

# Fournier Gangrene Severity Index (FGSI) and Simplified Fournier Gangrene Severity Index (SFGSI) as a Predictor of Mortality in H. Adam Malik General Hospital Medan

Firmansyah Putra\*, Dhirajaya Dharma Kadar\*\*, Syah Mirsya Warli\*\*\*

\* Department of Surgery, Faculty of Medicine Universitas Sumatera Utara/H. Adam Malik General Hospital, Medan

\*\* Division of Urology, Department of Surgery, Faculty of Medicine Universitas Sumatera Utara, H. Adam Malik General Hospital, Medan

\*\*\* Department of Urology, Faculty of Medicine Universitas Sumatera Utara, University of North Sumatera Hospital, Medan

DOI: 10.29322/IJSRP.10.02.2020.p98113

<http://dx.doi.org/10.29322/IJSRP.10.02.2020.p98113>

## Abstract-

**Background:** Fournier Gangrene (FG) is a case of emergency urology with high mortality. Early and aggressive intervention can be done with a simple assessment system. Simplified Fournier Gangrene Severity Index (SFGSI) simplifies the Fournier Gangrene Severity Index (FGSI) while remaining sensitive and specific. This study aims to compare the performance of FGSI and SFGSI as predictors of FG patient mortality in H. Adam Malik General Hospital Medan.

**Materials and Methods:** This study is an analytical study with a retrospective cross-sectional design. The research subjects were all patients of Medan Haji Adam Malik General Hospital who were diagnosed with FG in the period January 1, 2013 to December 31, 2017. Then the data that became components of the FGSI and SFGSI were age, body temperature, pulse, respiration, potassium, sodium, creatinine, hematocrit, leukocytes, and bicarbonate are recorded and compared against mortality outcomes. Data were analyzed using the Receiver Operator Curve (ROC).

**Results:** From a total of 34 patients sampled in this study, with an average age of 60.4 ( $\pm$  6.80) years in the living group and 61.5 ( $\pm$  7.04) years in the deceased group. The difference in length of stay in living patients was 23.42 ( $\pm$  3.59) days compared to 6.30 ( $\pm$  1.95) days in patients who died in which all patients were male. There was a significant relationship between FGSI scores with a cut-off  $>$  9 ( $P <$  0.001, sensitivity 90% specificity 95.8%). The SFGSI cut-off value was  $>$  2 ( $p <$  0.001, sensitivity 80%, specificity 91.7%).

**Conclusion:** FGSI results  $>$  9 are prognostic factors for determining FG output (sensitivity 90% and specificity 95.8%). SFGSI has good sensitivity and specificity at a lower cost (80% and 91.7%).

**Index Terms-** Fournier Gangrene, Fournier Gangrene Severity Index, Simplified Fournier Gangrene Severity Index, Mortality

## I. INTRODUCTION

Fournier Gangrene (FG) was first identified in 1883 when French venereologist Jean Alfred Fournier described a series of cases in previously healthy young men suffering from progressive gangrene of the penis and scrotum without apparent cause. FG is a relatively rare disease, with a disease incidence of 1.6 cases per 100,000 male patients with a case fatality rate of 7.5%.<sup>7</sup>

In an American study conducted retrospectively in 2017, 54 patients were treated with a diagnosis of FG at the LAC + USC Medical Center, which is the largest public hospital in Los Angeles, the USA in 2010-2016. Fournier Gangrene is a progressive necrotizing fasciitis in the penis, scrotum area, and perineum. The infection that occurs is polymicrobial, which is a combination of aerobic and anaerobic bacteria. Unlike the initial description, the disease is not limited to young people or men, and the cause is now generally identifiable.<sup>8</sup> FG is classified as a potentially fatal disease with high mortality and is included in the case of emergencies in the field of urology. Early and aggressive intervention is critical because this condition is associated with high mortality and morbidity rates.<sup>9</sup>

Recent studies have sought to develop a method for estimating the prognosis of patients with FG. One method that can be used is a scoring system known as the Fournier Gangrene Severity Index (FGSI) and Simplified Fournier Gangrene Severity Index (SFGSI). FGSI and SFGSI are quantitative methods that are used as prognostic parameters in FG patients to see predictions of patient mortality<sup>10</sup>. FGSI was first introduced in 1995 by Laor et al. to predict the prognosis of patients with Fournier Gangrene. Laor et al. conducted a study of 30 Fournier Gangrene patients over 15 years and modified the acute physiology and chronic health evaluation II severity score.<sup>11</sup> In clinical practice, a simple and trusted assessment system will be more readily accepted by clinicians and academics. Departing from this, Lin et al. developed the SFGSI score in 2014 by simplifying the variables in FGSI to

only three variables but without losing their sensitivity and specificity.<sup>12</sup>

This study aims to compare the performance of FGSI and SFGSI as predictors of mortality in patients with Fournier Gangrene in H. Adam Malik General Hospital Medan.

## II. RESEARCH ELABORATION

The research design used in this study is an analysis with a retrospective cross-sectional approach. This research was conducted at Haji Adam Malik General Hospital Medan from 1 January 2013 to 31 December 2017. In this study, the population was all patients of Haji Adam Malik General Hospital Medan who

## III. RESULTS AND FINDING

### A. Sample Characteristics

Of the 34 male patients, the mean age in the living group was 60.4 ( $\pm$  6.80) years, while in the deceased group was 61.5 ( $\pm$  7.04) years. The mean length of stay in the deceased group was 6.3 ( $\pm$  1.95) days and 23.42 ( $\pm$  3.59) days in the living group.

### B. Comparison of Patient Characteristics in Living and Deceased Group

The characteristics compared in the two groups consisted of temperature, pulse per minute, breath frequency per minute, serum sodium, potassium, creatinine, hematocrit, leukocytes, and bicarbonate. There were no statistical differences in the characteristics of the two groups (Table 1).

Table 1: Characteristic comparison of two groups.

Characteristics	Living	Deceased	P-Value
temperature (°C)	37.85 ( $\pm$ 0.62)	37.87 ( $\pm$ 0.99)	0.955 <sup>a</sup>
Pulse rate(x/minute)	89.38 ( $\pm$ 9.82)	89.40 ( $\pm$ 10.37)	0.995 <sup>a</sup>
(x/minute)	25.17 ( $\pm$ 2.35)	26.20 ( $\pm$ 5.85)	0.600 <sup>a</sup>
Serum Natrium (mmol/L)	134.38 ( $\pm$ 5.46)	134.90 ( $\pm$ 8.84)	0.834 <sup>a</sup>
Serum Kalium (mmol/L)	4.24 ( $\pm$ 0.66)	4.91 ( $\pm$ 1.01)	0.077 <sup>a</sup>
Serum Creatinin (mg/dL)	0.88 (0.61-2.20)	1.21 (0.46-7.00)	0.167 <sup>b</sup>
Serum Hematocrit (%)	29.20 (23.1-41.5)	26.1 (18.0-47.0)	0.334 <sup>b</sup>
Serum Leukocyte (/mm <sup>3</sup> )	13,024.92 ( $\pm$ 5,233.55)	13,507.00 ( $\pm$ 4,829.84)	0.804 <sup>a</sup>
Serum Bicarbonate (mEq/L)	25.32 ( $\pm$ 6.10)	22.36 ( $\pm$ 11.60)	0.623 <sup>a</sup>

were diagnosed with Fournier Gangrene from 1 January 2013 to 31 December 2017, the sampling used is total sampling.

The inclusion criteria in this study were patients diagnosed with Fournier Gangrene in the ER of Human Rights General Hospital, January 1, 2013, until December 31, 2017, and have a complete medical record data.

Data obtained from the recapitulation of medical record data will be entered into the FGSI and SFGSI tables and processed using a computer, with the steps of editing, coding, and tabulation. The data obtained were then analyzed using the Receiver Operator Curve (ROC) to obtain a cut-off of the FGSI and SFGSI scoring values. Under the Curve (AUC) area will show optimal values based on sensitivity and 1-specificity. The cut-off value obtained is then used as a predictive value for mortality

### C. Relationship between Fournier Gangrene Severity Index (FGSI) and Simplified Fournier Gangrene Severity Index (SFGSI) with Death

A comparison of the prognostic value was seen from the Area Under Curve (AUC) value which is 98.5% in FGSI compared to 92.5% in SFGSI. We get a cut-off of > 9 to obtain a sensitivity value of 90% and a specificity value of 95.8% for FGSI scoring from this research data. Whereas in the SFGSI scoring, we obtained a cut-off > 2 and obtained a lower sensitivity value than FGSI, which is 80% and a specificity value of 91.7%. (Figure 1)

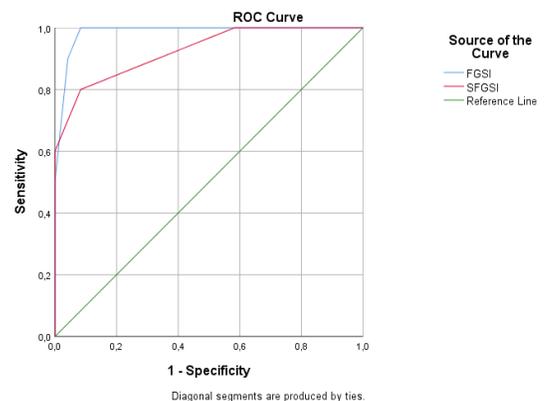


Figure 1. ROC curve for FGSI and SFGSI to mortality

Statistical analysis showed a P-value of <0.001, which means the relationship between the FGSI score with a cut-off value > 9 to  $\leq$  9 and SFGSI score with a cut-off of > 2 to  $\leq$  2 is significant.

Our study showed that the average age of patients was 60.71 years ( $\pm$  6.79) with 45 is the youngest and the oldest is 72 years. Laor's study in 1995, the median age was 61 years with the youngest age of 23 years and the oldest was 90 years. From some of these studies, it was found that Fournier Gangrene has a reasonably wide age distribution of patients, ranging from 20 years to 92 years of age.<sup>11,13,14</sup>

The length of stay of patients who lived was 23.42 days compared to patients who died, which was 6.30 days. Previous studies have shown similar results. Other studies report the length of stay of patients who lived was 29.6 days compared to 6.7 days in patients who died.<sup>15,16</sup>

Body temperature in this study between the living and the dead did not have a statistically significant difference, so was also found in a study from Lin et al. in 2019. In that study, the mean temperature of patients living in patients with Fournier Gangrene was 37.0 ( $\pm$  0.8) ° C while in the group who died was 37.3 ( $\pm$  0.8) ° C.<sup>17</sup>

In this study, for the variable heart rate, no difference was found between patients who had outcomes in the form of death and those who remained alive 89.40 ( $\pm$  10.37) x / minute and 89.38 ( $\pm$  9.82) x / minute. The result was also found in other studies.<sup>12,17</sup> Likewise for breath frequency, wherein this study it was found in living patients that had a mean breath frequency of 25.17 ( $\pm$  2.35) x / minute while in patients who died obtained breath frequency of 26.20 ( $\pm$  5.85) x / minutes.<sup>12,17</sup>

For electrolyte levels, in this study, measuring serum sodium and potassium where there is no difference between the two variables. Lin's research in 2014 and 2019 supports this finding (Lin, 2014; Lin, 2019). Whereas Tenório in 2018, found significant differences in serum potassium between patients who died and those who lived, where patients who live have lower serum potassium.<sup>18</sup>

Tenório's study in 2018 found there were differences in serum creatinine levels in patients who died with those living where patients who died had a higher mean serum creatinine compared with patients who lived. In that study, the mean serum creatinine of patients who died was 1.72 ( $\pm$  1.16) mg / dL and in this study, a median value of 1.21 (0.46-7.00) mg / dL was obtained. Tenório found that in living patients, the mean creatinine serum was 0.95 ( $\pm$  0.55) mg / dL while in our study, the median value was 0.88 (0.61-2.20) mg / dL.

The P-value in Tenório's study for this variable was 0.001, while in our study, it was 0.167.<sup>18</sup> Similar results to our study were found in Lin's study in 2019, where the mean number of patients who died and those who lived sequentially was 3.5  $\pm$  3.3 and 4.1  $\pm$  2.4 mg / dL with a P-value = 0.208.<sup>17</sup>

For serum hematocrit variables, Lin's study in 2019 also found insignificant differences.<sup>17</sup> The same thing was found in our study, where the mean value in living patients was 29.20 (23.1-41.5)%, and in those who died was 26.1 (18.0-47.0)% with a P-value = 0.334. Conflicting results were obtained in studies from Tenório in 2018 and Lin in 2014. In both studies, getting statistically significant differences in serum hematocrit variables with both P values were 0.0001.<sup>12,18</sup>

Leukocytes obtained in patients with Fournier Gangrene who survived and died in this study were 13,024.92 ( $\pm$  5,233.55) / mm<sup>3</sup> and 13,507.00 ( $\pm$  4,829.84) / mm<sup>3</sup> and the P-value = 0.804 so it was not significantly significant. The same thing was found in Lin's research in 2014 and 2018. In Lin's research in 2014, the mean value of living patients was 18.0 ( $\pm$  10.2) / mm<sup>3</sup> compared

to 17.3 ( $\pm$  9.3) / mm<sup>3</sup> with a value of P = 0.822. For Lin's study in 2019, living patients had a mean of 19.4 ( $\pm$  8.1) / mm<sup>3</sup> and those who died 17.2 ( $\pm$  5.8) / mm<sup>3</sup>.<sup>12,17</sup>

The final component assessed from the Fournier Gangrene Severity Index (FGSI) score is serum bicarbonate. In our study, the bicarbonate value of living patients was 25.32 ( $\pm$  6.10) mEq / L compared to patients who died 22.36 ( $\pm$  11.60) mEq / L and the P-value = 0.623. The finding is supported by Lin 2014 and 2019 research, in which both studies have a value of P = 0.410 and P = 0.732.

Several previous studies have tried to see FGSI as a predictor of mortality in patients with Fournier Gangrene. The majority of studies get a cut-off value of > 9 with sensitivity and specificity values ranging from 71-88% and 78-90%, respectively.<sup>11,19,20</sup> In our study, a cut-off value of > 9 was obtained and a sensitivity of 90% and specificity of 95.8% were obtained.

For the Simplified Fournier Gangrene Severity Index (SFGSI) in this study, a cut-off value of > 2 with a sensitivity value of 80% and a specificity value of 91.7% was obtained. Research from Lin in 2014 also has a cut-off value of > 2 and has a sensitivity of 87% and specificity of 77%.<sup>12</sup> There are differences in sensitivity and specificity values with these studies, so further research is needed to test the sensitivity and specificity values in patients with Fournier Gangrene.

#### IV. CONCLUSIONS

In this study, the higher Fournier Gangrene Severity Index (FGSI) (> 9) could become a prognostic factor that can be used to determine the outcome of the Fournier Gangrene conditions with a sensitivity of 90% and a specificity of 95.8% respectively. In addition to using the FGSI assessment, a simplified assessment was also developed, namely the Simplified Fournier Gangrene Severity Index (SFGSI), where based on this scoring, it could have other prognostic factors in the Fournier Gangrene case and have a sufficiently good result, with a sensitivity of as much as 80% and specificity 91.7%, while having a lower cost compared to Fournier Gangrene Severity Index (FGSI).

#### REFERENCES

- [1] G. O. Young, "Synthetic structure of industrial plastics (Book style with paper title and editor)," in *Plastics*, 2nd ed. vol. 3, J. Peters, Ed. New York: McGraw-Hill, 1964, pp. 15–64.
- [2] W.-K. Chen, *Linear Networks and Systems* (Book style). Belmont, CA: Wadsworth, 1993, pp. 123–135.
- [3] H. Poor, *An Introduction to Signal Detection and Estimation*. New York: Springer-Verlag, 1985, ch. 4.
- [4] B. Smith, "An approach to graphs of linear forms (Unpublished work style)," unpublished.
- [5] E. H. Miller, "A note on reflector arrays (Periodical style—Accepted for publication)," *IEEE Trans. Antennas Propagat.*, to be published.
- [6] J. Wang, "Fundamentals of erbium-doped fiber amplifiers arrays (Periodical style—Submitted for publication)," *IEEE J. Quantum Electron.*, submitted for publication.
- [7] Sorensen D. Mathew, "Fournier's Gangrene: Population Based Epidemiology and Outcomes", *The Journal Of Urology*®, Vol. 181, 2120-2126, May 2009

- [8] Ghodoussipour SB, "Surviving Fournier's gangrene: Multivariable analysis and a novel scoring system to predict length of stay", *J Plast Reconstr Aesthet Surg.*, Epub 2017 Dec 14
- [9] Singh A, "Fournier's gangrene. A Clinical Review", *Arch Ital Urol Androl*, 2016 Oct 5;88(3):157-164
- [10] Verma Satyajee, "Evaluation of the Utility of the Fournier's Gangrene Severity Index in the Management of Fournier's Gangrene in North India: A Multicentre Retrospective Study", *Journal of Cutaneous and Aesthetic Surgery*
- [11] Laor E, "Outcome Prediction In Patients With Fournier's Gangrene", *J Urol*. 1995 Jul;154(1):89-92
- [12] Lin TY, "Validation And Simplification Of Fournier's Gangrene Severity Index", *Int J Urol*. 2014 Jul;21(7):696-701
- [13] Atakan IH, "A life-Threatening Infection: Fournier's Gangrene", *Int Urol Nephrol*. 2002;34(3):387-92
- [14] Aridogan IA, "Epidemiological Characteristics of Fournier's Gangrene: A Report of 71 Patients", *Urol Int*. 2012;89(4):457-61
- [15] Ersay A, "Factors Affecting Mortality of Fournier's Gangrene: Review of 70 Patients", *ANZ J Surg*. 2007 Jan-Feb;77(1-2):43-8
- [16] Uluğ M, "The Evaluation of Microbiology and Fournier's Gangrene Severity Index in 27 Patients", *Int J Infect Dis*. 2009 Nov;13(6):e424-30
- [17] Lin TY, "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*, Volume26, Issue7 July 2019 Pages 737-743
- [18] Tenório CEL, Risk factors for mortality in Fournier's gangrene in a general hospital: use of simplified Fournier gangrene severity index score (SFGSI), *Int Braz J Urol*. 2018 Jan-Feb;44(1):95-101
- [19] Corcoran AT, "Validation of the Fournier's gangrene severity index in a large contemporary series", *J Urol*. 2008 Sep;180(3):944-8
- [20] Yeniol CO, "Fournier's gangrene: experience with 25 patients and use of Fournier's gangrene severity index score", *Urology*. 2004 Aug;64(2):218-22

#### AUTHORS

**First Author** – Firmansyah Putra, Department of Surgery, Faculty of Medicine Universitas Sumatera Utara, H. Adam Malik General Hospital, Medan. Email: pimen.dr@gmail.com

**Second Author** – Dhirajaya Dharma Kadar, Division of Urology, Department of Surgery, Faculty of Medicine Universitas Sumatera Utara, H. Adam Malik General Hospital, Medan. Email: dhira303@yahoo.com

**Third Author** – Syah Mirsya Warli, Department of Urology, Faculty of Medicine Universitas Sumatera Utara, University of North Sumatera Hospital, Medan. Email: war\_uro@yahoo.com

**Correspondence Author** – Firmansyah Putra, pimen.dr@gmail.com, +6285274401474