Journal of Tissue Viability 28 (2019) 231–236

Contents lists available at ScienceDirect

Journal of Tissue Viability

journal homepage: www.elsevier.com/locate/jtv

A retrospective analysis of recurrent pressure ulcer in a burn center in Northeast China

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ARTICLE INFO

Keywords:
Pressure ulcer
Recurrence
Risk assessment

ABSTRACT

Aim: A retrospective analysis for the pressure ulcer in our burns center in northeast China was taken in order to find the prognostic factors for ulcer recurrence.

Materials and methods: We collected the clinical data of hospitalized patients with pressure ulcer ranging from September 2013 to September 2018 involving initial hospitalized data, follow up visit data and recurrent hospitalized data, further univariable and multivariable Cox regression analysis were taken for searching the prognostic factors of recurrent ulcer.

Results: The recurrent rate was 8.02%, and in the result of univariable and multivariable Cox regression analysis, blood albumin level on admission below 25 g/dl contributed to the strongest predicting factor for recurrence, with HR = 32.745(95%CI = 8.061–133.022, $P < 0.001$). Multiple ulcers showed the second significant importance for predicting recurrence, with HR = 24.226(95%CI = 3.855–152.231, $P = 0.001 < 0.05$). Single caregiver contributed to the third prognostic factor, with HR = 0.016(95%CI = 0.004–0.076, $P < 0.001$).

Conclusion: In a conclusion, multiple ulcers, blood albumin level below 25 g/dl on admission and single caregiver were the three prognostic factors for recurrent pressure ulcer and the shortages of medical care out of hospital in northeast China need more attention urgently. Flap treatment may not be a protective factor for ulcer recurrence, but considered the advantages on the closure of deep wounds, it was still an effective treatment for pressure ulcer nowadays.

1. Introduction

Pressure ulcer is a skin or subcutaneous tissue damage, usually caused by ischemia and hypoxia, stemming from the pressure injury. There are more than 100 risk factors for ulcer occurrence [1], for instance, shear and friction force, immobility, moisture environment, reduced sensation and low blood flow, arteriosclerosis, diabetes, malnutrition, and infection, especially for those elderly patients aged more than 70 years [2]. Complications could be fatal including osteomyelitis, arthritis or sepsis. According to the Global Burden of Disease Study 2013, there were 14,000 deaths caused by pressure ulcer in 1990, while this number rose to 29,000 in 2013 [3]. A survey reported by Cochrane Database, the prevalence rate of pressure ulcer in European hospitals ranged from 8.3% to 23%, and the prevalence rate in Canadian hospitals was 26% [4]. Despite the fact that precautionary measures have been raised variously, it is quite difficult to prevent ulcer occurrence, especially for the critical ill patients in ICU, who suffer much more risk factors. Kasikci [5] reported that the prevalence rate was 35.3% in intensive care clinics in Turkey hospital.

In accordance with the National Pressure Ulcer Advisory Panel (NPUAP) [6], there are four stages referred to as stage I to IV with additional stages referred to as unstageable and suspected deep tissue injuries. It is possible to treat pressure ulcer with the help of the conservative or surgical management, depending on the wound category, size, and the patients' general conditions. Non-blanchable redness of local skin or partial thickness loss of dermis with shallow ulcer are indications of a moderated damage, which may have the potential possibilities to heal spontaneously in case of the appropriated care and dressings are taken. Nevertheless, there is unclear conclusion whether one topical agent or dressing is better as compared with another for the treatment of pressure ulcer [7]. With regard to the full thickness tissue loss with or without the exposed bone, tendon, or muscle, surgery intervention is usually required. Despite the availability of surgery treatments with satisfying results, the worry about recurrence requires

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https://doi.org/10.1016/j.jtv.2019.07.002
Received 2 November 2018; Received in revised form 28 June 2019; Accepted 31 July 2019

consideration. Traditionally, flap surgery is selected for the purpose of preventing recurrence in our mind with the possible reason that the wound can be reconstructed with the help of the healthy vascularized flap, which may have a robust potential ability resisting pressure injury, but the result obtained is not ideal. In accordance with a survey in spinal cord injuries patients, the ulcer recurrent rate rose to almost 35% [8]. Irrespective of the choice of the treatment measures, the recurrent possibility requires consideration, owing to the fragile local skin subsequent to healing, together with the unavoidable risk factors [9], these are likely to give rise to a higher recurrent rate as suspected. A survey only reported 49% recurrent rate in spin cord injury patients with no further investigation [10]. In order to find the prognostic factors for ulcer recurrence in our burns center in northeast China, we performed a retrospective analysis and the details were presented as hereunder.

2. Materials and methods

We gathered the clinical data of hospitalized patients with pressure ulcer, which ranged between September 2013 and September 2018, moreover, the including patients were clinically diagnosed with pressure ulcer and healed completely after treatment, while for the patients having a residual or incompletely healing in the preliminary hospitalization period were excluded. Furthermore, patients without the follow up visit, in addition to patients with psychiatric illness or self-abuse, and patients with the radiation injury or other non-stress injury factors, were also not included. Among the included patients, we regarded the cases as recurrent pressure ulcer when the pressure ulcer occurred again after initial complete healing. The recurrent cases were gathered all through the follow up visit for a further analysis. The initial hospitalized data, coupled with the follow up visit data, hospitalized data of recurrent ulcer, and the hospitalization data if the recurrent pressure ulcer relapsed again within the setting time were also gathered. With regard to fundamental characteristics, gander, age, bedridden reason, albumin level on admission, smoking, diabetes, expense and daily caregiver number were also assessed. Besides that, for wound characteristics, the wound location, stage, area, total wound number, and the treatment measures were gathered as well. According to the wound number, the following comparisons were divided into single or multiple ulcer items. Further comparisons between non-recurrent and recurrent groups were carried out with the help of a statistical analysis.

The survey was approved by the Ethics Committee of the First Hospital of Jilin University. All the data involved in the study was collected by two principal doctors. Patients' personal information was protected in accordance with the Chinese Law, only case numbers were provided for identification.

3. Data analysis

Statistical analyses were carried out with the use of the Statistical Package for the Social Sciences 25.0(SPSS). Categorical variables were reported as percentages or frequencies, and continuous variables were reported as mean ± SD. The hazard ratio (HR) and 95% CI were calculated correspondingly with the help of the univariate Cox regression analysis. Subsequent to the screening, meaningful factors were incorporated into the multivariate Cox regression analysis model, and the risk factors with the predictive value were screened out by the stepwise regression methodology. P values below 0.05 were regarded as significant.

4. Results

4.1. Basic data

The basic data of including patients was showed in Table 1. 15 patients with the recurrent pressure ulcer were assessed and the recurrent rate was 8.02%, which involved 6 males and 9 females, the recurrence interval time ranged between 3 and 48 months, whereas the mean time was 19.8 months. The recurrent age of pressure ulcer was between 39 and 81 years old, with an average of 62 years old. A comparison between non-recurrent and recurrent pressure ulcer was shown in Table 2. Among the 15 recurrent cases, three patients died owing to the deterioration of normal condition in the second hospitalization time, and there was one patient, who died owing to pneumonia during the follow up visit.

Table 1
Demographics of patients and basic characteristics of ulcer wound.

Characteristics		n	Percentage/range
Gender	male	77	41.18%
	female	110	58.82%
Age(years)		63.72	28–92
Bedridden time(years)		4.02	0.5–42
Bedridden reason	spinal injury	113	60.43%
	cerebral disease	50	26.74%
	trauma	13	6.95%
	other	11	5.88%
Albumin(g/dl)		24.58	17.1–31.5
Smoking		104	55.61%
Diabetes		89	47.59%
Caregiver number	one	78	41.71%
	two	92	49.20%
	three or more	17	9.09%
Wound composition	single	173	92.51%
	double	9	4.81%
	triple or more	5	2.67%
Expense(¥)		33089.51	10039.51–128077.58
Wound Number		207	
Wound Area(cm^2)		35.50	0.25–144
Wound stage	II	16	7.73%
	III	111	53.62%
	IV	80	38.65%
Wound location	trochanter	39	18.84%
	ischium	68	32.85%
	sacrum	66	31.88%
	iliac crest	19	9.18%
	post-trunk	15	7.25%
	flap	142	68.60%
Wound treatment	Skin graft	42	20.29%
	conservative	23	11.11%

4.2. Initial and relapsed data of recurrent pressure ulcer

The first episode hospitalization data of the recurrent pressure ulcer was extracted in Table 4. There were 5 relapsed cases subsequent to the recurrent pressure ulcer healing shown in Table 4, all of which had single wound. Recurrent interval time ranged from 1 to 18 months, with the mean time of 8.4 months. All through the setting time, one patient had the fourth hospitalization 10 months after the previous healing date and had received the flap surgery, with a stage III wound in the sacrum, which was the same position as compared with the previous location.

4.3. Cox regression analysis

For the purpose of investigating predictive factors for recurrent ulcer, univariable and multivariable Cox regression analysis model were taken among 11 risk factors (Table 3). In the univariable analysis, multiple ulcers manifested a predictive factor for pressure ulcer, with HR = 5.147 (95%CI = 1.637–16.184, $P = 0.001 < 0.005$). Blood albumin on admission level below 25 g/dl constituted a risk factor as well, with HR = 4.025(95%CI = 1.281–12.642, $P = 0.017 < 0.05$). Single caregiver also constituted another prognostic factor in comparison with the more caregiver groups, with HR = 0.126 (95%CI = 0.030–0.538, $P = 0.005 < 0.05$). On the other hand, with regard to the stage analysis, stage IV contributed to the recurrence as compared with the stage II or III,

Table 2
Data comparison between non-recurrent and recurrent pressure ulcer.

		Non-recurrent(n = 172)	Recurrent(n = 15)	x^2/t	P
Gender	male	71	6	0.009	0.924
	female	101	9		
Age(years)	< 60	95	8	0.020	0.887
	≥60	77	7		
Albumin(g/dl)	≥25	104	4	6.460	0.011
	< 25	68	11		
Bedridden time(years)	≥5	88	9	0.432	0.511
	< 5	84	6		
Bedridden reason	spinal injury	106	7	1.749	0.6216
	cerebral disease	45	5		
	trauma	11	2		
	other	10	1		
Smoking		95	9	0.127	0.722
Diabetes		79	10	2.379	0.123
Caregiver number	one	66	13	14.579	0.001
	two	89	2		
	three or more	17	0		
Wound composition	Single	162	11	10.039	0.007
	double	7	2		
	three or more	3	2		
Treatment	flap	120	14	3773	0.052
	non-flap	52	1		
Stage	II or III	106	1	17.026	0.001
	IV	66	14		
Expense(¥)		31449.60	55398.16	−3.228	0.006

with HR = 0.053(95%CI = 0.007–0.401, $P = 0.004 < 0.05$). Being specific, the flap surgery did not manifest any significant risk possibility, with HR = 0.179 (95%CI = 0.024–1.363, $P = 0.097 < 0.05$). With regard to the multivariable analysis, albumin level contributed to the strongest prognostic factor for the recurrence, with HR = 32.745(95%CI = 8.061–133.022, $P < 0.001$). In relation to the second predictive factor, multiple ulcers manifested a significant importance for the recurrence, with HR = 24.226(95%CI = 3.855–152.231, $P = 0.001 < 0.05$). Single caregiver contributed to the third prognostic factor, with HR = 0.016(95%CI = 0.004–0.076, $P < 0.001$). As a surprise, the IV stage wound did not manifest a meaningful predictive factor in the multivariable analysis in comparison with the univariable analysis outcome.

Together with that, the comparison of recurrent ulcer regarding the initial, recurrent and relapsed hospitalization data were also performed (Table 4). The wound composition manifested no significant difference, which included not only single, but also double, triple, or quadruple wounds ($x^2 = 4.853$, $P = 0.563 > 0.05$), indicating the same result for the wound location ($x^2 = 2.762$, $P = 0.948 > 0.05$). While for the wound stage, there was observed a substantial difference in the wound stage among three groups ($x^2 = 17.954$, $P = 0.001 < 0.05$). As a consequence of the wound stage, the treatment measures also manifested a substantial difference ($x^2 = 15.13$, $P = 0.004 < 0.05$). Moreover, the wound area and the expense of the recurrent cases revealed a significant decline as compared with the initial episode correspondingly ($t = 2.867$, $P = 0.006 < 0.05$; $t = 2.594$, $P = 0.021 < 0.05$).

5. Discussion

Pressure ulcer has a significant impact on health-related quality of life and causes substantial burden to patients, especially for the disabled, old [11], and the patients in the intensive care settings [12], Despite immense efforts, the incidence and prevalence of pressure ulcer have not been changed dramatically over the years [13]. The point prevalence of pressure ulcer in the total adult population in UK was 0.31 per 1000 population [14], it was also estimated that there were 2.5 million patients suffering from pressure ulcer in the United States every year according to the Agency for Healthcare Research and Quality [15]. In terms of prevalence rate, it varied greatly in different regions and countries. It's reported that the prevalence rate of hospital-acquired pressure ulcers was 8% in Australia [16] and 12%–19.7% in the United States [17]. Our department, as a burn center in Jilin province in northeast China, takes the main therapeutic task for pressure ulcer in our hospital, owing to the advantages in the wound management and closure. Currently, there are 65 beds in our Burn center. The main

Table 3
Univariable and multivariable Cox regression analysis for the prognostic factors of recurrent ulcer.

	Univariable analysis		Multivariable analysis	
	HR(95% CI)	P	HR(95% CI)	P
Age > 60years	1.112(0.403–3.068)	0.837		
Male/female	1.112(0.396–3.124)	0.841		
Albumin < 25 g/dl	4.025(1.281–12.642)	0.017	32.745(8.061–133.022)	< 0.001
Cause for staying in bed	1.919(0.695–5.295)	0.208		
Stay length > 5years	0.740(0.263–2.078)	0.567		
Multiple ulcers	5.147(1.637–16.184)	0.005	24.226(3.855–152.231)	0.001
Smoking	0.851(0.303–2.392)	0.760		
Diabetes	0.463(0.158–1.353)	0.159		
Caregiver(1 vs more)	0.126(0.030–0.538)	0.005	0.016(0.004–0.076)	< 0.001
Flap vs non flap	0.179(0.024–1.363)	0.097		
Stage IV vs II,III	0.053(0.007–0.401)	0.004		

Table 4
Comparsion between initial, recurrent, and relapsed hospitalization dataof 15 recurrent pressure ulcer cases. *compared to the initial episode, $t = 2.867$, $P = 0.006 < 0.05$; #compared to the recurrent group, $t = -0.608$, $P = 0.548 > 0.05$; &compared to the initial episode, $t = 2.594$, $P = 0.021 < 0.05$; %compared to the recurrent group, $t = 0.401$, $P = 0.709 > 0.05$.

		Initial pressure ulcer(n = 15)	Recurrent pressure ulcer(n = 15)	Relapse after recurrent(n = 5)	x^2	P
Compose	single	11	9	5	4.853	0.563
	double	2	4	0		
	triple	1	2	0		
	quadruple	1	0	0		
Wound number		22	23	5		
Wound area(cm^2)		60.41	31.53*	23#		
Stage	II	3	8	1	17.954	0.001
	III	2	8	4		
	IV	17	7	0		
Location	trochanter	5	4	1	2.762	0.948
	ischium	7	7	3		
	sacrum	8	8	1		
	iliac crest	1	2	0		
	post-trunk	1	2	0		
Site	same	–	20	4	0.162	0.687
	new	–	3	1		
Treatment	flap	19	9	4	15.13	0.004
	skin graft	3	5	1		
	conservative	0	9	0		
Expense(¥)		55398.16	28379.31&	26991.60%		
Follow-up	live/died	–	11/4	5/0		

therapeutic symptoms include burns, pressure ulcers, diabetic foot, refractory wounds, skin soft tissue infection and scarring plastic. Most of the inpatients transferred from local hospitals to our department for wound closure. The treatment measures include conservative and surgery measures, but the recurrent cases cannot be avoided no matter what measures, there is an urgent need to clarify what's the potential risk factors for ulcer recurrence, as it is the purpose of this study. In the current investigation, we collected the hospitalization data of pressure ulcer patients in recent five years for the purpose of evaluating the latent risk factors for the ulcer recurrence in northeast China.

Among the 187 inpatients, the recurrent rate was 8.02%, maybe the actual rate could be higher because of the filter conditions in the data collection. All through the data filtration, we excluded incompletely healing cases in the first episode, since the residual wound suffered from a higher recurrent rate as reported [18], which was likely to impact the study purpose. The primary onset of pressure ulcer here included both hospital acquired and community acquired pressure ulcer. Because of the data filtration, the cases of recurrent pressure ulcer belonged to community acquired pressure ulcer after initial complete healing. What's more, females occupied a larger percentage than males, it seemed that females suffered from pressure ulcer more often than males, despite the fact that it was not a risk factor for the ulcer recurrence in the univariable and multivariable Cox regression analysis. The natural strength of a male body might contribute to this, besides that, the poor psychological endurance of females facing the disability and illness constituted another possible reason [19].

The mean onset age was 63.72 years old, the onset age varied significantly since 65 years was also reported [20]. This earlier onset age reminded us the possibilities of the pressure ulcer happening even if the patients were younger, meanwhile those having other high risk factors. Among 15 recurrent cases, the mean interval time between the initial hospitalization and recurrent date was 19.8 months. 2 years after initial healing constituted a high risk period when 10 recurrent cases (66.7%) happened in accordance with our survey. We recommend that more efforts should be taken currently for the purpose of preventing the recurrence in the period of first 2 years after healing. In the Cox regression analysis, 60 years, as a median age, was taken for the purpose of grouping, moreover, no significant result suggested that this age constitute a risk predictor for the ulcer recurrence. As the available studies demonstrated, the old age might constitute a risk factor for the pressure ulcer occurrence, but not a prognostic factor.

Spinal disease took the major component for the bedridden reasons, and the cerebral disease took the second majority. Although not a prognostic factor for recurrence as the results showed, we could not neglect the effects of these diseases, as Mino [21] took a combined measure of albumin and incapability of self-positioning as a useful index for evaluating the risk of pressure ulcer, the spinal or cerebral disease could lead to the disability as well as sensory loss, which can lower the sensitivity for pain, in addition aggravating the poor nutrition of the local skin. Consequently, the fragile skin turned to be an ulcer wound when exposed to the pressure damage. According to Grey's study, the patients with spinal cord injuries showed a high risk for pressure ulcer, especially in the first 5 years, the prevalence rate was 20–30% [22]. Considering the above results, we took the spinal or cerebral disease as an important burden for the patients in the occurrence of pressure ulcer.

Blood albumin level on admission, smoking, and diabetes were usually taken as the risk factors for pressure ulcer, which were linked to the poor wound healing abilities. Keys [18] discovered the fact that poorly controlled diabetes with hemoglobin A1C > 6% was a key predictor for recurrent pressure ulcer, but no significant result was observed in the multivariable analysis by Wimon [23]. We did not find a significant difference on diabetes or smoking through the comparison between nonrecurrent and recurrent groups, most likely, different results were depended on the patients involved in. In our investigation, the blood albumin level below 25 g/dl was observed as a prognostic factor for the ulcer recurrence in the univariable and multivariable Cox regression analysis. This result reminded us the importance of nutrition, which was a major factor in both the initial and recurrent pressure ulcer [24]. Apparently, blood albumin level was associated with the nutrition level, which could not only reflect the daily care level out-hospital, but also an indicator for the severity of pressure ulcer, as albumin could be reduced as a result of the consumption by the ulcer infection. Clinical judgment was recommended in estimation of energy and protein needs, considering the size and severity of pressure ulcer [25]. While for supplying nutrition, the dietary prescription can be increasingly tailored to persons with pressure ulcers [26], nevertheless, there was little evidence supporting the use of oral or enteral nutrition supplementation for the prevention of ulcers [27].

Obviously, caregiver who was responsible for the daily care of patients, was absolutely important for the pressure ulcer patients. It was also apparent that the patients possessing the single caregiver suffered

from recurrent ulcer more often than others, as our univariable and multivariable Cox regression analysis suggested. It was a pity that 41.71% of the patients had only one caregiver and the situation went worse in the recurrent group, which contributed to the ulcer recurrence. This situation was related to the disadvantages of home nursing in our area. The shortages on the community medical care constituted a common malady in developing countries. As in European countries, more attentions were attached to the nursing standard for prevention [28], but the situation in our country was contrary, wherein the most pressing issue was the shortage of the basic medical care facilities and staffs, letting alone the professional caregivers. Since the caregivers were primarily the relatives of patients, an informal caregiver was not only a disaster for patients, but also a burden for their own quality of life [29].

The expense for the hospitalization amounted to be approximately 33089.51¥ per patient. According to the current report, the cost reached GBP 14,108 Pound for the stage IV ulcer in the UK, and the aggregate annual cost was approximately 1.4–2.1 billion Pound in the year 2004 [30], while the cost rose to 11 billion USD for the hospitalized patients in 2006 Surprisingly [31]. Nevertheless, in comparison with the income level, the expense was not so ideal. The patients were likely to give up treatment for financial reasons. Furthermore, the expense for the initial hospitalization of pressure ulcer showed much higher compared with the recurrent hospitalized period ($t = 2.594$, and $P = 0.021 < 0.05$). We attributed this to the difficulties in the primary treatment, owing to the severe stage of pressure ulcer, since there were 17 wounds in stage IV. Moreover, we observed that the expenditure of pressure ulcer for stage IV was usually higher in comparison with that for stage III, with the severity of pressure ulcer increasing, the cost rose resultantly. While a survey figured it out that the average cost for stage III ulcer was higher as compared with that for stage IV in the patients with spinal cord injuries, but the author showed no agreement to his result and contributed it to the limited including patient numbers of stage IV [32]. In our department, most of the cases receiving conservative treatment opted for being out of hospital, not hospitalization, which was likely to impact our data. As we were aware of the fact, special dressings were often used for the conservative management, and the daily changing dressings for a long time was quite expensive, which was likely to increase the expenditure. In contrast, surgery cost for single wound remained stable because of the similar surgery process.

It was obvious that it need more efforts in the closure of multiple ulcers compared to the single ulcer wound. As the study showed, there were more multiple wound cases in the recurrent group, further univariable and multivariable Cox regression analysis shed light on the fact that multiple ulcersconstituted a prognostic factor for the ulcer recurrence. Owing to the multiple ulcers, which resulting in malnutrition, the difficulties in daily care rose and recurrent ulcer occurred consequently. In addition, approximately 86.96% of the recurrent wounds occurred in the same site compared with the initial wound location, We noted the fact that stage III and IV were difficult in the wound closure with the loss of full thickness of skin, coupled with the exposure of joint. With the stage severity rising, the flap surgery rate reached to 68.60%. In a multivariable Cox regression analysis, stage IV wound did not manifest significance for the prediction of the ulcer recurrence, which suggested that the stage IV wound did not make a predictive factor, and the recurrence of pressure ulcer had no association with the severity of the wound, meanwhile being associated with the multiple ulcers.

Treatment strategies for pressure ulcer included the wound management, nutrition support, debridement and surgery reconstruction. As no ideal randomized controlled trials provided a robust evidence on the surgery intervention for pressure ulcer [33], accordingly, the published UK National Institute for Health and Clinical Excellence(NICE) guidelines did not put forward any particular recommendations. In our research, the comparison between the flap and non-flap cases in the nonrecurrent and recurrent group demonstrated no significant differences. With regard to the further exploration, we performed the analysis of the changes in the recurrent cases in three time points: initial and recurrent episode, relapsed data after recurrent ulcer healing. It's evident that the wound stage and area showed a reduction. Considering these features, we discovered that, even though the flap surgery methodology could not prevent the ulcer recurrence, as a consequence of receiving flap surgery, the recurrent wound stage lowered significantly, which was the benefit of the flap treatment in our view. It's difficult to prevent the pressure ulcer relapsing, in case of not being avoided, why not to choose flap surgery in order to lower the wound stage and area? Perhaps, the reduction of the wound stage and area were not only associated with the surgery option, but also benefited from the rising prevention awareness of the patients and caregivers. Schoeps [34] thought that patients' knowledge and participation showed a positive effect in preventing pressure ulcer. And Ljung [35] held the view that, with the increase in awareness, the low-grade of recurrent ulcer stemmed as a consequence of the early detection, and there was no need for the re-operation. Further discussion was required for evaluating the actual effect of this raising awareness in preventing ulcer recurrence.

As our data suggested, we did not perform the analysis of different dressings or topical agents for the treatment, since this investigation was just a review analysis emphasizing the recurrent pressure ulcer with limited cases involved in the investigation, not random trials. Together with that, there was a big variety of dressings or agents for different wounds, as a Cochrane review on dressings and topical agents for the treatment of pressure ulcers provided an uncertain conclusion owing to the same reason, evaluating 21 dressings as well as topical agents in 39 research works [7]. Furthermore, the decision of making use of which type of dressing or agent was primarily depended on not only the wound appearance, but also the clinical experience and cost. This varied substantially in different hospitals or countries, in our hospital, dressings or agents were typically applied on the superficial pressure ulcer or partial thickness dermal injury for the conservative treatment. In addition, we did not perform the analysis of different flaps as there was no clear conclusion on the option of flaps for different types of ulcers. Flap selection involved a consideration of several factors, which included the ulcer site, flap design and the location of the flap in relation to the site of coverage. Moreover, it was quite difficult to suggest which type of flap was the best choice in consideration of the doctors' skill. Besides that, the wound area was not taken into the Cox regression analysis, since we thought that the wound area had difficult in reflecting the severity of the ulcers, owing to the fact that there was an extensive variety in the manifestation of the pressure ulcer wound, as the wound was likely to present a small defect with a deep sinus tract reaching the muscle or joint. An approximately analysis discovered the fact that the initial defect size constituted a risk factor for the development of a recurrent ulcer, while only ulcer area was calculated, which we considered as requiring further discussion as the reason highlighted earlier [9]. Eventually, the factors we included for the ulcer recurrence were still insufficient, for instance, only caregiver numbers were calculated, but no further evaluation was carried out for the care level, which was considered as a pivotal factor for the prevention of ulcers.

6. Conclusions

As evident from the data analysis, the onset age of pressure ulcer showed younger, and the wound stages were the severe ulcer (III and IV stage) primarily. Albumin level on admission, single caregiver, multiple ulcers constituted the three key prognostic factors for the recurrent pressure ulcer, as our survey suggested. Moreover, lacking medical care out of the hospital in northeast China required more urgent attention. Ultimately, flap treatment was not likely to be a protective factor for the ulcer recurrence, meanwhile considering the advantages for the deep wound closure, which still made a productive treatment for pressure ulcer nowadays.

Conflict of interest

The authors declare that there is no conflict of interest.

Ethical approval

The survey was approved by the Ethics Committee of the First Hospital of Jilin University. All the data involved in the study was collected by two principal doctors. Patients' personal information was protected in accordance with the Chinese Law, only case numbers were provided for identification.

Acknowledgments

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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