliwinski et al. [154]	2014	M	1	24	>1	ND	1	0	ND	0
Agostini et al. [155]	2014	M	1	64	2	58	1	1	Staphylococcus epidermidis, Proteus mirabilis, Enterococcus faecalis	0
Oymaci et al. [156]	2014	10M, 6F	16	61.2	4.44	25.5	ND	0	Escherichia coli, Acinetobacter baumannii, Proteus mirabilis, Staphylococcus aureus, Enterococcus	3
Eskitascioglu et al. [157]	2014	76M, 4F	80	53.5	1.55	34.78	ND	0	Polymicrobial flora (14), Escherichia coli, Staphylococcus aureus, Enterococcus, Acinetobacter baumannii, Staphylococcus epidermidis, Proteus, etc.	3
Yilmazlar et al. [158]	2014	81M, 39F	120	58	3	14.5	48	0	Escherichia coli, Streptococci, Enterococci, Staphylococci, Klebsiella, Pseudomonas, Proteus, fungi	25
Akbulut et al. [159]	2014	M	1	77	1	20	0	0	Escherichia coli	0
Coyne et al. [160]	2014	M	1	48	1	ND	0	0	ND	0
Li et al. [161]	2014	48M, 3 F	51	49.7	>1	17	ND	0	Escherichia coli, Streptococcus, Staphylococcus aureus, Pseudomonas, Proteus, Clostridium, Bacteroides	6

Table 1 continued: review of the Literature up-to-date to July 2019

Reference	Year	Gender	N. of cases	Mean age	Surgical deb- ridement	Days of hos- pital stay	Sepsi / ICU	Hyperbaric oxygen therapy	Pathogen	N. of deaths
Oyaert et al. [162]	2014	M	1	43	1	63	1	0	Atopobium	0
Lee et al. [163]	2013	M	1	47	>1	ND	0	0	Enterococcus, Enterobacter	0
Abate et al. [164]	2013	M	1	63	1	21	0	0	Enterococcus faecalis, Citrobacter freundii,	0
Anantha et al. [165]	2013	M	1	59	1	16	1	0	Pseudomonas aeruginosa, Escherichia coli, Bacteroides fragilis, Bacteroides ovatus	0
Benjelloun et al. [166]	2013	44M, 6F	50	48	2.5	21	11	0	Streptococcus anginosus	12
Pastore et al. [167]	2013	M	1	60	>1	34	0	1	Escherichia coli, Klebsiella	0
Eray et al. [168]	2013	34M, 14F	48	53.7	ND	25.3	ND	0	Streptococcus A	0
Bjurlin et al. [169]	2013	40M, 1F	41	49	ND	ND	ND	ND	ND	9
Parik et al. [170]	2013	M	1	59	>1	ND	0	0	Polymicrobial flora (34), Bacteroides (43.9%), Escherichia coli (36.6%), Prevotella, Strepto- cocci, Staphylococcus aureus	2
Subramaniam et al. [171]	2013	M	1	80	3	ND	1	0	ND	0
Sabzi Sarvestani et al. [172]	2013	28M	28	44.6	2.2	17.22	ND	0	Escherichia coli, Anaerobes Escherichia coli, Bacteroides, Streptococci, Enterococci, Staphylococci, Pseudomonas, Klebsiella, Proteus	10
Katib et al. [173]	2013	20M	20	55.95	1.7	22.3	1	0	Acinetobacter spp. (most common)	0
Czymek et al. [174]	2013	72M, 14F	86	57.9	4	52	52	ND	Polymicrobial flora (71), Escherichia coli, Enterococci, Streptococci, Pseudomonas, Staphylococci, etc.	14
Akilov et al. [175]	2013	28M	28	47.1	3.5	24.4	8	0	Monomicrobial flora (18), Staphylococci, Streptococci, Enterobacter, Pseudomonas	0
Bakari et al. [176]	2013	10M	10	50.5	ND	ND	ND	0	ND	ND
Avakoudjo et al. [177]	2013	ND	72	ND	ND	72	ND	ND	Escherichia coli, Staphylococci, Pseu- domonas aeruginosa, Klebsiella	7
Chan et al. [178]	2013	M	1	78	1	ND	1	0	Escherichia coli	0
Chan et al. [179]	2013	M	1	49	15	ND	0	0	Escherichia coli, Streptococci, Arcanobacte- rium	0
Aliyu et al. [180]	2013	43M	43	37.82	>1	28	ND	0	Polymicrobial flora (27)	6
Ozkan et al. [181]	2013	F	1	43	4	ND	1	0	ND	0
Khan et al. [33]	2013	M	1	47	3	ND	1	0	ND	0
Vyas et al. [182]	2013	30M	30	39.6	2.2	9.7	ND	0	Escherichia coli, anaerobes, Streptococci, Pseudomonas, Staphylococci	6

ICU=intensive care unit  
ND=not defined



### 3 Case report

A 52-year-old man with a history of a cocaine use disorder, who was in methadone maintenance therapy and affected by HCV-related chronic liver disease, was admitted to the Emergency Department of a high-volume hospital. At admission to our institution, he presented with fever, acute renal impairment, anuria, poor hygienic conditions, and necrotic tissue involving the external genitalia (Figure 1). The laboratory tests showed  $29 \times 10^9/L$  white blood cells with 95% neutrophils, haemoglobin 15.6 g/dl, glucose 103 mg/dl, aspartate transaminase 79 UI/L, alanine transaminase 68 UI/L, creatinine 2.58 mg/dl, C-reactive protein 56.2 mg/dl, procalcitonin  $>100$  ng/ml. HIV testing was negative. The patient reported no other urological symptoms at hospital admission. He had a Charlson Comorbidity Index score of 2 and an Eastern Cooperative Oncology Group (ECOG) of 1, with no referring major comorbidities.

A scrotal ultrasound examination was performed. It showed the right testis augmented in volume with completely altered echogenicity, augmented vascular sign and hypoechoic areas. The left epididymis and involucres had irregular echogenicity. The left testis appeared to have irregular echogenicity and was hypervascularized with hypoechoic areas. A left hydrocele was present. Computed tomography (CT) was performed. It confirmed phlogosis and edema of the scrotum, with the right testis unrecog-

nizable. Skin, subcutaneous planes, spermatic cord were thickened. Inguinal bilateral and right external iliac lymphadenopathy was described on CT.

The patient underwent resuscitation intravenous fluid support; antibiotic therapy was administered with tigecycline and meropenem. A single, prompt, extended surgical debridement of external genital, perineal, perianal and infrapubic regions to healthy tissue was performed. The patient also underwent at the same time right orchiectomy.

The microbiologic culture of the wound specimen revealed *Staphylococcus lugdunensis* with tigecycline susceptibility. Urine and blood samples cultures were negative. Tigecycline and meropenem were administered until discharge.

The anuric condition persisted for 24 hours; then polyuria developed, but with a renal impairment that required treatment with dialysis.

Five days after the surgical debridement the patient reported the injection of cocaine into the superficial dorsal vein of the penis.

The histologic report confirmed an inflammatory necrotizing process of subcutaneous tissue that expanded to skin, testicular and epididymis parenchyma, rete testis and peritesticular tissue.



**Figure 1:** The physical examination was notable for necrotic-appearing tissue in the entire penis and scrotum, with areas of induration and crepitus

No other wound treatments were performed for the wide extension of involved cutaneous area and the correct development of granulation tissue.

The patient was discharged 17 days after the surgical debridement and was admitted to the waiting list for a skin graft, which was successfully performed 1 month later.

**Ethical approval:** The research related to human use has been complied with all the relevant national regulations, institutional policies and in accordance the tenets of the Helsinki Declaration, and has been approved by the authors' institutional review board of Perugia University.

Written informed consent was obtained from the patient.

## 4 Discussion

Fournier's gangrene is a surgical emergency characterized by necrotizing fasciitis of the genital, perineal and perianal soft tissue. It is a rare condition, representing 0.02% of hospitalizations, with an estimated incidence of 1.6 for 100.000 males/year [5]. This condition affects both males and females. Males are more affected than females with a ratio 10:1, and age of onset is becoming older (between 60s and 70s) [6].

The patient in our case of necrotizing fasciitis was 52 years old. Fournier's gangrene was initially described as an idiopathic process, which has been found to be true in only a few cases. Often the initial cause is an infection involving the ano-rectum (30-50%), uro-genitalia (20-40%) and genital skin (20%). [7-9]. Infection results in inflammation and edema, which leads to obliterating endarteritis of the subcutaneous vessels [10]. The resulting lower blood support leads to peripheral dissection, with consequent spread of infection between the subcutaneous tissue and the skin. The reduction of the blood supply therefore generates gangrena [11].

This necrotizing fasciitis may be due to a condition of compromised host immunity, like diabetes, alcoholism, human immunodeficiency syndrome (HIV), lymphoproliferative diseases, arterial hypertension, renal and hepatic insufficiency, obesity, dementia, tobacco consumption, chronic steroid abuse, chemo- and radiotherapy, or cancer and surgical treatment [12-20]. In our case, a correlation between gangrene and a patient with a history of cocaine abuse undergoing methadone substitution treatment has been highlighted. The patient was also affected by HCV-related chronic liver disease.

The pathogen involved is both aerobic and anaerobic, gram-negative and gram-positive. Some authors suggest the use of three different antibiotic classes to start an empiric treatment to cover all types of pathogen. In most of the cases, a polymicrobial infection (54%) is demonstrated, and *Escherichia coli* is the most frequently isolated pathogen (46.6%). The pathogens with a lower incidence are the streptococcus, bacteroides, enterobacter, staphylococcus, enterococcus, pseudomonas, corynebacterium, and *Klebsiella pneumoniae* [21]. Our review confirms that *E. coli* is the most involved pathogen (53,1%) and a polymicrobial infection the most common cause (68%) of Fournier's gangrene. However, many authors suggest the use of broad-spectrum penicillin or third-generation cephalosporins, an aminoglycoside (e.g. gentamicin) and metronidazole or clindamycin [11]. In our case tigecycline and meropenem were administered to cover aerobic gram-positive and gram-negative pathogens, as well as anaerobic gram-positive and gram-negative pathogens. The administration was related to renal-function impairment.

The risk of a fatal event makes this necrotizing fasciitis an emergency clinical condition. Prompt management is mandatory; hemodynamic support with resuscitation with fluids, broad-spectrum parental antibiotics and surgical debridement of the involved region are the main procedures [22, 23]. Thanks to these approaches, the mortality linked to Fournier's gangrene has dropped from between 20% and 88% to lower than 10% [24, 25]. On the basis of the data we collected, the reported mortality was 14,1 %. In our case, the patient survived the acute condition, and he is still alive.

The surgical debridement must be performed within a few hours of hospitalization, and the removal of necrotic tissue helps in stopping progression of necrotizing fasciitis and in reducing the risk of death [26]. Nevertheless, Proud et al, in a retrospective study of 219 patients found no differences in mortality in patients treated within 24 hours and those not treated. The authors linked this result to the severity of the infection [27]. For some authors (Chowla et al), more than one surgical debridement is necessary to obtain adequate infection control [28]. From our review of literature, more than one surgical debridement was performed in more than 60% of cases. In our case, we performed one surgical debridement, with the goal of obtaining a partial resection of viable tissue adjacent to the necrotic one.

Negative pressure wound therapy (NPWT) may represent a solution to the risk of infection of the large open wound that usually remains after a surgical debridement, since the patient's poor condition it may be difficult to create a skin flap with which to cover the wound [29]. In

NPWT the wound is exposed to a sub-atmospheric pressure between 50 and 125 mm Hg in order to increase blood supply, migration of inflammatory cells, and removal of exudates [11]. According to Chang *et al.*, NPWT allows less frequent wound medication and reduction of pain and length of hospital stay [30].

The use of hyperbaric oxygen therapy (HBOT) is increasing in the management of Fournier's gangrene, but evidence of efficacy is lacking [31]. In the HBOT treatment, the patient inhales 100% O<sub>2</sub> in increased ambient pressure (2 – 3 atmospheres). HBOT has bactericidal and bacteriostatic effects on anaerobic pathogens, in particular. It also improves bacterial lysis by leukocytes and stimulates collagen formation and superoxide dismutase with tissue survival [11,13]. Some authors have reported the range of mortality to be between 16% and 30%, whereas for the patients who undergo HBOT, the mortality is found to be approximately 17.6%.

In our case, our patient obtained a complete resolution of the necrotizing process without NPWT or HBOT, and a skin graft was then performed.

Cocaine, as described by Burnett [32], could be associated with priapism, and when administered into the corpora cavernosa, it could produce a prolonged erection [33]. In our knowledge, only two other cases of Fournier's gangrene associated with penile injection of cocaine [33, 34] and three cases of penile necrosis [35] have been described. In both cases of Fournier's gangrene, the necrosis was limited to the penis. The mechanism behind the necrotizing fasciitis after intra-corpora cavernosa injection of cocaine could be dual: cocaine has an intensive vasoconstrictive action that could lead to dermal necrosis that could be complicated by superinfection [33] or by inoculation of infective agents [34]. In our case, we believe that the inoculation of infective agents was the most plausible mechanism, since a skin commensal bacterium was involved.

## 5 Conclusion

Fournier's gangrene is a potentially fatal condition that must be treated in a multimodal setting.

Here we report a rare case of genital and perineal necrotizing fasciitis after a loco-regional intravenous injection of cocaine.

To offer the patient the possibility of survival, a prompt application of a multimodal approach with intravenous fluid support, antibiotic therapy and aggressive surgical debridement is mandatory.

**Conflict of interest statement:** Authors state no conflict of interest.

## References

- [1] Singh A, Ahmed K, Aydin A, Khan MS, Dasgupta P. Fournier's gangrene. A clinical review. *Arch Ital UrolAndrol*, 2016; 88, 3.
- [2] Marchesi A, Marcelli S, Parodi PC, Perrotta RE, Riccio M, Luca Vaienti L. Necrotizing fasciitis in aesthetic surgery: a review of the literature. *AesthPlastSurg*, 2017, 41:352-358
- [3] Ueshima J, Maeda K, Wakabayashi H, Nishioka S, Nara S, Nakatani H. Availability of early, intensive, and continuous nutrition management for Fournier's gangrene with rectal cancer: a case report. *J Acad Nutr Diet*, 2016, Vol. 116 No. 6, 909-916
- [4] Kranz J, Schlager D, Anheuser P, Mühlstädt S, *et al.* Desperate need for better management of Fournier's gangrene. *Cent European J Urol*, 2018; 71: 360-365
- [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*, 2009,181:2120-2126
- [6] Rodríguez Alonso A, Pérez García MD, Núñez López A, Ojea Calvo A, Alonso Rodrigo A, Rodríguez Iglesias B, Barros Rodríguez JM, Benavente Delgado J, Nogueira March JL. Fournier's gangrene: anatomo-clinical features in adults and children. *Therapy update. ActasUrolEsp*, 2000, 24(4):294-306
- [7] Eke N. Fournier's gangrene: a review of 1726 cases. *Br J Surg*, 2000, 87:718-728
- [8] Cirocchi R, Randolph JJ, Montedori A, Cochetti G, Arezzo A, Mearini E, Abraha I, Trastulli S. Staples versus sutures for surgical wound closure in adults. *Cochrane Database of Systematic Reviews* 2014, Issue 8. Art. No.: CD011250
- [9] Desiderio J, Trastulli S, Listorti C, Milani D, Cerroni M, Cochetti G, Cirocchi R, Boselli C, Parisi A, Mearini E, Noya G. Surgical approach of complicated diverticulitis with colovesical fistula: technical note in a particular condition. *Cent Eur J Med* 2012;7:5:578-583
- [10] Korkut M, Icoz G, Dayangac M, Akgun E, Yeniay L, Erdogan O *et al.* Outcome analysis in patients with Fournier's gangrene. Report of 45 cases. *Dis Colon Rectum*, 2003, 46: 649-652
- [11] Chennamsetty A, Khouardaji I, Burks F, Killinger KA. Contemporary diagnosis and management of Fournier's gangrene. *TherAdvUrol*, 2015, Vol. 7(4) 203-215
- [12] Pastore AL, Palleschi G, Ripoli A, *et al.* A multistep approach to manage Fournier's gangrene in a patient with unknown type II diabetes: surgery, hyperbaric oxygen, and vacuum-assisted closure therapy: a case report. *J Med Case Rep*, 2013, 7:1
- [13] Rosa I, Guerreiro F. Hyperbaric oxygen therapy for the treatment of Fournier's gangrene: a review of 34 cases. *Acta Med Port*, 2015, 28(5): 619-623
- [14] Trastulli S, Barillaro I, Desiderio J, Di Rocco G, Cochetti G, Mecarelli V, Cirocchi R, Santoro A, Boselli C, Redler A, Avenia N, Noya G. Colonic explosion during treatment of radiotherapy complications in prostatic cancer. *Oncol Lett*. 2012;4(5):915-918



- [15] Cochetti G, Del Zingaro M, Boni A, Cocca D, Panciarola M, Tiezzi A, Gaudio G, Balzarini F, Ursi P, Mearini E. Colovesical fistula: review on conservative management, surgical techniques and minimally invasive approaches. *G Chir*. 2018;39(4):195-207
- [16] Cirocchi R, Arezzo A, Renzi C, Cochetti G, D'Andrea V, Fingerhut A, Mearini E, Binda GA. Is laparoscopic surgery the best treatment in fistulas complicating diverticular disease of the sigmoid colon? A systematic review. *Int J Surg*. 2015;24(Pt A):95-100
- [17] Cirocchi R, Cochetti G, Randolph J, Listorti C, Castellani E, Renzi C, Mearini E, Fingerhut A. Laparoscopic treatment of colovesical fistulas due to complicated colonic diverticular disease: a systematic review. *Tech Coloproctol*. 2014 Oct;18(10):873-885
- [18] Giovanni C, Emanuele C, Francesco B, Emanuele L, Andrea B, Solajd P, Ettore M. Laparoscopic conservative treatment of colo-vesical fistula: a new surgical approach. *Int Braz J Urol*. 2013;39(5):752-753
- [19] Cochetti G, Cottini E, Cirocchi R, Pansadoro A, Lepri E, Corsi A, Barillaro F, Mearini E. Laparoscopic conservative surgery of colovesical fistula: is it the right way? *Wideochirurgia i Inne Techniki Maloinwazyjne*. 2013;8(2):162-165
- [20] Cochetti G, Lepri E, Cottini E, Cirocchi R, Corsi A, Barillaro F, Boni A, Mancuso R, Solajd P, Mearini E. Laparoscopic conservative treatment of colo-vesical fistulas following trauma and diverticulitis: report of two different cases. *Cent Eur J Med* 2013;8: 790-794
- [21] Tang LM, Su YJ, Lai YC. The evaluation of microbiology and prognosis of Fournier's gangrene in past five years. *Springerplus*, 2015, 4:14
- [22] Cochetti G, Barillaro F, Cottini E, D'Amico F, Pansadoro A, Pohja S, Boni A, Cirocchi R, Grassi V, Mancuso R, Silvi E, Ioannidou K, Egidi MG, Poli G, Mearini E. Pneumoscrotum: report of two different cases and review of the literature. *Ther Clin Risk Manag*, 2015, 11:581-587
- [23] Stevens DL, Bisno AL, Chambers HF, Patchen Dellinger E, Goldstein EJC, Gorbach SL, Hirschmann JV, Kaplan SL, Montoya JG, Wade JC. Practice guidelines for the diagnosis and management of skin and soft tissue infection: 2014 update by the Infectious Diseases Society of America. *Clin Infect Dis*, 2014 Jul 59:e10-e52
- [24] Osburn N, Hampson LA, Holt SK, Gore JL, Wessells H, Voelzke bb. Low-volume vs high-volume centers and management of Fournier's gangrene in Washington state. *J Am Coll Surg*, 2017, Vol. 224, No. 3, 270-275.e1
- [25] Sorensen MD, Krieger JN, Rivara FP, Klein MB, Wessells H. Fournier's gangrene: management and mortality predictors in a population based study. *J Urol*, 2009 Dec;182(6):2742-2747
- [26] Thwaini A, Khan A, Malik A, et al. Fournier's gangrene and its emergency management. *Postgrad Med J*, 2006, 82:516-519
- [27] Proud D, Raiola F, Holden D, Eldho P, Capstick R, Khoo A. Are we getting necrotizing soft tissue infections right? A 10-year review. *ANZ J Surg*, 2014, 84: 468-447
- [28] Chowla SN, Gallop C, Mydio JH. Analysis of repeated surgical debridement. *Eur Urol*, 2003, 43:572-575
- [29] Lee JY, Jung H, Kwon H, Jung SN. Extended negative pressure wound therapy-assisted dermatotraction for the closure of large open fasciotomy wounds in necrotizing fasciitis patients. *Word J Emerg Surg*, 2014; 9:29
- [30] Chang FS, Chou C, Hu CY, Huang SH. Suture technique to prevent air leakage during negative-pressure wound therapy in Fourniere Gangrene. *Plast Reconstr Surg Glob Open*, 2018 Jan 25;6(1):e1650
- [31] Thrane JF, Ovesen T. Scarce evidence of efficacy of hyperbaric oxygen therapy in necrotizing soft tissue infection: a systematic review. *Infect Dis (Lond)*, 2019 Jul;51(7):485-492
- [32] Burnett AL, Sharlip ID. Standard operating procedure for priapism. *J Sex Med*, 2013, 10(1):180-194
- [33] Khan F, Mukhtar S, Anjum F, Tripathi B, Sriprasad S, Dickinson IK, Madaan S. Fournier's gangrene associated with intradermal injection of cocaine. *J Sex Med* 2013;10:1184-1186
- [34] Mouraviev VB, Pautler SE, Hayman WP. Fournier's gangrene following penile self-injection with cocaine. *Scand J Urol Nephrol* 36: 317-318, 2002
- [35] Carey F, Dinsmore WW. Cocaine-induced penile necrosis. *Int J STD AIDS* 2004;15:424-425
- [36] Del Zingaro M, Boni A, Paladini A, Rossi de Vermandois JA, Ciarletti S, Felici G, Ursi P, Cirocchi R, Mearini E. Fournier's gangrene secondary to locally advanced prostate cancer: case report and review of the Literature. *G Chir*, 2019, *in press*
- [37] Arora, A., Rege, S., Surpam, S., Gothwal, K., & Narwade, A. Predicting Mortality in Fournier Gangrene and Validating the Fournier Gangrene Severity Index: Our Experience with 50 Patients in a Tertiary Care Center in India. *Urologia Internationalis*, 2019; 102(3):311-318
- [38] Ali T, Bowles M, Dastouri D, Allen N. Low thrombin tissue sealant ARTISS (Baxter), in complex primary closure after Fournier's gangrene. *Journal of Surgical Case Reports*. 2019 Feb 25;2019(2)
- [39] Mostaghim, A., Dhanani, M., & Ingalls, R. R. Fournier's gangrene as an initial manifestation of acute promyelocytic leukemia: A case report and review of the literature. *SAGE Open Medical Case Reports* 2019 Mar 1;7
- [40] Zhou, Z., Guo, F., & Huan, J. Fournier's Gangrene With Septic Shock and Multiple Organ Dysfunction Syndrome. *The International Journal of Lower Extremity Wounds*. 2019 Mar;18(1):94-96
- [41] Aslan, N., Yildizdas, D., Horoz, O. O., & Ozden, O. Fatal Agranulocytosis and Fournier's Gangrene due to the Use of Metamizole. *The Indian Journal of Pediatrics*. 2019 Mar;86(3):310-311
- [42] Heijkoop, B., Parker, N., & Spernat, D. Fournier's gangrene: not as lethal as previously thought? A case series. *ANZ J Surg*. 2019 Apr;89(4):350-352
- [43] Paone, R., & Romsí, P. A Case of Acute Aortoiliac Occlusive Disease Presenting as Cauda Equina Syndrome and Fournier's Gangrene. *Case Reports in Surgery*, 2019, 1-3
- [44] Lin, T., Cheng, I., Ou, C., Tsai, Y., Tong, Y., Cheng, H., ... Cheng, Y. Incorporating Simplified Fournier's Gangrene Severity Index with early surgical intervention can maximize survival in high-risk Fournier's gangrene patients. *International Journal of Urology* 2019 Apr 18
- [45] Akella P, Mishra AK, Grewal H. Fournier's gangrene following piquerism. *Am J Med Sci*. 2019 Apr 26 [ahead of print]
- [46] Klement, RJ, Schäfer G, & Sweeney RA. A fatal case of Fournier's gangrene during neoadjuvant radiotherapy for rectal cancer. *Strahlenther Onkol*. 2019 May;195(5):441-446
- [47] Onder, C. E., Gursoy, K., Kuskonmaz, S. M., Kocer, U., & Culha, C. Fournier's gangrene in a patient on dapagliflozin

- treatment for Type 2 Diabetes. *J Diabetes*. 2019 May;11(5):348-350
- [48] Bersoff-Matcha SJ, Chamberlain C, Cao C, Kortepeter C, Chong WH. Fournier Gangrene Associated With Sodium-Glucose Cotransporter-2 Inhibitors: A Review of Spontaneous Postmarketing Cases. *Ann Intern Med*. 2019 May 7
- [49] Louro JM, Albano M, Baltazar J, Vaz M, Diogo C, Ramos S, Cabral L. Fournier's Gangrene: 10-Year Experience of a Plastic Surgery and Burns Department at a Tertiary Hospital. *Acta Med Port*. 2019 May 31;32(5):368-374
- [50] Ünverdi ÖF, Kemalöglu CA. A Reliable Technique in the Reconstruction of Large Penoscrotal Defect: Internal Pudendal Artery Perforator Flap. *Urology*. 2019 Jun;128:102-106
- [51] Lin HC, Chen ZQ, Chen HX, He QL, Liu ZM, Zhou ZY, Shi R, Ren DL. Outcomes in patients with Fournier's gangrene originating from the anorectal region with a particular focus on those without perineal involvement. *Gastroenterol Rep (Oxf)*. 2019 Jun;7(3):212-217
- [52] Rachana K, Biswas R, Bhat P, Sistla S, Kumari S, Kate V. Rare isolation of *Fusobacterium varium* from a case of Fournier's gangrene. *Anaerobe*. 2019 Jun;57:82-85
- [53] Joury A, Mahendra A, Alshehri M, Downing A. Extensive necrotizing fasciitis from Fournier's gangrene. *Urol Case Rep*. 2019 Jun 9;26
- [54] Selvi I, Aykac A, Baran O, Burlukkara S, Ozok U, Sunay MM. A different perspective for morbidity related to Fournier's gangrene: which scoring system is more reliable to predict requirement of skin graft and flaps in survivors of Fournier's gangrene?
- [55] Majdoub W, Mosbahi A, Bonbled F. Sudden unexpected death due to Fournier gangrene. *Forensic Sci Med Pathol*. 2019 Mar;15(1):155-158
- [56] Hahn HM, Jeong KS, Park DH, Park MC, Lee IJ. Analysis of prognostic factors affecting poor outcomes in 41 cases of Fournier gangrene. *Ann Surg Treat Res*, 2018, 95(6): 324-332
- [57] Overholt T, Hajiran A, Ueno C, Zaslau S. Fournier's Gangrene of the Penis following a Human Bite Wound. *Case Reports in Urology* 2018 Oct 25, 2018:9798607
- [58] Pehlivanlı F, Aydin O. Factors Affecting Mortality in Fournier Gangrene: A Single Center Experience. *Surgical Infection*, 2018, Vol. 19, No. X
- [59] Kobayashi D, Masubuchi M, Takase T, Ichikawa T, Deguchi T, Yaguchi T. Fournier's gangrene caused by penetration of a rectal cancer followed by neoadjuvant chemotherapy. *Surg Case Rep*, 2018 Sep, 26;4(1):123
- [60] Pandey S, Sharma D, Aggarwal A, Sharma A. Isolated Fournier's gangrene of the penis with penile autoamputation. *BMJ Case Rep*, 2018 Sep 19;2018
- [61] Matsuura H, Iwasa K. Fournier gangrene. *Cleve Clin J Med*. 2018 Sep;85(9):664-665
- [62] Sen V, Sen P, Sahin MO. Fournier gangrene due to *Rhizobium Radiobacter*. *Pak J Med Sci*, 2018;34(4):1027-1029
- [63] Elsaket AE, Maharajh S, Urry RJ. The presentation, management and outcomes of Fournier's gangrene at a tertiary urology referral centre in South Africa. *S Afr Med J*, 2018 Jul 25;108(8):671-676
- [64] Heijkoop B, Parker N, Spornat D. Fournier's gangrene: not as lethal as previously thought? A case series. *ANZ J Surg*, 2018 Sep 2
- [65] Takano N, Yatabe MS, Yatabe J, Kato M, Sueoka D, Iguchi S, Yoshida A, Uzawa Y, Kikuchi K, Tani K, Ogawa S, Itabashi M, Yamamoto M, Watanabe D, Ando T, Morimoto S, Ichihara A. Fatal Fournier's gangrene caused by *Clostridium ramosum* in a patient with central diabetes insipidus and insulin-dependent diabetes mellitus: a case report. *BMC Infect Dis*, 2018 Aug 2;18(1):363
- [66] Semenič D, Kolar P. Fournier's gangrene does not spare young adults. *Wounds*, 2018 Jul;30(7):E73-E76
- [67] Abass-Shereef J, Kovacs M, Simon EL. Fournier's gangrene masking as perineal and scrotal cellulitis. *Am J Emerg Med*. 2018 Sep;36(9):1719.e1-1719.e2
- [68] Wetterauer C, Ebbing J, Halla A, Kuehl R, Erb S, Egli A, Schaefer DJ, Seifert HH. A contemporary case series of Fournier's gangrene at a Swiss tertiary care center—can scoring systems accurately predict mortality and morbidity? *World J Emerg Surg*. 2018 Jun 22;13:25
- [69] Demir CY1, Yuzkat N, Ozsular Y, Kocak OF, Soyalp C, Demirkiran H. Fournier Gangrene: Association of Mortality with the Complete Blood Count Parameters. *Plast Reconstr Surg*, 2018 Jul;142(1):68e-75e3
- [70] Chen Y, Wang X, Lin G, Xiao R. Successful treatment following early recognition of a case of Fournier's scrotal gangrene after a perianal abscess debridement: a case report. *J Med Case Rep*, 2018 Jun 27;12(1):193
- [71] Yuan L, Xiong Q, Wang B. Fournier's gangrene associated with a decubitus ulcer. *IDCases*, 2018 May 17;12:149-150
- [72] Katsimantas A, Ferakis N, Skandalakis P, Filippou D. A Rare Case of Localised Isolated Penile Fournier's Gangrene and a Short Review of the Literature. *Case Rep Urol*, 2018 May 9; 2018: 5135616
- [73] Althunayyan S, Karamitosos E. Fournier's gangrene in an obese female in third trimester of pregnancy. *Saudi Med J*, 2018 Apr; 39(4):415-418
- [74] Pittaka M, Georgiou C, Polyviou P, Kountourakis P, Loizou P, Constantinou I, Andreopoulos D, Vassiliou VP. Fournier Gangrene in a patient receiving chemo-radiation for rectal cancer. *Oxf Med Case Reports*, 2018 Feb 26;2018(2):omx101
- [75] Taylor GM, Hess DV. Fournier gangrene: a rare case of necrotizing fasciitis of the entire right hemi-pelvis in a diabetic female. *Oxf Med Case Reports*, 2018 Feb 9; 2018(2):omx094
- [76] Dos Santos DR, Roman ULT, Westphalen AP, Lovison K, Spencer Neto FAC. Profile of patients with Fournier's gangrene and their clinical evaluation. *Rev Col Bras Cir*, 2018;45(1):e1430
- [77] Fukui K, Fujioka M, Ishiyama S. Sacral pressure ulcer-induced Fournier's Gangrene extending to the retroperitoneum: a case report. *Wounds*, 2018 Jan;30(1): E5-E8
- [78] Kuzaka B, Wróblewska MM, Borkowski T, Kawecki D, Kuzaka P, Młynarczyk G, Radziszewski P. Fournier's Gangrene: Clinical Presentation of 13 Cases. *Med Sci Monit*, 2018 Jan 28;24:548-555
- [79] Goel A, Gupta S, Agarwal A, Shiwach N, Chawda V, Bhagat TS. Fournier's gangrene: a rare manifestation of Chikungunya fever. *Trop Doct*, 2018 Jan;48(1):36-37
- [80] Ghodoussipour SB, Gould D, Lifton J, Badash I, Krug A, Miranda G, Loh-Doyle J, Carey J, Djaladat H, Doumanian L, Ginsberg D. Surviving Fournier's gangrene: Multivariable

- analysis and a novel scoring system to predict length of stay. *J Plast Reconstr Aesthet Surg*, 2018 May;71(5):712-718
- [81] Tenório CEL, Lima SVC, Albuquerque AV, Cavalcanti MP, Teles F. Risk factors for mortality in Fournier's gangrene in a general hospital: use of simplified Fournier gangrene severe index score (SFGSI). *Int Braz J Urol*, 2018 Jan-Feb;44(1):95-101
- [82] Weimer SB, Matthews MR, Caruso DM, Foster KN. Retroperitoneal Necrotizing Fasciitis from Fournier's Gangrene in an Immunocompromised Patient. *Case Rep Surg*, 2017; 2017:5290793
- [83] Wähmann M, Wähmann M, Schütz F, Sohn C, Schott S, Kremer T, Hernekamp JF, Kneser U. Severe Fournier's gangrene—a conjoint challenge of gynaecology and plastic surgery. *J Surg Case Rep*, 2017 Dec 8;2017(12):rjx239
- [84] Wang T, Zhao G, Rui YJ, Mi JY. Bilateral femoral posterior neurocutaneous perforator flap successfully treating Fournier gangrene: a case report. *Medicine (Baltimore)*, 2017 Nov;96(46):e8720
- [85] Yücel M, Özpek A, Başak F, Kılıç A, Ünal E, Yüksekdağ S, Acar A, Baş G. Fournier's gangrene: A retrospective analysis of 25 patients. *Ulus Travma Acil Cerrahi Derg*. 2017 Sep;23(5):400-404
- [86] Üreyen O, Acar A, Gökçelli U, Atahan MK, İlhan E. Usefulness of FGSi and UFGSI scoring systems for predicting mortality in patients with Fournier's gangrene: A multicenter study. *Ulus Travma Acil Cerrahi Derg*, 2017 Sep;23(5):389-394
- [87] Dell'Atti L, Cantoro D, Maselli G, Galosi AB. Distant subcutaneous spreading of Fournier's gangrene: An unusual clinical identification by preoperative ultrasound study. *Arch Ital Urol Androl*, 2017 Oct 3;89(3):238-239
- [88] Yanaral F, Balci C, Ozgor F, Simsek A, Onuk O, Aydin M, Nuhoglu B. Comparison of conventional dressings and vacuum-assisted closure in the wound therapy of Fournier's gangrene. *Arch Ital Urol Androl*, 2017 Oct 3;89(3):208-211
- [89] Chia L, Crum-Cianflone NF. Emergence of multi-drug resistant organisms (MDROs) causing Fournier's gangrene. *J Infect*, 2018 Jan;76(1):38-43
- [90] Kordahi AM, Suliman AS. A case of Fournier's gangrene. *Eplasty*, 2017 Sep 18;17:ic25
- [91] Hong KS, Yi HJ, Lee RA, Kim KH, Chung SS. Prognostic factors and treatment outcomes for patients with Fournier's gangrene: a retrospective study. *Int Wound J*, 2017 Dec;14(6):1352-1358
- [92] Sanders O, Gilbert-Kawai E, Saha R. Intravenous immunoglobulin as adjunctive treatment for Fournier's gangrene. *Br J Hosp Med (Lond)*, 2017 Sep 2;78(9):530-531
- [93] Ferretti M, Saji AA, Phillips J. Fournier's Gangrene: A Review and Outcome Comparison from 2009 to 2016. *Adv Wound Care (New Rochelle)*, 2017 Sep 1;6(9):289-295
- [94] Kumar S, Costello AJ, Colman P. Fournier's gangrene in a man on empagliflozin for treatment of Type 2 diabetes. *Diabet Med*, 2017 Nov;34(11):1646-1648
- [95] Ioannidis O, Kitsikosta L, Tatsis D, Skandalos I, Cheva A, Gkioti A, Varnalidis I, Symeonidis S, Savvala NA, Parpoudi S, Paraskevas GK, Pramateftakis MG, Kotidis E, Mantzoros I, Tsalis KG. Fournier's Gangrene: Lessons Learned from Multimodal and Multidisciplinary Management of Perineal Necrotizing Fasciitis. *Front Surg*, 2017 Jul 10;4:36
- [96] Bocchiotti MA, Bogetti P, Parisi A, Rivarossa F, Frenello A, Baglioni EA. Management of Fournier's gangrene non-healing wounds by autologous skin micrograft biotechnology: a new technique. *J Wound Care*, 2017 Jun 2;26(6):314-317
- [97] Choi H, Kim YS, Na CH, Shin BS. Fournier's Gangrene: A Rare Complication of Sweet's syndrome. *Ann Dermatol*, 2017 Jun;29(3):387-389
- [98] Sawayama H, Miyanari N, Sugihara H, Iwagami S, Mizumoto T, Kubota T, Haga Y, Baba H. A fascia lata free flap in pelvic exenteration for Fournier gangrene due to advanced rectal cancer: a case report. *Surg Case Rep*, 2017 Dec;3(1):74
- [99] Lauerman MH, Kolesnik O, Sethuraman K, Rabinowitz R, Joshi M, Clark E, Stein D, Scalea T, Henry S. Less is more? Antibiotic duration and outcomes in Fournier's gangrene. *J Trauma Acute Care Surg*, 2017 Sep;83(3):443-448
- [100] Smith MT Jr, Graham JN Jr, Levy EB, Olugbade K, Flores V, Emeruwa C, Shimonovich S, Roudnitsky V, Winer AG. Penile Preservation With Subcutaneous Transposition During Fournier's Gangrene. *Urol Case Rep*, 2017 Apr 6;12:81-83
- [101] Baek SO, Park SH, Rhie JW, Han HH. Peri-vulvar reconstruction using internal pudendal artery perforator flap in female Fournier's gangrene. *Int Wound J*, 2017 Dec;14(6):1378-1381
- [102] Huang CS. Fournier's Gangrene. *N Engl J Med*, 2017 Mar 23;376(12):1158
- [103] Morais H, Neves J, Maciel Ribeiro H, Ferreira M, Guimarães N, Azenha N, Dias R, Fonseca A, Conceição L. Case series of Fournier's gangrene: Affected body surface area - The underestimated prognostic factor. *Ann Med Surg (Lond)*, 2017 Feb 27;16:19-22
- [104] Okumura K, Kubota T, Nishida K, Lefor AK, Mizokami K. Treatment of Complete Anal Stricture after Diverting Colostomy for Fournier's Gangrene. *Case Rep Surg*, 2017; 2017:2062157
- [105] Osburn N, Voelzke BB. Transfer of patients with Fournier's gangrene: in reply to Fujita. *J Am Coll Surg*, 2017 Aug;225(2):347-348
- [106] Kahn BE, Tatem AJ, Mazur DJ, Wren J, Hehemann M, Desai AS, Keeter MK, Hensley P, Walker J, Angel JB, Lewis K, Mellon MJ, Bylund JR, Bennett NE, Brannigan RE. Contemporary report of a multi-institutional experience with Fournier's gangrene. *J Urol*, 2017 Vol. 197, No. 4S
- [107] Misiakos EP, Bagias G, Papadopoulos I, Danias N, Patapis P, Machairas N, Karatzas T, Arkadopoulos N, Toutouzas K, Alexakis N, Konstantoulakis MN, Zografos G, Smyrniotis V, Kouraklis G, Machairas A. Early Diagnosis and Surgical Treatment for Necrotizing Fasciitis: A Multicenter Study. *Front Surg*, 2017 Feb 7;4:5
- [108] Obi AO. Isolated Fournier's gangrene of the penis. *Niger J Clin Pract*, 2016 May-Jun;19(3):426-430
- [109] Perneti R, Palmieri F, Sagrini E, Negri M, Morisi C, Carbone A, Bassi P, Voce S. Fournier's gangrene: Clinical case and review of the literature. *Arch Ital Urol Androl*, 2016 Oct 5;88(3):237-238
- [110] Faria SN, Helman A. Deep tissue infection of the perineum: Case report and literature review of Fournier gangrene. *Can Fam Physician*, 2016 May;62(5):405-407
- [111] Ozkan OF, Koksal N, Altinli E, Celik A, Uzun MA, Cıkman O, Akbas A, Ergun E, Kiraz HA, Karaayvaz M. Fournier's gangrene current approaches. *Int Wound J* 2016; 13:713-716
- [112] Yoshino H, Kawakami K, Yoshino G, Sawada K. Case of anal fistula with Fournier's gangrene in an obese type 2 diabetes

- mellitus patient. *J Diabetes Investig* Vol. 7 No. 2 March 2016, 7: 276-278
- [113] Crowell W, Roberts R, Tarry S. Inflammation and Infection, Fungal Fourniers Gangrene in an Immunocompromised Patient, *Urology Case Reports* 4 2016; 1-3
- [114] Taken K, Oncu M.R., Ergun M, Eryilmaz R, Demir C.Y., Demir M., Gunes M. Fournier's gangrene: Causes, presentation and survival of sixty-five patients, *Pak J Med Sci* 2016 Vol. 32(3):746-750
- [115] Wanis M, Nafie S, and Mellon J.K. A case of Fournier's gangrene in a young immunocompetent male patient resulting from a delayed diagnosis of appendicitis, *Journal of Surgical Case Reports*, 2016;4, 1-3
- [116] Sheehy S, Kelly M.E., Francis E.C., Sweeney K.J., Hussey A, A rare case of Fournier's Gangrene, *Journal of Surgical Case Reports*, 2016;5, 1-3
- [117] Sarkut P, Işık O, Öztürk E, Gülcü B, Ercan I, Yılmazlar T. Gender does not affect the prognosis of Fournier's gangrene: a case-matched study. *Ulus Travma Acil Cerrahi Derg*, November 2016, Vol. 22(6): 441-544
- [118] Sinha R, Arachchi A, Lee P, Marwan K. Fournier Gangrene in Pregnancy. *The American College of Obstetricians and Gynecologists* 2015. Vol 125(6):541-544
- [119] Marin A, Turegano Fuentes F, Cuadrado Ayuso M, Andueza Lillo J.A., Cano Ballesteros J.C., Perez Lopez M. Predictive Factors for Mortality in Fournier's Gangrene: A Series of 59 Cases. *Cir ESP* 2015 ; 93 (1): 12-17
- [120] Chalya P, Igenge J.Z., Mabula J.B. and Simbila S. Fournier's gangrene at a tertiary health facility in northwestern Tanzania: a single centre experiences with 84 patients. *BMC Res Notes* 2015; 8:481
- [121] Namkoong H, Ishii M, Koizumi M, Betsuyaku T. Fournier's gangrene: a surgical emergency. Springer-Verlag Berlin Heidelberg 2015. *Infection* 2016; 44:143-144
- [122] Schulz D, Mohor G, Solovan C. Unusual foreign body in the sigmoid colon, chronic alcohol abuse, and Fournier gangrene: a case report. Dovepress, *Clinical Intervention in Aging* 2015;10 673-677
- [123] McCormack M, Valiquette A, Ismail S. Fournier's gangrene: A retrospective analysis of 26 cases in a Canadian hospital and literature review. *Can Urol Assoc J* 2015;9(5-6):E407-10
- [124] Tarchouli M, Bounaim A, Essarghini M, Ratbi M, Belhamidi M.S., Bensal A, Zemmouri A, Ali A, Sair K. Analysis of prognostic factors affecting mortality in Fournier's gangrene: A study of 72 cases. *Can Urol Assoc J* 2015;9(11-12):E800-4
- [125] Paonam SS, Bag S. Fournier gangrene with extensive necrosis of urethra and bladder mucosa: A rare occurrence in a patient with advanced prostate cancer. *Urol Ann.* 2015 OctDec;7(4): 507-509
- [126] Oguz A, Gumus M, Turkoglu A, Bozdag Z, Ulger V.B., Agacayak E, Boyuk A. Fournier's Gangrene: A Summary of 10 Years of Clinical Experience. *Int Surg* 2015;100:934-941
- [127] S Asahata, Y Hirai, Y Ainoda, T Fujita, Y Okada, K Kikuchi. Fournier's gangrene caused by *Listeria Monocytogenes* as the primary organism. *Can J Infect Dis Med Microbiol* Vol 26 No 1 January/February 2015;26(1):44-46
- [128] Ye J, Xie T, Wu M, Ni P and Lu S. Negative Pressure Wound Therapy Applied Before and After Split-Thickness Skin Graft Helps Healing of Fournier Gangrene. *NPWT for Treating Fournier Gangrene* 2014. Vol.94(5)pag 1-4
- [129] Danesh H, Saboury M, Sabzi A, Saboury M, Jafary M, Saboury S. Don't underestimate Fournier's Gangrene: report of 8 cases in 10 month survey. *MJIRI* 2015, Vol. 29.172, pag1-5
- [130] Ossibi P.E., Souiki T, Majdoub K, Toughrai I, Laalim S, Mazaz K, Tenkorang S, Farih M.H. Fournier gangrene: rare complication of rectal cancer. *Pan African Medical Journal.* 2015; 20:288
- [131] Mahmoudi A, Hamdi A. La gangrène de Fournier compliquant un empalement. *Pan African Medical Journal.* 2015; 21:250
- [132] Sarmah P.B., Khan M and Zilvetti M. Fournier's gangrene secondary to an acutely inflamed appendix herniating into the deep inguinal ring. *Journal of Surgical Case Reports*, 2015: 1-3
- [133] Papadimitriou G, Koukoulaki M, Vardas K, Grigorakis A, Vougas V, Drakopoulos S. Fournier's Gangrene due to Perioperative Iatrogenic Colon Perforation in a Renal Transplant Recipient. *Saudi J Kidney Dis Transpl* 2015;26(6):1257-1261
- [134] Özşaker E, Yavuz M, Altınbaş Y, Köze B.S, Nurülke B. The care of a patient with Fournier's gangrene. *Ulus Travma Acil Cerrahi Derg*, January 2015, vol. 21(1):71-74
- [135] Garcia Marin A, Turegano Fuentes F, Cuadrado Ayuso M, Andueza Lillo J.A., Cano Ballesteros J.C, Perez Lopez M. Predictive Factors for Mortality in Fournier's Gangrene: A Series of 59 Cases. *Cir ESP.* 2015; 93 (1):12-17
- [136] Toh J, Gibson K, Vanlioglu B, Ang S, Ong E. Rapid progression of perianal abscess into Fournier's Gangrene. *Royal Australasian College of surgeons* 2014; 192-193
- [137] Parry N. Fournier gangrene. *Clinical Case Reports* 2015; 3(3): 198–199
- [138] Tena D, Losa C, Medina-Pascual M, Sáez-Nieto J.A. Fournier's gangrene caused by *Actinomyces funkei*, *Fusobacterium gonidiaformans* and *Clostridium hathewayi*. *Anaerobe* 2014. 27:14-16
- [139] Matilsky D, Lewiss R, Whalen M, Saul T. Fournier's Gangrene- Case Report. *Med Ultrason* 2014, Vol. 16(3)262-263
- [140] Di Serafino M, Gullotto C, Gregorini C, Nocentini C. A clinical case of Fournier's gangrene: imaging Ultrasound. *J Ultrasound* (2014) 17:303-306
- [141] Galukande M, Bbaale Sekavuga D, Muganzi A and Coutinho A. Fournier's gangrene after adult male Circumcision. *International Journal of Emergency Medicine* 2014, 7:37
- [142] Tattersall T, Thangasamy I, Reynolds J. Bilateral adrenal haemorrhage associated with heparin-induced thrombocytopenia during treatment of Fournier gangrene. *BMJ Case Rep* 2014; 1-4
- [143] Omisanjo OA, Bioku MJ, Ikuerowo SO, Sule GA, Esho JO. Clinical characteristics and outcome of management of Fournier's gangrene at the Lagos State University Teaching Hospital, Ikeja, Lagos, Nigeria. *Ann Afr Med* 2014;13:174-178
- [144] Rubegni P, Lamberti A, Natalini Y and Fimiani M. Treatment of two cases of Fournier's gangrene and review of the literature. *Journal of Dermatological Treatment*, 2014; 25: 189-192
- [145] Dinc T, Kayilioglu SI, Sozen I, Yildiz BD and Coskun F. Fournier's Gangrene as a Postoperative Complication of Inguinal Hernia Repair. *Hindawi Publishing Corporation. Case Reports in Surgery.* Vo.2014, Art. ID 408217, 3 pag
- [146] Dayan J, Clarke-Pearson EM, Dayan E, Smith ML. Aesthetic scrotal reconstruction following extensive Fournier's gangrene using bilateral island pedicled sensate antero-



- lateral thigh flaps: A case report. *Can Urol Assoc J* 2014;8(1-2):e114-7
- [147] Ludolph I, Titel T, Beier JP, Dragu A, Schmitz M, Wullich B and Horch RE. Penile reconstruction with dermal template and vacuum therapy in severe skin and soft tissue defects caused by Fournier's gangrene and hidradenitis suppurativa. *Int Wound J* 2016; 13:77-81
- [148] Ozkan OF, Koksall N, Altinli E, Celik A, Uzun MA, Cıkman O, Akbas A, Ergun E, Kiraz HA and Karaayvaz M. Fournier's gangrene current approaches. *Int Wound J* 2016; 13:713-716
- [149] Shimizu T, Harada K, Akazawa S, Yamaguchi M, Inozume T, Kwamura T, Shibagaki N, Momosawa A, Shimada S. Identification of the cause of severe skin infection by Fournier transform infrared spectroscopy: A case Of Fournier's gangrene caused by fish bone. *Journal of Dermatology* 2014; 41: 547-550
- [150] Ho M, Chou A, Cheung W. Fournier's Gangrene in an elderly woman. *JAGS - February 2014–Vol. 62(2): 402-403*
- [151] Aslanidis T, Myrou A, Pefoulidou M. Management of a young female patient with Fournier's gangrene and Lemierre's syndrome. *The Pan African Medical Journal - ISSN 1937-8688*
- [152] D'Arena G, Cammarota A, Musto P. Fournier's gangrene complicating thrombocytopenia treated with Steroids. *Lancet* 2014; 383: 1580
- [153] Perkins TA, Bieniek JM, Sumfest JM. Solitary *Candida albicans* Infection Causing Fournier Gangrene and Review of Fungal Etiologies. *Rev Urol.* 2014;16(2):95-98
- [154] Sliwinski A, Kavanagh LE, Bolton D, Lawrentschuk N, Crock JC. Fournier's gangrene - delayed pedicle flap based upon the anterior abdominal wall. *IBJU* 2014 Vol. 40 (3): 423-426
- [155] Agostini T, Mori F, Perello R, Dini M, Lo Russo G. Successful combined approach to a severe Fournier's gangrene. *Indian J Plast Surg*, 2014 Jan/Apr, 47(1): 132-136
- [156] Oymacı E, Coşkun A, Yakan S, Erkan N, Uçar AD, Yıldırım M. Evaluation of factors affecting mortality in Fournier's Gangrene: Retrospective clinical study of sixteen cases. *Ulus Cerrahi Derg*, 2014 Jun 1;30(2):85-89
- [157] Eskitaşcıoğlu T, Özyazgan I, Coruh A, Günay GK, Altıparmak M, Yontar Y, Doğan F. Experience of 80 cases with Fournier's gangrene and "trauma" as a trigger factor in the etiopathogenesis. *Ulus Travma Acil Cerrahi Derg*, 2014 Jul;20(4):265-274
- [158] Yılmazlar T, Işık Ö, Öztürk E, Özer A, Gülcü B, Ercan I. Fournier's gangrene: Review of 120 patients and predictors of mortality. *Ulus Travma Acil Cerrahi Derg*, 2014 Sep;20(5):3337
- [159] Akbulut F, Kucuktopcu O, Sonmezay E, Simsek A, Ozgor F, Gurbuz ZG. Partial penectomy after debridement of a Fournier's gangrene progressing with an isolated penile necrosis. *Ulus Travma Acil Cerrahi Derg*, 2014 Sep;20(5):385-388
- [160] Coyne C, Mailhot T, Perera P. Diagnosis of Fournier's gangrene on bedside ultrasound. *West J Emerg Med*, 2014 Mar;15(2):122
- [161] Li YD, Zhu WF, Qiao JJ, Lin JJ. Enterostomy can decrease the mortality of patients with Fournier gangrene. *World J Gastroenterol*, 2014 Jun 28;20(24):7950-7954
- [162] Oyaert M, Cools P, Breyné J, Heyvaert G, Vandewiele A, Vanechoutte M, Vervaeke S, De Laere E. Sepsis with an Atopobium-Like Species in a Patient with Fournier's Gangrene. *J Clin Microbiol*, 2014 Jan;52(1):364-366
- [163] Lee G, Hong JH. Fournier Gangrene: An Unusual Presentation Involving the Bulbous Urethra and Forming Free Gas in the Urinary Bladder. *J Emerg Med*, 2013 Jan;44(1):166-168
- [164] Abate G, Shirin M, Kandanati V. Fournier gangrene from a thirty-two centimetre rectosigmoid foreign body. *J Emerg Med*, 2013 Feb;44(2):e247-249
- [165] Anantha RV, Kasper KJ, Patterson KG, Zeppa JJ, Delport J, McCormick JK. Fournier's gangrene of the penis caused by *Streptococcus dysgalactiae* subspecies *equisimilis*: case report and incidence study in a tertiary-care hospital. *BMC Infect Dis*, 2013 Aug 20;13:381
- [166] Benjelloun et al. El Bachir Benjelloun EB, Souiki T, Yakla N, Ousadden A, Mazaz K, Louchi A, Kanjaa N, Taleb KA. Fournier's gangrene: our experience with 50 patients and analysis of factors affecting mortality. *World J Emerg Surg*, 2013 Apr 1;8(1):13
- [167] Pastore AL, Palleschi G, Ripoli A, et al. A multistep approach to manage Fournier's gangrene in a patient with unknown type II diabetes: surgery, hyperbaric oxygen, and vacuum-assisted closure therapy: a case report. *J Med Case Rep*, 2013, 7:1
- [168] Eray IC, Alabaz O, Akcam AT, Ulku A, Parsak CK, Sakman G, Seydaoglu G. Comparison of Diverting Colostomy and Bowel Management Catheter Applications in Fournier Gangrene Cases Requiring Fecal Diversion. *Indian J Surg*, 2015 Dec;77(Suppl 2):438-441
- [169] Bjurlin MA, O'Grady T, Kim DY, Divakaruni N, Drago A, Blumetti J, Hollowell CM. Causative pathogens, antibiotic sensitivity, resistance patterns, and severity in a contemporary series of Fournier's gangrene. *Urology*, 2013 Apr;81(4):752-758
- [170] Park KR, Kim TG, Lee J, Ha JH, Kim YH. Single-stage reconstruction of extensive defects after Fournier's gangrene with an exposed iliac crest and testes. *Arch Plast Surg*, 2013 Jan;40(1):74-76
- [171] Subramaniam D, Hureibi K, Zia K, Uheba M. The development of Fournier's gangrene following rubber band ligation of haemorrhoids. *BMJ Case Rep*, 2013 Nov 28;2013
- [172] Sabzi Sarvestani A, Zamiri M, Sabouri M. Prognostic factors for Fournier's gangrene; a 10-year experience in southeastern Iran. *Bull Emerg Trauma*, 2013 Jul;1(3):116-122
- [173] Katib A, Al-Adawi M, Dakkak B, Bakhsh A. A three-year review of the management of Fournier's gangrene presented in a single Saudi Arabian institute. *Cent European J Urol*, 2013;66(3):331-334
- [174] Czymek R, Kujath P, Bruch HP, Pfeiffer D, Nebrig M, Seehofer D, Guckelberger O. Treatment, outcome and quality of life after Fournier's gangrene: a multicentre study. *Colorectal Dis*, 2013 Dec;15(12):1529-1536
- [175] Akilov O, Pompeo A, Seher D, Bowlin P, Molina WR, Kim FJ. Early scrotal approximation after hemiscrotopectomy in patients with Fournier's gangrene prevents scrotal reconstruction with skin graft. *Can Urol Assoc J*, 2013 Jul-Aug;7(7-8):E481-485
- [176] Bakari AA, Ali N, Gadam IA, Gali BM, Tahir C, Yawe K, Dahiru AB, Mohammed BS, Wadinga D. Fistula-in-ano complicated by Fournier's gangrene our experience in north-eastern region of Nigeria. *Niger J Surg*, 2013 Jul;19(2):56-60
- [177] Avakoudjo DGJ, Hounnasso PP, Natchagandé G, Gandaho KI, Hodonou F, Tore-Sanni R, Agoukpé MM, Paré AK. Fournier's



- gangrene in Cotonou, Benin Republic. *J West Afr Coll Surg*, 2013 Jul Sep; 3(3):75-87
- [178] Chan CC, Williams M. Fournier gangrene as a manifestation of undiagnosed metastatic perforated colorectal cancer. *Int Surg*, 2013 Jan-Mar;98(1):43-48
- [179] Chan CC, Shahrour K, Collier RD, Welch M, Chang S, Williams M. Abdominal implantation of testicles in the management of intractable testicular pain in Fournier gangrene. *Int Surg*, 2013 Oct-Dec;98(4):367-371
- [180] Aliyu S, Ibrahim AG, Ali N, Waziri AM. Fournier's gangrene as seen in University of Maiduguri teaching hospital. *ISRN Urol*, 2013 Aug 12;2013:673121
- [181] Ozkan OF, Altýnlý E, Koksal N, Senger S, Celik A. Combining Flexi-Seal and negative pressure wound therapy for wound management in Fournier's gangrene. *Int Wound J*, 2015 Jun;12(3):364-365
- [182] Vyas HG, Kumar A, Bhandari V, Kumar N, Jain A, Kumar R. Prospective evaluation of risk factors for mortality in patients of Fournier's gangrene: A single center experience. *Indian J Urol*, 2013 Jul;29(3):161-165