

Pediatric genital burns: a 15-year experience from a tertiary burn center

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ABSTRACT

Aims: To describe the epidemiological features, clinical management, and outcomes of pediatric genital burns over a 15-year period at a tertiary burn center.

Methods: A retrospective review was conducted on 227 pediatric patients with genital burns admitted between 2005 and 2019. Data collected included demographics, burn mechanism, total burn surface area (TBSA), genital burn surface area (GBSA), treatment details, complications, and follow-up outcomes. Multivariate analyses were performed to investigate the associations between selected clinical variables and outcomes, including graft requirement and long-term genitourinary complications.

Results: Scald injuries predominated in children under 5 years, while flame and electrical burns were more common in older patients. The mean TBSA was 28.0%, and 11% of the patients required genital skin grafting. Bloodstream infections and full-thickness burns were associated with increased risk of long-term GU complications. Genital involvement itself was not an independent predictor of adverse outcomes.

Conclusion: This study provides a cohort-level overview of pediatric genital burns and their management. TBSA and burn depth were the primary factors associated with clinical outcomes. Genital location alone did not confer additional risk but it may stiwwarrant specialized follow-up.

Keywords: Burns, genitalia, skin transplantation, postoperative complications, sepsis, child

INTRODUCTION

Burn injuries are a major cause of morbidity and mortality in the pediatric population, requiring specialized and multidisciplinary care.^{1,2} Although genital burns constitute a small subset of pediatric burns, they present distinct challenges due to anatomical sensitivity, risk of infection—including occasional resistant genitourinary pathogens—and long-term psychosocial sequelae.^{3,4}

The genital and perineal regions, although partially shielded by the thighs and lower abdomen, remain vulnerable to thermal injury—particularly in young children who lack situational awareness and have limited ability to escape hazardous environments.⁵ Recognizing their potential impact on urinary, reproductive, and sexual function, the National Burn Repository classifies all genital burns as severe, regardless of the percentage of TBSA involved.⁶

Pediatric genital burns often occur in conjunction with extensive burns to other body regions, complicating both acute and long-term management. These injuries increase the

risk of systemic complications such as infection, sepsis, and multi-organ failure. The etiology of genital burns varies by age: scald injuries are more common in infants and toddlers, whereas flame and electrical burns predominate among older children.^{5,7} Management typically involves meticulous wound care, pain control, and surgical interventions such as debridement, grafting, or reconstruction. Psychosocial consequences—including anxiety, social withdrawal, or body image concerns—have also been reported in affected children.^{4,8}

Despite improvements in burn care, pediatric genital burns remain underreported and insufficiently studied. The majority of existing studies focus on general burn injury patterns and outcomes. However, data specifically addressing genital burns as a distinct clinical entity are limited and often anecdotal.⁹ This gap in the literature restricts our ability to develop evidence-based protocols tailored to this unique patient group.

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This study aims to describe the epidemiological characteristics, clinical management strategies, and outcomes of pediatric genital burns over a 15-year period at a tertiary burn center. By addressing an overlooked area in pediatric burn care, we seek to contribute to the establishment of standardized treatment guidelines and to support improved long-term outcomes in affected children.

METHODS

This study was conducted as a retrospective analysis of pediatric patients aged 0–18 years who were admitted to a tertiary pediatric burn center for the treatment of genital burns between January 1, 2005, and December 31, 2019. All patient data were anonymized in compliance with institutional data privacy regulations. This study has been approved by the Ankara Bilkent City Hospital No. 2 Clinical Researches Ethics Committee (Date: 10.03.2021, Decision No: 10.03.2021/E2-21-240) and conducted in accordance with the principles of the Declaration of Helsinki.

Patients were included if they had burns involving the scrotum, penis, perineum, labia majora, inguinal region, or perianal area. Inguinal involvement was defined as burns extending from the anterior superior iliac spine along the external oblique aponeurosis and contiguous with the perineum. Cases limited to the inner thighs or gluteal region without perineal involvement were excluded. Demographic data, including age, gender, and burn etiology, were recorded. The extent of burns was assessed based on TBSA and GBSA. Additional clinical parameters such as hospital length of stay, surgical interventions, infection rates, and mortality were also analyzed.

Burn etiology was classified into four categories: scald burns, flame burns, electrical burns, and other less common causes. The depth of the burns was categorized as superficial partial-thickness, deep partial-thickness, or full-thickness burns. The presence of complications, including urinary tract infections, bloodstream infections, and sepsis, was noted, along with their management strategies. Urine cultures were obtained routinely at admission and thereafter only when clinical symptoms (fever, dysuria) were present.

Indwelling urinary catheters were inserted selectively, in patients with TBSA greater than 20% or in those with perineal burns requiring repeated wound debridement. Catheters were removed as soon as hemodynamic stability was achieved to minimize infection risk.

Surgical intervention was defined as the need for debridement, excision, or skin grafting. The indications for grafting were determined based on burn severity, with full-thickness burns or deep partial-thickness burns demonstrating delayed healing being considered for grafting. Split-thickness skin grafts were primarily used for reconstruction.

Long-term follow-up data were obtained for patients who returned for outpatient visits. Patients were scheduled for follow-up at 1, 3, 6, and 12 months post-discharge, and annually thereafter. Follow-up evaluations included the assessment of functional and aesthetic outcomes, the development of contractures, and the need for reconstructive surgery.

Additional complications such as urinary dysfunction, hypospadias, and undescended testes were documented.

Statistical Analysis

The data analysis was performed using IBM SPSS Statistics, version 23. The normality of continuous variables was assessed using the Kolmogorov-Smirnov test. Continuous data were compared using the Student's t-test or Mann-Whitney U test, depending on distribution normality. Categorical variables were analyzed using the Chi-square test or Fisher's exact test.

To identify independent predictors of mortality, multivariate logistic regression analysis was performed. Variables that were statistically significant ($p < 0.05$) in univariate analyses or clinically relevant were included in the multivariate model. The results were expressed as odds ratios (OR) with 95% confidence intervals (CI). A p-value of < 0.05 was considered statistically significant in all analyses.

RESULTS

Demographic Characteristics and Clinical Results

Between January 1, 2005, and December 31, 2019, a total of 1,723 pediatric patients were admitted to our tertiary burn center. Among them, 227 (13.1%) sustained genital burns. The vast majority (96.5%, $n=219$) had concomitant burns in other body regions, while only 3.5% ($n=8$) had isolated genital injuries. The mean age was 5.4 ± 4.3 years, and males accounted for 60.4% ($n=137$) of the cohort. The mean TBSA was $28.0 \pm 18.4\%$, and the mean GBSA was $4.4 \pm 2.8\%$. An overview of demographic and clinical features is presented in **Table 1**.

Table 1. Demographic and clinical outcome datas

Patients, n	227
Median age, years	5.4±4.3
Male/female, n (%)	137/90 (60.4/39.6)
Burn etiology	
Scald, n (%)	152 (67)
Flame, n (%)	60 (26.5)
Electrical, n (%)	12 (5.3)
Other, n (%)	3 (1.2)
Median TBSA, %	28.0±18.4
Median GBSA, %	4.4±2.8
Genital burn degree, n (%)	
2 nd degree superficial, n (%)	89 (39.2)
2 nd degree deep, n (%)	118 (52.0)
3 rd degree, n (%)	20 (8.8)
Blood culture positivity, n (%)	40 (17.6)
Urine culture positivity, n (%)	9 (3.9)
Operative management	
Debridement, n (%)	183 (80.6)
Split thickness skin grafting, n (%)	25 (11.0)
Hospital LOS, day (mean±SD)	23.9±21.3
Complication, n (%)	17 (7.5)
Mortality, n (%)	17 (7.5)
TBSA: Total burn surface area, GBSA: Genital burn surface area, SD: Standard deviation	

Comparison by Gender

The mean age was similar across sexes. However, the distribution of burn etiology differed significantly ($p=0.048$). Scald burns were the most common in both groups, but flame and electrical burns occurred more frequently in males. While no significant difference in TBSA was observed between sexes ($p=0.193$), females exhibited a significantly higher GBSA ($4.9\pm3.1\%$ vs. $4.1\pm2.5\%$, $p=0.035$). This may be attributed to anatomical and exposure-related factors. Detailed data are presented in **Table 2**.

Table 2. Demographic data with genital burns based on patient sex

	Male	Female	p
Patients, n (%)	137 (60.4)	90 (39.6)	
Median age, years	5.3 $\pm$ 4.4	5.4 $\pm$ 4.2	0.958
Burn etiology			
Scald, n (%)	82 (59.9)	70 (77.8)	
Flame, n (%)	44 (32.1)	16 (17.8)	0.048
Electrical, n (%)	10 (7.3)	2 (2.2)	
Other, n (%)	1 (0.7)	2 (2.2)	
Median TBSA, %	29.3 $\pm$ 19.6	26.0 $\pm$ 16.3	0.193
Median GBSA, %	4.1 $\pm$ 2.5	4.9 $\pm$ 3.1	0.035

TBSA: Total burn surface area, GBSA: Genital burn surface area

Comparison by Age Group

Patients were divided into two groups: ≤ 5 years (group 1, $n=126$, 55.5%) and >5 years (group 2, $n=101$, 44.5%). Scald burns predominated in group 1 (87.3%), while flame burns were more prevalent in group 2 (47.5%) ($p<0.001$). Older children had significantly greater TBSA involvement ($33.1\pm21.8\%$ vs. $25.5\pm14.7\%$, $p=0.031$) and a higher incidence of bloodstream infections ($p=0.010$). Mortality was notably higher among older children (12.9% vs. 3.2% , $p=0.006$). Other variables—including genital burn size, surgical intervention, urinary tract infection, and hospital stay—showed no significant differences. **Table 3** presents the demographic characteristics of pediatric patients with genital burns, stratified by age groups, highlighting variations in burn mechanisms, severity, and associated clinical outcomes.

Graft Requirement and Associated Outcomes

A total of 25 patients (11%) underwent surgical grafting. These patients had significantly higher TBSA ($35.2\pm15.8\%$ vs. $27.1\pm18.5\%$, $p=0.038$), deeper burns ($p<0.001$), and longer hospital stays (37.4 ± 20.0 vs. 22.2 ± 20.9 days, $p=0.001$). Flame and electrical burns were significantly more common in this group ($p=0.007$). However, age, sex, GBSA, and infection rates did not differ significantly. Notably, none of the grafted patients died, while all mortalities ($n=17$) occurred in the non-grafted group. This observation highlights a potential survival benefit of early surgical grafting in patients with severe burns (**Table 4**).

Among grafted patients, 44% had full-thickness burns and 52% had deep partial-thickness burns, while only 4% had superficial burns. This finding underscores burn depth as

Table 3. Demographic data with genital burns based on patient age

	Group 1	Group 2	p
Patients, n (%)	126 (55.5)	101 (44.5)	
Male/female, n (%)	48/78	42/59	0.593
Burn etiology			
Scald, n (%)	110 (87.3)	42 (41.5)	
Flame, n (%)	12 (9.5)	48 (47.5)	<0.001
Electrical, n (%)	1 (0.8)	11 (11.0)	
Other, n (%)	3 (2.4)	0	
Median TBSA, %	25.5 $\pm$ 14.7	3.1 $\pm$ 21.8	0.031
Median GBSA, %	4.6 $\pm$ 2.9	4.2 $\pm$ 2.8	0.316
Genital burn degree, n (%)			
2 nd degree superficial, n (%)	47 (37.3)	42 (41.6)	
2 nd degree deep, n (%)	71 (56.4)	47 (46.5)	0.197
3 rd degree, n (%)	8 (6.3)	12 (11.9)	
Blood culture positivity, n (%)	12 (9.5)	28 (27.7)	0.010
Urine culture positivity, n (%)	4 (3.1)	5 (4.9)	1.000
Operative management			
Debridement, n (%)	105 (91.3)	78 (83.8)	0.247
Split thickness skin grafting, n (%)	10 (8.7)	15 (16.2)	
Hospital LOS, day (mean $\pm$ SD)	22.8 $\pm$ 18.5	25.3 $\pm$ 24.4	0.383
Mortality, n (%)	4 (3.2)	13 (12.9)	0.006

TBSA: Total burn surface area, GBSA: Genital burn surface area, SD: Standard deviation

Table 4. Demographic characteristics and clinical results of patients required genital split thickness skin grafting

Genital split thickness skin grafting	No	Yes	p
Patients, n (%)	202(89)	25(11)	
Median age, years	5.3 $\pm$ 4.3	6.1 $\pm$ 4.3	0.339
Male/female, n (%)	80/122	10/15	0.970
Burn etiology			
Scald, n (%)	142 (70.3)	10 (40)	
Flame, n (%)	49 (24.3)	11 (44)	0.007
Electrical, n (%)	8 (4)	4 (16)	
Other, n (%)	3 (1.5)	0	
Median TBSA, %	27.1 $\pm$ 18.5	35.2 $\pm$ 15.8	0.038
Median GBSA, %	4.3 $\pm$ 2.9	5.0 $\pm$ 2.0	0.267
Genital burn degree, n (%)			
2 nd degree superficial, n (%)	88 (43.6)	1 (4.0)	
2 nd degree deep, n (%)	105 (52.0)	13 (52.0)	<0.001
3 rd degree, n (%)	9 (4.5)	11 (44.0)	
Blood culture positivity, n (%)	32 (50.0)	8 (42.1)	0.545
Urine culture positivity, n (%)	8 (29.6)	1 (14.3)	0.644
Hospital LOS, day (mean $\pm$ SD)	22.2 $\pm$ 20.9	37.4 $\pm$ 20.0	0.001
Mortality	17	0	

TBSA: Total burn surface area, GBSA: Genital burn surface area, SD: Standard deviation

the primary determinant of grafting and provides a clearer framework for comparing our results with previous studies.

Multivariate logistic regression identified TBSA as the strongest independent predictor of grafting (OR: 1.06 per

1% increase; 95% CI: 1.04–1.08; $p<0.001$). Burn depth and etiology were not significant after adjustment. Similarly, TBSA (OR: 1.08; $p<0.001$) and full-thickness burn depth (OR: 1.79; $p=0.04$) independently predicted long-term genitourinary complications.

Microbiological Culture Results

Bloodstream infections occurred more frequently in older children ($p=0.010$) and those with greater TBSA. Urinary tract infections were rare (3.9%) and showed no correlation with age or gender ($p=1.000$). The presence of bloodstream infection was significantly associated with increased mortality and prolonged hospital stay, underscoring the importance of infection surveillance.

Long-Term Genitourinary Complications

Long-term follow-up (mean 5.6 years, range 2–7 years) identified complications in 17 patients (7.5%). Genital contractures occurred in 11 patients (4.8%), all requiring reconstructive surgery. One patient developed bilateral undescended testes (Figure). Family history and admission records confirmed that no pre-existing cryptorchidism was present, and surgical findings demonstrated that the abnormal positioning developed secondary to post-burn scrotal contracture. During orchiopexy, adequate space for testicular placement was achieved through scar tissue release and local scrotal flap mobilization. Four patients were diagnosed with hypospadias during follow-up, which became clinically evident after scar-related contractures; two of these required revision surgery due to insufficient surrounding tissue. No cases of erectile dysfunction were reported during follow-up.



Figure. Bilateral undescended testis developed in a patient who developed contracture in the genital region due to deformation of the scrotum

Mortality

Seventeen patients (7.5%) died. Sepsis was the leading cause (70.5%), followed by multi-organ failure. Non-survivors were more likely to be ≥ 5 years old (82.4% vs. 40.0%, $p=0.0017$) and had significantly higher TBSA ($35\% \pm 6\%$ vs. $28\% \pm 8\%$, $p<0.001$). Bloodstream infection was present in 70.6% of deceased patients (vs. 19% of survivors, $p<0.001$). Flame

(64.7%) and electrical (29.4%) burns were more frequent among non-survivors (Table 5).

Table 5. Comparative analysis between survivors and non-survivors

Variable	Survived (n=210)	Deceased (n=17)	p-value
Age ≥ 5 years	84 (40.0%)	14 (82.4%)	0.0017
Mean TBSA	28 ± 8	35 ± 6	<0.001
Bloodstream infection	40 (19 %)	12 (70.6%)	<0.001
Flame burn	60 (28.6%)	11 (64.7%)	0.0048
Electrical burn	12 (5.7%)	5 (29.4%)	0.0019
Grafted	25 (11.9%)	0	

TBSA: Total burn surface area

Among the 17 patients who died, bloodstream infections were documented in 12 cases. The most common pathogens were *Pseudomonas aeruginosa* (n=6), *Klebsiella pneumoniae* (n=5), and *Staphylococcus aureus* (n=3), while other organisms were isolated in three patients. Urine cultures were available in 3 of the deceased patients, yielding *Escherichia coli* in two cases and *Enterococcus faecalis* in one.

None of the deceased patients had undergone grafting, whereas 11.9% of survivors had. Though this association did not reach statistical significance in multivariate analysis—likely due to collinearity with TBSA and depth—it strongly suggests that surgical grafting may confer a clinical survival advantage.

Multivariate logistic regression identified flame burns (OR: 4.09, $p<0.001$), electrical burns (OR: 2.39, $p=0.012$), higher TBSA (OR: 1.13 per 1% increase, $p<0.001$), and bloodstream infection (OR: 1.83, $p=0.002$) as independent predictors of mortality.

DISCUSSION

Pediatric genital burns, while comprising a small proportion of overall burn cases, represent a distinct clinical entity due to their anatomical sensitivity and the potential for long-term functional and psychosocial consequences.⁵ This 15-year retrospective study provides a detailed evaluation of the demographics, clinical characteristics, treatment strategies, and outcomes in affected children treated at a tertiary burn center.

The 13.1% incidence rate observed aligns with prior reports (1%–12.5%) [5,10], with male predominance and higher frequency in children under five years of age. These findings are consistent with established literature and likely reflect gender-related anatomical exposure and behavior-related risk factors.^{5,10}

Scald burns predominated in younger children, while flame injuries were more frequent in older patients, supporting previous findings that injury mechanisms vary with developmental stage and environmental exposure.^{1,4,5} Electrical burns were associated with deeper injuries, higher TBSA, and more frequent grafting, emphasizing the need for aggressive early surgical planning in these cases.^{3,11,12}

The grafting rate of 11% in our cohort was at the lower end of the range reported in the literature (8.5%–31.5%),^{6,7} which likely reflects improvements in wound care and conservative management strategies at our center. Importantly, analysis of burn depth demonstrated that grafting was almost exclusively required in patients with deep partial-thickness or full-thickness burns (52% and 44%, respectively), whereas superficial burns accounted for only 4% of grafted cases. This finding emphasizes that burn depth, rather than genital location itself, was the principal determinant of grafting. Our results are therefore consistent with prior studies reporting that deeper burns significantly increase the likelihood of excision and grafting.

A key observation was the absence of mortality in grafted patients, whereas all deaths occurred in the non-grafted group. While this association was not statistically significant in multivariate analysis—likely due to collinearity with burn severity—it suggests that timely grafting may play a protective role. Similar observations in the literature support the survival benefit of early excision and grafting.¹³

Mortality in this cohort was independently associated with flame burns, electrical injuries, higher TBSA, and bloodstream infections. These findings mirror earlier studies highlighting the systemic burden of high-voltage and flame-related injuries in children. Sepsis was the leading cause of death, reinforcing the critical need for infection control, especially in perineal injuries prone to contamination.^{6,14}

The association between bloodstream infections and poor outcomes underscores the need for vigilant surveillance and timely antimicrobial therapy. At our center, Foley catheters were removed once hemodynamic stability was achieved to reduce infection risk—a strategy supported by Jimbo et al.,¹⁷ who found higher UTI and sepsis rates in genital burn patients.¹⁵⁻¹⁷

Long-term complications were observed in 7.5% of patients, with genital contractures being the most common (4.8%). Reconstructive surgery was necessary in all such cases. We also identified four cases of post-burn hypospadias and one of bilateral undescended testes—consistent with prior literature describing genital deformities secondary to scarring.^{8,18} Notably, no cases of erectile dysfunction were reported during follow-up.

The psychosocial burden of genital burns should not be overlooked. In our cohort, two patients who had reached adulthood reported concerns related to genital appearance and function, affecting their self-esteem and interpersonal relationships. Previous studies confirm the risk of social withdrawal and sexual dysfunction in these patients, further supporting the need for multidisciplinary care.¹⁵

Importantly, our findings highlight TBSA as the strongest predictor of both acute intervention (grafting) and long-term complications. Although genital involvement itself was not an independent predictor of adverse outcomes, its anatomical implications necessitate specialized follow-up. Based on our findings, we propose a risk stratification model that incorporates three major predictors: (1) TBSA

greater than 30%, (2) full-thickness burn depth, and (3) the presence of bloodstream infection. Patients meeting one or more of these criteria were considered at high risk for long-term genitourinary complications and were prioritized for structured multidisciplinary follow-up. This framework may assist clinicians in identifying patients who require closer surveillance and early intervention.

This study emphasizes the need for standardized treatment protocols and structured long-term follow-up. Our findings highlight that burn depth and TBSA are the primary predictors of outcomes, and that genital involvement requires specialized attention despite not being an independent predictor of morbidity. Future directions should focus on the development of bioengineered grafting materials and infection-resistant dressing systems, which may further improve clinical outcomes in pediatric patients with genital burns.

Limitations

This retrospective single-center study may be subject to selection and information biases, limiting generalizability. The relatively small number of grafted patients and rare complications reduced statistical power for subgroup analyses. Psychosocial and quality-of-life outcomes were not systematically evaluated, which limits assessment of long-term functional impacts.

CONCLUSION

Pediatric genital burns require a multidisciplinary approach encompassing acute management, surgical intervention, infection control, and psychological support. Flame and electrical injuries are associated with greater burn depth, increased grafting needs, and higher morbidity. We suggest standardized follow-up protocols and early graft planning for high-risk cases, particularly those with flame or electrical burns to minimise long-term complications, including genital contractures and urinary dysfunction.

ETHICAL DECLARATIONS

Ethics Committee Approval

This study has been approved by the Ankara Bilkent City Hospital No. 2 Clinical Researches Ethics Committee (Date: 10.03.2021, Decision No: 10.03.2021/E2-21-240).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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