Int J Clin Exp Med 2017;10(5):7443-7449
www.ijcem.com /ISSN:1940-5901/IJCEM0016986

Review Article

Investigation and analysis on occurrence of incontinence-associated dermatitis of ICU patients with fecal incontinence

Zhen-Zhi Ma*, Jun-Ying Song*, Min Wang

*Department of ICU, Zaozhuang Municipal Hospital, Zaozhuang 277100, Shandong, China. *Equal contributors.*

Received September 28, 2015; Accepted April 5, 2016; Epub May 15, 2017; Published May 30, 2017

Abstract: Objective: To describe the occurrence of incontinence-associated dermatitis of ICU patients with fecal incontinence, and analyze the risk factors of its occurrence. Methods: ICU Patients with fecal incontinence of a three-level first grade hospital in Suzhou were taken as study objects. Data of every patient were collected with self-made "Data list of patients with fecal incontinence" until these patients left ICU, were dead, or healed in dermatitis. All the results were analyzed. Results: Among 104 patients with fecal incontinence, 30 patients had IAD with occurrence rate of 28.85%. The median time to form IAD is 3 days, and the score on the 3rd day is the highest. The average healing time is 8 day. Logistic regression analysis shows that vasoactive agent, sensory ability, friction force, and shear force are the risk factors of IAD occurrence. Conclusion: IAD formation of patients with fecal incontinence in ICU is featured with short time and rapid development. Vasoactive agent, sensory ability, friction force, and shear force are the risk factors of IAD occurrence.

Keywords: ICU, incontinence-associated dermatitis, risk factor

Introduction

Incontinence-associated dermatitis (IAD) refers to the irritant dermatitis caused by the exposure to defecation, which may be accompanied or unaccompanied by erosion or secondary infection on superficial skin. This is one the most common skin injuries for the patients with incontinence [1, 2]. Foreign reports show that the morbidity of IAD of ICU patients can be up to 50% [3]. The latent period ranges from 1 to 6 days, with an average time of 4 days; while the healing time ranges from 1 to 19 days, with an average of 7 days [4]. The domestic research by Wang Xin [5] *et al*. shows that the morbidity of IAD by the patients received and cured in comprehensive hospital is 34.2%. IAD can not only cause pain and itching and lead to the reduction of the patients' living quality, but also add the risks of urinary tract infection, pressure sores, secondary skin infection and *etc*. [6-8]. ICU patients are the highest-risk population suffering from IAD. Some research shows [1] that it is beneficial to diagnose IAD at an early stage by understanding its occurrence and development. Therefore, this study describes the occurrence of IAD in ICU patients with incontinence in third-grade class-A hospitals in Suzhou, and analyzes the relevant risk factors for providing evidence of early prevention and intervention of IAD.

Objects and methods

Objects

ICU patients with incontinence treated in ICU, neurosurgery ICU, and neurology ICU of a third-grade class-A hospital in Zaozhuang from September 2014 to February 2015 were selected as the research objects. Admission standards are described below: (1) age ≥18; and (2) the patients with indwelling catheter for fecal incontinence and defecation incontinence caused by various reasons. Exclusion criteria include (1) there have been skin injuries (IAD, pressure sores, skin avulsion, *etc*.) in the observed parts; (2) the patients using anal

Table 1. Comparison of IAD morbidity in all parts

Part	Cases	Morbidity (%)
Perianal skin	30	46.88
Crease between buttocks	6	9.38
Left lower buttock	3	4.69
Right lower buttock	3	4.69
Left upper buttock	2	3.12
Right upper buttock	2	3.12
Genitalia (Labia/Scrotum)	9	14.07
Lower abdomen/Suprapubic	0	0
Crease between genitalia and thigh	3	4.69
Left inner thigh	1	1.56
Right inner thigh	1	1.56
Left posterior thigh	2	3.12
Right posterior thigh	2	3.12
Total	64	100

ostomy bag or fecal drainage system; (3) the patients who have serious illness state and instable hemodynamics, or who cannot turn over according to a doctor's advice for skin observation. There were 104 patients (72 males and 32 females) admitted in this study between the age of 27~100, with an average age of (63.09±15.63). Among these patients, 36 cases had cerebrovascular disease, 19 cases had cerebral trauma, 15 cases had brain lesion disease, 15 cases had respiratory disease, 8 cases had cardiovascular disease, 8 cases had multiple injury, 2 cases had lumbar vertebrae injuries, and 1 case had epilepsy. All the patients used disposable absorbable urinal pads. The patients in these three kinds of ICUs had no unified standard for IAD care, and nurses could choose different care methods and products.

Methods

Research tool: a. Data list of ICU patients with fecal incontinence. This list includes two parts. The first part is the list of basic conditions of the ICU patients with fecal incontinence, including age, sex, diagnosis, incontinence time, stool characters, times, Lagoras score, Barthel index, APACHEII score, Braden score, oxygen use, nutrition support method, antibiotics, depressant, use condition of vasoactive agent and hormone, use condition of restraint strap, albumin, and body temperature. The second part is the list of basic conditions of IAD patients, including formation time, part, severity, healing time, and clinical performance. b. Incontinence-associated dermatitis (IADS) and its severity instrument. This is used to judge if the patient has IAD and its severity degree. This instrument was proposed by Borchert and Bliss [9] in 2010. It can divide the skin around the patient's private parts and anus into 13 areas, and evaluate the color, skin defects, and rash of skin in every area. The degree of severity can be classified into 3 classes: erythema (pink and red), rash, and skin defect. In addition, the corresponding scores will be given. For example, 0 refers to no occurrence, and ≥1 refers to occurrence. The higher the score, the more severe the IAD. The Cronbach coefficient α of this instrument is 0.72, the reliability among evaluators is 0.82, and CVR is 0.91 [10]. c. Braden rating scale. This is used to evaluate the occurrence risk of pressure sores. According to international standards, Braden score ≤9 refers to extremely dangerous, 10~12 scores refer to highly dangerous, 13~14 scores refer to medium dangerous, and 15~16 scores refer to a low level of danger [11]. d. Britos stool classification. This is used to evaluate the stool characters of patients. Stool can be classified into seven classes. Type I and II refer to constipation, type III and IV refer to ideal stool, especially type IV is the shape which can be defecated most easily, and type V to VII may possibly have diarrhea [12]. According to research demands, stool characters can be divided into three types: formed stool, loose and formless stool, and watery stool.

Data collecting method: The baseline information of the selected patients was collected with self-made "Data list of ICU patients with fecal incontinence" by the researchers once every day until the patients left ICU, are dead, or are healed in dermatitis.

Data processing: Statistical analysis on data was conducted using SPSS18.0 statistical package. Mean, standard deviation, and constituent ratio were used for descriptive statistics. Single factor analysis was conducted on the influential factors of IAD at first, and enumeration data was verified with x^2 and measurement data was verified with two independent samples. Then, variables with statistical significance obtained by single factor analysis were substituted into a logistic regression model for analysis. $P<0.05$ means that the difference has statistical significance.

Table 2. Data comparison between 30 patients with IAD and without IAD

Factors		With IAD (n=30)		Without IAD (n=74)		x^2 value	*P* value
		Cases	Percentage (%)	Cases	Percentage (%)		
Sex	Male	15	50.00	57	77.03	7.320	0.007
	Female	15	50.00	17	22.97		
Age	<50	5	16.67	9	12.16	3.260	0.517
	50~	4	13.33	21	28.38		
	60~	10	33.33	23	31.08		
	70~	5	16.67	11	14.86		
	≥80	6	20.00	10	13.52		
Mechanical ventilation	No	23	76.67	38	51.35	3.000	0.083
	Yes	7	23.33	36	48.65		
Nutrition support	Oral	1	3.33	7	9.46	3.022	0.198
	Tube feed	28	93.34	67	90.54		
	IV	1	3.33	0	0		
Defecation times	≤2 times/d	0	0	63	85.14	73.123	<0.001
	3-5 times/d	19	63.33	6	8.11		
	≥6 times/d	11	36.67	5	6.75		
Stool characters	Formed stool	7	23.33	31	41.89	17.361	<0.001
	Loose and formless	12	40.00	40	54.05		
	Watery stool	11	36.67	3	4.06		
Restraint strap	No	5	16.67	12	16.22	0.003	0.955
	Yes	25	83.33	62	83.78		
Hormone	No	15	50.00	40	54.05	0.141	0.707
	Yes	15	50.00	34	45.95		
Depressant	No	21	70.00	49	66.22	0.139	0.709
	Yes	9	30.00	25	33.78		
Vasoactive agent	No	17	56.67	58	78.38	5.004	0.025
	Yes	13	43.33	16	21.62		
Antibiotic	No	2	6.67	4	5.41	5.282	0.212
	One-unit	12	40.00	38	51.35		
	Two-unit	14	46.66	32	43.24		
	≥Three-unit	2	6.67	0	0		
Albumin	>35 g/L	15	51.72	31	41.89	0.815	0.367
	≤35 g/L	14	48.28	43	58.11		
Body temperature	No heat	9	30.00	25	33.78	0.139	0.709
	Heat	21	70.00	49	66.22		

Results

IAD occurrence conditions for the ICU patient with fecal incontinence

There were 104 patients with fecal incontinence in this study, including 28 patients in comprehensive ICU, 55 patients in neurosurgery ICU, and 21 patients in neurology ICU. There were totally 30 patients suffering from IAD with a morbidity of 28.85%, including 19 patients with light IAD, 2 patients with medium IAD, and 9 patients with serious IAD. 5 patients suffer from rash and 9 patients suffer from skin injury. All of these patients had the perianal region involved, and the specific involved parts and cases are shown in **Table 1**. The formative period of IAD is 1~13 days, with an average time of 3 days. On the 3rd day, IAD score is the highest. The average time from light to serious is 2 days, and the average time for healing is 8 days. 7 patients were not healed when they left ICU (7/30, 23.33%) (see **Table 1**).

Table 3. Data comparison between patients with IAD and without IAD

Factors	With IAD (n=30)	Without IAD (n=74)	*z*	*p*
APACHEII score	13 (10, 28)	14 (10, 28)	-0.927	0.354
GCS score	10 (4, 15)	9 (4, 15)	-1.695	0.09
Braden score	10 (7, 13)	11 (7, 13)	-1.277	0.202
Sensory ability	2 (1, 4)	2 (1, 3)	-3.315	0.001
Dampness degree	2 (1, 4)	3 (1, 4)	-5.749	<0.001
Mobility	1 (1, 1)	1 (1, 1)	0.000	1.0
Motility	1 (1, 2)	1 (1, 2)	-2.084	0.037
Capability of nutrition intake	2 (1, 3)	2 (1, 3)	-0.06	0.952
Friction force and shear force	1 (1, 2)	2 (1, 2)	-4.002	<0.001

Data comparison between 30 patients with IAD and without IAD (see **Tables 2** and **3**).

Influential factors of IAD occurrence for the ICU patients with fecal incontinence. A logistic regression analysis was conducted by taking IAD occurrence condition as the dependent variable (with IAD=1, without IAD=0), and parameter items with P<0.05 in **Table 2** as the self-variable, with the aim of screening out the influential factors of IAD occurrence for the ICU patients with fecal incontinence (see **Table 4**).

Discussions

Analysis on IAD occurrence conditions

This study used 104 ICU patients with fecal incontinence as the study objects, in which 30 patients suffered from IAD, with a morbidity of 28.85%. The median formative time of IAD is 3 days, which is close to the research results as reported in foreign literatures [4]. In addition, one can conclude that the IAD score on the 3rd day is the highest, and the average time from light to severe IAD is 2 days. Therefore, IAD formation of ICU patients is characterized by short time and rapid development. Such characteristics require that ICU nurses should rapidly identify the risk factors and clinical performance of IAD occurrence and take prevention and treatment measures as early as possible. However, there is no unified care standard in three kinds of ICU, so the nurses may take different care methods and products. A cross-section investigation on pressure sores [13] found that some practical measures for prevention taken by nurses are harmful and negative, and different preventive measures are also an indirect factor for the occurrence of pressure sores. There is no relevant cross-section investigation on IAD, and similar conditions also exist in IAD care during the case tracking. The average healing time for ICU patients is 8 days, and the intervention measures and attitude taken by nurses are crucial to the healing of IAD. In one case, a patient with severe IAD experienced defecation more than 6 times per day in the form of watery stool, and several skin injuries occurred in perianal region and buttocks. The responsible nurse paid great attention to it, and contacted with the doctor immediately to take appropriate intestinal tract management and asked the hospital's wound care team to do a consultation. This patient was healed on the 6th day, which is lower than the average healing time. Therefore, IAD management should be enhanced, relevant knowledge and attention level of nurses should be enhanced, and moreover, a unified care plan should be taken.

This study applied incontinence-associated dermatitis and its severity instrument (IADS) proposed by Borchert and Bliss [9] to judge whether the patient had IAD and to determine its severity. This instrument makes careful division of the skin in the perianal region and perineum to avoid the measurement of erythema, rash, and skin defect area of patients with dermatitis. It is convenient and suitable for the nurses in clinic applications. The result showed that all the patients had perianal region followed by the region of genitals (labium/scrotum) involved, while little inner thigh and rear parts, found relatively far away from perianal region, were involved. The patients with these parts involved always had watery stool with defecation more than 6 times per day. Some research results [14] proved that frequent watery excretion is the main risk factor of IAD occurrence. Watery stool had much cholate and pancrepipase, and various enzymes in it have high activity; moreover, it had large contact area with skin, resulting great harms to the skin. Therefore, the patients with frequent watery excretion should have their skin cleaned in

Table 4. Logistic regression analysis on IAD influential factors

Factors	B	SE	wald	*P*	*OR*	*OR* 95% CI
Sex	-0.308	0.797	0150	0.699	0.735	0.154-3.502
Stool characters	1.361	0.840	2.625	0.105	3.902	0.752-20.255
Defecation times	0.874	0.968	0.814	0.367	2.395	0.359-15.978
Vasoactive agent	2.967	1.072	7.667	0.006	19.439	2.380-158.804
Sensory ability	2.686	1.060	6.416	0.011	14.668	1.836-117.192
Dampness degree	-1.121	0.735	2.327	0.127	0.326	0.077-1.376
Mobility	-1.385	1.374	1.015	0.314	0.250	0.017-3.702
Friction force and shear force	-3.126	1.323	5.585	0.018	0.044	0.003-0.587
Constant	-2.221	4.153	0.286	0.593	0.109	—

time to be vigilant to damaged skin in far regions.

Analysis on risk factors of IAD occurrence

This study taken the frame model proposed by Brown et al. [15] as its reference and reviewed the previous literatures to confirm IAD risk factors of ICU patients, including tissue tolerance, perineum environment, and defecation ability. Specifically, tissue tolerance includes age, sex, APACHEII score, the application of hormone, depressant, antibiotic, and vasoactive agent, mechanical ventilation, nutrition support method, albumin level, and body temperature; perineum environment includes fecal incontinence times, stool characters, friction force and shear force, and dampness degree; defecation ability includes mobility, activity, sensory ability, application of restraint strip, and GCS score; logistic regression analysis concluded that vasoactive agent, sensory ability, and friction force and shear force are the risk factors of IAD occurrence.

Relationship between Braden score and IAD occurrence: This study shows that the influence of Braden score on IAD occurrence is not great. This does not conform to previous research results. The previous research [16] shows that the lower the Braden score, the higher the risk of IAD occurrence. The reason may be that the patients involved in this study were all bedridden patients, in which 67.31% (70/104) had cerebral disease and consciousness disturbance with low GCS scores. Therefore, the scores of sensory ability, mobility, and activity are quite low. Under this condition, among 104 patients, there were 102 patients in extreme and high danger, while only 2 patients were in medium danger. Braden score fluctuates in 7-13 scores with small scope, so it cannot reflect the influence of Braden score on IAD occurrence at all. This study does not conclude the relationship between Braden score and IAD, but logistic regression analysis shows that sensory ability, friction force, and shear force are all the risk factors of IAD occurrence. The study by Arnold *et al*. [17] shows that patients with 1 score or 2 scores in sensory ability are more likely to form IAD than those with 4 scores; when the score of friction force and shear force reduces 1, the risk of IAD occurrence will increase by 1.87 times. Therefore, Braden score still has good warning effect on IAD occurrence. Nurses should carefully evaluate six aspects in Braden scale, maintain the bed unit dry and flat, and reduce the friction between disposable absorbable urinal pad and patient skin as much as possible.

Relationship between medicine and IAD occurrence: ICU patients with critical condition always require anesthesia and sedation medicine which may reduce their sensory ability, so they cannot change their position, or the use of vasoactive agent may affect the perfusion of soft tissue. Shannon *et al*. [18] thought that some medical treatment used by ICU patients may threaten the completeness of their skin. This study discussed the relationships of antibiotic, hormone, depressant, and vasoactive agent with IAD occurrence, and concluded that vasoactive agent has a close relationship with IAD occurrence. Vasoactive agent may affect the perfusion of soft tissue, and make skin hypoxia more severe. Therefore, nurses should pay close attention and vigilance to patients' skin when applying vasoactive agent.

Relationships of stool characters and times with IAD occurrence: ICU patients always have

fecal incontinence for inappropriate enteral nutrition, mechanical ventilation treatment, frequent cough, machine suction, application of various broad-spectrum antibiotics, and intestinal bacterial translocation [19]. The study conducted by Thibault *et al*. [20] shows that when enteral nutrition reaches 60% more than target volume, the risk of diarrhea will increase greatly, and the stool times and characters will change. In this study, the patients with loose and formless stool, watery stool, and more stool times may be more likely to have IAD than those with formed stool and less stool times. However, the result shows that stool characters and times are not the risk factors of IAD occurrence. This is may be related to the small sampling volume.

Conclusions

This study shows that IAD formation of ICU patients is characterized by short time and rapid development by longitudinally studying and analyzing 104 ICU patients with fecal incontinence, so nurses should take effective intervention measures as soon as possible. According to logistic regression analysis, one can conclude that vasoactive agent, sensory ability, and friction force and shear force are the risk factors of IAD occurrence. However, there are still many factors related to IAD occurrence, including age, antibiotics, and albumin level according to literatures and reports [15, 18]. It is suggested that a larger sampling volume in subsequent studies during the investigations of the risk factors of IAD occurrence so as to provide more scientific evidence for reducing IAD occurrence.

Disclosure of conflicts of interest

None.

Address correspondence to: Min Wang, Department of Intensive Care Unit, Zaozhuang Municipal Hospital, No.41 of Longtou Street, Shizhong District, Zaozhuang 277100, Shandong, China. Tel: +86 13606322986; Fax: +86 010 3288018; E-mail: wangminkk@163.com

References

[1] Gray M, Bliss DZ, Doughty DB, Ermer-Sulten J, Kennedy-Evans KL, Palmer MH. Incontinence-Associated dermatitis: a consensus. J Wound Ostomy Continence Nurs 2007; 34: 45-54.

[2] Junkin J, Selekof JL, Lerner J. Prevalence of incontinence and associated skin injury in the acute care patient. J Wound Ostomy Continence Nurs 2007; 34: 260-269.

[3] Driver DS. Perineal dermatitis in criticl care patients. J Crit Care Nurs 2007; 27: 42-46.

[4] Bliss DZ, Savik K, Thorson MA, Ehman SJ, Lebak K, Beilman G. Incontinence-Associated dermatitis in critically ill adults: time to development, severity, and risk factors. J Wound Ostomy Continence Nurs 2011; 38: 433-445.

[5] Wang X, Ruan QH, Chen YJ. Analysis Status quo of incontinence associated dermatitis in a three grade A hospital. Chinese Nursing Research 2014; 28: 4025-4027.

[6] Bliss DZ, Zehrer C, Savik K, Smith G, Hedblom E. An economic evaluation of four skin damage prevention regimens in nursing home residents with incontinence: Economics of skin damage prevention. J Wound Ostomy Continence Nurs 2007; 34: 143-152.

[7] Wishin J, Gallagher TJ, McCann E. Emerging options for the management of fecal incontinence in hospitalized patients. J Wound Ostomy Continence Nurs 2008; 35: 104-110.

[8] Campbell JL, Coyer FM, Osborne SR. Incontinence-associated dermatitis: a cross-sectional prevalence study in the Australian acute care hospital setting. J Int Wound J 2014; [Epub ahead of print].

[9] Borchert K, Bliss DZ, Savik K, Radosevich DM. The incontinence-associated dermatitis and its severity instrument: development and validation. J Wound Ostomy Continence Nurs 2010; 37: 527-535.

[10] Zhang N. The construction and implementation of the nursing process for the prevention of the incontinence associated dermatitis in patients with critical illness [D]. Nantong: Nantong University; 2013. Need too check.

[11] Guan X, Wang L, Shao X. The incidence and risk factors of pressure ulcer in the intersive care unit patients. China Journal of Nursing 2014; 7: 840-843.

[12] Lewis SJ, Heaton KW. Stool form scale as a useful guide to intestinal transit time. J Scand J Gastroenterol 1997; 32: 920-924.

[13] Moore Z, Price P. Nurses, attitudes, behaviors and perceived barriers towards pressure ulcer prevention. J Clin Nurs 2004; 13: 942-951.

[14] Gray M, Beeckman D, Bliss DZ, Fader M, Logan S, Junkin J, Selekof J, Doughty D, Kurz P. Incontinence-Associated dermatitis: a comprehensive Review and Update. J Wound Ostomy Continence Nurs 2012; 39: 61-74.

[15] Brown DS, Sears M. Perineal dermatitis: a conceptual framework. Ostomy Wound Manage 1993; 39: 20-2, 24-5.

[16] Zhang N, Xie CX, Wu J. Logistic regression analysis of risk factors for incontinence associated dermatitis among patients with incontinence. Journal of Nursing 2013; 20: 4-7.

[17] Long MA, Reed LA. Incontinence-associated dermatitis in a long-term acute care facility. J Wound Ostomy Continence Nurs 2012; 39: 318-327.
[18] Shannon ML, Lehman CA. Protecting the skin of the elderly patient in the intensive care unit. J Crit Care Nurs Clin North Am 1996; 8: 17-28.
[19] Vanessa C, Foxx-Orenstein AE, Mayer AP, Crowell MD. Office-based management of fecal incontinence. Gastroenterol Hepatol (N Y) 2013; 9: 423-433.
[20] Thibault R, Graf S, Clerc A, Delieuvin N, Heidegger CP, Pichard C. Diarrhoea in the ICU: respective contribution of feeding and antibiotics. Crit Care 2013; 17: R153.