

Effect of Self-Adhesive Soft Silicone Foam Dressing Combined with Clustered Nursing Strategy on Prevent Pressure Injury in Patients after Pancreaticoduodenal Surgery

Le Wang^{1,2,3}
Hongying Tan^{1,2,3}
Honghui Zhang^{1,2,3}
Sulai Liu^{1,2,3}
Yinghui Song^{1,2,3}
Xuee Luo^{1,2,3}
Qinghua Zeng^{1,2,3}
Chuang Peng^{1,2,3*}

Abstract:Background and purpose: Pancreaticoduodenectomy is a kind of abdominal surgery with large trauma, complicated operation and high incidence of postoperative complications especially for elderly patients. Pressure injury is one of its common complications. This study explored the preventive effect of self-adhesive soft silicone foam dressing combined with clustered nursing strategy on patients with pressure injury after pancreaticoduodenal surgery. Methods: From November 2018 to November 2020, 120 elderly patients who underwent pancreaticoduodenectomy in the Department of Hepatobiliary Surgery of Hunan Provincial People's Hospital were selected and randomly divided into a control group and an observation group. The control group was treated with routine care, and the observation group was treated with self-adhesive soft silicone foam dressing combined with clustered care. The pressure injury risk score, pressure injury incidence rate, skin complication rate, psychological concern score, and sense of trust score, comfort score, physiological problem score and nursing satisfaction score were compared between the two groups. Results: Compared with the control group, the pressure injury risk score, pressure injury incidence rate, and skin complications incidence rate of the observation group were lower ($P < 0.05$), while the psychological concern score, trust score, comfort score, the scores of physiological problems and nursing satisfaction were higher ($P < 0.05$). Conclusion: Self-adhesive soft silicone foam dressing combined with clustered nursing strategy can reduce the risk score and incidence of pressure injury in elderly patients after pancreaticoduodenal surgery, reduce the occurrence of complications, and improve nursing comfort and satisfaction. It is worthy of promotion

Keywords: self-adhesive soft silicone ordinary foam dressing; cluster nursing strategy; pressure injury

Tob Regul Sci.™ 2021;7(5-1):4040-4048

DOI: doi.org/10.18001/TRS.5.1.179

¹Department of Hepatobiliary Surgery, The People's Hospital of Hunan Province, The First Affiliated Hospital of Hunan Normal University, Changsha, 410005 Hunan Province, China ²Biliary Disease Research Laboratory of Hunan Provincial People's Hospital, Key Laboratory of Hunan Normal University, Changsha, 410005 Hunan Province, China ³Clinical Medical Technology Research Center of Hunan Provincial for Biliary Disease Prevention and Treatment, Changsha, 410005 Hunan Province, China *Corresponding author: Chuang Peng, PhD, M.D., Department of Hepatobiliary Surgery, Hunan Provincial People's Hospital, The First Affiliated Hospital of Hunan Normal University, Changsha, Hunan Province, People's Republic of China. E-mail: pengchuangcn@163.com

pancreaticoduodenectomy (PD) is an abdominal surgery with large trauma, complicated operation, and a high incidence of postoperative complications [1,2]. There are many organs that need to be removed during PD surgery, also the steps of gastrointestinal reconstruction are complicated, so the operation time of PD often reaches more than 5 to 6 hours [3].

One of its common complications is pressure injury [4]. The occurrence of stress injury could prolong the hospital stay, waste medical resources, and increase the economic burden of patients [5].

Pressure injury refers to the local injury of the skin and/or subcutaneous tissue caused by pressure or pressure combined with shear force, usually located at the bone carina, and may also be related to medical devices or other objects [6]. Postoperative PD patients are often unable to change their position on their own due to large surgical trauma, pain and other reasons to relieve the pressure of local tissues and induce pressure injuries, which are mostly in the sacral and coccyx, hips and other parts [7]. It has been reported that the operation time exceeding 150 minutes is an independent risk factor for the occurrence of stress injury. If the operation time exceeds 240 minutes, there is also a higher risk of pressure injury for young patients. It also points out that the operation time is extended for every 3 minutes in patients with stress, the probability of pressure injury will increase by 33% [8].

A number of studies have shown that the main preventive measure for pressure injury is to relieve the long-term pressure on the skin [9,10]. The self-adhesive soft silicone foam dressing can reduce the pressure and shear force of the compressed skin of bedridden patients, and create a moist environment to promote tissue repair. It can also seal the wound edge and protect the skin from destructive leakage and maceration. Relieve pain and reduce the occurrence of pressure injuries, and promote wound healing [11]. Many studies have shown that sticky soft silicone foam dressings can reduce the occurrence of pressure injuries [12,13], but the impact on pressure injuries after pancreaticoduodenectomy has not been reported.

The prevention and care of stress injury is a continuous process, so choosing appropriate nursing intervention measures is particularly important to reduce the incidence of patients with stress injury. There are many ways to prevent stress injuries, but there is no uniform nursing process and standard [14,15]. Clustered nursing is a series of evidence-based interventions combined to form a nursing program, usually including 3 to 5 simple, clear and effective evidence-based practice measures

[16]. Clustered nursing has been used in the management of postoperative complications of multiple types of surgery [17,18], but the impact of clustered nursing on pressure injury after pancreaticoduodenectomy has not been reported.

In this study, elderly patients treated by pancreaticoduodenectomy were enrolled to observe the effect of self-adhesive soft silicone foam dressing combined with clustered nursing strategies on postoperative pressure injury in PD patients. The report is as follows:

MATERIALS AND METHODS

General Information

Elderly patients who received PD treatment in our department from November 2018 to November 2020 were enrolled, and they were divided into observation group and control group according to the blind drawing method, with 60 cases in each group.

Inclusion criteria: ①Age ≥ 60 years; ②Receive PD surgery; ③Expected hospital stay ≥ 7 days; ④Patients and family members agree; ⑤Patients can cooperate with nursing staff to complete the study.

Exclusion criteria: ①Age ≥ 80 years old or age < 60 years old; ②Combined with diabetes, hypoproteinemia, wound infection with special drug-resistant bacteria, etc.; ③Patients with pressure injury; ④Allergic to foam dressings; ⑤Combined Patients with other skin diseases.

There was no significant difference in general information between the two groups ($P > 0.05$). Each subjects included in this study signed an informed consent form for the study, which was reviewed and approved by the hospital's medical ethics committee.

Self-Adhesive Soft Silicone Foam Dressing

Self-adhesive soft silicone foam dressing were purchased from Adopt Mepilex (Molnlycke Health Care AB, Sweden).

Nursing Methods

Control group intervention method:

The control group carried out routine preventive care of pressure injury for patients after PD, including risk assessment; helping the patient turn over once every 2 hours; using water pads, turning pads, soft pillows, etc. to avoid pressure injury; keep the patient list clean and hygienic to avoid irritating the patient's skin; urine and urine tools are intact; wipe the patient's skin with warm water every day to promote blood circulation, massage the compressed skin; timely supplement nutrition, such as protein, vitamins, carbohydrates Etc., in order to improve the immunity of patients; to carry out health education and so on.

Observation group intervention methods:

Develop a nursing strategy: a pressure injury clustering research team composed of 1 wound therapist, 1 chief physician of hepatobiliary surgery, 1 deputy chief nurse, and 2 chief nurses, consulted relevant literatures, and formulated "self-adhesiveness" "Soft silicone foam dressing combined with clustered nursing strategy to prevent postoperative pressure injury in PD patients" first draft. The first draft was scored and evaluated by the expert consultation method, and the research team improved and refined the intervention strategy for the prevention of pressure injury clustering, and determined the final draft of the intervention strategy for the prevention of pressure injury clustering.

Nursing intervention measurement: ①Risk assessment: The Braden score sheet was used to assess the risk of patients after PD every day after the operation, and the assessment results were recorded. ②Use of self-adhesive soft silicone foam dressing: Self-adhesive soft silicone foam dressing were used on bone carinas (such as heels, sacral coccyx) and the skin under and around medical devices and various ducts; the dressings should be replaced in time when they were curled, peeled off, or wet. ③Use of supporting surface: Soft pillows, turning pads, air beds and other auxiliary devices were applied to avoid skin pressure on the sacrococcygeal and back bones. ④Skin care: Gentle skin cleansers were applied daily to clean the skin. Emulsion was applied to maintain skin moisture. Sheets and clothing should be kept clean and level. Absorbent pads or dry pads were used to control moisture. ⑤Position and early activities: The patients turned over or changed position regularly (at least once every 2 hours). The lateral position was kept less than 30° and the bed head elevation was kept less than 30° to reduce vertical pressure. The patients were instructed to active movement and assisted to passive movement. ⑥Prevention of medical device-related pressure injuries: The medical pipeline is left in place to prevent the medical pipeline from compressing the local skin. The medical equipment is worn correctly to prevent the medical equipment from compressing the local skin. The skin under and around the medical equipment is checked regularly. The skin under the medical equipment is kept clean and dry.

⑦ Training and guidance for pressure injury: The cause of the stress injury, the harm to the body, the purpose of nursing, etc. were told to the patient to understand the measures and methods to prevent stress injuries for patients, which was also helpful to improve patient cooperation and reduce patient anxiety.

Evaluation Items

Risk of stress injury: The risk of stress injury was assessed by the nurse in the ward 1 day before the operation and 1 week after the operation. The Braden Stress Injury Risk Assessment Scale was used to evaluate the risk of stress injury. The scale includes activity, movement, wetness, sensation, friction and nutrition, etc., with a total score of 23. Four hazard levels are divided according to the score: extremely high risk: ≤9 points; high risk: 10-12 points; medium risk: 13-14 points; low risk: 15-18 points. The lower the score the higher the risk of stress injury.

Skin condition: The skin conditions of the two groups of patients were observed every day after 1 week, including whether there were erythema, redness, blisters, skin breakage, etc. The incidence of skin complications was the percentage of the number of complications that occurred in the total number of cases.

Incidence rate of pressure injury: The pressure injury four-stage grading system revised by the National Pressure Ulcer Advisory Panel (NPUAP) in 2016 were adopted to evaluate the pressure injury staging.

Digital assessment scale (NRS): 0-10 points are applied to grade the degree of pain . 0 means no pain, 1-3 means mild pain, 4-6 means moderate pain, and 7-10 means severe pain.

Self-rating anxiety scale (SAS): 20 items are included in the SAS assessment. The scores of each item are added together, and then multiplied by 1.25 to obtain the integer part and get the standard score. 50-59 is divided into mild anxiety, 60-69 is divided into moderate anxiety, and more than 69 is considered severe anxiety.

Clinical nursing effect: The MOS item short from health survey (SF-36) was applied to evaluate the quality of life of patients after treatment, including the SERVQUAL scale of physiological function, physiological function, physical pain and social

function, 5 points represent very satisfied, 4 points A score of 3 means average, a score of 2 means relatively dissatisfied, and a score of 1 means very dissatisfied.

Nursing satisfaction rate: Nursing satisfaction is divided into very satisfied, satisfied and dissatisfied, the total satisfaction rate (%) = (very satisfied + satisfied) / total * 100%.

Statistical Methods

SPSS23.0 statistical software was used to analyze the data.. Quantitative data was expressed as mean plus and minus standard deviation (x±s), and qualitative data was expressed as n (%). Qualitative data and quantitative data were

analyzed by χ^2 test and t test respectively. Two-sided P<0.05 indicated that the difference was statistically significant. All statistical graphs were generated by Graph Pad Prism.

RESULTS

Basic Clinical Characteristics of the Two Groups of Patients

120 patients were included, with 60 in the observation group and 60 in the control group. There was no significant difference in gender composition, age distribution, Braden score, fasting blood glucose and albumin (P > 0.05), see Table 1 for details. It shows that the two groups of patients were balanced and comparable.

Table 1
Comparison of clinical data between the two groups of patients

	Control group (n=60)	Observation group (n=60)	P value
Gender			
Male	34	36	0.845
Female	26	24	
Age/years	65.35±3.56	67.57±5.63	0.758
Body Mass Index	22.46±1.78	22.84±1.47	0.836
Braden score	21.54±2.12	22.08±3.08	0.763
Blood glucose (mmol/L)	8.34±2.76	8.52±2.38	0.576
Albumin (g/L)	34.32±4.28	35.48±4.16	0.624
Operation time (min)	424.74±34.36	438.26±38.18	0.539
Intraoperative blood loss (ml)	354.64±24.28	372.48±29.54	0.438

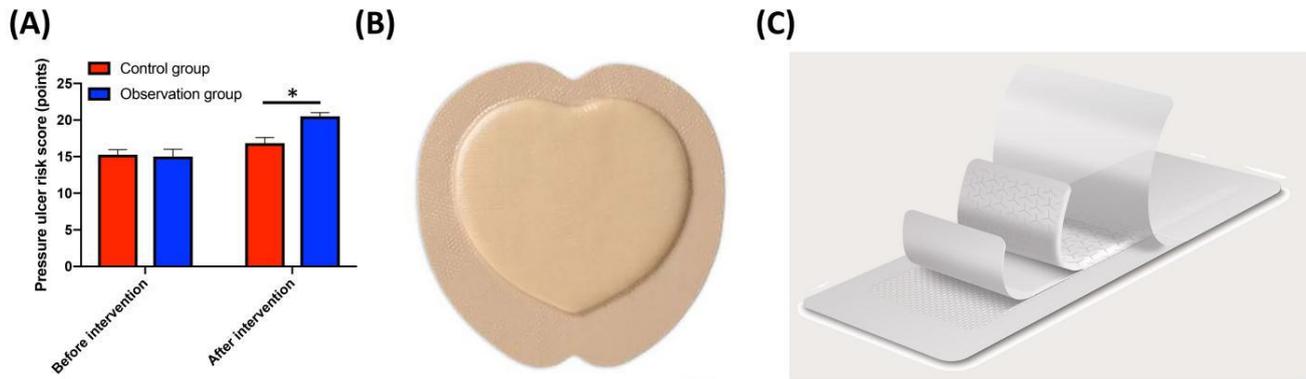
Comparison of the Risk of Stress Injury between the Two Groups

Before the intervention, the control group had a pressure injury risk score of (15.51±2.24) points, and the observation group had a score of (15.43±2.19) points (P > 0.05). After the

intervention, the control group had a pressure injury risk score of (20.15±2.17) points higher than those of the conventional group (17.42±3.62) points (t=5.709, P < 0.001; Figure 1A). The observation group was treated with Mepilex preventive treatment, and the pictures of Mepilex products were shown in Figure 1B, C.

Figure 1

Comparison of the pressure injury risk scores between the two groups.



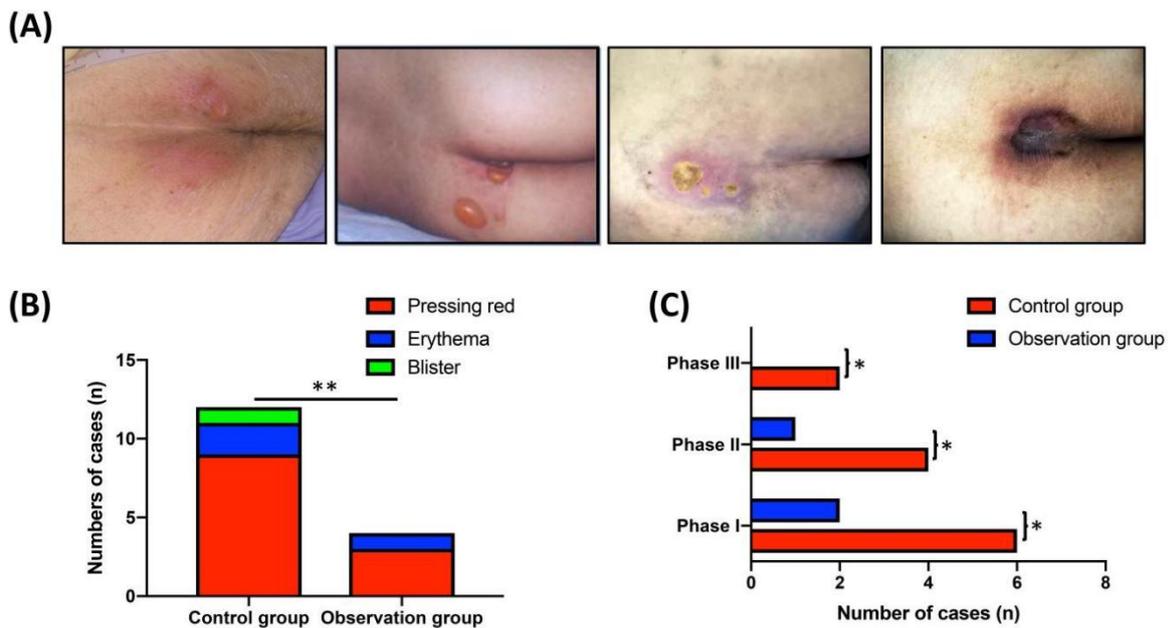
Note: The Braden Stress Injury Risk Assessment Scale was used to evaluate the risk of stress injury. (A) Before the intervention, there was no difference of two groups of injury risk scores. After the intervention, the control group had a pressure injury risk score higher than those of the observation group ($t=5.709$, $P < 0.001$; Figure 1A). (B) and (C) The pictures of Mepilex products. * indicates that compared with the control group, $P < 0.05$.

Comparison of the Occurrence of Pressure Injuries between the Two Groups

In the control group, there were 9 cases of redness, 2 cases of erythema, and 1 case of blisters. While the observation group had 3 cases of redness,

1 case of erythema, and no blisters. The specific skin injuries were shown in Figure 2A. The incidence of pressure injury in the observation group was 6.66% which lower than that in the control group of 20% ($\chi^2=5.970$, $P=0.016$; Figure 2B, C).

Figure 2 Comparison of skin conditions between the two groups.



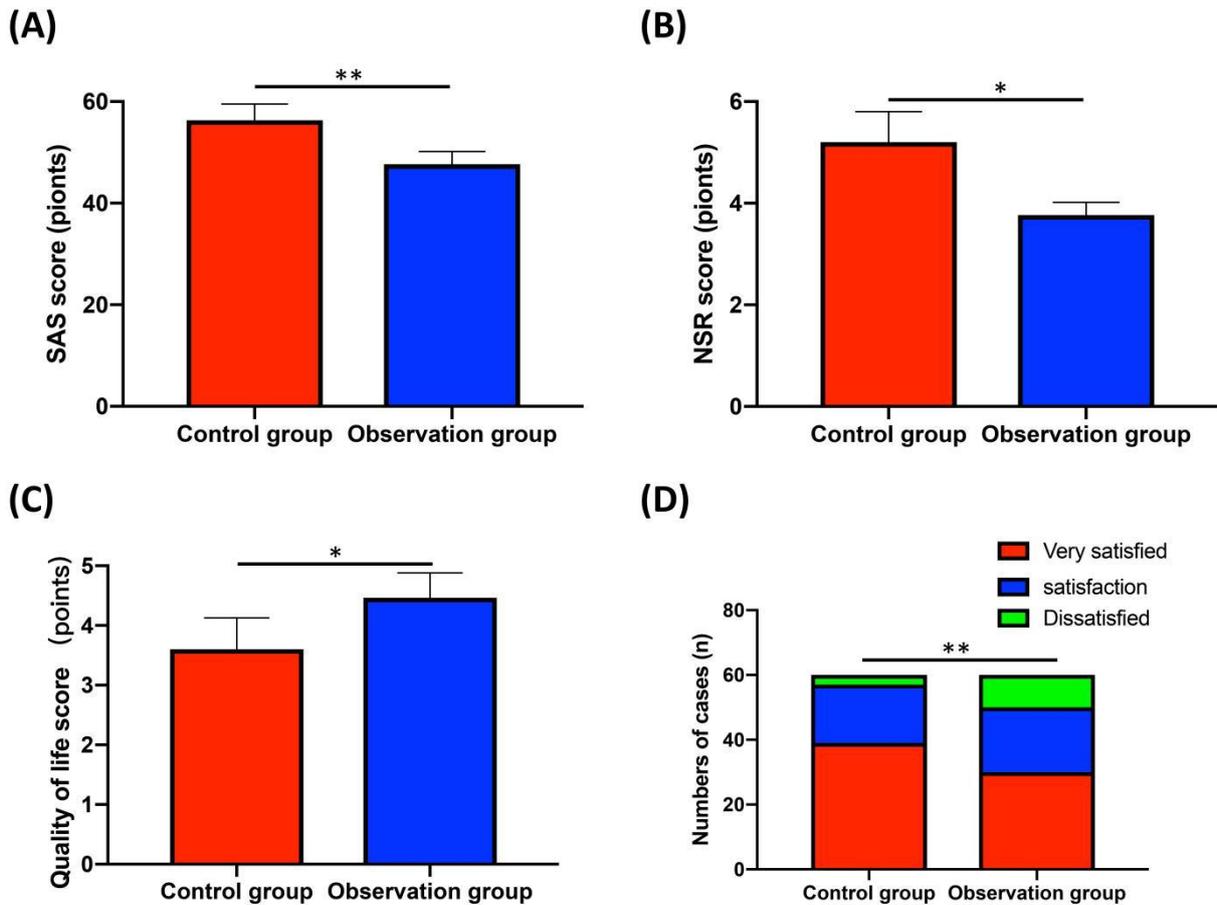
Note: (A) Different degrees of pressure-induced skin injury. (B) and (C) The incidence of pressure injury in the observation group was lower than that in the control group. * indicates that compared with the control group, $P < 0.05$. ** indicates that compared with the control group, $P < 0.01$.

Comparison of Nursing Effects between the Two Groups

The SAS score of the observation group was (47.67 ± 6.13) points, which was lower than the control group (56.33 ± 7.18) points (P=0.021). The NSR score was (3.77 ± 0.31) points for the observation group, which was lower than the control group (5.20 ± 0.39) points (P=0.018). The results of the SERVQUAL scale showed that the

quality of life score of the observation group was (4.92 ± 0.24) points which was higher than that of the control group (3.48 ± 0.16) points (P=0.032). Meanwhile, the nursing satisfaction survey showed that 39 cases were very satisfied, 18 cases were satisfied, and 3 cases were dissatisfied in observation group. The overall satisfaction rate was 95%, while the total satisfaction rate of the control group was only 83% (P=0.014). See Figure 3 for details.

Figure 3
Comparison of nursing effects between the two groups.



Note: (A) The SAS score of observation group was lower than the control group. (B) The NSR score of observation group was lower than the control group. (C) The quality of life score of observation group was higher than the control group. (D) The nursing satisfaction rate of observation group was higher than the control group. * indicates that compared with the control group, P<0.05. ** indicates that compared with the control group, P<0.01.

Comparison of Hospitalization Time and Medical Expenses between the Two Groups

The average hospital stay of the observation group was (18.56 ± 2.63) days, which was significantly shorter than that of the control group (21.32 ± 1.79) days (P=0.043). Moreover, the

average hospitalization cost of the observation group was (100,350 ± 357) yuan, which was significantly lower than that of the control group (120,350 ± 765) yuan (P=0.027), which significantly reduced the economic burden of patients. See Table 2 for details.

Table 2
Comparison of hospitalization time and expenses between the two groups

	Control group (n=60)	Observation group (n=60)	P value
Average hospitalization time (days)	21.32±1.79	18.56±2.63	0.043
expenses (yuan)	120350±765	100350±357	0.027

DISCUSSION

The treatment of pressure injury after PD is very difficult. This study found that self-adhesive soft silicone foam dressing combined with clustered nursing strategy could significantly reduce the incidence of pressure injury in patients after pancreaticoduodenal surgery.

The European Pressure Ulcer Advisory Panel, the U.S. National Pressure Injury Advisory Panel and the Pan-Pacific Pressure Injury Alliance jointly developed the third edition of "Pressure Prevention and Treatment of Pressure Injuries: Clinical Practice Guidelines. All the evidence in the guidelines indicates that soft silicone multilayer foam dressings have statistical significance in reducing the incidence of pressure injuries compared with patients who do not use preventive dressings. Another study pointed out that soft multi-layer foam dressings, compared with polyurethane film dressings, statistically reduced the incidence of pressure injuries [19].

The self-adhesive soft silicone foam dressing is composed of a breathable and waterproof external film, a polyurethane foam absorbent layer with strong elasticity, and a soft silicone wound contact layer [20]. The semipermeable polyurethane film has waterproof and antibacterial effects, which can reduce injury to new granulation tissue, reduce the occurrence of re-injury and edema of the surrounding skin, and promote wound healing [21]. It is reported that the healing speed of pressure injuries in a humid environment is approximately twice of the healing speed of pressure injuries in a natural perception environment [22]. Self-adhesive soft silicone is a polymer organic compound that can prevent the evaporation of water vapor on the wound surface, which can provide a slightly acidic environment and a suitable local temperature for the wound surface, and promote the proliferation of endothelial cells, fibroblasts and keratinocytes of wound [23]. Also self-adhesive soft silicone can promote the healing of scabs on the wound [24].

The special foam layer of Mepilex dressing can effectively absorb and store exudate, avoiding the

risk of impregnation. The application of Mepilex dressing reduces the friction between the skin and the bed sheet in the ulcer-prone parts, avoids skin abrasion, improves the local blood supply and oxygen supply, and reduces the shear force of the skin [25]. On the other hand, Mepilex dressing can absorb the secretions of the skin, keep the skin dry, and maintain a proper temperature, which is beneficial to prevent the occurrence and development of pressure injury [26]. It is worth mentioning that in the process of treatment, the principle of sterility should be strictly followed, the dressing should be properly fixed, nutrition should be strengthened during the treatment, and in basic care, turning over once an hour is more conducive to wound healing.

The prevention and management of stress injuries has been included in Australia's national safety and quality health service standards [27]. And the management strategy for the prevention of stress injury has gradually changed from the medical staff-led to the patient-centered [28]. In this study, perioperative nursing intervention effectively reduced the incidence of stress injuries. The main reason was the establishment of a professional nursing team for stress injuries. After searching literature for training, nursing interventions were carried out for high-risk factors that occurred during the operation. The risk assessment was applied and the high-risk patients were identified, which were helpful to implement targeted interventions. After the operation, each patient would receive a systematic nursing intervention plan through special follow-up. The formulation of targeted procedures also helps to clarify the focus of nursing staff and provides support and guidance for nursing work.

Therefore, risk assessment, the use of preventive dressings, the use of support surfaces, skin care, posture changes and early activities, prevention of medical device-related pressure injuries, and other clustered care measures have comprehensive and targeted characteristics, which are effective in preventing postoperative PD patients.

CONCLUSION

Self-adhesive soft silicone foam dressing combined with clustered nursing strategy has a good effect on preventing postoperative pressure injury in PD patients. The clinical application of self-adhesive soft silicone foam dressing combined with clustered nursing strategy provides guidance for postoperative skin care of PD patients, makes nursing work more scientific and standardized. It can reduce the incidence of pressure injury, and improve patient satisfaction to improve the quality of nursing work.

CONFLICT OF INTEREST

The authors declare that they have no financial or commercial conflict of interest.

FUNDING

This work was financially supported by The Project of Improving the Diagnosis and Treatment Capacity of Hepatobiliary, Pancreas and Intestine in Hunan Province (Xiangwei [2019] No. 118).

AVAILABILITY OF DATA AND MATERIALS

Data and materials are included in the manuscript.

REFERENCE

- Javed AA, Mirza MB, Sham JG, Ali DM, Jones GF 4th, Sanjeevi S, Burkhart RA, Cameron JL, Weiss MJ, Wolfgang CL, He J. Postoperative biliary anastomotic strictures after pancreaticoduodenectomy. *HPB (Oxford)*. 2021 Apr 27;S1365-182X(21)00108-8.
- Shen J, Guo F, Sun Y, Zhao J, Hu J, Ke Z, Zhang Y, Jin X, Wu H. Predictive nomogram for postoperative pancreatic fistula following pancreaticoduodenectomy: a retrospective study. *BMC Cancer*. 2021 May 15;21(1):550.
- Da Dong X, Felsenreich DM, Gogna S, Rojas A, Zhang E, Dong M, Azim A, Gachabayov M. Robotic pancreaticoduodenectomy provides better histopathological outcomes as compared to its open counterpart: a meta-analysis. *Sci Rep*. 2021 Feb 12;11(1):3774.
- Chen Y, He L, Qu W, Zhang C. Predictors of Intraoperative Pressure Injury in Patients Undergoing Major Hepatobiliary Surgery. *J Wound Ostomy Continence Nurs*. 2017 Sep/Oct;44(5):445-449.
- Song W, Kang MJ, Zhang L, Jung W, Song J, Bates DW, Dykes PC. Predicting pressure injury using nursing assessment phenotypes and machine learning methods. *J Am Med Inform Assoc*. 2021 Mar 18;28(4):759-765.
- Zhang YB, He L, Gou L, Pei JH, Nan RL, Chen HX, Wang XL, Du YH, Yan H, Dou XM. Knowledge, attitude, and practice of nurses in intensive care unit on preventing medical device-related pressure injury: A cross-sectional study in western China. *Int Wound J*. 2021 May 7.
- Chen HL, Zhu B, Wei R, Zhou ZY. A Retrospective Analysis to Evaluate Seasonal Pressure Injury Incidence Differences Among Hip Fracture Patients in a Tertiary Hospital in East China. *Ostomy Wound Manage*. 2018 Feb;64(2):40-44.
- Guzman S, Allegritti AL, Kormos RL, Brienza DM. A comparison of air-cell and gel surgical table pads and an evaluation of the influence of pressure distribution and other factors on pressure injury prevention. *J Tissue Viability*. 2021 Feb;30(1):9-15. doi: 10.1016/j.jtv.2020.12.006. Epub 2021 Jan 2.
- Nakagami G, Yokota S, Kitamura A, Takahashi T, Morita K, Noguchi H, Ohe K, Sanada H. Supervised machine learning-based prediction for in-hospital pressure injury development using electronic health records: A retrospective observational cohort study in a university hospital in Japan. *Int J Nurs Stud*. 2021 Mar 26;119:103932.
- Kadota H, Miyashita K, Fukushima S, Oryoji C, Hanada M, Yoshida S, Fujita H, Tachibana Y. Successful Management of a Severe Sacral Pressure Injury Penetrating to the Retroperitoneum. *Wounds*. 2021 Mar;33(3):E24-E27.
- Viamontes L, Temple D, Wytall D, Walker A. An evaluation of an adhesive hydrocellular foam dressing and a self-adherent soft silicone foam dressing in a nursing home setting. *Ostomy Wound Manage*. 2003 Aug;49(8):48-52, 54-6, 58.
- Yoshimura M, Ohura N, Tanaka J, Ichimura S, Kasuya Y, Hotta O, Kagaya Y, Sekiyama T, Tannba M, Suzuki N. Soft silicone foam dressing is more effective than polyurethane film dressing for preventing intraoperatively acquired pressure ulcers in spinal surgery patients: the Border Operating room Spinal Surgery (BOSS) trial in Japan. *Int Wound J*. 2018 Apr;15(2):188-197.
- Silverstein P, Heimbach D, Meites H, Latenser B, Mazingo D, Mullins F, Garner W, Turkowski J, Shupp J, Glat P, Purdue G. An open, parallel, randomized, comparative, multicenter study to evaluate the cost-effectiveness, performance, tolerance, and safety of a silver-containing soft silicone foam dressing (intervention) vs silver sulfadiazine cream. *J Burn Care Res*. 2011 Nov-Dec;32(6):617-26.
- Warden SJ, Davis IS, Fredericson M. Management and prevention of bone stress injuries in long-distance runners. *J Orthop Sports Phys Ther*. 2014 Oct;44(10):749-65.
- Johnson M, Ferreira M, Hush J. Lumbar vertebral stress injuries in fast bowlers: a review of prevalence and risk factors. *Phys Ther Sport*. 2012 Feb;13(1):45-52.
- Genzler L, Johnson PJ, Ghildayal N, Pangarakis S, Sendelbach S. End-tidal carbon dioxide as a measure of stress response to clustered nursing interventions in neurologic patients. *Am J Crit Care*. 2013

May;22(3):239-45.

17. Genzler L, Johnson PJ, Ghildayal N, Pangarakis S, Sendelbach S. End-tidal carbon dioxide as a measure of stress response to clustered nursing interventions in neurologic patients. *Am J Crit Care.* 2013 May;22(3):239-45.
18. Allinson LG, Denehy L, Doyle LW, Eeles AL, Dawson JA, Lee KJ, Spittle AJ. Physiological stress responses in infants at 29-32 weeks' postmenstrual age during clustered nursing cares and standardised neurobehavioural assessments. *BMJ Paediatr Open.* 2017 Nov 25;1(1):e000025.
19. Santamaria N, Gerdtz M, Liu W, Rakis S, Sage S, Ng AW, Tudor H, McCann J, Vassiliou T, Morrow F, Smith K, Knott J, Liew D. Clinical effectiveness of a silicone foam dressing for the prevention of heel pressure ulcers in critically ill patients: Border II Trial. *J Wound Care.* 2015 Aug;24(8):340-5.
20. Wang H, Li TT, Ren H, Peng H, Huang SY, Lin Q, Lin JH, Lou CW. Expanded Vermiculite-Filled Polyurethane Foam-Core Bionic Composites: Preparation and Thermal, Compression, and Dynamic Cushion Properties. *Polymers (Basel).* 2019 Jun 11;11(6):1028.
21. Jeffery SL. Advanced wound therapies in the management of severe military lower limb trauma: a new perspective. *Eplasty.* 2009 Jul 21;9:e28.
22. Schwartz D, Magen YK, Levy A, Gefen A. Effects of humidity on skin friction against medical textiles as related to prevention of pressure injuries. *Int Wound J.* 2018 Dec;15(6):866-874.
23. Zeng J, Wu X, Chen Z, Zhang M, Ke M. Modified silicone stent for the treatment of post-surgical bronchopleural fistula: a clinical observation of 17 cases. *BMC Pulm Med.* 2021 Jan 6;21(1):10.
24. Lin YS, Ting PS, Hsu KC. Comparison of Silicone Sheets and Paper Tape for the Management of Postoperative Scars: A Randomized Comparative Study. *Adv Skin Wound Care.* 2020 Jun;33(6):1-6.
25. Wan BA, Chan S, Herst P, Yee C, Popovic M, Lee J, Lam H, Pon K, Aljabri S, Soliman H, Wronski M, Chow E. Mepitel Film and Mepilex Lite for the prophylaxis and treatment of skin toxicities from breast radiation. *Breast.* 2019 Aug;46:87-89.
26. Hundeshagen G, Collins VN, Wurzer P, Sherman W, Voigt CD, Cambiaso-Daniel J, Nunez Lopez O, Sheaffer J, Herndon DN, Finnerty CC, Branski LK. A Prospective, Randomized, Controlled Trial Comparing the Outpatient Treatment of Pediatric and Adult Partial-Thickness Burns with Suprathel or Mepilex Ag. *J Burn Care Res.* 2018 Feb 20;39(2):261-267.
27. Bateman RM, Sharpe MD, Jagger JE, Ellis CG, Solé-Violán J, et al. 36th International Symposium on Intensive Care and Emergency Medicine : Brussels, Belgium. 15-18 March 2016. *Crit Care.* 2016 Apr 20;20(Suppl 2):94.
28. Chaboyer W, Bucknall T, Webster J, McInnes E, Banks M, Wallis M, Gillespie BM, Whitty JA, Thalib L, Roberts S, Cullum N. IN'Troducing A Care bundle To prevent pressure injury (INTACT) in at-risk patients: A protocol for a cluster randomised trial. *Int J Nurs Stud.* 2015 Nov;52(11):1659-68.