



Glasgow Coma Scale as a Correlate of Fall Risk Measured by the Morse Fall Scale in the Emergency Department

Sirojudin^{1*} , Bambang Sudono Dwi Saputro² 

¹ STIKES Estu Utomo, Boyolali, Indonesia

² STIKES Estu Utomo, Boyolali, Indonesia

* Correspondence jsiro171@gmail.com; +62 858 7636 6002

Abstract

Background. Patient falls in the emergency department (ED) represent a serious adverse event. Although the Morse Fall Scale is commonly used for fall risk assessment, its integration with objective neurological measures, such as the Glasgow Coma Scale, in ED settings remains limited.

Aim. To investigate the correlation between Glasgow Coma Scale scores and Morse Fall Scale scores in adult ED patients.

Methods. A cross-sectional analytical observational study was conducted using medical records of 72 adult patients in the ED. Glasgow Coma Scale scores and Morse Fall Scale scores were extracted from initial nursing assessments. Spearman's rank correlation was used to evaluate associations, with statistical significance set at $p < 0.05$.

Results. A strong negative correlation was observed between Glasgow Coma Scale scores and Morse Fall Scale scores ($r = -0.714$, $p < 0.001$), indicating that lower Glasgow Coma Scale scores were associated with higher Morse Fall Scale scores. The median Glasgow Coma Scale score was 14 (range: 3–15), and the median Morse Fall Scale score was 40 (range: 0–85).

Conclusions. Glasgow Coma Scale scores are significantly correlated with fall risk as assessed by the Morse Fall Scale in ED patients. Incorporating the Glasgow Coma Scale into existing fall risk assessment protocols may enhance the identification of patients at higher risk of falls and provide additional clinical guidance for preventive interventions.

Keywords: emergency nursing; fall prediction; Glasgow Coma Scale; Morse Fall Scale; patient safety

1. INTRODUCTION

Patient safety remains a critical concern in healthcare delivery, with patient falls representing the second most common adverse event after medication errors (Zunaedi et al., 2023). In Indonesian health-care facilities, falls account for approximately 14% of reported clinical incidents (Salawati, 2020). The emergency department (ED) environment presents particular challenges for fall prevention due to high patient acuity, frequent environmental hazards, and time-sensitive clinical interventions that may divert attention from safety monitoring.



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The Glasgow Coma Scale (GCS) serves as the standard tool for assessing level of consciousness in acute care settings, while the Morse Fall Scale (MFS) is widely implemented for fall risk stratification (Bóriková et al., 2018). However, current literature reveals significant gaps in understanding the relationship between these two assessment tools. Previous studies have validated Morse Fall Scale in specific patient populations in Mao et al. (2024), or examined Glasgow Coma Scale in relation to physiological markers in Suharto et al. (2019), but none have systematically investigated the correlation between Glasgow Coma Scale and Morse Fall Scale in a general ED population.

This gap in knowledge has practical implications for clinical practice. Inadequate risk assessment may fail to identify patients with concurrent consciousness impairment and elevated fall risk, particularly in older adults with multiple comorbidities who are disproportionately represented in ED utilisation patterns (Weng et al., 2022). The integration of routinely collected neurological assessment data into fall prevention strategies could enhance early identification of high-risk patients without additional resource burden.

2. METHODS

2.1 Study design and setting

This analytical observational study employed a cross-sectional design to examine the relationship between Glasgow Coma Scale scores and Morse Fall Scale scores in adult patients (≥ 18 years) reported to the Emergency Department of Dr. Gunawan Mangunkusumo Hospital, Indonesia, during July 2024. The cross-sectional design was selected to efficiently examine associations between variables at a single time point using existing clinical data.

2.2 Participants

From an accessible population of 263 ED patients during the study period, a sample size of 72 was determined using Slovin's formula with a 10% margin of error. Participants were selected through systematic random sampling with an interval of four, beginning at a randomly selected starting point.

Inclusion criteria comprised: (1) age ≥ 18 years; (2) complete documentation of both Glasgow Coma Scale scores and Morse Fall Scale scores in the medical record. Exclusion criteria included: (1) severe cognitive impairment (Mini-Mental State Examination score < 18); (2) acute psychiatric disorders; (3) terminal conditions; (4) chronic neurological diseases that could confound clinical assessments.

2.3 Data collection and instruments

Data were retrospectively collected from electronic medical records using a standardised extraction form. The data collection process focused on documentation completed during the initial nursing assessment at ED admission.

Glasgow Coma Scale (GCS): Consciousness was assessed through three components: eye response (1–4 points), verbal response (1–5 points), and motor response (1–6 points), with total scores ranging from 3 to 15. The Glasgow Coma Scale has established validity and reliability in clinical practice (Yatsko et al., 2023).

Morse Fall Scale (MFS): Fall risk was evaluated through six parameters: history of falling, secondary diagnoses, use of ambulatory aids, intravenous (IV) therapy/heparin lock, gait characteristics, and mental status. Total scores range from 0 to 125, with higher scores indicating greater fall risk. The Morse Fall Scale has demonstrated satisfactory sensitivity (78%) and specificity (83%) in previous validation studies (Bóriková et al., 2018).

2.4 Data analysis

Data analysis was performed using IBM SPSS Statistics version 27.0 software. Descriptive statistics included frequencies and medians. The Kolmogorov–Smirnov test confirmed non-normal distri-

bution of both Glasgow Coma Scale scores and Morse Fall Scale scores. Consequently, Spearman's rank correlation coefficient was used to examine the relationship between Glasgow Coma Scale scores and Morse Fall Scale scores, with statistical significance set at $p < 0.05$.

2.5 Ethical considerations

The study protocol received ethical approval from the Hospital Director (Approval No. 400.7.3.5//2025). The requirement for informed consent was waived due to the retrospective nature of the study involving anonymised data. Patient confidentiality was maintained through data de-identification and secure storage.

3. RESULTS

The study analysed 72 adult emergency department (ED) patients. The detailed age distribution of the participants is presented in Table 1. Briefly, the patient population was predominantly older, with patients over 66 years constituting the largest group (40.3%). Female patients predominated (61.1%). Hypertension was the most common admission diagnosis (15.3%), followed by chronic obstructive pulmonary disease (COPD) (12.5%) and dyspepsia (8.3%).

Pain was the most frequent chief complaint (37.5%). Among these patients, the median pain intensity was 7 on a 0–10 numeric rating scale, indicating severe pain. Shortness of breath was reported by 18.1% of patients, with a median Modified British Medical Research Council (mMRC) Dyspnoea Scale grade of two, suggesting that breathlessness stopped them after walking short distances. Furthermore, 11.1% of patients complained of impaired consciousness or weakness. Finally, 22.2% suggested other complaints.

Table 1. Demographic and clinical characteristics of participants (n = 72)

Variable	Value
Gender, n (%)	
Male	28 (38.9%)
Female	44 (61.1%)
Age (years), n (%)	
26–35	6 (8.3%)
36–45	9 (12.5%)
46–55	8 (11.1%)
56–65	20 (27.8%)
>66	29 (40.3%)
Admission diagnosis, n (%)	
Hypertension	11 (15.3%)
Chronic obstructive pulmonary disease	9 (12.5%)
Dyspepsia	6 (8.3%)
Stroke	4 (5.6%)
Other ¹	38 (52.8%)
Chief complaint, n (%)	
Pain	27 (37.5%)
Shortness of breath	13 (18.1%)

Variable	Value
Weakness	8 (11.1%)
Impaired consciousness	8 (11.1%)
Other ²	16 (22.2%)

Notes: ¹ – includes fracture (4.2%), diabetes mellitus (4.2%), chronic kidney disease (4.2%), and other conditions (40.3%). ² – includes dizziness (6.9%) and unspecified symptoms (15.3%).

The median Glasgow Coma Scale (GCS) score was 14 (range: 3–15), indicating generally preserved consciousness. In contrast, the median Morse Fall Scale (MFS) score was 40 (range: 0–85), reflecting moderate-to-high fall risk across the cohort.

Kolmogorov–Smirnov tests confirmed non-normal distributions for both Glasgow Coma Scale (statistic = 0.208, $p < 0.001$) and Morse Fall Scale scores (statistic = 0.152, $p < 0.001$). Non-parametric analyses were therefore employed.

Spearman's rank correlation revealed a strong, statistically significant inverse relationship between Glasgow Coma Scale and Morse Fall Scale scores ($r = -0.714$, $p < 0.001$). Lower Glasgow Coma Scale scores (indicating reduced consciousness) consistently corresponded to higher Morse Fall Scale scores (elevated fall risk). This association explained 51.0% of the variance in fall risk ($R^2 = 0.510$).

Table 2. **Spearman's correlation analysis of Glasgow Coma Scale and Morse Fall Scale scores (n = 72)**

Variable	Correlation coefficient (r)	p-value
Glasgow Coma Scale and Morse Fall Scale	-0.714	<0.001

4. DISCUSSION

This study demonstrates a strong negative correlation between Glasgow Coma Scale (GCS) scores and Morse Fall Scale (MFS) scores ($r = -0.714$, $p < 0.001$) in adult patients within an Indonesian ED, indicating that lower levels of consciousness are significantly associated with elevated fall risk. Reduced consciousness compromises postural stability, environmental awareness, and protective reflexes. Disorientation, limited motor responses, and cognitive deficits inherent to low GCS directly exacerbate both intrinsic (e.g. gait instability) and extrinsic (e.g. environmental hazard recognition) fall risks. These findings highlight consciousness as a critical, previously underexplored predictor in ED fall-risk assessment, complementing traditional MFS domains such as mobility aids or intravenous therapy.

Mechanistic studies corroborate the link between impaired consciousness and fall severity. Hino et al. (2019) and Ito et al. (2020) reported that loss of consciousness during falls increases the risk of maxillofacial injuries due to compromised protective reflexes, supporting the observed GCS-MFS relationship. In contrast, trauma-focused studies (Amudhan et al., 2024; Réen et al., 2025) found no significant correlation, likely because GCS reductions in those populations arise from acute intracranial pathology rather than generalised fall-risk mechanisms. The heterogeneous ED cohort in this study, which included patients with stroke, infection, and hypertension, emphasises the universality of consciousness as a fall-risk indicator beyond trauma, addressing a gap in the literature.

Patient characteristics further highlight vulnerability patterns. The predominance of elderly women, hypertensive patients, and individuals presenting with pain identifies subgroups at particularly high risk. Elderly women align with global ED utilisation trends (Weng et al., 2022) and may face gender-specific risks, such as polypharmacy or osteoporosis. Antihypertensive therapy may include sedation (Riyadina, 2019), compounding reduced consciousness and fall risk. Pain, a frequent ED reported complaint (Dépelteau et al., 2020), can divert cognitive attention, diminishing environmental awareness and increasing susceptibility to falls. These findings underscore the need for targeted screening protocols that integrate both GCS and MFS assessments in high-risk subpopulations.

This study contributes three key insights. First, it demonstrates the enhanced predictive utility of combining GCS and MFS in ED fall-risk assessment. Second, the approach leverages routinely collected GCS data, minimising additional staff burden in resource-constrained settings. Finally, the findings establish consciousness as a central determinant of postural stability, providing a neurophysiological rationale for fall risk that extends beyond conventional assessment metrics.

5. CONCLUSIONS AND PERSPECTIVES

This study demonstrates a strong negative correlation between Glasgow Coma Scale (GCS) scores and Morse Fall Scale (MFS) scores in adult patients at the Emergency Department of Dr. Gunawan Mangunkusumo Ambarawa Hospital. Reduced levels of consciousness, as indicated by lower GCS scores, are significantly associated with an elevated risk of falls, particularly among high-risk subgroups including elderly women, hypertensive patients, and individuals presenting with chronic pain. These findings highlight the utility of integrating GCS assessments into fall-risk evaluation protocols to improve patient safety. Future research should focus on longitudinal studies to confirm causal relationships, develop predictive algorithms combining GCS and MFS scores, evaluate nursing interventions guided by GCS-based fall risk, and validate these approaches across diverse ED populations to optimise fall prevention strategies.

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Conflicts of Interest: The authors declare no conflict of interest.

References

- Amudhan, K. P. S., Kathires, V., & Kavinila, S. (2024). A prospective study on road traffic accidents with cranio cerebral injury and correlation between non-contrast computed findings and Glasgow Coma Scale. *International Journal of Academic Medicine and Pharmacy*, 6(2), 1181–1183. <https://doi.org/10.47009/jamp.2024.6.2.236>
- Bóriková, I., Žiaková, K., Tomagová, M., & Záhumenská, J. (2018). The risk of falling among older adults in long-term care: Screening by the Morse Fall Scale. *Kontakt*, 20(2), 115–123. <https://doi.org/10.1016/j.kontakt.2017.11.006>
- Dépelteau, A., Racine-Hemmings, F., Lagueux, É., & Hudon, C. (2020). Chronic pain and frequent use of emergency department: A systematic review. *American Journal of Emergency Medicine*, 38(2), 358–363. <https://doi.org/10.1016/j.ajem.2019.158492>
- Hino, S., Yamada, M., Araki, R., Kaneko, T., & Horie, N. (2019). Effects of loss of consciousness on maxillofacial fractures in simple falls. *Dental Traumatology*, 35(1), 48–53. <https://doi.org/10.1111/edt.12452>
- Ito, R., Kubota, K., Yaguchi, S., Furudate, K., Tanaka, Y., & Kobayashi, W. (2020). Falls due to loss of consciousness are associated with maxillofacial fracture severity. *Journal of Oral and Maxillofacial Surgery*, 78(3), 423–429. <https://doi.org/10.1016/j.joms.2019.10.023>
- Mao, B., Jiang, H., Chen, Y., Wang, C., Liu, L., Gu, H., Shen, Y., & Zhou, P. (2024). Re-evaluating the Morse Fall Scale in obstetrics and gynecology wards and determining optimal cut-off scores for enhanced risk assessment: A retrospective survey. *PLoS ONE*, 19(9 September), 1–11. <https://doi.org/10.1371/journal.pone.0305735>
- Réen, L., Radman, A., Visse, E., Cederberg, D., Marklund, N., & Siesjö, P. (2025). *A cerebral perfusion pressure (CPP) ≤ 60 mmHg correlated with favorable outcome in adult severe traumatic brain injury patients – A retrospective study*. Research Square. <https://doi.org/10.21203/rs.3.rs-6079964/v1>
- Riyadina, W. (2019). *Hipertensi pada wanita menopause*. LIPI Press.
- Salawati, L. (2020). Penerapan keselamatan pasien rumah sakit. *AVERROUS: Jurnal Kedokteran dan Kesehatan Malikussaleh*, 6(1), 98. <https://doi.org/10.29103/averrous.v6i1.2665>
- Suharto, G. M. F., Sikumbang, K. M., & Pratiwi, D. I. N. (2019). Hubungan antara Skor GCS dengan kadar c-reactive protein (CRP) pasien cedera otak traumatik di IGD RSUD Ulin Banjarmasin. *Jurnal Neuroanestesi Indonesia*, 8(3), 153–159. <https://doi.org/10.24244/jni.v8i3.208>
- Weng, T. I., Chen, L. Y., Chen, H. Y., Yu, J. H., Su, Y. J., Liu, S. W., Tracy, D. K., Chen, Y. C., Lin, C. C., & Fang, C. C. (2022). Gender differences in clinical characteristics of emergency department patients involving illicit drugs use with analytical confirmation. *Journal of the Formosan Medical Association*, 121, 1832–1840. <https://doi.org/10.1016/j.jfma.2022.03.007>

- Yatsko, K., Yusupova, D., Zimin, A., Yazeva, E., Domashenko, M., Samorukov, V., Belkin, A., Kondratyeva, E., Kondratyev, S., Ramazanov, G., Kovaleva, E., Popugaev, K., Petrikov, S., Piradov, M., Ryabinkina, Y., & Suponeva, N. (2023). Glasgow coma scale and full outline of unresponsiveness. Multicenter validation study in Russia. *Journal of the Neurological Sciences*, 455, 122679. <https://doi.org/10.1016/j.jns.2023.122679>
- Zunaedi, R., Ririhena, J., & Ramadhani, R. (2023). Hubungan pengetahuan perawat tentang keselamatan pasien dengan pelaksanaan pengkajian risiko pasien jatuh. *Media Husada Journal of Nursing Science*, 4(1), 8–14. <https://doi.org/10.33475/mhjns.v4i1.116>

Glazgo komos skalės ir Morse griuvimų skalės koreliacija vertinant griuvimų riziką skubios pagalbos skyriuje

Sirojudin^{1*}, Bambang Sudono Dwi Saputro²

¹ STIKES Estu Utomo, Bojolalis, Indonezija

² STIKES Estu Utomo, Bojolalis, Indonezija

* Susirašinėjimui: jsiro171@gmail.com; +62 858 7636 6002

Santrauka

Tyrimo pagrindimas. Griuvimai skubios pagalbos skyriuose yra rimti ir nepageidaujami reiškiniai. Nors Morse griuvimų skalė dažnai naudojama vertinant griuvimų riziką, jos derinimas su objektyviais neurologiniais rodikliais, pavyzdžiui Glazgo komos skale, skubios pagalbos skyriuose tebėra ribotas.

Tikslas. Ištirti Glazgo komos skalės ir Morse griuvimų skalės balų koreliaciją skubios pagalbos skyriuje gydomų suaugusių pacientų atveju.

Metodai. Buvo atliktas analitinis skerspjūvio tyrimas, remiantis 72-iejų suaugusių pacientų sveikatos įrašais skubios pagalbos skyriuje. Glazgo komos skalės ir Morse griuvimų skalės rezultatai buvo išgauti iš pirminių slaugos vertinimų. Koreliacijai įvertinti naudotas Spearmano ranginis koreliacijos koeficientas, statistinis reikšmingumas – $p < 0,05$.

Rezultatai. Buvo nustatyta stipri neigiama koreliacija tarp Glazgo komos skalės ir Morse griuvimų skalės balų ($r = -0,714$, $p < 0,001$), rodanti, kad mažesni Glazgo komos skalės balai buvo susiję su aukštesniais Morse griuvimų skalės balais. Glazgo komos skalės balų mediana buvo 14 (intervalas: 3–15), o Morse griuvimų skalės balų mediana buvo 40 (intervalas: 0–85).

Išvados. Glazgo komos skalės balai, lyginant su Morse griuvimų skalės balais, yra reikšmingai susiję su griuvimų rizikos vertinimu skubios pagalbos skyriuje gydomiems pacientams. Glazgo komos skalės įtraukimas į esamus griuvimų rizikos vertinimo protokolus gali pagerinti pacientų, kuriems nustatyta padidėjusi griuvimų rizika, identifikavimą ir suteikti papildomą klinikinę informaciją prevencinėms priemonėms.

Reikšminiai žodžiai: skubios pagalbos slauga; griuvimų prognozė; Glazgo komos skalė; Morse griuvimų skalė; pacientų sauga

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