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CUPI Score: A Novel Scoring System for Predicting the Hospital Stay in Patients with Fourniers Gangrene

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Abstract: ***Introduction & Objectives: Fournier's gangrene is a rapidly progressive necrotizing fasciitis of the genital, perineal and perianal regions caused by bacterial infection with a much lower mortality rate of approximately 10% or less in the recent times. Subsequent survivors require lengthy hospital stays including pelvic debridement and the need for reconstruction. Therefore, the focus of Fournier's management is shifting from preventing mortality to reducing morbidity, resource utilization and length of hospital stay. The aim of this study is to identify patient factors associated with hospital length of stay and to use these factors to create a novel scoring system that can accurately predict length of stay at the time of admission. Through the use of such a scoring system, patients requiring more extensive hospital management can be identified. Consequently, resources will be better allocated to patients based on a systematic assessment of healthcare needs, with the goal of improving patient outcomes and reducing hospital costs. Materials & methods: It is a retrospective study, data obtained from medical records. Inclusion criteria were a diagnosis of Fournier's gangrene and having undergone surgical debridement during hospital stay. Patients with superficial abscesses were excluded. Predictors of LOS, morbidity, mortality and resource utilization were identified and univariate linear regressions performed to determine significance. The Combined Urology and Plastics Index (CUPI) score was then compared to existing scoring systems (FGSI,NRC,CCI) for predicting length of stay. Results & Observations: The mean patient age was 52.2, and the mean BMI was 32.3 Patients on average were hospitalized for 15.4 days with mean of 4.1 days in the ICU. Multivariate logistic modelling showed that BMI ($p = 0.001$) and alkaline phosphatase ($p < 0.05$) correlated with decreasing length of stay, while age at admission was not significantly correlated ($p = 0.369$). CUPI score was shown to be a significant predictor of longer hospital stays ($p = 0.032$). Conclusions: The CUPI scoring system helps to predict length of stay in patients with Fournier's gangrene, and may help increasing care to at-risk patients. Multi-disciplinary care, aggressive nutrition and operative intervention all contribute to successful treatment for Fournier's gangrene with lower mortality rates.***

Keywords: Fournier's gangrene; genitalia; mortality; prognosis; risk factors.

1. Introduction

In 1883, Jean Alfred Fournier, a French dermatologist and venereologist, described a group of five young men in whom gangrene of the genitalia occurred with no apparent causal factor [1]. Fournier's gangrene is a rapidly progressive necrotizing fasciitis of the genital, perineal and perianal regions caused by bacterial infection with a much lower mortality rate of approximately 10% or less in the recent times[2] [3]. Subsequent survivors require lengthy hospital stays including pelvic debridement and the need for reconstruction. Therefore, the focus of Fournier's management is shifting from preventing mortality to reducing morbidity, resource utilization and length of hospital stay [4] [5].

2. Objectives

To identify patient factors associated with hospital length of stay and to use these factors to create a novel scoring system that can accurately predict length of stay at the time of admission. Through the use of such a scoring system, patients requiring more extensive hospital management can be identified. Consequently, resources will be better allocated to patients based on a systematic assessment of healthcare needs, with the goal of improving patient outcomes and reducing hospital costs.

3. Materials & Methods

It is a retrospective study, data obtained from medical records. Patients admitted in our institute from 2012 to 2021 diagnosed with Fournier's gangrene are included in the study.

Inclusion criteria: Fournier's gangrene having undergone surgical debridement during hospital stay.

Exclusion criteria: Patients with superficial abscesses were excluded.

Predictors of LOS, morbidity, mortality and resource utilization were identified and univariate linear regressions performed to determine significance.

The Combined Urology and Plastics Index (CUPI) score was then compared to existing scoring systems (FGSI,LRINEC) for predicting length of stay.

Statistical analysis
There were 70 patients identified who were treated for Fournier gangrene and met inclusion criteria between 2012 and 2021.

Variables analyzed:
- Patient demographics
- Lab values
- Risk factors
- Fournier's Gangrene Severity Index (FGSI)

- Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC)

Patient demographics and procedure settings were abstracted from the medical record. Events and percentages were calculated for categorical variables, and means (SDs) were calculated for age and BMI.

Univariate regressions were used to identify promising relationships between outcome measures and potential predictors of outcome, which included: age, BMI, CBC values, standard serum chemistry values

The Combined Urology and Plastics Index (CUPI) was used with a clinically relevant subset of the significant or near-significant univariate predictors of length of stay.

The aim was to include parameters that were objective and easily measurable at the initial evaluation of a patient, and that would be supported by prior literature and clinical judgment.

Post-hoc weighting was given to each variable based on the relative size of their regression coefficients.

CUPI Score:

Criteria	0	1	2
Age	<35	35-50	>50
Hematocrit	30-50%	<30%	>50%
Serum Calcium	08-10	<8	>10
Serum ALP	40-150	<40/>150	-
INR	1-1.5	1.5-2.0	>2.0
Serum Albumin	>4	-	<4
Serum Bicorbonate	20-30	<20/>30	-
Total Bilirubin	0.3-1.9	-	>1.9
BUN	Oct-20	>20	-
Max score: 15			

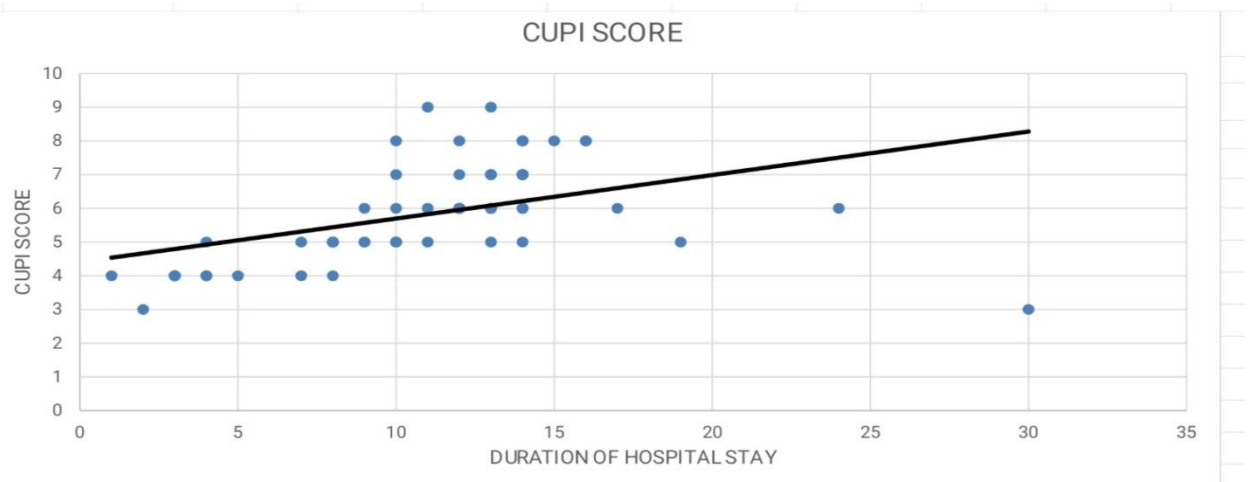
The point values for each parameter were then added together for each patient, yielding their individual CUPI score [6].

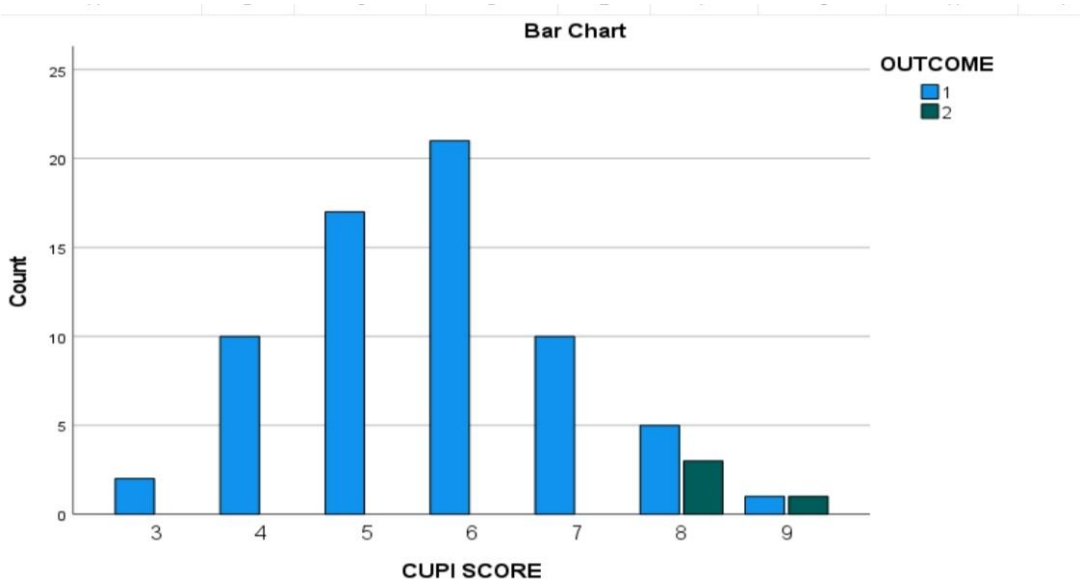
Median, mean, and standard deviations were calculated for the CUPI and the other scoring systems. Univariate linear regressions were subsequently used to evaluate the CUPI score as a predictor of length of stay, and to examine the relationship between existing measures of disease severity and length of stay.

		HOSPITAL STAY	ICU STAY	BMI	OUTCOME	CUPI SCORE	LRINEC SCORE
N	Valid	70	70	70	70	70	70
	Missing	0	0	0	0	0	0
Mean		11.13	0.99	32.173	1.06	5.84	3.50
Std. Error of Mean		0.574	0.152	0.3517	0.028	0.166	0.290
Median		12.00	0.00	32.100	1.00	6.00	3.00
Std. Deviation		4.803	1.268	2.9422	0.234	1.390	2.424
Range		29	5	12.3	1	6	11
Minimum		1	0	26.8	1	3	0
Maximum		30	5	39.1	2	9	11
Percentiles	25	8.00	0.00	29.875	1.00	5.00	2.00
	50	12.00	0.00	32.100	1.00	6.00	3.00
	75	14.00	2.00	34.200	1.00	7.00	5.00

Correlation between CUPI score and Hospital stay:

Test	Value	Degree of freedom	p- value
Chi Square	25.919	6	0.004
Likelihood ratio	17.301	6	0.008
Linear by linear association	12.72	1	0.002





4. Results & Observations

The mean patient age was 52.2, and the mean BMI was 32.17. Patients on average were hospitalized for 11.13 days with mean of 0.99 days in the ICU. Multivariate logistic modelling showed that BMI ($p = 0.001$) and alkaline phosphatase ($p < 0.05$) correlated with decreasing length of stay, while age was not significantly correlated ($p = 0.369$). CUPI score was shown to be a significant predictor of longer hospital stays ($p = 0.008$). Number of patients that survived in the second group was lower (4.3%) in cut-off score < 9 points, rather than in <11 points (17.3%). Cut-off score of 9 points still gives the most consistent result with the other study, >9 points sufficiently gives a sensitive and specific result, with sensitivity and specificity of 65–88% and 70–100%, respectively

Scoring System	p- value	Coefficient (CI 95%)
CUPI	0.008	12.72
FGSI	0.101	2.64
LRINEC	0.412	

5. Discussion

A study by Serdar Kirmizi et al. Showed that CUPI score determine the length of hospital stay more accurately than other systems (R2=0.28, p=0.04). FGSI or the LRINEC (ß=11.8 [95% CI: 5.7, 17.9], p=0.001).

A study by Ismail Selvi et al with 30 patients. 27 patients who survived were divided into 2 groups based on the applied skin reconstruction method (primary closure or skin grafting and flaps). This study showed that earlier prediction of a reconstruction requirement based on the results of scoring systems may allow for better disease management and good cosmetic results and a more satisfactory quality of life.

A study by Saum B. Ghodoussipour et al. Patients on average were hospitalized for 37.5 days, with a mean of 8.3 days in the ICU. Multivariate logistic modelling showed that BMI ($p = 0.001$) and alkaline phosphatase ($p < 0.001$) correlated with decreasing length of stay, while age at admission was not significantly correlated ($p = 0.369$).

Univariate analysis of existing scoring systems showed that FGSI, LRINEC, NLR, and CCI were not significantly correlated with length of stay. CUPI score was shown to be a significant predictor of longer hospital stays ($p = 0.001$).

6. Conclusion

The CUPI scoring system helps to predict length of stay in patients with Fournier's gangrene, and may help increasing care to at-risk patients. Multi-disciplinary care, aggressive nutrition and operative intervention all contribute to successful treatment for Fournier's gangrene with lower mortality rates.

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