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RESEARCH ARTICLE

Fournier's Gangrene in the Turkish Population: A Two-Decade Analysis

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ABSTRACT

Aim: The nature and rarity of Fournier's gangrene (FG) limit the conducting of clinical studies with large patient populations. The present study aims to determine FG risk factors and predictors of mortality among the Turkish population using published data.

Method: A literature review was conducted via PubMed Central® using the keywords "FG" and "Turkey," revealing 95 articles published between January 2000 and December 2020. Studies including <20 patients and consecutive studies by the same author were excluded from the review. Finally, a total of 41 studies were included, and the respective correlations between mortality and the other variables were analyzed.

Results: A total of 1,919 patients were reported in the 41 studies; the majority of the patients were men (83.11%), with a median age of 55 years, and the median mortality rate was 17.39%. A total of 16 studies were published between 2000 and 2010 (the first decade). The mortality rate was lower in the studies published between 2010 and 2020 (second decade) than in the first-decade studies (14.72%±7.1 vs. 22.46%±11.62; p=0.011). The cutaneous origin and mortality (r=-0.615; p=0.033) were negatively correlated, and chronic renal failure (r=0.705; p=0.005) and fecal diversion (r=0.371; p=0.037) were positively correlated. The rate of women was higher in the high-mortality group than in the low-mortality group (27.25% vs. 4.35%; p=0.034).

Conclusion: The features of patients with FG in the Turkish population are comparable with the literature data. Proper comorbidity assessment, the female gender, origin of the disease, and avoidance of unnecessary fecal diversion may have an impact on mortality.

Keywords: Fecal diversion, Fournier's gangrene, mortality, renal failure, Turkey

Introduction

Fournier's gangrene (FG) is a rare, life-threatening, rapidly progressive, polymicrobial, and synergistic form of infective necrotizing fasciitis of the perineal, genital, or perianal regions. It leads to thrombosis of the small subcutaneous vessels and necrosis of the overlying skin. It was initially described by Baurienne in 1764; however, it was named by Jean Alfred Fournier, a Parisian dermatologist and venerologist, who reported it in 1883.[1] The treatment of FG basically consists of hemodynamic resuscitation, aggressive surgical debridement, and administration of broad-spectrum antibiotics.[2,3]

Reported overall mortality rates for FG vary between 0% and 88%.[4,5] However, studies published during the last three decades report a mortality rate ranging from 20% to 40%. In 2000, Eke[6] reviewed 1,726 cases of FG from literature written in English and reported a mortality rate of 16%. The study by Furr et al.[7], which included the largest patient population in the literature, reported a 4.7% inpatient mortality.

Since FG is a rare disease, designing a prospective clinical study may not be feasible. To overcome this limitation, which is associated with the nature of FG, the authors aimed to conduct a retrospective study with a large patient population. Thus, the authors retrospectively reviewed published literature reporting FG mortality and risk factors in the Turkish population during the last two decades.

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Materials and Methods

A database search was conducted via PubMed Central® using the keywords "FG" and "Turkey" between January 2000 and December 2020. The search revealed 95 articles. Articles that included <20 patients and those published in a country other than Turkey were excluded. In the case of consecutive publications from the same first author and institution, only the article with the largest patient number was included. A total of 41 studies were finally included. A flow chart showing the included papers is presented in Figure 1, and a full list of manuscripts is presented in Appendix 1. Approval from the institutional review board was obtained for this study.

Data regarding the etiological origin of FG, patient demographics, comorbidities, treatment methods, and mortality rates were collected from the reviewed articles. The overall data and the subgroups including two decades (2000-2010 and 2010-2020) were analyzed for factors affecting mortality. The authors aimed to evaluate whether there were differences between the patient characteristics and, in particular, the outcomes (mortality) between the two decades, as the authors believed that the outcomes may have improved with a better understanding of the disease and the advances in treatment modalities.

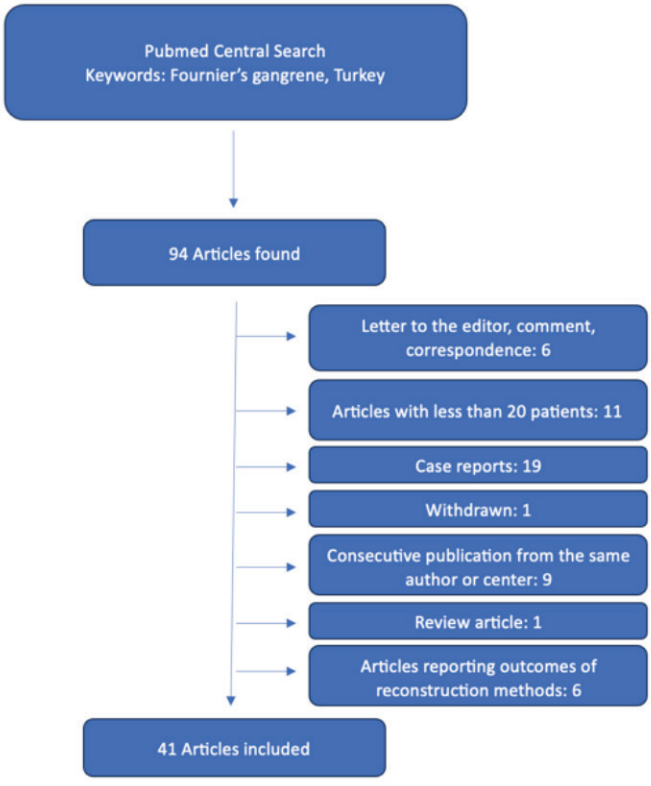

Figure 1. Flow chart of included manuscripts

Statistical Analysis

Statistical analyses were performed using SPSS for Windows version 23.0 (IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp). A normality check for the data was performed using the Shapiro-Wilk test. Normally distributed variables were reported as mean ± standard deviation, and two independent groups were compared using the t-test. Non-normally distributed variables were reported as the median (minimum-maximum), and two independent groups were compared using the Mann-Whitney U test. The correlations between the variables were analyzed using the Spearman correlation coefficient. An α-value of <0.05 was accepted as statistically significant.

Results

The median patient number was 38 (20-120). The distribution of the patient numbers based on the publication date are presented in Figure 2. The reported median mortality was 6 (1-129) patients; mortality rates were calculated for every single study, and the median mortality rate was 17.39% (2.89-40.54). The distributions of mortality rates by year are shown in Figure 3. The number of patients with diabetes mellitus (DM) were reported in all studies except two; the rate of patients with DM was 50.02%±16.59% among the overall population.

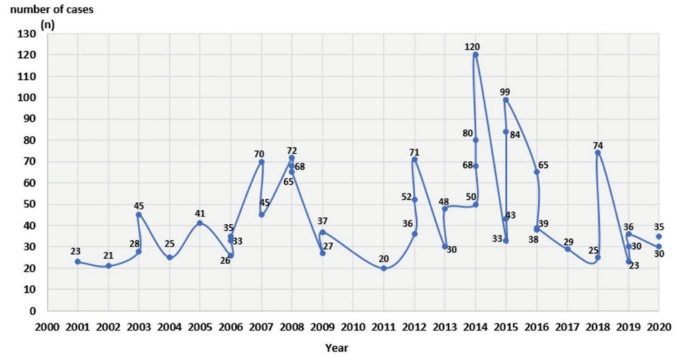

Figure 2. Distribution of the patient volume of the included studies based on the publication date

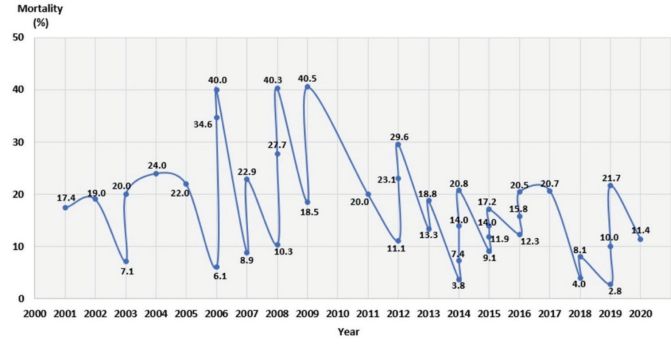

Figure 3. Distribution of the mortality rates by year

A total of 16 (39%) studies were published in the first decade (2000-2010), and 25 (61%) were published in the second decade (2010-2020). The mortality rate was 22.46%±11.62% for the studies published in the first decade and 14.72%±7.10% for studies published in the second decade. The mortality rate was significantly high for the first decade (p=0.011). Furthermore, the rate of patients with DM was higher in the second decade than in the first decade (p=0.022). The comparison of mortality rates and patients with DM between the two decades is presented in Figure 4. A summary of the comparison of the data obtained from reviewed articles, as well as the differences between the two decades are shown in Table 1.

The respective associations between the mortality rate and other variables were analyzed. The mortality rate was negatively correlated with the cutaneous origin and positively correlated with chronic renal failure (CRF) and fecal diversion (Table 2).

The studies were classified into two groups based on the median mortality rate (<17.39 "low mortality" vs. >17.39 "high mortality"). Female patients, CRF and anorectal origin rates were common in the high-mortality group, and the cutaneous origin rate was common in the low-mortality group (Table 3).

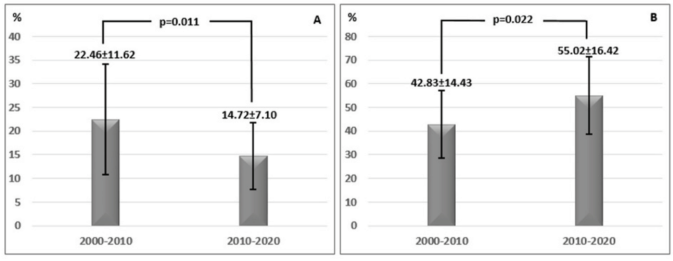

Figure 4. Comparison of (A) mortality and (B) diabetes mellitus rates between the two decades (2000-2010 and 2010-2020)

Discussion

FG is a devastating disease that can rapidly progress to sepsis, septic shock with multi-organ failure, and death.[8] In the present study, data collected from previously published articles from Turkish institutions between 2000 and 2020 were analyzed to determine the related risk factors and mortality in the Turkish population. It was shown that FG is still associated with a significant mortality rate (17.39%) and that the female gender, anorectal origin, CRF, and fecal diversion may be associated with a poor outcome.

Studies published in the last three decades report mortality rates of between 0% and 43%.[5,9] However, studies with high patient numbers published during the last two decades reported mortality rates as low as 4.7%-16%.[6,7,10] The median mortality rate was 17.39% in the present study; this rate is

Table 1. Comparison of the data reported in the articles between two decades

Variables	2000-2010		2010-2020		p-value
	n	Descriptive statistics	n	Descriptive statistics	
Patient number*	16	36 (21-72)	25	39 (20-120)	0.259
Age#	16	54.58±3.91	25	57.04±4.29	0.072
Debridement count*	5	3 (2.00-7.33)	9	2.36 (1.55-6.21)	0.298
Symptom time*	5	6.40 (3.50-8.09)	11	5.48 (3.74-7.50)	0.510
Male (%)*	16	91.55 (59.46-100)	25	82.61 (44.00-100)	0.500
Anorectal/colorectal (%)*	14	47.30 (9.09-63.08)	14	46.25 (6.06-78.26)	0.982
Urogenital (%)*	13	15.38 (4.44-69.70)	15	35.00 (4.35-68.00)	0.294
Cutaneous (%)*	7	21.21 (4.88-33.33)	5	15.38 (7.50-24.32)	0.343
Idiopathic (%)*	10	22.25 (4.44-71.43)	9	33.33 (19.23-73.53)	0.095
Hypertension (%)*	4	13.25 (5.56-28.00)	7	20.00 (10.26-51.92)	0.164
Cardiac comorbidity (%)*	4	13.18 (7.32-31.43)	8	10.39 (4.35-22.00)	0.368
Chronic renal failure (%)*	7	3.57 (2.22-20.00)	7	4.65 (1.25-17.31)	0.710
Malignancy (%)*	6	7.29 (2.22-24.62)	13	6.67 (1.47-19.72)	0.966
Alcoholism (%)*	7	8.33 (4.41-30.30)	4	6.97 (3.33-26.67)	0.648
Fecal diversion (%)*	12	33.57 (4.76-75.61)	20	18.37 (4.00-66.67)	0.076
Urinary diversion (%)*	8	11.77 (1.54-100.00)	8	6.55 (1.01-73.33)	0.279

Variables reported in * median (minimum-maximum) or #mean ± standard deviation. n: number of studies reporting the variable

comparable with that reported in Eke's[6] study (16%) but higher than those in the studies published in North America. However, the authors determined a higher mortality rate in the first decade (2000-2010) than in the second decade (2010-2020). The emerging technologies and advances in medical knowledge appear to have improved the outcome of FG by providing better surgical and medical care.

Two previously published studies with the largest patient populations reported different gender rates in FG. Eke[6] reported a 10:1 rate dominancy of men, while Sorensen et al.[10] reported that 2.32% of the included 1,680 patients were women. In the present study, the majority of the 1,919 included patients were men, with the women-patient rate 16.88%. The impact of gender on the prognosis of FG is controversial; several studies report female gender either as a risk factor or as inconsequential to the prognosis.[11-13] In the present study, the rate of women patients was higher in the high-mortality group than in the low-mortality group. The association between gender and mortality in FG might be explained by the anatomical features of the female pelvis, which allow for widespread necrotizing fasciitis.[12] However, there is a need for further studies to establish a precise explanation.

Major sources of infection are the local skin, colon, anus and rectum, and the lower urinary tract.[6] The infection has a polymicrobial and synergistic pattern and includes both Gram-positive and Gram-negative aerobe and anaerobic bacteria.[14] Colonic, anal, and rectal sources are associated

Table 2. The correlations between the mortality rate and other variables

	r	p-value
Male (%)	-0.257	0.104
Anorectal/colorectal (%)	0.253	0.194
Urogenital (%)	-0.099	0.617
Cutaneous (%)	-0.615	**0.033**
Idiopathic (%)	-0.330	0.168
Diabetes mellitus (%)	0.148	0.368
Hypertension (%)	-0.342	0.304
Cardiac comorbidity (%)	0.161	0.618
Chronic renal failure (%)	0.705	**0.005**
Malignancy (%)	0.360	0.130
Alcoholism (%)	-0.118	0.729
Fecal diversion (%)	0.371	**0.037**
Urinary diversion (%)	-0.129	0.633

Table 3. Comparison of the low- and high-mortality groups

Variables	Low-mortality group		High-mortality group		p-value
	n	Descriptive statistics	n	Descriptive statistics	
Patient number*	21	38 (23-99)	20	38 (20-120)	0.411
Age*	21	55.20 (51.98-66.30)	20	54.60 (46.22-65.91)	0.489
Debridement count*	6	2.20 (1.55-3.00)	9	2.68 (1.79-7.33)	0.282
Symptom time*	10	5.34 (3.74-6.40)	6	7.00 (3.50-8.09)	0.263
Females (%)*	21	4.35 (0.00-56.00)	20	27.25 (0.00-46.67)	**0.034**
Anorectal origin (%)*	13	31.25 (6.06-60.29)	15	49.17 (14.29-78.26)	**0.041**
Urogenital origin (%)*	14	37.25 (4.41-69.70)	14	16.35 (4.35-56.67)	0.306
Cutaneous origin (%)*	5	24.32 (15.38-33.33)	7	11.27 (4.88-24.44)	**0.048**
Idiopathic (%)*	11	32.00 (13.33-73.53)	8	21.16 (4.44-71.43)	0.206
Diabetes mellitus (%)#	20	46.71±15.25	19	53.50±17.61	0.206
Hypertension (%)*	5	20.00 (16.25-33.33)	6	13.25 (5.56-51.92)	0.247
Cardiac comorbidity (%)*	6	10.65 (8.75-22.00)	6	10.90 (4.35-31.43)	0.937
Chronic renal failure (%)*	8	3.26 (1.25-9.09)	6	7.99 (3.08-2.00)	**0.043**
Malignancy (%)*	10	4.85 (1.47-17.57)	9	12.20 (2.22-24.62)	0.182
Alcoholism (%)*	7	7.14 (3.33-30.30)	4	8.93 (5.71-12.20)	0.648
Fecal diversion (%)#	15	22.32±13.63	17	33.80±19.90	0.070
Urinary diversion (%)*	10	7.20 (1.01-73.33)	6	9.56 (1.54-100.00)	0.562

Variables reported in * median (minimum-maximum) or # mean ± standard deviation. n: Number of studies reporting the variable

with a bad prognosis.[2,6] Perianal infection is the most common of these (19%-50%), either as a primary infection or infection secondary to perianal surgical interventions.[2] In the present study, the cutaneous origin was negatively correlated with mortality, while the anorectal origin rate was higher in the high-mortality group than in the low-mortality group; these results were in line with previously published data.

Comorbidities such as DM, obesity, alcoholism, smoking, CRF, liver failure, malignancy, and HIV infection play an important role in the prognosis of FG. All these conditions may impair microcirculation and/or immunity.[15] Specifically, DM is a well-defined risk factor that may influence the frequency and the prognosis of the disease.[16] In the present study, the rate of patients with DM was significantly higher in the last decade (2010-2020) than in the first (2000-2010). The study failed to show a correlation between DM and the mortality rate, much like the previously published studies from our department;[13,17] however, the study did reveal a positive correlation between CRF and the mortality rate.

The gold standard treatment of FG includes aggressive and repeated debridement of necrotic tissue in conjunction with the administration of broad-spectrum antibiotics and hemodynamic supportive measures in the intensive care unit.[13] Recurrent surgical debridement may cause wide perianal tissue defects and impair anal sphincter functions due to direct trauma. As a result of these factors, fecal contamination of the wound may be unavoidable. Fecal diversion is an option for such patients for facilitating wound care. However, fecal diversion does not improve the treatment outcome and increases morbidity and the cost of treatment.[18] In addition, the mortality rate was reported to be relatively high in patients with a diverting stoma.[19] Similarly, the present study found a positive correlation between fecal diversion and the mortality rate. However, the need for a stoma is common in patients with extensive diseases, and it should be borne in mind that extensive disease may be another factor impairing the treatment outcome.

Study Limitations

The major limitation of this study is its retrospective nature. Since every article has its original study design, reviewing variables from previously published articles may be associated with missing data, which may affect the results of the study. Another important issue is that the manuscripts were published by different specialties from different centers, and there may be differences in disease management among the centers and specialties, which again may have affected the study outcomes. However, the high patient number provides this study with clinical value. Furthermore, this is the first study reflecting data on patients with FG in the Turkish population.

Conclusion

In conclusion, FG remains a fatal disease. The mortality rate and correlated risk factors of FG in the Turkish population appear to be comparable with the literature data. The cutaneous origin may be associated with better outcomes, and female gender, CRF, and the need for fecal diversion may be associated with a poor prognosis.

Ethics

Ethics Committee Approval: The study was approved by the Bursa Uludağ University Local Ethics Committee (approval number: 2023-17/43, date: 19.09.2023).

Informed Consent: Retrospective study.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: Ö.I., T.Y., Concept: T.Y., Design: Ö.I., M.Ş., T.Y., Data Collection or Processing: Ö.I., M.Ş., D.S., T.Y., Analysis or Interpretation: Ö.I., D.S., T.Y., Literature Search: Ö.I., M.Ş., D.S., T.Y., Writing: Ö.I., D.S., T.Y.

Conflict of Interest: No conflict of interest was declared by the authors.

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Appendix 1. A full list of manuscripts

No	Author	Article title	Journal	Publication year
1	Kılıç	Fourniers's gangrene: etiology, treatment and complications	Ann Plast Surg	2001
2	Atakan	A life - threatening infection: Fourniers's gangrene	Int Urol Nephrol	2002
3	Gürdal	Predisposing factors and treatment outcome in Fournier's gangrene	Urol Int	2003
4	Korkut	Outcome analysis in patients with Fournier's gangrene: report of 45 cases	Dis Colon Rectum	2003
5	Yeniyol	Fournier's gangrene: experience with 25 patients and use of Fournier's gangrene severity index score	Urology	2004
6	Ayan	Fournier's gangrene: a retrspective clinical study on forty - one patients	ANZ J Surg	2005
7	Ünal	Fournier's gangrene: approaches to diagnosis and treatment	Saudi Med J	2006
8	Tahmaz	Fournier's gangrene: report of thirty - three cases and a review of the literature	Int J Urol	2006
9	Yanar	Fournier's gangrene: risk factors and strategies for management	World J Surg	2006
10	Ersay	Factors affecting mortality of Fournier's gangrene: review of 70 patients	ANZ J Surg	2007
11	Başoğlu	Management of Fournier's gangrene: review of 45 cases	Surg Today	2007
12	Ünalp	Fournier's gangrene: evalation of 68 patients and analysis of prognostic variables	J Postgrad Med	2008
13	Kabay	The clinical features of Fournier's gangrene and the predictivity of the Fournier's gangrene severity index on the outcomes	Int Urol Nephrol	2008
14	Çakmak	Fournier's gangrene: is it scrotal gangrene?	Adv Ther	2008
15	Uluğ	The evaluation of microbiology and Fournier's gangrene severity index in 27 patients	Int J Infect Dis	2009
16	Akcan	Necessity of preventive colostomy for Fournier's gangrene of the anorectal region	Ulus Travma Acil Cerrahi Derg	2009
17	Çelik	Fournier's gangrene: series of twenty patients	Eur Surg Res	2011
18	Göktaş	Factors affecting the number of debridements in Fournier's gangrene: our results in 36 cases	Ulus Travma Acil Cerrahi Derg	2012
19	Ersöz	Factors affecting mortality in Fournier's gangrene: experience with fifty - two patients	Singapore Med	2012
20	Arıdoğan	Epidemiological characteristics of Fournier's gangrene: a report of 71 patients	Urol Int	2012
21	Tuncel	Comparison of different scoring systems for outcome prediction in patients with Fournier's gangrene: experience with 50 patients	Scand J Urol	2014
22	Kahramanca	Are neutrophil - lymphocyte ratio ant platelet - lymphocyte ratio as affective as Fournier's gangrene severity index for predicting the number of debriedements in Fournier's gangrene?	Ulus Travma Acil Cerrahi Derg	2014

Appendix 1. Continued

No	Author	Article title	Journal	Publication year
23	Eskitaşçıoğlu	Experience of 80 cases with Fournier's gangrene and "trauma" as trigger factor in etiopathogenesis	Ulus Travma Acil Cerrahi Derg	2014
24	Yılmazlar	Fournier's gangrene; review of 120 patients and predicts of mortality	Ulus Travma Acil Cerrahi Derg	2014
25	Bozkurt	Evaluation of the utility of different scoring systems (FSGI, LRINEC and NLR) in the management of Fournier's gangrene	Int Urol Nephrol	2015
26	Oğuz	Fournier's gangrene: a summary of 10 years clinical experience	Int Surg	2015
27	Erol	Low magnesium levels an important new prognostic parameter can be overlooked in patients with Fournier's gangrene: a multicentric study	Int Urol Nephrol	2015
28	Eray	Comparison of diverting colostomy and bowel management catheter applications in Fournier's gangrene cases requiring fecal diversion	Indian J Surg	2015
29	Erdoğan	Simple scoring system for prediction of mortality in Fournier's gangrene	Eur J Trauma Emerg Surg	2016
30	Taken	Fournier's gangrene: causes, presentation and survivial of sixty - five patients	Pak J Med Sci	2016
31	Şen	Is hemoglobin A1c level effective in predicting the prognosis of Fournier's gangrene?	Urol Ann	2016
32	Doluoğlu	Overview of different scoring systems in Fournier's gangrene and assessment of prognostic factors	Turk J Urol	2016
33	Yanaral	Comparition of conventional dressings and vacuum - assisted closure in the wound theraphy of Fournier's gangrene	Arch Ital Urol Androl	2017
34	Üreyen	Usefulness of FSGI and UFGI scoring systems for predicting mortality in partinents with Fournier's gangrene	Ulus Travma Acil Cerrahi Derg	2017
35	Yücel	Fournier's gangrene: a retrospecite analysis of 25 patients	Ulus Travma Acil Cerrahi Derg	2017
36	Demir	Fournier's gangrene; association of mortality with the complate blood count parameters	Plast Reconstr Surg	2018
37	Pehlivanlı	Factors affecting mortality in Fournier's single center experience	Surg Infect	2019
38	Selvi	A different perspective for morbidity related to Fournier's gangrene: which scoring system is mode more reliable to predict requirement of skin graft and flaps in surviviors of Fournier's gangrene?	Int Urol Nephrol	2019
39	Çalışkan	Fournier's gangrene: review of 36 cases	Ulus Travma Acil Cerrahi Derg	2019
40	Hatipoğlu	Fournier's gangrene; Five years' experience from a single center in Turkey	Ulus Travma Acil Cerrahi Derg	2020
41	Egin	Comparison of mortality in Fournier's gangrene with two scoring systems	J Coll Pyhsicians Surg Pak	2020