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EC GASTROENTEROLOGY AND DIGESTIVE SYSTEM

Research Article

Pressure Ulcers an Evolutionary Paradigm

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Received: December 09, 2019; **Published:** December 31, 2019

Abstract

Introduction: Pressure ulcers are defined according to The European Pressure Ulcer Advisory Panel as a damaged area of the underlying skin and tissue caused by pressure above 14 mm Hg, caused by shear, friction or combination mechanisms. The age group in which pressure ulcers occur most frequently are patients over 60 years of age; which is due to the conditions of its immobility and physiological changes of the skin. The management for its prevention of pressure ulcers must follow the same principles as that of wounds and its treatment is diverse, complex and to date very controversial.

Objective: Describe and specify the various possible treatments available in patients presenting with pressure ulcers, with isolated or combined modalities, which are cures, surgery and/or debridement and the use of dressings.

Materials and Methods: It is a prospective, cross-sectional, observational and descriptive study. Hospitalized patients suffering from pressure ulcers are identified in two hospitals of the Ministry of Health of Mexico City, in a study period from January to October 2019.

Results: There were 104 patients in total, 42 of the female sex that represent 40% and 62 of the male sex that are 60%, with an age range of 23 to 88 years, with a time of in-hospital evolution that varied from 4 to 25 days, the management was carried out with the various therapeutic modalities, achieving their discharge prematurely at home with subsequent follow-up in the outpatient clinic.

Conclusion: The combination of the therapeutic modalities carried out according to the specific evolution of each patient with pressure ulcer, successfully succeeds in shortening hospitalization times, as well as the number of surgical interventions and early healing.

Keywords: *Ulcers; Debridement; Tissue; Dressing; Scarring; Healing; Controversial*

Introduction

Patients with pressure ulcers (UPP) represent a public health problem in Mexico, with exorbitant costs that are unknown to date, and with catastrophic consequences on a personal, family and institutional level (health system).

The first historical reference was made in Egypt in 1070 BC, where they used "patches" of gazelle skin to cover wounds. Hippocrates in 460 BC described for the first time as a disease the UPP [1]. The European Pressure Ulcer Advisory Panel (EPUAP) currently defines UPPs as the damaged area of the underlying skin and tissue caused by pressure, shear, friction or the combination of these [2]. With regard to pathophysiology, this consists of excessive pressure in the tissues due to the intensity and duration of the same, as well as the same resistance of the tissue in question [3].

The risk factors are divided into [4]:

- Extrinsic factors: Humidity, substances containing alcohol, support surfaces, splints and casts).
- Intrinsic factors: Immobility, respiratory and/or circulatory disorders, nervous disorders, septicemia, malnutrition and dehydration.

There are multiple scales to determine the risk of each patient of presenting UPP, however, the most used is the Norton scale which consists of giving a score that ranges from 1 to 4 points, evaluating five parameters: physical condition, mental state, activity, mobility and incontinence. The sum of the values for the five parameters produces a score that can vary from 5 to 20 points, therefore, the lower the score, the greater the risk of presenting UPP [3]. The classification or stages of the UPPs is carried out based on what Darrel Shea referred to in 1975, which defined it in 4 stages, based on the depth of the damaged tissue:

- Stage or grade I: Ulcer with superficial changes in the skin.
- Stage or grade II: Ulcer that affects the epidermis, dermis or both. The ulcer is superficial and presents clinically as an abrasion.
- Stage or grade III: Ulcer that involves damage or necrosis of the subcutaneous tissue that can extend to the adjacent fascia but does not penetrate it.
- Stage or grade IV: Ulcer with tissue necrosis with bone extension [5].

The management of pressure ulcers should follow the same principles as that of wounds, that is, the control and elimination of risk factors, as well as maintaining preventive measures, even if the patient already has the ulcer. Secondly, to control the patient's metabolic state, management of existing comorbidities such infection, malnutrition and finally, to provide an adequate environment to the wound, which is achieved with the combined or isolated modalities, which are surgery with cures, surgery with dressings or cures exclusively [5,6].

Materials and Methods

The study has a prospective, transversal, observational and descriptive design. In which hospitalized patients were identified and followed up upon admission who presented pressure ulcers at different stages, which were given various treatment modalities, in two hospitals in Mexico City of the Ministry of Health:

- General Hospital "Ticomán", of the Secretary of Health of Mexico City, Country Mexico.
- General Hospital "Dr. Rubén Leñero" of the Secretary of Health of Mexico City, Country Mexico.

With a study period from January to October 2019. From each patient the age, sex, comorbidities, type of ulcer, days of hospital stay, complications, crop results, treatment lines and healing period were obtained. With follow-up of the patients through the external consultation a month, at 3 and 6 months. The result of the study was carried out using descriptive statistics procedures.

Treatment used in this study was:

The cures, which were performed according to the severity determined by the depth, necrosis and type of infection, which we classify as follows:

Paradigm of evolutionary management (PME) of the UPP:

- I: Depth grade I without infection; healing with irrigation:
- Ia: Depth grade I with infection; cures with only irrigation and surgical soap.
- Ib: Depth grade II without infection; cures with irrigation and surgical soap.

- Ic: Depth grade II with infection; cures with povidone iodine, prophylactic or systemic antibiotic.
- II: Depth grade III without infection; cures with irrigation and surgical soap:
- IIa: Grade III and IV with infection; with debridement, drainage of abscesses, more healing with povidone iodine, empirical and specific antibiotic treatment after culture. Use of dressing according to the case.
- IIb: Grade III and IV after handling IIa with satisfactory evolution management as Ia.

The surgical technique described in this study is described: Surgical debridement with dressing (DQA)

After asepsis and antisepsis, 1% lidocaine is infiltrated on the periphery of the ulcer, all necrotic tissue and fibrin are removed (Figure 1). With standard technique, culture is taken 2 to 3 samples (a sterile swab, sometimes fluids are aspirated from the infected area or even biopsy cultures are performed), with the sedated patient intentionally seeking isolated non-visible communications ("rabbit huts") Hidden abscesses, once draining the purulent material collections, the wound edges are rekindled, and subsequently washed with povidone iodine, until the bloody area is kept clean, irrigating with 2% aqueous chlorhexidine. Once the surgical debridement is finished, a bioactive or mixed dressing is placed as appropriate (Figure 2).

Figure 1: *1% lidocaine is infiltrated on the periphery of the ulcer, all necrotic tissue and fibrin are removed.*

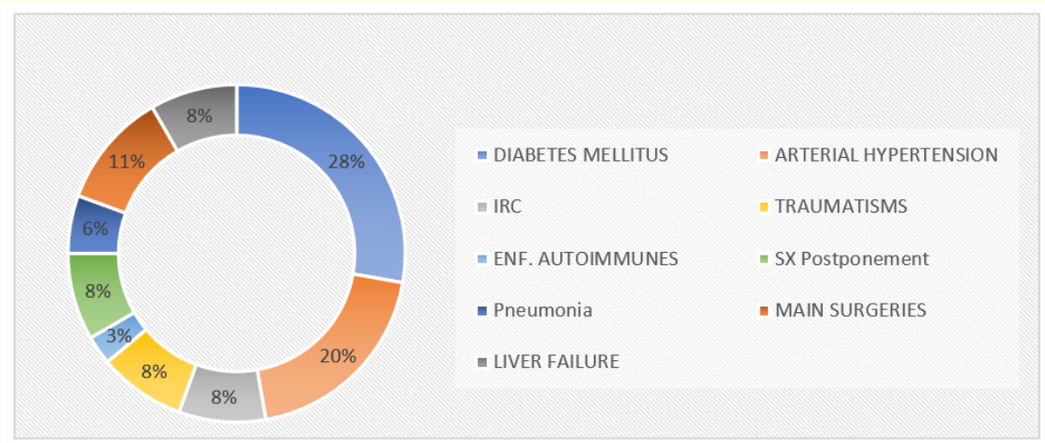
Figure 2: *The surgical debridement is finished, a bioactive or mixed dressing is placed as appropriate.*

Results

There were 104 patients in total, of which 42 patients were female representing 40% and 62 male patients corresponding to 60%, with an age range from 23 to 88 years with an average of 56 years; with the time of intrahospital evolution that varied from 4 to 25 days and average of 16 days. Carrying out pressure ulcer management with the various modalities achieving home discharge with zero mortality and follow-up by external consultation. Observing a tissue granulation process (Figure 3) until healing with a maximum time of up to 50 days.

Figure 3: *Observing a tissue granulation process until healing with a maximum time of up to 50 days.*

Associated morbidity was found in this group of patients, the most frequent being diabetes mellitus, arterial hypertension, spinal cord trauma, renal failure, post-stop syndrome, major surgery, liver cirrhosis and with the association in the vast majority of cases with moderate to severe acute chronic malnutrition (See graph 1).



Graph 1: *Main comorbidities associated with UPP.*

Based on their location, an incidence of presentation of UPPs is described in the patients of this study in one or more anatomical sites, in the same subject; Sacral region 82 cases that are 79%, in the trochanteric area 70 individuals representing 67%, in the heel 8 cases that are 8%, in the subscapular region in 4 subjects, 3 in the shoulder and 3 in the parietal region which would be 4, 3 and 3% respectively (See table 1).

	Grade I	Grade II	Grade III	Grade IV	Total
Sacred	21	10	19	32	82
Trochanteric	7	5	32	26	70
Heel	5	2		1	8
Region Parietal	1	2			3
Subscapular	2	1		1	4
Shoulder	1	2			3
Total	37	22	51	60	170

Table 1: *Total number of ulcers by pressing by anatomic site.*

The main complication that was presented in this study was the infection, which goes from the skin to the bone presenting as dermatitis, cellulitis, abscesses, fasciitis and osteomyelitis, with tissue necrosis in each of the UPPs. Of the 104 patients 80 presented infection, being 77%, of which 29 are women and 51 men representing 36 and 64% respectively. 7 infections in the UPPs were a grade I, 15 cases grade II, 40 patients grade III and 54 in grade IV. 53 cases that are 66% presented aggregate abscess and in 57 patients there was necrotic tissue that represented 71%. Cures were performed in infected UPPs according to the method established by PME, carrying out 63 surgical procedures of DQA that were 61%; as specifically required in each patient and/or suffering from more than one UPP. Healing has a range from 5 to 50 days, with a total average healing of 19 days, which will depend on the degree of the ulcer; in grade I the average was 7 days, in grade II it was 12 days, in grade III it was 26 days and in grade IV it happened 31 days (See table 2).

Type of ulcer	Patients with UPP	UPP clinical condition		Treatment PME/ DQA	Cicatrization time
		Infected	Not infected		
Grade I	37	7	30	Healing	5-10 days
Grade II	22	15	7	Healing	7-17 days
Grade III	51	40	11	Debridation/positioning healing	20-34 days
Grade IV	60	54	4	Debridation/placement of aposito healing	17 - 48 days

Table 2: *UPP management and grade indication index.*

With regard to infected UPP cultures, 80 cultures were taken in each patient to identify gram-positive, gram-negative, anaerobic and fungal microorganisms; with number of colonies, MRSA and antibiogram. Of which 53 were positive that 67% of the samples were, and isolating in order of greater frequency: *E. coli* ESBL in 22 samples that are 42%, followed by *Pseudomonas aeruginosa* in 12 cases representing 23%, Thirdly, *Acinetobacter baumannii* 8 cases that are 15% and *Morganella morganii* in 6 cases that are 11%. In 5 patients, it showed a mixed culture of *Candida albicans* and *Staphylococcus aureus*, which represent the remaining 9%. Empirical antibiotic treatment was initiated and at 4 days with the results the cultures were administered the specific antibiotic treatment.

Finally, the healing time of the UPPs, grade I ulcers with a closure range ranging from 5 to 10 days, is described. Stage II ulcers have a closing range time that ranges from 7 to 35 days. On the other hand, in the ulcers grade III and IV the results are very varied, but the average closure with optimal healing reached up to 50 days; with outpatient management criteria that consist of an evolution without infection and improvement of the clinical conditions of the patients, achieving at home in a range in 5 to 7 days and follow-up in the outpatient clinic, which significantly reduced the stay In-hospital and costs (See table 2).

Discussion

The UPP is a devastating pathology because it disproportionately consumes economic, social and human capital resources. It is therefore an exorbitant public health problem, not yet described in our country, however in the United States of America it is estimated more than 10 billion dollars a year; its management is still controversial, diverse and multidisciplinary, so it is stigmatized as a challenge to establish a therapeutic paradigm to avoid unnecessary costs and resources; use them efficiently and effectively, providing an improvement in the practice of medical practice and public health in Mexico [7,8].

UPPs usually occur on a bony prominence, the sacral, trochanter, heel, subscapular region, parietal region and shoulder region being the most affected in incidence, respectively. Having as age group more frequently on average 60 years of age, due to its greater immobility and physiological changes of the skin. The etiology is unclear; clinical variables often have to do with age, nutritional status and comorbidities; Intraoperative variables include surgical time, episodes of hypotension and type of procedure. Tissue damage can occur in two hours or up to three days. The initial manifestations may be a change in skin color that evolves to blistering, necrosis or both. As this process occurs in several days; Identifying the time of the initial injury is complicated [4,5,7,8].

The preventive measures against UPPs are to take into account that all hospitalized patients are at risk of developing them at any time during their hospital stay, minimize or eliminate friction, shear, minimize pressure, wet environment management, proper management of nutrition and Hydration of the patient, a comprehensive assessment of the state of health is necessary for people at risk of developing UPP. There is a direct relationship between malnutrition and the appearance of ulcers, and even UPPs with more advanced stages are directly proportional to nutritional status. Good nutrition instead favors proper healing, preventing the appearance of ulcers. In addition, the loss of fat and muscle tissue decreases the protection exercised over bone prominences [4,6].

The management of pressure ulcers should follow the same principles as that of wounds:

1. Control and elimination of risk factors, and also maintain preventive measures, even if the patient already has the ulcer.
2. Secondly, control the patient's metabolic and support status, management of existing comorbidities.
3. And finally provide a suitable environment for the wound, for example with dressings or negative pressure therapy [4-6,8].

With great concern the research team agrees that treating a disease is not the same as treating sick people, it is different from a "recipe"; Management paradigms are changing, according to time and evolution, therefore, the authors conclude that there is a therapeutic reality and therefore, the complexity of management or the paradigm. It is important to mention that the therapeutic modalities and instruments are multiple and diverse, ranging from larval therapy to negative pressure therapy.

Larval therapy has been traced since ancient times, in multiple cultures such as the Maya and Australian aborigines among others; since 1980 the boom has been a growing therapy in Europe; for its direct efficient debridement, antibacterial and anti-inflammatory effects [9]. One of the larvae used is *Lucilia sericata* since 1990 and its disinfectant products (serine proteases), until used in coagulation [10]. There are other species of larvae with debridative and antimicrobial powers [11]; However, in our country it has no clinical or cultural use.

In our environment (Mexico) it is disqualifying for theorists to perform cures with disinfectant substances; but of course in the expert and in the clinical reality the use is indispensable and imminent, with the adequate indication in time and evolution of the clinical course of the UPP. This clinical behavior is based on the fact that most UPPs contain bacterial biofilms in more than 80% of cases, and their reduction or elimination with antiseptic substances (povidone iodine, silver lactate and chlorhexidine digluconate) bacteriostatic and bactericidal, they help in the healing of UPPs [12]. Single irrigation with 0.9% sterile saline solution with moisture preservation; it did not reduce bacterial load in consecutive cultures, but only after the use of povidone iodine, hypochlorite, polyhexanide and octenidine [12,13]. Povidone iodine is today, the preferred and most popular antiseptic that has demonstrated beneficial and efficient characteristics for decades such as low resistance and high potency in bacterial biofilms, with low toxicity and good tolerance [14]. It should be mentioned that the use of chlorhexidine digluconate achieves a reduction in bacterial biofilm at 24 hours only in certain bacterial species with limited efficacy to some extent [15].

With regard to the use of dressings, the evaluation of each patient with infected or non-infected UPPs is essential, decisive, and is for now for many authors the cornerstone for the treatment of UPPs [16]. Which must meet certain criteria for their use, all dressings should not be standardized, each will have a specific function so it must be individualized in each patient in the use of them. Among the criteria to be taken into account for its use are [17,18]:

- They should not be toxic or allergenic.
- They must have absorption capacity.
- They should be easy to use and eliminate bad smell.
- Provide a humid environment.
- Be sterile and adapt to anybody surface.
- Have antimicrobial activity.

Currently dressings are classified as:

A) Passive dressings: They are simple and low cost dressings. They mainly serve to protect, isolate, plug and absorb.

B) Interactive dressings: They serve to maintain a moist physiological environment in the wound or ulcer. The use of interactive dressings stimulates catalytic enzymes favoring autolysis and allows debridement to be painless. Do not adhere to the wound.

C) Bioactive dressings: They have the characteristic of interacting with the wound. They are designed to maintain a physiological moisture in the wound or ulcer and allow oxygenation.

D) Mixed dressings: They are dressings with different levels of permeability that combine the characteristics of different types of dressings: passive, interactive and other components.

The choice of dressing should adapt to the patient's ulcer, prematurely achieving a decrease in the diameter of the ulcer, eliminating the infection and with granulation tissue already achieve the phase of contraction in healing, in less time; That is why its great value as an instrument in the arsenal in the therapy of UPPs [17-20].

Finally, negative pressure therapy is a tool used in specialized centers and with greater resources for UPPs of greater complexity, to achieve an effective closure or healing [21]. Indications for the use of negative pressure therapy are diabetic foot ulcers, pressure ulcers, burns, crush injuries, wound dehiscence, fasciotomy wounds, animal bites or frostbite injuries; its contraindication is in patients with oncological pathology in the ulcer, untreated osteomyelitis, fistulas in organs or body cavities, necrotic tissue, exposure of vessels or nerves and at sites of anastomosed organs [22-24]. Vacuum-assisted closure therapy is a system that promotes healing of UPPs through the application of negative pressure especially in infected tissues; It can be operated continuously or intermittently, varying from 50 to 125 mm Hg of pressure [22]. Negative pressure therapy sponges are changed on the third day, stabilize the wound environment, reduce edema, bacterial load, improve tissue perfusion, stimulate granulation tissue and angiogenesis; all this improves the possibility of a successful secondary closure of the UPP; It seems to be simpler and more effective than conventional dressings for the treatment of difficult UPPs in terms of reducing the ulcer diameter, depth and duration of treatment [23]. However, equipment that provides negative pressure therapy for UPP is expensive and therefore its availability in hospitals in the health sector is very stunted or even non-existent [23,24].

It is essential to determine that UPPs are a complex pathology and their management is due to various scenarios that are selective and must be analyzed in a comprehensive manner, but which will depend on the experience of medical staff and hospital resources.

Conclusion

Pressure ulcer management is not due to a standardized process as it will depend on its presentation and its evolution.

The availability of resources to access the different therapeutic alternatives for UPPs, are influenced by extrinsic factors such as economic, cultural and political.

In this research, the combination of proposed therapeutic modalities successfully manages to shorten hospitalization times, as well as the number of surgical interventions with early healing; becoming a substantially beneficial paradigm mainly for the patient and secondly in cost-effectiveness.

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Volume 7 Issue 1 January 2020