Commentary

Historical Perspective on Pressure Injury Classification: The Legacy of J. Darrell Shea

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Our pressure injury classification system has been evolving since the 19th century and will continue to develop as our understanding of this disease progresses. Factors influencing its evolution include changes in epidemiology and demographics, advances in medical knowledge, improvements in imaging technology, and new treatment strategies.

The sequential four-stage decubitus classification proposed in 1975 by orthopedic surgeon and spinal injury specialist J. Darrell Shea[1] has remained a cornerstone of thinking regarding pressure injuries. Although much has been written regarding the four-stage system since its publication, little has been discussed regarding the reasoning behind Shea's framework, and few questions have been raised about its continued usefulness and relevance in the 21st century.

In today's practice and throughout the healthcare continuum, Shea's framework remains deeply embedded; that said, those stages are much different from the ones we currently use. Understanding Shea's reasoning for this organizational structure, as well as its historical context, allows us to view today's system as only an evolutionary step in our understanding of pressure injuries. Reevaluation of Shea's original article and its legacy in light of current knowledge may cause us to question the benefits of maintaining a four-stage classification format.

Nomenclature used by Shea included ''pressure sore'' and ''decubitus.'' For the purposes of this article, we use Shea's preferred terminology while acknowledging that these terms are synonymous with the terms ''bedsore,'' ''pressure ulcer,'' and ''pressure injury.'' Shea used the term ''grade,'' whereas today we use the term ''stage.'' Here we will also use Shea's original term. Further, Shea used Roman numerals (current guidelines recommend Arabic ones), and this commentary will therefore refer to pressure sore grades using Roman numerals.

Pressure Sore Staging Before Shea

In 1859, Charcot classified bedsores into decubitus acutus, chronicus, and ominosus.[2] Decubitus acutus, or acute bedsore, occurred in patients with acute paralysis or other central nervous system injury, which distinguished it from decubitus chronicus.[2] Charcot also described decubitus ominosus, or ominous bedsore, which heralded oncoming death.[3]

Interest in defining a staging system accelerated in the mid-20th century as a result of World War II casualties, which included thousands of men with paraplegia and spinal cord injuries.[4] Several medical developments increased the number of severely injured casualties surviving the battlefield, including transfusion technologies, antibiotics, improved evacuation strategies, and better postinjury stabilization methods.[5,6] Surgical procedures improved, and the first report of surgical closure of a decubitus with the aid of penicillin was published in 1945.[7] In the postwar years, numerous publications appeared regarding pressure sore treatment in war veterans, nearly all of whom were young males.[8] In treating this cohort of patients, doctors began to understand the importance of a pressure sore classification system that could assist in prescribing specific therapeutic strategies and operative procedures.

Prior to Shea's publication, Guttman[9] proposed a six-stage classification that included infection and malignant transformation, with each stage linked to a treatment plan. Campbell[10] proposed seven clinically distinct stages of pressure sores, ranging from reversible redness to osteomyelitis, sepsis, and death, with advanced stages linked directly to a need for surgical management. Shea saw the need to further refine and clarify the classification system to assist clinicians with determining treatment decisions and formulating prognosis.

SHEA'S GRADING SYSTEM FOR PRESSURE SORES

Shea[1] proposed a simplified four-grade system of pressure sore progression. All grades applied to areas directly adjacent to bony prominences and thereby were subjected to pressure and local ischemia. He recognized that the skin is only one of the layers affected by pressure and that different layers of tissue have different physiologic and physical characteristics that react differently to stress. He also acknowledged that pressure was not the only etiologic factor, with local irritation from friction and maceration playing a part. Shea supported his clinical observations with histologic sections of skin and schematic diagrams that appeared in his manuscript.

An essential component of Shea's system was the assumption that wounds followed an orderly developmental progression from Grade I to IV. In addition, his schema incorporated

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systemic symptoms and the presence of infection to assist in differentiating Grades III and IV. Each grade was directly linked to specific treatment recommendations.

According to Shea,[1] Grade I was an acute inflammatory response involving superficial soft tissue layers, which included local swelling, induration, warmth, and redness, and ulceration limited to the dermis and resembling an abrasion. Grade II was a shallow full-thickness skin ulcer whose edges were more distinct, with greater inflammatory and fibrotic involvement. Shea recognized that Grades I and II pressure sores were reversible with local cleansing, supportive measures such as improved diet, correction of anemia and dehydration, and pressure relief.

A Grade III pressure sore represented frank infection with fat necrosis from small vessel thrombosis, ischemia, and chronic inflammation, with a wound edge that rolled over the ulcer base. This wound did not penetrate the deep fascia, and muscle may be swollen and inflamed but not directly involved. There may also be bone response with local inflammation and new bone formation, with swelling of contiguous joints. Shea noted that a Grade III pressure sore was equivalent to a ''classical decubitus ulcer'' accompanied by fever, dehydration, anemia, and leukocytosis.

A Grade IV pressure sore penetrated into deep fascia with rapid progression that led to undermining, drainage, and necrosis, and sometimes caused toxicity and death. There was associated septic arthritis and osteomyelitis with penetration into body cavities and communication via fascial planes to adjacent and distant pressure sores of similar grade.

An essential component of his system was recognition that pressure sores could start either at the surface or deep within tissues adjacent to bone, which he called a ''closed pressure sore.'' This was characterized by a seemingly innocent clinical presentation that concealed a deep, potentially rapidly fatal lesion. It was caused by pressure and shear forces that led to ischemic necrosis in subcutaneous fat, which would eventually rupture, creating a small draining skin defect with a large, contaminated interior base whose full extent could not be appreciated until postmortem examination.

For each grade of pressure ulcer, Shea[1] described a specific array of therapeutics. He noted the diverse variety of treatments used at the time and advocated a simplified approach that included local cleansing, nutrition, sharp debridement of necrotic tissue, and drainage of loculated abscesses. He recommended regular debridement of the ulcer bed through saline wet-to-dry dressings repeated every 3 to 4 hours around the clock.

Shea understood the therapeutic value of eliminating necrotic tissue and control of bacterial overload. He also recognized the weakness of scar tissue when wounds heal by secondary intention and recommended generous resection of involved tissue followed by surgical closure. Incision and drainage was a core principle, with wide surgical excisions, muscle flaps, and removal of bony prominences and diseased bone. For extreme cases of pelvic involvement, Shea recommended hemicorporectomy (lower body amputation) as an alternative to death.

THE LEGACY OF SHEA'S GRADING SYSTEM

Shea's grading system was adapted and modified by the National Pressure Ulcer Advisory Panel and the International Association for Enterostomal Therapy and published in the widely distributed Agency for Health Care Policy and Research clinical practice guideline in 1992.[11–13] Major modifications of the Shea criteria included the elimination of signs and symptoms of infection and an emphasis on visual observation of tissue depth. The framework remained in place (with modifications of stage descriptions) in subsequent clinical practice guidelines, including the addition of new classifications such as unstageable pressure injury, deep-tissue pressure injury, medical device-related pressure injury, and mucosal membrane pressure injury.[14,15]

It is widely acknowledged that the present-day system grew directly out of Shea's original concept,[16,17] but there are multiple reasons to challenge its relevance. These include changing epidemiology and demographics, variations in human anatomy, diminished importance of visual determination of wound depth, inaccurate conceptualization of wound progression, outdated notions of stage predicating treatment, inherent inaccuracies of stage determination, and unintended use (and misuse) of the numeric staging system. Each of these factors is discussed below.

Changing Epidemiology and Demographics

Shea's classification system grew out of the post-World War II need to treat veterans with paraplegia and was therefore developed based on a population of primarily young males. The epidemiology of pressure injuries is now vastly different, with high incidence in critical care settings and vulnerable populations including geriatric patients with multiple comorbidities such as dementia and severe neurologic impairment. For example, residents of nursing facilities (where pressure injury prevalence is as high as 7.3%) are mostly older than 75 years, and 67.2% are female.[18] It is well established that aging and chronic disease alter the architecture of the body, and the staging system requires critical reassessment in consideration of these changes.[19]

Variations in Human Anatomy

Shea's classification does not adequately take into consideration the anatomic diversity of the human body, with regional variation of skin structure that defies a one-size-fits-all model of pressure injury pathogenesis and progression. Variations can occur in the thickness of the epidermis, distribution of the hair follicles and sebaceous glands, flattening of the dermoepidermal junction, altered structure of the dermis, and in regional blood supply.[20] For example, pressure injuries of the heel comprise greater than 20% of all pressure injuries and have a much

different appearance and progression when compared with a sacral pressure injury.[21,22]

Diminished Relevance of Visual Determination of Wound Depth

The four-grade classification relies heavily upon visual determination of wound depth. A component of Shea's system that was not part of the numbered continuum was the closed pressure sore, the forerunner of today's deep-tissue pressure injury.[23] Today, it is increasingly recognized that damage to deep tissue not visualized at the surface is an important component of pressure injury.[24] New technologies and innovations in imaging such as long-wave infrared thermography have brought us closer to quantifying damage to deep structures.[25,26] The emphasis on visual depth is therefore becoming less relevant and even misleading, as it fails to take into consideration deeper structures.

Inaccurate Concepts of Wound Progression

The intention of Shea's system was to illustrate the progression of these wounds. However, it has since been recognized that pressure injuries do not follow this hypothesized orderly sequence of development.[16] Nonetheless, it is difficult to bypass the progression inherent in a 1-to-4 labeling system, the legacy of which remains with us today. The sequential progression is further reinforced by teaching materials that depict increasing depth with higher-numbered stage. In other words, the numeric 1-to-4 classification implicitly reinforces incorrect concepts of wound progression.

Outdated Notions of Stage Predicating Treatment

Shea's system was based on the assumption that the numeric grade of the pressure sore should be a direct guide for treatment. Treatment modalities in 1975 were limited, and today's formulary includes many options whose indications are not predicated upon a numbered stage.[15] Concepts of wound bed preparation have replaced stage-specific guidelines, and palliative care considerations have caused providers to defer many aggressive surgical procedures.[27,28] The expansion of treatment options forces us to rethink a system that no longer serves its original intended purpose.

Inherent Inaccuracies of Stage Determination

The literature contains abundant reports of interrater unreliability and clinically important disagreements in diagnosis that undermine the accuracy and usefulness of the staging system.[29–34] Given the importance of staging in quality reporting, reimbursement, and risk management, a system based upon visual depth imposes unacceptable imprecision, particularly in light of what we know about damage to deep structures that cannot yet be easily identified or measured. Disparities in wound classification among providers have an adverse impact upon quality measurement and risk-management situations.

Unintended Use (and Misuse) of the Staging System

Today, the staging system has been adapted for purposes much different from its original intent. Staging has become the basis for quality measurement that in turn impacts facility reputation and reimbursement. For example, in long-term and postacute settings, coding for Minimum Data Set 3.0 Section M is largely based upon a 1-to-4 staging system predicated upon wound depth.[35] The Centers for Medicare & Medicaid Services will not provide enhanced reimbursement for hospital-acquired Stages III and IV pressure injuries as designated in the 1-to-4 staging system.[36] The National Database of Nursing Quality Indicators relies on the 1-to-4 staging of pressure injuries to measure the quality of nursing care.[37] The *International Classification of Diseases, 10th Edition*, the standard diagnostic tool for epidemiology, health management, and clinical purposes, has more than 180 separate codes for pressure injuries, which are broken down largely by the 1-to-4 staging system.[38]

According to the Agency for Healthcare Research and Quality, there are more than 17,000 lawsuits per year related to pressure injuries.[39] The 1-to-4 staging system with its well-documented, inherent inaccuracies of stage determination allows considerable room for documentation disparities among providers, which adversely impacts risk management by making it easier for plaintiff attorneys to claim improper wound assessment.

LOOKING TO THE FUTURE

The purpose of a classification system is to standardize record keeping and provide common descriptors of injury severity for clinical practice, auditing, and research.[30] Shea's sequential four-stage classification is firmly embedded within our healthcare system, but time has revealed that it is a product of a misunderstanding of wound biology and outdated assumptions. In the decades since its publication, many things in wound care have changed, including patient demographics, the epidemiology of chronic disease, our understanding of pathophysiology, and available treatment strategies. The 1-to-4 staging system is obsolete, because it reinforces concepts of wound care that are either incorrect or no longer relevant, and our classification system therefore needs to evolve.

Revision of the classification system would be a substantial task, requiring input from a variety of stakeholders who may include scientists, pathologists, vascular surgeons, plastic surgeons, dermatologists, geriatricians, podiatrists, palliative care specialists, intensivists, rehabilitation specialists, and nurses. Leaders in these fields need to rethink the pathophysiology of this disease and how it fits into the larger continuum of wound types with commonalities in healing and pathophysiology, including arterial, venous, nonhealing surgical wounds; diabetic ulcers; and others. Revision must take into consideration that the integrity of skin and underlying tissues is reflective of the total state of the organism, including inflammation, infection,

nutrition state, chronic and critical illness, pharmacologic factors, the effects of aging, and the dying process.[40–44]

The sequential four-stage classification has outlived its usefulness and needs to be replaced with a simplified system that recognizes both "top-down" and "bottom-up" genesis, embracing the concept of multiple etiologies, including local and systemic factors.[44,45] Further, we need to rethink the commonly accepted notion that pressure injuries are a direct measure of quality—a concept that is increasingly challenged by the recognition of unavoidable wounds, skin failure, and the importance of genetic factors in the prevalence of specific diseases.[46]

J. Darrell Shea stated that one cannot properly treat a lesion that is not well understood, and his proposal for a sequential four-stage system was an attempt to better understand and treat pressure sores. This framework is now firmly embedded within today's healthcare system, but the scientific method demands that we must be wary of fixed beliefs and open to new observations even if they run counter to what we always assumed is true.[47] Thomas Kuhn,[48] a noted 20th century philosopher of science, stated that science progresses by "paradigm shifts" when preexisting theories are undermined by new information and replaced by radically different approaches to understanding. Perhaps we are ready for a paradigm shift in our understanding and classification of pressure injuries. ●

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