Middle-East Journal of
Non-Communicable Diseases
ISSN: 3115-929X

2026, Volume 1, Number 1

Brief Report

An observational study to evaluate the prescription pattern of intravenous acetaminophen used in the cardiovascular hospitalized patients

Mohammad Sobhan Bojdi Gzik[1], Ali Mirmansouri[1], Zahra Ahmadnia[2], Gholamreza Kanani[1], Aboozar Fakhr Mousavi[1], Mohamad Ebrahim Ghafari[3], Marziye Jafari[1*]

1. *Cardiovascular Diseases Research Center, Department of Cardiology, Heshmat Hospital, School of Medicine, Guilan University of Medical Sciences, Rasht, Iran*
2. *PhD by Research Student in Epidemiology, Gastrointestinal and Liver Diseases Research Center, Guilan University of Medical Sciences, Rasht, Iran.*
3. *Department of Epidemiology and Biostatistics, Faculty of Health, Qom University of Medical Sciences, Qom, Iran*

Article info:
Received: 29 Nov 2025
Accepted: 28 Jan 2026

Keywords:
Acetaminophen
Analgesia
Pain

ABSTRACT

Background: Intravenous (IV) acetaminophen is a potent analgesic and antipyretic agent increasingly utilized in various hospital settings. While its efficacy in pain management is established, its application within the specific population of hospitalized cardiovascular patients warrants closer examination regarding appropriate prescription practices and adherence to clinical guidelines. The study aimed to evaluate the prescription pattern of intravenous acetaminophen used in cardiovascular hospitalized patients in a referral and teaching hospital in Northeast Iran.

Method: This cross-sectional descriptive study was conducted in a hospital setting and enrolled 288 participants, selected through systematic random sampling during 2022–2023. Data were gathered using a structured checklist. All statistical analyses were performed using IBM SPSS Statistics for Windows (Version 22.0; IBM Corp., Armonk, NY, USA).

Results: In this study, 288 patients were examined. A total of 187 (64.9%) were men. The average age of the patients was 60.03±12.98 years. The frequency of irrational prescription of acetaminophen among patients at Dr. Heshmat Hospital in Rasht was 4 cases (1.4%). In 6 cases (2%), the incorrect indication for intravenous acetaminophen was observed. In three cases, the indication was not documented, and in one case, lack of proper training was the cause of inappropriate administration of acetaminophen injection. In 5 cases (1.7%), a prescription dose mismatch was observed.

Conclusion: The study shows that although IV acetaminophen is used frequently in cardiovascular patients, its prescribing pattern remains inconsistent, particularly in dosing and treatment duration. Clear IV-to-oral conversion guidance and improved education on appropriate therapy duration may help promote more rational use.

Corresponding Author(s):
Marziye Jafari, MD
Address: *Cardiovascular Diseases Research Center, Department of Cardiology, Heshmat Hospital, School of Medicine, Guilan University of Medical Sciences, Rasht, Iran*
Tel: +98 13 33618177
E-mail: marzijafari1985@gmail.com

https://doi.org/10.61882/MEJNCD.1.1.5

1. Introduction

Research on medication utilization patterns involves the systematic collection and analysis of prescription data to identify, assess, and resolve drug-related problems, thereby promoting the fundamental objective of Rational Drug Use (RDU) [1].

RDU is formally defined as the process by which patients receive medications appropriate to their clinical conditions, in doses that meet their individual requirements, for an adequate duration, and at the lowest cost to both the patient and the community [2,3]. The essential goals of RDU are to optimize therapeutic outcomes, minimize costs, prevent avoidable adverse drug reactions and interactions, and enhance overall quality of care through improved patient adherence [2,4].

Despite these established principles, irrational drug use persists as a critical global public health challenge, particularly in developing nations where factors such as shortages of trained healthcare personnel, knowledge gaps, and economic constraints exacerbate the issue [5]. This irrationality often manifests through prescribing and dispensing errors.

The quality of patient care during the dispensing encounter is significantly influenced by the time available for pharmacist–patient interaction. Adequate time for proper counseling is crucial to ensure patient comprehension of medication regimens and improve adherence. Furthermore, prevalent self-medication practices among patients constitute another major driver of irrational drug use [2,4,5].

A pertinent example of a medication where administration practices warrant scrutiny is intravenous (IV) acetaminophen. Approved by the US Food and Drug Administration in 2010 for pain and fever management, its prescribing information mandates administration over 15 minutes [6]. This recommendation originates from experiences with its prodrug, pro paracetamol, which was associated with infusion-site pain [6,7].

Beyond administration specifics, the broader irrational use of injectable formulations such as IV acetaminophen may give rise to concealed problems, including avoidable injection-related adverse effects and unnecessary steps required for administering injectable products [8].

Therefore, this study aimed to analyze the utilization process of intravenous acetaminophen and to evaluate the impact of pharmaceutical care protocols on improving rational drug use.

2. Materials and Methods

2.1 Study Design

This cross-sectional descriptive study enrolled all patients administered injectable acetaminophen per physician orders during their admission to Dr. Heshmat Hospital in Rasht. The indication of drug use in these patients was matched with the protocol prepared by the medical care department of the hospital.

The study was conducted from September 2022 to March 2023. Exclusion criteria included addiction to opium, methadone, etc. A total of 288 patients were included. Informed consent was obtained, explaining the study objectives.

Systematic random sampling was used, and data were collected using a structured checklist. The checklist included demographic and clinical information such as age, gender, type of diagnosis, length of hospitalization, department of admission, dose, frequency of use, duration of treatment with injectable acetaminophen, and information on other drugs.

During hospitalization, data on the conversion from injectable acetaminophen to other analgesics (oral or injectable) were collected, including dosage and frequency of use. These data were followed up throughout hospitalization.

2.2 Statistical Analysis

Frequency and percentage were used to describe qualitative data, and mean and standard deviation were used for quantitative data. All statistical analyses were performed using IBM SPSS Statistics for Windows, Version 22.0 (IBM Corp., Armonk, NY, USA).

3. Results

In a study of 288 patients receiving injectable acetaminophen, the vast majority demonstrated appropriate medication use, with only small percentages experiencing medication errors: 1.4% (n = 4) had irrational administration, 2.1% (n = 6) received incorrect dosages, and 1.7% (n = 5) showed non-compliance with the prescribed dose administration schedule. The mean ± SD age of the participants was 60.03 ± 12.98 years, and 64.9% of them were male.

Based on the results, irrational administration of injectable acetaminophen was observed in four departments: ICU, CCU, Emergency, and post-angiography. The highest percentage was observed in the Post-Angiography department and the lowest in the ICU department.

Incorrect indications for acetaminophen administration were observed in ICU, CCU, and Emergency departments. The highest frequency was observed in CCU and the lowest in the Emergency department (Table 1).

Table 2 shows the frequency of each of the causes of improper administration of injectable acetaminophen in different departments of the hospital. Based on the results obtained, in three cases, lack of knowledge about the indication and in one case lack of proper training was observed.

Table 1. The frequency of irrational, incorrect prescription and compliance with the prescription dose of injectable acetaminophen in different departments of the hospital (288 patients).

Departments	Frequency n (%)					
	Irrational prescription n		Incorrect prescription		Compliance with the prescription	
	Yes	No	Yes	No	Yes	No
ICU	1 (0.7)	141 (99.3)	3 (2.1)	139 (97.9)	138 (97.2)	4 (2.8)
CCU	1 (2.7)	36 (97.3)	2 (5.4)	35 (94.6)	36 (97.3)	1 (2.7)
Emergency	1 (1.6)	62 (98.4)	1 (1.3)	78 (98.7)	116 (100)	0 (0)
POST-Angiography	1 (8.3)	11(91.7)	0(0)	12 (100)	12 (100)	0 (0)
General	0 (0)	7 (87.5)	0 (0)	7 (87.5)	7 (87.5)	0 (0)
Post -EPS	0 (0)	6 (100)	0 (0)	6 (100)	6 (100)	0 (0)
Pediatric	0 (0)	5 (100)	0 (0)	5 (100)	5 (100)	0 (0)

Abbreviation. ICU: Intensive Care Unit; CCU: Cardiac Care Unit; Post-EPS: Post-Electrophysiology Study

Table 2. Frequency of causes of inappropriate administration of injectable acetaminophen.

Departments	Frequency n (%)		
	Not knowing the indication (Yes)	Lack of proper training (Yes)	Appropriate prescription (Yes)
ICU	0(0)	1(0.7)	141(99.3)
CCU	1(2.7)	0(0)	36(97.3)
Emergency	1(1.7)	0(0)	78(98.3)
POST-Angiography	1(8.3)	0(0)	11(91.7)
General	0(0)	0(0)	7(100)
Post -EPS	0(0)	0(0)	6(100)
Pediatric	0(0)	0(0)	5(100)

Abbreviation. ICU: Intensive Care Unit; CCU: Cardiac Care Unit; Post-EPS: Post-Electrophysiology Study

4. Discussion

In the present study, the evaluation of prescribing patterns of IV acetaminophen revealed instances of irrational administration, incorrect indications, and dose non-compliance. A study by Esfahani et al. [9] assessed IV acetaminophen administration across various wards of a teaching hospital in Tehran. Their findings showed that 92.42% of prescriptions deviated from guidelines, consistent with the findings of the present study. Similarly, an Australian study on IV acetaminophen reported a 25% non-adherence rate [10]. Within this group, 98% of cases involved IV use despite the availability of an alternative route, aligning with our results.

The overuse and misuse of IV acetaminophen contribute significantly to the economic burden on healthcare systems. Recent educational interventions in Iran have aimed to enhance prescribing quality [9,11], but many efforts have focused primarily on general practitioners.

Broader educational strategies are needed. This study has several limitations, including its single-center design, reliance on medical records, and lack of patient outcome data. Future multi-center studies with clinical assessments are recommended.

The study highlights that, despite its frequent use among cardiovascular patients, the practice of prescribing IV acetaminophen is still not uniform, especially regarding dosing accuracy and length of treatment. Establishing straightforward IV-to-oral conversion guidance and reinforcing education on proper therapy duration may support more appropriate utilization of this medication.

Ethical declarations

The research conducted in this study adhered to the principles outlined in the Declaration of Helsinki and was approved by the Ethics Committee of Guilan University of Medical Sciences (IR.GUMS.REC.1399.441).

Conflict of interest

No potential conflict of interest was reported by the authors.

Financial support

This project has received a grant from Guilan University of Medical Sciences with tracking code 2425.

Authors' contributions

MJ is the principal investigator; she conceived the study and led the proposal and protocol development. ZA, AM and GK contributed to development of the proposal, study design, and analysis plans. ZA and MSBG drafted and finalized the manuscript. AFM, ZA and MEG edited the manuscript. All authors reviewed and confirmed the final manuscript.

Acknowledgments

The authors thank the Vice-Chancellor of Research and Technology, head of the department, the managers and nurses at Dr. Heshmat Rasht Medical Education Center, and all those who helped us with this research.

Declaration of using generative AI and AI-assisted technologies

While preparing this work, AI was used to improve the grammar and language of the manuscript. The authors reviewed and edited the content as needed and took full responsibility for the publication's content.

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