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Artificial Intelligence Versus Human Systematic Literature Review Into Negative-pressure Wound Therapy in Plastic Surgery

Augustine J. Deering III, BS*
Payden A. Harrah, BS*
Melinda Lue, MD†
Daanish Sheikh, BS*
C. Anton Fries, MD, PhD‡

Background: The potential of artificial intelligence (AI) to support physician evidence-based medicine is vast. We compared AI's ability to perform a systematic review of the literature to that of human investigators. Negative-pressure wound therapy (NPWT), a mainstay of wound management with a large but varied body of evidence, was therefore chosen as the subject of this investigation. Producing high-level evidence of NPWT's impact on wound healing has been challenging due to trial design issues, making a systematic review important and challenging. In this article, NPWT efficacy and the ability of AI to assess levels of evidence were evaluated.

Methods: A literature search was conducted using PubMed, SCOPUS, and CINAHL. The resulting articles were screened using Preferred Reporting Items for Systematic Reviews and Meta-Analysis guidelines. The Grading of Recommendations, Assessment, Development, and Evaluations criteria were applied by both humans and AI to analyze the quality and evidence of each article.

Results: Eighteen studies on 3131 patients were reviewed. Seven studies addressed length of stay; five showed shorter stays with NPWT. Fourteen studies examined infection rates. Eight found significant improvement with the use of NPWT. Twelve articles analyzed time to wound closure, and nine of those articles found reduced time when NPWT was utilized. AI generally assigned lower quality of evidence scores compared with humans.

Conclusions: AI is a promising tool but remains limited in accurately determining evidence quality. AI's lower scores may reflect reduced bias. Multiple confounders and the diversity of its application lead to a lack of high-level evidence of NPWT's efficacy.
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INTRODUCTION

Artificial intelligence (AI) is the most disruptive technology of our age, with the potential to change almost all conceivable aspects of human life; the field of medicine is no exception. The combination of AI and robotic technology could eventually make doctors and surgeons obsolete. The potential is limitless, but early adoptive AI practices in research and education are already being realized. The use of AI to assist physicians in decision-making and practicing evidence-based medicine is one such area. This study addresses the knowledge gap of whether AI has utility in supporting clinician decision-making by safely and accurately performing systematic reviews of published evidence. Negative-pressure wound therapy (NPWT) has been a mainstay of open wound management strategies since Morykwas et al[1] described its successful use in animal models in 1997. NPWT combines the sealing of open-cell foam into a wound, and the application of subatmospheric pressure, to promote healing by secondary intention.[2–4] The clinical success and relatively low cost of NPWT led to a rapid expansion of its use in acute traumatic and chronic wound management.[5] Over time, NPWT has expanded in scope and has been incorporated into the treatment of nontraumatic wounds, including ulcers, burns, and open surgical abdominal wounds.[4]

*From the *Long School of Medicine, University of Texas Health Science Center San Antonio, San Antonio, TX; †Division of Plastic Surgery, Baylor Scott and White Health, Temple, TX; and ‡Division of Plastic Surgery, University of Texas Health Science Center San Antonio, San Antonio, TX.*

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Despite the widespread use of NPWT due to its purported benefits, the literature on NPWT presents a heterogeneous body of evidence. Studies typically focus on individual indications for specific anatomical locations. Although there have been numerous literature reviews, they present either a mixed response on the cost-effectiveness and efficacy of NPWT or focus on specific populations that are not generalizable.[6–9] NPWT is, therefore, an ideal topic to use to study the ability of AI to review complex levels of evidence and to compare this to human evaluation. Although this is a review article, there is still clinical relevance concerning NPWT and general clinical applications regarding the use of AI in clinical decision-making.

The rationale for this study is that it is unknown whether AI can safely/effectively review articles. The goal is to evaluate the capabilities of AI to assess the quality of evidence during a literature review in the form of Grading of Recommendations, Assessment, Development, and Evaluations (GRADE) for each article included in our literature review to further establish a potential avenue of utility of AI in research.

Takeaways

Question: How effective is negative-pressure wound therapy (NPWT) according to artificial intelligence (AI) and human assessment?

Findings: Studies regarding NPWT efficacy typically favor its use in surgical wound healing by both methods of analysis, although AI attributes a lower evidence quality across all articles considered.

Meaning: AI needs further improvement in assessing evidence quality but corroborates human assessment that NPWT is an impactful mainstay of wound management.

METHODS

Articles were collected from PubMed, SCOPUS, and CINAHL with the assistance of a librarian. Articles were limited to English and those published in the last 15 years. The Medical Subject Heading terms and keywords used to conduct the search are described in Table 1. After removing duplicates, abstracts from the 156 remaining articles were screened for relevance using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis guidelines (Fig. 1).

Studies were included where endpoints of infection rate (IR), wound closure (WC), and length of stay (LOS) were evaluated, and NPWT was a major aspect of the intervention in the settings of reconstructive surgery. Case reports were not included. Other systemic reviews, case reports, and studies performed on animal models were excluded. Three blinded reviewers analyzed all 156 abstracts and individually voted on eligibility based on inclusion criteria (Fig. 1). In cases where the vote was not unanimous, all reviewers discussed the merits of the article and its relevance to the study until a consensus was reached. Based on these inclusion criteria, 55 articles were selected for further eligibility. Of these, further screening for inclusion criteria and applicable studies to use the GRADE framework provided 18 eligible studies for this systematic review using the AI program GPT-4. A GRADE framework was assigned to each study using an AI model (GPT-4) trained to apply the GRADE criteria to a full-text article. The prompt instructed the model to apply current GRADE criteria to assign a score of high, moderate, low, or very low. This was accomplished by training the AI program by inputting the current GRADE criteria into the AI

Table 1. NPWT LOS Literature Review Average GRADE Table

Title	Author	Patients	Significant Results	GRADE
Use of incisional negative pressure wound therapy in skin-containing free tissue transfer[10]	Bi et al	24	Postoperatively, patients remained in the hospital for an average of 15.5 d following flaps with NPWT	Low
Randomized clinical trial of negative pressure wound therapy for high-risk groin wounds in lower extremity revascularization[11]	Lee et al	102	There was a statistically significant shorter mean duration of hospital stay in the NPWT group (6.4 d) compared with the standard group (8.9 d; $P = 0.01$).	Moderate
Negative pressure wound therapy versus gauze dressings for the treatment of contaminated traumatic wounds[12]	Kaushik et al	104	The duration of hospital stay was significantly less in the NPWT group (mean 17.3 d) than in the control group (mean 23.8 d).	Moderate
Factors influencing the fascial closure rate after open abdomen treatment: results from the European Hernia Society (EuraHS) Registry: surgical technique matters[13]	Willms et al	630	Successful definitive fascial closure that was improved by the addition of NPWT did not significantly reduce hospital LOS	Moderate
Open abdomen and VAC® in severe diffuse peritonitis[14]	Mutafchiyski et al	108	VAC showed shorter intensive care unit (6.1 versus 10.6 d, $P = 0.002$) and hospital stay (15.1 versus 25.9 d, $P = 0.000$)	Low
Negative-pressure wound therapy: an effective adjunctive treatment to assist flap survival and wound closure[15]	Wu et al	261	The NPWT group had a significantly shorter hospitalization length compared with the conventional dressing group (7.11 ± 0.72 d versus 10.97 ± 0.68 d, $P = 0.013$).	Very low
Small incisions combined with negative-pressure wound therapy for treatment of protobothrops mucrosquamatus bite envenomation: a new treatment strategy[16]	Zeng et al	50	The mean duration of hospital stay was significantly lower in the observation group (5.44 ± 0.89 d) than in the control group (7.71 ± 1.70 d)	Very low
Totals		1279		

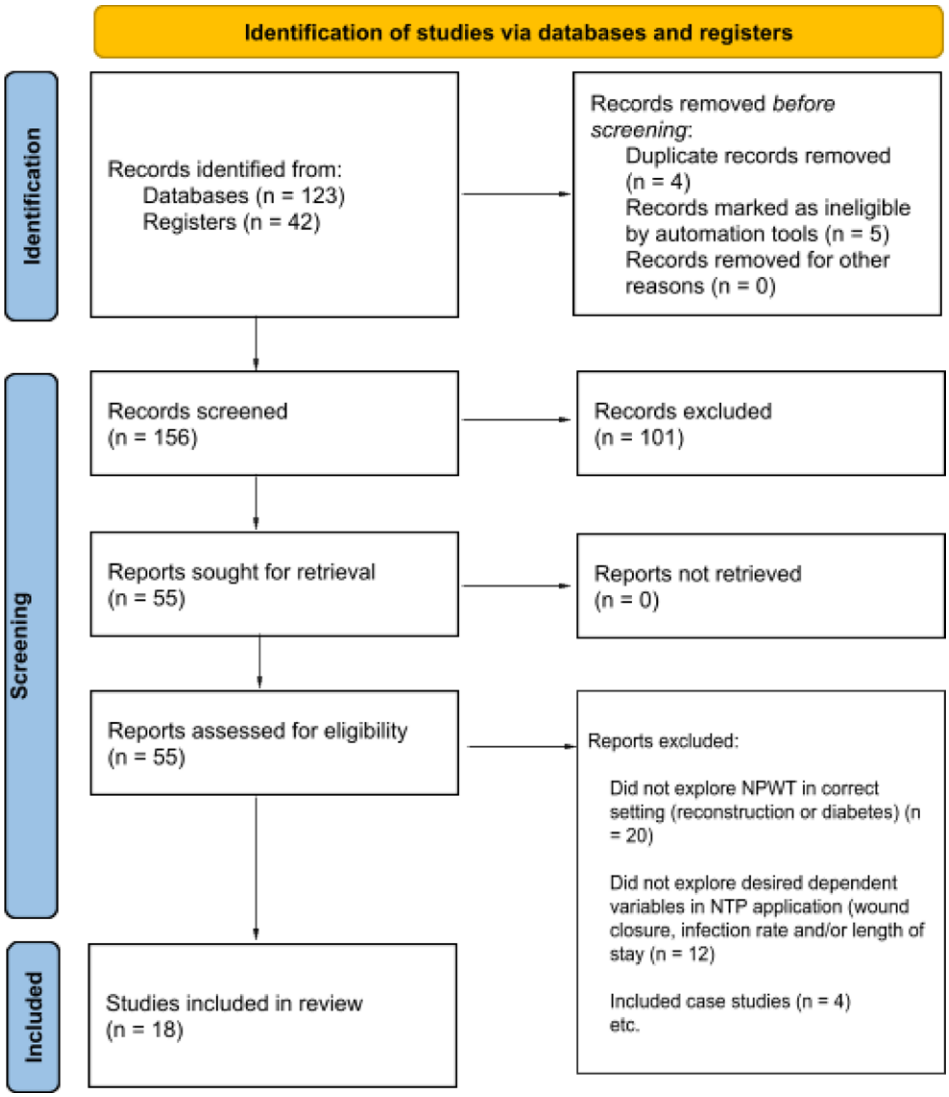

Fig. 1. Preferred Reporting Items for Systematic Reviews and Meta-Analysis flowchart illustrating the process of article inclusion of 18 final articles.

program. Next, the desired article was input into the AI program, which was asked to apply the GRADE criteria and the scores discussed earlier. To ensure accuracy, we also prompted the AI program to justify the reason for the assigned score, which was then reviewed by a human reviewer. There was no instruction in the prompt to bias the AI program. Two reviewers independently reviewed the same articles and assigned a GRADE score manually based on current criteria. Tables were compiled detailing the authors, type of study, number of participants, and statistically significant findings.

RESULTS

There were a total of 18 studies included in this review investigating the effects of NPWT on wounds arising from a variety of etiologies (Table 1). Study designs included 9 randomized controlled trials (RCTs), 2 case-control studies, 3 cohort studies, and 4 observational/miscellaneous studies, with a total of 3131 patients.

Artificial Intelligence

After following the GRADE criteria, we found there to be 2 articles of high-quality evidence, 8 articles of moderate-quality evidence, and 8 articles of low-quality evidence. AI was instructed to follow a prompt to apply the same criteria to each article, and the results were 1 article of high-quality evidence, 9 articles of moderate-quality evidence, 7 articles of low-quality evidence, and 2 articles of very low evidence.

Length of Stay

There were a total of 7 studies (1279 patients) that included results pertaining to the effect of NPWT on LOS.[10–16] These 7 articles consisted of 3 RCTs, 2 case-controlled comparisons, 1 retrospective analysis, and 1 prospective longitudinal study. The etiology of the wounds being dressed with NPWT included abdominal wall closure, surgical wounds, traumatic wounds, free flaps, and chronic wounds. Out of the 7 articles investigating LOS, 5 articles had significant improvements following NPWT

usage, and 2 articles found no significant changes. Of the 2 articles with insignificant findings, neither were categorized as RCTs and included a retrospective review[16] and a prospective longitudinal study.[10] The 2 RCTs looking at LOS for NPWT use found a significant decrease in LOS.[10,11]

Infection Rate

Fourteen articles (2201 patients) in this review discuss the impact NPWT has on IRs in reconstruction procedures (Table 2). These 14 articles consisted of 8 RCTs, 2 prospective longitudinal studies, 2 case-control studies, and 2 retrospective studies. The etiology of the wounds being dressed with NPWT included abdominal wall closure, surgical wounds, traumatic wounds, free flaps, and chronic wounds. Seven RCTs addressed NPWT's effect on IRs, with 3 finding significant results.[18,21,22] When addressing study validity through GRADE, the significant studies had a higher level of

Table 2. NPWT IR Literature Review GRADE Table

Title	Author	Patients	Significant Results	GRADE
Use of incisional negative pressure wound therapy in skin-containing free tissue transfer[10]	Bi et al	24	The study reported no cases of hematomas, seromas, surgical-site infections, or deep vein thrombosis/pulmonary embolism in the series	Low
Effect of negative pressure wound therapy vs standard wound management on 12-month disability among adults with severe open fracture of the lower limb: the WOLLF Randomized Clinical Trial[17]	Costa et al	460	There was no significant difference between groups for IRs	High
Negative pressure wound therapy after severe open fractures: a prospective randomized study[18]	Stannard et al	58	There was a significant difference between groups for total infections ($P = 0.024$). The relative risk ratio was 0.199 (95% confidence interval: 0.045–0.874)	Moderate
Randomized clinical trial of negative pressure wound therapy for high-risk groin wounds in lower extremity revascularization[11]	Lee et al	102	There was no significant difference for surgical-site IRs	Moderate
Comparison of negative pressure wound therapy (NPWT) & conventional wound dressings in the open fracture wounds[19]	Arti et al	90	There was no significant difference between group I or NPWT group and group II for IR	Moderate
Closed-incision negative pressure therapy to reduce groin wound infections in vascular surgery: a randomised controlled trial[20]	Engelhardt et al	132	The overall IRs were 14% (9 of 64) in the closed-incision negative pressure therapy (ciNPT) group and 28% (19 of 68) in the control group ($P = 0.055$). Early infections were observed in 6% (4 of 64) of the ciNPT group and 15% (10 of 68) of the control group ($P = 0.125$)	Low
Negative pressure wound therapy versus gauze dressings for the treatment of contaminated traumatic wounds[12]	Kaushik et al	104	The NPWT group had significantly lower rates of total and deep infections compared with the control group	Moderate
Reducing surgical site infection with negative-pressure wound therapy after open abdominal surgery: a prospective randomized controlled study[21]	Li et al	72	The infection incidence was statistically different between the NPWT experimental group and the control group (3.0% versus 23.7%, $P = 0.031$)	Low
Negative pressure wound therapy in the management of mine blast injuries of lower limbs: Lessons learnt at a tertiary care center[22]	Maurya et al	17	Surface microbiology was positive in 18% of patients	Low
Open abdomen and VAC® in severe diffuse peritonitis[14]	Mutafchiyski et al	108	VAC was associated with lower rates of necrotizing fasciitis (2% versus 15%, $P = 0.012$), intra-abdominal abscesses (10% versus 20%), enteroatmospheric fistulas (8% versus 19%), overall mortality (31% versus 53%, $P < 0.05$)	Low
Impact of negative pressure wound therapy on open diaphyseal tibial fractures: a prospective randomized trial[23]	Virani et al	93	The control group had a total of 11 infections (22%), whereas the NPWT group had only 2 infections (4.6%). The relative risk was 5.5, indicating that patients who received NPWT were 5.5 times less likely to develop infection	Low
Negative-pressure wound therapy: an effective adjunctive treatment to assist flap survival and wound closure[15]	Wu et al	261	The NPWT group had a significantly lower incidence of overall infection compared with the conventional dressing group (1% versus 5%, $P = 0.015$)	Very low
Small incisions combined with negative-pressure wound therapy for treatment of protobothrops mucrosquamatus bite envenomation: a new treatment strategy[16]	Zeng et al	50	No complications were observed in the NPWT group, whereas the control group had a complication rate of 19%	Very low
Factors influencing the fascial closure rate after open abdomen treatment: results from the European Hernia Society (EuraHS) Registry: surgical technique matters[13]	Willms et al	630	The multivariable analysis showed a negative correlation of NPWT and intra-abdominal contamination (odds ratio: 0.630, $P = 0.029$)	Moderate
Total		2201		

validity when compared with the insignificant studies for NPWT's effect on IR. Significant studies[10,12–16,18,20–22] had GRADE scores of high (1), moderate (5), low (2), and very low (2), whereas insignificant studies[11,19,23,24] had GRADE scores of low (4).

Wound Closure

Twelve articles (2233 patients) in this review discuss the impact NPWT has on WC rates (Table 3). These 12 articles consisted of 5 RCTs, 5 prospective longitudinal studies, and 2 case-control studies. The etiology of the wounds being dressed with NPWT included abdominal wall closure, surgical wounds, traumatic wounds, free flaps, and chronic wounds. Of the 3 variables addressed in this review, WC had the highest ratio of significant[12–15,19,25–28] to insignificant[22,23,29] (9:3) findings. Both RCTs looking at WC had insignificant results.[22,30]

DISCUSSION

Thus, although there have been RCTs investigating NPWT, it is very challenging to design wound studies that can control for wound size, location, microbiome, vascular status of the wound, and/or exposed vital structures among other confounders. Hence, the levels of evidence in clinical wound care research are often low, as reflected by our results. Given these challenges, it is appropriate to evaluate the ability of AI to recognize these issues and aid us in accurately assigning weight to the evidence we use to direct clinical decision-making.

Initially used to treat traumatic wounds, the indications for NPWT have expanded to include chronic wounds, ulcers, surgical incisions, abdominal wall closures, skin grafts, and free flaps, among other etiologies. The mechanism of negative pressure on wound healing has been investigated and relates to increased

Table 3. NPWT WC Literature Review GRADE Table

Title	Author	Patients	Significant Results	GRADE
Use of negative pressure wound therapy on conflict-related wounds.[25]	Atwood et al	174	NPWT did not affect WC time. WC by day 5: 49% of participants in the NPWT group versus 60% in the standard treatment group had closed wounds by day 5	Moderate
Comparison of negative pressure wound therapy (NPWT) & conventional wound dressings in the open fracture wounds[19]	Arti et al	90	There was a significant difference between the rate of wound healing in group I or NPWT group and group II (conventional wound dressings), $P < 0.05$	Moderate
Negative pressure wound therapy versus gauze dressings for the treatment of contaminated traumatic wounds[12]	Kaushik et al	104	The time between injury and complete WC was significantly shorter in the NPWT group (mean 12.5 d) than in the control group (mean 21.4 d)	Moderate
Negative pressure wound therapy in the management of mine blast injuries of lower limbs: Lessons learnt at a tertiary care center[22]	Maurya et al	17	NPWT was useful in providing temporary WC and preventing IRs leading to reconstruction	Low
Open abdomen and VAC® in severe diffuse peritonitis[14]	Mutafchiyski et al	108	VAC was associated with higher overall (73% versus 53%) and late primary fascial closure rates (31% versus 7%)	Low
Quality of life after open abdominal treatment with vacuum-assisted wound closure and Mesh-mediated fascial traction[26]	Schaaf et al	55	The results showed a fascial closure rate of 74% (intention-to-treat) and 89% (per-protocol)	Moderate
Impact of negative pressure wound therapy on open diaphyseal tibial fractures: a prospective randomized trial[23]	Virani et al	93	There was no significant difference in the time required for the wound to be ready for delayed primary closure or coverage between the NPWT group (average of 8.3 d) and the control group (average of 9.8 d).	Low
Negative-pressure wound therapy: an effective adjunctive treatment to assist flap survival and wound closure[15]	Wu et al	261	The NPWT group had a significantly shorter time for drainage tubes to be removed compared with the conventional dressing group (2.19 ± 0.45 d versus 3.87 ± 0.57 d, $P = 0.001$).	Very low
Factors influencing the fascial closure rate after open abdomen treatment: results from the European Hernia Society (EuraHS) Registry: surgical technique matters[13]	Willms et al	630	Showed a positive correlation of negative-pressure wound therapy (odds ratio: 2.496, $P < 0.001$) with fascial closure times	Moderate
Using negative pressure wound therapy on microskin autograft wounds[27]	Zhang et al	81	The study group exhibited a significantly shorter 95% wound healing time (8.56 ± 1.53 d) compared with the control group (10.02 ± 3.23 d)	Low
Comparison of negative pressure wound therapy using vacuum-assisted closure with advanced moist wound therapy in the treatment of diabetic foot ulcers[28]	Sajid et al	278	Wound size measured after 2-wk treatment, significantly faster healing/wound size reduction in NPWT group ($P < 0.001$)	Moderate
Comparison of negative pressure wound therapy using vacuum-assisted closure with advanced moist wound therapy in the treatment of diabetic foot ulcers: a multicenter randomized controlled trial[29]	Blume et al	342	NPWT achieved complete WC at a higher rate compared with the control group over a 4-mo period (43.2% versus 28.9%)	Moderate
Total		2233		

granulation of damaged tissue and increased wound healing, which explains the significant studies identified in this review relating to all 3 variables that are wound-healing dependent.[31] NPWT can be applied directly to superficial fascia following trauma or postoperatively to create a sealed environment and minimize contamination.[24] Critiques of NPWT reflect on the lack of a mechanistic relationship between the effects of topical pressure and wound healing being definitively shown, and on the methodological flaws in many of the clinical studies.[32] Despite these concerns, many wound care practitioners and surgeons find NPWT to be a convenient and practical dressing choice.

Role of AI in Literature Review

This review attempted to streamline this process using the help of the open-access AI program GPT-4. GPT-4 was able to accurately summarize long articles, allowing us to select articles based on inclusion criteria as well as assign a GRADE score based on current guidelines. Once these articles were selected, a script was imputed into GPT-4, instructing the program to extract the variables LOS, WC, and IRs. After these variables were reported, they were manually verified to ensure accuracy. The AI program worked effectively and only seemed to struggle with classifying what data would fit the criteria set, such as taking a time measurement out of context and reporting it as LOS data. A notable observation was that GPT-4 was able to extract information pertinent to our study that was subtly reported in the article and was not an obvious finding highlighted in the summary or abstract. There were several articles where the AI program and reviewers had differing scores; there are several possible explanations for this, not limited to the fact that the GRADE criteria are subjective, and with this, differing amounts of emphasis can be placed on aspects of the criteria, which may lead to varied scores. There is also the possibility that human error is a possible source of varied scores, whereas subjective scoring systems can be a limitation for an AI program. With a human review team analyzing a large volume of articles, the possibility of errors in scoring through manual review is always a potential study limitation. The utility of AI in literature review and meta-analysis has been identified. However, the extent of AI integration into future practice remains a mystery. Using an AI program in a large systematic review can act as a strong tool for organizing articles as well as consolidating and searching for desired outcomes in articles. When applying any criteria or parameters to a large volume of articles, AI allows for the same prompt to be followed and avoids variations that would normally be present with a team of reviewers who will inherently have differing subjective opinions.

Significance of NPWT

In cases of traumatic injuries and diabetic wounds, a modest yet consistent quality of evidence emerges in favor of NPWT usage. In contrast, the support for its effectiveness in reconstructive surgery is less pronounced, highlighting an area of emphasis for further studies. There is a presence of significant evidence favoring NPWT in at least half of the studies across all measured variables. It is worth noting that these supportive articles generally possess lower levels of evidence scores. Nonetheless, this consistency suggests a potential benefit of NPWT.

There was a near-even split of significance for all articles included in this review, with significant studies generally having a lower GRADE score when compared with insignificant studies. A likely reason for such inconclusiveness and debate in NPWT studies is the inconsistency that follows wound research, such as wound size, location, depth, and the inability to control external factors that are not addressed in each article.[31] In the Älgå et al[32] study on conflict-related wounds, their conclusion of insignificance could be due to their choice of endpoint, which was set as a composite of WC by day 5 and freedom from any bleeding, wound infection, sepsis, or amputation of the index limb. This endpoint would most likely be unrealistic, given the nature of the injury, and too short to accurately assess significant differences in wound healing, considering that it takes approximately 5 days for re-epithelization to begin and infections after a traumatic injury can occur 12–15 days postinjury.[33,34] These confounding variables and lack of consistency contribute to the mixed findings in NPWT efficacy studies, as LOS, IR, and WC are all dependent on the specific type of wound and variables not accounted for by each study.[8,30]

Throughout the literature, the more detailed and methodologically sound a study was, the higher the likelihood it had of producing insignificant results. This can be seen when comparing the Wound Management of Open Lower Limb Fractures (WOLLF) trial[17] to other RCTs: the WOLLF trial had the highest GRADE score and found NPWT insignificant for multiple variables, yet other RCTs with lower GRADE typically had significant results for the same variables.[12,17] Due to the inherent difficulty in designing generalizable wound studies and controlling for outside variables, there is weak GRADE evidence that NPWT has improved effects on the variables investigated in this review.

WC Variability

An important consideration is the use of NPWT and its significance in different wound types. Most of the significant evidence linking NPWT to faster WC comes from isolated cases of trauma or patients with comorbidities, such as diabetic patients with foot ulcers.[22,28] Part of the struggle to define the efficacy over a wide range of etiologies is the fact that some applications are predisposed for certain results, such as a planned surgical free flap compared with a trauma wound, and the vast variation in patient-related comorbid factors. This trend leads to the assumption that NPWT is only significant when applied on wounds that are less likely to have uncomplicated healing. The heterogeneity of NPWT application in wound treatment is 1 reason why there is such controversy in large-scale randomized control studies over the significance of NPWT.

Study Limitations

A literature review on NPWT faces various limitations. The diverse nature of study designs, patient demographics, and NPWT application methods contributes to heterogeneity, challenging direct comparisons. The quality and quantity of evidence vary, with potential biases due to publication tendencies favoring positive results. The evolution of NPWT technology might yield some outdated literature, impacting the study's relevance. Additionally, limited long-term follow-up data, confounding variables beyond NPWT (such as comorbidities and the application to many trauma-related injuries), and nongeneralizable findings pose challenges. Addressing these limitations is crucial to ensure a comprehensive and accurate assessment of NPWT's efficacy across different clinical contexts.

Regarding our use of AI to assess the quality of evidence of research articles, we were limited by a relatively small number of articles that fit our inclusion criteria for the initial review article to generate a broader scale human–AI comparison of significant statistical power. Notably, limiting our literature review to English articles published in the last 5 years excludes substantial contributions published in German and a great deal of foundational literature from the 1990s and early 2000s. The GRADE scale is also inherently subjective, such as assessing for possible risk of bias, which makes comparing AI to a subjective human score difficult as there is not always an obvious right answer. The comparative risk of bias between humans and AI is unknowable at this stage and warrants further analysis. There is also an unknown risk of bias when using an AI program to subjectively score a scholarly article. The AI program was explicitly instructed to remain unbiased, but when using AI, there is no real way to screen for unknown biases built into the algorithms driving these programs or biases that develop as these AI programs apply machine learning.

Specific criteria for standardization and maximal control over RCTs in NPWT studies are needed to confidently understand the efficacy of NPWT on LOS, IR, and WC. Such direction can be implemented first in animal studies, where constant wound size, location, and conditions during healing stages can be tracked to eliminate the confounding variables addressed earlier.

CONCLUSIONS

The use of AI in supporting physicians in practicing evidence-based medicine is an exciting prospect. This article has achieved proof of concept but also shown differences in evidence grading between human and algorithmic analysis. Understanding these differences is critical to assessing the safety of the use of AI in supporting medical decision-making. Our systematic review was able to derive 18 articles with varying GRADE scores to conclude that there are varying degrees of endorsement for NPWT application in cases of traumatic, burn, surgical, and diabetic wounds. We assessed the efficacy of AI to assess the quality of evidence and aid in the review process, finding that although making a direct human comparison is difficult, especially with subjective applications, there is promise for future development.

There remains, however, the ambiguity of NPWT significance in reconstructive settings. The diversity of wound type, healing time, and confounding variables highlighted in several articles reviewed by this study prevent solidified findings in RCT evaluating NPWT. Despite these concerns, many wound care practitioners and surgeons find NPWT to be a practical dressing choice linked to improved outcomes in patients.

Augustine J. Deering III, BS
Long School of Medicine, Univesity of Texas Health Science Center San Antonio 7703 Floyd Curl Dr
San Antonio, TX 78229
E-mail: deeringa@uthscsa.edu

DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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REFERENCES

1. Morykwas MJ, Argenta LC, Shelton-Brown EI, et al. Vacuum-assisted closure: a new method for wound control and treatment: animal studies and basic foundation. *Ann Plast Surg.* 1997;38:553–562.
2. Bovill E, Banwell PE, Teot L, et al; International Advisory Panel on Topical Negative Pressure. Topical negative pressure wound therapy: a review of its role and guidelines for its use in the management of acute wounds. *Int Wound J.* 2008;5:511–529.
3. Fox JW, Golden GT. The use of drains in subcutaneous surgical procedures. *Am J Surg.* 1976;132:673–674.
4. Poteet SJ, Schulz SA, Povoski SP, et al. Negative pressure wound therapy: device design, indications, and the evidence supporting its use. *Expert Rev Med Devices.* 2021;18:151–160.
5. Maurya S, Bhandari PS. Negative pressure wound therapy in the management of combat wounds: a critical review. *Adv Wound Care (New Rochelle).* 2016;5:379–389.
6. Peinemann F, McGauran N, Sauerland S, et al. Disagreement in primary study selection between systematic reviews on negative pressure wound therapy. *BMC Med Res Methodol.* 2008;8:41.
7. Ubbink DT, Westerbos SJ, Nelson EA, et al. A systematic review of topical negative pressure therapy for acute and chronic wounds. *Br J Surg.* 2008;95:685–692.
8. Fries CA, Jeffery SLA, Kay AR. Topical negative pressure and military wounds—a review of the evidence. *Injury.* 2011;42:436–440.
9. Burhan A, Khusein NA, Sebayang SM. Effectiveness of negative pressure wound therapy on chronic wound healing: a systematic review and meta-analysis. *Belitung Nurs J.* 2022;8:470–480.
10. Bi H, Khan M, Li J, et al. Use of incisional negative pressure wound therapy in skin-containing free tissue transfer. *J Reconstr Microsurg.* 2018;34:200–205.
11. Lee K, Murphy PB, Ingves MV, et al. Randomized clinical trial of negative pressure wound therapy for high-risk groin wounds in lower extremity revascularization. *J Vasc Surg.* 2017;66:1814–1819.
12. Kaushik D, Joshi N, Kumar R, et al. Negative pressure wound therapy versus gauze dressings for the treatment of contaminated traumatic wounds. *J Wound Care.* 2017;26:600–606.
13. Willms AG, Schwab R, von Websky MW, et al; EURAHS Open Abdomen Group. Factors influencing the fascial closure rate after open abdomen treatment: results from the European

Hernia Society (EuraHS) Registry: surgical technique matters. *Hernia*. 2022;26:61–73.
14. Mutafchiyski VM, Popivanov GI, Kjossev KT, et al. Open abdomen and VAC ® in severe diffuse peritonitis. *J R Army Med Corps*. 2016;162:30–34.
15. Wu M, Sun M, Dai H, et al. Negative-pressure wound therapy: an effective adjunctive treatment to assist flap survival and wound closure. *J Plast Reconstr Aesthet Surg*. 2018;71:1664–1678.
16. Zeng F, Chen C, Chen X, et al. Small incisions combined with negative-pressure wound therapy for treatment of protobothrops mucrosquamatus bite envenomation: a new treatment strategy. *Med Sci Monit*. 2019;25:4495–4502.
17. Costa ML, Achten J, Bruce J, et al; UK WOLLF Collaboration. Effect of negative pressure wound therapy vs standard wound management on 12-month disability among adults with severe open fracture of the lower limb. *JAMA*. 2018;319:2280–2288.
18. Stannard JP, Volgas DA, Stewart R, et al. Negative pressure wound therapy after severe open fractures: a prospective randomized study. *J Orthop Trauma*. 2009;23:552–557.
19. Arti H, Khorami M, Ebrahimi-Nejad V. Comparison of negative pressure wound therapy (NPWT) & conventional wound dressings in the open fracture wounds. *Pak J Med Sci*. 2016;32:65–69.
20. Engelhardt M, Rashad NA, Willy C, et al. Closed-incision negative pressure therapy to reduce groin wound infections in vascular surgery: a randomised controlled trial. *Int Wound J*. 2018;15:327–332.
21. Li PY, Yang D, Liu D, et al. Reducing surgical site infection with negative-pressure wound therapy after open abdominal surgery: a prospective randomized controlled study. *Scand J Surg*. 2017;106:189–195.
22. Maurya S, Srinath N, Bhandari PS. Negative pressure wound therapy in the management of mine blast injuries of lower limbs: lessons learnt at a tertiary care center. *Med J Armed Forces India*. 2017;73:321–327.
23. Virani SR, Dahapute AA, Bava SS, et al. Impact of negative pressure wound therapy on open diaphyseal tibial fractures: a prospective randomized trial. *J Clin Orthop Trauma*. 2016;7:256–259.
24. Banwell PE, Musgrave M. Topical negative pressure therapy: mechanisms and indications. *Int Wound J*. 2004;1:95–106.
25. Atwood RE, Bradley MJ, Elster EA. Use of negative pressure wound therapy on conflict-related wounds. *Lancet Glob Health*. 2020;8:e319–e320.
26. Schaaf S, Schwab R, Willms A. Quality of life after open abdominal treatment with vacuum-assisted wound closure and Mesh-mediated fascial traction. *Mil Med*. 2021;186:452–457.
27. Zhang F, Lv KY, Qiu XC, et al. Using negative pressure wound therapy on microskin autograft wounds. *J Surg Res*. 2015;195:344–350.
28. Sajid MT, Mustafa QA, Shaheen N, et al. Comparison of negative pressure wound therapy using vacuum-assisted closure with advanced moist wound therapy in the treatment of diabetic foot ulcers. *J Coll Physicians Surg Pak*. 2015;25:789–793.
29. Blume PA, Walters J, Payne W, et al. Comparison of negative pressure wound therapy using vacuum-assisted closure with advanced moist wound therapy in the treatment of diabetic foot ulcers: a multicenter randomized controlled trial. *Diabetes Care*. 2008;31:631–636.
30. Dubay DA, Franz MG. Acute wound healing: the biology of acute wound failure. *Surg Clin North Am*. 2003;83:463–481.
31. Sun W, Chen M, Duan D, et al. Effectiveness of moist dressings in wound healing after surgical suturing: a Bayesian network meta-analysis of randomised controlled trials. *Int Wound J*. 2023;20:69–78.
32. Älgå A, Haweizy R, Bashaireh K, et al. Negative pressure wound therapy versus standard treatment in patients with acute conflict-related extremity wounds: a pragmatic, multisite, randomised controlled trial. *Lancet Glob Health*. 2020;8:e423–e429.
33. Ben Amar M, Wu M. Re-epithelialization: advancing epithelium frontier during wound healing. *J R Soc Interface*. 2014;11:20131038.
34. Pastar I, Stojadinovic O, Yin NC, et al. Epithelialization in wound healing: a comprehensive review. *Adv Wound Care (New Rochelle)*. 2014;3:445–464.