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Exploring the relationship between skin property and absorbent pad environment

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Aim. The aim of this study is to identify the related factors of skin lesions found in the surrounding environment of absorbent pads by clinical investigation.

Background. Most older patients with incontinence use absorbent products, therefore causing many patients to have skin lesion in the absorbent pad area. To prevent these skin lesions from occurring, it is necessary to examine the absorbent pad environment of clinical patients since there are many contributing factors that complicate the pathophysiology in this area.

Design. A cross-sectional design was used.

Methods. One hundred older Japanese patients with faecal and/or urinary incontinence using diapers and absorbent pads participated. Excluding blanchable erythema, the presence of skin lesions in the absorbent pad area was confirmed. Skin pH, hydration level and bacterial cultures were used to assess the skin property. Absorbent pad environment and patient demographics were also investigated.

Results. The overall prevalence of skin lesions was 36%. Forty percent of the skin lesions were contact dermatitis. Multivariate logistic regression analysis revealed that only the presence of diarrhoea independently affected contact dermatitis.

Conclusion. There was a significant relationship between contact dermatitis and the use of absorbent pads when the patient had diarrhoea. Although the factors related to skin lesions in the absorbent pad area are complexly intertwined, this study was the first to be able to determine diarrhoea as one specific factor in clinical setting.

Relevance to clinical practice. This finding suggests that the presence of diarrhoea is significantly related with contact dermatitis. Therefore, when a patient has diarrhoea, health-care professionals should immediately implement a preventative care program which includes careful skin observation and improved skin care. It is also necessary to develop a more effective absorbent pad to protect the skin of incontinent patients who suffer from the irritating effects of liquid stool.

Key words: incontinence, Japan, nurses, nursing, older people, urinary

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Introduction

Incontinence is a frequent and bothersome symptom in older people (Kikuchi *et al.* 2007). Statistics show that 46–72% of nursing home residents suffer from urine and/or faeces incontinence (Bliss *et al.* 2006) and most of these residents use commercial absorbent products such as diapers or absorbent pads (APs) (Peet *et al.* 1996, Yoshida *et al.* 1996).

Due to the high prevalence of incontinence in older people, skin lesions in the absorbent product area such as dermatitis and pressure ulcers are a common complication. Although its pathophysiology is not fully elucidated, chemical irritation, increased susceptibility to secondary infection and mechanical injury are reported to be contributing factors. With exposure to excess moisture, skin pH can increase to alkaline levels deteriorating the acid mantle. In this state, the skin is more permeable to chemical irritating substances such as urine and faeces (Zimmerer *et al.* 1986, Gray 2004). Since the acid mantle of the skin provides significant resistance against bacterial invasion, disrupting it allows for secondary infection (Farage *et al.* 2007). As the coefficient of skin friction increases with skin wetness, the skin is more susceptible to damage (Zimmerer *et al.* 1986). Using absorbent products promotes this phenomenon (Zhai & Maibach 2001, Gray *et al.* 2007). Furthermore, use of these products on older incontinent patients whose skin is weak due to age makes them especially susceptible to developing skin lesions (Ghadially *et al.* 1995). Consequently, health care professionals are responsible for incontinence management and skin care.

Accompanying symptoms including discomfort, itching, burning and pain all of which negatively influence the quality of life for patients with these skin lesions (Nix 2006, Gray *et al.* 2007). Moreover, an estimated total cost of incontinence-related skin lesion in nursing home residents is $136·3 million per year in the USA (Wagner & Hu 1998). The economic impact of this health problem is of considerable magnitude. Therefore, there is a pressing need to prevent such skin lesions from developing in the absorbent product area.

Past studies suggested a relationship exists between skin lesions and certain factors. Zimmerer *et al.* (1986) reported that skin exposed for two hours to a patch containing synthetic urine was significantly more susceptible to abrasion damage than skin under a dry patch. Andersen *et al.* (1994) revealed that by patch-testing various concentrations of bile salt on the backs of healthy adult volunteers they found transepidermal water loss, reflectance spectroscopy and pH indicated damage to the skin barrier indicated by redness, irritancy and water loss by day 5 of their experiment. However, since these laboratory studies assessed the factors that influence skin lesion development under a simplified aetiological model, they could not reveal the most important contributing factors of complicated pathophysiology in clinical patients wearing diapers and APs. Therefore, an effective prevention strategy for skin lesions, especially for older patients was yet to be established. Since APs mainly absorbed urine and faeces we focused on APs in this study. The aim of this study is to clearly identify the prevalence, type and location of skin lesions and the factors associated with skin lesions in the AP area among those AP-wearing older patients with incontinence in a clinical setting.

Materials and methods

Participants

This cross-sectional study involved 100 in-patients of a long-term medical facility with 500 beds in Ishikawa Prefecture, Japan. We divided the participants into two groups; those that had both urine and faecal exposure were categorised in the Dual Incontinent Group (DIG) and those that had only faecal exposure were categorised in the Faecal Incontinent Group (FIG). Participants with indwelling urinary catheter were grouped under FIG. We sequentially recruited the patients from entire 261 patients with dual incontinence and 96 faecal incontinence patients in this hospital. We finished the recruitment when the patients reached 100 patients (50 males and 50 females). The inclusion criteria in this study were patients who had urine and/or faecal incontinence, constantly wore absorbent products and could not change their APs by themselves. The exclusion criteria disallowed patients with a serious medical problem or who were acutely-ill from participating and with only urine continence. Since having perineal dermatitis was not significantly associated with having urine incontinence only in previous study, patients with only urine incontinence were excluded from participating in this study (Zimmaro *et al.* 2006). Data collection was carried out from 5 March 2007–2 April 2007.

Absorbent products and skin care regimens

All patients used an adult diaper (fitted brief) in combination with APs. An adult diaper has a role to encompass the entire hip and perineum area and fastened by adhesive tape (Fig. 1). An AP has a role to mainly absorb urine and faeces (Fig. 2). An adult diaper and AP were used in combination (Fig. 3). The basic structure of an AP consists of three layers:

1 A fluid-impermeable backing sheet;
2 A fluid-permeable top sheet on the body-contacting surface;

Figure 1 An adult diaper (fitted brief).

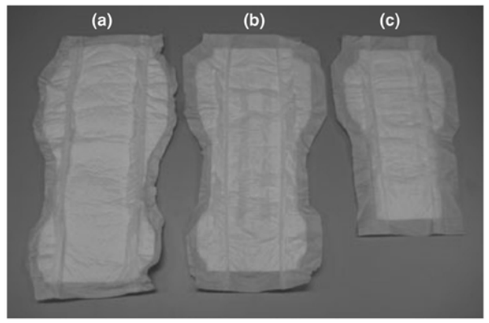

Figure 2 Absorbent pads (APs): (a) most absorbent pad (32·0 cm × 64·0 cm); (b) second most absorbent pad (32·0 cm × 60·5 cm) and (c) most small pad (29·0 cm × 49·0 cm).

Figure 3 An adult diaper and APs are constantly used together.

3 An interposed absorbent core constructed of pulp fibre and super absorbent polymer (Edlich *et al.* 2006).

Three different sized APs with different absorption capacities were used. The size of the AP selected for use was decided according to the amount of urine excreted by the participant. All of FIG patients used a pad of the size of 29·0 cm × 49·0 cm. The AP for DIG patients was able to absorb 900 g (32·0 cm × 60·5 cm) or 2000 g (32·0 cm × 64·0 cm) of urine. Male DIG participants used an extra AP to wrap around the penis region. The facility staff implemented the same skin care regimen to all patients. Participant's buttocks and perineal area were wiped with wet cotton towel in every AP change. This consisted of washing the area enclosed by the absorbent products with soap and water once a day and bathing the participants twice a week. These above-mentioned skin cares are commonly provided in Japan.

The study framework

The study framework consists of two kinds of variables:
1 Presence of skin lesions (dependent variable);
2 Related factors (independent variable)
where moisture/chemical irritation and external force were the two main related factors (Fig. 4). Skin lesions result due to the presence of moisture/chemical irritation along with faeces, urine and others, which is promoted by the presence of microorganism (Leyden *et al.* 1977, Brown & Sears 1993, Brown 1995). These conditions increased skin pH and hydration which in turn elevated skin permeableness allowing skin lesions to develop (Brown & Sears 1993, Brown 1995). Skin lesions also result due to the presence of an external force that increases interface pressure leading to a decrease in blood flow of the tissue, causing tissue ischaemia followed by the development of a skin lesion (Chang & Seireg 1999). Furthermore, specific characteristics (demographic data, etc.) of each patient and the care they received were included as another factor affecting skin property.

Measurements and instruments

Skin lesions

Patient skin in the AP area was inspected three times a day at 9, 14 and 20 hours within one specific day. We recorded any skin abnormality as a skin lesion if it was present during all three inspection times. Blanchable erythema was excluded as a skin lesion in this study. A fully-trained researcher from the Department of Wound Care Management performed the inspection. One dermatologist and one Wound, Ostomy and Continence nurse diagnosed any skin lesions by photo.

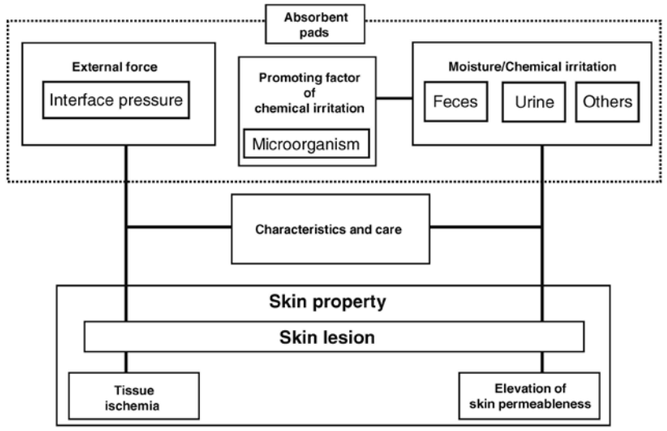

Figure 4 The study framework for etiology of skin lesion in the APs.

Skin property

At the 9 a.m. AP change the same researcher measured the skin property. Skin hydration was measured using a capacitive method (Corneometer CM-825®; Courage Khazaka GmbH, Cologne, Germany) (Wendling & Dell'Acqua 2003). Skin pH was determined using the glass electrode method (Skin-pH-meter PH905®, Courage Khazaka GmbH, Germany) (Ehlers *et al.* 2001). The skin hydration and pH data were obtained at least three times per measurement from each of the following locations: subumbilical region, pubic region, coccygeal region, sacral region and the adjacent area of skin lesion. The average values were used for data analysis. The intra-assay coefficients of variance of the Corneometer CM-825® and Skin-pH-meter PH905® in this study were 7·1 and 2·5%, respectively, indicating sufficient reliability of the devices. To compare the skin pH and hydration between the participants with and without skin lesions, we selected an area adjacent to the skin lesion and the coccygeal region. We chose coccygeal region for comparison since the values of skin pH and hydration were the highest in the coccygeal region.

The presence of bacteria was confirmed by a swab culture. The bacterial culture was performed in the meatus urinarius and coccygeal regions. Trypticase soy and MacConkey agar were incubated at 35 °C for 18 hours.

Absorbent pad environment

At the 9 a.m. AP change the related factors were measured by the same researcher. With respect to the faeces, the faecal frequency and the presence of diarrhoea for past four days were noted from a medical record. Diarrhoea was defined as type 6 or 7 according to the Bristol stool form scale (O'Donnell *et al.* 1990). The location where urine had contacted the skin was identified. The amount of urine was measured by the weight of the soiled AP. The amount of rewet was evaluated by the urinary amount that the paper filter absorbed. Rewet is an indication of the liquid forced back through the top sheet when a saturated AP is placed under load or pressure. Paper filters (100 mm × 100 mm) which had previously been weighed were placed on the top sheet of the AP contacted with coccygeal region, then a weight of 5·0 kg/100 × 100 mm^2 was placed on the paper filters for 10 seconds. The surface pH of the AP which had contacted with meatus urinarius and coccygeal region was measured the same way as skin pH. The presence of polyhydrosis and vaginal fluor was also recorded.

External force was confirmed by measuring the interface pressure using a multi-pad pressure evaluator (Cello®; Cape Co. Ltd, Kanagawa, Japan) at the sacral region (in the supine position) and at the coccygeal region (in the 45-degree head-elevated position) (Sugama *et al.* 2002). Regarding microorganisms, a bacteria swab was taken from the AP surface where the meatus urinarius region and coccygeal region came into contact. This swab method was subsequently cultured at 35 °C for 48 hours using CA and CPS agar. Patient characteristics were obtained by direct observation or from their medical record.

Statistical analysis

Values are represented with median (range) unless indicated. Descriptive statistics were used to explain the type, region and number of skin lesions. Associations between categorical variables were determined using a chi-square test or Fisher's exact probability test. Differences in interval variables were assessed using an independent *t*-test and Wilcoxon rank sum

test. Variables showing at p less than 0·20 were considered as potential associated factors of skin lesion for inclusion in multivariate logistic regression analysis. In this study, a p value less than 0·05 was considered as statistically significant. All analyses were performed using Statistical Analysis System Ver. 9·1 (SAS Institute Inc., Cary, NC, USA).

Ethical consideration

Participants or their family were informed of the procedure and written consent was obtained. This study was approved by the Ethical Committee of the Graduate School of Medicine, The University of Tokyo, Japan (#1670).

Results

Patient characteristics are summarised in Table 1. The mean age ± standard deviation of the patients was 83·1 years (SD 9·1), 66·0% were physically immobile and 82·0% suffered from cerebrovascular disease. Female participants were significantly older than male participants (p = 0·003).

Skin lesions

The overall prevalence of skin lesions was 36·0% (36 of 100) with 32·0% of the male participants and 40·0% of the female participants. A significant difference between the male and female participants was not found (p = 0·405). Moreover, there was no significant difference in the prevalence of skin lesions between DIG and FIG (p = 0·317). The most common type of skin lesion was contact dermatitis (CD) found in 17·0% of patients, followed by 6·0% pressure ulcers (PUs) and 6·0% seborrheic dermatitides (SDs). SD was only evident in the female participants. The location varied according to the kind of skin lesion diagnosis. CD was present most often in the perineal area, PU only on the buttocks side and SD only in the groin area (Table 2).

Table 1 Patient characteristics

	Total (n = 100)	Male (n = 50)	Female (n = 50)
Age (years)	83·1 ± 9·1	80·3 ± 9·8	86·0 ± 7·4
Subjects with body mass index < 18·5	64 (64·0)	36 (72·0)	28 (56·0)
Immobility	66 (66·0)	30 (60·0)	36 (72·0)
Subjects with dual incontinence	70 (70·0)	35 (70·0)	35 (70·0)
Frequency of exchanged pads (times/day)	3 (1–5)	3 (1–5)	3 (1–4)
Paralysis	63 (63·0)	37 (74·0)	26 (52·0)
Contracture	65 (65·0)	36 (72·0)	29 (58·0)
Nutrition route			
Oral nutrition	29 (29·0)	12 (24·0)	17 (34·0)
Enteral nutrition	64 (64·0)	33 (66·0)	31 (62·0)
Intravenous nutrition	7 (7·0)	5 (10·0)	2 (4·0)
Underlying disease			
Cerebrovascular disease	82 (82·0)	46 (92·0)	36 (72·0)
Cardiac disease	9 (9·0)	2 (4·0)	7 (14·0)
Malignant neoplasm	1 (1·0)	1 (2·0)	0 (0)
Other disease	8 (8·0)	1 (2·0)	7 (14·0)

Values are mean ± standard deviation, median (range), number of patients (%).

Skin property and AP environment

The most common type of skin lesion found in this study was CD, thus we mainly analysed the details of the relationship between CD and the skin property of the AP environment.

Contact dermatitis

Skin property according to the presence or absence of CD is summarised in Table 3. When we compared the coccygeal region with the adjacent area of CD, the values of the skin pH were found to be significantly high in the area adjacent to CD [6·9 (6·1–8·4) vs. 6·2 (4·7–8·5), p = 0·001].

The relationship of CD and AP environment are shown in Table 4. Concerning the presence or absence of CD, no significant difference was found in the urine-related variables. A higher proportion of patients with urease-producing bacteria, *Proteus mirabilis* at meatus urinarius had CD than patients without *P. mirabilis* (35·3% vs. 19·3%, p = 0·197). However, this difference was not statistically significant. The surface pH of the AP in grope with *P. mirabilis* was significantly higher than the group without *P. mirabilis* [8·5 (6·4–9·9) vs. 7·3 (4·9 –9·3), p = 0·005]. In this study three variables were possibly associated with the presence of CD, faecal frequency (p = 0·010), presence of diarrhoea (p = 0·001) and presence of the urease-producing bacteria in the meatus urinarius (p = 0·197). While the variables were considered in a multivariate logistic regression analysis, we found that only diarrhoea was a significantly associated factor for CD (odds ratio; 9·0, 95% confidence intervals; 2·5–32·1, p < 0·001). No significant difference in patient characteristics was found between patients with CD and without CD.

Pressure ulcers

All patients with PU did not have an exposure to urine in the buttocks (0% vs. 37·2%, p = 0·088). A significant difference was found in the interface pressure (in the 45-degree head-elevated position) between patients with and without PU [69·3 (38·5–121·8) mmHg vs. 43·6 (12·6–123·0) mmHg, p = 0·029]. The proportion that used the support surface was significantly lower in the patients with PU than those without PU (33·3% vs. 85·1%, p = 0·018). A significantly higher proportion of patients with PU was in a wheelchair during daytime than those without PU (83·3% vs. 30·9%, p = 0·017).

Table 2 Diagnosis and location of skin lesions

Location		Number of skin lesions	Male DIG	Male FIG	Female DIG	Female FIG
Abdominal side	Lower abdomen	3	SW (1) CE (1) Dermatomycosis (1)	–	–	–
	Groin	8	Dermatomycosis (1)	–	SD (3) Dermatomycosis (1)	SD (3)
	Inner aspect of the thigh	6	CD (3) Dermatomycosis (1)	–	Dermatomycosis (2)	–
Perineal area	Scrotum	2	CD (1) SW (1)	–	–	–
	Penis	1	SW (1)	–	–	–
	Labia	1	–	–	–	CD (1)
	Rectal area	7	CD (2)	CD (2)	CD (2)	CD (1)
	Gluteal cleft	6	CD (2)	CD (2)	CD (2)	–
	Gluteal fold	2	CD (1)	–	CD (1)	–
Buttocks side	Ischium	5	ND (1)	ND (1)	SW (2) Folliculitis (1)	–
	Coccyx	2	–	PU (1)	–	CD (1)
	Iliac crest	4	CE (1) ND (1)	–	SW (1)	PU (1)
	Sacrum	4	PU (2)	–	–	PU (2)
	Total	51	21	6	15	9

CD, contact dermatitis; PU, pressure ulcer; SD, seborrheic dermatitis; SW, scratched wound; ND, nummular dermatitis; CE, chronic eczema; DIG, dual incontinent group (patients with urine incontinence and faecal incontinence); FIG, faecal incontinent group (patients with only faecal incontinence). When there were skin lesions in various part, number of skin lesion was redundantly counted; () Number of skin lesions.

Table 3 Relationship between contact dermatitis and skin property

	Patients with CD (n = 17)	Patients without CD (n = 83)	p
Skin hydration			
Subumbilical region	34·6 (20·0–68·2)	33·5 (16·0–109·4)	0·829
Pubic region	47·4 (32·0–75·0)	44·2 (20·0–117·0)	0·427
Coccygeal region	60·7 (19·4–113·0)	55·2 (14·0–122·3)	0·633
Sacral region	52·8 (12·2–114·0)	44·4 (6·3–122·3)	0·853
Adjacent area of CD or coccygeal region	71·3 (40·3–119·3)	55·2 (14·0–122·3)	0·068
Skin pH			
Subumbilical region	5·4 (4·3–6·3)	5·4 (4·2–6·5)	0·861
Pubic region	5·8 (4·4–7·3)	5·8 (4·4–8·3)	0·656
Coccygeal region	6·2 (5·1–7·9)	6·2 (4·7–8·5)	0·790
Sacral region	6·2 (5·7–8·2)	6·2 (4·9–8·3)	0·446
Area adjacent to CD or coccygeal region	6·9 (6·1–8·4)	6·2 (4·7–8·5)	0·001
Urease-producing bacteria (*P. mirabillis*)			
Meatus urinarius region	5 (29·4)	17 (20·5)	0·520
Coccygeal region	3 (17·7)	9 (10·8)	0·424

Values are median (range), number of patients (%).

Table 4 Relationship between CD and AP environment

	Patients with CD (n = 17)	Patients without CD (n = 83)	p
Subjects with dual incontinence	11 (64·7)	59 (71·1)	0·601
Combined urine and faeces	4 (23·5)	31 (37·4)	0·276
Frequency of changed absorbent pads (times/day)	3 (1–5)	3 (1–5)	0·463
Faecal frequency (times/4 days)	4 (1–8)	2 (0–9)	0·010
Presence of diarrhoea	7 (41·2)	6 (7·2)	0·001
Location where urine attached			
Abdominal side			
Pubic region	6 (35·3)	27 (32·5)	0·825
Buttocks side			
Gluteal cleft region	0 (0)	3 (3·6)	0·855
Coccygeal region	1 (5·9)	12 (14·5)	
Sacral region	5 (29·4)	20 (24·1)	
Surface pH of AP			
Meatus urinarius region	7·8 (5·4–9·9)	7·5 (4·9–9·3)	0·653
Coccygeal region	6·5 (5·5–9·1)	6·4 (5·0–9·6)	0·931
Subjects with amount of rewet >0·5 g	1 (5·9)	8 (9·6)	1·000
Amount of urine (g)	350·0 (0–980·0)	375·0 (0–780·0)	0·757
Polyhydrosis	1 (5·9)	3 (3·6)	0·531
Vaginal fluor	3 (17·7)	7 (8·4)	0·367
Interface pressure (mmHg)			
Supine position	43·6 (12·8–87·2)	35·9 (10·3–106·4)	0·378
45-degree head-elevated position	41·0 (15·4–83·3)	43·6 (12·6–123·0)	0·611
Urease-producing bacteria (*P. mirabillis*)			
Meatus urinarius region	6 (35·3)	16 (19·3)	0·197
Coccygeal region	4 (23·5)	11 (13·3)	0·279

Values are median (range), number of patients (%).

Seborrheic dermatitis

Regarding SD, means of body-mass index in the patients with SD were slightly higher than those without SD; however no significant difference was observed [18·7 (17·7–19·6) vs. 17·4 (12·1–26·8), p = 0·194].

Discussion

This study revealed the high prevalence of skin lesions in older incontinence patients. CD accounted for the majority of the skin lesions and diarrhoea was statistically clarified to be an associated factor out of several other multiple factors. Although the factors related to CD were intricately influenced, this study was the first to report diarrhoea as an associated factor of CD by clinical investigation.

Prevalence of skin lesions

Bliss *et al.* (2006) previously reported that skin damage developed in 4·6% of nursing home residents with incontinence. In addition, Bale *et al.* (2004) reported 25·3% in the similar population. Until now, skin lesions associated with incontinence had not been clearly defined, thus the criteria for skin lesions varied according to each study. Although it is difficult to compare the present study with previous studies, this high prevalence should be treated as a critical problem. Moreover, even though patients of FIG did not have an exposure to urine, it is interesting that there was not a significant difference in prevalence of skin lesions between the two groups.

Contact dermatitis

The skin pH values were significantly high in the area adjacent to CD. Thus, we assume that a failure of the cutaneous barrier function in this area occurred, something that must be given attention to, especially for those with CD since they have a higher risk of new skin lesions developing than those without CD.

With respect to CD and the AP environment, it was revealed that diarrhoea was significantly associated with the presence of CD. In our finding, the location of CD was mostly in the perineal area where faeces might have direct contact with the skin. Therefore, it is understandable that CD has been closely associated with faeces. This finding was consistent with previous experimental studies. Faeces are alkaline, thus contributing to an abnormally high local skin pH in patients with incontinence (Driver 2007). Furthermore, liquid stool tends to be richer in digestive enzymes than solid stool (Gray *et al.* 2007) and increased pH of enzyme solution induce more severe skin alterations (Andersen *et al.* 1994). Moreover, these results may show that the absorbency of the AP currently being used is insufficient for diarrhoea. The AP must absorb any liquid stool and keep it from contacting the skin to prevent diarrhoea from causing harm. This implies the need to develop a new AP that can effectively absorb such liquid stool found in diarrhoea. The skin care including wiping off urine or faeces using wet towels or wipes on the AP change is commonly provided in Japan. However wiping results in mechanical irritation to skin, thus leading to skin damage. Therefore it is necessary to decrease mechanical irritation by using no rinse cleanses and drying by evaporation for skin care provided on the AP change (Hodgkinson *et al.* 2007, Voegeli 2008). Since this study included only the patients with faecal incontinence, other unknown factors should be considered in the patients without faecal incontinence.

Berg *et al.* (1986) reported that the risk of diaper dermatitis increased by a mixture of urine and faeces by laboratory test. Lyder *et al.* (1992) reported that all subjects who had perineal dermatitis were incontinent of both urine and stool in the clinical setting. However the results of this study did not support it. Only females in the DIG had a potential mixture urine and faeces, nevertheless, they did not demonstrate a higher prevalence of CD than the other group. The reason for this could be due to improved AP technology which may have prevented the mixing of faeces and urine. Absorbent product technology has advanced significantly during the last decade and efforts continue to focus on eliminating leaking and skin irritation associated with absorbent product use (Odio & Friedlander 2000). When the amount of rewet is more than 0·5 g, it is very likely that faeces and urine are mixed. In this study, the amount of rewet was less than 0·5 g in 91·0% of patients.

Although a significant relationship between surface pH of the AP and the urease-producing bacteria was found, the relationship between CD and the urease-producing bacteria was not significant. Urease can decompose urea into ammonia and the urinary pH increase is the result of ammonia production from urinary urea (Faria *et al.* 1996). The elevation of urinary pH influences chemical irritation for the skin and activates faecal enzymes (Berg 1987, Faria *et al.* 1996). Due to limited number of participants in this study, the relationship between urease-producing bacteria and CD might not be statistically significant.

Pressure ulcers

Fader *et al.* (2004) reported that the presence of an incontinence pad between the patient and his or her support surface rose the peak pressure by around 20–25%. Therefore, there is a possibility that the use of the AP increased the risk of developing PUs. However, since all patients used an AP in our study, we could not investigate the effect of the AP on interface pressure. There was significant difference in the support surface and the sitting position between patients with and without PU. These results could reflect that external force rather than incontinence influenced the presence of PUs (Anton 2006, Reger *et al.* 2007). In this study, interface pressure management was the only suggested factor associated with PUs. In addition, none of the participants who had exposure to urine in the buttocks had PUs. It is described in the WOCN clinical practice guideline series that moisture from incontinence contributes to pressure ulcer development by macerating the skin (Guideline for Prevention and Management of Pressure Ulcers 2003). However, our results might indicate that urinary incontinence and PUs are unrelated when patients use APs. Consequently, even if there are patients with urine incontinence, we should not easily be swayed into using an indwelling urinary catheter to prevent PU.

Seborrheic dermatitis

Seborrheic dermatitis appears in areas of increased sebaceous gland activity and may affect flexural creases of the arms, legs and groin (Janniger & Schwartz 1995). The risk of developing SD in the groin region might have been high due to sebum secretion and occlusion of skin. Furthermore, a higher body-mass index of the participants grouped with SD may indicate that being fat may promote skin overlap in the sebum region. The reason why SD was present in only females may be a result of a more ample figure than their male counterpart.

Relevance to clinical practice

This finding suggests that the presence of diarrhoea is significantly related with CD. Therefore, when a patient has diarrhoea, health-care professionals should immediately implement a preventative care program which includes careful skin observation and improved skin care. It is also necessary to develop a more effective AP to protect the skin of incontinent patients who suffer from the irritating effects of liquid stool.

Limitations

The average age of the male participants was significantly lower than that of the female participants. Therefore, it is possible that the risk of males with skin lesions was underestimated. Since all participants used APs from the same manufacturer and their usage was nearly the same, the effects of different manufacturers and different usage concerning AP environment could not be investigated. Additionally, only older inpatients whose physical state was stable were selected as to participate. Consequently, it is not known whether these results can be extrapolated for acutely-ill patient.

Further research

Future research into APs; their frequency of change, type, usage and their relationship concerning skin properties is a desirable topic of study. It is necessary to study whether APs that can adequately absorb the liquid stool of diarrhoea are capable of preventing the development of CD. Similarly, it is important to determine whether an AP controlling pH can influence the skin pH.

Conclusion

The prevalence of skin lesions in the AP area was identified. The most common skin lesion in the AP was CD whose state could be affected by the performance of an AP especially when the patient has diarrhoea. Although the factors related to skin lesions are complexly intertwined, this study was able to determine diarrhoea as one specific factor from multiple related factors. In the future, we will strive to improve the performance of absorbent pads, educate health care professionals about skin lesions in the AP area and try to establish a prevention protocol for skin lesions in the AP area.

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Contributions

Study design: HS, JS, CK, MO, GN, YS, JF; data collection: JS, CK, YS, JF; data analysis: HS, MO, GN, YS and manuscript preparation: HS, JS, MO, GN, YS.

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