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ORIGINAL ARTICLE

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CASE REPORT

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Table of Contents

Documentation practice and associated factors among nurses working in adult intensive care units at public hospitals in Addis Ababa, Ethiopia, 2022	1
Clinical Pattern, Management Outcome, and Associated factors of patients admitted to COVID-19 ICU Center of St. Paul's Hospital Millennium Medical College.....	13
Rising Epidemic of Road Traffic Injuries in Ethiopia: A Systematic Review of Available Literature	26
Case report on atypical Guillain Barre Syndrome with bulbar dysfunction and descending paralysis	36
Acute Intentional Iron Overdose in Pregnancy: An overview of case and treatment in a resource-limited setting	43
Acute Phenobarbital Poisoning in a Resource-Limited Setting: A Case Report of Successful Management through High Index of Suspicion and Immediate Care	48

Documentation practice and associated factors among nurses working in adult intensive care units at public hospitals in Addis Ababa, Ethiopia, 2022

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ABSTRACT

Background: Nursing care documentation is a vital and powerful tool in the healthcare system to ensure continuity of care and communication between health personnel for better patient outcomes. Nurses' practice towards nursing care documentation affects the quality and coordination of patient care. Hence, this study aimed to assess practice and associated factors towards nursing care documentation among nurses working at public hospitals in Addis Ababa, Ethiopia.

Methods: An institutional-based cross-sectional study was conducted among 358 nurses working in intensive care units at public hospitals in Addis Ababa from August 2021 to January 2022. All nurses were selected by proportional allocation. Data was collected by using a self-administered questionnaire and observation checklist. EPI info and SPSS were used for data entry and analysis, respectively. Binary analysis was performed to select candidate variables for multivariable logistic regression analysis. All independent variables with p-values less than 0.20 were taken as candidates for the multivariable logistic regression model. The AOR is estimated to measure the strength of the association. In the final model, a p-value of less than 0.05 at 95% CI was considered a statistically significant association.

Results: 358 respondents participated in this study, with a response rate of 97.8%. Of all the nurses who took part in the study, 61.17% of them were females. Two hundred twenty (61.45%) of the study respondents scored as having good practice, 222 (62.01%) as having good knowledge, and 221 (61.73%) had favorable attitudes. In the final model of multivariable logistic analysis, knowledge (AOR= 1.63; 95% CI: 1.04, 2.54) and attitude of nurses (AOR= 2.30; 95%CI: 1.47, 3.58) had a statically significant association with nursing documentation practice.

Conclusion and Recommendation: This study revealed that good nursing documentation practice was 61.45 % among ICU nurses. The knowledge and attitude of intensive care unit nurses toward nursing documentation were the only factors associated with nursing care documentation practice.

Keywords: documentation, nursing care, practice, intensive care units

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1. Introduction

Nursing documentation is the process of recording and keeping evidence to have an account of what happened and when it happened.⁽¹⁾ The history of nursing care documentation started when Florence Nightingale defined it as the record of nursing care planned and given to individual patients and clients by nurses.⁽²⁾ The quality and coordination of care depend on the communication between nurses with each other and other healthcare team members for continuity of care for their patients.⁽³⁾

Failure to have nursing documentation of a patient's condition, medications administered, or anything related to patient care can result in poor patient outcomes and liability issues for the facility, the physician in charge, and nurses.⁽⁴⁾ Accurate documentation is important for communication and continuation of care.⁽⁵⁾ Nursing documentation is also very important for legal issues regarding patient records that can be used as evidence in court.⁽⁶⁾ Clear, accurate, timely, and accessible documentation is essential to safe, quality, and evidence-based nursing practice.⁽⁷⁾ Nursing is not complete until the care has been properly documented, and as the old saying goes, "If it was not documented, it was not done".⁽⁸⁾ Additionally, nursing documentation is important for education, research, quality assurance, and reimbursement by third-party claimants.⁽⁹⁾ A study by Bjorvelleal suggests that nurses perceive nursing documentation as an important element in their practice and also to ensure patient safety.⁽¹⁰⁾

Nurses bear a large burden in managing and implementing the interdisciplinary team's plan for documenting the care and progress toward the goals since documentation is a working framework that provides a comprehensive account of

care provided to a patient.^(8, 11) Nurses' low practice on nursing care documentation has negative impacts on the health care of patients, the health care providers, and the profession and is associated with omitting of medications, improper or double medication administrations, and the risk of legal harm become high.^(5, 12, 13) In Ethiopia, even though it is declared that nursing care outlines; the assessment, planning, and evaluation of care must be clearly documented but still now nurses' practice towards documentation

The prevalence of poor nursing documentation practice is different from country to country and institution to institution. A study from London and Iraq, which have poor documentation practices, shows 53% and 51.7%, respectively.^(14, 15) Similarly, studies done in South Africa and Uganda both reported poor practice of nursing documentation among nurses.^(16, 17) In Ethiopia, data collection inadequacy and lack of quality were found to be a problem.

Poor documentation by nurses negatively impacts patients' health care and may lead to harmful consequences like exposing the care provider to medication administration errors.⁽¹⁸⁾ Quality of patient care and good documentation improve the credibility of the institution and make the nursing profession visible, and the situation may lead to an extent that can affect the reputation of the healthcare facilities.⁽¹⁹⁾ Therefore, this study aimed to assess documentation practice and its associated factors among ICU nurses working at public Hospitals in Addis Ababa, Ethiopia, in 2022. The findings of this study will provide baseline data for interventions implemented at hospitals with ICUs and any further research conducted in Ethiopia. This study will also help to picture the practice of documentation explicitly.

2. Methods and Materials

Study area, Study design and period

The Study sites were public Hospitals in Addis Ababa, including Tikur-Anbesa specialized Hospital, St Paul's Millennium Medical Collage, St Peter's Specialized Hospital, AaBET Hospital, Zewditu Memorial Hospital, Yekatit 12 Hospital, Rasdesta Damtewu Memorial Hospital, Dagmawi Menelik Hospital, and Ghandi Memorial Hospital; Tirunesh Beijing Hospital nurses working in intensive care units at public hospitals. The data was collected from December 10 to 30, 2021.

An institutional-based cross-sectional study was conducted to assess the documentation of practice among ICU nurses working at public hospitals in Addis Ababa and all nurses working in Adult ICUs at public hospitals in Addis Ababa.

The study included nurses with at least 6 months of experience in each public hospital and nurses who were available during the study period. Nurses on annual leave and unable to participate

in the study due to illness during data collection were excluded.

Sample size determination

The study employed a single population proportion sample size determination formula, taking the proportion as 47.5% from a previous study conducted in Harar Hospital and Dire Dawa Administration Governmental Hospitals (26), a 95% confidence interval (CI), and a 5% margin of error.

A sample size of 422 was calculated, with 10% compensation for no response. Although the sample size was calculated to be 422, the total number of nurses working in the Adult ICUs of sample hospitals was 366. Hence, data was collected from all nurses as shown below

Sampling technique

During the data collection period, there were 12 public hospitals in Addis Ababa. Lists of nurses from each hospital were identified, and data was collected based on the number of nurses available.

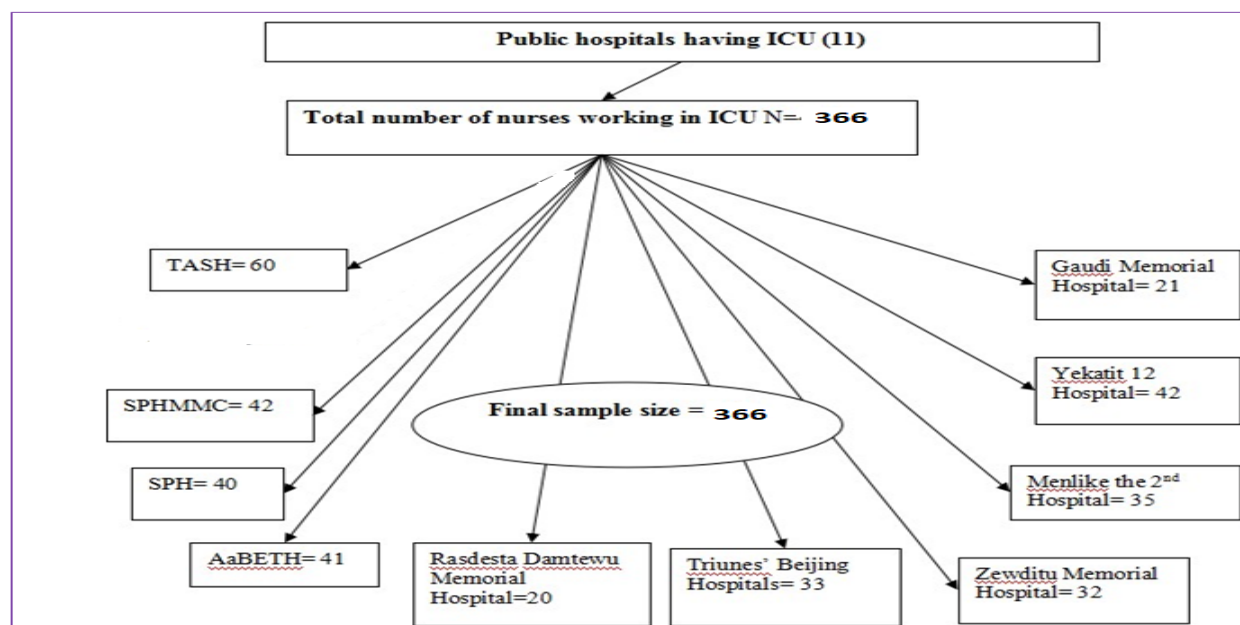


Figure 1: Schematic presentation of hospitals and distribution of nurses for each hospital in Addis Ababa, Ethiopia, 2022

Study variables

Dependent variable: documentation practice

Independent variables:

Socio-demographic factors (age, sex, educational status, current working hospitals, and work experience), availability of standard guidelines, in-service training, recording time, motivation, knowledge, and attitude towards nursing documentation.

Operational definition

Practice: In this study, practice refers to the actions taken by the nurses on the documentation practice checklist.

Good practice refers to those study participants who correctly perform the documentation practice checklist through observation and score greater than the mean score.

Poor practice: refers to study participants who correctly perform the practice checklist through observation and have a score less than or equal to the mean score.

Good knowledge: those respondents who scored above or equal to the mean score of knowledge questions

Poor knowledge: those respondents who scored below the mean score of knowledge questions

Favorable attitude: Those respondents who scored above or equal to the mean score

Unfavorable attitude: Those respondents who scored below the mean score of attitude questions

Nursing documentation practice: a record of nursing care delivered to individual clients by nurses.

Data collection tools and procedures

An observation checklist and a structured, self-administered questionnaire were used for data

collection. Both instruments were modified and adapted from other research. The documentation practice of nurses working in intensive care units was assessed using an observation checklist with 13 practice-related questions. Based on the observation checklist, nurses who applied/ followed the recommended action were included in the "Yes" section, and nurses who didn't apply/ follow the recommended action were included in the "No" section. Finally, from this aggregate score, nurses who performed greater than the mean score of practice-related questions using a checklist were categorized as having good practice. In contrast, nurses who practiced less than or equal to the mean score of practice-related questions were categorized as having poor practice. The data was collected by trained data collectors and supervisors. The observation was conducted by the principal investigator, two supervisors, and two data collectors, and they were given scores according to the checklist. Participant nurses were observed for 15-30 minutes; the time was selected randomly.

After the observation, a structured self-administered questionnaire was implemented.^(6, 24, 25, 28) Nine multiple-choice questions were used to measure respondents' knowledge of the nursing documentation adopted.⁽³²⁾ Participants' attitudes were assessed via a Likert scale, with item scores ranging from strongly agree⁽⁵⁾ to strongly disagree.⁽³²⁾

Data quality control

To ensure data quality, data was collected by BSC nurses who were not employees of the study hospitals after two days of training on the techniques of data collection. The principal investigator and supervisors checked the completeness of the data. 5% (19) of the sample size were pre-tested at Shashemene ICU, which was not included in the final study.

Data processing and analysis

The collected data was checked visually for completeness, and the responses were coded and entered into the computer using the Epi info statistical package. Five percent of the responses were randomly selected and checked for the consistency of data entry and exported to Windows of Statistical Package for Social Science (SPSS) for data analysis. Results were summarized using frequencies, percentages, mean, standard deviation, and media and inter-quartile range presented using figures, tables, and text. Binary logistic regression was done to see the crude significant relation of each independent variable with dependent variables. Variables with P value <0.20 at a 95% confidence interval during the bi-variable analysis were used in multivariable logistic regression analysis by using the backward likelihood ratio method to see the relative effect of confounding variables and the interaction of variables. Odds ratio with 95%CI was performed to determine the strength of association of variables at p-value less than 0.05, which was taken as significant.

Ethical clearance

The research protocol was approved, and ethical clearance was obtained from SPHMMC Institutional Review.

Consent from the city health bureau and respective public hospitals was also obtained. All nurses serving as data collectors and supervisors were informed in writing about the study.

Data collectors gave full information to the study participants about the purpose of the study and asked them to give their consent before participating in the study. Participation in the study was entirely voluntary and any involvement in the study was assured only after obtaining complete verbal informed consent. Confidentiality was strictly adhered to, and identification numbers (using codes) rather than names were used during the data collection and analysis.

3. Result

Socio-demographic characteristics of respondents

A total of 358 respondents participated in this study, achieving a response rate of 97.8%. Among the participants, 61.17% were female nurses. The age distribution revealed that 74.3% of the respondents were between 25 and 30 years old, with a median age of 28 years and an interquartile range (IQR) of 3 years. Additionally, the majority (91.34%) held a degree-level qualification. Over three-quarters (82.12%) of the participants had three years or less of work experience, while 15.08% had between 4 and 7 years of experience (see Table 1).

Table 1: Socio demographic characteristics of intensive care unit nurses at public hospitals in Addis Ababa from December 10th - 30th 2021 (n=358)

Variable's	Response	Frequency	Percent
Age in years	21-24	7	1.96
	25-30	266	74.30
	31-34	54	15.08
	≥35	31	8.66
	Median ± IQR	28 ± 3	
Sex	Male	139	38.83
	Female	219	61.17
Education	Diploma	5	1.40
	Degree	327	91.34
	MSC	26	7.26
Experience in years	≤3	294	82.12
	4-7	54	15.08
	≥8	10	2.79

Work area-related characteristics of study participants

In this study, 95 respondents (26.54%) reported receiving in-service training. Among those trained, more than three-fourths (88.66%) completed their training within two years. When asked about the availability of clinical guidelines, 59 participants (16.34%) indicated that these guidelines were accessible. Additionally, over half of the respondents (66.13%) were familiar with the guidelines.

Regarding patient care, 355 respondents (99.16%) reported a 1:1 patient-to-nurse ratio. A significant majority of nurses (86.87%) stated they had sufficient sheets for patient care, while 236 participants (65.92%) felt that having more sheets motivated them. Furthermore, 183 respondents (48.32%) documented patient care shortly after it was completed.

Nurses' attitudes towards nursing documentation practice

In this study, participants were assessed on 13 items from a questionnaire regarding documentation practices. A total of 346 respondents (96.65%) reported documenting every patient's

records. More than three-quarters (87.99%) provided documented subjective data, while 329 participants (91.90%) documented objective data. Additionally, 294 respondents (82.12%) indicated that they documented significant communications with family members.

The majority of respondents (81.84%) confirmed that they engaged in advocacy on behalf of patients. Regarding the legibility of documentation, 322 participants (89.94%) ensured that documents were clear when using paper forms. Furthermore, 307 nurses (85.75%) documented advice, care, or services provided to individuals within groups, communities, or populations. Notably, 325 participants (90.78%) reported completing documentation in a timely manner, either during or immediately after care events.

As illustrated in Figure 2, participants' performance was categorized into good and poor practices. Scores of 0.8756 (the mean value) or above were classified as good practice, while scores below the mean indicated poor practice. Of the respondents, 220 (61.45%) demonstrated good practice, while 138 (38.55%) scored below the mean, indicating poor practice.

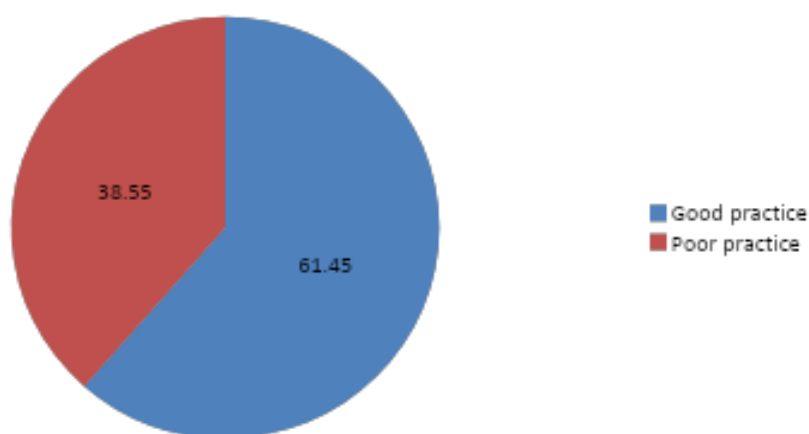


Figure 2: Percentage of practice of documentation among Nurses working in Public Hospital in Addis Ababa (n=358)

Knowledge of respondents towards nursing documentation

In this study, respondents were assessed on their knowledge of documentation through nine questionnaire items, each allowing multiple responses. A total of 315 participants (88.0%) reported that nursing care should be documented according to established guidelines. Regarding the principles that should be followed during documentation, more than three-quarters (88.83%) of participants indicated they were knowledgeable, and 313 nurses (87.43%) confirmed that the documents were easily readable.

Furthermore, 341 respondents (95.25%) noted that improved quality was achieved through proper documentation, and 330 participants (92.18%) described effective communication with staff regarding the benefits of patient care documentation. When asked about the main nursing activities expected to be documented, the responses included: assessing data (315 participants, 89.11%), tracking patient progress (322

participants, 89.94%), recording transfers and discharges (284 participants, 79.33%), providing care (295 participants, 82.40%), and evaluating care.

However, the majority (91.62%) acknowledged inadequate awareness of the potential consequences of poor documentation. More than three-quarters (89.39%) also incorrectly associated the use of non-standard abbreviations with errors in patient care documentation. A significant number of respondents (334, or 93.30%) reported that documenting the date and time of actions protects them from legal issues, and 337 (94.13%) were aware of the necessary components of medication administration documentation. Regarding who should document the care provided, 289 participants (80.73%) stated that the same individual who delivered the care should be responsible for documentation.

As illustrated in Figure 3, 222 participants (62.01%) demonstrated good knowledge, while the remaining 136 (37.99%) scored below the mean, indicating poor knowledge.

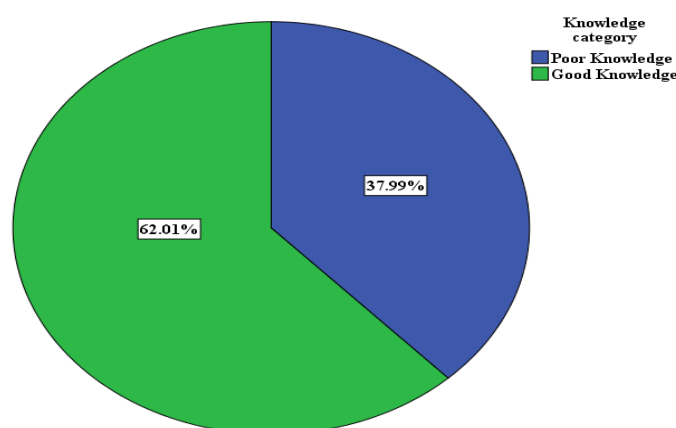


Figure 3: Knowledge of nurses towards nursing documentation in public hospital, Addis Ababa

Attitudes of nurses towards nursing documentation practices

The study respondents were assessed on their attitudes towards documentation through twelve

items. Among the participants, 189 (52.79%) strongly agreed that Nursing documentation is equally important as any other task. Additionally,

206 (57.54%) strongly agreed that documentation ensures continuity of care.

Regarding the importance of documentation to other healthcare professionals, 136 nurses (37.99%) expressed agreement. More than half of the respondents (58.66%) strongly agreed that documentation serves to show the workload and tasks performed. However, only 120 nurses

(33.52%) agreed with the statement that many benefits can be derived from the use of documentation.

As illustrated in Figure 4, 137 participants (38.27%) were categorized as having an unfavorable attitude toward documentation, while 221 (61.73%) displayed a favorable attitude.

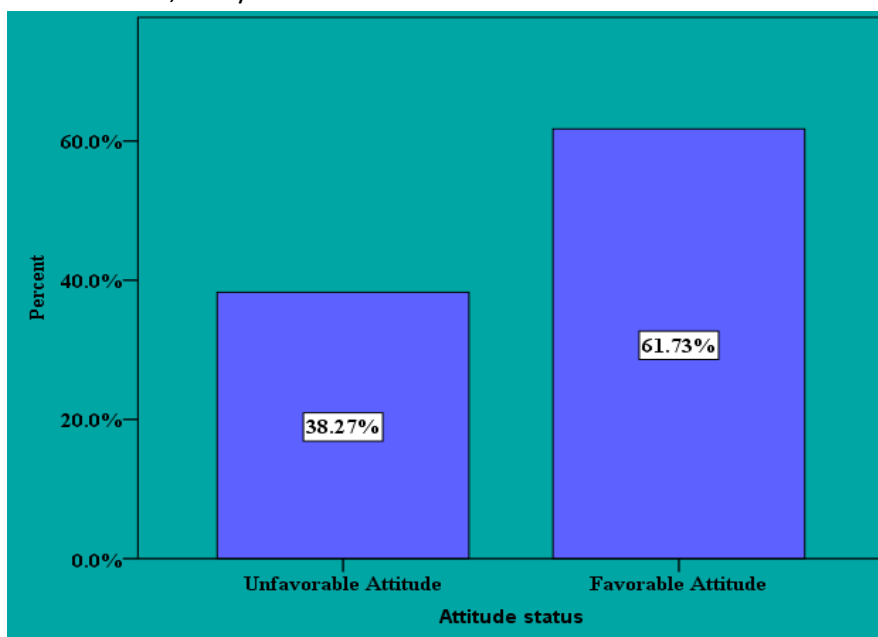


Figure 4: Attitudes of nurses towards nursing documentation in public hospital, Addis Ababa

Associated factors

A bivariate analysis was conducted to examine the correlation between nurse documentation practices and independent variables. Initially, each variable was entered separately into a binary logistic regression model. Subsequently, variables with a p-value less than 0.20 were selected for multivariate logistic regression analysis. The bivariate analysis identified several variables associated with documentation practice: age (in years), educational background, work experience, availability of guidelines, documentation time, knowledge, and attitude.

To further assess these relationships, a multivariable logistic regression was performed to determine the independent effects of these variables

while controlling for potential confounders. Two variables demonstrated a significant association with documentation practice at a p-value of less than 0.05: nurses' knowledge and attitude.

Intensive care unit nurses with good knowledge were found to be 1.63 times more likely to exhibit good documentation practices compared to those with poor knowledge (AOR = 1.63; 95% CI: 1.04, 2.54). Similarly, the odds of having good documentation practices among intensive care unit nurses with a favorable attitude were 2.30 times greater than those with an unfavorable attitude (AOR = 2.30; 95% CI: 1.47, 3.58).

Table 2: Factors associated with nursing documentation practice among nurses working in ICU in public hospital in Addis Ababa (n=358)

Variables	Category	COR(95%CI)	AOR(95%CI)	P-value
Age in years	21-24	1.00		
	25-30	4.36(0.83, 22.88)	3.80(.61, 23.86)	0.154
	31-34	3.37(0.60, 18.94)	3.20(.47, 21.71)	0.233
	≥35	3.46(0.58, 20.70)	4.03(.55, 29.71)	0.172
Education	Diploma	5.45(0.53, 55.80)	4.40(.34, 56.21)	0.255
	Degree	2.29(1.02, 5.15)	1.63(.61, 4.35)	0.329
	MSC	1.00		
Experience	≤3	1.00		
	4-7	0.56(0.31, 1.01)	.77(.39, 1.53)	0.456
	≥8	0.56(0.16, 1.99)	.84(.19, 3.67)	0.813
Guidelines Availability	Yes	0.50(0.29, 0.88)	.72(.38, 1.40)	0.335
	No	1.00		
When you document	Any time when convenient	2.10(0.87, 5.07)	1.48(.58, 3.80)	0.411
	Soon after care finished	2.27(0.94, 5.48)	1.43(.56, 3.68)	0.453
	At the end of shift hours	1.00		
Knowledge	Poor	1.00		
	Good	1.69(1.09, 2.62)	1.63(1.04, 2.54)	0.033*
Attitude	Unfavorable	1.00		
	Favorable	2.35(1.51, 3.65)	2.30(1.47, 3.58)	<0.001*

Keys: 1.00 indicates reference category; * significance at p-value < 0.05

4. Discussion

The main purpose of this study was to investigate nursing documentation practice and associated factors among intensive care unit nurses in public hospitals in Addis Ababa, Ethiopia. The findings of this study showed that 61.45% of the study respondents had good practice. This finding is higher than a study conducted in the United Kingdom (47.3%)⁽¹⁴⁾ and Iraq (49.3%).⁽¹⁵⁾ The result of this study agrees with the study conducted in Jimma, Ethiopia, demonstrating that 51.4% of nursing documentation practice was poor among nurses⁽²⁴⁾, and a study conducted in Harari and Dire Dawa indicates nursing documentation practice was 47.5%.⁽²⁵⁾ Similarly, our study finding is higher than that of a study by

West Gojjam, which reveals that 47.5% of nurses had good documentation practice.⁽²⁸⁾

The result of this study shows that knowledge of intensive care towards practice nursing care documentation was good (62.01%). In the current study, nurses with good knowledge regarding documentation were 1.63 times more likely to have good nursing documentation practice than those with poor knowledge. This finding aligns with the studies from Uganda⁽²³⁾ and the United States.⁽⁵⁾ This can be explained by the following: good knowledge of nursing care documentation improves familiarity with documentation guidelines and manuals and enhances adherence to standardized nursing practice and nursing professionalism.

Regarding attitude, 61.73% of the intensive care unit nurses had a favorable attitude. Nurses who had a good attitude towards nursing care documentation were also 2.30 times more likely to have good documentation practice compared to those who had a poor attitude. This observation is consistent with study results from Sweden.⁽³³⁾

Limitations

The study design for this study was cross-sectional, which did not illustrate the cause-and-effect relationship between independent and dependent variables. The study was done in public hospitals in Addis Ababa, which might not represent the entire hospital in Ethiopia. A structural self-administer questionnaire is always subject to respondents' response bias.

5. Conclusion and recommendation

This study revealed that nursing care documentation practice was good (61.4%) among intensive care unit nurses. The knowledge and attitude of intensive care unit nurses towards nursing documentation were the only factors associated with this practice. Nursing documentation is a very important aspect of professional practice for nurses. Based on the findings of this study, the following recommendations are forwarded: The researcher suggests to the hospitals and health facilities to work on improving nurses' knowledge, attitude, and documentation practice skills through different mechanisms, like training, sharing experiences with other hospitals, and giving short-term courses. It is also important for stakeholders like staff, higher officials of the health system, and researchers.

Abbreviation

CNE: Comprehensive Nursing Education
EPI Info: Epidemiological Information Software
ICU: Intensive Care Unit
IRB: Institutional review board

NGO: Non-governmental organization
PPS: Probability proportion to sample size
SPSS: Statistical Package for Social Science
WHO: World Health Organization

Author Contributions

AK- supervision, data collection, data analysis and interpretation
MK- Data collection and data entry

Funding

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Conflict of Interest

The authors declare they have no competing conflict of interest

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References

- 1) Kebede M, Endris Y, Zegeye DT. Nursing care documentation practice: The unfinished task of nursing care in the University of Gondar Hospital. *Inform Health Soc Care*. 2017 Sep; 42(3):290- 302. doi: 10.1080/17538157.2016.1252766. Epub 2016 December 5. PMID:27918228.
- 2) Wang N, Hailey D, Yu P. Quality of nursing documentation and approaches to its evaluation: a mixed-method systematic review. *J Adv Nurs*. 2011 Sep;67(9):1858-75. doi: 10.1111/j.1365-2648.2011.05634.x. Epub 2011 April 6. PMID:21466578.
- 3) MACHUDO, Sabo Y; MOHIDIN, Sharifah. Nursing Documentation Project at Teaching Hospital in KSA. *International Journal of Research in Science*, [S.l.], v. 1, n. 1, p. 4-7, june 2015. ISSN 2412-4389.
- 4) Avoka Asamani J, Delasi Amenorpe F, Babanawo F, Maria Ansah Ofei A. Nursing documentation of inpatient care in eastern Ghana. *Br J Nurs*. 2014 Jan 9-22;

- 23(1):48-54. doi: 10.12968/bjon.2014.23.1.48. PMID:24406496.
- 5) The American Nurses Association (ANA) is a national professional association Nursing: Scope and Standards of Practice, Third Edition, guides nurses in the application of their professional knowledge, skills, and responsibilities. 2009
 - 6) H Tasew · 2019 · Cited by 16 — 2014;4(1):137–44. Google Scholar. 17. Nakate G, et al. Knowledge and Attitudes of Select Ugandan Nurses towards Documentation of Patient Care.
 - 7) 2017 American Nurses Association. Committee on Nursing Practice Standards 2017. Patricia Bowe, DNP, MS, RN. Danette Culver, MSN, APRN, ACNS-BC, CCRN.
 - 8) Oliver JM. record keeping : self reported attitudes , knowledge and practice behaviors of nurses in selected cape town hospitals 2021
 - 9) Elisha M. Okaisu; Florence Kalikwani; Grace Wanyana; Minette Coetzee Improving the quality of nursing documentation: An action research project scinlo south Africa vol.37 n.2 Pretoria 2014
 - 10) Björvell, Catrin & Wredling, R & Thorell-Ekstrand, Ingrid. (2002). Long-term increase in quality of nursing documentation: Effects of a comprehensive intervention. Scandinavian journal of caring sciences. 16. 34-42. 10.1046/j.1471-6712.2002.00049.x.
 - 11) The American Nurses Association (ANA) is a national professional association Nursing: Scope and Standards of Practice, Third Edition, guides nurses in the application of their professional knowledge, skills, and responsibilities. 2010
 - 12) Chebor, Alex. (2013). Chelagat D, Sum T, Obel M, Chebor A, Kiptoo R and Bundotich B, Documentation: Historical Perspectives, Purposes, Benefits and Challenges as Faced by Nurses, International Journal of Humanities and Social Science Vol. 3 No. 16 [Special Issue –August 2013] P 236-240. ISSN 2220-8488 (print) 221-0989 (online). International Journal of Humanities and Social Science. 3. 236-240.
 - 13) Taylor, Helen. (2003). an exploration of the factors that affect nurses' record keeping. British journal of nursing (Mark Allen Publishing). 12. 751-4, 756. 10.12968/bjon.2003.12.12.11338.
 - 14) Law L, Akroyd K, Burke L. Improving nurse documentation and record keeping in stoma care. Br J Nurs. 2010 Nov 25-Dec 8; 19(21):1328-32. doi: 10.12968/bjon.2010.19.21.80002. PMID:21355356
 - 15) Jebur HG, Mohammed W. Evaluation of Nursing Staffs' Documentation Standard Related to Nursing Procedures at Medical Wards in Al-Najaf Al-Ashraf Governorate. J Kufa Nurs Sci. 2017;
 - 16) Taiye BH. Knowledge and practice of documentation in Ahmadu Bella University Teaching hospital (9Abth) Zaria, Kaduna State. IOSR Journal of Nursing and Health Science. 2015;4(6):1-6.
 - 17) Vital Wave Consulting. Health information systems in developing countries, in a landscape analysis; 2009. P.69–70.
 - 18) Admasu. Documentation Practice and associated factors among Nurses Working at JUMC
 - 19) Mutshatshi, T. E., Mothiba, T. M., Mamogobo, P. M., & Mbombi, M. O. (2018). Record-keeping: Challenges experienced by nurses in selected public hospitals. Curationis, 41(1), e1–e6.
 - 20) Gugerty, Brian & Maranda, Michael & Beachley, Mary & Navarro, VB & Newbold, Susan & Hawk, W & Karp, J & Koszalka, M & Morrison, S & Poe, Stephanie & Wilhelm, D. (2007). Challenges and Opportunities in Documentation of Nursing Care of Patients.
 - 21) Joint Commission Center for Transforming Healthcare releases targeted solutions tool for hand-off communications. Jt Comm Perspect. 2012 Aug; 32(8):1, 3. PMID:22928243.
 - 22) Alhawri, Fouad & Rampal, Krishna Gopal

- & Abdulla, Abdelkodose. (2021). Knowledge, Attitude, Performance, and Associated Factors Towards Nursing Documentation Among Nurses in Public Hospitals, Sana'a City, Yemen.
- 23) Nakate, G. & Dahl, D. & Drake, K.B. & Petrucka, Pammla. (2015). Knowledge and Attitudes of Select Ugandan Nurses towards Documentation of Patient Care. *African Journal of Nursing and Midwifery*. 2.56-65.
 - 24) Gizaw, Admasu. (2018). Documentation Practice and associated factors among Nurses Working at JUMC
 - 25) TamirT, GedaB, MengistieB. Documentation Practice and Associated Factors Among Nurses in
 - 26) Harari Regional State and Dire Dawa Administration Governmental Hospitals, Eastern Ethiopia. *Adv Med Educ Pract*. 2021;12:453-462
 - 27) Blair W, Smith B. Nursing documentation: frameworks and barriers. *Contemp Nurse*. 2012 Jun;41(2):160-8. doi: 10.5172/conu.2012.41.2.160. PMID: 22800381.
 - 28) Collins SA, Cato K, Albers D, Scott K, Stetson PD, Bakken S, Vawdrey DK. Relationship between nursing documentation and patients' mortality. *Am J Crit Care*. 2013 Jul;22(4):306-13. doi: 10.4037/ajcc2013426. PMID: 23817819; PMCID: PMC3771321.
 - 29) Atsedemariam A., Tarekegn A., Mezinew S., Tiliksew L., Afework E., Bekalu B. and Mihretie G.: Knowledge, attitude, practice and associated factors towards nursing care documentation among nurses in West Gojjam Zone public hospitals, Amhara Ethiopia, *Clinical Journal of Nursing Care and Practice*: 2018
 - 30) Yeung MS, Lapinsky SE, Granton JT, Doran DM, Cafazzo JA. Examining nursing vital signs documentation workflow: barriers and opportunities in general internal medicine units. *J Clin Nurs*. 2012 Apr;21(7-8):975-82. doi: 10.1111/j.1365-2702.2011.03937.x. Epub 2012 January 14. PMID: 22243491.
 - 31) Prideaux, Antony. (2011). Issues in nursing documentation and record-keeping practice. *British journal of nursing* (Mark Allen Publishing). 20. 1450-4.10.12968/bjon.2011.20.22.1450.
 - 32) Petkovšek-Gregorin R, Skela-Savič B. Nurses' perceptions and attitudes towards documentation in nursing. *Obzor-nik zdravstvene nege*. 2015 Jun;27;49(2).
 - 33) AyeleS, GobenaT, BirhanuS, YadetaTA. Attitude Towards Documentation and Its Associated Factors Among Nurses Working in Public Hospitals of Hawassa City Administration, Southern Ethiopia. *SAGE Open-Nurs*.
 - 34) Ehnfors M. Nursing documentation practice on 153 hospital wards in Sweden as described by nurses. *Scand J Caring Sci*. 1993;7(4):201-7. doi: 10.1111/j.1471-6712.1993.tb00204.x. PMID: 8108624

Clinical Pattern, Management Outcome, and Associated factors of patients admitted to COVID-19 ICU Center of St. Paul's Hospital Millennium Medical College

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ABSTRACT

Background: The coronavirus disease 2019, caused by the recent severe acute respiratory syndrome novel virus, is considered one of the greatest global public health crises by the WHO. It claimed millions of lives globally, with death occurring among populations with certain contributing factors. This study aimed to assess the clinical profile, management outcome, and associated factors of COVID-19-infected patients who were admitted to St. Paul Hospital Millennium Medical College COVID-19 ICU Center.

Methods: Institution-based cross-sectional study was conducted in St. Paul's Hospital Millennium Medical College among patients admitted to the COVID-19 ICU from June 8, 2020, to May 30, 2021. A systematic random sampling technique was applied to select eligible patients' charts. The data were entered and analyzed using SPSS version 26. Descriptive analysis was used for statistical analysis of baseline data, and regression analysis was used to determine the association between dependent and independent variables. A p-value <0.05 was considered significant.

Results: A total data of 272 patients were analyzed, with a median age of 60.5 years and more than two-thirds, 183(67.3%) being males. Most (75.7%) had a pre-existing comorbid medical condition, and a majority (71.3%) had a COVID-19 disease of critical disease severity. Overall, the in-ICU mortality rate was 64.3%. Multivariable analysis showed that mortality was significantly associated with intubation (AOR: 2.813; 95% CI: 1.176–6.731), pulmonary embolism (AOR: 36.702; 95% CI: 4.062–331.605), Vasopressor usage (AOR: 84.954; 95% CI: 23.413–308.254), Dialysis or RRT (AOR: 4.191; 95% CI: 1.511–11.620) and ARDS (AOR: 21.149; 95% CI: 4.217–106.075) were associated with death among the studied patients.

Conclusion: The most common comorbidities were hypertension, diabetes, and CKD. Moreover, high mortality among ICU-admitted COVID-19 patients was strongly associated with septic shock with vasopressor use, ARDS, Pulmonary embolism, RRT, and intubated patients.

Keywords: COVID-19, clinical pattern, management outcome, associated factors, ICU, Ethiopia

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1. Introduction

In December 2019, Wuhan, Hubei Province, China, reported a cluster of pneumonia cases of unknown cause, later identified as severe acute respiratory syndrome Coronavirus2 (SARS-CoV2). COVID-19 was declared a pandemic by the WHO on March 11, 2020. As of January 17, 2021, 1 year had passed since the pandemic began, at which more than 93 million cases and 2 million deaths were reported worldwide.⁽¹⁾ Ethiopia has come among the COVID-19-affected countries as of March 15, the date on which one imported case was first detected. On May 7, 2020, there were 191 total notified cases and 4 deaths in Ethiopia.⁽²⁾

Coronaviruses belong to a large family of diverse enveloped, single-stranded positive-sense RNA viruses that are recognized to bring about respiratory, hepatic, neuronal, and gastrointestinal diseases in humans and animals. SARS-CoV, HCoV-NL63, HCoV-OC43, HCoV-HKU1, HCoV-229E, and MERS CoV, were until recently the coronaviruses that were known to affect humans. SARS-CoV and MERS-CoV infections resulted in 10% and 40% mortality rates in humans, respectively, the highest among the coronaviruses. SARS-CoV-2, the most recently ascertained Coronavirus, is the seventh of the coronavirus family known to affect *Homo sapiens* and currently has a mortality rate of 3.2%.⁽³⁾

Moreover, the probability of serious COVID-19 disease is higher in people aged ≥ 60 years, those living in a nursing home or long-term care facility, and those with chronic medical conditions.⁽⁴⁾ The pandemic has significantly harmed a wide array of health services globally, particularly in low-and middle-income countries. African countries report the highest level of disruption in health service delivery.⁽⁵⁾

Coronavirus disease 2019 (COVID-19) has affected millions of people around the world since December 2019, of which 6 to 10% of patients develop a more severe form of COVID-19 and will require admission to the intensive care unit (ICU) mainly due to acute hypoxemic respiratory failure.⁽⁶⁾ Based on severity, COVID-19 cases are classified as non-severe, severe, and critical COVID-19.⁽⁷⁾ At present, most studies of COVID-19 have focused on risk factor analysis and mortality prediction for mild and moderate cases, which comprise a large proportion of patients with COVID-19. However, 14% to 20% of cases are severe or even critical, and the mortality rate of these patients is as high as 50%.^(8–10)

At present, most studies of COVID-19 have focused on risk factor analysis and mortality prediction for mild and moderate cases, which comprise a large proportion of patients with COVID-19. However, 14% to 20% of cases are severe or even critical, and the mortality rate of these patients is as high as 50%.^(8–10)

Despite the increasing available literature on COVID-19, very few publications have emerged from Africa, including Ethiopia. There are few studies on the clinical patterns and outcomes of critically ill COVID-19 infected patients. The aim of this study is to assess the clinical profile, management outcome, and associated factors of COVID-19-infected patients who were admitted to the COVID-19 ICU in Saint Paul Hospital Millennium Medical College. This study will provide additional knowledge on the topic to help in early identification and management. Also, it will be a supportive study for further research in Africa, particularly Ethiopia.

2. Methods and Materials

This study was conducted at Saint Paul's Hospital Millennium Medical College (SPHMMC) COVID-19 ICU treatment center. SPHMMC is located in the

capital city of Ethiopia. It was established through a decree of the Council of Ministers in 2010. The hospital was designated officially starting on June 8, 2020, as the national center for the management of COVID-19-infected patients in Ethiopia, mainly serving the city and surrounding area populations. It has 13 ICU beds with mechanical ventilators and dialysis machines.

Sample Size

The sample size was calculated by using the single population proportion formula; a prevalence of (0.23) was used where 23 % of the overall mortality rate among patients who were admitted to COVID-19 ICU from a similar study done in Africa, Ghana⁽¹¹⁾, with a 10% error sample size of 286 patients was included using simple random sampling from a total of 523 patients admitted to COVID 19 ICU during the 12 months of the study period. Among 286 patients, only 272 charts were found to be eligible and were analyzed. Fourteen were excluded based on exclusion criteria.

Sampling technique

After receiving ethical approval from the ethical review committee, a retrospective chart review was done. A total of 272 patients were selected among those who were consecutively admitted to the ICU with real-time polymerase chain reaction (RT-PCR) confirmed COVID-19 from June 8, 2020, to May 30, 2021, after which the hospital closed due to the full resumption of other services.

All adult patients with laboratory-confirmed COVID-19 infection by RT-PCR assay of naso/oropharyngeal swab specimens and admitted to ICU during the study period were taken as source population. Our exclusion criteria were charts to which the primary outcome, i.e., death or life, was not documented. Alive patients can be transferred (to another facility or ward) or discharged.

Additionally, lost charts were not included in the final study

Variables

Our dependent variable was the primary outcome, which can be either death or alive. N.B: Alive patients were those who were discharged or transferred.

Age, Sex, Clinical presentation (signs and symptoms), Chronic kidney disease, Diabetes mellitus, Hypertension, Heart failure, Laboratory values upon admission to ICU, vital signs at initial presentation, ICU length of stay, respiratory support, complication, and treatments given were independent variables.

Data Collection Tools and Procedures

Data were collected from patients' medical records using structured checklists. The questionnaire was prepared by reviewing different literature and undertaking modifications for the population studied. It was modified further after a pre-test and before the data collection, then followed and reviewed during data collection. Data was collected by trained Emergency Medicine and Critical Care Residents in SPHMMC who worked at the COVID-19 treatment center, and completeness was checked by the principal investigator. The information of all patients, including demographics, clinical presentation, comorbidity, complications, laboratory parameters, and outcome data, was extracted from medical records (electronic medical records were not applicable in the COVID-19 adult ICU during the study period). Close supervision was maintained during data collection, and filled checklists were double-checked daily by data collectors and the principal investigator for consistency and completeness before analysis.

Data Processing and Analysis

Data entering, coding, and cleaning were performed using Epi-info version 7.0, and statistical

analysis was done using SPSS (Statistical Package for Social Science) version 26. Frequency and cross-tabulation were used to check for missed values and variables. The demographic and clinical characteristics of patients were computed by using descriptive statistics such as mean (standard deviation), percentage, and frequencies. Logistic regression was used to determine the association between independent and dependent variables. Bivariate logistic regression was done for the assessment of the association between the dependent variable (mortality) and independent variables; only variables with a P-value < 0.25 were (Table 3) displayed. Those variables with a p-

value of ≤ 0.25 in bivariate logistic regression were taken to multivariate logistic regressions. Finally, the study findings were presented using diagrams, tables, and figures.

3. Result

Socio-demographic profile of study participants

A total of two hundred seventy-two patients' medical records were reviewed in this study. The median age at diagnosis was 60.5 years, with an interquartile range of 45–70 years. More than half, 142 (52.2%) aged 60 years or more. Males accounted for over two-thirds, 183 (67.3%) of the study population (Figures 1 and 2).

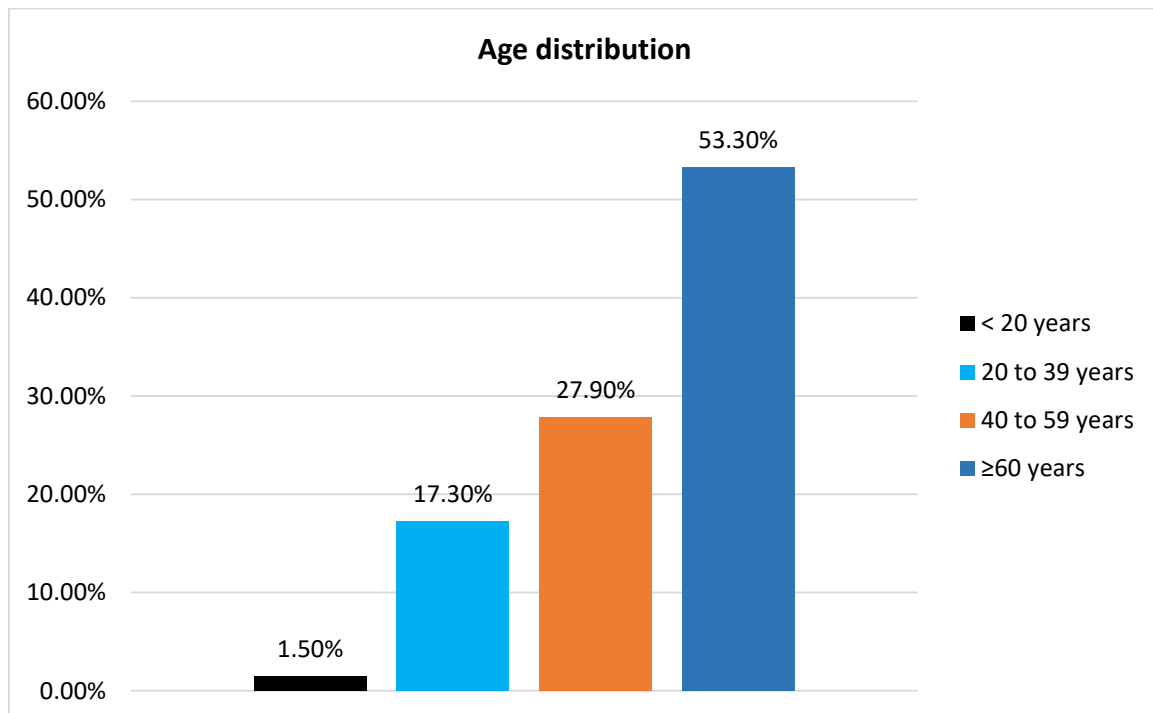


Figure 1: Age distribution of COVID-19 infected patients admitted to COVID-19 ICU Center of St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia from June 8, 2020, to May 30, 2021

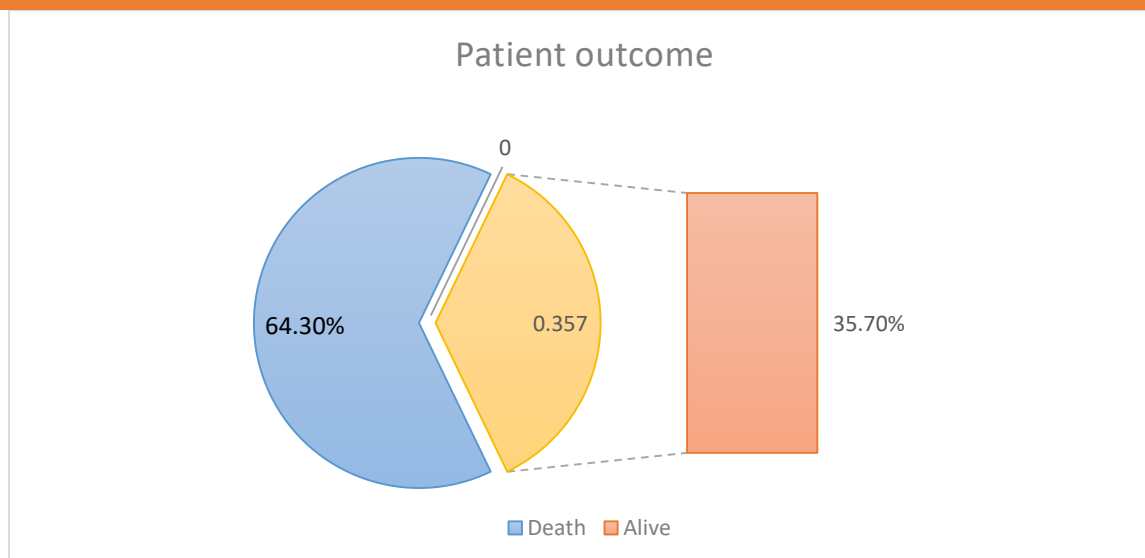


Figure 2: The outcome of COVID-19-infected patients admitted to the COVID-19 ICU Center of St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia, from June 8, 2020, to May 30, 2021

Clinical profile of study participants

Regarding the clinical profile of the studied patients, most, 206(75.7%) had some form of chronic comorbidity. Hypertension 109(40.1%), diabetes mellitus 90(33.1%) and chronic kidney disease 40(14.7%) were the most commonly documented comorbidity. The majority, 194(71.3%) of the patients were diagnosed with critical COVID-19 disease based on WHO classification, while a little more than a quarter, 75(27.6%), had a severe form of the disease (Table 1).

The median (interquartile range) time duration from onset of symptom(s) to hospital admission for the ICU-admitted patients was 5 (4–7) days, while the corresponding time duration from onset of symptom(s) to ICU admission was 6 (4–8) days. Similarly, the median (IQR) duration from

the onset of initial symptom(s) to intubation was 8 (6–10) days. Most, 246(90.8%) of the patients had a systolic blood pressure measuring ≥ 90 mm of Hg at the initial presentation to the ICU.

Regarding the vital signs recorded at arrival to the ICU, two hundred forty-six (90.8%) patients had a baseline systolic blood pressure measuring 90mm of Hg or more, while 153(56.3%) were tachycardic, having a pulse rate exceeding 100 beats per minute. Most (243, 89.3%) of the patients were tachypneic, with more than 20 breaths per minute. Meanwhile, about two-thirds, 171(62.9%), were hypothermic as they had an axillary temperature of less than 36.5 °C. Finally, hypoxemia (peripheral oxygen saturation <90%) was noted in 161 (59.2%) of the patients (Table 1).

Table 1: Clinical data of COVID-19 infected patients admitted to COVID-19 ICU SPHMMC, Addis Ababa, Ethiopia, from June 8, 2020, to May 30, 2021

Variable	Frequency	Percent (%)
Comorbidity		
No	66	24.3
Yes	206	75.7
Type of comorbidity		
Hypertension	109	40.1
Diabetes mellitus	90	33.1
Chronic kidney disease	40	14.7
Bronchial asthma	21	7.7
Malignancy	13	4.8
Retroviral infection	13	4.8
Stroke	10	3.7
Chronic obstructive lung disease	9	3.3
Tuberculosis	8	2.9
Other	18	6.6
Disease severity		
Mild	3	1.1
Severe	75	27.6
Critical	194	71.3
Chief complaints		
Cough	118	43.4
Shortness of breath	112	41.2
Myalgia	20	7.4
Fever	17	6.3
Diarrhea	3	1.1
Anosmia	2	0.7
Duration of symptoms in days(median+ IQR)	5	4–7
Duration from the onset of symptoms to ICU admission(median+ IQR)	6	4–8
Time interval before intubation in days (median+ IQR)	8	6–10
Systolic blood pressure (mmHg)		
<90	25	9.2
≥90	246	90.8
Pulse rate		
<60 beats per minute	4	1.5
60-100 beats per minute	115	42.3
>100 beats per minute	153	56.3
Respiratory rate		
<12 breaths per minute	1	0.4
12-20 breaths per minute	28	10.3
>20 breaths per minute	243	89.3
Axillary temperature (C)		
<36.5	171	62.9
36.5–37.5	69	25.4
>37.5	32	11.8
Oxygen saturation (%)		
<90	161	59.2
90–95	92	33.8
>95	19	7.0

Laboratory, complication, and management-related data

About the laboratory data of the studied patients, the majority (201, 73.9%) of the patients had leukocytosis, evidenced by a baseline white blood cell count of 11,000 cells/L. Of all, 105(38.6%) had a hemoglobin level of less than 12g/dL at initial presentation to the ICU, and 162(39.7%) of the patients had thrombocytopenia (platelet count <150,000).

On the other hand, all patients needed ventilator support, with 108(39.7%) and 164(60.3%) receiving noninvasive and invasive mechanical ventilator support, respectively. The median (IQR) days

on mechanical ventilation for the intubated patients was 14(6–20) days. Further, hospital-acquired pneumonia, septic shock, and acute kidney injury were the leading intra-facility complications, affecting 138 (50.7%), 117 (43%), and 110 (40.4%) of the patients, respectively. Moreover, neuromuscular blocking agents were administered to 28 (10.3%) of the patients, while renal replacement therapy and vasopressors were given to 58 (21.3%) and 111 (40.8%) of the patients. Finally, the overall median length of hospital stay was 17 days, with an interquartile range of 9–23.75 (Table 2).

Table 2: Laboratory, complication, and management-related data of COVID-19 infected patients admitted to COVID-19 ICU Center of St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia from June 8, 2020, to May 30, 2021

Variable	Frequency	Percent (%)
Leukocyte count(*10⁹/L)		
<11	71	26.1
≥11	201	73.9
Hemoglobin (g/dL)		
<12	105	38.6
≥12	167	61.4
Platelet (*10³)		
<150	162	39.7
≥150	210	60.3
Respiratory support		
Noninvasive ventilation	108	39.7
Invasive mechanical ventilation	164	60.3
Duration in mechanical ventilation in days (median + IQR) (n=164)	14	6–20
No	108	39.7
Yes	164	60.3
Type of in-ICU complication		
Hospital-acquired pneumonia	138	50.7
Septic shock	117	43.0
Acute kidney injury	110	40.4
Acute respiratory distress syndrome	63	23.2
Deep venous thrombosis	24	8.8
Pulmonary embolism	23	8.5
Ventilator-associated pneumonia	21	7.7
Disseminated intravascular coagulopathy	4	1.5
Adjuvant therapy given		
Neuromuscular blocking agent	28	10.3
Renal replacement therapy	58	21.3
Vasopressor	111	40.8
Length of hospital stay in days(In median + IQR)	17	9–23.75

Assessment of management outcome and associated factors with mortality

In the present study, about two-thirds (n=173) of all patients died, making a mortality rate of 64.3% (95CI: 58.6–70.1%). Among those who left the ICU alive, fifty (18.4%) were discharged successfully,

and forty-seven were transferred to other units (Figure 3). After a stepwise multivariate logistic analysis, the only variables that showed statistically significant association with mortality were intubation ARDS, pulmonary embolism, and vasopressor usage.

Table 3: Binary logistic regression result on ICU management, interventions and complications of patients with COVID-19 who were died in ICU after admission.

Variable	Number of deaths	Score	P-value	OR
Comorbidity	150(70%)	10.695	0.001	0.569
Intubated (1)	135(83%)	54.96	0.000	.362
Complications				
DVT	14(60.9%)	0.109	0.639	37.469
HAP	101(72%)	8.205	0.880	1.945
VAP	18(86%)	5.320	0.071	3.592
AKI	91(82%)	24.369	0.051	4.171
Pulmonary Embolism	22(96%)	9.172	0.001	13.804
DIC	4(100%)	2.454	0.172	
Septic shock	115(97%)	106.027	0.016	44.563
ARDS	26(93%)	12.468	0.000	9.188
Management				
Renal replacement Therapy	52(83%)	12.468	0.004	3.305
Vasopressor use	118(79.1%)	109.549	0.000	64.865
NMBA used	16(94%)	3.994	0.056	9.660
Antifungal Used	32(76.2%)	4.164	0.077	1.947

The result showed that mortality was significantly associated with (Table 4), intubation (AOR: 2.813; 95% CI: 1.176–6.731), pulmonary embolism (AOR: 36.702; 95% CI: 4.062–331.605), Vasopressor usage (AOR: 84.954; 95% CI: 23.413–308.254),

Dialysis or RRT (AOR: 4.191; 95% CI: 1.511–11.620) and ARDS (AOR: 21.149; 95% CI: 4.217–106.075).

Table 4. Results of multivariate logistic regression analysis of factors associated with mortality among COVID-19 infected patients admitted to COVID-19 ICU Center of St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia.

Factors	OR	S.E.	Wald	df	Sig.	AOR	95% C.I. for EXP(B)	
Intubation	1.034	.445	5.398	1	.020	2.813	1.176	6.731
Not intubated		.196	4.8	1	0.000	0.652		
Vasopressor use	3.603	1.123	10.292	1	.001	36.702	4.062	331.605
Vasopressors not used		.17	12.4	1	.000	0.547		
Pulmonary Embolism(PE)	2.07	.724	8.2	1	.004	7.9	1.9	32.93
Without PE		.186	17.776	1	0.00	0.456		
ARDS	1.433	.520	7.584	1	.006	4.191	1.511	11.620
Without ARDS		0.222	24.4	1	.000	0.335		

Note: Only variables with p-value <0.05 were shown here from multivariate logistic regression

4. Discussion

The COVID-19 pandemic continues as a significant global health threat, with a disproportionately high case-to-fatality ratio in settings with poor healthcare and limited resources.^(12,13) Identifying the factors for these poor short-term outcomes among hospitalized patients helps guide evidence-based interventions and mitigate the problem. Thus, this study was conducted to explore the mortality rate of COVID-19 disease and associated factors by analyzing patients admitted to the intensive care unit of St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia.

The current study showed a high mortality rate, with patients having a critical based on disease severity at presentation, comorbidity (diabetic mellitus, hypertension), septic shock, and intubated patients having an increased risk for death.

Our study demonstrated a comparable mortality rate of 64.3% to the earlier Ethiopian study conducted in north-central Ethiopia, where the overall prevalence of mortality was 67.4% among adult patients admitted to the ICU during the COVID-19 pandemic.⁽¹⁴⁾ Similarly, it was very close to the findings of Elhadi and other authors, who found an ICU mortality of 60.4% among critically ill COVID-19 patients in Libya.⁽¹⁵⁾ The above findings were slightly higher than the in-hospital mortality (48.2%) observed in a multicenter prospective cohort study conducted over multiple African nations.⁽¹⁶⁾

In contrast, it was much higher than the ICU and hospital mortality rates (20.2%) obtained in a tertiary care center in the United Arab Emirates.⁽¹⁷⁾ The present mortality rate was also much higher than the mortality rate documented among COVID-19 patients in Western Ethiopia, in which the mortality rate and incidence rate of

mortality were 16.04% and 14.1 per/1000, respectively.⁽¹⁸⁾ The in-hospital mortality reported in our cohort was higher than the one observed in Latin America (24.1%).⁽¹⁹⁾

Furthermore, it was also different from the reports of Dongelmans and others who documented crude hospital mortality of 29.9% and 32.0% during Wave 1 and Wave 2 among patients in the Netherlands set, respectively.⁽²⁰⁾ The overall hospital mortality noted in this study was more than thrice as much as that of the USA, Poland, Germany, and Sweden, being 19.8%⁽⁶⁾, 18.4%⁽²¹⁾, 17%⁽²²⁾, and 30.3%.⁽²³⁾ It was quite different from the Americans, who recorded mean ICU and hospital mortality rates of 18.4% and 23.8%, respectively.⁽²⁴⁾

Our study reported (Table 3) that 83% with (AOR 1.499; 95% CI 1.176–6.731) mortality rate among intubated patients who received IMV. This was comparable with earlier reports of 86–97% from the study done in Wuhan.^(25,26)

Vasopressor usage and pulmonary embolism were other significantly associated factors of this adverse outcome. This was also supported by the study done in South Africa, which demonstrated that the need for inotropes or vasopressors was associated with mortality (OR 6.36, 95% CI 1.89–21.36) and A. Alharthy et al., respectively.

Our result showed that 79% of deaths among patients who received vasopressors which was slightly lower than the study done in Atlanta, Georgia, United States, those patients with shock requiring vasopressors (90.3% vs 53.7%; $p < 0.001$) and higher percentage death was observed in patients receiving RRT, 83% as compared to the study done by⁽²⁹⁾ that compare mortality in patients with renal failure requiring renal replacement therapy (53.2% vs 18.4%; $p < 0.05$).

In this particular study, ARDS was another significantly associated complication with COVID-19 ICU mortality (AOR 21.14795%CI: 4.217-106.075), which was supported by the report done in a systematic review⁽³⁰⁾, ARDS mortality and ARDS (AOR 6.52, 95% CI 2.66–16.01). The wide CI interval in our case could be explained by a small sample size, which may need further study with a large sample size. These disparities across the different regions can be justified by differences in patient characteristics and socio-economic status, ICU admission thresholds, health care systems, and availability of variable numbers of ICU beds.⁽¹⁴⁾ Multiple possible explanations can be enumerated for the high mortality noted in this study.

In part, the high critical care mortality might be due to the scarcity of essential resources of care, including steroid therapy, in African countries such as Ethiopia.⁽¹⁶⁾ Most of the studied patients were critically ill at admission to higher care, with various comorbidities. This high mortality might be due to medical complications such as acute respiratory distress syndrome, septic shock, hospital-acquired pneumonia, ventilation-acquired pneumonia, and high intubation rate, which were shown to be strongly associated with mortality.

Furthermore, this study was conducted during the period when COVID-19 cases were intense in Ethiopia when many patients could not be admitted properly and promptly to the ICU due to a shortage of resources and a lack of ICU beds on the background of a high patient flow, which could lead to delay in patient care and subsequent poor outcome. An additional likely explanation is the scarcity of healthcare supplies and inadequate training of healthcare practitioners, as noted in other similar settings.⁽¹⁵⁾ In this regard, better preparedness and state-level control of the surge in COVID-19 infections were

quoted to be the possible reasons for better outcomes in affluent countries.⁽²⁴⁾

In this particular study, the presence of a comorbid medical condition, intubation, higher length of stay, and patients who develop ARDS were independently associated with the risk of death from COVID-19 disease. These findings were supported by several studies, including the works of Jasparda et al.⁽³¹⁾, Mezgebu et al.⁽³²⁾, and Kaso et al.⁽³³⁾ that showed an independent association between the presence of comorbidity and poor short-term outcomes among patients with COVID-19. Again, this study showed that patients with critical disease at admission were more likely to die in comparison to patients who were not critical in addition to the hospital, and this is supported by the study done by Elhadi et al. and Oliveira et al., which showed an independent association of disease severity and death.^(6,15) Additionally, a systematic review by Taylor et al. supports this finding.⁽³⁴⁾

Limitations

Some important variables that can potentially affect mortality were not consistently available for all patients, and hence, they were not included in the final model. These included neuromuscular blocker effects, the use of systemic corticosteroids, prone positioning, and coagulation profiles. The study was conducted at a single center, and thus, the findings may not be generalizable.

5. Conclusion

This study showed a high mortality rate in the study setting, claiming the lives of two-thirds of the ICU-admitted patients. Patients with critical disease severity, comorbidity, intubation, and those patients who were who developed ARDS and septic shock were at increased risk for death.

Implications of the study

The study tried to touch a timely clinical area, where there is a scarcity of data on African patients with COVID-19 that describes outcomes along with contributing factors during the COVID-19 crisis.

Abbreviation

ARDS: Acute Respiratory Distress Syndrome
CI-Confidence Interval
COVID-19-CoronaVirus 2019
EMCCR- Emergency Medicine and Critical Care Resident
HDU-High Dependence Unit
ICU-Intensive Care Unit
IQR-Interquartile Range
MERS-Middle East Respiratory Syndrome
MV-Mechanical Ventilation
OR-Odd Ratio
RT-PCR-Real-Time Reverse Transcriptase Polymerase Chain Reaction
SARS-COV2- Severe Acute Respiratory Syndrome Corona Virus 2
SPHMMC-Saint Paul's Hospital Millennium Medical College
SPSS-Statistical Package for Social Science
WHO-World Health Organization

Author Contributions

All authors made substantial contributions to the conception, design, acquisition of data, analysis, interpretation of data, drafting of the manuscript, and the critical review of the draft

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Conflict of Interest

The authors declare that they have no competing interests

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References

- 1) Zhan Z, Yang X, Du H, Zhang C, Song Y, Ran X, et al. Early improvement of acute respiratory distress syndrome in patients with COVID-19 in the intensive care unit: retrospective analysis. *JMIR Public Heal Surveill.* 2021;7(3):1.
- 2) Kebede Y, Yitayih Y, Birhanu Z, Mekonen S, Ambelu A. Knowledge, perceptions and preventive practices towards COVID-19 early in the outbreak among Jimma university medical center visitors, Southwest Ethiopia. *PloS one.* 2020; 15: e0233744.
- 3) Mungroo MR, Khan NA, Siddiqui R. The increasing importance of the novel Coronavirus. *Hosp Pract (1995)* [Internet]. 2021;49(1):1–11. Available from: <https://doi.org/10.1080/21548331.2020.1828888>
- 4) Pijls BG, Jolani S, Atherley A, Derckx RT, Dijkstra JIR, Franssen GHL, et al. Demographic risk factors for COVID-19 infection, severity, ICU admission and death: A meta-analysis of 59 studies. *BMJ Open.* 2021;11(1):1–10.
- 5) Akande O, Akande T. COVID-19 pandemic: A global health burden. *Niger Postgrad Med J.* 2020;27(3):147.
- 6) Id EO, Parikh A, Lopez-ruiz A, Carrilo M, Goldberg J, Cearras M, et al. ICU outcomes and survival in patients with severe COVID-

- 19 in the largest health care system in central Florida. 2021;131:1–14. Available from: <http://dx.doi.org/10.1371/journal.pone.0249038>
- 7) WHO. Clinical management Clinical management Living guidance COVID-19. 2021B. 2021;(January):16–44.
 - 8) Liu D, Wang Y, Wang J, Liu J, Yue Y, Liu W, et al. Characteristics and outcomes of a sample of patients with COVID-19 identified through social media in Wuhan, China: Observational study. *J Med Internet Res*. 2020;22(8):1–15.
 - 9) Li J, Chen Z, Nie Y, Ma Y, Guo Q, Dai X. Identification of symptoms prognostic of COVID-19 severity: Multivariate data analysis of a case series in Henan Province. *J Med Internet Res*. 2020;22(6):1–11.
 - 10) Wander PL, Orlov M, Merel SE, Enquobahrie DA. Risk factors for severe COVID-19 illness in healthcare workers: Too many unknowns. *Infect Control Hosp Epidemiol*. 2020;41(11):1369–70.
 - 11) Afriyie-Mensah J, Aboagye ET, Ganu VJ, Bondzi S, Tetteh D, Kwarteng E, et al. Clinical and therapeutic outcomes of covid-19 intensive care units (Icu) patients: A retrospective study in ghana. *Pan Afr Med J*. 2021;38.
 - 12) Bwire G, Ario AR, Eyu P, Ocom F, Wamala JF, Kusi KA, et al. The COVID-19 pandemic in the African continent. *BMC Med*. 2022;20(1):1–23.
 - 13) Nigussie H. The Coronavirus Intervention in Ethiopia and the Challenges for Implementation. *Front Commun*. 2021;6(May):1–12.
 - 14) Seid S, Adane H, Mekete G. Patterns of presentation, prevalence and associated factors of mortality in ICU among adult patients during the pandemic of COVID 19: A retrospective cross-sectional study. *Ann Med Surg*. 2022;77(April):103618.
 - 15) Elhadi M, Alsoufi A, Abusalama A, Alkaseek A, Abdeewi S, Yahya M, et al. Epidemiology, outcomes, and utilization of intensive care unit resources for critically ill COVID-19 patients in Libya: A prospective multicenter cohort study. *PLoS One* [Internet]. 2021;16(4 April):1–25. Available from: <http://dx.doi.org/10.1371/journal.pone.0251085>
 - 16) Biccard BM, Gopalan PD, Miller M, Michell WL, Thomson D, Ademuyiwa A, et al. Patient care and clinical outcomes for patients with COVID-19 infection admitted to African high-care or intensive care units (ACCCOS): a multicentre, prospective, observational cohort study. *Lancet*. 2021;397(10288):1885–94.
 - 17) Ismail K, Bensasi H, Taha A, Nazir A, Abdelkhalek M, Mohamed W, et al. Characteristics and outcome of critically ill patients with coronavirus disease-2019 (COVID-19) pneumonia admitted to a tertiary care center in the United Arab Emirates during the first wave of the SARS-CoV-2 pandemic. A retrospective analysis. *PLoS One* [Internet]. 2021;16(10 October):5–17. Available from: <http://dx.doi.org/10.1371/journal.pone.0251687>
 - 18) Tsegaye R, Shibiru T, Turi E, Bayisa L, Id GF. Incidence and predictors of death from COVID-19 among patients admitted to treatment center of Wollega University Referral Hospital , Western Ethiopia : A retrospective cohort study. 2022;1–13.
 - 19) Reyes LF, Murthy S, Garcia-Gallo E, Irvine M, Merson L, Martin-Loeches I, et al. Clinical characteristics, risk factors and outcomes in patients with severe COVID-19 registered in the International Severe Acute Respiratory and Emerging Infection Consortium WHO clinical characterisation protocol: a prospective, multinational, multicent. *ERJ Open Res*. 2022;8(1).
 - 20) Dongelmans DA, Termorshuizen F, Brinkman S, Bakhshi-Raiez F, Arbous MS, de Lange DW, et al. Characteristics and outcome of COVID-19 patients admitted to the ICU: a nationwide cohort study on the comparison between the first and the consecutive upsurges of the second wave of the COVID-19 pandemic in the Netherlands.

- Ann Intensive Care. 2022;12(1).
- 21) Gujski M, Jankowski M, Rabczenko D, Goryński P, Juszczak G. Characteristics and Clinical Outcomes of 116,539 Patients Hospitalized with COVID-19—Poland, March–December 2020. *Viruses*. 2021 Jul;13(8):1458.
 - 22) Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel Coronavirus COVID- 19 . The COVID-19 resource centre is hosted on Elsevier Connect , the company ' s public news and information . 2020;(January):2020–2.
 - 23) Larsson E, Brattström O, Agvald-Öhman C, Grip J, Campoccia Jalde F, Strålin K, et al. Characteristics and outcomes of patients with COVID-19 admitted to ICU in a tertiary hospital in Stockholm, Sweden. *Acta Anaesthesiol Scand*. 2021;65(1):76–81.
 - 24) Fadel FA, Al-Jaghbeer M, Kumar S, Griffiths L, Wang X, Han X, et al. Clinical characteristics and outcomes of critically ill patients with COVID-19 in Northeast Ohio: Low mortality and length of stay. *Acute Crit Care*. 2020;35(4):242–8.
 - 25) Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical Course and Risk Factors for Mortality of Adult Inpatients with COVID-19 in Wuhan. *Lancet*. 2020;395(January):1054–62.
 - 26) Ramanathan K, Antognini D, Combes A, Paden M, Zakhary B, Ogino M, et al. Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel Coronavirus COVID- research that is available on the COVID-19 resource centre - including this for unrestricted research re-use a. 2020;(January):19–21.
 - 27) Zhou F, Yu T, Du R, et al (2020) Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet*. 395:1054–1062', no date.
 - 28) Yang X, Yu Y, Xu J, et al (2020) Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study. *Lancet Respir Med* 8:475–481', no date;
 - 29) Auld SC, Caridi-Scheible M, Blum JM, Robichaux C, Kraft C, Jacob JT, et al. ICU and Ventilator Mortality among Critically Ill Adults with Coronavirus Disease 2019*. *Crit Care Med*. 2020;E799–804.
 - 30) Chang R, Elhusseiny KM, Yeh YC, Sun WZ. COVID-19 ICU and mechanical ventilation patient characteristics and outcomes—A systematic review and meta-analysis. *PLoS One* [Internet]. 2021;16(2 February):1–16. Available from: <http://dx.doi.org/10.1371/journal.pone.0246318>
 - 31) Jaspard M, Sow MS, Juchet S, Dienderé E, Serra B, Kojan R, et al. Clinical presentation, outcomes and factors associated with mortality: A prospective study from three COVID-19 referral care centres in West Africa. *Int J Infect Dis*. 2021;108:45–52.
 - 32) Mezgebu AT, Sibhat MM, Getnet MT, Gebeyehu T, Zewde W, Id C, et al. Risk factors of early mortality among COVID- 19 deceased patients in Addis Ababa COVID-. 2022;261:1–13.
 - 33) Kaso AW, Hareru HE, Kaso T, Agero G. Factors Associated with Poor Treatment Outcome among Hospitalized COVID-19 Patients in South Central, Ethiopia. *Biomed Res Int*. 2022;2022.
 - 34) Taylor EH, Marson EJ, Elhadi M, Macleod KDM, Yu YC, Davids R, et al. Factors associated with mortality in patients with COVID-19 admitted to intensive care: a systematic review and meta-analysis. *Anaesthesia*. 2021;76(9):1224–32.

Rising Epidemic of Road Traffic Injuries in Ethiopia: A Systematic Review of Available Literature

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ABSTRACT

Introduction: Road traffic injury is a silent epidemic causing death in low and middle-income countries, including Ethiopia. In this systematic review, we seek to analyze road traffic injury characteristics in Ethiopia from available literatures.

Methods: An electronic search for road traffic injuries was conducted on peer-reviewed literature and websites from 1965 to 2022. A systematic narrative summary was done on the literature involving study design, study setting, topic focus, results, and other study variables. Identified themes were analyzed.

Result: A total of 451 literature search results were found in the specified period, with 33 of the studies meeting the inclusion criteria. The majority of studies (28/33) were hospital-based. In all reports, a higher proportion of injury was found in economically active age groups, with an age range of 10-50, with the highest proportion of 87.9%. Most of the studies reported a higher proportion (2/3rd) of injuries among male patients. One study (31) gave occupational details of the patients. The majority of the road traffic victims were daily laborers 41.3%. The proportion of pedestrians affected in Addis Ababa was more than in the outskirts, ranging from 62.6-93 % (11, 22, 23), while in the regional hospitals' report, the range was from 33.4-35.4. In regards to the causes of the accidents, indicated that 84% were due to driver error. After 2004, the incidence of car crashes rapidly increased. In central Ethiopia, the number of crashes, fatal accidents, and non-fatal road traffic collisions had increased by more than double in a six-year period.

Conclusion: This literature review has revealed the increasing burden of road traffic accidents in Ethiopia. People of low socioeconomic status, young age, male sex, and productive communities are disproportionately affected. Urgent action, focusing on human factors, should be taken to prevent road traffic injuries in Ethiopia.

Keywords Road traffic injury, increasing pattern, Ethiopia

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1. Introduction

A silent epidemic of death is occurring in low and middle-income countries due to road traffic injuries. Communicable diseases like Ebola are not silently tolerated like RTI's where the people, governments, and media react, but that is not the case with RTI, despite killing more people. RTI is one of the leading causes of death and life-long disability globally.^(1, 2) According to the World Health Organization (WHO) (2004), globally, more than 1.23 million people die due to RTI every year, while the number of injured is as high as 50 million.⁽³⁾ Recent estimates in 2013 revealed that annual deaths due to RTI have risen to 1.4 million.⁽⁴⁾ After 1996, the annual number of deaths from RTI worldwide was estimated to rise by 10%. The rise was mostly assumed to be in low and middle-income countries. If the trend in RTI continues without intervention, it is estimated that road traffic deaths and injuries could rise by 65% by 2020 and be the third leading cause of mortality from its current place of eighth.^(3, 5, 6)

In 2013, over 85% of all deaths and 90% of disability-adjusted life years (DALYs) were lost due to road traffic injuries in low- and middle-income countries, which have only 47% of the world's registered vehicles.^(2,4) Furthermore, globally, road traffic injuries are reported as the leading cause of death among young people aged 15–29 years and are among the top three causes of mortality among people aged 15–44 years.⁽¹⁾

In Africa, the number of road traffic injuries and deaths has been increasing over the last three decades.^(7, 8) It appears that the volume of vehicles and road users is growing due to rapid urbanization and motorization. According to the 2015 Global Status Report on Road Safety, the WHO African Region had the highest rate of fatalities from road traffic injuries worldwide, at 26.6 per 100,000 population for the year 2013.⁽¹⁾

Ethiopia, having less than one million vehicles, is often mentioned for its high rate of fatalities due to traffic accidents. The WHO's 2009 global status report on road safety described the fatality rate per 10,000 vehicles in the country as 114, which was higher than the sub-Saharan average of 60.⁽⁷⁾ This number is declining, according to the Road Transport Authority report, which reports 62 per 10,000 vehicles in 2015/2016. But, the actual number of deaths is increasing.⁽⁹⁾

It is imperative that all stakeholders, including policymakers, work together to reduce the burden of this preventable problem at various levels. Empirical evidence is needed to formulate appropriate interventions. Therefore, in this paper, the existing literature in the country is systematically reviewed to describe the epidemiology, trends, and associated mortality related to RTI.

2. Methods and Materials

Data Sources: To identify all studies that investigated road traffic accidents, a search of the electronic database containing keywords such as "road traffic," "injury," "accident," and "trauma" was conducted. To identify peer-reviewed English language literature from 1965 to 2015, the search engines PubMed, Google Scholar, and Embase were used. In addition, the reference lists from relevant studies were examined to identify older papers in particular.

Inclusion and exclusion criteria: This review included literature on road traffic accidents and trauma in general from Ethiopia. There were no restrictions on study setting, demography, the number of study participants, or study design. After reading the full text and abstracts by two reviewers, trauma studies that did not include road traffic injuries, abstracts without full text, editorials, and letters were excluded.

Data Extraction: After reviewing the selected studies, data extraction was done on a standard data extraction form for the selected variables, which

included the study design, topic focus, methodology, study setting, and their main results (socio-demographics, victim affected, type of vehicle, magnitude, and trend of road traffic injuries).

Analysis: The identified studies were a prospective and retrospective review of data that were different in study focus, study design, and outcome characteristics, which were not suitable for Meta-analysis. A systematic summary and grouping of all identified studies with their main results was performed, and a thematic analysis was performed. Accordingly, themes involving socio-demographic patterns, temporal characteristics, and the magnitude of RTI compared to other injuries, victims affected, types of vehicles and circumstances of injury, errors leading to accidents, and trends of RTI were identified. Qualitative and descriptive quantitative analysis was done for identified themes.

3. Result

Identified Studies

A total of twenty-eight studies have been identified that meet the inclusion criteria spanning five decades. Most of the older studies involved general injuries, but in the past two decades, more studies have focused on road traffic injuries. The majority of studies (23/28) were hospital-based, 12 prospective and 11 retrospective. Among 28 articles that met inclusion criteria, 17 investigated the magnitude and pattern of injuries within hospitalized patients, including RTI. Four studies looked specifically into RTI in Emergency Departments, with one describing features of imaging in RTI patients. There were 4 studies investigating patterns of RTI in different parts of the country utilizing police reports. Two studies conducted mortality audits following trauma, and only one study was on community-based injuries.

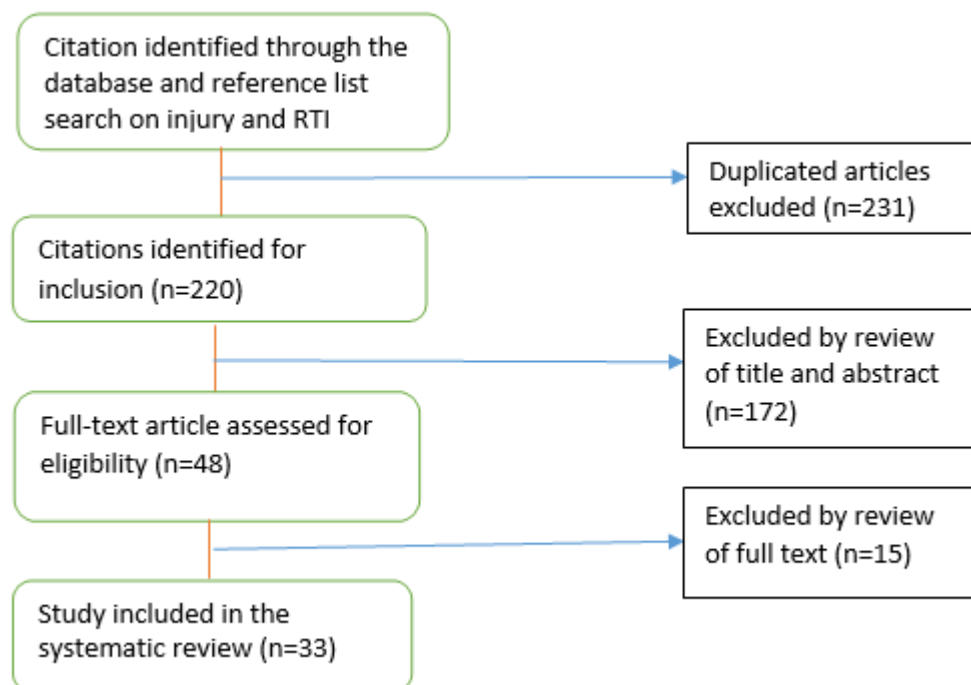


Fig 1: Selection process for the systematic review

Socio-demographic pattern

Age: Two of the 28 studies reported on injuries in children up to 15 years of age,^(24,25) twenty-four

studies examined injuries in all age groups [10,11,12,13,14,16,17,18,19,21,22,23,35,36,37,3,26,27,30,32,33,(1,2),3,4,5] a

mong which two were autopsy studies.^(17,18) Eight studies^(15, 20, 28, 29, 31, and 34) reported only an adult population. Of the 26 studies where all age groups were included, a higher proportion of injury was found in economically active age groups. The highest proportion described by Feleke et al., 87.9%, was in the age range of 10-50, among which the 10-30 age group accounted for 59.5%.⁽³²⁾

Among RTI studies, Fekade Assefa has shown the mean age of drivers involved in accidents to have been 32.9, while the majority of accidents occurred in the age group of 19-30 (51.7%) and 31-50(40.3%). The highest number of crashes (fatal, injury, and property damage) involved drivers in the 18–30-year-old age group (45%) and in the 31-50-year-old age group (35%). In an analysis of 12,140 clashes and 14,540 fatalities by Getu Tulu et al., the commonest driver age was 18-30=49.46%, followed by 31-50=45.7 %, >51=6.29% and age-<18=2.81.^(37, 2)

Sex: Most of the studies reported a higher proportion (Mostly 2/3rd) of injuries among males. The highest proportion of males (86.4%) was described by Bekelcho et al in a hospital series, while among the RTI police series, Fisseha et al. reported the highest proportion of 80%.⁽²⁾

Occupation and residence: Among studies that focused on RTI, two ^(3, 4, 5, 32) gave details of occupations, demonstrating that the majority of road traffic victims were daily laborers (41.3%), followed by students (12.2 %). Another study described that 70% of RTI victims were from urban areas.⁽³⁾

Temporal Characteristics

Among 11 studies focused on RTI, only five investigated temporal characteristics within the year. Studies^(2, 3, 35) showed the majority of the accidents

occurred from June to September in the rainy season, but the other two^(34, 38) reported uniform distribution throughout the year, with a small peak in January

The magnitude of RTI compared to other injuries

Twenty-six studies analyzed all injuries and showed the relative magnitude of RTI. The contribution of RTI varies from 2.5-62.5%, with a weighted pool of 33.16%, while 21/24(87.5%) studies showed RTI was predominant. In these ranges, the lowest proportion was in a community-based injury survey in Jima zone ⁽¹⁴⁾, and the highest proportion of 62.5% was from the Wolaita Sodo hospital study.⁽³²⁾ See Table 1 below.

Victims affected by the RTI

Among all injury series, 10 studies showed the types of victims involved in the accident. It was observed the proportion of pedestrians compared to passengers was different in Addis Ababa and regional hospitals. The proportion of pedestrians affected in Addis Ababa was greater, ranging from 62.6-93 %^(11, 22, 23, 5 2), while in the regional hospitals' report, the range was from 33.4-35.4.^(10, 12) Conversely, in the report of regional hospitals, passengers were primarily affected, with a range of 45.8% to 59.3 %.^(3, 10, 12) In one report,⁽³⁵⁾ a higher proportion of drivers (20.5%) were affected.

Two of four traffic police report analyses described the victims involved in RTI. Table 2 shows that data pooled and analyzed from the whole country, central Ethiopia, and Amhara region showed pedestrian mortality of 59.9%, 53.5%, and 35.5%, respectively. Similar to Addis Ababa, in the Amhara region, a detailed analysis of RTI in cities Gonder, Bahrdar, and Dessie showed the pattern was more pedestrian predominant.⁽³⁵⁾

Table 1: Percentage distribution of victims affected and RTI magnitude in Ethiopia, 2017

Principal investigator	Total No Of Injury	RTI	Situation of Injured Pedestrian	Passenger	Driver/Assistant
Berhanu N.	1277	416(32.6)	139(33.4)	211(50.7)	NA
Mulat T.	3822	1578(41.3)	1457(93)	NA	NA
Mensur O.	1982	289(14.6)	104(35.4)	172(59.3)	NA
Kifle W.	1102	334(30.3)	NA	NA	NA
Kifle W.	3909	98(2.5)	NA	NA	NA
Zuriyash M.	328	161(49.1)	NA	NA	NA
Alemu MH.	120	56(46.7)	NA	NA	NA
Tufa G.	90	34(37.9)	NA	NA	NA
F.Tsegaye	2107	784(37.2)	NA	NA	NA
Munayazewal D.	1487	639(43.0)	NA	NA	NA
Daniel A	422	202(49.7)	NA	NA	NA
Elias A.	507	211(41.6)	NA	NA	NA
Ahmed E.	7151	2793(39.1)	2458(88)	335(12)	NA
Lambisso W.	3687	1733(47.0)	1462(80)	NA	NA
Fisseha T.	343	93(27.1)	NA	NA	NA
Gedlu E.	313	45(14.4)	NA	NA	NA
Isabel	47	17(36.5)	NA	NA	NA
Hagos	385	127(32.9)	NA	NA	NA
Finot D	84	31(37)	NA	NA	NA
B.Tadesse	321	123(38.3)	NA	NA	NA
Fasika	600	85(14.1)	NA	NA	NA
Seid M.	690	250(36.2)	NA	NA	NA
Feleke HM	416	240(62.5)	81(34)	110(45.8)	49(20.5)
Debrework	230	78(33.9)	NA	NA	NA
Bekelcho et al.	8458	8458(100)	6039 (71.4)	1632 (19.3)	787(9.3)
S. Getachew	779	779(100)	514	NA	NA
Ashenafi H.	327	327(100)	73(25.5%)	117(40.9)	96(33.6)
Duko et al.	350	143 (40.9%)	NA	NA	NA
Amare Demisse	381	381(100)	NA	NA	NA

Types of vehicles and circumstances of injury

A report from Amhara Police records⁽³⁵⁾ showed fire trucks (51%) to be the predominant cause of RTI, followed by long-distance buses (34.5%). A study at Tikur Anbessa Specialized Hospital (31) also showed similar findings where trucks, minibusses, and long-distance buses contributed 30.8%, 30.7%, and 10.9%, respectively. A recent study from Wolaita Hospital showed a predominance of motorcycles (31%) and Bajaj (14.2%), while traditional vehicles accounted for the following: Isuzu truck (21.2%), Minibus (10.8%), long-dis-

tance bus (9.6%). A study conducted in Addis Ababa city revealed that a substantial number of cases, amounting to 2608 incidents (30.8%), were attributed to public transport.⁽²⁾ In contrast, a study conducted at Hawassa University demonstrated a higher incidence of crashes associated with motorcycles.⁽⁴⁾

An Article from TASH⁽³¹⁾ described the circumstances of the injury. The most common circumstances were crossing the road (36.1%), sidewalk strikes (22.6%), and falls from vehicles (18.7%), followed by collisions and rolling in 17.4%. Analysis of

police reports from the Amhara region⁽³⁵⁾ also described vehicle-pedestrian collisions contributing to 54.5% of all accidents.

Errors leading to accidents

Two articles from the police data pool have analyzed common errors associated with RTIs. The first one⁽³⁵⁾ indicated that 84% was following drivers' error, which further detailed into 32.1% was due to failure to give priority to pedestrians, 31.5% due to abnormal speed, 10.7% was due to driving on the wrong side, and 4.1% due to not keeping an appropriate distance. The other article by Fekadu Assefa et al.⁽³⁶⁾ described driving at midnight, driving above speed limits, failing to give priority to other vehicles and pedestrians, and vehicular technical problems as determinants of fatality. A study conducted in Addis Ababa elucidated that the predominant causes of incidents were the movement of pedestrians crossing, accounting for 4469 occurrences (52.8%), followed by issues related to the division of roads and roundabouts, with 3555 incidents (42.0%). Additionally, the study identified the types of road as contributing significantly to

the occurrences, with 5917 cases (70.0%) associated with this factor.⁽²⁾

Trends of RTI

Analysis of police reports from 1996-2011 in the Amhara region showed that the pattern of vehicle crashes was relatively low, with a steep increase between 1996 and 2004. Beyond 2004, the crash pattern continued increasing.⁽³⁸⁾ Similarly, another study in the central part of Ethiopia⁽³⁶⁾ showed that the number of crashes were 257 in 2008/2009, which was more than doubled or increased to 636 or 147.4% rise after 6 years in 2011/2012. During this period, the number of fatal accidents doubled from 42 to 96 (128.5% rise), and non-fatal RTCs increased from 215 to 540.

The Ethiopian road safety summary for the last six years also showed that the trend is worsening. The total amount of deaths registered nationally in 2010/11 was 2541, and in 2015/16, 4312, which is a 69.7% rise. Table 2 shows detailed trend analysis and traffic data reports

Table 2: Traffic Police data analyzed from Ethiopia and two other regions in the country

Author and Period of RTI Data	Getu Tulu 2005 -2011.	Fisseha 2007-2011.	Fekade Assefa etal 2007 - 2012.	Tariku Bekelcho 2017-2020
Region	Whole Country	Amhara Region	Central Ethiopia (Dukem to Adama)	Addis Ababa
Magnitude				
Fatal injury	14,545(22%)	2761(41.51%)	515(29.5%)	1274(14.7%)
Non-Fatal Injury	51,570(78%)	3890(58.48%)	1230(70.5%)	7,184(85.3%)
Total	66,115(100%)	6651(100%)	1745(100%)	8458(100%)
Injury /Drivers age	(Fatal Injuries)		(All Injuries)	(All Injuries)
<18	342(2.8%)	NA	25(1.1%)	126 (1.5%)
18-30	6005(49.46%)		1175(51.7%)	3893 (46.0%)
31-50	3853(31.73%)		916(40.3%)	3868 (45.7%)
>51	764(6.29)		158(69%)	571 (6.8%)
Fatal Injury/type of victims				
Pedestrian	7770(53.54%)	966(35%)	307(59.9%)	8458(100%)
Passengers	5702(39.21%)	1560(56.5%)	145 (28.2%)	6039 (71.4%)
Drivers	1070(7.35%)	235(8.5%)	63(12.2%)	1,632(19.3%)
	14542 (1000)	2761(100)	515(100)	1,087(9.3%)
Reasons for accident				
Driver error	NA	83.8%	NA	NA
Vehicle problem		7.6%		
Pedestrian error		7.65		
Environment		1%		

NA=not applicable

4. Discussion

This study has systematically analyzed existing data on RTI in Ethiopia from hospital-based studies, community surveys, and police reports. Most studies described RTI as the most prevalent cause of injury of all trauma. This feature was also described in another systematic survey.⁽³⁷⁾ This phenomenon is not exclusive to Ethiopia but also in other developing countries, where RTI is a primary contributor to morbidity, mortality, and disability.⁽⁶⁾

In this study, the most vulnerable groups were the young and productive. The largest proportion in one study were between the ages of 10 and 30, contributing 57.8%, and between the ages of 10 and 50, accounting for 87.9%. Global reports describe similar phenomena, and the youngest population affected was mostly from low—and middle-income countries.⁽⁶⁾ Hence, it is becoming a huge burden to society that RTIs are affecting the most productive age group.

Previously, it was expressed that the highest burden of injuries and fatalities was borne disproportionately by poor people in developing countries, such as pedestrians, passengers of buses and minibusses, and cyclists.⁽⁵⁰⁾ This systematic analysis also showed pedestrians and passengers were the main victims of RTI in Ethiopia. It was also shown that the majority of victims in bigger cities were pedestrians, while in the regions or regional hospitals, passengers were involved more frequently. Previously, in most studies in Ethiopia, the proportion of drivers involved in RTI was very low, but recently, one study showed that the involvement of drivers or assistant drivers was unusually high (20.5%). This might be due to a wider usage of motorcycles and tricycles (Bajaj) in rural areas. In fact, the above study showed that the contribution of motorcycles (31%) and Bajaj (14.2%) to RTIs is significantly increasing in the regions. This was not described in previous studies to this magnitude.⁽³⁷⁾

Besides, we assume that pedestrians and passengers are from economically disadvantaged groups. Many studies did not give a detailed analysis of the socioeconomic status of the victims. Nonetheless, one study⁽³⁷⁾ showed that Daily laborers and students were involved in 41.3 % and 12.2% of RTIs, respectively. Studies have shown that drivers' age is strongly associated with magnitude and fatality of motor cycle accidents.⁽⁵⁰⁾ In our analysis, most RTIs were associated with driver errors such as inappropriate speed and not giving priority to pedestrians. Furthermore, a large proportion of injuries occurred in the younger age group, though one has to know how much the real proportion of youngsters are on the road compared to the other age group. There are many features that are consistent in most studies, but there are also peculiar features that depend on the study time and place.

The study describes human, vehicle, and environment related factors. Most of the data is from hospital registries, though there were a few police data reports involved. This analysis has shown that beyond 2004, crash incidents continued to increase. The number of crashes, fatal accidents, and non-fatal road traffic crashes increased by more than double in a six-year period. This demonstrates that urgent action should be taken to prevent death, disability, economic loss, and social problems that arise from the devastating effect of road traffic injury, with an emphasis on the human factors contributing to the rise in RTIs.

Abbreviation

RTC: Road Traffic Collision

RTI: Road Traffic Injury

WHO: World Health Organization

Author Contributions

AA-MS: - conception and design of the study, analysis and interpretation of data, drafting the manuscript.

MK-LB: - acquisition of data, critical revision of the manuscript for important intellectual content,

analysis and interpretation of data, final approval of the version to be published

WW: - critical revision of the manuscript, supervision of the research.

All authors have read and approved the final manuscript. Each author has participated sufficiently in the work to take public responsibility for the content. The order of authorship reflects the relative contribution of each author

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References

- 1) Shewade HD, Govindarajan S, Thekkur P, Palanivel C, Muthaiah M, Kumar AM V, et al. Public Health Action. 2016;l(4):242–6.
- 2) Bekelcho T, Olani AB, Woldemeskel A, Alemayehu M, Guta G. Identification of determinant factors for crash severity levels occurred in Addis Ababa City, Ethiopia, from 2017 to 2020: using ordinal logistic regression model approach. BMC Public Health [Internet]. 2023;23(1):1–15. Available from: <https://doi.org/10.1186/s12889-023-16785-3>
- 3) Woyessa AH, Heyi WD, Ture NH, Moti BK. Patterns of road traffic accident, nature of related injuries, and post-crash outcome determinants in western Ethiopia - a hospital based study. African J Emerg Med [Internet]. 2021;11(1):123–31. Available from: <https://doi.org/10.1016/j.afjem.2020.09.008>
- 4) Duko B, Tadesse F, Oltaye Z. Patterns of road traffic injury and potential consequences among patients visiting Hawassa University Comprehensive Specialized Hospital, Hawassa, Ethiopia. BMC Res Notes [Internet]. 2019;12(1):10–3. Available from: <https://doi.org/10.1186/s13104-019-4192-5>
- 5) Demisse A, Shore H, Ayana GM, Negash B, Raru TB, Merga BT, et al. Magnitude of death and associated factors among road traffic injury victims admitted to emergency outpatient departments of public and private hospitals at Adama Town, East Shewa Zone, Ethiopia. SAGE Open Med. 2021;9.
- 6) Global status report on road safety 2015. Geneva: World Health Organization; 2015.
- 7) Global status report on road safety 2013: supporting a decade of action. Geneva: World Health Organization; 2013
- 8) WHO: World Report on Road Traffic Injury Prevention. Geneva: WHO; 2004. M. Peden
- 9) GBD 2013 Mortality and Causes of Death Collaborators. Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet. 2015 Jan 10;385(9963):117–71.[http://dx.doi.org/10.1016/S0140-6736\(14\)61682-2](http://dx.doi.org/10.1016/S0140-6736(14)61682-2) pmid: 25530442
- 10) Murray CJ, et al., Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet, 2012. 380(9859): p. 2197–223. doi:

- 10.1016/S0140-6736(12)61689-4.
pmid:23245608
- 11) Murray CJ, Lopez AD. The global burden of disease and injury series, volume 1: a comprehensive assessment of mortality and disability from diseases, injuries, and risk factors in 1990 and projected to 2020. Cambridge, MA, 1996.
 - 12) Status report on road safety in countries of the WHO African Region 2009. Brazzaville: WHO Regional Office for Africa; 2010
 - 13) Khayesi M, Peden M. Road safety in Africa. BMJ 2005;331: 710-1.
 - 14) 2015/16 Ethiopian Federal Ministry of Transport report
 - 15) Berhanu Nega, Abebe G.Mariam, Zerihun Tadesse, A two years review of injury related Admission to Jimma Hospital, South West Ethiopia, *Ethiopian Journal of health sciences* 1998; 8(2):83-88
 - 16) Mulat Taye, Tadios Munie, Trauma registry in Tikur Anbessa Hospital, Addis Ababa, Ethiopia, *Ethiop Med J*, 2003 Jul;41(3):221-226 10
 - 17) Mensur Osman; Yigzaw Kebede; Sissay Anberbir, Magnitude and pattern of injuries in North Gondar administrative zone, north-west Ethiopia, *Ethiop Med J*, 2003; 41(3):213-220
 - 18) Kifle Woldemichael, Negalign Berhanu, Magnitude and pattern of injuries in Jimma university specialized hospital, South West Ethiopia, *Ethiopian Journal of health sciences* 2011; 21(3): 155-166
 - 19) Kifle Woldemichael, Fassil Tessema, Lelisa Sena, Sofonias Getachew, Kunuz Abdella, Community based survey of injury in Jimma Zone, South West Ethiopia, *Ethiopian Journal of health sciences* 2008; 17(4) : 179-188
 - 20) Zuryash Mengistu, Aklilu Azaj, Trauma Severities scores and their prediction of outcome among trauma patients in two hospitals of Addis Ababa, Ethiopia, *Ethiop Med J*, 2012; 50(3): 231-237 14 [15,22,]
 - 21) Alemu MH, Pattern of pre hospital fatal injuries in Mekelle ,Ethiopia, *Ethiop Med J*, 2008; 46(2): 179-83
 - 22) Tufa Gemechu, Mihret Tinsae, Senait Ashenafi et al, Most common causes of natural and Injury related deaths in Addis Ababa, Ethiopia, *Pathol Res Pract*, 2009; 205(9):608-614 19
 - 23) F Tsegaye, K Abdella, E Ahmed, T Tadesse, K Bartolomeos Pattern of Fatal Injuries in Addis Ababa, Ethiopia: A One-year Audit, *East and Central African Journal of Surgery*, Vol. 15, No. 2, July-December, 2010, pp. 10-17
 - 24) Manyazewal Dessie, Major Limb Trauma in Eastern Ethiopia, *East Cent.Afr.J.Surg*, 2009; 14(1):84-87
 - 25) Daniel Admassie, Tekle Yirga, Biruk L.Wamisho, Adult limb fractures in Tikur Anbessa Hospital caused by road traffic injuries: Half year plain radiographic pattern, *Ethiop. J. Health Dev.*, 2010; 24(1):61-63
 - 26) Elias Ahmed, Tezera Chaka, The pattern of orthopedic admissions in Tikur Anbessa University hospital, Addis Ababa, *Ethiop Med J*, 2005; 43(2): 85-91
 - 27) Ahmed Elias, Chaka Tezera, Orthopedic and Major Limb Trauma at the Tikur Anbessa University Hospital, Addis Ababa-Ethiopia, *East Cent.Afr.J.Surg*, 2005; 10(2):43-50
 - 28) Lambisso W. Biruk, Permanent Civilian Musculoskeletal disability following injury -17 years trends , *East Cent.Afr.J.Surg*, 2006;11(1):41-48 24
 - 29) F. TekleWold, Accident in childhood, *Ethiop Med J*, 1973; 11(1): 41-46
 - 30) Gedlu E, Accidental injuries among children in North West Ethiopia, *East Afr Med J*, 1994; 71(12): 807-810
 - 31) Isabel Aenderl, Teshager Gashaw, Matthias Siebeck, and Wolf Mutschler "Head Injury-A Neglected Public Health Problem: A Four-Month Prospective Study at Jimma University Specialized Hospital, Ethiopia, *Ethiop J Health Sci*. 2014 Jan; 24(1): 27-34.
 - 32) Hagos Biluts, Mersha Abebe, Tsegazeab Laeke, Abenezer Tirsit, Addisalem Belete. ,PATTERN OF SPINE AND SPINAL CORD INJURIES, *Ethiop Med J*, 2015, Vol. 53, No. 2
 - 33) Finot Debebe , Assefu Woldetsadik , Adam D. Laytin , Aklilu Azazh , James Maskalyk ,The clinical profile and acute care of patients with traumatic spinal cord injury at a tertiary care emergency centre in Addis Ababa, Ethiopia, ,*Afr J Emerg Med* (2016),

- 34) B. Tadesse, S. Tekilu, B. Nega, N. Seyoum, Pattern of Injury and Associated Variables as Seen in the Emergency Department at Tikur Anbessa Specialized Referral Hospital, Addis Ababa, Ethiopia, East and Central African Journal of Surgery. March/April 2014 Volume 19 (1)
- 35) Fasika Amdeslasie, Mizan Kidanu, Wondwosen Lerebo, Dagim Ali. patterns of trauma in patient seen at the emergency clinics of public hospitals in mekelle, northern ethiopia, *Ethiop Med J*, 2016, Vol. 54, No. 2
- 36) Mohammed Seid, Aklilu Azazh , Fikre Enquesslassie and Engida Yisma, Injury characteristics and outcome of road traffic accident among victims at Adult Emergency Department of Tikur Anbessa specialized hospital, Addis Ababa, Ethiopia: a prospective hospital based study, *BMC Emergency Medicine* (2015) 15:10
- 37) Feleke Hailemichael, Mohammed Suleiman and Wondimagegn Pauolos Magnitude and outcomes of road traffic accidents at Hospitals in Wolaita Zone, SNNPR, Ethiopia *BMC Research Notes* (2015) 8:135
- 38) Debrework Tesgera Bashah, Berihun Assefa Dachew and Bewket Tadesse Tiruneh ,Prevalence of injury and associated factors among patients visiting the Emergency Departments of Amhara Regional State Referral Hospitals, Ethiopia: a cross-sectional study, *BMC Emergency Medicine* (2015) 15:20
- 39) S. Getachew, E. Ali, K. Tayler-Smith, B. Hedt-Gauthier, W. Silkondez, D. Abebe, W. Deressa, F. Enquessilase, J. K. Edwards, The burden of road traffic injuries in an emergency department in Addis Ababa, Ethiopia, *Public Health Action* Vol. 6 (2) , june 2016
- 40) Fesseha Hailu Mekonnen, Sileshi Teshager, Road traffic accident: The neglected health problem in Amhara National Regional State, Ethiopia , *Ethiop. J. Health Dev.* 2014;28(1):3-10]
- 41) Fekede Asefa , Demeke Assefa and Gezahegn Tesfaye ,Magnitude of, trends in, and associated factors of road traffic collision in central Ethiopia, Asefa et al. *BMC Public Health* 2014, 14:1072
- 42) Getu S. Tulua,, Simon Washington, Mark J. King, Characteristics of Police-reported Road Traffic Crashes in Ethiopia over a Six Year Period , Proceedings of the 2013 Australasian Road Safety Research, Policing & Education Conference 28th – 30th August, Brisbane, Queensland
- 43) Solomon Meseret Woldeyohannes , Haimanot Gebrehiwot Moges ,Trends and projections of vehicle crash related fatalities and injuries in Northwest Gondar, Ethiopia: A time series analysis, *Int J Env Health Eng* 2014, 3:30
- 44) A. Azaj, N. Seyoum, B. Nega, Trauma in Ethiopia Revisited: A systematic Review, *East and Central African Journal of Surgery.* July/August; 2013 Volume 18 (2)
- 45) Vinand M Nantulya, Michael R Reich ,The neglected epidemic: road traffic injuries in developing countries, *BMJ* 2002;324:1139–41
- 46) Damen Haile Mariam, Road traffic accident: A major public health problem in Ethiopia., *Ethiop. J. Health Dev.* 2014;28(1)-Editorial
- 47) Teferi Abegaz , Yemane Berhane, Alemayehu Worku, Abebe Assrat, Abebayehu Assefa, Road Traffic Deaths and Injuries Are Under-Reported in Ethiopia: A Capture-Recapture Method
- 48) Persson, Road traffic accidents in Ethiopia: magnitude, causes and possible interventions, *Advances in Transportation Studies an international Journal* Section A 15 (2008)- 5
- 49) The Haddon Matrix.
- 50) Bernadette Mullin, Rodney Jackson, John Langley, Robyn Norton, Increasing age and experience: are both protective against motorcycle injury? A case-control study, *Inj Prev* 2000;6:32-35 doi:10.1136/ip.6.1.32
- 51) World Health Organization. In: Peden M, Scurfield R, Sleet D, Mohan D, Hyder AA, Jarawan E, Mathers C, editors. World Report on Road Traffic Injury Prevention, Geneva.
- 52) Nantulya VM, Reich MR. The neglected epidemic: Road traffic injuries in developing countries *BMJ* 2002; 324;1139-41.

Case report on atypical Guillain Barre Syndrome with bulbar dysfunction and descending paralysis

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ABSTRACT

Guillain-Barre syndrome (GBS) is a common cause of acute flaccid, usually ascending paralysis, characterized by symmetrical weakness of the limbs and hyporeflexia or areflexia, which reaches maximum severity within 4 weeks. The motor and sensory axons of the peripheral and autonomic nervous systems may be locally or regionally involved in the atypical presentation group of Guillain-Barré syndrome. We describe the case of a male patient, age 17, who came to our ED with symptoms of bulbar dysfunction and descending areflexic quadriparesis. A nerve conduction test confirmed the diagnosis of atypical GBS. He was treated in the emergency room with mechanical ventilation support for respiratory failure and airway protection and other fundamental supportive care like analgesia and sedation. He was then admitted to the intensive care unit (ICU) and treated for complications, such as autonomic dysfunction and ventilator-associated pneumonia that arose during his stay at the emergency room. After a three-month stay in the ICU, he was transferred to the medical ward, where he was discharged walking with support and able to feed himself with no swallowing difficulty with instructions on how to comply with ongoing medical management of his dysautonomia and follow-up.

Keywords: Atypical Guillain Barre syndrome; bulbar dysfunction; GBS variants; descending weakness

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1. Introduction

GBS is a common cause of acute flaccid paralysis, characterized by symmetrical weakness of the limbs, and hyporeflexia or areflexia, which reaches a maximum severity within 4 weeks.⁽¹⁾ A molecular mimicry attacks the peripheral nervous system responsible for the pathogenesis of this immune system-mediated polyneuropathy.⁽²⁾ The classical feature of GBS is an acute ascending weakness accompanied by the absence of deep tendon reflexes. Respiratory failure requiring intensive care also occurs in 20-30% of patients. However, other patients showed more benign and uncommon clinical features, which is usually referred to as atypical GBS. Typical presentations of GBS include acute inflammatory demyelinating polyradiculoneuropathy (AIDP), acute motoric axonal neuropathy (AMAN), and acute motorsensory axonal neuropathy (AMSAN). Atypical GBS is characterized by local or regional involvement of motor and sensory axons of the peripheral nerves and autonomic nervous system. Atypical presentations include cranial nerve involvement, pharyngo-cervical-brachial, and cranial polyneuritis, as well as other presentations such as acute pandysautonomic and acute sensory neuropathy.⁽³⁻⁶⁾ The clinical manifestations of atypical GBS often overlap with those of other diseases in early onset, thus making diagnosis more difficult. In initial onset, serial EMG and sometimes MRI are required to rule out the differential diagnosis if the clinical presentation is atypical. Currently, intravenous immunoglobulin (IVIG) and plasma exchange are proven effective treatments for GBS. However, despite these treatment options, many patients have a severe disease course, pain, and residual deficits.⁽⁷⁻¹²⁾

Here, we report a case of atypical GBS, which imposed diagnostic and treatment challenges that resulted in delayed diagnosis and treatment.

2. Case report

A 17-year-old male patient came to St. Paul Adult

ED with a complaint of worsening difficulty in swallowing and communication (speaking) for one-day duration.

The symptoms were progressively worsening over the past three days before his presentation. He had a preceding nausea and malaise. On the last day of his presentation, he started to have an associated body weakness, which initially involved the upper extremities, and over half a day involved the lower extremities.

For the above complaints, he visited the Health Center and private clinics and received unspecified IV medications and IV fluids for the diagnosis of acute tonsillopharyngitis (as the attendant claimed). Also, he was evaluated at ENT for considerations of acute tonsillopharyngitis and at the psychiatry unit for possibilities of underlying psychiatric illness like depression at St. Paul's Hospital Millennium Medical College in Addis Ababa. Both sides evaluated and ruled out any illness concerning the respective departments, and finally, he was sent to adult ED. However, the family didn't take him to the ED. Instead, they took him home against the will of the referring physician as the situation was cumbersome for them, only to bring him back the next day to the ED for worsening of symptoms and new onset agitation. Otherwise, he has no history of fever, cough, chest pain, no history of preceding upper respiratory tract infection or diarrheal illness, no history of similar illness in the vicinity or among family members, no known personal and family history of chronic illness (medical/surgical), no previous history of similar episode, and no history of trauma.

On physical examination, he looked acutely sick, in respiratory distress, agitated and non-communicative, having progressive bradypnea (RR was decreasing from 34 to 28, 24, 16...), desaturating to the level of 80%, hypertensive (150/85), and also progressively became bradycardic (pulse decreased from a baseline of 90bpm to 50 to 55bpm). ECG monitor was displaying sinus rhythm. He had

also coarse crepitation bilaterally in the lower 2/3rd of the chest. He had GCS 12(E4V2M6), pupils mid-sized reactive bilaterally, power 0/5 in upper extremities and 2/5 in lower extremities, hypotonic and areflexic in all extremities. Cranial nerves IX, X, and XII were affected. Meningeal signs were negative, and there were no sensory level conditions. No other pertinent finding in other systems examination was found.

For the above history and examination findings, respiratory failure secondary to massive aspiration and possible diaphragmatic paralysis plus acute flaccid(descending) paralysis with bulbar dysfunction secondary to botulism r/o atypical GBS was considered.

Investigations: CBC organ function test and serum electrolyte results were unremarkable initially

VDRL, PICT, and Hepatitis B surface antigen were also negative. Brain CT with C-spine and Nerve conduction test was planned to be done after stabilization. Serum and stool assays for identification of *Clostridium botulinum* toxin were not available in our setup.

At ED the patient was managed with intubation (intubated with sedation alone) and MV support, sedation and analgesia, and ulcer prophylaxis. After initial stabilization on MV, he was admitted to the ICU with the same assessment after 24 hours of stay.

Mechanical ventilation support, physiotherapy, DVT prophylaxis, and other supportive management continued at the intensive care unit. Low-dose morphine, gabapentin, and as-needed IV labetalol were added for the consideration of dysautonomia (Evidenced by persistently and significantly fluctuating vital signs and diaphoresis). Brain and C-spine CT became unremarkable, and nerve conduction test done (On 2nd week) showed reduced motor nerve amplitude with conduction blocks and delayed all F waves latencies with nor-

mal sensory nerve exam suggesting motor dominant demyelinating polyradiculoneuropathy likely acute inflammatory demyelinating polyneuropathy. Therefore, the assessment of atypical GBS strengthened, and four doses of IVIG were given subsequently.

Over his ICU stay, he was also managed for ventilator-associated pneumonia (evidenced by persistent fever, leucocytosis with left shift, and consolidative changes seen on bedside US and Chest x-ray), otitis media, and oral candidiasis.

After two weeks of MV support, as he was showing significant improvement, passing the weaning and spontaneous breathing trials, extubation was tried but failed after 24 hours. For this reason, he was re-intubated, and subsequently, a tracheostomy was done. Then, progressively, he was off mechanical ventilation and put on direct oxygen support via a tracheostomy tube. Other supportive management such as tracheostomy care, gabapentin and morphine (For the dysautonomia), analgesia, chest and musculoskeletal physiotherapy, high protein diet via NGT, ulcer, and DVT prophylaxis continued.

Generally, during his ICU stay he showed progressive improvement with relatively stable vital signs, well-controlled dysautonomia, off mechanical ventilation support, desclating oxygen dose support via tracheostomy tube, and improved muscle power (3/5 in all extremities) from the baseline of zero out of five and two out of five in upper and lower extremities, respectively.

After ninety days of stay at the Medical ICU, his condition improved, and he was discharged with advice on continued basic care, physiotherapy, and medical management of the dysautonomia with a short appointment.

3. Discussion

Landry first described acute ascending weakness in 1859, but Guillain, Barré, and Strohl expanded its

extent and characteristics in 1916, naming the disease Guillain Barré Syndrome.⁽¹³⁾ The disease gained international notoriety under the name that remains today. Guillain Barré Syndrome.⁽¹⁴⁾ GBS is a rare disease with a median incidence of 0.81-1.89 per 100,000 person-years, more common in men.^(1,15) Worldwide, incidence varies, with low rates in Brazil and high rates in Curaçao and Bangladesh.⁽¹⁵⁻¹⁹⁾

GBS is an autoimmune disease caused by an infectious disease that results in nerve damage or blockage. The type of infection and antiganglioside antibodies determine the subtype and clinical course of GBS. *Campylobacter Jejuni* is the most common pathogen causing antecedent infections, which is associated with the AMAN subtype of GBS.

GBS patients often experience sensory symptoms like paraesthesia or numbness, cranial nerve deficits, and pain. About half have cranial nerve deficits, while one-third experience muscle weakness.⁽²⁰⁾ About 25% develop respiratory insufficiency requiring artificial ventilation.^(13,21-23) Autonomic dysfunction (predominantly cardiovascular dysregulation) is present in about two-thirds of patients, although its severity is highly variable, with one-third remaining able to walk.⁽²⁴⁻²⁶⁾

Although most GBS cases show classic areflexic descending paralysis, appropriate attention should be paid to atypical presentations due to the risk of overlooking atypicals, as seen in our instance. The atypical presentation group of Guillain-Barré syndrome is distinguished by localized or regional involvement of peripheral nerve motor and sensory axons as well as the autonomic nervous system.^(27,28) AIDP and axonal forms (AMAN and AMSAN) are classified as the typical ascending GBS. The atypical presentation included prominent cranial nerve involvement, Miller Fisher syndrome, Bickerstaff brainstem encephalitis, pharyngo-cervical-brachial and polyneuritis cranialis, and others, which included acute pandysautonomia and acute

sensory neuropathy.^(13,29) About 8% of patients with GBS present with paraparesis, which often complicates the diagnosis and requires extensive diagnostic work-up. Definite asymmetrical limb weakness, however, is very uncommon in patients with GBS.⁽¹⁴⁾ Although the 1990 GBS criteria require hyporeflexia or areflexia for the diagnosis of GBS, in one cohort of patients with GBS, 9% had normal tendon reflexes in weak arms, and 2% had normal tendon reflexes in weak legs at presentation.⁽¹⁴⁾ During follow-up, all patients developed hyporeflexia or areflexia in their legs, but in some patients, normal reflexes persisted in the arms.^[14] For unknown reasons, a small proportion of patients with GBS, especially those with the AMAN subtype, have well-preserved or even exaggerated tendon reflexes.^(30,31) Given the supportive feature of nerve conduction studies and improvement with IVIG, though incomplete, our case is also under the common subtype, AIDP, but with a rare form of presentation. The diagnoses are more clinical using criteria, with nerve conduction study and CSF analysis being part of supportive features.^(32,33) Electrodiagnostic tests (nerve conduction studies and electromyography) can help with the diagnosis, prognosis, and follow-up of GBS patients. However, they are not required to diagnose patients with typical presentation. Because there are several entities that might induce weakness and sensory impairments, it is critical to rule out other aetiologies before diagnosing GBS. Poliomyelitis, myasthenia gravis, electrolyte disruption, botulism, acute myopathy, diphtheria, vasculitis, porphyria, tick paralysis, and toxic neuropathy are all possible GBS mimics.^(34, 35)

Treatment of GBS includes plasmapheresis or intravenous immunoglobulin (IVIg), as well as respiratory support when needed. Plasmapheresis and IVIg in GBS have been shown to be equal in efficacy; however, the ease of use of IVIg has made this the treatment of choice.⁽³⁶⁻⁴²⁾ There was controversy regarding whether a steroid regimen

added benefit to therapy, but current recommendations do not support steroid use.^(41, 43) Ventilator support is needed in approximately 25% of GBS cases and in cases with more rapid progression. With treatment, most will have a linear progression of recovery in weeks to months. However, those with a more aggressive onset tend to do more poorly with recovery, and overall, 10-20% are left with a disabling motor deficit.⁽³⁸⁾

We report this case as it will remain the best example of how differently a GBS patient can present in the ED. Our patient presented with atypical features, such as features of bulbar dysfunction preceding descending limb paralysis. The progression of the weakness is also fast, involving all the four extremities within twenty-four hours. Because of this unusual presentation, the patient was initially subjected to additional health costs, including receiving medications and other costly treatments for tonsillopharyngitis from private clinics (as claimed by his father), delayed diagnosis, and extensive unnecessary visits to various departments. However, this instance will serve as a useful reminder to emergency departments and other departments to thoroughly evaluate patients before sending them out for another visit. Our case is also a typical patient who needs an electrodiagnostic test (EDT) as soon as possible for diagnostic and prognostication purposes. EDT and other pertinent investigation modalities should better be near by ED. We also recommend that the responsible body make serum and/or stool assays for botulinum toxin as botulism is not uncommon in our setup as there are more case reports than atypical GBS in Ethiopia.⁽⁴⁴⁾ However, the immediate management of patients with acute peripheral neuropathy or Acute neuromuscular diseases with bulbar dysfunction and/or respiratory muscle weakness in the ED is almost the same, with due attention always being given to anticipation and early airway protection and respiratory support with intubation

and mechanical ventilation. And the other supportive management will continue subsequently.

A 10-year retrospective study was conducted in Ethiopia at Addis Ababa University from September 1992 to September 2001 to assess the clinical profile and outcomes of GBS patients in Ethiopia. The study showed that the major presenting feature was an ascending areflexic quadriparesis (78.5%), followed by descending areflexic quadriparesis (12.7%). In 7.4% of patients, the weakness was confined to the lower extremities (paraparetic variant). The commonest electrophysiologic abnormality was demyelinating (55.3%), followed by mixed (25.5%) and axonal (19.1%) ones.⁽⁴⁵⁾

This case is one of the rarest presentations of GBS, and no exactly similar case report has been found in the world so far. However, there are few case reports of atypical GBS (including descending weakness pattern but without features of bulbar dysfunction), including in Ethiopia, as seen in the above study.

4. Conclusion

Even though there are various GBS types, our situation does not fit properly into any of them. Our case had atypical GBS symptoms that included initial onset with bulbar palsy and respiratory muscle weakness, which necessitated early intensive care in the emergency room, such as intubation.

Atypical presentations are notorious for delaying diagnosis and therapy. To avoid this, emergency physicians should be aware of GBS patients' varied clinical presentations. A high index of suspicion and early proactive management, including consultation with the appropriate department in the ED, can save lives.

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References

- 1) Hughes, R.A.C., D. R. , Guillain–Barré syndrome. . *Lancet* 2005. 366: p. 1653–1666.
- 2) Chalela, J.A., Guillain–Barre Variant in the Deployed Setting. *Military Medicine*, 2013. 178(10): p. e1156.
- 3) Sheridan, J.M., Smith, D., Atypical Guillain–Barré in the Emergency Department. . *The Western Journal of Emergency Medicine*, 2010. 11(1): p. 80 – 82. .
- 4) Turan, M.I., Özden, Ö., Disci, E., Tan, H. , Atypical Presentation of Guillain–Barré Syndrome. *European Journal of General Medicine*, 2014. 11(2): p. p.119 – 120.
- 5) Papathanasiou, A., Markakis Case Report: Clinical Heterogeneity of Guillain–Barré Syndrome in the Emergency Department: Impact on Clinical Outcome. . *Case Reports in Emergency Medicine*, 2016. 2016.
- 6) Griffin, J.W.L.C., Ho TW, Xue P, Macko C, Gao CY, Yang C, Tian M, Mishu B, Cornblath DR., Guillain–Barré syndrome in northern China. The spectrum of neuropathological changes in clinically defined cases. . *Brain*, 1995. 118(Pt 3): p. 577–95.
- 7) Hughes, R.A., Swan AV, Raphael JC, Annane D, Van Doorn PA, Immunotherapy for Guillain–Barré syndrome: a systematic review. *Brain* 2007. 130: p. 2245–2257
- 8) Hughes, R.A., Swan A. V. & van Doorn, P. A, Intravenous immunoglobulin for Guillain–Barré syndrome. . *Cochrane Database of Systematic Reviews*, (Issue 12).
- 9) Raphael, J.C., Chevret, S., Hughes, R. A. & Annane, D. , Plasma exchange for Guillain–Barré syndrome. *Cochrane Database of Systematic Reviews*, 2012(Issue 7).
- 10) Hughes, R.A., Pritchard, J. & Hadden, R. D. Art. No.: CD008630. <http://dx.doi.org/10.1002/14651858.CD008630.pub3>, Pharmacological treatment other than corticosteroids, intravenous immunoglobulin and plasma exchange for Guillain–Barré syndrome. *Cochrane Database of Systematic Reviews*, 2013(Issue 2.).
- 11) Hughes, R.A.v.D., P. A. , Corticosteroids for Guillain–Barré syndrome. . *Cochrane Database of Systematic Reviews*, 2012(Issue 8.).
- 12) Sejvar, J.J., Baughman, A. L., Wise, M. & Morgan, O. W. , Population incidence of Guillain–Barré syndrome ,a systematic review and meta-analysis. . *Neuroepidemiology*, 2011. 36.: p. 123–133
- 13) Susuki K, K.M., Hirata K, Isogai E, Yuki N. , A Guillain–Barré syndrome variant with prominent facial diplegia. . *J Neurol.* , 2009 Nov. 256(11): p. 1899–905. .
- 14) Moulin, D.E., Hagen, N., Feasby, T. E., Amireh, R. & Hahn, A. , Pain in Guillain–Barré syndrome. *Neurology* 1997. 48: p. 328–331.
- 15) Islam, Z., Bart C.Jacobs, Mohammad B. Islam, Quazi D. Mohammad, Sergei Diorditsa, Hubert P. Endtz, High incidence of Guillain–Barré syndrome in children, Bangladesh. . *Emerg. Infect. Dis.* , 2011. 17: p. 1317–1318.
- 16) McGrogan, A., Madle, G. C., Seaman, H. E. & de Vries, C. S. , The epidemiology of Guillain–Barré syndrome worldwide. A systematic literature review. *Neuroepidemiology* 2009. 32: p. 150–163
- 17) Rocha, M.S., Brucki, S. M., Carvalho, A. A. & Lima, U. W. , Epidemiologic features of Guillain–Barré syndrome in São Paulo, Brazil. *Arq. Neuropsiquiatr.* , 2004. 62: p. 33–37.
- 18) Van Koningsveld, R., Rico R, Gerstenbluth I, Schmitz PI, Ang CW, Merckies IS, Jacobs BC, Halabi Y, Endtz HP, Van der Meche FG, Van doorn PA, Gastroenteritis-associated Guillain–Barré syndrome on the Caribbean island Curaçao. . *Neurology* 2001. 56(11): p. 1467–1472
- 19) p. 1467–1472
- 20) JB., W., Guillain–Barré syndrome: clinical variants and their pathogenesis. *J Neuroimmunol*, 2011 Feb. . 231((1–2)): p. 70–2.
- 21) Asbury, A.K.C., D. R. , Assessment of current diagnostic criteria for Guillain–Barré syndrome. . *Ann. Neurol.*, 1990. 27 (Suppl.): p. S21–S24.
- 22) van Koningsveld, R., Schmitz PI, Meche FG, Visser LH, Van doorn PA; Dutch study group, Effect of methylprednisolone when added to standard treatment with intravenous immunoglobulin for Guillain–Barré syndrome: randomised trial. . *Lancet* 2004. 363 p. 192–196
- 23) Randomised trial of plasma exchange, intravenous immunoglobulin, and combined treatments in Guillain–Barré syndrome. Plasma Exchange/Sandoglobulin Guillain–Barré Syndrome Trial Group. *Lancet* 1997. 349 p. 225–230
- 24) Samadi, M., Kazemi, B., Goltzari Oskoui, S. & Barzegar, M. , Assessment of autonomic dysfunction in childhood Guillain–Barré syndrome. . *J.*

- Cardiovasc. Thorac. Res. , 2013. 5: p. 81–85
- 25) Van Doorn, P.A., Ruts, L. & Jacobs, B. C. , Clinical features, pathogenesis, and treatment of Guillain–Barré syndrome. . *Lancet Neurol.*, 2008. 7: p. 939–950
 - 26) Winer, J.B., Hughes, R. A., Osmond, C. , A prospective study of acute idiopathic neuropathy; Clinical features and their prognostic value. . *J. Neurol. Neurosurg. Psychiatry*, 1988. 51: p. 605–612.
 - 27) Yuki, N., Kokubun N, Kuwabara S, Sekiguchi Y, Ito M, Odaka M, Hirata K, Notturmo F, Uncini A, Guillain–Barré syndrome associated with normal or exaggerated tendon reflexes. *J. Neurol. Neurosurg. Psychiatry*, 2012. 259(6): p. 1181–1190
 - 28) KH., L., Variants and mimics of Guillain–Barré Syndrome. . *Neurologist.* , 2004 Mar.
 - 29) 10(2): p. 61–74.
 - 30) Fokke, C., Van den BAerg B, Drenthen J, Walgaard C, Van Doorn PA, Jacobs BC, Diagnosis of Guillain–Barré syndrome and validation of Brighton criteria. *Brain* 2014. 137(Pt 1): p. 33–43.
 - 31) M., B., Guillain–Barré syndrome. *Arch Neurol.* , 1998. 55(11): p. 1483–4.
 - 32) Van der Meché, F.G., Van Doorn, P. A., Meulstee, J., Jennekens, F. G. & GBS- consensus group of the Dutch Neuromuscular Research Support Centre. , Diagnostic and classification criteria for the Guillain–Barré syndrome. *Eur. Neurol.*, 2001 45: p. 133–139
 - 33) van Doorn PA, R.L., Jacobs BC, Clinical features, pathogenesis, and treatment of Guillain–Barré syndrome. . *Lancet Neurol.* , 2008 Oct. 7(10): p. 939–50. .
 - 34) *Ann Neurol*, criteria for diagnoses of GBS, 1978. 3(6): p. 565–6.
 - 35) Govoni V, G.E., Tola MR, Casetta I, Ruppi P, Vaghi L , , *J Neurol.* , 1999. 246(11): p. 1010.
 - 36) Hughes RA, C.D., Guillain–Barré syndrome. *Lancet.* , 2005. 366(9497): p. 1653–66.
 - 37) McGillicuddy DC, W.O., Shapiro NI, Jonathan A, Edlow MD, Guillain–Barré syndrome in the emergency department. *Ann Emerg Med.*, 2006. 47(4): p. 390–3.
 - 38) Hughes RA, C.D., Guillain–Barré syndrome. . *Lancet.* , 2005. 366(9497): p. 1653–66. .
 - 39) McGillicuddy DC, W.O., Shapiro NI, Edlow JA, Guillain–Barré syndrome in the emergency department. *Ann Emerg Med.* , 2006. 47(4): p. 390–3.
 - 40) Cosi V, V.M., Guillain–Barré syndrome. *Neurol Sci.*, 2006. 27(Suppl 1): p. S47–51.
 - 41) RS., T., The relationship of Campylobacter jejuni infection and the development of Guillain–Barré syndrome. *Curr Opin Infect Dis.* , 2002. 15(3): p. 221–8.
 - 42) Stangel M, P.R., Basic principles of intravenous immunoglobulin (IVIg) treatment. *J Neurol.*, 2006. 253(Suppl 5): p. v18–24. .
 - 43) Darabi K, A.-W.O., Dzik WH. Transfusion.; , Current usage of intravenous immune globulin and the rationale behind it: the Massachusetts General Hospital data and a review of the literature. . *Transfusion* 2006. 46(5): p. 741–53. .
 - 44) Hughes RA, R.J., Swan AV, van Doorn PA. , Intravenous immunoglobulin for Guillain–Barré syndrome. . *Cochrane Database Syst Rev.*, 2006.
 - 45) Hughes RA, S.A., van Koningsveld R, et al. , Corticosteroids for Guillain–Barré syndrome. *Cochrane Database Syst Rev.*, 2006.
 - 46) Tigist Bacha, E.A., Ayalew Moges, Amsalu Bekele, Afework Tamiru and Ishmael Shemsedin, Botulism outbreak in a rural Ethiopia: a case series. *BMC Infectious Diseases*, Dec. 20, 2021. 21(1).
 - 47) Melaku Z, Z.G., Bekele A, Gullian–barrie symptom in ethiopian patents. *ethiop med j*, 2005 JAN. 43(1): p. 21–6.

Acute Intentional Iron Overdose in Pregnancy: An overview of case and treatment in a resource-limited setting

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ABSTRACT

Iron is a commonly ingested overdose medication in pregnancy, considering it is easily accessible to pregnant women. Iron toxicity is a serious but often overlooked problem because of its unspecific and gradually developing symptoms. When Iron toxicity fails to be treated, it may sequentially undergo gastrointestinal, latent, systemic, hepatic, and obstructive stages.

This case report discusses a 21-year-old primigravida patient at 17week gestation who presented with acute iron toxicity after ingesting 76 tablets of pills containing ferrous sulfate. She presented with severe abdominal pain and persistent vomiting. This report highlights the clinical presentation, diagnostic approach, and management strategies employed to treat this rare case of severe iron toxicity during pregnancy.

Keywords: Iron toxicity, Pregnancy, Deferoxamine, Ferrous sulfate

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1. Introduction

Iron toxicity is rare during pregnancy but poses significant risks to both maternal and fetal health. It occurs primarily due to intentional overdose or accidental ingestion of iron supplements, which are commonly used in pregnancy.⁽¹⁾ Iron overdose can lead to complications for both the mother and the fetus, including severe gastrointestinal and systemic toxicity, which is exacerbated in pregnancy and can rarely lead to fetal demise.⁽²⁾ This case report provides insights into the presentation, diagnosis, and management of iron toxicity in a pregnant woman.

2. Case presentation

A 21-year-old female from Addis Ababa, Ethiopia, in her 17th week of pregnancy, presented to the emergency department with severe abdominal pain for six hours. The patient had ingested 76 tablets of [150 mg ferrous sulfate + 0.5mg Folic acid]. Taking into account that each tablet contains 30 mg of elemental iron, the patient had, therefore, ingested 2,280 mg of elemental iron following an alleged conflict with her boyfriend. Her symptoms began five hours after ingestion, and she had multiple episodes of non-projectile vomiting of ingested matter, severe crampy epigastric pain,

chills, and rigor. Twelve hours after the presentation, the patient subjectively complained of fast breathing and failure to pass feces in addition to the crampy epigastric pain. Otherwise, she had no seizures or loss of consciousness. The patient had no previous history of suicidal attempts or psychiatric conditions. She had no history of using any other medication.

She was first assessed at a primary hospital in Addis Ababa and was referred to Black Lion Hospital Emergency Department for further evaluation, and management.

Physical Examination

Upon arrival at Black Lion Hospital, vital signs were BP 100/70 mmHg, Pulse rate 96, Respiratory rate 28, SpO2 98% (room air), and Temperature 36.1°C. A thorough physical examination revealed a rigid abdomen with significant tenderness in the upper quadrants; other parts of the exam were unremarkable. The patient was in pain but alert, with a Glasgow Coma Scale score of 15/15.

A day later, up on progress examination, vital signs became BP=110/70 PR=103 RR=30 Tc=36.4 S02=96% with diffuse abdominal tenderness with no other pertinent findings.

Investigations

Table 1: Laboratory results included

Investigation	Result on 23/08/2024	Result on 24/08/2024	Result on 25/08/2024
Complete Blood Count	WBC=11.9k, 92% neutrophils, Hgb 12.7g/dl, PLT=218k	WBC=5.5K, 84.8% neutrophils, Hgb = 11.7, PLT=191k	WBC=8.9K 72.3% Neutrophils, Hgb = 11.9, PLT=254k
Serum Electrolytes	Na+=134.7, K+=3.46, Cl-=111	K+=2.76, Na+=135.3. Cl=108	Na+=134.1, K+=3.52, Cl=109
Coagulation Profile	PT=21.7, INR=1.86, PTT=31.5		INR=1.00
Renal Function Test	Cr=0.7	Cr = 0.62	Cr = 0.57
Liver function Test	Liver enzymes: AST-14, ALT-9, ALP-32 Total Bilirubin=0.4 Coagulation Profile: PT=21.7, INR=1.86, PTT=31.5	AST=11, ALT=7, ALP=39 Albumin: 2.7	AST=12, ALT=8 ALP=62 Coagulation Profile: 1.00
Abdominal U/s	The abdominal ultrasound showed an anechoic free fluid collection with low-level echo debris in the peritoneal cavity. Viable singleton intrauterine pregnancy with 17 weeks and positive fetal cardiac activity	There is minimal anechoic free fluid collection in the peritoneal cavity. Gallbladder sludge Viable intrauterine pregnancy with positive heartbeat anterior fundal placenta.	
Iron studies	* Serum ferritin lab exam wasn't available in the hospital		



Figure 1: ECG of the client recorded on 03-10-2022



Figure 2: Client Abdominal X-ray taken on 03-10-2022

Diagnosis:

Moderate acute iron toxicity.

Management

The patient was initially kept at the Emergency Department of Black Lion Hospital and was on a continuous cardiac monitor. She was resuscitated with 2 bags of normal saline, and treated with IV cimetidine and antiemetic therapy (Plasil 10mg IV TID). Moderate hypokalemia was identified, and KCL 40meq IV TID started. Deferoxamine was planned in the management but wasn't administered due to the unavailability of the medication in our hospital; referral to the toxicology center was planned but deferred by the

patient. Subsequently, the patient was transferred to the intensive care unit for better follow-up and management. In the ICU, the diagnosis was further revised to include moderate hypokalemia, and the management plan was revised to include IV diluted potassium chloride with cardiac monitoring.

Follow-up and Outcome

The patient was discharged after a 7-day hospital stay, during which her abdominal pain subsided and her condition stabilized. She was evaluated by the psychiatry team, and an outpatient follow-up was arranged. Additionally, her serum

potassium level normalized to 3.7 mg/dl at discharge.

3. Discussion

Iron is an essential nutrient with limited bioavailability. It is essential to the function of hemoglobin, myoglobin, and many cytochromes and enzymes. It is always bound to a carrier molecule under normal circumstances. Excess iron may saturate the body's mechanisms for iron homeostasis, allowing for unbound ("free") iron to cause organ toxicity because the body cannot directly excrete iron.⁽³⁾

Mechanism of Injury includes direct toxicity to the gastrointestinal mucosa and impaired metabolism in other systemic organs, including the liver, brain, and heart. This results from the non-transferrin-bound iron (NTBI) binding in organs with L-type calcium channels. The NTBI then binds to hydrogen peroxide to generate reactive oxygen species (ROS). These ROS, in turn, cause tissue damage, inflammation, and fibrosis in the organs listed above.^(4,6)

Iron toxicity in pregnancy is a life-threatening condition, often resulting from intentional ingestion. According to studies, maternal iron can potentially impact an infant's cognition as well as future neurodevelopmental processes and cause type 1 diabetes.^(5,6) Iron toxicity management in pregnancy should prioritize maternal stabilization while considering fetal well-being. Pregnancy complicates management due to the physiological changes in drug metabolism and concerns for fetal safety.⁽⁷⁾ Although healthcare providers may hesitate about using deferoxamine as an antidote during iron toxicity in pregnancy over the potential harm of the antidote to the fetus, maternal health and treatment should be prioritized in managing these cases.⁽⁸⁾ Furthermore, although risks can't be overlooked, the

majority of pregnancies complicated by iron toxicity and managed with an antidote will have normal pregnancies. Antidote treatment, if appropriate, should be given considering the dangers of iron toxicity on mortality and morbidity.^(9,10,11)

In this case, the patient's significant iron overdose necessitated a careful balance between maternal health and fetal safety, emphasizing that while deferoxamine is the standard antidote for iron toxicity, its use in pregnancy remains contentious due to potential risks to the fetus. However, the urgency of treating maternal toxicity cannot be understated, as untreated iron overload can lead to severe complications for both mother and child. The absence of deferoxamine, in this case, underscores the resource limitations often faced in healthcare settings, which can hinder effective management. Ultimately, this case serves as a reminder of the importance of establishing protocols for rapid referral to specialized centers capable of providing necessary treatments, alongside ongoing psychiatric support for patients with intentional overdoses.

Limitation

Lack of a high-quality abdominal X-ray image.

4. Conclusion

This case illustrated the importance of prompt recognition and treatment of iron toxicity in pregnant patients. Awareness of iron's toxic effects and the implementation of standard management protocols are essential in preventing severe maternal and fetal outcomes. Immediate referral to toxicology centers capable of providing the antidote is necessary because early recognition and initiation of treatment can significantly improve outcomes. Regular follow-up and psychiatric support are also recommended for patients presenting with intentional overdoses.

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Competing interests

No conflicts of interest declared

References

- 1) Lacoste H, Goyert GL, Goldman LS, Wright DJ, Schwartz DB. Acute iron intoxication in pregnancy: case report and review of the literature. *Obstet Gynecol.* 1992;80(3 Pt 2):500-501.
- 2) Manoguerra AS, Erdman AR, Booze LL, Christianson G, Wax PM, Scharman EJ, Woolf AD, Chyka PA, Keyes DC, Olson KR, Caravati EM. Iron ingestion: an evidence-based consensus guideline for out-of-hospital management. *Clinical Toxicology.* 2005 Jan 1;43(6):553-70.
- 3) Papanikolaou G, Pantopoulos K. Iron metabolism and toxicity. *Toxicology and applied pharmacology.* 2005 Jan 15;202(2):199-211
- 4) Eaton JW, Qian M. Molecular bases of cellular iron toxicity. *Free Radical Biology and Medicine.* 2002 May 1;32(9):833-40.
- 5) Tran T, Wax JR, Philput C, Steinfeld JD, Ingardia CJ. Intentional iron overdose in pregnancy—management and outcome. *The Journal of emergency medicine.* 2000 Feb 1;18(2):225-8.
- 6) Casanueva E, Viteri FE. Iron and oxidative stress in pregnancy. *The Journal of nutrition.* 2003 May 1;133(5):1700S-8S.
- 7) Milman N. Iron and pregnancy—a delicate balance. *Annals of hematology.* 2006 Sep;85:559-65.
- 8) Quezada-Pinedo HG, Cassel F, Duijts L, Muckenthaler MU, Gassmann M, Jaddoe VW, Reiss IK, Vermeulen MJ. Maternal iron status in pregnancy and child health outcomes after birth: a systematic review and meta-analysis. *Nutrients.* 2021 Jun 28;13(7):2221.
- 9) McElhatton PR, Roberts JC, Sullivan FM. The consequences of iron overdose and its treatment with desferrioxamine in pregnancy. *Human & experimental toxicology.* 1991 Jul;10(4):251-9.
- 10) Benson AE, Shatzel JJ, Ryan KS, Hedges MA, Martens K, Aslan JE, Lo JO. The incidence, complications, and treatment of iron deficiency in pregnancy. *European journal of haematology.* 2022 Dec;109(6):633-42.
- 11) Geraci MJ, Heagney H. Iron overdose during pregnancy: Case and treatment review. *International Journal of Clinical Medicine.* 2012 Jan 2;3(07):715-21.

Acute Phenobarbital Poisoning in a Resource-Limited Setting: A Case Report of Successful Management through High Index of Suspicion and Immediate Care

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ABSTRACT

A 33-year-old known epileptic female patient, who has been on phenobarbital 100 mg orally once daily for the past 6 years, presented to our emergency room after she was found unconscious. On presentation, she was unable to protect her airway and had significant oral secretions upon airway examination. Glasgow Coma Scale was 3/15 with severe respiratory compromise, necessitating immediate intubation and mechanical ventilation. Due to the high index of suspicion given the clinical presentation, serum phenobarbital level was determined and had shown to be markedly elevated. Hence, the diagnosis of phenobarbital poisoning was confirmed. Following this, the patient was promptly managed with two cycles of hemodialysis. After that, the patient regained consciousness. This case led us to conclude that clinicians need to have a high index of suspicion of medication overdose in epileptic patients and, therefore, should take a thorough medication history.

Keywords: Phenobarbital overdose, Phenobarbital poisoning, Epilepsy, Hemodialysis, case report

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1. Introduction

Phenobarbital, a first-generation antiepileptic, is commonly prescribed to treat generalized tonic-clonic seizures and focal seizures and as second-line management for status epilepticus.⁽¹⁾ Despite its efficacy in clinical practice, it is also associated with adverse side effects, some of which include depressed cardiorespiratory system, and loss of consciousness.^(2,3) This case report aims to show-case the clinical presentation of phenobarbital overdose and its management in resource-limited settings via the use of hemodialysis.

2. Case presentation

The patient was a 33-year-old female who has been a known epileptic for the past 6 years on phenobarbital 100 mg orally once daily for the past 2 years, with good adherence to the regimen. The patient had presented at our emergency with loss of consciousness of unknown duration (estimated around 4 hours) after she was found unconscious in her bedroom. There was no history of witnessed abnormal body movements, previous suicidal attempts, or significant medical history such as diabetes mellitus, hypertension, or cardiac issues. During the evaluation of the patient in the Emergency room, underlying psychological stressors

that could have prompted an intentional overdose were suspected but not explicitly confirmed.

On presentation at our hospital, the patient was unable to protect her airway with significant oral secretions and had desaturated to the level of 77% on room air. She was tachycardic to the level of 114. The respiratory drive was almost absent. With a Glasgow Coma Scale (GCS) score of 5/15 that had dropped to 3/15 within minutes, the patient was immediately intubated with an Endotracheal tube (6.5 mm). Secretions were suctioned, and the patient was put on a mechanical ventilator.

After a complete physical examination, a decreased air entry with crepitations was noted in the right lower one-third of the lung field. The rest of the physical examination remained normal.

Investigation

Upon the patient's arrival at the emergency room, a point of care ultrasound exam was performed, which revealed a collapsing IVC and bilateral b.lines. After the patient was stabilized, CBC, Serum electrolyte (K, Na, Cl, Ca), RBS, RFT, LFT, ECG, CXR, Brain CT scan, and Serum Phenobarbital were planned. The results are summarized in Table 1, Figure 1, and Figure 2.

Table 1: The investigation summary of the patient

Ordered Tests	Date (16/07/2024)	Date (17/07/2024)
Complete blood count	WBC= 5.4k with 86% Neutrophil and 11% lymphocyte Hgb= 14.9, HCT= 45.9, MCV= 93.8 PLT=179k	WBC= 7.54k with 82.6% Neutrophil and 10.1% lymphocyte Hgb= 10.2, HCT= 28, MCV= 90.3 PLT=139k
Renal Function Test	Ur= 15, Cr= 0.6	
Liver Function Test	AST= 16, ALT=10, ALP=49 TB=0.3, DB=0.085	AST= 16, ALT=8, ALP=43
Serum Electrolyte	Na+= 135, K+= 3.6, Cl-= 107	Na+= 142, K+= 3.3, Cl-= 107.6
Urine HCG	negative	
Urine Analysis	Non-revealing	
Infectious Panel	VDRL: Non-reactive, HepB Surface antigen: Negative, HCV antibody: Negative	
Serum Phenobarbital	88µg/ml	
Brain Computed Tomography (CT) Scan	Normal	

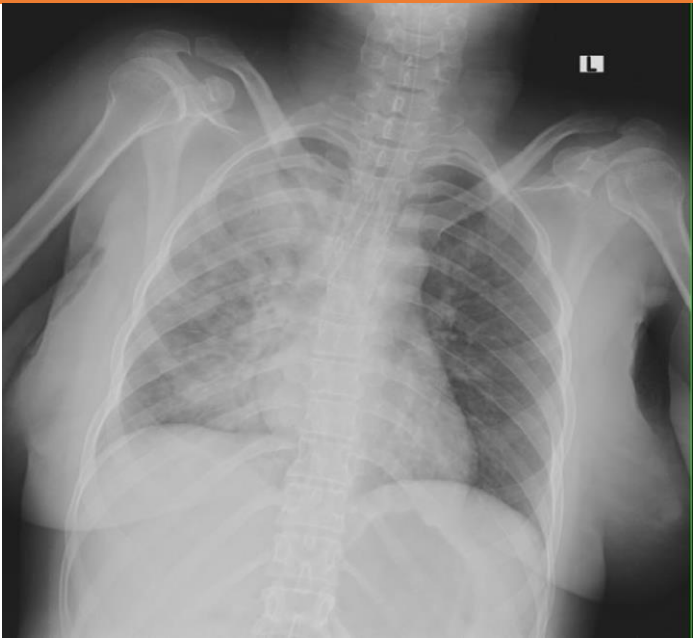


Figure 1: The chest x-ray imaging of the patient taken on 16/07/2024

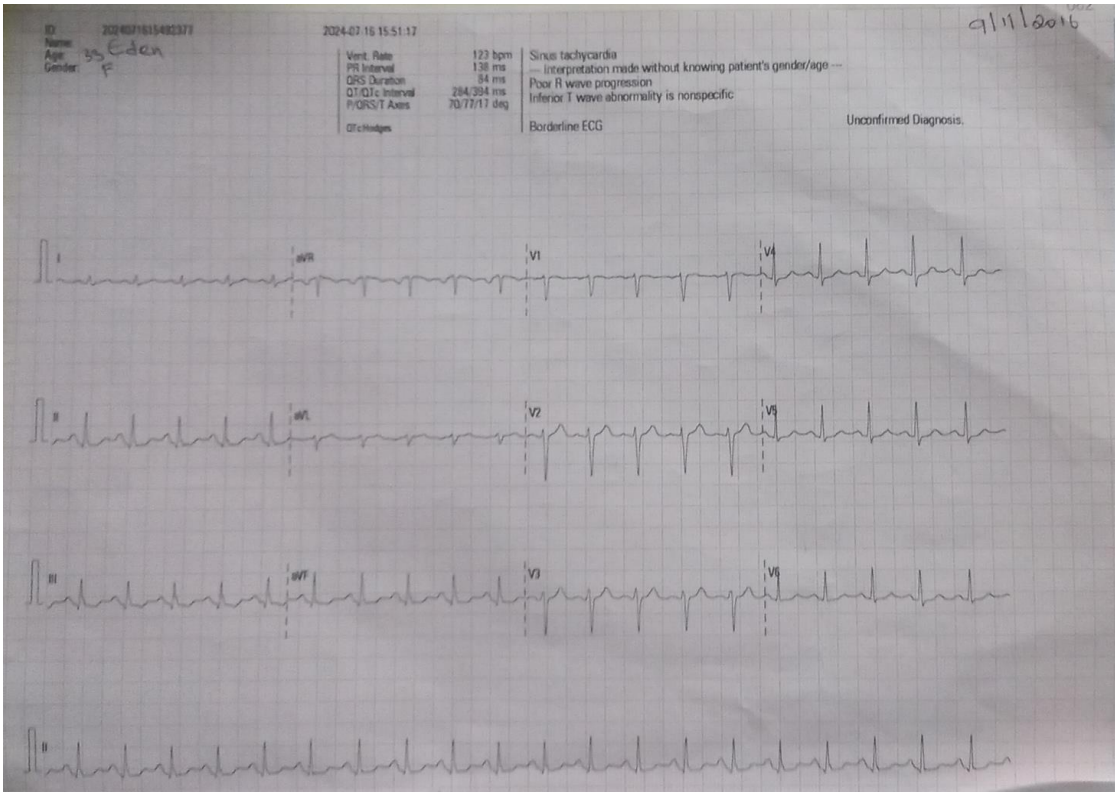


Figure 2: The ECG finding of the patient taken on 16/07/2024

Diagnosis

A diagnosis of coma secondary to acute phenobarbital overdose and aspiration pneumonia was made based on the clinical presentation and supportive investigation results.

Management

The patient was admitted to the red zone of the adult emergency room, put on mechanical ventilator support, and immediately resuscitated. She was on coma care and intravenously managed with maintenance fluid, morphine, omeprazole, diazepam, ceftriaxone, and metronidazole. She also underwent one session of hemodialysis in the emergency room and then was promptly transferred to the ICU and underwent a second hemodialysis for phenobarbital poisoning.

Follow up

After the two cycles of hemodialysis, the patient's clinical presentation and investigation panels improved, and she was extubated on the third day. After a few days of observation, she was discharged home.

3. Discussion

Phenobarbital is a commonly prescribed medication as a first-line management modality for generalized tonic-clonic and focal seizures, especially in resource-limited settings.⁽¹⁾ Its mechanism of action is activating the Gamma-Aminobutyric Acid type A receptors (GABA_A) either directly or by boosting Gamma-Aminobutyric Acid (GABA). This boosted neurotransmitter will then interact with the GABA_A and open the chloride channels for a longer period, increasing their influx into the brain cell membrane. This, in return, makes the inside of the cell more negative and stops the epileptic signals.⁽¹⁾

Phenobarbitals, with their potential to activate the receptors directly, their low clearance, and

longer half-life, are commonly noted to have drowsiness as a side effect. Additional side effects include restlessness, flat affect, ataxia, nystagmus, pulmonary edema, cardiorespiratory depression, particularly in rapid intravenous administration, and rarely symptoms of fever, rash, lymphadenopathy, and multiorgan affection as a result of the syndrome of hypersensitivity.⁽¹⁻⁶⁾

Acute Phenobarbital toxicity/overdose should be clinically diagnosed and promptly managed. While the concentration of serum phenobarbital may not match the degree of cardiorespiratory depression⁽⁷⁾, it is essential to determine the value while managing a patient with potential exposure to the drug or presenting with altered mentation. With a therapeutic range of 10-40 mcg/mL, serum phenobarbital concentration above 80 mcg/mL is potentially fatal, and levels exceeding 100 mcg/mL can result in death if not managed immediately^{8,9,10}. In addition to the toxicology screening, baseline investigations, ECG, and imaging are also needed to establish diagnosis in comatose patients and during their further management.

The best modality of treatment for phenobarbital poisoning is aggressive supportive care, including respiratory support and quick elimination of the drug from the body. The elimination methods include Multidose Activated charcoal (MDAC), hemoperfusion, hemodialysis, dialysis, and urine alkalinization.⁽¹¹⁻¹⁶⁾ There is limited evidence to support the use of urine alkalinization for phenobarbital overdose^(14,16), while MDAC and hemoperfusion are cited to be useful for severe and life-compromising toxicities.⁽¹²⁻¹⁶⁾ If hemoperfusion becomes challenging to implement, healthcare providers can alternatively include low-efficiency dialysis in their treatment plan.⁽¹⁾

In our patient's case, despite the lack of a clear clinical history that impaired the reliability of our secondary survey, a quick clinical diagnosis was made with the information provided. The patient, with a serum phenobarbital value of 88µg/ml, was promptly managed with two cycles of hemodialysis, improving the patient's condition and ensuring a good recovery and discharge from the hospital.

This case, with a hypothesis of an intentional overdose and an unaddressed psychological stressor, also highlights a gap in comprehensive care. Healthcare providers are not only expected to monitor medication adherence in epileptic patients on long-term treatment, but they also need to include mental health checkups in their patient care, as undiagnosed and unaddressed stressors may lead to medication misuse. If clinicians incorporate routine psychological evaluation into epilepsy management, they are more likely to identify and treat such risks at an early stage and subsequently improve patient outcomes.

4. Conclusion

This case summarized that early intervention is crucial when managing patients with phenobarbital poisoning. Furthermore, healthcare providers need to have a high index of suspicion for overdose in patients who are taking chronic medications and acutely presenting with decreased mentation.

Abbreviation

ALP: Alkaline Phosphatase
 ALT: Alanine Aminotransferase
 AST: Aspartate Aminotransferase
 Cr: Creatinine
 Cl⁻: Chloride
 CXR: Chest X-ray
 DB: Direct Bilirubin
 ECG: Electrocardiogram

GABA: Gamma-Aminobutyric Acid
 GABA_A: Gamma-Aminobutyric Acid type A receptor
 HBsAG: Hepatitis B Surface Antigen
 HCT: Hematocrit
 HCV: Hepatitis C Virus
 Hgb: Hemoglobin
 IVC: Inferior Vena Cava
 K⁺: Potassium
 LFT: Liver Function Test
 MCV: Mean corpuscular volume
 MDAC: Multidose Activated charcoal
 Na⁺: Sodium
 PLT: Platelet
 RBS: Random Blood Sugar
 RFT: Renal Function Test
 TB: Total Bilirubin
 Ur: Urea
 WBC: White blood cells
 VDRL: Venereal disease research laboratory test

Author Contributions

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Competing interests

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References

- 1) Jana S, Chakravarty C, Taraphder A, Ramasubban S. Successful use of sustained low efficiency dialysis in a case of severe phenobarbital poisoning. *Indian Journal of Critical Care Medicine: Peer-reviewed, Official Publication of Indian Society of Critical Care Medicine*. 2014 Aug;18(8):530.
- 2) Kwan P, Brodie MJ. Phenobarbital for the treatment of epilepsy in the 21st century: a critical review. *Epilepsia*. 2004 Sep;45(9):1141-9.
- 3) Lindberg MC, Cunningham A, Lindberg NH. Acute phenobarbital intoxication. *Southern medical journal*. 1992 Aug 1;85(8):803-7.
- 4) Roberts DM, Chau AM, Nair P, Day RO. Enhanced elimination of phenobarbital using charcoal haemoperfusion in a patient with severe poisoning. *British journal of anaesthesia*. 2011 Nov 1;107(5):820-1.
- 5) Roberts DM, Buckley NA. Enhanced elimination in acute barbiturate poisoning—a systematic review. *Clinical Toxicology*. 2011 Jan 1;49(1):2-12.
- 6) Zhang LL, Zeng LN, Li YP. Side effects of phenobarbital in epilepsy: a systematic review. *Epileptic disorders*. 2011 Dec;13:349-65.
- 7) McCarron MM, Schulze BW, Walberg CB, Thompson GA, Ansari A. Short-acting barbiturate overdose: Correlation of intoxication score with serum barbiturate concentration. *JAMA*. 1982 Jul 2;248(1):55-61.
- 8) Hoyland K, Hoy M, Austin R, Wildman M. Successful use of haemodialysis to treat phenobarbital overdose. *Case Reports*. 2013 Nov 21;2013:bcr2013010011.
- 9) Mactier R, Laliberté M, Mardini J, Ghanoun M, Lavergne V, Gosselin S, Hoffman RS, Nolin TD, Workgroup EX. Extracorporeal treatment for barbiturate poisoning: recommendations from the EXTRIP Workgroup. *American journal of kidney diseases*. 2014 Sep 1;64(3):347-58.
- 10) Shubin H, Weil MH. Shock associated with barbiturate intoxication. *JAMA*. 1971 Jan 11;215(2):263-8.
- 11) Raskurazhev AA, Kuznetsova PI, Tanashyan MM. Clinical case of ataxia of toxic origin. *Bulletin of Siberian Medicine*. 2021 Apr 12;20(1):218-20.
- 12) Vittorio CC, Muglia JJ. Anticonvulsant hypersensitivity syndrome. *Archives of Internal Medicine*. 1995 Nov 27;155(21):2285-90.
- 13) Murphy JM, Motiwala R, Devinsky O. Phenytoin intoxication. *Southern Medical Journal*. 1991 Oct 1;84(10):1199-204.
- 14) Patel A, Parate TR, Bhure N, Charde S. Effect of haemodialysis in phenobarbital toxicity: A case report. *Int J Sci Res*. 2023;12(12):791-792.
- 15) Ebid AH, Hana'a M. Pharmacokinetics of phenobarbital during certain enhanced elimination modalities to evaluate their clinical efficacy in management of drug overdose. *Therapeutic drug monitoring*. 2001 Jun 1;23(3):209-16.
- 16) Ghorani-Azam A, Balali-Mood M, Riahi-Zanjani B, Darchini-Maragheh E, Sadeghi M. Acute phenobarbital poisoning for the management of seizures in newborns and children; a systematic literature review. *CNS & Neurological Disorders-Drug Targets (Formerly Current Drug Targets-CNS & Neurological Disorders)*. 2021 Feb 1;20(2):174-80.