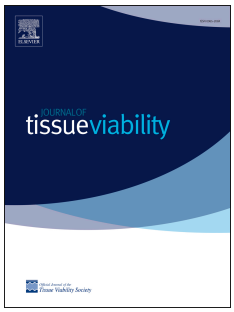

Kennedy terminal ulcer and other skin wounds at the end of life: an integrative review

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Title

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KENNEDY TERMINAL ULCER AND OTHER SKIN WOUNDS AT THE END OF LIFE: AN INTEGRATIVE REVIEW

ABSTRACT.

Aims: To undertake an integrative literature review to identify, analyse and synthesize current literature on the Kennedy terminal ulcer (KTU) and other unavoidable skin injuries that appear at the end of life regardless of the healthcare context in which they occur.

Methods: Integrative review following the Whittemore and Knafl methodology.

The search was carried out in PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL), and Scopus. It was limited to articles in English, French, Portuguese and Spanish. As there is little scientific production on the subject, no restrictions were applied regarding publication date.

Results: Only 17 articles met the inclusion criteria. These articles were reviewed and analysed. Four relevant issues emerged: Skin failure, SCALE, Kennedy Terminal Ulcer, Trombley-Brennan: different names for the same problem; the defining characteristics and physiopathology of KTU; the differences between KTU and other injuries; and the care approach for KTU and other unavoidable injuries at the end of life.

Conclusions: We identified gaps regarding the physiopathology of KTU since the current knowledge is based only on hypotheses. There is also a large gap in the knowledge about care approaches, perhaps because care plans are not recorded. Despite this, it is clear that the main objective in this situation at the end of life would be to prioritize patient comfort and quality of life.

Key words: *Kennedy terminal ulcer (KTU), Skin changes at life's end (SCALE), end-of-life skin failure, Trombley-Brennan terminal tissue injury, unavoidable pressure injuries, pressure injuries.*

Key points: Disseminating the current state of knowledge about KTU and other unavoidable injuries that occur at the end of life could contribute to them being recognized and managed appropriately, prioritizing comfort as a basis for care.

1. INTRODUCTION

There is widespread consensus among the scientific community that pressure injuries (PI) can be avoided,[1,2] although no intervention has been reported that consistently and reproducibly reduces the incidence of PI to zero.[3] Consequently, the appearance of PI in any healthcare context has important implications not only in terms of pain, suffering, loss of self-esteem and loss of quality of life, but also at the legal level.[4] Prevention is considered the key tool for avoiding the occurrence of PI;[5] however, it is currently acknowledged that some PI may be *unavoidable.*[3] According to the National Pressure Injury Advisory Panel (NPIAP) an unavoidable pressure injury is one that develops even though the carer has: evaluated the patient's clinical condition and pressure injury risk factors; defined and implemented interventions that are consistent with the patient's needs and goals, and with recognized practice standards; monitored and evaluated the impact of interventions; and revised these approaches as appropriate.[3]

Many terms have been used to refer to unavoidable injuries, which can lead to some confusion both for recognizing them and for establishing appropriate care plans to guide professionals/families towards realistic care. These terms include Charcot's decubitus ominosus, Trombley-Brennan Terminal Tissue Injury, Skin Changes at Life's

End (SCALE), Skin failure, and Kennedy terminal ulcer (KTU),[6] which are the most frequently documented in the literature. The differential diagnosis between avoidable and unavoidable injuries is key to being able to establish achievable care goals and not raising false hopes of a cure since, if the development of the injury is unavoidable, it is unrealistic to propose curing it.

These injuries all appear in the hours or weeks before the death of the patient. Although the literature places most cases in patients in palliative care units and/or long-stay units, it is possible that professionals' ignorance of this pathological entity means that it is underdiagnosed in other healthcare settings.[7,8] Kennedy terminal ulcer prevalence data are limited, with no validated assessment tools available.

These injuries are difficult to identify and are therefore difficult to differentiate from avoidable PI. There are currently no clinical studies or validated algorithms that allow us to definitively determine which PU are unavoidable. Identifying these injuries therefore becomes a difficult health problem to address.[9,10] To contribute to their recognition it is important to inform professionals of the defining characteristics of each type of wound and disseminate the current state of knowledge on this topic. It is also necessary to continue working on a unified classification system that would lead to a more appropriate care approach for these wounds.

2. PURPOSE

To identify, analyse and synthesize the current literature related to KTU and other unavoidable skin injuries that appear at the end of life, regardless of the healthcare context in which they occur.

3. METHODS

3.1 Design

The literature on skin wounds at the end of life was reviewed using the five steps of Whittemore and Knafl's integrative review model[11]: problem identification, literature search, data evaluation, data analysis and presentation. This model allows diverse methodological designs to be included, provides a better understanding of a specific topic and plays an important role in evidence-based practice by representing the complexity inherent in all health problems that concern nursing.

3.2 Searches

The searches were undertaken from January to December 2019. The review included the articles that study all skin injuries considered unavoidable and that appear at the end of life in any healthcare context and not only in palliative care units.

To determine the relevant literature on the subject, a search was conducted in the following databases: PubMed, Cumulative Index to Nursing and Allied Health Literature (CINHAL), and Scopus. The keywords used were *Kennedy terminal ulcer (KTU), Skin changes at life's end (SCALE), skin failure, Trombley-Brennan terminal tissue injury* and *unavoidable pressure injuries.* The search was limited to articles in English, French, Portuguese and Spanish. In terms of the methodology used in the studies, articles published in peer-reviewed scientific journals were accepted: systematic reviews, narratives, case studies and original or secondary articles. Editorials, letters to the editor and other grey literature were not included, and neither were articles on avoidable pressure injuries or chronic and acute skin failure not directly related with the end of life. As there is little scientific production on the subject, case studies and systematic reviews were accepted and there were no limitations regarding the publication date of the studies.

3.2 Procedure and analysis

The studies were examined based on their contribution to the knowledge of non-preventable skin injuries that may appear at the end of life. The Whittemore and Knafl process was used to extract and synthesize the data in relation to the study objectives.[11] To add rigour to the method used and ensure reliability in the selection, review and analysis of the articles, four trained researchers worked in pairs to conduct an independent search in the databases with the pre-defined search terms. Subsequently, the four researchers met, agreed on the articles to be included and analysed them together. Discrepancies were resolved by consensus. The search strategy is represented graphically in Figure A.1.

Four analysis themes were identified: Skin failure at end of life, SCALE, Kennedy Terminal Ulcer, Trombley-Brennan: different names for the same problem; defining characteristics and physiopathology of KTU; the differences between KTU and other injuries; the care approach for KTU and other unavoidable injuries at the end of life.

4. RESULTS

The selected articles include seven descriptive studies, four reviews, one care plan and five case studies. The summary of the reviewed articles can be seen in Table A.1

- **End-of-life Skin failure, SCALE, Kennedy Terminal Ulcer, Trombley-Brennan: Different names for the same problem**

Many changes occur in the skin when the end of life approaches and very different terms are used to describe them: KTU, SCALE, end-of-life skin failure and TB-TTL. Although they all refer to unavoidable injuries, each of them has its own particular characteristics.

The term KTU was first described in 1983 by Karen Lou Kennedy who observed that some people who suffered a certain type of skin injury that looked like a PI died within two weeks of its appearance.[12] In 1989, the NPIAP defined this injury as a pressure injury that appears at the end of life, usually located at the sacrum or coccyx (although it can occur in other anatomical areas), in the shape of a pear, butterfly or horseshoe, with a rapid progression, producing ulcerations of total thickness, and is often an indicator of imminent death.[1] It should be noted that this description coincides with the one by Jean-Martin Charcot of "debubitus ominosus" in 1877.[13]

In 2008, a panel of 18 experts met in Chicago to reach a consensus on SCALE calls. According to this group of experts, SCALE are "physiological changes that occur as a result of the dying process and affect the skin and soft tissues and may manifest observable (objective) changes in skin color, turgor, or integrity, or as subjective symptoms such as localized pain".[14] It is a broad term that includes all skin changes that occur at the end of life regardless of whether they are unavoidable. This consensus upholds that the pathophysiological phenomenon called *skin failure* can occur at the end of life and consequently in this life stage some pressure ulcers (PU) may appear that are unavoidable.

The term skin failure was defined by Langemo and Brown in 2006[15] as “an event in which the skin and underlying tissue die due to hypoperfusion that occurs concurrently with severe dysfunction or failure of other organ systems”. In 2017, Jeffrey M Levine defined this same situation as “the state in which tissue tolerance is so compromised that cells can no longer survive in zones of physiological impairment that includes hypoxia, local mechanical stresses, impaired delivery of nutrients, and build-up of toxic metabolic by-products”. According to Levine, both PI and SCALE could be a consequence of this skin failure.[9]

In 2012, Mary R Brennan and Kathy Trombley [16] described for the first time a type of injury that they call Trombley-Brennan Terminal Tissue Injury that, like KTU, appears in patients who are at life's end. According to the authors these injuries are spontaneously appearing skin changes with rapid evolution, enlargement and progression. They appear in areas of little to no pressure such as skin and thighs, and there can be mirror imaging.

From this information it can be deduced that scientific advances have led us to the description of different phenomena that are often interrelated and that seem to have a common origin: the end of people's lives.

4.1 Defining characteristics and physiopathology of the Kennedy terminal ulcer

This integrative review found that the KTU is generally located at the sacrum or coccyx, although it may also be located on the back of calf muscles, arms or heels.[17] It usually presents in the shape of a pear, horseshoe or butterfly and has irregular edges. It has a sudden onset and usually evolves in a few hours from a superficial ulcer to a stage 3 or 4 ulcer.[16–18] Most studies agree that it is usually reddish, black or yellowish in colour. It can also have a bluish or violaceous colouration.[19–21] Some articles state that at first this type of injury can appear to be a dirt stain or faecal remains.[22,23]

Two presentations are identified in the general characteristics of the KTU:[6,12] firstly bilateral presentation (both buttocks are affected), in the shape of a pear or horseshoe with irregular edges, usually appearing at the sacrum or coccyx. Initially it appears erythematous and/or purpuric, and may have epidermal erosion that is yellowish and/or dark coloured, of sudden onset and appears from two weeks to a few months before death. Secondly, unilateral presentation, which occurs on the left or the right buttock and its progression is faster than bilateral presentation. It consists of a macular lesion that is usually a small area of blackish or purple colour with irregular

edges. It tends to develop quite rapidly and does not usually erode. The time from onset to death in this unilateral presentation is significantly shorter than in bilateral presentation, generally occurring between eight and 24 hours before death.

The vast majority of the articles reviewed agree that there is little research on KTU and its physiopathology is still unknown; therefore, the information about it is based on hypotheses taken from the studies conducted. Such studies establish that this injury occurs at the end of life as a consequence of the existence of one or more terminal-stage diseases that lead the patient to suffer multiple comorbidities. The main hypothesis that most articles provide is that this injury may be caused by skin failure or skin death. This skin failure is caused by a decrease in blood flow (hypoperfusion) and hypoxemia, produced in turn by multiple-organ failure.[8] The patient's organism focuses on perfusing internal organs of a vital nature (lung or liver), which reduces cutaneous perfusion.[9] The KTU would be a visible manifestation of an internal failure that is reflected through skin death. It is also believed that due to their location, pressure and rubbing could influence, although they are not the direct causes.[6] Vasopressor medications that patients take for certain diseases at the end of life that divert blood flow to other vital organs may also be related to the production mechanism.[17]

According to Megan Reitz and Christine A. Schindler,[18] the patients at greatest risk of suffering from KTU are those with respiratory, renal or circulatory insufficiency, hypoalbuminemia, hypoxemia or insufficiency of two or more organs. In agreement with this study, in the clinical case presented in the article by Roca-Biosca et al.[19] patients who develop a KTU display severe respiratory insufficiency and have a history of arterial hypertension and obesity.

Sibbald et al.[14] established that the most influential factors in skin changes at the end of life are hypoperfusion, alteration in the elimination of toxic metabolites,

decreased defensive capacity of the skin and others such as low weight, loss of appetite, cachexia, reduced mobility, poor or inadequate nutrition, and low albumin levels. These factors are involved in the appearance of both the KTU and the TB-TTL and are largely a consequence of skin failure associated with the dying process.

4.2 The differences between the Kennedy terminal ulcer and other injuries

The main difference from PI is in the aetiology. PI are formed by pressure, shearing or continuous friction, producing local ischemia and tissue damage, while KTU is associated with hypoperfusion due to multiple-organ failure that leads to skin failure. Therefore, intrinsic factors influence more than extrinsic factors in the formation of the KTU.[8,18,20] In terms of characteristics, PI have a slow and insidious onset, an erythematous colour or appearance at the beginning, and are round in shape over bony prominence.[20] Jeffrey Levine[9] establish a basic appearance to identify and differentiate the two injuries to recognize the imminent death of the patient suffering from KTU.

TB-TTL is an injury that can be confused with KTU and also occurs in terminal situations. Its aetiology is unknown, although it seems that it may be due to the physiological changes that occur with death. It usually has the shape of a butterfly or a series of linear grooves, its onset is sudden and it appears as an elevation of the skin's surface; however, the skin is not ruptured, differentiating it from the KTU. It is usually purple or red, similar to a bruise. It is primarily located at the sacrum or on bony prominences, although it has also been described on extremities and the torso. When injuries appear on the extremities they follow an ascending trajectory. Another characteristic that distinguishes the TB-TTL from the KTU is that it never evolves into a deep wound and appears hours or days before death, never weeks. [6,16,21]

Joyce Black et al.[22] looked at the difference from other injuries such as dermatitis associated with incontinence, which is caused by exposure to organic fluids

such as faeces and urine, appears as an inflamed area with an erythematous appearance, has irregular and diffuse edges, is shallow in depth and there is no eschar or granulation tissue.

Another injury to distinguish from is gluteal compartment syndrome, which has a diverse aetiology: hypogastric artery compression, prolonged immobilization, drug addiction, alcoholism or surgery. It is purple and is rarely caused by pressure.[3,6,22]

Finally, it should also be differentiated from Coumadin necrosis, associated with the consumption of Coumadin. There is pain and redness in the affected area, as it evolves it becomes an injury with sharp edges and like petechiae, hard and purpuric. It can form large, irregular and bloody blisters with eventual necrosis. It is usually located in areas of high fat content of the subcutaneous tissue.[22]

Despite the clear differences in shape between the last three injuries mentioned and the KTU, it should be recalled that we are not only evaluating injuries. Differential diagnosis begins by assessing the affected person's health background, and careful monitoring should be carried out of their body systems together with the relevant complementary tests.[20] In short, contextual elements like the patient's health status and the context of the appearance of the lesions are essential for their proper diagnosis. [6]

4.3 Care approach for patients with Kennedy terminal ulcer and other unavoidable injuries at life's end

The KTU is an injury that, despite prevention interventions such as pressure management, cannot be avoided, as this is not its aetiology. Early diagnosis and early identification are very important given the complexity of the situation in which it appears, since it is an injury that indicates the closeness of death. To identify it, a thorough evaluation of the patient's clinical, physical and social history must be carried

out. Recording skin changes and periodic monitoring will help prevent greater deterioration.[3,6,8,12,14]

All the authors agree that, when this type of wound is identified, the clinical objective should change, prioritizing palliative care, focusing interventions on managing symptoms, comfort and the well-being of the patient, instead of closing or healing the ulcer.[19,23–25]

In the case of a KTU in a paediatric patient, presented by Megan Reitz and Christine Schindler[18], the authors showed that despite administering adequate oxygen, maintaining the acid mantle of the skin and a good supply of nutrients, the objectives were not achieved due to the severity of the pathological process. This reinforces the inevitability, and that more realistic goals such as wound pain management, infection prevention and perilesional maceration should be established other than healing.

Roca-Biosca et al.[19] established a non-agressive care plan for KTU treatment that seeks the welfare and comfort of the patient and family, performing interventions aimed at preventing further deterioration, symptom management, intervention support (emotional, in decision-making) and avoiding family conflicts. This study obtains interesting results such as enabling the patient to die surrounded by their loved ones, without pain and maintaining their dignity.

Guinot and Furió[25] obtained similar results. After carrying out a series of interventions focused on healing without achieving improvement, they established the diagnosis of KTU and drafted a care plan focused on pain control, analgesia with opioids, care in a humid environment, enzymatic and autolytic debridement and perilesional skin protection. The emotional assistance in this case stands out. The family is informed about the prognosis and meaning of the injury, and given emotional support to help in the grieving process.

All clinical cases included in this review agree that professionals, family, caregivers and patients must be well informed and advised on what these injuries indicate and why they occur. This aspect is considered essential to avoid feelings of guilt, and erroneous thoughts related to lack of attention or negligence.[19,23,25,26]

5. DISCUSSION

Due to the enormous gap in the knowledge on this topic, the aim of this study was to update the existing knowledge on KTU and other unavoidable ulcers that appear at the end of life. The number of articles published between 2016 and 2018 reveals growing interest in the subject in recent years.

The literature reports that both the KTU and the TB-TTL are wounds that appear when the patient is close to death, and act as an indicator of impending death. According to international consensus, both injuries are considered SCALE.[14] Bearing in mind that many other wounds that are not unavoidable also come under this umbrella acronym, the use of this term could lead to confusion. Hence the importance of continuing research to seek a unified classification system that allows a more adequate approach to this health problem.[9]

There is not much variability in the literature reviewed regarding the clinical characteristics of KTU. All agree that it is a deep tissue injury that is normally located in the sacrococcygeal region, shaped like a pear, butterfly or horseshoe with irregular edges, and occurs suddenly with a rapid evolution. It should be noted that all clinical cases included in the review provide data on injuries that occur bilaterally.[18,19,22,23,25]

The study results show that with regard to the KTU production mechanism we only have hypotheses, which establish that this type of injury appears in patients with one or more end-stage diseases that cause multiple-organ failure, translating into

hypoperfusion and hypoxemia in the periphery (skin) that in turn leads to skin failure resulting in the formation and evolution of the KTU. The fact of working with hypotheses has led some authors such as Michael S. Miller[27] and Ruiz Henao[24] to question whether KTU are in fact unavoidable. Miller argued that the terminal situation is more a factor of systemic stress and not the cause of its appearance, thus rejecting the concept of KTU. Although it is only a theory, the lack of evidence on the subject opens up a space for debate in the scientific community.

There are not many articles on the difference between the KTU and other types of injuries. The greatest consensus is perhaps found in the difference between the KTU and PI. PI are mainly caused by factors external to the individual, such as pressure and shearing over a prolonged period and in a sustained manner so that ischaemia occurs due to lack of irrigation to the area under pressure, while in the KTU, the aetiology is due to internal factors.[20,22]

Only two studies have been found that refer to TB-TTL.[16,21] The fact that these injuries do not involve pain or discomfort for those who suffer them and they remain intact until the moment of death does not prevent them from sometimes being mistaken for deep tissue injuries, when they appear as dark spots. Failure to recognize them could result in inappropriate and unjustified treatment from the viewpoint of care ethics.

This research reveals that the majority of studies were conducted in palliative care settings in the adult population.[12,16,17,23–25,28] Only one case was found that describes a situation of a patient admitted to an ICU, as well as one article that refers to the paediatric population.[18,19] This could be due to a lack of knowledge about this type of injury in other care settings where professionals are not familiar with this final stage of life.

Due to the lack of previous studies on the subject, documents were not selected according to quality criteria, which is a potential limitation of this study.

As already indicated in the results of this review, the establishment and diagnosis of the KTU must not only change the treatment given to the patient, but also the goal of the professionals and the management of or contact with the family. Given the diagnosis of KTU, it is very important that the clinical team should be prepared. There is little literature on how to handle a KTU, but it seems that the goal is clear: prioritize the patient's comfort and quality of life, leaving aside measures or techniques that involve the patient suffering further since the injury will not heal as it is an indicator of the closeness of death. The main objective in terms of the injury would be to prevent further deterioration, manage pain and odour and other symptoms that generate greater discomfort and suffering to the patient as well as perilesional skin care. We would conclude by pointing out that the appearance of this type of wound can be painful for professionals and family, even more so if it is not known to be unavoidable and thus could be associated with an unfounded feeling of guilt for not having taken the appropriate preventive measures. Going deeper into this topic can help everyone involved to understand that these injuries occur because the patient is near death and not because of neglect or lack of care.

6. CONCLUSIONS

There is very little information in the literature about unavoidable skin injuries that appear at the end of life.

Although we can intuit that the KTU production mechanism depends largely on factors inside the body rather than external factors, more research is needed to help

clarify some aspects of its physiopathology since current knowledge is based solely on hypotheses.

It is difficult to differentiate between avoidable injuries, such as PIs, and unavoidable injuries, such as KTU or TB-TTL, since there are few studies that compare them. The literature especially differentiates the KTU from the PI, highlighting the main differences as being the aetiology, evolution, treatment and prognosis.

There is a great lack of knowledge and literature on caring for and treating the KTU, perhaps because care plans are not recorded. Despite this, it is clear that the main care objective would be to prioritize the patient's comfort and quality of life.

7. REFERENCES

1. National Pressure Injury Advisory Panel, European Pressure Injury Advisory Panel, Pan Pacific Pressure Injury Alliance. Prevention and treatment of pressure ulcers: quick reference guide. Haesler E, editor. Perth, Australia: Cambridge Media; 2014.
2. Pancorbo-Hidalgo PL, García-Fernández FP, Torra i Bou J-E, Verdú Soriano J, Soldevilla-Agreda JJ. Epidemiología de las úlceras por presión en España en 2013: 4.º Estudio Nacional de Prevalencia. Gerokomos. 2014 Dec;25(4):162–70.
3. Edsberg LE, Langemo D, Baharestani MM, Posthauer ME, Goldberg M. Unavoidable Pressure Injury: state of the science and consensus outcomes. J Wound, Ostomy Cont Nurs. 2014;41(4):313–34.
4. Silverman JD. Pressure Sores and the Law. J Leg Nurse Consult. 2012;23(1):28–31.
5. Kim J, Yoo S, Nho J, Ju J. Performance and Influencing Factors of Evidence-Based Pressure Ulcer Care Among Acute Care Hospital Nurses. Worldviews

Evidence-Based Nurs. 2019 Feb;16(1):29–35.

6. Alvarez OM, Brindle CT, Langemo D, Kennedy-Evans K Lou, Krasner DL, Brennan MR, et al. The VCU Pressure Ulcer Summit. J Wound, Ostomy Cont Nurs. 2016;43(5):455–63.
7. Department of Health & Human Services (DHHS). CMS Manual System. Pub. 100-07 State Operations Provider Certification SUBJECT: Revisions to State Operations Manual (SOM), Appendix PP-"Guidance to Surveyors for Long Term Care Facilities". 2004.
8. Lepak V. Avoidable & Inevitable? Skin Failure: The Kennedy Terminal Lesion. J Leg Nurse Consult Leg Nurse Consult. 2012;23.
9. Levine JM. Unavoidable Pressure Injuries, Terminal Ulceration, and Skin Failure. Adv Skin Wound Care. 2017 May;30(5):200–2.
10. Levine JM, Zulkowski KM. Secondary Analysis of Office of Inspector General's Pressure Ulcer Data. Adv Skin Wound Care. 2015 Sep;28(9):420–8.
11. Whittemore R, Knafl K. The integrative review: updated methodology. J Adv Nurs. 2005 Dec;52(5):546–53.
12. Kennedy KL. The prevalence of pressure ulcers in an intermediate care facility. Decubitus. 1989 May;2(2):44–5.
13. Charcot JM. Clinical lectures on senile and chronic diseases. New York: Arno Press; 1979.
14. Sibbald RG, Krasner DL, Lutz J. SCALE: Skin Changes at Life's End: Final Consensus Statement: October 1, 2009. Adv Skin Wound Care. 2010 May 1;23(5):225–36; quiz 237–8.
15. Langemo DK, Brown G. Skin fails too: acute, chronic, and end-stage skin failure. Adv Skin Wound Care. 2006 May;19(4):206–11.

16. Trombley K, Brennan MR, Thomas L, Kline M. Prelude to Death or Practice Failure? Trombley-Brennan Terminal Tissue Injuries. Am J Hosp Palliat Med. 2012 Nov 4;29(7):541–5.

17. Schank JE. Kennedy Terminal Ulcer: the “Ah-Ha!” Moment and Diagnosis. Ostomy Wound Manage. 2009 Sep 15;55(9):40–4.

18. Reitz M, Schindler CA. Pediatric Kennedy Terminal Ulcer. J Pediatr Heal Care. 2016 May;30(3):274–8.

19. Roca-Biosca A, Rubio-Rico L, Velasco-Guillen MC, Anguera-Saperas L. [The adapting of a care plan after Kennedy terminal ulcer diagnosis]. Enferm intensiva. 2016 May 21;

20. Yastrub DJ. Pressure or pathology: Distinguishing pressure ulcers from the kennedy terminal ulcer. J Wound, Ostomy Cont Nurs. 2010 May;37(3):249–50.

21. Brennan MR, Trombley K. Kennedy Terminal Ulcers - a Palliative Care Unit’s Experience over a 12-month Period of Time. World Counc Enteros Ther. 2010;30(2):20–2.

22. Black JM, Brindle CT, Honaker JS. Differential diagnosis of suspected deep tissue injury. Int Wound J. 2016 Aug 1;13(4):531–9.

23. Miner KJ. Discharge to hospice: a kennedy terminal ulcer case report. J Am Col Certif Wound Spec. 2009 Jul;1(3):84–5.

24. Ruiz Henao C, Roviralta Gómez S. Caso Clínico Úlcera Terminal de Kennedy: ¿Úlcera por presión inevitable? Heridas y cicatrización. 2015;5(19):16–20.

25. Guinot Bachero J, Furió Vizcaíno T. Poliulceración en paciente terminal úlceras de Kennedy. Plan de cuidados paliativos. Enfermería dermatológica. 2014;8(22):32–40.

26. Beldon P. Skin changes at life’s end: SCALE ulcer or pressure ulcer? Br J

Community Nurs. 2011 Oct;16(10):491–4.

27. Miller MS. The Death of the Kennedy Terminal Ulcer. J Am Coll Clin Wound Spec. 2016;8(1–3):44–6.

28. Ramos Sánchez A, Aguila Pollo M del C, Vázquez M, Fernández Ayuso D, Arribas Marín JM, Fernandes Ribeiro A sofía. Úlceras por presión en el paciente paliativo oncológico y no-oncológico ¿inevitables?. Un estudio retrospectivo. Enfermería Oncológica. 2018;20(2):13–7.

Figure A.1 Search strategy

MSTOTEL

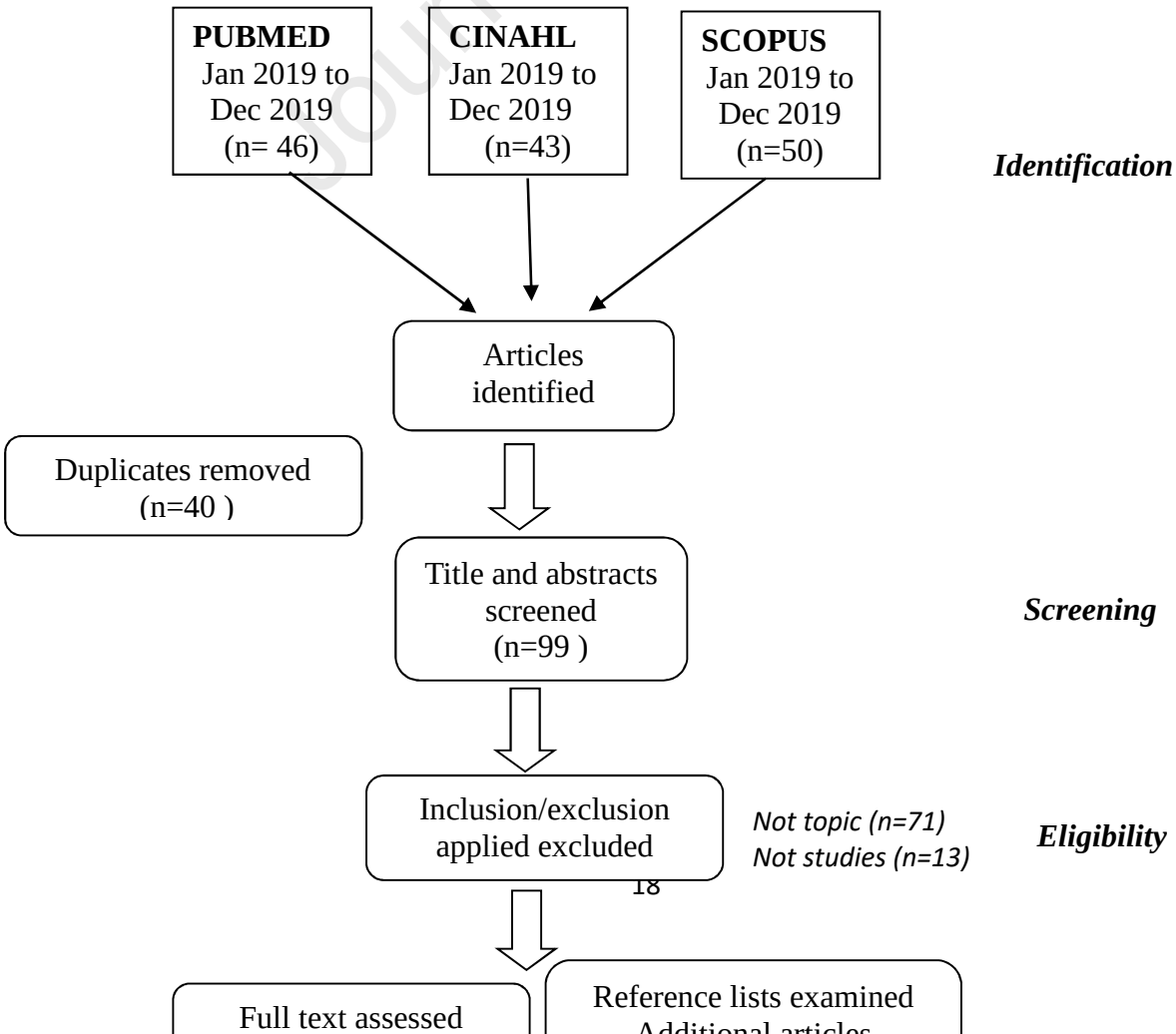


Table A.1 Summary Profile of Studies Reviewed (n=17).

Author/ journal/ / Health care setting/ Year	Title	Research design	Study Purpose(s)	Results
Kennedy K. Decubitus. Intermediate care. 1989	The prevalence of pressure ulcers in an intermediate care facility	Descriptive study	To describes a type of wound called Kennedy Terminal Ulcer and differentiate it from pressure ulcers.	The development of pressure ulcers is often a sign of impending death. There is truly a terminal ulcer and it is called The Kennedy Terminal Ulcer.
Miner KJ. Journal of the American College of Certified Wound Specialists. Palliative care.	Discharge to Hospice: a Kennedy Terminal Ulcer Case Report	Case study	The authors present a clinical case of a patient with a sacrum ulcer with clinical characteristics that coincide with a KTU.	The diagnosis of KTU allows the patient to be cared for from a more realistic and human perspective.

2009				
Schank JE. et al. Ostomy Wound Management. Long-term care. 2009	Kennedy Terminal Ulcer: the “Ah-Ha!” Moment and Diagnosis	Review article. Case study	The literature on KTU is reviewed and two cases of patients with this diagnosis are described.	Diagnosis should help/guide the patient and family, allowing them to accept the inevitable. Realizing that a patient has a KTU has become an “Ah-ha!” moment that helps guide patient care.
Brennan M, Trombley K. World Council of Enterostomal Therapist Journal. Palliative care. 2010	Kennedy Terminal Ulcers- a palliative care unit´s experience over a 12-month period of time	Descriptive study	To describe the wounds that appear on the skin in a patient population of a palliative care unit (n = 22) as well as those aspects related to their appearance (location, stage, etc.)	The time frame for the development of pressure ulcers ranged from two hours prior to death to as long as six days prior to death. Many patients were unable to verbalize pain or discomfort as medications were being routinely administered for comfort.

Sibbald RG, Krasner DL, Lutz J. Advances in Skin & Wound Care. Uncontextualized. 2010	SCALE: Skin Changes at Life's End: Final Consensus Statement: October 1, 2009		Delphi study with an international group of 69 experts in wound care.	Consensus on the physiopathology of the changes that occur in the skin at the end of life, the clinical characteristics of the KTU and how to deal with the changes in the skin at the end of life.
Yastrub DJ. Journal of Wound, Ostomy and Continence Nursing. Uncontextualized. 2010	Pressure or Pathology: Distinguishing Pressure Ulcers From the Kennedy Terminal Ulcer	Descriptive study	To distinguish pressure ulcers from KTU.	The difference between KTU and other types of injuries related to dependence, clinical characteristics of KTU and possible physiopathology.
Beldon P. British Journal of Community Nursing.	Skin changes at life's end: SCALE ulcer or pressure ulcer?	Descriptive study	To recognize Skin Changes at Life's End (SCALE) ulcers.	Pressure ulceration causes much distress to patients and family, and can be taken as an indication of poor

Uncontextualized. 2011				nursing care. It is vital that both parties understand when pressure damage can be prevented as well as those circumstances when skin failure at the end of life cannot be avoided.
Trombley K. et al. American Journal of Hospice & Palliative Medicine. Palliative care. 2012	Prelude to Death or Practice Failure? Trombley-Brennan Terminal Tissue Injuries	Descriptive study	To define, describe, compare, and contrast the observed skin changes in end-of-life patients.	Different wounds appear at the end of life and not all of them are KTU. The Trombley-Brennan Terminal Tissue Injury is defined for the first time.
Lepak V. Journal of Legal Nurse Consulting. Uncontextualized.	Avoidable & Inevitable? Skin Failure: The Kennedy Terminal Lesion.	Review article	To describe the pathophysiological processes that occur at the end of life and that affect the skin as another organ as well as analyse the	Some pressure ulcers are inevitable, even when adequate care is provided. The care and communication with the patient, family and caregivers is

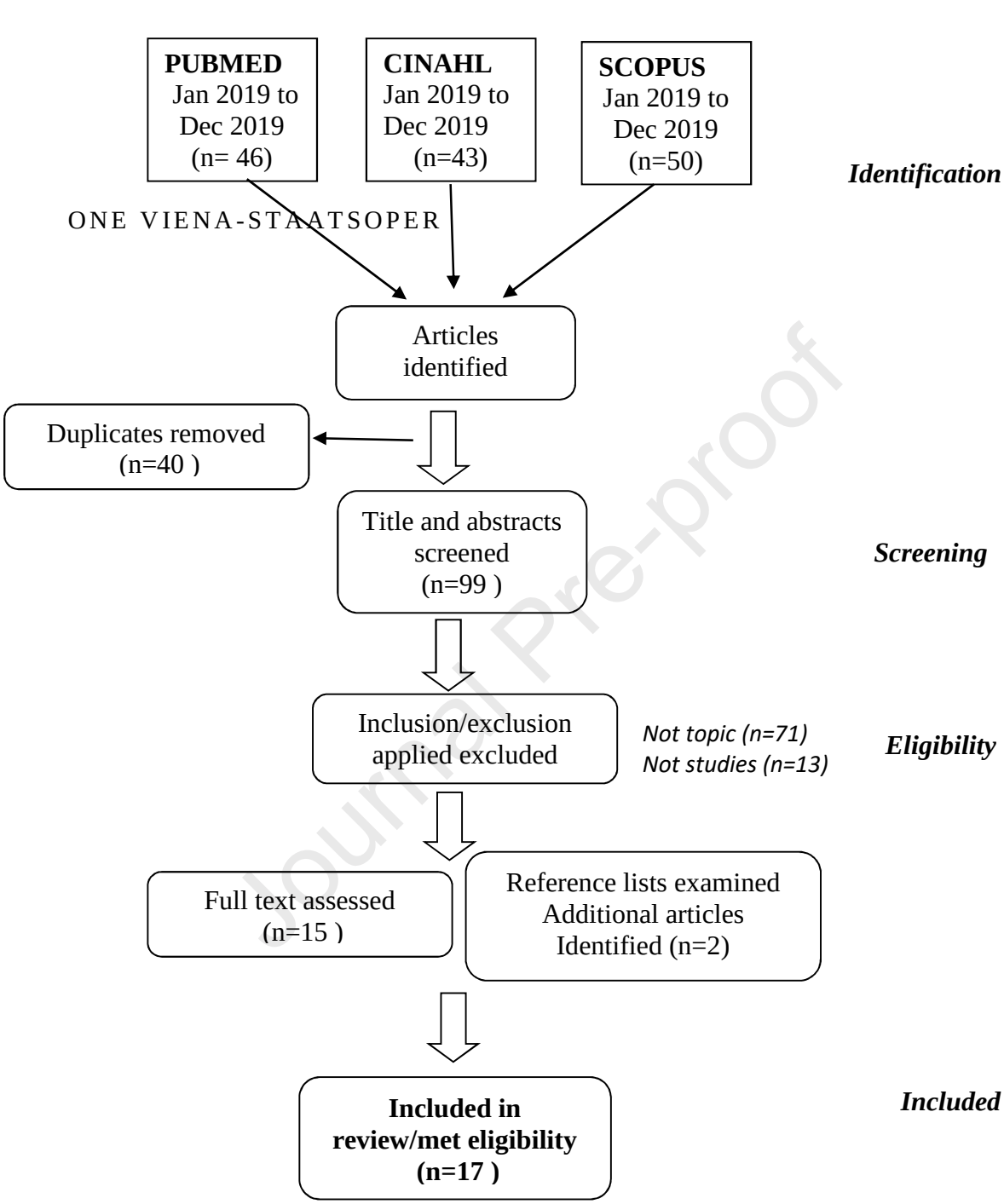
2012			implications that the appearance of ulcers can have in this context.	important to avoid perceiving the appearance of these injuries as the consequence of inadequate care.
Guinot J, Furió T. Dermatologic Nursing. Palliative care. 2014	Poly-ulceration in terminal patients: Kennedy ulcer palliative care plan	Care plan	To design a nursing care plan from a holistic perspective that allows the terminal patient to be comfortable	The study provides information about what to do before the KTU appears as well as the results of the care plan used by the author of the article.
Ruiz CE, Roviralta S. Wounds and Scarring´. Community. 2015	Kennedy Terminal Ulcer: Ulcer caused by inevitable pressure?	Case study	The authors present two clinical cases of frail old-aged patients in a terminal state with ulcers, one trochanteric and the other gluteal. The former evolves towards improvement and the second patient dies.	The authors evaluate, in light of the current literature, whether the KTU is really an unavoidable pressure ulcer.

Alvarez O. et al. Journal of Wound, Ostomy and Continence Nursing. Uncontextualized. 2016	The VCU Pressure Ulcer Summit	Descriptive study	To provide an updated review of unavoidable pressure injuries that have been identified with the end-of-life situations.	The article provides data on the aetiology, presentation and diagnosis of both avoidable and unavoidable changes in the skin that can occur at the end of life. It contributes to the differentiation from other types of injuries related to dependence.
Black JM, Brindle CT, Honaker JS. International Wound Journal. Uncontextualized. 2016	Differential diagnosis of suspected deep tissue injury	Review article	To address the differential diagnosis of deep tissue injuries versus other types of injuries.	Deep tissue injury can be difficult to diagnose because many other skin and wound problems can appear as purple skin or rapidly appearing eschar. Differential diagnosis includes stage 2 pressure ulcers, incontinence-associated dermatitis, skin tears, bruising, venous engorgement, arterial insufficiency and

				terminal skin ulcers.
Reitz M, Schindler CA. Journal of Pediatric Health Care. Pediatry. 2016	Pediatric Kennedy Terminal Ulcer	Review article. Case study	To identify the differences between pressure ulcers and KTU in children.	The role of the paediatric nurse practitioner in the care of children with a KTU is very important. The diagnosis of KTU may help guide health care decision-making because its presence typically heralds the end of life.
Roca-Biosca A. et al. Intensive Nursing. Critical care. 2016	Adapting the care plan to the diagnosis of Kennedy Terminal Ulcer	Case study	To develop an individualized care plan to identify the problems of a patient with KTU who evolves from a critical to terminal situation.	The diagnosis of KTU is helpful for the care team's decision-making when considering limiting the treatment of life support and, in turn, allowing the adaptation of the care plan.
Levine JM. Advances in Skin &	Unavoidable Pressure Injuries, Terminal	Review article	To define skin failure and its relationship to	Difference between the KTU and other types of injuries related to dependence.

Wound Care. Uncontextualized. 2017	Ulceration, and Skin Failure: In Search of a Unifying Classification System.		unavoidable pressure injury and terminal ulceration. To offer suggestions for simplifying the taxonomy and directions for evidence-based research.	Contributions on how the diagnosis could be approached or the different taxonomies of injuries related to dependence.
Sánchez A. et al. Oncology nursing. Palliative care. 2018	Pressure ulcers in the palliative oncological and non-oncological patient, Are they Inevitable? a retrospective study	Descriptive study	To determine the prevalence and incidence of pressure ulcers in a palliative care unit, as well as when they appear.	A total of 36.36% of the ulcers developed in the week before the death of the patients included in the study. The average time that elapsed between the appearance of the ulcer and death was 3.96 ± 1.94 days. The most common anatomical localization was the sacrum.

Figure A.1 Search strategy



Highlights

- Pressure injuries at the end of-life
- Skin care at the end of life
- Palliative care

Conflict of interest

The authors declare no conflict of interest or external financing.