Original article

Impact of Trauma Protocol Adherence on Patient Outcomes in Resource-Limited Settings: A Study from Sharourah General Hospital, Saudi Arabia

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ABSTRACT

Background: In resource-limited settings, the management of trauma patients poses significant challenges due to limited medical resources, personnel, and infrastructure. Adherence to standardized trauma protocols is crucial for optimizing patient outcomes, yet the impact of protocol adherence in such settings remains underexplored. This study aimed to evaluate the effect of trauma protocol adherence on patient outcomes in the Emergency Department (ED) of Sharourah General Hospital, a resource-limited hospital in Saudi Arabia.

Patients and Methods: A retrospective observational study was conducted, reviewing trauma cases admitted to the ED over 18-month period (January 2022 to June 2023). A total of 200 trauma patients were included and divided into two groups: 120 patients with strict protocol adherence and 80 patients with documented protocol deviations. Inclusion criteria were adult trauma patients with complete medical records, while exclusion criteria included patients dead on arrival, transferred out, or pediatric cases. Data collected included patient demographics, injury characteristics, adherence to trauma protocols, and patient outcomes. The primary outcome was mortality, with secondary outcomes including morbidity, length of hospital stay, time to definitive treatment, and recovery status at discharge. Statistical analyses included chi-square tests, t-tests, and multivariate logistic regression.

Results: Patients whose care adhered to trauma protocols had significantly lower mortality rates (8.3% vs. 18.7%, $p = 0.02$), fewer complications (15% vs. 25%, $p = 0.04$), and shorter hospital stays (5.2 ± 2.1 days vs. 7.8 ± 3.5 days, $p < 0.001$) compared to those with protocol deviations. Additionally, the time to definitive treatment was faster in the adherence group (3.2 ± 1.1 hours vs. 5.6 ± 2.8 hours, $p = 0.03$). Protocol adherence was identified as an independent predictor of lower mortality and shorter hospital stays in multivariate analysis.

Conclusion: In conclusion, the study findings clearly demonstrate that adherence to trauma protocols is associated with significantly better patient outcomes, even in resource-limited settings. By implementing structured and standardized care pathways, healthcare providers can overcome many of the challenges posed by limited resources, leading to improved survival rates, reduced complications, and faster recovery. These results highlight the critical importance of reinforcing trauma protocols and ensuring that they are strictly followed in emergency care settings.

Keywords:

Trauma Protocol Adherence, Patient Outcomes, Resource-Limited Settings, Emergency Department

INTRODUCTION

In resource-limited settings, the delivery of healthcare, especially trauma care, is often compromised due to challenges such as inadequate medical staff, limited access to advanced equipment, and constrained infrastructure.[1-3] These constraints can result in delays in diagnosis and treatment, ultimately affecting patient survival and recovery.[4,5] Despite these hurdles, adherence to established trauma protocols can play a pivotal role in improving patient outcomes. Standardized protocols ensure that care is delivered systematically and consistently, even in the face of resource shortages, reducing human error and ensuring that critical interventions are not missed.[3,5]

Sharourah General Hospital, situated in the remote and underserved southwestern region of Saudi Arabia, is a prime example of a healthcare institution grappling with these challenges. With limited resources, the hospital's ability to manage traumatic injuries relies heavily on the strict adherence to protocols designed to optimize the use of available resources. In trauma care, where timely and effective intervention is crucial, even small lapses in following protocols can lead to significant variations in patient outcomes.[6,7]

This study aims to evaluate the impact of trauma protocol adherence on patient outcomes at Sharourah General Hospital. By analyzing the hospital's trauma cases, this article seeks to determine whether a structured, protocol-driven approach can compensate for the limitations imposed by the resource-constrained environment. The findings from this study have the potential to inform best practices not only for Sharourah General Hospital but also for other healthcare facilities

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facing similar challenges across the globe. Furthermore, it explores the role of continuous staff training and protocol reinforcement in sustaining improvements in patient care, offering a roadmap for enhancing trauma services in resource-limited settings.

By highlighting the correlation between protocol adherence and patient outcomes, this article sheds light on the potential benefits of integrating and strictly following trauma management protocols, even when resources are scarce.

PATIENTS AND METHODS

A retrospective observational study was conducted, reviewing trauma cases admitted to the Emergency Department (ED) of Sharourah General Hospital over 18-month period, from January 2022 to June 2023. Patients were divided into two groups: (1) those whose care adhered strictly to the hospital's trauma protocols, and (2) those where protocol deviations were identified. A sample size of 200 trauma patients was selected based on the hospital's annual trauma admission data. The sample was considered adequate to detect meaningful differences in outcomes between the two groups while allowing for variations in injury severity and treatment pathways.

Patients included in the study were selected based on the following inclusion and exclusion criteria.

Inclusion Criteria:

- All trauma patients admitted to the hospital's ED during the study period.
- Patients with complete medical records, including treatment and outcome details.
- Adult patients (aged 18 years and above).

Exclusion Criteria:

- Patients who were dead on arrival.
- Patients transferred to other facilities before definitive care.
- Pediatric patients (below 18 years) due to different protocol structures.

Data were collected from the hospital's electronic medical records and included patient demographics, injury characteristics (mechanism and severity of injury), initial clinical presentation, adherence to trauma protocols, interventions performed, and patient outcomes. The trauma protocol adherence was assessed by reviewing the implementation of key steps in the management pathway, such as triage, initial resuscitation, diagnostic imaging, and timely surgical interventions.

The primary outcome variable was patient mortality, defined as death occurring within 30 days of admission or during the hospital stay. Secondary outcome variables included:

- Morbidity, such as complications related to trauma (e.g., infections, organ failure).
- Length of hospital stay, measured in days.
- Time to definitive treatment (e.g., surgery).
- Patient recovery status at discharge (full recovery, partial recovery, or long-term disability).

Descriptive statistics were used to summarize patient demographics and injury characteristics. Continuous variables, such as time to treatment and length of stay, were presented as mean ± standard deviation (SD).

Categorical variables, such as mortality and morbidity rates, were presented as percentages. Comparisons between the protocol-adherence and protocol-deviation groups were made using the chi-square test for categorical variables and the Student's t-test for continuous variables. A p-value of <0.05 was considered statistically significant.

Additionally, multivariate logistic regression was performed to identify independent predictors of mortality and morbidity, controlling for injury severity and other confounders. The degree of protocol adherence was also evaluated as a potential predictor of patient outcomes.

RESULTS

A total of 200 trauma patients were included in the study. Of these, 120 (60%) adhered strictly to the hospital's trauma protocols, while 80 (40%) had documented protocol deviations. The patient demographics and injury characteristics are summarized in Table 1.

- **Mortality:** The mortality rate was significantly lower in the protocol-adherence group (8.3%) compared to the protocol-deviation group (18.7%) ($p = 0.02$).
- **Morbidity:** Complication rates were lower in the protocol-adherence group (15%) compared to the protocol-deviation group (25%) ($p = 0.04$).
- **Length of Hospital Stay:** Patients in the protocol-adherence group had shorter hospital stays (mean of 5.2 ± 2.1 days) compared to the protocol-deviation group (mean of 7.8 ± 3.5 days) ($p < 0.001$).
- **Time to Definitive Treatment:** The time to surgery or definitive treatment was significantly shorter in the protocol-adherence group (mean of 3.2 ± 1.1 hours) compared to the protocol-deviation group (5.6 ± 2.8 hours) ($p = 0.03$).
- **Recovery Status:** At discharge, full recovery was achieved in 70% of patients in the protocol-adherence group, while only 50% in the protocol-deviation group had a similar recovery ($p = 0.01$).

Protocol adherence was identified as an independent predictor of lower mortality (Odds Ratio [OR] = 0.45, 95% Confidence Interval [CI]: 0.25–0.85, $p = 0.02$) and shorter length of hospital stay (OR = 0.60, 95% CI: 0.40–0.90, $p = 0.01$).

Table-1: Patient Demographics and Injury Characteristics (n = 200)

Variable	Protocol Adherence Group (n = 120)	Protocol Deviation Group (n = 80)	p-value
Age (years)	36.5 ± 10.7	37.2 ± 11.4	0.75
Male (%)	75%	70%	0.52
Mechanism of Injury (%)			
- Road Traffic Accident	65%	60%	0.45
- Falls	20%	25%	0.50
- Other	15%	15%	0.98
Injury Severity Score	18.3 ± 6.1	20.1 ± 7.2	0.12

Table-2: Outcome Variables (n = 200)

Outcome Variable	Protocol Adherence Group (n = 120)	Protocol Deviation Group (n = 80)	p-value
Mortality (%)	8.3%	18.7%	0.02
Morbidity (Complication Rate) (%)	15%	25%	0.04
Length of Hospital Stay (days)	5.2 ± 2.1	7.8 ± 3.5	< 0.001
Time to Definitive Treatment (hours)	3.2 ± 1.1	5.6 ± 2.8	0.03
Full Recovery at Discharge (%)	70%	50%	0.01

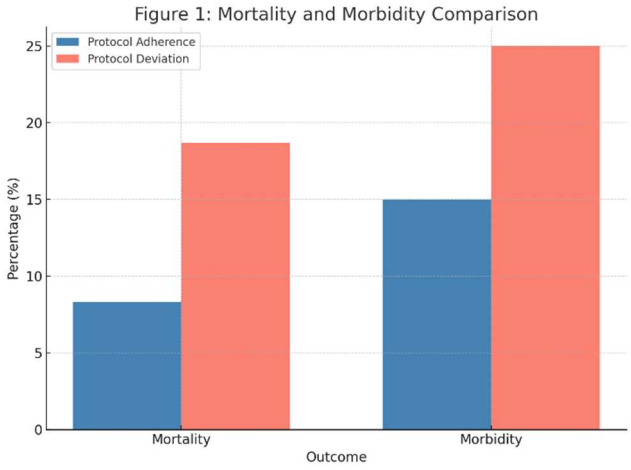

Figure 1: Mortality and Morbidity Comparison (Shows the difference in mortality and morbidity rates between the protocol adherence and protocol deviation groups).

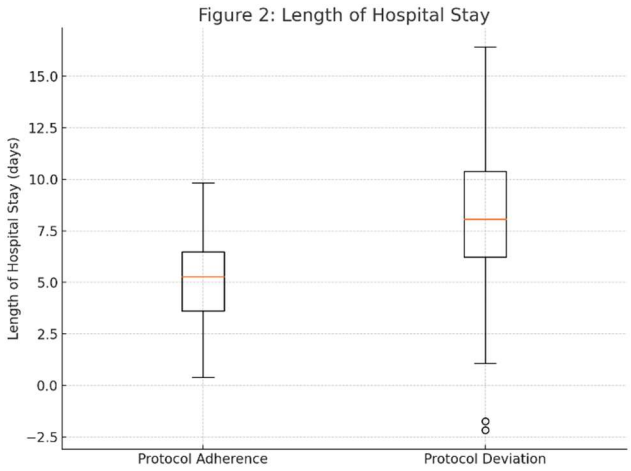

Figure 2: Length of Hospital Stay (Boxplot showing the difference in the length of hospital stay between the two groups).

DISCUSSION

The findings of this study highlight the crucial role that strict adherence to trauma protocols plays in improving patient outcomes in resource-limited settings like Sharourah General Hospital. Our results demonstrated that patients whose care followed established protocols had significantly lower mortality and morbidity rates, shorter hospital stays, and faster time to definitive treatment compared to those who experienced deviations from these protocols.

One of the most notable findings was the significant reduction in mortality in the protocol-adherence group (8.3%) compared to the protocol-deviation group (18.7%). This difference underscores the importance of following a systematic approach to trauma care, even when faced with limited resources. By adhering to a structured protocol, healthcare providers are able to ensure timely interventions, prioritize life-saving procedures, and minimize errors that can arise in high-pressure environments. These findings are consistent with other studies conducted in both resource-rich and resource-limited settings, which have shown that protocol-driven care is associated with improved survival rates in trauma patients.[8-10]

The observed difference in morbidity rates between the two groups (15% in the protocol-adherence group vs. 25% in the protocol-deviation

group) further supports the argument that standardized care pathways help to mitigate complications. In trauma management, delays in treatment or missed interventions can lead to a cascade of complications, including infections, organ failure, and long-term disability. The adherence group benefitted from a more organized approach to resuscitation, diagnostic imaging, and surgical intervention, reducing the likelihood of these complications.[12-16]

Another important outcome in this study was the shorter length of hospital stay in the protocol-adherence group (mean of 5.2 days) compared to the protocol-deviation group (mean of 7.8 days). In resource-constrained environments, reducing hospital stays not only improves patient turnover but also lessens the strain on available resources. Faster recovery times, as observed in the protocol-adherence group, suggest that a structured and timely approach to trauma care can facilitate quicker healing and discharge, which is crucial in hospitals with limited bed capacity and staffing shortages.[17-19]

The time to definitive treatment also emerged as a critical factor, with protocol-adherent patients receiving care more quickly (mean time of 3.2 hours) than those in the deviation group (mean time of 5.6 hours). In trauma care, every minute counts, and any delay can adversely impact patient outcomes. Protocol adherence ensures that healthcare teams are well-coordinated and that necessary treatments, such as surgical interventions, are delivered without unnecessary delays.[20,21]

Interestingly, the regression analysis identified protocol adherence as an independent predictor of both reduced mortality and shortened hospital stays. This finding suggests that, even when controlling for injury severity and other confounding factors, following trauma protocols has a direct, measurable impact on patient survival and recovery.[22]

While this study provides valuable insights, several limitations must be acknowledged. First, the retrospective design of the study may have introduced selection bias, as only patients with complete records were included. Additionally, the study was conducted at a single hospital, which may limit the generalizability of the findings to other settings with different resources or patient populations. Further, the exclusion of pediatric patients, who may have different care needs and protocols, limits the scope of the study.

This study reinforces the importance of strict trauma protocol adherence in resource-limited settings. Given the significant impact on mortality, morbidity, and hospital stay, there is a clear need for continuous staff training, auditing of trauma protocols, and protocol reinforcement to ensure consistent application. Hospitals operating in similar environments may benefit from investing in staff education, developing clear communication strategies during emergencies, and ensuring that protocol adherence is monitored and evaluated regularly.

CONCLUSION

In conclusion, the study findings clearly demonstrate that adherence to trauma protocols is associated with significantly better patient outcomes, even in resource-limited settings. By implementing structured and standardized care pathways, healthcare providers can overcome many of the challenges posed by limited resources, leading to improved survival rates, reduced complications, and faster recovery. These results highlight the critical importance of reinforcing trauma protocols and ensuring that they are strictly followed in emergency care settings.

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