



Palm Vein Biometrics A Rapid Patient Identification Tool for Emergency and Trauma Care

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Received: November 17, 2025

Revised: February 18, 2026

Accepted: April 20, 2026

Keywords: Palm vein; Biometrics; Emergency department; Trauma; Patient identification.

Please cite this paper as:

Karajizadeh M, Khosravi MR, Paydar S, Yadollahi M, Arabian S. Palm Vein Biometrics A Rapid Patient Identification Tool for Emergency and Trauma Care. *Bull Emerg Trauma*. 2026;14(2):92-94. doi: 10.30476/beat.2026.109718.1651.

Dear Editor

Accurate and rapid patient identification remains a persistent challenge in emergency and trauma care. Patients frequently present unconscious, unaccompanied, or without valid identification, thereby elevating the risk of medication errors, delayed treatment, duplicate records, and medico-legal complications [1, 2]. A robust and automated identification system is therefore essential to enhance patient safety and clinical efficiency. Traditional methods, such as verbal confirmation, wristbands, or identity cards, have often proven unreliable in chaotic clinical environments. Biometric technologies, already widely used in banking and border control, are now being introduced into healthcare to enable secure and rapid recognition. Among these, palm vein biometrics offers distinct advantages owing to its contactless acquisition, reliance on internal anatomical features, and exceptionally low error rates [3].

In an increasingly interconnected healthcare landscape—characterized by a greater integration between electronic health record (EHR) systems

and more frequent patient movement across care settings—the demand for reliable biometric identification has grown quickly in recent years. Evidence indicated that registration errors and wrong-patient assignment (WPA) remain prevalent in the emergency department (ED), contributing to disidentification events and heightened patient safety risks [4, 5]. Incident-report data from large hospital systems demonstrated that administrative and process failures, such as the absence of a patient wristband or the inadvertent mixing of charts among patients with identical names, rank among the most common root causes for patient identification errors [6]. In this context, palm vein biometrics presents a feasible solution capable of reducing dependence on error-prone manual processes and strengthening the reliability of patient identity verification of patient identity verification.

Palm vein recognition uses near-infrared (NIR) imaging to visualize the unique vascular pattern within the palm. As NIR light is absorbed by deoxygenated hemoglobin, a clear image of the subdermal vein network is captured and digitally encoded. Each individual's vein pattern is unique

and remains stable throughout their lifespan, even among identical twins [7]. Recognition is rapid and unaffected by superficial injuries or skin contamination, rendering the technology particularly well-suited to emergency applications [8].

Application in Emergency and Trauma Settings

In EDs and trauma systems, palm vein biometrics can bridge the critical gap between unidentified patients and their existing electronic medical records (EMRs). A simple palm scan could immediately retrieve essential clinical data—such as allergies, blood type, or prior surgical history—that are vital for trauma resuscitation. Integration with hospital information systems (HIS) via Health Level Seven (HL7) or Fast Healthcare Interoperability Resources (FHIR) standards enables secure and automatic linkage to trauma registries, longitudinal tracking, and national data networks.

In mass-casualty incidents and disaster triage, portable NIR palm-vein scanners can identify victims without verbal interaction, thereby reducing manual data entry and ensuring continuity of care between prehospital and in-hospital teams. These systems can also prevent the creation of duplicate trauma records, a major challenge in multicenter trauma research [9].

Implementation Challenges

Despite its promise, several implementation challenges must be addressed. Operational limitations include the potential for severe burns, amputations, or heavily contaminated hands to compromise scanning capability. From an infrastructural perspective, scanners must integrate seamlessly with EMRs, maintain offline functionality for field deployment, and comply with stringent data-security protocols. With respect to ethical and legal governance, biometric data storage and consent procedures must adhere to privacy, confidentiality, and security regulations—such as the General Data Protection Regulation (GDPR) and the Health Insurance Portability and Accountability Act (HIPAA)—as well as national health information standards. Economic evaluation is also warranted. Initial equipment costs and staff training requirements should be weighed against potential savings arising from reduced identification errors and diminished administrative burden [10, 11].

Future Perspectives

Emerging research is exploring deep-learning-based palm vein recognition to enhance accuracy

under adverse conditions, including motion artefacts, partial occlusion, and low-light environments. Hybrid methods, combining palm vein recognition with facial or iris recognition, represent an additional strategy for increasing robustness in trauma cases. Furthermore, artificial intelligence (AI)-assisted triage platforms could incorporate biometric identification and link directly to EHR, thereby reducing the persistent complexity of patient identification errors, delayed access to critical inpatient data, and gaps in oversight of trauma workflows [12].

These technological advancements represent the necessary next steps to overcome the challenges outlined above, connecting the potential of palm vein biometrics directly to improved patient safety and clinical efficiency. Given the expanding adoption of digital health systems and trauma registries, palm vein biometrics represents a practical and technically mature solution for rapid and secure patient identification. We therefore recommend that trauma centers, emergency departments, health information policymakers, and researchers invest resources in a real-world evaluation and adoption of this technology into clinical practice. Further studies should evaluate its actual deployment in real emergency settings, with particular attention to the impacts on workflow, user acceptability, cost-effectiveness, and quantifiable patient-safety outcomes.

Declaration

Ethics Approval and Consent to Participate: Not Applicable.

Consent for Publication: All the authors declare their consent for publication.

Conflict of Interest: The authors have no competing interests for this research.

Funding: The authors have no funding source for this research.

Authors' Contribution: MK: Study conception and design, drafting and revision; MK: Drafting and revision; SHP: Drafting and revision; MY: Drafting and revision.

Data Availability: De-identified data may be available from the corresponding author upon reasonable request and with institutional approvals.

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