

Cost comparison of pressure ulcer preventive dressings: hydrocolloid dressing versus transparent polyurethane film

Objective: To evaluate and compare the costs of using a transparent polyurethane film (PF) and hydrocolloid dressing (HD) in the prevention of pressure ulcers (PUs).

Method: This descriptive, observational, longitudinal, comparative study was conducted in the intensive care units, coronary care unit and medical clinic of a charity hospital in Brazil. Data were collected during a 30-day study period, consisting of physical examination, assessment of risk factors for PU development and application of the Braden scale, which were performed at inclusion in the study and once daily during hospitalisation. Either PF or HD was applied bilaterally in the sacral and trochanteric regions for prevention of PUs in patients at a moderate to

high risk of PUs according to the Braden scale, and costs of using PU preventive dressings were estimated.

Results: The mean total costs per dressing change per patient when using the HD and PF to prevent PUs were 413.60 BRL and 74.04 BRL, respectively. There were significant between-group differences in mean costs for all variables, except for saline solution and nurse-technician services.

Conclusion: Results showed that the mean cost per dressing change per patient was lower when using the transparent PF than when using the HD.

Declaration of interest: The authors state no conflict of interest.

pressure ulcers • risk factors • Braden scale

Pressure ulcers (PUs) are a serious problem affecting approximately 9% of all hospitalised patients and 23% of bedridden patients receiving home care.^{1,2} The condition is difficult to treat and often associated with pain, increased morbidity and prolonged hospitalisation. The use of various types of dressings and surgical procedures demanding professional time contribute to the high costs of treatment, affecting the patient's quality of life.^{3,4} However, immediate and effective care can minimise its deleterious effects, accelerate recovery and reduce hospital stay, decreasing hospital costs.

The National Pressure Ulcer Advisory Panel (NPUAP) recommends the application of prophylactic dressings to bony prominences for the prevention of PUs in anatomical areas frequently subjected to friction and shear.⁵ This procedure should be combined with the use of all other preventive measures.⁵ There are various studies on the use of PU preventive dressings in the literature; transparent polyurethane film (PF) and hydrocolloid dressings (HD) are commonly used for this purpose.⁶⁻¹³

Implementation of protocols for PU prevention should be based on research and scientific evidence. However, for that to happen, professionals need technical and scientific knowledge of risk factors associated with the development of PUs, as well as knowledge of the most effective and least expensive dressings available on the market that can be used to prevent PUs. The development and implementation of

protocols to evaluate the risk of developing PUs and therapeutic protocols contributes to improving the quality of life of patients and their caregivers, allowing optimal care and reduced hospital costs.^{4,14}

Assuming that decision making should not be based on an individual opinion, but rather on the best evidence regarding efficacy, safety and cost-effectiveness of interventions, the question worth asking is: which dressing (PF or HD) shows the best cost-benefit relation for preventing PUs in hospitalised, bedridden patients? Thus, the aim of this study was to evaluate and compare the costs of using PF and HD to prevent PUs.

Methods

This descriptive, observational, longitudinal, comparative study was approved by the Institutional Research Ethics Committee, protocol no. 59868. All patients were informed of the investigational nature

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Table 1. Sociodemographic characteristics of study participants

Variables	Group						p-value
	HD		PF		Total		
Race	n	%	n	%	n	%	
Caucasian	73	91.25	65	81.25	138	86.25	0.023*
Afro-Brazilian	2	2.5	6	7.5	8	5.0	
Mixed race	5	6.25	9	11.25	14	8.75	
Total	80	100	80	100	160	100	
Age group	n	%	n	%	n	%	p-value
<50 years	12	15.0	15	18.75	27	16.88	0.069
50–59 years	9	11.25	13	16.25	22	13.75	
60–69 years	22	27.5	13	16.25	35	21.88	
70–79 years	21	26.25	25	31.25	46	28.75	
≥80 years	16	20.0	14	17.5	30	18.75	
Total	80	100	80	100	160	100	
Descriptive	HD	PF					
Mean	65.15	64.13					
Median	68.50	76.50					
SD	18.00	17.49					
Minimum	22	20					
Maximum	99	92					
Sex	n	%	n	%	n	%	p-value
Women	36	45.0	33	41.25	69	43.13	0.63
Men	44	55.0	47	58.75	91	56.88	
Total	80	100	80	100	160	100	
Smoker	n	%	n	%	n	%	p-value
No	56	70.0	64	80.0	120	75.0	0.14
Yes	24	30.0	16	20.0	40	25.0	
Total	80	100	80	100	160	100	

HD–hydrocolloid dressing; PF–transparent polyurethane film; SD–standard deviation
*Statistical significance (p<0.05).

of the study and written informed consent was obtained from all patients or their representatives before their inclusion. A 30-day study was conducted in the adult intensive care units (ICUs), coronary care unit (CCU) and medical clinic (MC) of a charity hospital in Brazil.

Eligibility criteria included bedridden patients without PUs, ≥18 years old, of both genders, at a moderate-to-high risk of PU development assessed by the Braden scale 48 hours after admission to the participating units. Exclusion criteria were presence of PUs and admission to the participating units for less than 48 hours. Patients who declined to participate or whose family members did not authorise their participation in the study and those who died or had a medical diagnosis of brain death were also excluded from the study.

Patients were selected at moderate-to-high risk of PUs and divided into two treatment groups according to the order of admission. The first 80 patients were included in the HD group and treated with a hydrocolloid dressing (Systagenix Wound

Table 2. Distribution of patients according to causes of hospitalisation in both groups

Causes of hospitalisation	Group				p-value
	HD		PF		
	n	%	n	%	
Stroke	25	31.25	22	27.50	0.075
Respiratory failure	22	27.50	19	23.75	
Auto-pedestrian accident	18	22.50	20	25.0	
Uncontrolled hypertension	10	12.50	12	15.0	
Uncontrolled diabetes	5	6.25	7	8.75	
Total	80	100	80	100	

HD–hydrocolloid dressing; PF–transparent polyurethane film

Management Ltd., Vinhedo, Brazil), and the other 80 patients were included in the PF group and treated with a transparent polyurethane film (OpSite, Smith and Nephew Ltd., Hull, UK).

Physical examination, assessment of risk factors for PU development and application of the Braden scale¹⁵ were performed at inclusion in the study and once daily during the period the patient remained in the study (i.e., for the 30-day study period or until the patient developed a PU, discharged, transferred, or died).

For PU prevention, either PF or HD was applied bilaterally to the sacral and trochanteric regions. Other nursing actions to prevent PU development included adequate patient repositioning and use of appropriate hygiene and skin care techniques.

A validated Brazilian version of the Braden Scale was used to assess the level of risk for PU development.¹⁸ The Braden Scale is composed of six categories that assess the degree of sensory perception, moisture, physical activity, nutrition, mobility, friction and shear. All categories are rated on a scale of 1–4, excluding the category friction and shear which is rated on a scale of 1–3. The scores range from 6–23 points, divided as follows: no risk 19–23 points; mild risk 15–18 points; moderate risk 13–14 points; high risk 10–12 points; very high risk ≤9 points.^{5,15}

Data on resource use were collected at every dressing change. Dressings were changed only if showing loss of adhesiveness, shear, excessive moisture, friction, presence of wrinkles, or a combination of these factors. The mean costs for applying and changing PU preventive dressings per patient in each group were estimated considering the number of patients who developed PUs, length of time in the study, number of dressing changes per patient during the study period, amount and type of materials (i.e., PU preventive dressings, gauze, gloves and saline solution) used during dressing changes and the time spent by nurses and nurse technicians on dressing changes. Other patient-management costs were not assessed because all patients in both groups were

Table 3. Risk factors for pressure ulcers identified in both groups

Risk factors for PUs		Group				p-value
		HD		PF		
		n	%	n	%	
Mechanical ventilation	No	38	47.5	30	37.5	0.201
	Yes	42	52.5	50	62.5	
Vasoactive drugs	No	36	45.0	26	32.5	0.105
	Yes	44	55.0	54	67.5	
Sedation	No	38	48.1	39	48.75	0.690
	Yes	41	51.9	41	51.25	
Urinary/faecal incontinence	No	31	38.8	24	30.0	0.244
	Yes	49	61.25	56	70.0	
Psychomotor agitation	No	9	11.25	20	25.0	0.024*
	Yes	71	88.75	60	75.0	
Unconsciousness	No	31	38.75	36	45.0	0.036*
	Yes	49	61.25	44	55.0	
Fasting	No	2	2.5	30	37.5	0.001*
	Yes	78	97.5	50	62.5	

PU=pressure ulcers; HD=hydrocolloid dressing; PF=transparent polyurethane film;
*Statistical significance (p<0.05).

Table 4. Distribution of patients according to length of hospital stay in both groups

Length of time in the study (days)	Group				p-value
	HD		PF		
	n	%	n	%	
1-10	15	18.75	18	22.50	0.081
11-20	27	33.75	29	36.25	
21-30	38	47.50	33	41.25	
Total	80	100.00	80	100	

HD=hydrocolloid dressing; PF=transparent polyurethane film

treated with the same protocol, except for dressing changes, in which different types of dressings (HD or PF) were used according to group assignment.

After the daily patient assessment and if a dressing change was required, all the materials used in the dressing change and the time spent by each health professional in the dressing change procedure were entered into the patient computer file. As each patient left the study, the sum of all costs regarding dressing changes was calculated, resulting in the patient's total cost of using a PU preventive dressing. The mean cost per dressing per patient change was estimated by dividing the patient's total cost with dressing changes by the number of dressing changes. The mean costs per dressing change per patient were then calculated for each group (HD and PF groups).

The cost of dressings, nursing interventions, and materials were in accordance with the Simpro reference catalogue. Simpro is a Brazilian company that collects and publishes the prices of medical costs that are released by the governmental National Health

Surveillance Agency (ANVISA–Agencia Nacional de Vigilância Sanitária).

Data were entered into a Microsoft Excel spreadsheet using double data entry to prevent error. The Mann–Whitney and Kolmogorov Smirnov tests were used for data analysis.

Results

Patients in the HD group had a mean age of 65.15 years, 73 (91.3%) were Caucasians, 44 (55%) were men and 56 (70%) were smokers. In the PF group, the mean age was 64.13 years, 65 (81.30%) were Caucasians, 47 (58.8%) were men, and 64 (80%) were smokers. A significant difference in ethnicity between groups was noted (Table 1). The most common causes of hospitalisation in both groups were stroke, respiratory failure and auto-pedestrian accidents with no significant difference between groups (Table 2).

The main risk factors of PUs identified in both groups are depicted in Table 3. The number of patients who were unconscious, fasting or showing psychomotor agitation was significantly greater in the HD group than in the PF group (Table 3).

In the HD group 38 (47.5%) and in the PF group 33 (41.2%) patients remained in the study for 30 days without developing PU; the other patients developed a PU, were discharged, transferred or died. No significant differences between groups (p=0.081) were found in the distribution of patients according to their length time in the study (Table 4).

The mean period of time elapsed to the onset of PUs was 5.5 days in the HD group and 6.71 days in the PF group. Time to the onset of PUs in both groups is shown in Table 5. The overall incidence of PUs was 11.9% (19/160). The incidence of PUs was significantly lower (p=0.038) in the PF group (8.7%; 7/80) than in the HD group (15%; 12/80). It was also observed that, between days 21 and 30 of the study period, the incidence of PUs was much higher (p<0.001) in the HD group (10%) than in the PF group (1.25%), as seen in Table 5. All ulcers were detected at category I.

The mean costs per dressing change per patient in Brazilian currency for nursing services and materials used in both the HD and PF groups are shown in Table 6. The mean cost per dressing unit was 372.44 BRL for the HD and 35.91 BRL for the PF (Table 6). The mean total costs per dressing change per patient were 413.60 BRL and 74.04 BRL for the HD and PF groups, respectively. There were significant between-group differences in mean cost per patient for all variables, except for saline solution and nurse technician services. However, the median values indicated that the variable that most contributed to the difference in costs between groups was 'price per dressing unit' (Table 6). The mean number of dressing changes per patients was 6.09±1.66 (median: 6.0) in the HD group and 5.59±2.04 (median: 6.0) in the PF group.

Discussion

In the present study, most participants in both

groups were older adults, men and smokers, which is consistent with previous studies.^{7,16–24} The skin of the elderly has reduced elasticity, blood circulation and peripheral sensitivity, and produces less collagen, thereby increasing the vulnerability to mechanical forces and, consequently, the risk of developing PUs.²² Smoking habit is another factor that increases the patient risk of PUs; smoking a cigarette reduces subcutaneous oxygen tension for about 30 to 45 minutes, enhancing its vasoconstrictor effect.²¹ Moreover, smoking decreases appetite, causes multiple vitamin deficiency and reduces collagen synthesis.²¹

The professional who provides care to patients with haemodynamic changes at risk of developing PUs must be prepared to respond to new management challenges during their professional activity, including cost management of these individuals, contributing to the financial viability of health care in both the public and private sectors. According to the World Health Organisation, nurses are those with the greatest potential to ensure cost-effective care.²⁵ Increased prevalence and incidence rates of PUs in a health-care setting, type and amount of material of used for wound dressing, frequency of dressing changes and procedure duration may represent high costs for the institution and, therefore, nurses are responsible for managing available resources, care provided and human resources, as well as choosing materials.^{26,27}

In the US, patients develop approximately 1.6 million ulcers every year, resulting in an estimated cost ranging from 2.2–3.6 billion dollars to the health-care system.³ A previous study found that the cost per patient of 11 primary dressing changes followed by secondary dressings in Brazilian currency was 579.88 BRL and that the cost per patient of 9 changes of secondary dressings alone was 23.46 BRL, for a total of 603.48 BRL.

In this study, the mean total costs per change of PU preventive dressings per patient were 413.60 BRL and 74.04 BRL for the HD and PF groups, respectively. It was found that the mean cost per patient of most materials and services was significantly lower in the PF group than in the HD group. However, the median costs of materials and services per patient indicate that ‘price per dressing unit’ was the variable that most contributed to the difference in costs between groups. No clinically significant differences between groups were found in the mean number of dressing changes per patient and patient length time in the study, suggesting that patient characteristics at baseline may have not resulted in significant between-group differences in mean total cost per dressing change per patient.

It was also observed that the overall incidence of PUs was significantly lower in the PF group (8.7%) compared with that of the HD group (15%). However, it is important to note that the number of patients who were Caucasians, unconscious, fasting or showing psychomotor agitation was significantly greater in the HD group than in the PF group, suggesting that patients in the HD group could be more predisposed to PU

Table 5. Time to the onset of pressure ulcers in both groups

Time to onset (days)	Group						Total		
	HD (n=80)			PF (n=80)			(n=160)		
	n	%	Incid	n	%	Incid	n	%	Incid
2–10	1	8.33	1.25%	2	28.57	2.5%	3	15.79	1.88%
11–20	3	20.50	3.75%	4	57.14	5.0%	7	36.84	4.38%
21–30	8	66.67	10.0%	1	14.29	1.25%	9	47.37	5.62%
Total	12	100	15.0%	7	100	8.75%	19	100	11.88%

N=number of patients with pressure ulcers; n=number of participants; HD=hydrocolloid dressing; PF=transparent polyurethane film; Incid=incidence of pressure ulcers

Table 6. Mean costs per dressing change per patient in BRL of materials and professional nursing services for both groups

Variables (cost per dressing change per patient)	p-value	Group					
		HD (n=80)			PF (n=80)		
		Mean	Median	SD	Mean	Median	SD
Price per dressing unit	0.001*	372.44	366.42	99.928	35.91	38.22	14.342
Nursing services	0.015*	12.57	12.60	3.584	11.77	12.60	4.783
Nurse technician services	0.051	5.98	6.00	1.707	5.74	6.00	2.220
Gauze material	0.002*	8.72	8.52	2.274	7.81	8.52	2.711
Gloves (cost per pair)	0.002*	10.19	9.96	2.664	9.11	9.96	3.171
Saline solution	0.963	3.70	3.60	0.976	3.70	4.20	1.433
Total cost	0.001*	413.60	407.10	110.225	74.04	79.50	23.188

HD=hydrocolloid dressing; PF=transparent polyurethane film; SD=standard deviation; *Statistical significance (p<0.05)

development. Patients with an altered level of consciousness may not perceive painful stimuli or discomfort from intense pressure and may fail to change body position independently or request a position change. Nutritional deficiencies may reduce collagen synthesis, decreasing the elasticity and tolerance of the skin to shear stress. Friction or shear may occur when a patient is agitated. Ethnicity may influence effectiveness in detecting category I pressure ulcers. These differences between groups can be considered as potential limitations of the study.

The National Health Service (NHS) published the Five Year Forward View, setting out how the health service in England needs to change through investments, efficiency gains and cost savings.²⁸ Over the next five years the NHS will support improvements in prevention and integrated health and social care.²⁸

Treatment requires high investment in materials and equipment and increases consumption of drugs and costs associated with surgical procedures or prolonged hospitalisation.^{29,30} In this context, the present study provides information that may help improve prevention of PUs with cost savings in health services.

Further studies assessing the influence of comorbidities, arterial pressure, body mass index and nutritional status on patient management and associated costs are necessary.

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Conclusion

Results showed that the mean total cost per change of a PU preventive dressing per patient was lower when using the transparent PF than when using the HD. **JWC**

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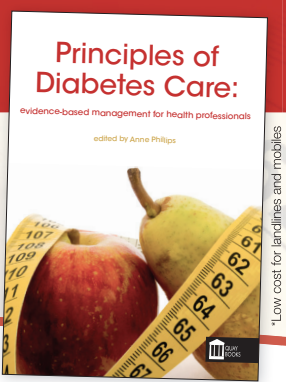
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