

# Fournier gangrene – a challenge for the surgeon

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## ABSTRACT:

**Introduction:** Fournier gangrene (FG) is a life-threatening condition, defined as necrotizing fasciitis of the perineum and can spread to adjacent areas. It is a rare disease and the infection is caused by mixed bacterial flora, seldom by fungal infection. The risk factors include male sex, diabetes, hypertension, malignant neoplasms, alcoholism, immunosuppression.

**Material and methods:** The diagnostic and therapeutic process and prognosis assessment using the FGSI (Fournier's Gangrene Severity Index) scale were analyzed in a group of four patients treated for Fournier gangrene.

**Results:** All patients were males. The average age at the moment of diagnosis was 60. All of the patients had comorbidities resulting with a higher risk of susceptibility to FG. Morbidity was 50%, despite the fact that all patients scored less than 9 points in the FGSI.

**Discussion:** Despite better diagnostic tools and technological progress, FG remains a significant clinical issue due to mortality at a level of 80%. The "golden standard" is surgical excision of necrotic tissues. Broad-spectrum antibiotic therapy, fluid resuscitation, correction of electrolyte and acid-base disorders, and the level of glycemia are very important. Treatment results were assessed on the basis of the FGSI. The moment of surgical intervention is decisive – it has been proven that it is best to perform it on the first day. Hyperbaric oxygen therapy is controversial, with no studies confirming the effectiveness of this procedure. It seems appropriate if the infection is caused by anaerobic bacteria.

**Conclusions:** Fournier syndrome is a significant clinical issue. Treatment requires an early surgical approach with excision of necrotic tissues, broad-spectrum antibiotic therapy and treatment with hyperbaric oxygen in some cases.

## KEYWORDS:

early surgical approach, Fournier gangrene, hyperbaric oxygen treatment

## ABBREVIATIONS

**FG** – Fournier gangrene

**FGSI** – Fournier's Gangrene Severity Index

**CT** – computed tomography

**PCT** – Procalcitonin

**CEA** – Carcinoembryonic Antigen

**PSA** – prostate specific antibody

## INTRODUCTION

Fournier gangrene, described by the French venereologist Jean Alfred Fournier in 1993 [1], is a life-threatening condition defined as necrotizing fasciitis of the perineum, external genitalia and the anus with the ability to spread to the adjacent areas, e.g. abdominal wall or retroperitoneal space.

It is a rare disease – 1.6/100000/year (men) [2] and yet its etiology has been described quite extensively in the literature. It is emphasized that it is an infection with mixed aerobic and anaerobic bacterial flora [3, 4], and fungal infections should be considered as rare causes [5, 6]. The risk factors for Fournier gangrene have been defined precisely and include male sex with the male/female incidence rate of 10:1 [7]. The disease develops more often in men between 30 and 60 years of age, however, more than 80 cases of Fournier syndrome in newborns have already been described [8, 9, 10]. Apart from the abovementioned, the predisposing factors are diabetes, hypertension, malignant tumors and related treatment,

alcoholism, immunosuppression, AIDS [2, 11]. Fournier gangrene is still a very severe clinical concern. Treatment requires immediate surgery – early excision of necrotic tissue, drainage, broad-spectrum antibiotic therapy [12], and in some cases hyperbaric oxygen therapy, which is still a subject of discussion [13]. Despite this, it is still associated with a very high mortality of usually 20–40% [14]; however, it can reach up to 80%.

The aim of the paper was a clinical analysis of a group of patients with Fournier gangrene, including the treatment method and results.

## MATERIAL AND METHOD

The diagnostic and therapeutic process and prognosis assessment using the FGSI (Fournier's Gangrene Severity Index) scale (Tab. II.) were analyzed in four patients (Tab. I. presents the general characteristics of the group) treated due to Fournier syndrome.

## RESULTS

All analyzed patients were male. The average age of onset was 60 years. Each of the patients was found with a disease associated with a higher risk of developing Fournier gangrene. Mortality in the whole group was 50%.

1. A sick 65-year-old man was admitted to the General, Oncological and Endocrinological Surgery Clinic of the Provincial Hospital

in Kielce due to a suspicion of rectal tumor with accompanying weakness and the passing of pencil-thin stools persisting for two months. The patient's general condition upon admission was moderate, he did not have a fever, blood pressure was normal, body structure was asthenic, with a BMI of 20 kg/m<sup>2</sup>. He has not been chronically treated until now. Laboratory tests showed leukocytosis 21.6 thous./ml and anemia 9.8 g% hemoglobin. In immunochemical tests, both carcinoembryonic antigen levels were 40.3 ng/ml and Ca-19.9 – 138.6 U/ml, significantly above the norm. On the 5th day of hospitalization, the patient developed necrosis of the scrotal and perineal skin. On the same day, extensive excision of necrotic tissue and bilateral orchiectomy were performed. Material for microbiological testing was collected, infection with *Clostridium perfringens* was excluded. Two units of red blood cell concentrate were transfused after surgery due to low morphotic parameters of blood. Before surgery, empirical antibiotic therapy was started with amoxicillin/clavulanate at a dose of 3 x 1.2 g intravenously, metronidazole 3 x 0.5 g intravenously. On day 6, meropenem was administered empirically at a dose of 3 x 1000 mg intravenously. In the next (7th) day of hospitalization, the patient was reoperated – further penile skin necrosis was excised, as well as the skin and subcutaneous tissue of the sacrum, and drainage of both ischio-anal fossas was performed. After the procedure, the patient required artificial ventilation and an infusion of pressor amines. The patient was extubated on the next day of hospitalization and was transfused two units of red blood cell concentrate and two units of fresh frozen plasma. Already during the first surgery, the doctor on duty at the National Center for Hyperbaric Medicine in Gdynia was contacted and the patient's transfer was initially established, but it did not take place due to the patient's very bad general condition.

After the patient's condition stabilized, AIO (All-in-One) nutritional treatment was initiated. Antibiotic therapy, initially empirical, then targeted – amikacin 1 x 1000 mg intravenously, was continued for 10 days. On the 19th day of hospitalization, double-barreled intestinal fistula was performed on the sigmoid colon due to perineal wound healing disorders. Nutritional treatment was continued until 24 hours of hospitalization. Healing of perineal wounds with granulation was observed in the patient. During this period, the patient was in a relatively good clinical condition. No prominent, significant deviations from the norm were found in laboratory tests. In the next days of hospitalization, streaking of material from the intestinal contents from the stoma into the abdominal wall was noted. On the 34th day of hospitalization, relaparotomy was performed. A double-barreled fistula was made on the crotransverse colon – this was the only solution allowed for by technical conditions. Necrotizing fasciitis of the anterior abdominal wall was found during the procedure, extending to the lateral region of the abdomen, and drainage of these spaces was performed. After surgery, tigecycline was administered at a dose of 2 x 50 mg iv, the patient required a total transfusion after relaparotomy of 5 units of fresh frozen plasma and two units of red blood cell concentrate. Again, after the patient's condition stabilized, nutritional treatment was started. On the 38th day of hospitalization, there occurred wound dehiscence – the patient was operated again. On the 39th day of hospitalization, spontaneous pneumothorax of the left pleural cavity occurred, and active drainage was used. The patient's condition after the last surgery deteriorated significantly. CT angiography of the chest was performed to exclude pulmonary embolism. From the 39th day of hos-

pitalization, the patient required continuous infusion of pressor amines. The lungs could not be expanded with an active drainage. The patient died on the 45th day of hospitalization.

2. A sick 58-year-old man was treated with methotrexate for rheumatoid arthritis. He remained under the care of the Surgery Out-patient Clinic due to a non-healing pressure ulcer of the sacrum. The patient was referred to the General, Oncological and Endocrinological Surgery Clinic due to inflammatory infiltration of the perineal tissues. Upon admission, the patient was in a moderate general condition, blood pressure was normal, his BMI was 27 kg/m<sup>2</sup>. He was feverish to 38°C. Laboratory tests revealed only leukocytosis – 16.8 thous./ml. Empirical antibiotic therapy with ciprofloxacin 2 x 400 mg iv, metronidazole 3 x 500 mg iv, clindamycin 3 x 600 mg was included. On day 4 of hospitalization, the inflammatory infiltration progressed, and there appeared gangrenous lesions in the scrotum and perineal tissues. Immediate excision of necrotic tissue was performed, antibiotic therapy was modified with meropenem 3 x 1000 mg iv, teicoplanin 1 x 400 mg iv, Fluconazole 1 x 100 mg iv. The National Hyperbaric Medicine Center in Gdynia was contacted and on the 5th day of hospitalization, the patient was transported to the Maritime and Hyperbaric Medicine Clinic in Gdynia. After 6 days of hospitalization at the University Center for Maritime and Hyperbaric Medicine in Gdynia, the patient was readmitted to the Department of Surgery at the University of Medical Sciences in Kielce. Upon re-admission, the wounds healed by granulation, without signs of active inflammation and necrosis. Conservative treatment was continued with Tazocin 3 x 4.5 g for 7 days and vancomycin 3 x 1 g for 9 days. Gradual healing of the perineal wound was observed. On the 35th day of hospitalization, the perineal wound was surgically treated and on the 40th day of hospitalization the patient was discharged from the hospital.

3. A sick 56-year-old man suffered from type 2 diabetes. On the first day of hospitalization, he reported severe pain in the anus, perineum and scrotum, and was feverish to 39°C. Physical examination revealed swelling and redness of the perineum, groin and lower abdomen. Around the anus, there was skin necrosis with a defect at "9 o'clock" position, from the right buttock there was scrotal skin necrosis of approx. 4 x 4 cm and necrosis of penile skin of 2 x 2 cm. Extensive incisions in the buttocks, scrotum and penis were performed. Purulent content and tissue fragment from the abovementioned regions were sent for bacteriological and histopathological examination. Empirical antibiotic therapy was introduced with Tazocin 4 x 4.5 g administered intravenously and Metronidazole 3 x 0.5 g also intravenously. Furthermore, the patient was treated symptomatically with balanced fluid therapy, forced diuresis with furosemide, fast-acting insulin depending on blood glucose levels. No significant deviations from the norm were found in laboratory tests (HGB 13.6 g%). In the 12th hour of hospitalization, the extent of excision of necrotic tissue due to the spread of infection was increased, serum hemoglobin levels were 11.6 g%, and 2 units of red blood cell concentrate were transfused. After 20 hours of hospitalization, the patient was sent to the Department of Hyperbaric Medicine and Maritime Rescue in Gdynia due to a further spread of infection in the abdominal wall. In the local unit, the patient received targeted antibiotic therapy for 17 days (*E. coli* sensitive to Tazocin) and underwent 26 sessions in a hyperbaric chamber. On the 44th day of hospitalization,

**Tab. I.** General characteristics of the examined group.

	AGE OF ONSET	GENDE M/F	COMORBIDITIES	END-POINTS: SURVIVAL/WELLBEING/DEATH
Patient	65 years old	M	Rectal cancer, probably cancer	/ / +
Patient	58 years old	M	Rheumatoid arthritis	+ / + /
Patient	56 years old	M	Type 2 diabetes	+ / + /
Patient	61 years old	M	History of coeliac disease, history of cancer	/ / +

**Tab. II.** Severity scale of the general condition of the patient with Fournier gangrene; measurement of nine parameters, the points obtained in each parameter are added to obtain a score.

PARAMETER	SCORE								
	+4	+3	+2	+1	0	+1	+2	+3	+4
Body temperature [°C]	>41	39–40.9	–	38.5–35.9	36–38.4	34–35.9	32–33.9	30–31.9	<29.9
Heart rate [beats/min]	>180	140–179	110–139	–	70–109	–	56–69	40–54	<39
Respiratory rate [breaths/min]	>50	35–49	–	25–34	12–24	10–11	6–9	–	<5
Serum sodium levels [mmol/l]	>180	160–179	155–159	150–154	130–149	–	120–129	111–119	<110
Serum potassium levels [mmol/l]	>7	6–6.9	–	5.5–5.9	3.5–5.4	3–3.4	2.5–2.9	–	<2.5
Serum creatinine levels [mg/dl]	>3.5	2–3.4	1.5–1.9	–	0.6–1.4	–	<0.6	–	–
Hematocrit [%]	>60	–	50–59	46–49.4	30–45.9	–	20–29.9	–	<20
White blood cell count [10 <sup>3</sup> /μl]	>40	–	20–39	15–19.9	3–14.9	–	1–2.9	–	<1
Bicarbonate concentration [mmol/l]	>52	41–51.9	–	32–40.9	22–31.9	–	18–21.9	15–17.9	<15

wounds were covered with skin grafts of intermediate thickness. After 6 months, wound healing was achieved.

4. The sick 61-year-old man is an example of Fournier syndrome with a rather unusual course. Skin changes in areas characteristic for the disease appeared quickly, but it took a long time for the necrosis itself to develop. The patient was admitted to the Department of Internal Medicine of the Provincial Integrated Hospital in Kielce due to weakness, shortness of breath and the presence of skin lesions in the perineum, scrotum and inner thighs. The patient's condition upon admission was severe, with shortness of breath at rest, hypotension with a blood pressure of 90/60 mmHg. The patient has an asthenic body build. Upon examination, there was shortness of breath and fever of up to 38°C persisting for two days, skin changes also appeared at that time. Furthermore, 13 years ago the patient underwent gastrointestinal resection – probably due to colorectal cancer complicated by adhesive small bowel obstruction and necrosis of the small intestine; the exact scope of the surgery was unknown. The patient was additionally burdened with celiac disease and short bowel syndrome. During 27 days of hospitalization in the Internal Ward, the patient underwent many dermatological and surgical consultations. Demarcation of skin necrosis in the abovementioned areas was not revealed, and therefore no excision was performed. Additional studies showed a significant decrease in total protein, albumin, and water and electrolyte disturbances. The serum concentrations of PCT were 334 ng/ml and significantly decreased as a result of the initially empirical antibiotic therapy – amoxicillin with clavulanic acid 3 x 1.2 g intravenously and ciprofloxacin 2 x 400 mg intravenously, then targeted with meropenem 3 x 1 g intravenously and amikacin at a dose of 1 g intravenously (bacteriological test results are given below). Nutritional treatment with Aminomix, Cernevit, Addamel, Addiphos was started after stabilization. The patient was further treated conservatively with silver dressings and octenidine. Bacteriological examinations involving the cultures isolated from the perineum revealed the presence of *Klebsiella pneumoniae* sensitive to ertapenem,

meropenem, imipenem, colistin and the presence of *Acinetobacter baumannii* sensitive to amikacin, colistin and tobramycin was found. Blood cultures were negative. Skin sections from the above areas were also taken. The result was developed at the Department of Clinical Pathomorphology of the Collegium Medicum of the Jagiellonian University. The image of changes is not characteristic, fasciitis necroticans should be included in differential diagnosis. After 27 days of hospitalization in the Internal Ward, in the absence of improvement after conservative treatment, the patient was transferred to the General, Oncological and Endocrinological Surgery Clinic of the Provincial Integrated Hospital in Kielce. After three days, the patient was operated, and necrotic tissue was excised. After surgery, the patient required a transfusion of two units of red blood cell concentrate. A gradual improvement in local condition was observed within the perineal wounds. Targeted antibiotic therapy was continued until the fourth day after surgery. Due to the increased energy requirement, apart from the oral diet, nutritional treatment with Kabiven Peripheral was also included, and after obtaining vascular access – SmofKabiven and Cernevit, Addamel, and Addiphos were continued. Twenty-five days after the excision of necrotic tissue, an intermediate thickness skin graft was applied to the perineum and groin. Nutritional treatment was continued. Disorders in wound healing after transplantation were noted. Colistin of 3 x 1 million units was included and the therapy was continued for 7 days. The patient's condition gradually deteriorated. The patient stopped eating. A CT of the head revealed no significant changes. The patient was consulted psychiatrically and treated as recommended by the consultant with quetiapine of 12.5 mg overnight. Morphotic parameters of blood were equalized by transfusion of red blood concentrate. A total of 10 units of red blood cell concentrate were transfused. The spread of cancer began to be suspected, but neither the results of the CT scan of the chest, the abdomen, nor the results of immunohistochemistry – Ca 19-9, CEA, PSA confirmed these suspicions. After 69 days of hospitalization in the Department of General, Oncological and Endocrine Surgery, the patient died.

## DISCUSSION

Fournier syndrome, despite learning about its pathophysiology, the increasingly better diagnostic tools, and technological progress still remains a clinical concern due to its association with a high mortality of 20–30% [15, 16], with no clear downward trend. It is a condition which requires an immediate response, inclining to an aggressive surgical approach, which remains the “gold standard” of management. Also, broad-spectrum antibiotic therapy, fluid resuscitation, correction of electrolyte and acid-base disorders are important; in diabetes, glycemic control is extremely significant [20].

Gangrene occurs in the course of inflammation of the perineum, anus and genitals, extensive tissue necrosis occurs due to anatomical conditions. The inflammatory process spreads in loose connective tissue filling interfascial space [2]. In addition to the aforementioned risk factors, it was found that Fournier gangrene most often develops from inflammatory focus of the anorectal area – 30–50% (trauma to this area, perianal abscess, appendicitis, diverticulitis, rectal biopsy, topical steroids, rectal cancer) and from inflammatory focus in the genitourinary system – about 20% (trauma to this area, urethral stenosis, urinary catheterization, prostate biopsy, inflammation of Bartholin’s glands, epididymitis, orchitis, episiotomy, scrotal abscess) [18].

Factors influencing the outcome of treatment remained unclear until the publishing of a study by Laor et al. in 1995 [17]. They described Fournier’s Gangrene Severity Index (FGSI), which is based on the measurement of some clinical parameters and the determination of laboratory tests on admission to hospital (heart rate, respiration rate, body temperature, leukocyte count, hematocrit, serum sodium, potassium, creatinine and bicarbonate levels). A score of >9 is associated with a 75% probability of death from Fournier syndrome, while a score of <9 is associated with 78% probability of survival.

When assessing patients treated in the Department of General, Oncological and Endocrinological Surgery according to the severity scale of Fournier gangrene, the first patient scored 4 points, while the second and third patient scored 1 point. It should be emphasized that the patient was not admitted with Fournier gangrene or symptoms that could herald this unit – the disease did not develop until the 5<sup>th</sup> day of hospitalization. In the second patient, the only parameter for which he received a point on the severity scale was the increased number of white blood cells.

Most authors point out the risk factors for Fournier gangrene, such as diabetes, alcoholism, hypertension, HIV, and cancer [7, 19]. Such risk factors were present in all patients described in this study. The first patient probably had rectal cancer – which may be suggested by the fact that laboratory tests revealed a value significantly above the norm – carcinoembryonic antigen (CEA) and Ca 19–9 marker, in addition laparotomy revealed a rectal tumor, but the patient’s condition did not allow for a microscopic confirmation. The second patient was treated for years due to rheumatoid arthritis; he took methotrexate, which significantly influenced his immunity, while the third patient, probably suffered a secondary immuno-

deficiency due to celiac disease and short bowel syndrome. Attention is also drawn to the need for immediate surgical intervention – aggressive excision of necrotic tissues, drainage of interfascial spaces, and empirical antibiotic therapy affecting the aerobic and anaerobic flora [21]. The moment of introducing surgical intervention is of fundamental importance for the fate of patients. It has been proved that in the group of patients in which surgical treatment was possible only after 6 days from the onset of symptoms, the mortality rate was 76%, compared to a 12% mortality in the group in which surgical treatment took place in the first 24 hours [17]. Both patients treated at the Department of General, Oncological and Endocrinological Surgery at the University of Medical Sciences in Kielce were operated immediately after the onset of symptoms (such as pain, inflammatory edema, the presence of blisters filled with serous fluid, crackling) and suspicion of Fournier gangrene, and were started on broad-spectrum antibiotics. There are also reports of vacuum therapy, which brings measurable benefits in the treatment of wounds caused by Fournier gangrene [22]. However, due to the small number of patients treated for this disease entity, it was not used.

It is interesting that therapy in the hyperbaric chamber remains controversial to this day and there are no studies confirming the effectiveness of this procedure. There are, however, reports of an increased mortality rate for people treated with hyperbaric oxygen for Fournier gangrene. Shupak et al. report a 36% mortality in the hyperbaric oxygen group compared to a 25% mortality in the non-hyperbaric oxygen group. It is also worth noting that in both cases described above, the results of bacteriological studies showed abundant growth of relatively anaerobic or absolutely anaerobic bacteria (*E. coli*, *Bacteroides* spp, *Enterococcus faecium*). Hence, it seems a sensible solution to use hyperbaric oxygen treatment in this case. Such treatment was used in two of the described patients. After 6 days of treatment in the Department of Hyperbaric Medicine and Maritime Rescue, the disease was suppressed. When the patient was re-admitted, the wound was relatively clean, without necrosis, and healing by granulation.

Undoubtedly, therapeutic success in the second patient was possible due to a rapid surgical intervention and broad-spectrum empirical antibiotic therapy. On the other hand, taking into account the results of bacteriological examination, it can be concluded that hyperbaric oxygen treatment was extremely helpful. As can be seen from the above description, the situation in the first patient was much more challenging. After the first laparotomy, when the wounds seemed to begin to slowly granulate, there was a leakage of intestinal contents in the abdominal wall. The associated infection and another reoperation exhausted the body’s compensatory possibilities.

## CONCLUSIONS

Fournier gangrene still remains a difficult-to-treat disease entity. This is probably also due to the fact that it is a relatively rare condition. Surgical treatment – extensive necrectomy and antibiotic therapy play a major role in treatment. However, the effects of hyperbaric oxygen treatment require further study.



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