



# THE WOCISI JOURNAL OF MEDICAL SCIENCE



**WOUND & OSTOMY CARE  
SOCIETY OF INDIA**

Chief Editor  
**Dr. CHANDRAPRAKAS CHOUHAN**

Executive Editor  
**NIPIN KALAL**

Managing Editor  
**VIJAY KUMAR**

# The Role of Artificial Intelligence in Chronic Wound Assessment and Management

Ramawat Yashawant<sup>1</sup>, Kumawat Nitesh<sup>1</sup>, Kumar Vijay, Shatrughan Pareek<sup>3</sup>

<sup>1</sup>Wound and Ostomy Care Unit, AIIMS, Jodhpur, Rajasthan

<sup>1</sup>Wound and Ostomy Care Unit, AIIMS, Jodhpur, Rajasthan

<sup>2</sup>DR. B.R. Ambedkar Institute Rotary Cancer Hospital, AIIMS, New Delhi

<sup>3</sup>Indian Railway Health Services, Bikaner, Rajasthan

## Abstract:

Chronic wounds, including diabetic wounds, venous ulcers, and bedsores, are a significant healthcare problem worldwide, resulting in significant morbidity and healthcare expenses. Appropriate management of chronic wounds requires a comprehensive approach that includes identifying the underlying cause of the wound, developing personalized treatment plans, and using advanced wound care products. Advanced wound care products, including wound dressings, skin substitutes, and growth factors, are commonly used to manage chronic wounds. However, these products can be expensive and may not always be effective in promoting wound healing. Artificial intelligence (AI) has the potential to revolutionize wound care by providing faster and more accurate wound assessments, improving treatment efficacy, and reducing healthcare expenses. This article reviews the current understanding of chronic wounds, their prevalence, and the challenges associated with their management. It also discusses the potential of AI in chronic wound assessment and management, including the types of AI available for wound assessment, the benefits of using AI in wound care, and future directions for research in this area.

**Keywords :** Artificial Intelligence, Chronic Wound, Artificial intelligence Wound Management, Artificial intelligence Wound Assessment.

Correspondence : Yashawant Ramawat

Email : yashramawat19@gmail.com

Received: 15/09/2023  
20/10/2023

Accepted: 1/10/2023

Published:

Copyright: This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY 3.0), which permits unrestricted use, distribution, and reproduction in any medium.

## Introduction

Wounds are a common occurrence in daily life and can result from various factors such as accidents, surgery, and medical conditions. Wounds can be acute or chronic, with the latter being wounds that fail to heal within a reasonable amount of time. Chronic wounds can be difficult to manage and can lead to significant morbidity, including pain, disability, and reduced quality of life. The World Health Organization (WHO) estimates that chronic wounds affect approximately 4.5 million people in the United States alone, with an estimated cost of \$20 billion in healthcare expenses annually. The assessment of chronic wounds

can be challenging and time-consuming, and this is where AI can play a significant role in improving wound management. This article will discuss the role of AI in chronic wound assessment, the types of wounds, chronic wounds' prevalence and their associated diseases, why it is essential to work on chronic wounds, the challenges in assessing wounds, and the different types of AI tools available for wound assessment.

## Types of Wounds

There are several types of wounds, including acute wounds and chronic wounds. Acute wounds typically heal within a few weeks, while chronic wounds fail to heal within a reasonable amount of

time and can persist for months or even years. Chronic wounds can result from various factors such as diabetes, vascular disease, and immune disorders. Some common types of chronic wounds include venous ulcers, pressure ulcers, and diabetic foot ulcers.

Venous ulcers are a type of wound that results from damage to the veins in the legs, leading to poor blood circulation and fluid buildup in the lower leg. This can result in the development of a venous ulcer, which is a shallow, irregularly shaped wound that is usually located on the inner part of the leg above the ankle. Venous ulcers can be painful and can result in significant morbidity if left untreated.

Pressure ulcers, also known as bedsores or pressure sores, are wounds that result from prolonged pressure on the skin, typically in patients who are bedridden or use a wheelchair. Pressure ulcers typically develop on bony areas of the body such as the hips, heels, and tailbone. These wounds can be painful and can lead to serious complications such as infections and even death in severe cases.

Diabetic foot ulcers are a type of wound that results from diabetes-related complications such as poor circulation, nerve damage, and reduced immune function. Diabetic foot ulcers typically develop on the soles of the feet or toes and can be difficult to treat and manage. These wounds can be painful and can lead to serious complications such as infections, gangrene, and amputations.

#### **Chronic Wounds Prevalence and Associated Diseases**

Chronic wounds are a significant healthcare problem worldwide, affecting millions of people and resulting in significant morbidity and healthcare expenses. According to the WHO, chronic wounds affect approximately 4.5 million people in the United States alone, with an estimated cost of \$20 billion in healthcare expenses annually. Chronic wounds are often associated with underlying health conditions that impair the body's ability to heal, such as diabetes, vascular disease, and immune disorders.

Diabetes is a significant risk factor for chronic wounds, as it can result in complications such as poor circulation, nerve damage, and reduced immune function. These complications can make it difficult for wounds to heal and can increase the risk of infections and other complications. According to the American Diabetes Association, approximately 15% of patients with diabetes will develop a diabetic foot ulcer during their lifetime.

Vascular disease, including peripheral artery disease and venous insufficiency, is another significant risk factor for chronic wounds. Vascular disease can lead to poor blood circulation, resulting in tissue damage and increased risk of infections. According to the Centers for Disease Control and Prevention, approximately 8.5 million people in the United States have peripheral artery disease, a condition that can increase the risk of developing chronic wounds.

Immune disorders, such as rheumatoid arthritis and lupus, can also increase the risk of chronic wounds by impairing the body's immune response and ability to heal. Other factors that can

increase the risk of chronic wounds include age, obesity, smoking, and poor nutrition.

#### **Why It Is Essential to Work on Chronic Wounds**

Chronic wounds can significantly impact a patient's quality of life and can lead to significant morbidity, including pain, disability, and reduced mobility. These wounds can also increase the risk of infections, sepsis, and other complications that can be life-threatening in severe cases. In addition, chronic wounds can be difficult and expensive to manage, leading to significant healthcare expenses and burden on the healthcare system.

Improving the assessment and management of chronic wounds is essential to improve patient outcomes and reduce healthcare expenses. Early detection and appropriate treatment of chronic wounds can help prevent complications and improve healing rates. AI can play a significant role in improving wound assessment and management by providing faster and more accurate wound assessment tools.

#### **Challenges in Assessing Wounds**

Assessing wounds can be challenging and time-consuming, requiring careful examination of the wound's size, depth, location, and other characteristics. Traditional wound assessment methods involve manual measurements using rulers or other instruments and visual inspection by healthcare professionals. These methods can be subjective and prone to errors, leading to inaccurate wound assessments and delayed treatment.

In addition, wound assessment can be a time-consuming process, particularly for healthcare professionals who have to assess multiple wounds on a regular basis. This can lead to delays in treatment and increased healthcare expenses. AI can help overcome these challenges by providing faster and more accurate wound assessment tools that can improve the efficiency and accuracy of wound management.

#### **Role of AI in Chronic Wound Assessment**

AI has the potential to revolutionize wound assessment by providing faster and more accurate wound assessment tools that can improve the efficiency and accuracy of wound management. AI tools can analyze wound images and provide automated measurements of wound size, depth, and other characteristics. This can help healthcare professionals to make more accurate wound assessments and develop appropriate treatment plans.

AI can also provide predictive analytics tools that can help identify patients at risk of developing chronic wounds and develop appropriate prevention strategies. For example, AI tools can analyze patient data such as age, medical history, and lifestyle factors to identify patients at high risk of developing chronic wounds and provide appropriate interventions to prevent wound development.

#### **Types of AI Tools Available for Wound Assessment**

There are several types of AI tools available for wound assessment, including computer vision, machine learning, and natural language processing.

Computer vision tools use algorithms to analyze wound images and provide automated measurements of wound size, depth, and other characteristics. These tools can also identify changes in wound characteristics over time and provide alerts to healthcare professionals if significant changes occur.

Machine learning tools use algorithms to analyze patient data and identify patterns and trends that can help healthcare professionals develop appropriate treatment plans. For example, machine learning tools can analyze patient data such as age, medical history, and lifestyle factors to identify patients at high risk of developing chronic wounds and provide appropriate interventions to prevent wound development.

Natural language processing tools can analyze electronic health records and other text-based documents to identify patterns and trends related to wound management. These tools can provide insights into patient outcomes, treatment efficacy, and other factors that can help healthcare professionals develop more effective wound management strategies.

### Conclusion

Chronic wounds are a significant healthcare problem worldwide, affecting millions of people and resulting in significant morbidity and healthcare expenses. AI has the potential to revolutionize wound assessment by providing faster and more accurate wound assessment tools that can improve the efficiency and accuracy of wound management. AI tools can analyze wound images and provide automated measurements of wound size, depth some more data about chronic wound and diabetic wounds.

### References

- [1] Riley WJ. Health disparities: gaps in access, quality and affordability of medical care. *Trans Am Clin Climatol Assoc.* 2012; 123: 167- 172.
- [2] Bartelt A, Leipsic J, Weber C. The new age of radiomic risk profiling: perivascular fat at the heart of the matter. *Eur Heart J.* 2019; 40(43): 3544- 3546. doi:10.1093/eurheartj/ehz717
- [3] Mathur P, Srivastava S, Xu X, Mehta JL. Artificial intelligence, machine learning, and cardiovascular

disease. *Clin Med Insights Cardiol.* 2020; 14:1179546820927404.

doi:10.1177/1179546820927404

- [4] Beaulieu-Jones BK, Yuan W, Brat GA, et al. Machine learning for patient risk stratification: standing on, or looking over, the shoulders of clinicians? *NPJ Digit Med.* 2021; 4: 62. doi:10.1038/s41746-021-00426-3
- [5] Schultz GS, Sibbald RG, Falanga V, et al. Wound bed preparation: a systematic approach to wound management. *Wound Repair Regen.* 2003; 11(suppl 1): S1- S28.
- [6] Martinengo, L.; Olsson, M.; Bajpai, R.; Soljak, M.; Upton, Z.; Schmidtchen, A.; Car, J.; Järbrink, K. Prevalence of chronic wounds in the general population: Systematic review and meta-analysis of observational studies. *Ann. Epidemiol.* 2019, 29, 8–15. [Google Scholar] [CrossRef] [PubMed]
- [7] Marijanović, D.; Filko, D. A Systematic Overview of Recent Methods for Non-Contact Chronic Wound Analysis. *Appl. Sci.* 2020, 10, 7613. [Google Scholar] [CrossRef]
- [8] Bowers, S.; Franco, E. Chronic Wounds: Evaluation and Management. *Am. Fam. Physician* 2020, 101, 159–166. [Google Scholar] [PubMed]
- [9] Keast, D.H.; Bowering, C.K.; Evans, A.W.; Mackean, G.L.; Burrows, C.; D’Souza, L. Contents. MEASURE: A proposed assessment framework for developing best practice recommendations for wound assessment. *Wound Repair Regen.* 2004, 12, s1–s17. [Google Scholar] [CrossRef] [PubMed]
- [10] Wang, C.; Anisuzzaman, D.M.; Williamson, V.; Dhar, M.K.; Rostami, B.; Niezgodna, J.; Gopalakrishnan, S.; Yu, Z. Fully automatic wound segmentation with deep convolutional neural networks. *Sci. Rep.* 2020, 10, 21897. [Google Scholar] [CrossRef]