The modified TIME-H scoring system, a versatile tool in wound management practice: a preliminary report

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Abstract. *Background and Aims:* The concept of WBP (wound bed preparation) has revolutionized the way to diagnose and correctly identify the best therapeutic path about the widespread clinical problem of difficult wounds. Starting from the modified TIME-H, authors conducted a preliminary study with the aim of assessing the impact of skin lesions and soft tissues for the surgical patient. *Materials and Methods*: 38 patients were preliminarily evaluated. The patients were classified according to the lesion examined, in particular among those who had an infectious or vascular etiology (SSTIs), and patients with surgical site lesions (SSI) and assigned to one of three categories prognosis: favorable (with healing expected within 12 weeks) (0-3A, 0-1B), intermediate (with healing expected over 12 weeks) (4-6A, 2-4B) and uncertain healing (7- 8A, 5-8B). *Results:* At the end of the one-year observation period, authors established the healing prediction rate among the studied lesions: the surgical site lesions presented the highest percentage of predictivity (88%), followed by the mixed etiology (72%) and the infectious/vascular injuries (63%). *Conclusion*: This modified-TIME-H can be considered as a versatile and useful scoring tool that should be used in daily clinical practice for the study and treatment of chronic wound diseases.

Background and Aims

Lesions of the skin and soft tissues, especially those characterized by infectious etiology (SSTIs), and those charged to the surgical site (SSI), represent the most frequent postoperative complication in the hospital environment (1). Several studies and meta-analyzes have tried to quantify the extent of the problem (2): it is calculated that, approximately, a range of surgical patients, located between 2.8% and 7%, develop SSTIs (3). In recent years technological innovation has offered new and powerful prospects in the treatment of skin lesions with an infectious etiology. Despite the introduction of therapies based on new antibiotic molecules, less and less invasive surgery and advanced dressings, the diffusion of a simple decision-making algorithm is still scarce and replicable, to guide the clinician from the preparation of the wound bed

to the complete healing. The morphological evaluation of the lesion and the systemic health conditions of the patient represent the first step in establishing a correct healing prognosis. The concept of WBP (wound bed preparation) has revolutionized the way to diagnose and correctly identify the best therapeutic path about the widespread clinical problem of difficult wounds. It is precisely in this perspective that the TIME protocol was introduced, which stands for "Tissue, Inflammation / Infection, Moisture, Edge / Epithelialisation", with the aim of promoting the acceleration of the wound repair process (4). As widely debated in literature, especially by Ligresti et al. (5), The TIME protocol had some limitations in its field of application, given that it was unable to provide a fundamental answer to patients suffering from chronic ulcers: the quantification of the prognosis in terms of healing time. The TIME-H scoring system was thus

proposed, which included a healing score based on the patient's general health and topical wound conditions. A healing score was thus calculated which indicated the expected time of wound closure, in order to obtain the elaboration of a personalized therapy protocol. The system involved assigning a numerical value to each parameter, and it has been modified several times in the literature, as proposed by Conduit et Al. (6). Just starting from the modified TIME-H proposed by Lim et Al. (7), authors conducted a preliminary study with the aim of assessing the impact of skin lesions and soft tissues for the surgical patient.

Materials and Methods

This preliminary study was conducted at the Surgical Division and at the local referral Center of Wound Care of Parma Hospital (Parma, Italy). Starting from the modified TIME-H score (7), 38 patients were preliminarily evaluated. The patients were classified according to the lesion examined, in particular among those who had an infectious or vascular etiology (SSTIs), and patients with surgical site lesions (SSI) and assigned to one of three categories prognosis: favorable (with healing expected within 12 weeks) (0-3A, 0-1B), intermediate (with healing expected over 12 weeks) (4-6A, 2-4B) and uncertain healing (7- 8A, 5-8B). This work was approved by the local Ethics Committee of Emilia Romagna (AVEN) and all the patients gave their informed consent before the enrollment. Authors included patients with at least one chronic lesion (present ≥ 3 months) or a dehiscence of a surgical wound that appeared in the immediate post-operative period (21 days), patients available to undergo subsequent follow-up of the study and patients capable of providing informed consent. Authors excluded from the study patients undergoing surgical revision of the lesion; patients not available to undergo subsequent follow-up of the study and patients unable to provide informed consent. Once assigned a score to a patient, the expected result was documented in a database. The patients were then treated with the help of a therapeutic protocol based on an appropriate standard for etiology and wound conditions, choosing in this phase

between traditional dressings and advanced dressings (according to the international, national and Emilia-Romagna Region guidelines in both cases). In each subsequent follow-up the same lesion was re-evaluated and the TIME-H score, based on the state of the current wound, was then updated. For the purpose of this study, patient follow-up was continued until complete healing of the wound or the end of the study period, depending on which event occurs first. Authors also collected other informations for each patient, always based on TIME-H score, including percentage of healed wounds, duration (expressed in terms of weeks) of wound healing, duration (expressed in terms of weeks) of the hospital stay and the subsequent one outpatient evaluation, the rate of change in the size of the wound (cm2/ month) and the final outcome of the healing process at the end of study period. The results of the medians are then put to comparison based on the different categories of lesions and therapeutic strategies. The Mann-Whitney U test allowed authors to analyze data (expressed as + standard deviation [SD]-mean) and to compare values. All changes with a P value of .05 or less were considered statistically significant for the study.

Results

38 patients were enrolled for this preliminary report over a one-year period (from March 2019 to February 2020) (Table 1).

Of these 7 were excluded (they were lost during the follow-up). Of the remaining 31 patients, 16 (52%) were male aged between 67 and 86 years old (median age was 77). 15 patients (48%) were female, aged between 64 and 88 years old (median age was 76,7). The evaluated injury types were classified as follows: 13 surgical site lesions - (40 %); 9 infectious or vascular etiology (SSTIs) – (30%); - 9 presented ulcers from mixed etiology (30%). Studied subjects reported their chronic lesions to have been present for a median of 6 months before the first evaluation. The modified TIME-H score questionnaire also allowed to calculate the median wound size (6,8 cm2), with a total median score of 4.0 (range 3.0 – 5.0). After the first evaluation, 6 (19,35%) patients were classified in the

Table 1. Modified TIME-H scoring system.

Wound score	0	1	2
Tissue necrosis (%)	0	<50	≥50
Infection	Contamination	Colonisation	Infection
Moisture	No exudate	Exudate	Smelly exudate
Epidermal reconstruction (%)	>90	90–30	<30
Wound score	**A**		**B**
Age (years)	≤ 70		>70
Mental state	Good		Poor
Self-sufficiency	Good		Very poor
Nutrition	Good		Poor
Predisposing disease	Absent		Present
Predicted outcome categories	**Score**		
Certain healing (within 12 weeks)	0–3A, 0–1B		
Uncertain healing (more than 12 weeks)	4–6A, 2–4B		
Difficult healing (healing unlikely)	7–8A, 5–8B		

Table 2. Results of the preliminary report.

Modified TIME-H category	Number of patients		Duration of specialist intervention		Reduction in wound size	
	Healed % (n)	*Unhealed % (n)*	*Healed months median (IQR)*	*Unhealed months median (IQR)*	*Healed (cm2/ month)*	*Unhealed (cm2/ month)*
Certain healing	83,33 (5)	16,67 (1)	2.6 (1.9–3.3)	1.6 (1.5–1.7)	8.9 (2.6–4.4)	1.2 (1.1–1.3)
Uncertain healing	75 (12)	25 (16)	2.7 (1.3–3.9)	4.2 (3.3–5.5)	0.94 (4.70–0.55)	0.22 (–0.83–1.56)
Difficult healing	44,44 (4)	55,56 (9)	2.5 (2.6–3.7)	2.7 (2.2–3.7)	0.55 (2.2–0.68)	–1.8 (–5.2–1.3)

certain healing category, 16 patients (51,60%) in the uncertain healing category, and 9 patients (29.05%) in the difficult healing category. A total of 5 patients of the six in the certain healing category presented effective total healing; 12 of 16 patients in the uncertain healing category and 4 of the 9 in the difficult healing category have been correctly classified according to the original prognosis. At the end of the one-year observation period, authors established the healing prediction rate among the studied lesions: the surgical site lesions presented the highest percentage of predictivity (88%), followed by the mixed etiology (72%) and the infectious/vascular injuries (63%). Authors also evaluated the duration of specialist intervention and the reduction in wound size for the three categories (Table 2).

Discussion

The management of chronic lesions of the skin and soft tissues, especially those with an infectious etiology (SSTIs), and those charged to the surgical site (SSI), represent an important postoperative challenge in the hospital environment (8-9-10). If primary intention closure is not suitable, or if part of a wound closed by this method requires secondary intention closure, the most important goal is to select the most appropriate treatment for the wound. The available treatment options will depend on the findings on wound and global patient assessment and on the local situation of the wound at the given time. Surgical, sharp and autolytic debridement represent several ways to remove dead and devitalised tissue on the wound bed (e.g. necrosis,

gangrene, slough) or infected tissues (11). Topical negative pressure is a method of wound healing that can only be used once the wound is free from dead and devitalised tissues. Negative pressure is applied to the wound bed, which then promotes an increase in the blood supply to the wound bed. This increases the rate of angiogenesis and therefore the growth of granulation tissue (12-13). It removes excess exudate, therefore maintaining a moist wound healing environment. As it removes the exudate it maintains minimal levels of bacteria on the wound bed, thereby reducing the risk of wound infection whilst it is in operation. Healing rates with this method are usually quicker than with traditional methods of healing (14-15). Topical negative pressure is also known as vacuum-assisted closure (VAC). TIME (acronym for Tissue, Inflammation / Infection, Moisture, Edge / Epithelialisation) represents a protocol developed on the basis of the "wound bed preparation concept" (WBP), in order to promote an acceleration of the healing process. The modified TIME-H version has been later developed, with the addition of a healing score (H) based on the wound conditions, the systemic state of the patients and the associated chronic pathologies. Authors started from the modified TIME-H proposed by Lim et Al. (7), in order to clearly quantify the prognosis of chronic wounds and improve patients' satisfaction. This preliminary report was conducted at the Surgical Division and at the local referral center of wound Care of Parma Hospital (Parma, Italy). Authors have studied the 38 enrolled patients prospectively, and involved individuals in different levels of health in determining the Modified TIME-H score for chronic lesions. Authors discovered that scoring lesions through the Modified TIME-H system, a higher proportion of patients in the certain healing category can be predicted to achieve complete healing, with a higher rate of wound size reduction, and a shorter duration of clinical follow up, when compared with other categories of predicted outcomes. This modified TIME-H scoring system should be considered as a ready-to-use daily assessment tool, easily applicable even when the prognosis of patients is not favorable. This is the first report that discovers the several healing predictivity rates among several wound types. At the end of the one-year observation the surgical site lesions presented the highest percentage of predictivity, followed by the mixed etiology lesions and the infectious/vascular injuries.

The limitations of this study are represented by the relatively small number of enrolled patients and short duration in follow-up. Authors simply suggest additional studies, involving multiple centers, with a larger population and longer follow-up to better confirm the validity of this Modified TIME-H scoring system.

Conclusion

This preliminary report showed that this modified-TIME-H score should be addressed as a versatile and useful scoring tool that should be used in daily clinical practice for the study and treatment of chronic wound diseases. The current standards of a correct clinical practice cannot ignore the growing economic and social impact of chronic wounds, reason why the reduction of the treatment period represents a precious target: authors found that by applying the described method, the average healing time was considerably reduced.

Conflicts of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

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