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Original Research Article:

An assessment of the effectiveness of polyurethane foam dressing versus hydrocolloid dressing in the prevention of pressure injuries.

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Statements & Declarations

1. **Funding**

The authors declare that no funds, grants, or other support were received during the preparation of this manuscript.

2. **Competing Interests**

The authors have no relevant financial or non-financial interests to disclose.

3. **Data Availability**

The datasets generated during and/or analysed during the current study are not publicly available due to institutional policy but are available from the corresponding author on reasonable request.

4. **Ethics approval**

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Banaras Hindu University, IMS

5. **Consent to participate**

Informed and written consent was obtained from all individual participants included in the study.

6. **Author contributions**

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Dr. Rohit Kumar Singh, Dr, Sweta Singh, Professor S.K. Tiwary, Professor Puneet and Professor Ajay K Khanna. The first draft of the manuscript was written by Dr. Rohit Kumar Singh and all authors commented on previous

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versions of the manuscript. All authors read and approved the final manuscript.

Abstract
Background:
The purpose of this study is to compare the effectiveness of hydrocolloid dressing and polyurethane foam dressing in preventing pressure ulcers (PUs) in patients.
Methods:
This study, conducted at a single center, received approval from the Research Ethics Committee of the University. A sample size of 124 was determined for the study. The study randomly assigned all participating patients to either the polyurethane foam dressing group or the hydrocolloid dressing group, with each group comprising 62 participants.
Results:
The comparison of clinical outcomes between the two groups will be presented in Tables 1 and 2.
Conclusions:
The combination of standard preventive measures and either hydrocellular foam or hydrocolloid dressing helped prevent pressure injuries in high-risk patients. However, compared to hydrocellular foam, the use of hydrocolloid dressing was found to cause significantly more discomfort during dressing removal.
Aim:
The aim of this study was to compare the efficacy of polyurethane foam dressing and hydrocolloid dressings in preventing pressure injuries among high-risk patients.
Keywords:
hydrocolloid dressing, polyurethane foam dressing, pressure ulcer.

Introduction

The incidence of pressure ulcers, a significant healthcare concern worldwide, imposes a substantial strain on healthcare resources (1). These wounds are typically challenging to heal and can severely compromise the quality of life and mortality. compromise the quality of life and mortality of affected patients. A serious complication that results from various factors, pressure ulcers have a significant social and economic impact, which can severely diminish a patient's quality of life (2). Numerous studies involving humans and animals have indicated that these dressing materials are capable of redistributing mechanical forces, such as pressure, shear, and friction. Pressure injuries have a varying incidence rate of 1% to 40 % and a global prevalence of nearly 20%, with the highest incidence rates observed in intensive care units (ICUs) (3). Although pressure ulcers are typically the result of poor health and other underlying conditions, in numerous instances, they can be prevented. Identifying the at-risk population at an early stage, conducting regular skin assessments, and establishing and executing preventive measures are the primary pillars in preventing these injuries. The physical characteristics of hydrocolloid and foam dressings aid in the prevention of pressure injuries. Given the high cost and challenges associated with treating pressure ulcers, our aim is to prevent their occurrence (4,5).

The objective of this study was to compare the efficacy of polyurethane foam dressing and hydrocolloid dressings in preventing pressure injuries among high-risk patients (6).

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Materials And Methods

This study, conducted at a single center, received approval from the Research Ethics Committee of the University and was carried out in accordance with its ethical standards. The study was carried out at SSH Hospital in B.H.U between October 2020 and March 2022, and it involved patients admitted to hospital wards, ICUs, and semi-intensive care units (SICUs). Before being enrolled in the study, all patients or their representatives provided written informed consent, and patient anonymity was strictly maintained. A sample size of 124 was determined for the study. The study included 124 adult hospitalized patients who were at risk for pressure injuries. The study randomly assigned all participating patients to either the polyurethane foam dressing group or the hydrocolloid dressing group, with each group comprising 62 participants.

Exclusion criteria

- Patients having scars
- Patients with changes in their skin color
- Patients who died
- Patients discharged before completion of the study
- Patients having hypersensitivity or allergy to the substances in dressings
- The dressings were replaced on a weekly basis or whenever they became damp, loosened, or soiled.
- Patients were included in the study if they remained at risk for pressure injury during the 8-week study period, and were followed up until the end of the study."

Intervention

All patients received a standardized preventive intervention aimed at reducing pressure and promoting the healing process of pressure ulcers.

When changing the research dressings, the wound must be cleansed, but it's important to avoid skin cleansers and local antiseptics as they can be harmful to newly forming tissue.

Gentleness is important during the drying process as rough materials can lead to minor wounds in the wound bed, which can interfere with the healing process and increase the risk of infection. The wound bed should be kept moist while the edges of the wound should be clean and dry.

To prevent bacterial infections, it is important to utilize aseptic techniques whenever possible, including the use of clean gloves. Proper debridement and wound healing procedures can also benefit in reducing the risk of infection. If the patient has more than one pressure ulcer, it is recommended to leave the most contaminated one for treatment last.

Polyurethane foam dressing

These dressings, which are made of polyurethane, have a hydrophilic structure and are characterized by their ability to absorb high amounts of exudates and promote autolytic debridement and avoid drying out of the wound bed (7-10). Moreover, these dressings prevent unpleasant odors, stains, and leaks, preserve the integrity of the skin surrounding the wound, and do not cause damage upon removal. Additionally, they are appropriate for all

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stages of pressure ulcers (11-15).

Hydrocolloid dressing

These dressings consist of carboxymethyl cellulose along with other water-activated compounds, adhesive substances, or hydrocolloids that provide them with their absorbent capacity (16,17,18). Additionally, these dressings have the ability to absorb exudates and necrotic debris by forming a gel with specific color and odor properties, resulting in a slightly acidic environment with bacteriostatic effects. They also reduce friction. These dressings are appropriate for pressure ulcers that are not infected (19,20).

Statistical analysis

The data was inputted into a Microsoft Excel spreadsheet, and statistical analysis was performed using SPSS for Windows version 20.2. To compare between groups, various statistical tests were employed, such as Student's t-test, chi-square test and Mann-Whitney U test. The significance level for all statistical tests was set at $\alpha = 0.05$ ($P < .05$).

Results

Among the 158 patients initially selected for the study, 34 had to be excluded from the sample due to being discharged from the hospital or having passed away before the second skin assessment could be conducted. The study continued with a total of 124 patients, with 62 assigned to the polyurethane foam group and 62 assigned to the hydrocolloid dressing group.

At the beginning of the study, 28 (22.58%) patients were admitted to ICUs, 20 (16.13%) were admitted to SICUs, and 76 (61.29%) to inpatient wards. The study commenced with 28 patients (22.58%) being admitted to ICUs, 20 patients (16.13%) being admitted to SICUs, and 76 patients (61.29%) being admitted to inpatient wards. Out of the 124 patients, 54 (43.55%) were male and 70 (56.45%) were female. Among the patients, the age group with the highest number of individuals was 61 to 80 years old, comprising 50 patients (40%) of the total sample.

Out of all the hospitalized patients, approximately half of them (50%) had underlying cardiovascular system involvement, while 27.42% had nervous system involvement, 25.81% had respiratory system involvement, and 22.58% had endocrine system involvement. In addition, 37.10% of the patients had involvement in other systems. During the course of the study, 54 patients (43.5%) received mechanical ventilation, 36 patients (29.03%) were continuously sedated, and 20 patients (16.3%) received vasoactive drugs.

During the study period, it was observed that 46.77% of the patients had both fecal and urinary incontinence, while only 1.61% of the patient’s remained continent throughout the entire study(Table -1).

	Gp1 Polyurethane foam Dressing		**Gp2 Hydrocolloid dressing**		**Total**		**p-value**
	No.	**%**	**No.**	**%**	**No.**	**P**	
Gender							0.717
Male	26	41.94	28	45.16	54	43.55	

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Female	36	58.06	34	57.84	70	56.45	
Age							
<40	12	19.35	18	29.03	30	24.19	
41-60	10	16.13	12	19.35	22	17.74	0.376
61-80	26	41.94	24	38.71	50	40.32	
>81	14	22.58	8	12.90	22	17.74	
Educational level							
Illiterate	32	51.61	30	48.39	62	50.00	
5th Standard	6	9.68	14	22.58	20	16.13	0.261
10th Standard	8	12.90	4	6.45	12	9.68	
Higher education	4	6.45	2	3.23	6	4.84	
Not informed	12	19.35	12	19.35	24	19.35	
Hospitalization							
ICU	16	25.81	12	19.35	28	22.58	0.330
SICU	12	19.35	8	12.90	20	16.13	
Inpatient ward	34	54.84	42	67.74	76	61.29	
Underlying disease							
CVS	30	48.39	32	51.61	62	50.00	0.719
CNS	20	32.26	14	22.58	34	27.42	0.227
Pulmonary	12	19.35	20	32.26	32	25.81	0.100
Endocrine system	12	19.35	16	25.81	28	22.58	0.390
Other	30	48.39	16	25.81	46	37.10	**0.009**
Mechanical Ventilation							
No	40	64.52	30	48.39	70	56.45	0.070
Yes	22	35.48	32	51.61	54	43.55	
Incontinence							
Anal	32	51.61	30	48.39	62	50.00	
Urinary	2	3.23	0	0.00	2	1.61	0.196
Anal and urinary	26	41.94	32	51.61	58	46.77	
Total continence	2	3.23	0	0.00	2	1.61	
Risk level for pressure injury							
Low	6	9.68	0	0.00	6	4.84	0.038
Moderate	18	29.03	20	32.26	38	30.65	
High	36	58.06	42	67.74	78	62.90	
Very high	2	3.2	0	0	2	1.6	

Table - 1

The Braden Scale scores showed that at admission, 6 patients (4.84%) were at low risk for pressure injury development, 38 patients (30.6%) were at moderate risk, 78 patients (62.9%) were at high risk, and 2 patients (1.6%) were at very high risk. The groups did not differ significantly across all variables."

Participants in both groups underwent weekly prophylactic dressing changes, with the

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frequency of changes being determined by their duration of participation in the study.
There was no statistically significant difference observed in the frequency of dressing changes between the group.
No pressure injuries were observed in either group of patients.
Nevertheless, changes in skin condition including blanchable erythema (n = 38; 30.64%), Exfoliation (n = 56; 45.1%), itching (n = 14; 11.29%), and skin injury resulting from strong stickiness between the skin and dressing (n = 28; 22.58%), were observed in both groups in the sacral and trochanteric regions, with no statistically significant differences in both the groups. Severely ill and non-severely ill patients did not demonstrate any significant differences in terms of skin alterations and medical adhesive-related skin injuries. Significantly more patients in the hydrocolloid group (n=30) reported uneasiness or pain during dressing removal due to strong stickiness, compared to the polyurethane foam group (n=8) (P = .001) (Table-2).

	Gp1 Polyurethane foam Dressing		**Gp2 Hydrocolloid dressing**		**p-value**
	No.	**%**	**No.**	**%**	
Absence of blanchable erythema	48	77.42	38	61.29	0.051
Blanchable erythema	14	22.58	24	38.71	
No Exfoliation	38	61.29	30	48.39	0.148
Exfoliation	24	38.71	32	51.61	
No itching	58	93.55	52	83.87	0.088
Itching	4	6.45	10	16.13	
No uneasiness at time of dressing removal	54	87.10	32	51.61	**<0.001**
Uneasiness at time of dressing removal	8	12.90	30	48.39	
No skin injury due to dressing stickiness	50	80.65	46	74.19	0.390
Skin injury due to dressing stickiness	12	19.35	16	25.81	
Rate of epithelialization					**0.002**
Early	38	61.29	21	33.87	
Late	24	38.71	41	66.13	

Table 2

Discussion

Pressure injuries are prevalent in all healthcare facilities, and can impact individuals of any age. They can lead to extended treatment times and high costs, and can cause significant physical and emotional distress for patients and their families. Although preventing pressure injuries requires time and trained personnel to provide patient care, it is important to note that most pressure injuries can be avoided with appropriate preventive measures. The

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advancement of new techniques and technologies is crucial in assisting the prevention of these injuries. Application of prophylactic dressings on areas vulnerable to pressure injury development can provide protection by reducing shear and friction forces, providing a barrier against excess moisture, and facilitating the redistribution of pressure Despite the potential benefits of prophylactic dressings in preventing pressure injuries, only a limited number of studies have investigated their effectiveness (18-19). These results are consistent with a previous meta-analysis, which concluded that combining standard preventive measures with prophylactic dressings on high-risk areas is more effective than relying on standard preventive measures alone. Most of the study's participants were old females, with urinary or fecal incontinence, and categorized as being at high risk for developing pressure injuries. Patients who are critically ill and undergoing mechanical ventilation, receiving vasoactive drugs, or sedatives are highly vulnerable to the development of pressure injuries Despite patient severity, the study did not uncover any notable differences in skin alterations or medical adhesive-related injuries between severely ill and non-severely ill patients."

Moore and Webster (20) conducted a Cochrane review which found that the incidence of pressure injuries was reduced through the use of prophylactic dressings or essential fatty acids. However, the quality of the trials included in the study was questioned. In their study, Cortés et al. (21) discovered that standard preventive care proved to be a more effective method of preventing pressure injuries in regions at risk compared to using a hydrocolloid dressing.

Santamaria et al. (22) conducted a study on critically ill patients (n = 90) to assess the effectiveness of hydrocolloid and foam dressings in preventing pressure injuries. According to the study's findings, none of the patients who received foam dressings developed pressure injuries.

In a study conducted by Jing et al. (23) it was observed that the application of foam dressings along with transparent film on high-risk skin areas in spinal surgery patients resulted in a lower incidence of pressure injuries compared to the control group.

Brindle and Wegelin (24) conducted a study on patients who underwent cardiac surgery and reported that patients who received foam dressings in the sacral region had a significantly lower risk of developing pressure injuries than the control group, with the latter having a more than 3-fold greater chance of developing pressure injuries

In his research on ICU patients with unbroken skin in the sacral area, Park (25) observed that the application of foam dressings led to a lower incidence of pressure injuries in the study group compared to the control group. Walker et al. (26) also obtained comparable findings.

Limitations

One of the primary limitations of the study was its small sample size. As a result, further research involving a larger number of patients is needed to compare the effectiveness of polyurethane foam dressings with hydrocolloid dressings in various age groups, clinical contexts, and susceptible skin regions.

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Conclusion

In vulnerable patients, the combination of standard preventive measures and the application of either polyurethane foam or hydrocolloid dressing was critical in reducing the occurrence of pressure injuries. Although no pressure injuries were observed in either group, changes in the skin such as blanchable erythema, exfoliation, itching, and skin injury due to the strong adhesive properties of the prophylactic dressing were noted in both the sacral and trochanteric regions, with no significant differences between the two groups. However, removal of the hydrocolloid dressings was found to cause considerably more discomfort and pain.

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