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Sugardine Versus Povidine-Iodine In Management Of Pressure Ulcers

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Abstract: *An admixture of antifungal/antibacterial agent such as povidone-iodine and an antibacterial tissue nourisher e.g. sugar in appropriate proportions provides a stable effective antibiotic composition that facilitates healing of wounds to which it is directly applied. The aim of the present study was to evaluate the effect of applying sugardine versus povidine-iodine (Betadine) in management of pressure ulcers. Pre/post- test quasi-experimental design was used to fulfill the aim of the study. The study was conducted on adult patients admitted to different units (medical, orthopedic wards and intensive care units) affiliated to governmental hospital, Egypt. A sample of 150 adult male and female patients, aged from 40-60 years, with acute pressure ulcers (2nd and 3rd stage), and on systemic antibiotics as line of treatment constituted the study sample. Patients receiving anticoagulant or anti-platelet medications, diabetics, immuno-compromised, as well as had vascular or arterial insufficiency diseases were excluded from the study. Two tools were utilized to collect data (a) Socio-Demographic and related data, and (b) Pressure Ulcer Scale for Healing (PUSH) by* ***National Ulcer Advisory Panel taskforce in 1997.*** *The study findings revealed a statistical significant difference between study and control group along the three assessment readings regarding total pressure ulcer healing scores. The study recommended replication of the study on a larger sample for longer period in different settings and on different patients with various types of ulcers; also, further studies to compare sugardine against other evidence-based dressing modalities to assess its effectiveness and provide a high standard of care to be investigated.*

Key Words: *Sugardine, Povidine-iodine, Management, Pressure Ulcers*

I. Introduction

The terms decubitus ulcer, bedsore, and pressure ulcer are often used interchangeably. Decubitus, means "to lie down." Decubitus ulcers therefore, occur at sites overlying bony structures that are prominent when the person is lying in a recumbent position. These ulcers may occur on the scalp, back, tailbone, hip, heel, or any other areas to which pressure is applied for long time. Because the common denominator of all such ulcerations is pressure, the term that best describes this condition is pressure ulcer (Kirman&Vistnes, 2012). The authors further pointed out that, the prevalence of pressure ulcers in hospitalized patients worldwide has been reported to be from 14:21% over the last decade. The cost to heal a single full-thickness pressure sore may be as high as 70,000 dollars every year in each country. The overall annual cost worldwide has recently been estimated to be between 5 billion and 8.5 billion dollars, with the cost of hospital-acquired pressure ulcers between 2.2 and 3.6 billion dollars.

Pressure ulcers (PUs) are an important aspect of geriatrics and palliative care that amplifies morbidity of the chronically bed-ridden patients posing a threat to health-care economy and resources. **Helvig, Ritter &Heinsler(2011)** indicated thatPUs can interfere with functional recovery, may be complicated by pain and infection and can prolong hospital length of stay. Their presence may be a marker of poor overall prognosis and premature mortality. In 1997, The National Pressure Ulcer Advisory Panel's defined PUs with different staging system, stage I is an intact skin with non-blanchable redness of a localized area, stage II as shallow open ulcer with a red pink wound bed without slough (representing partial thickness loss of dermis), stage III as full-thickness tissue loss with visible subcutaneous fat/slough, while stage IV is a full thickness loss with exposed bone, tendon, or muscles that often includes undermining/tunneling with slough/eschar (Ruth & Bryant, 2012).

Several methods to heal pressure ulcers have been studied for the past four to five millennia. Surgery's earliest known document on the care of wounds is The Edwin Smith Surgical Papyrus, dated around 1700 BC, which describes the treatment of a number of difficult wounds encountered on the battlefields of Egypt. Since then, our knowledge of the physiology of wound healing has been elucidated, but timely and efficient wound healing has remained somewhat elusive, especially in areas where technology and modern wound care supplies are limited. However, natural resources have been used extensively for wound care with acceptable results. The use of sugar for wound healing is one of the earliest known methods. In pre-modern times, the idea that sugar can facilitate the healing of wounds has been documented. In modern times, the use of sugar as a general

treatment for the healing of wounds has received much attention. Sugar became an attractive candidate for the healing of wounds, especially in economically challenged areas, and certain types of wounds such as chronic wounds may benefit from a more cost-effective method of wound healing (Biswas , Bharara , Hurst, Gruessner, Armstrong, &Rilo, 2010) said.

Literature revealed large number of reports on the value of sugar in wound management. For example, antibacterial effect of topical sugar has been enhanced by combination with povidone-iodine or other antiseptics in some reports. Murandu & Dealey (2012) explained that povidine- iodine has been broadly used for prevention of infection and treatment of wounds. It is available in several forms (solution, cream, ointment, scrub. The value of sugar has been supported by some acceptable scientific enquiry which shows that sugar can enhance fibroblast activity in vitro, and granulation tissue and collagen formation in vivo, with minimal scarring in treating cavity wounds. The same authors further explained that this clinical effectiveness of sugar might be primarily antibacterial, accompanied by an osmotic, or debriding effect, as well it might have a direct topical nutritive effect. On the other hand, Fitzgerald (2013) also added that sugar treatment is successful because bacteria need water to grow, and using sugar to treat a wound draws the water away, ridding the bacteria of water. This stops the bacteria from growing and eventually it die. Sugar alone can create a perfect medium for bacterial growth and further to overcome this problem, sugar is now mixed with a mild bacteria-killing iodine liquid on patients with anything from burns to shotgun wounds. The mixture is applied as a paste; "It's easy to use, painless, inexpensive, and it works.

Significance of the study

Pressure ulcers have been documented as a significant problem across the lifespan and across all health care settings, as well as a significant source of pain and human suffering. The elderly may be at greater risk to develop pressure ulcers due to the changes in the skin related to aging, as well as the many co morbidity factors present among this population. Millions of money was spent annually worldwide on the prevention and treatment of pressure ulcers. Cost aside, these wounds affect quality of life for the patients who experience them, and sometimes render them to be unable to fully participate in their lives physically and socially. Also, the pain associated with these wounds can be debilitating (Swezey, 2008).
In addition, pressure ulcers have been used as an indicator of quality of care and their development in long-term care residents has constituted grounds for litigation The prevalence of pressure ulcers in hospitals varies from 1-30% depending on the type of pressure ulcers included in the count. According to the extrapolated statistics in Egypt in 2010, there were 132,839 patients out of a total population of 76.117.421, had pressure ulcers (Statistics by Country for Bedsores, 2010).

Therefore, as with the advent of several innovative wound care management tools, the choice of products and treatment modalities available to clinicians continues to expand. High costs associated with wound care, especially pressure ulcer wounds, make it important for clinician scientists to search for alternative therapies, and optimally incorporate these therapies into wound care protocols appropriately. Sugar has been used in wounds for 3000 years and still is in traditional and cultural medicine. It is clearly attractive to developing countries as it is cheap and available, and attractive to sugar manufacturers as it presents a positive effect rather than dental caries, obesity and the relation to diabetes mellitus. Since, pressure ulcers occur in patients who are immobile in majority of cases of ridden patients, nurses are considered to be responsible for the assessment and prevention of pressure ulcers and the role of the doctors come only secondary to the role of the nurse in particular case.

Therefore, the current study was carried out to evaluate the effect of applying sugardine versus povidine- iodine (Betadine) on the management of pressure ulcers.

II. Materials and methods

Aim of the study

The present study was carried out to evaluate the effect of applying sugardine versus povidine-iodine (Betadine) on the management of pressure ulcers.

Research hypothesis

To fulfill the aim of this study, the following research hypothesis was formulated:

Patients with pressure ulcers who managed with povidine-iodine (Batadine) would have higher scores on the pressure ulcer healing scale (PUSH) than those who managed with sugardine.

Research design

Pre/post- test quasi-experimental design was used to fulfill the aim of the study. In this study the researchers have a new intervention, randomization is absent. A quasi-experimental study is a type of evaluation which aims to determine whether a program or intervention has the intended effect on a study's participants. Quasi-experimental studies take on many forms, but may best be defined as lacking key components of a true experiment. While a true experiment includes (1) pre-post test design, (2) a treatment groupand a control group, and (3) random assignment of study participants, quasi-experimental studies lack one or more of these design elements. Since the most common form of a quasi-experimental study includes a pre-post test design with both a treatment group and a control group, quasi-experimental studies are often an impact evaluation that assigns members to the treatment group and control group by a method other than random assignment.**(William, 2008).**

Setting

The study was conducted at medical, orthopedic wards and intensive care units affiliated to governmental hospital, Egypt.

Subjects

A Convenient sample of 150 adult male and female patients, aged from 40-60 years, with acute pressure ulcers(second and third stage), and receiving systemic antibiotics. Patients receiving anticoagulant or anti-platelet medications, diabetics, immuno-compromised as well as had vascular or arterial insufficiency diseases were excluded from the study.

Tools

To collect data pertinent to the study, the following tools were utilized: (a) Socio-Demographic and related data sheet, and (b) Pressure Ulcer Scale for Healing (PUSH) by **National Ulcer Advisory Panel taskforce in 1997.**

1- **Socio-Demographic and related data:** it consisted of nine items, included general data as age, sex, marital status, level of education, place of residence, and monthly income. The sheet also covered data related to medical diagnosis, pressure ulcer shape and its location.

2- **Pressure Ulcer Scale for Healing (PUSH):** Developed by Panel taskforce in 1997 was used.The items in the PUSH tool indicate whether a pressure wound is getting better or worse over time. Size is measured by length times width rated on a scale of 0-10; the lower the number, the smaller the wound. The size ranges are listed on the tool for ease of use. Exudates describe the amount: 0= none, 1= light amount, 2 =moderate amount, and 3 = heavy amount. Tissue type ranges from 0 to 4: closed, epithelial tissue, granulation tissue, slough, and necrotic tissue, respectively. The sub-scores are added to arrive at the total score. The range of total scores is 0-17, with the lower the score the better. The total scores are compared at intervals to provide an indication of healing. The total scores were plotted on a graph for a visual of wound healing. Sub-scores are not assessed individually to predict healing. It takes 5 minutes per ulcer to score **(National Pressure Ulcer Advisory Panel; 2009).**

Ethical Consideration

Permission to conduct the proposed study was obtained from the hospital authorities of the governmental Hospital. Prior to the initial interview, the researchers introduced themselves to individual members who met the inclusion criteria; each potential member was fully informed with the title, purpose and nature of the study, and then an informed consent was taken from participants who accept to participate in the study. Following their acceptance to take part, each question was addressed one by one, with the interviewer explaining any difficulties along the way. The patients were assured about the confidentiality and ethical principles that would be followed. The researchers emphasized that participation in the study is entirely voluntary and withdrawal from the study doesn't affect provided care; anonymity and confidentiality were assured through coding the data.

Procedure

Once the permission was granted to proceed with the proposed study, names of potential patients who had pressure ulcers, as well as met the criteria for possible inclusion was approached from each involved ward. Patients were assigned to a study and a control groups (75 patients in each group). Dressing for control group was done utilizing povidine-iodone, on the other hand sugardine was applied for the study group. Sugardine is a mix of white granulated sugar with povidine- iodine until a thick mixture have reached (about the consistency of

honey) — approximately twice the amount of sugar to the povidine-iodine, but exact proportions are not identified. Then, it kept in a sterile container to be utilized for each dressing per day**.** As with any traumatic wound, the wound is first irrigated. Deep wounds are treated by pouring sugardine into the wound, making sure to fill all cavities and then covered with a gauze sponge soaked in povidine-iodine solution. Superficial wounds are dressed with sugardine-soaked gauze sponges. In a few hours, the granulated sugar is dissolved into a "syrup" by body fluid drawn into the wound site. Since the effect of granulated sugar upon bacteria is based upon osmotic effect and withdrawal of water that is necessary for bacterial growth and reproduction, this diluted syrup has little antibacterial capacity and may aid rather than inhibit bacterial growth. To continually inhibit bacterial growth, the wound is cleaned with water and repacked at least three times daily (or as soon as the granular sugar becomes diluted) with more solute (sugar) to "re-concentrate" the aqueous solution in the environment of the bacteria.

Socio-demographic and medical data were collected before the intervention from both groups (study & control groups). Both groups were assessed utilizing PUSH tool to ascertain homogeneity of the study sample where it was utilized as a baseline data. Size of pressure ulcer was measured in cm^2, utilizing a 20cm ruler, while the amount of exudates was calculated by estimation. At the 7^{th} and 14^{th} day post intervention both study and control groups were assessed utilizing PUSH tool.

Statistical analysis

Data was analyzed using Statistical Package for Social Science (SPSS version 13.0) program. Descriptive statistics were calculated to determine the demographic characteristics and related data of the patients, as well as PUSH rating system scale regarding patients with pressure ulcers. T-test was done to assess if there was any statistically significant difference between study and control groups on three different occasions. Significant level was pre-set at $p<0.05$.

Limitation of the study

Most of references were case reports not a full paper and most of them were about applying sugardine on horses' ulcers and wounds.

III. Results

Table (1): Socio-demographic Characteristics and Medical Data among Total Study Sample (Total=150)

Socio-demographic characteristics	Study Group		Control Group	
	No	%	No	%
Age:				
40-<50	24	32.0	25	33.4
50-<60	33	44.0	33	44.0
60- above	18	24.0	17	22.6
Sex:				
Male	43	57.3	39	52.0
Female	32	42.7	36	48.0
Marital Status:				
Married	55	73.3	53	70.7
Widow	16	21.3	17	22.7
Divorced	4	5.4	5	6.6
Education:				
Illiterate	17	22.7	26	34.7
Read &Write	14	18.7	22	29.3
Primary Education	26	34.7	17	22.7
Secondary Education	16	21.3	8	10.7
University Education	2	2.7	2	2.6
Residence:				
Rural	49	65.3	44	58.7
Urban	26	34.7	31	41.3
Income: (LE)				
0-500	52	69.3	57	76.0
501-1000	23	30.7	18	24.0

Table (2): Percentage Distribution regarding Medical Data of Study versus Control Group (Total=150)

Variables	Study Group		Control Group	
	No	%	No	%
Medical Diagnoses:				
Cerebro-Vascular Stroke (CVS)	14	18.7	33	30.7
Head Trauma	18	24.0	19	25.3
Cerebral Hemorrhage	22	29.3	14	18.7
Fracture Pelvis	14	18.7	11	14.7
Hepatic Coma	7	9.3	8	10.6
Pressure Ulcer Location:				
Sacrum & Coccyx	31	41.3	22	29.3
Trochanter	4	5.3	4	5.3
Ankle	9	12.0	11	14.7
Heel	31	41.4	38	50.7
Pressure Ulcer Shape:				
Irregular	21	28.0	26	34.7
Round/oval	54	72.0	49	65.3

Table (3): Percentage Distribution of Wound size-related Pressure Ulcer Healing Readings of the Study versus Control Group (Total=150)

Variables	Study Group		Control Group	
	No	%	No	%
First Assessment:				
1.1-2 cm^2	4	5.3	10	13.3
2.1-3 cm^2	13	17.3	23	30.7
3.1-4 cm^2	21	28.0	26	34.7
4.1-8 cm^2	24	32.0	13	17.3
8.1-12 cm^2	13	17.3	3	4.0
Mean	6.386		5.680	
Second Assessment:				
0.7-1.0 cm^2	-	-	1	1.3
1.1-2 cm^2	3	4.0	10	13.3
2.1-3 cm^2	14	18.7	22	29.3
3.1-4 cm^2	21	28.0	26	34.7
4.1-8 cm^2	24	32.0	13	17.3
8.1-12 cm^2	13	17.3	3	4.0
Mean	6.400		5.653	
Third Assessment:				
0.7-1.0 cm^2	1	1.3	1	1.3
1.1-2 cm^2	6	8.0	13	17.3
2.1-3 cm^2	12	16.0	19	25.3
3.1-4 cm^2	20	26.7	26	34.7
4.1-8 cm^2	22	29.3	13	17.3
8.1-12 cm^2	14	18.7	3	4.0
Mean	6.306		5.613	

Table (4): Frequency Distribution of Exudates -related Pressure Ulcer Healing Readings of Study versus Control Group (Total=150)

Exudates' amount	Study Group		Control Group	
	No	%	No	%
First Assessment:				
None	-	-	-	-
Light	3	4.0	-	-
Moderate	52	69.3	36	48
Heavy	20	26.7	39	52
Mean	2.226		2.520	
Second Assessment:				
None	-	-	-	-
Light	7	9.3	1	1.3
Moderate	65	86.7	35	46.7
Heavy	3	4.0	39	52.0
Mean	1.946		2.506	
Third Assessment:				
None	6	8.0	-	-
Light	12	16.0	3	4.0
Moderate	50	66.7	33	44.0
Heavy	7	9.3	39	52.0
Mean	1.853		2.480	

Table (5): Frequency Distribution of Tissue Type -related Pressure Ulcer Healing Readings of Study versus Control Group (Total=150)

Tissue Type	Study Group		Control Group	
	No	%	No	%
First Assessment:				
Granulation tissues	-	-	-	-
Slough	63	84.0	52	69.3
Necrotic tissues	12	16.0	23	30.7
Mean	3.160		3.306	
Second Assessment:				
Granulation tissues	3	4.0	1	1.3
Slough	59	78.7	51	68.0
Necrotic tissues	13	17.3	23	30.7
Mean	3.133		3.293	
Third Assessment:				
Granulation tissues	12	16	4	5.3
Slough	49	65.3	48	64.0
Necrotic tissues	14	18.7	23	30.7
Mean	3.026		3.253	

Table (6): Frequency Distribution of Total Scores regarding Pressure Ulcer Healing Assessment Data among Study Sample (Total=150)

Total scores in the three assessments	Study Group		Control Group	
	No	%	No	%
First Assessment:				
6-10	17	22.7	28	37.4
11-15	58	77.3	47	62.6
Second Assessment:				
6-10	18	24.0	29	38.7
11-15	57	76.0	46	61.3
Third Assessment:				
6-10	26	34.7	29	38.7
11-15	49	65.3	46	61.3

Table (7): Pressure Ulcer Healing Assessment Data among Total Study Sample Throughout the three assessments (Total=150)

Intervals of assessments	Study Group				Control Group			
	$\bar{x}$	SD	T-test	P	$\bar{x}$	SD	T-test	P
Woundsize:								
First & Second	0.013	0.115	1.000	0.321	0.026	0.162	1.424	0.159
First & Third	0.080	0.318	2.173	0.033*	0.066	0.251	2.299	0.024*
Second & Third	0.093	0.373	2.162	0.034*	0.040	0.196	1.756	0.083
Exudates amount:								
First & Second	0.280	0.508	4.770	0.000*	0.013	0.115	1.000	0.321
First & Third	0.373	0.631	5.117	0.000*	0.040	0.197	1.756	0.083
Second & Third	0.093	0.681	1.186	0.239	0.026	0.162	1.424	0.159
Tissue type:								
First & Second	0.026	0.230	1.000	0.321	0.013	0.115	1.000	0.321
First & Third	0.133	0.413	2.791	0.007*	0.053	0.226	2.042	0.045*
Second & Third	0.106	0.351	2.628	0.010*	0.040	0.197	1.756	0.083

Table (8): Comparison of Pressure Ulcer Healing Assessment of study versus control group Throughout the three assessments (Total=150)

Variable	$\bar{x}$	SD	T-test	P
Woundsize:				
1st assessment	0.706	1.522	4.019	0.000*
2nd assessment	0.746	1.507	4.289	0.000*
3rd assessment	0.693	1.651	3.635	0.001*
Exudates amount:				
1st assessment	0.293	0.693	3.665	0.000*
2nd assessment	0.560	0.575	8.432	0.000*
3rd assessment	0.626	0.955	5.680	0.000*
Tissue type:				
1st assessment	0.146	0.537	2.363	0.021*
2nd assessment	0.160	0.593	2.334	0.022*
3rd assessment	0.226	0.669	2.933	0.004*

As can seen in table (1) the highest percentage in both study and control groups aged from 50 to less than 60 years represented 44%, as well as residing in rural areas (65.3% & 58.7%). More than one half of the total sample were males represented 57.3% & 52% respectively. The majority of subjects in both groups were married (73.3% & 70.7%)with monthly income ranged from 0-500 Egyptian pounds (69.3% & 76% respectively). More than one third of the study group (34.7%) with primary education, compared to same percent in the control group as illiterate.

Regarding distribution of medical data among the study subjects table (2) showed that about one third of the study group had cerebral hemorrhage, compared to same percentage 29.3% & 30.7% respectively in the control group with cerebro-vascular stroke. The highest percentage of both groups had pressure ulcers in their heels (41.4% & 50.7%) with a round or oval shapes represented 72% & 65.3% respectively.

Regarding wound size-related pressure healing assessment data, it was obvious that slight improvement was observed throughout the three assessments in both groups. The highest percentage of study group had averaged wound size from 4.1-8cm^2 represented 32% respectively. While the average wound size in the control group was from 3.1-4cm^2 represented 34.7% respectively (Table 3).

In relation to amount of exudates a significant improvement was observed along the three assessments of the study group in where the percentage of subjects who had no exudates increased from 0% in the first and second assessment to 8% in the third assessment. While it still 0% in the control group throughout the three assessments (Table 4).

Table (5) illustrated the distribution of tissue type-related pressure ulcer healing assessment data, where a significant improvement in wound condition was found in the study group. Granulation tissues were significant in 16% compared to 4% in the second assessment; and 0% in the first assessment. Furthermore, slight improvement was found in control group along the three assessments.

Regarding total scores of pressure ulcer healing assessment data, results showed that a total score ranged from 11-15 was declined through the three assessments in the study group and represented 77.3%, 76.0% & 65.3% respectively. It is worth mentioning that, the same range of total scores was found in 62.4%, 61.3% & 61.3% of the control group through the three assessments (Table 6).

As regards the 1st and 2nd assessments in the study group for wound size and tissue type, no statistically significant difference was found. Also, no statistically significant difference was found between the second and third assessments regarding amount of exudates. While in the control group a statistically significant difference was found only between the first and third assessment regarding wound size and tissue type with p values of 0.024& 0.045 respectively (Table 7). Highly statistically significant difference was found between study and control groups in relation to wound size, exudates amount, and tissue type throughout the three assessments (Table 8).

IV. Discussion

Pressure sores are complex wounds that result from one or more contributing factors. Stress, time, spasticity, infection, edema, moisture, and poor nutrition are considered fundamental issues that result in or contribute to pressure ulcer development. Debilitation and development of pressure ulcer poses a legal liability risk to healthcare practitioners and hospital managers. In the present study, results regarding Socio-demographic and related medical data revealed that the highest percentage in both study and control groups were males, aged from 50 to less than 60 years, married, had low income, as well as residing in rural areas. The majority of them were unconscious (had either cerebral hemorrhage or cerebro-vascular stroke). Sacrum and heels were the commonest locations of pressure ulcers with a round or oval shapes. In this regards, Salcido & Lorenzo (2012) pointed out that pressure ulcers commonly develop on the occiput of geriatric patients who spend extended amounts of time lying supine. The same authors indicated that elderly patients often have pressure ulcers on the heel. The incidence in hospitalized patients ranged from 2.7%to 29% respectively. Patients in critical care units have an increased risk of pressure ulcers, as evidenced by a 33% incidence and 41% prevalence. Elderly patients admitted to acute care hospitals for non-elective orthopedic procedures, such as hip replacement and treatment of long bone fractures, are at even greater risk, with a 66% incidence rate.

The present study results were supported by **Sarabahi & Tiwari (2012),** who found that, more than 60% of pressure sores developed within the hospital wards. One probable source is the increasing geriatric population requiring hospitalization in whom one third to one half experiences a functional decline. These results might be due to prolonged contact between the human body and hard objects that result in ischemic necrosis and pressure sore formation of the intervening tissues. One study conducted in 2006 on 240 paraplegic patients denoted that more than 50% of pressure sores form at the ischium and sacrum. The same study also documented the heel, external malleoli, tibial crest, and costal margin as non-pelvic sites susceptible to pressure sore formation. Such information was virtually duplicated by another study on 2000 paraplegics with pressure sores, adding only the high incidence of trochanteric sore. Another study from Denmark in 2006, showed that almost two thirds of pressure sores occurred when patients are in the hospital. Fifty-three percent of

patients were bedridden, one third were wheelchair bound, and only 10% were ambulating. These results stressed that sacral, ischial, and trochanteric are the most common sites of developing pressure sores **(Sarabahi & Tiwari, 2012)**.

Romanelli, Clark & Cherry (2012), recommended that accurate assessment of all pressure damage in terms of grading, size and type of tissue visible in wound should be done, where the type of tissue in the wound bed will determine the treatment objective and the choice of dressing, product or technique to achieve the objective. The same author added that prevention of pressure ulcer is essential , planning for and providing competency –based training and ensuring specialist nurse are essential. Every nurse has a role to play in implementing guidelines for treatment of pressure ulcers utilizing proper treatment. As regards, pressure ulcer healing assessment data in the current study un-considerable improvement was observed along the three assessment readings among both study and control groups. While a new interval of 0.7-1.0 cm^2 was observed in both second and third assessments in the control group, and in the third assessment only in the study group. Regarding exudates amount, no improvement was found in the control group along the three assessments. Although there was a significant improvement observed through the three assessments in the study group, the percentage of subjects who had heavy exudates increased slightly in the third assessment in the same group. It is worth mentioning that the percentage of subjects who had granulation tissues increased significantly along three assessments, while the percentage of subjects who had necrotic tissues slightly increased along the three assessments in the study group. This could be due to patient's health condition, stage of pressure ulcer, patient's age, presence of ward infection, and interval between each dressing.

Regarding the total scores of pressure ulcer assessment data, it was obvious that subjects in the control group had nearly equal scores along the three assessments. While a significant improvement was observed along the three assessments in the study group. No statistically significant differences were found between first and second assessments in the study group in relation to wound size and tissue type. Also, no statistically significant differences were found between the second and third assessments regarding exudates amount in the same group. In the control group, statistically significant differences were found only between the first and third assessments regarding wound size and tissue type. It was obvious that, there was significant improvement in the total pressure ulcer healing scores along the three assessment. These results could highlight the significant and positive effect of sugardine rather than povidine – iodine alone on healing pressure ulcers especially in the second assessment. In the same vein, **Bames & Segelman (2008)** reported that for extreme cases of bedsores, sugar has been found to help hard-to-heal areas such as bedsores by acting as a scavenger of sorts--picking up dead bacteria and white blood cells. This debris is later flushed away from the wound, and creates an unfavorable environment for bacterial growth as well.

In addition, **Murandu & Dealey (2012)** reported that granulated sugar is the disaccharide sucrose, when applied to a wound it will normally dissolve within four hours, creating a highly concentrated environment on the wound surface. Body fluids are attracted to the wound surface to equalize the high concentration gradient (osmosis), increasing the volume of exudates produced. This appears to cleanse/irrigate the wound and to liquefy devitalized dead tissue. The dead tissue is removed each time the wound is re-dressed, promoting the generation of new tissue. **Murandu and Dealey (2012),** added that sugar is widely used in a number of countries across Africa and there has been more limited use in the United Kingdom and the United States of America. To date, there is scant evidence of its efficacy in infected wounds; while the largest study in the US ran over a 56-month period and treated a total of 605 patients with wounds of different etiologies. The study reported rapid wound healing when using sugar and povidine-iodine to enhance wound healing. Moreover, on the 14th day, there was no evidence of infection and less exudates was present in wounds. Patients with heel ulcers were able to stand and walk to the toilet as well as around the bed.

In 2012, Sarabahi & Tiwari, indicated that a study done over a 5-year period in which 605 human patients were treated exclusively with sugardine and nearly all cases, among these patients (whose injuries included ulcers, cat scratches and gunshot wounds) healed more rapidly with sugardine than any alternative method of treatment. Also, purulent decubitus ulcers which observed among the same patients sample were not healed until packed with sugardine. It was observed that within 72 hours, healthy granulation was observed and most drainage stopped.

One case study reports performed in the United States on the successful use of a white granulated sugar dressing on a patient with two infected pressure ulcers. The wound was no longer malodorous within 12 hours of treatment. The sugar dressing facilitated autolytic debridement of the wound and promoted granulation tissue formation with a reduction in wound size **(Murandu &Dealey, 2012)**. Results of this case report might indicate that sugar, which is a relatively cheap dressing, can be effective on infected, malodorous wounds of different etiology, including pressure ulcers. The two authors suggested that a larger randomized controlled trial comparing white granulated sugar to standard treatment when managing exudating wounds, with parallel economic evaluation, and more laboratory work on the use of sugar dressings is recommended and planned to prove the efficacy and cost effectiveness of utilizing this line of treatment**.**

A variety of other case reports provide amazing data supporting the use of sugar in treating infected wounds. Leon Herszage treated 120 cases of infected wounds and other superficial lesions with ordinary granulated sugar purchased in a supermarket. The sugar was not mixed with any anti-septic, and no antibiotics were used concurrently. Of these 120 cases, 99.2 percent had cure rate, with a varied time of cure between 9 days to 17 weeks. Also, the odor and secretions from the wound were diminished within 24 hours and disappeared within 72 to 96 hours from onset of treatment **(Goldsmith, 2008)**

Although Latin America, Europe, and Asia have held an interest in using sugar for wound healing, its use has not been practiced in Egypt. The use of sugar in a wound appears counterintuitive since there is evidence that systemic hyperglycemia impairs host defenses and may inhibit healing. There is counter evidence however, that systemic hyperglycemia and local hyperglycemia do not promote impaired wound healing by themselves. Direct instillation of sugar in the wound apparently exerts a local osmotic effect that promotes granulation tissue formation, reduces edema in wounds, lowers wound pH, thereby enhancing the bacteriostatic effect, promotes dilation of small blood vessels, promotes bacterial lysis, and inhibits bacterial growth by lowering the water activity available that is required for the growth of most bacterial organisms. This technique has been employed in the treatment of burns, postoperative wounds, mediastinitis, diabetic ulcers, and a variety of other wounds. Since sucrose is not metabolized outside the intestinal tract, local application of sugar would not be expected to lead to systemic absorption; however, this treatment, when used in large open wounds, has been associated with one case of acute renal failure and severe hyponatremia wounds **(Biswas, Bharara, Hurst, Gruessner, Armstrong, &Rilo, 2010).**

The same authors illustrated that, a case of a 64-year-old male who was being treated with granulated sugar for an infected pneumonectomy cavity developed severe hyponatremia and acute renal failure with an osmolar gap and elevated sucrose levels in the urine and blood. Once the sugar was removed from the infected cavity, the patient resumed urine flow, and a diagnosis of sucrose-induced osmotic nephrosis was concluded. The authors indicated that topical use of sugar has not been associated with toxic events and that the patient had mild renal insufficiency prior to sugar therapy. With this caveat, the use of sugar for treatment of wounds is safe, easy to teach, cost-effective, and worthy as an alternative modality for the treatment of refractory wounds **(Biswas, Bharara, Hurst, Gruessner, Armstrong, &Rilo, 2010).**

Regarding utilizing povidine-iodine in wound dressing **Cohen (2011)** documented that the use of povidine-iodine alone in wound care is controversial. Several experimental studies have demonstrated concerns regarding its safety and effect on wound healing. Povidine (10%) was found to have a toxicity index of 100,000 (the most cytotoxic) in keratinocytes . The same author conducted another study evaluating cytotoxicity of antiseptic medications using human skin substitutes observed that the application of Betadine resulted in a substantial decrease in cell viability and a detrimental effect on tissue histology. In contrast to these studies povidone-iodine was shown to be active against many resistant strains of microorganisms, spores, Candida, adenovirus, herpes virus and HIV. Povidone-iodine has antiseptic, disinfectant, antibacterial, antifungal, anti - protozoal and antiviral effect. It has some significant advantages: it keeps high antiseptic properties of iodine, even in the presence of blood, plasma, does not cause development of resistant forms of microorganisms, doesn't have allergic effects, and non-toxic to the body (http://iodine.kz/en/in_medicine)/.

More recently, an investigation into the mechanism of delayed wound healing by commonly used antiseptics demonstrated that povidine-iodine reduced both migration and proliferation of fibroblasts in a dose-dependent fashion **(Issues of Clinical Advisor, 2011)**. However, in **2012, the Cochrane Central Register** of Controlled Trials evaluated five trials of povidine -iodine and concluded that further good quality research is required before definitive conclusions can be made about the effectiveness of topical povidine-iodine in healing pressure ulcers.

Pressure ulcers are recognized as serious problems across health care settings, leading to poor patient outcomes and increased costs for health care organizations. The prevalence of pressure ulcers is estimated to be between 9 and 30% of the patient population. Assessment of pressure ulcer status and healing presents a challenge to nurses, having the primary responsibility for evaluation of pressure ulcers. This challenge is complicated by the lack of a standardized method of measurement of wound healing in pressure ulcers (**Cauble, 2010).**

V. Conclusion

The present study concluded a significant positive improvement in the total pressure ulcer healing scores in the study group compared to the total scores in the control group was evident indicating that the research hypothesis of the current study was supported**.** In addition, no statistically significant difference was observed between first and second assessments in the study group in relation to wound size and tissue type. Moreover, no statistically significant differences were found between the second and third assessments regarding exudates amount. In the control group, statistically significant differences were found only between the first and third assessments regarding wound size and tissue type.

VI. Recommendations

Replication of the study on a larger sample for longer period in different settings as well as on different patients with various types of ulcers. Further studies comparing sugardine to other evidence-based dressing modalities to assess its effectiveness and provide a high standard of care.

Health care professionals should provide updated wound care and pressure ulcer management that is based on scientific guidelines and best practice information. Individuals and organizations who invest in education in evidence-based management of wounds should reap the benefits of lower financial cost as well as the satisfaction of knowing that they are providing their patients with the most current, up-to-date management practices available

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