Effect of Eight Different Methods for Preventing Incontinence-associated Dermatitis: A Network Meta-analysis

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Abstract. The objective is to systematically evaluate the effects of different methods in the prevention of incontinence-associated dermatitis. Methods is based on Searched PubMed, the Cochrane Library, Web of Science, EMbase, CNKI, VIP and CBM,and the search time limit was all built until January 2019.Two investigators independently screened the literature, extracted the data and evaluated the risk of bias in the included studies. The R 3.5.2 software gemtc package, JAGS 4.3.0, and Stata 13.0 software were used for analysis. Results: A total of 24 articles were included and 2367 patients were included. Mesh meta-analysis results show that the skin protective agent, ostomy bag combined drainage device, ostomy bag, ostomy bag combined with skin protectant, built-in tampon to prevent the incidence of incontinence-related dermatitis is better than conventional care; The effect of devices and ostomy bags on preventing the incidence of incontinence-associated dermatitis is better than that of drainage devices and built-in tampon; the effect of ostomy pouch combined with skin protectant on preventing the incidence of incontinence-associated dermatitis is better than that of built-in tampon. The ranking probability map shows that the ostomy combined drainage device is a better solution to prevent the incidence of incontinence-associated dermatitis. Conclusion: According to the results of mesh meta-analysis and probabilistic ranking, the effect of the laparoscopic combined drainage device bag on preventing the incidence of incontinence-associated dermatitis is better than other methods. Future research should also be focused on the direct comparison of effects between different methods and the evaluation of cost effectiveness.

Keywords: Incontinent-related dermatitis; Prevention; Network meta-analysis.

1. Introduction

Incontinence-associated dermatitis (IAD) arises as an inflammation of the skin due to prolonged exposure to urine and/or feces. Its main clinical manifestations are skin erythema, edema, and exfoliation .The incidence of IAD is high. The incidence is 19% to 50% among hospital inpatients and 3.4% to 7.6% in long-term care facilities . The main methods of preventing IAD include cleaning, moisturizing, using skin protectors, and using aids such as absorbent products, collection products, and drainage devices .Meta-analysis showed that for routine care, the use of an ostomy bag, an ostomy bag combined with a drainage device, or an ostomy bag combined with a skin protector reduced the incidence of incontinence-associated dermatitis [5,6]. However, the advantages and disadvantages of the effectiveness of different methods to prevent incontinence-associated dermatitis are not clear, so this study used the method of reticulated Meta-analysis to systematically evaluate the effectiveness of two or more different methods to prevent the incidence of incontinence-associated dermatitis and rank them according to the effectiveness of outcome indicators to arrive at the best prevention method . In order to provide a more objective basis for clinical practice.

2. Source of data and study methods

2.1 Inclusion and exclusion criteria

2.1.1 Study type Randomized Controlled trial (RCT) of different methods for the prevention of incontinence-associated dermatitis.

2.1.2 Study population Patients aged ≥18 years with incontinence-associated dermatitis.

2.1.3 Intervention Intervention group: skin protectant, ostomy bag combined with drainage device, ostomy bag, ostomy bag combined with skin protectant, drainage device, built-in tampon, absorbent product; control group: usual care.

2.1.4 Outcome indicators Incidence of incontinence-associated dermatitis.

2.1.5 Exclusion criteria

(1) Repeatedly published or incomplete relevant data; (2) Nursing measures for therapeutic purposes; (3) Non-English and Chinese literature; (4) Those with combined pressure sores; (5) Studies with outcome indicators that do not include incidence.

2.2 Search method

In this study, relevant literature from PubMed, CNKI, and VIP databases were searched, and the time range was from the date of database creation to January 2019. English search terms included: Incontinent-related dermatitis, Incontinence associated dermatitis, Ncontinence-associated dermatitis, Incontinence related dermatitis, Incontinence-associated dermatitis, Randomized controlled trial, RCT; Chinese search terms included: Incontinence-related dermatitis, Fecal water dermatitis, Randomized, Randomized controlled trial.

2.3 Literature screening and data extraction

The author went through the steps of literature screening and data extraction, and when different opinions were encountered, re-screening was performed according to the inclusion criteria. The content extracted by the homemade data extraction form was: first author, time of publication, type of study, sample size of each group, age, specific details of prevention methods, outcome indicators and key elements of risk of bias evaluation.

2.4 Risk of bias evaluation of included studies

This study was based on the evaluation criteria of the RCT . The evaluation included: generation of random sequences, allocation concealment, blinding of participants and investigators, blinding of outcome measures, completeness of outcome indicators, selective reporting, and bias from other sources. Each item was evaluated as "low risk of bias", "unclear" and "high risk of bias".

2.5 Statistical analysis

R 3.5.2 software gemtc package and JAGS 4.3.0 software were used for data analysis. The number of pre-iterations was set to 25,000 and the number of iterative operations was set to 50,000. The incidence of incontinence-associated dermatitis was calculated using the odds ratio (OR) with 95% CI. the magnitude of heterogeneity was judged by I2, and if $I2 \leqslant 50\%$, the data could be analyzed directly; if $I2>50\%$, the source of heterogeneity was first excluded before data analysis. The node-splitting model was used to determine the consistency, and when $P<0.05$, it indicated a statistical difference between direct and indirect comparisons . Potential scale reduction factor (PSRF) was used to evaluate the convergence of the model, and when PSRF was close to or equal to 1, it indicated that the model converged well and the conclusions of the consistency model analysis had high confidence. Stata 13.0 was used to plot network relationships and funnel plots to identify the presence of publication bias.

3. Results

3.1 Literature screening results

Through the initial screening of the literature, a total of 1633 papers were obtained and 24 RCTs were finally selected [12-35]. The number of patients was 2367 cases. The specific process and results are shown in Figure 1.

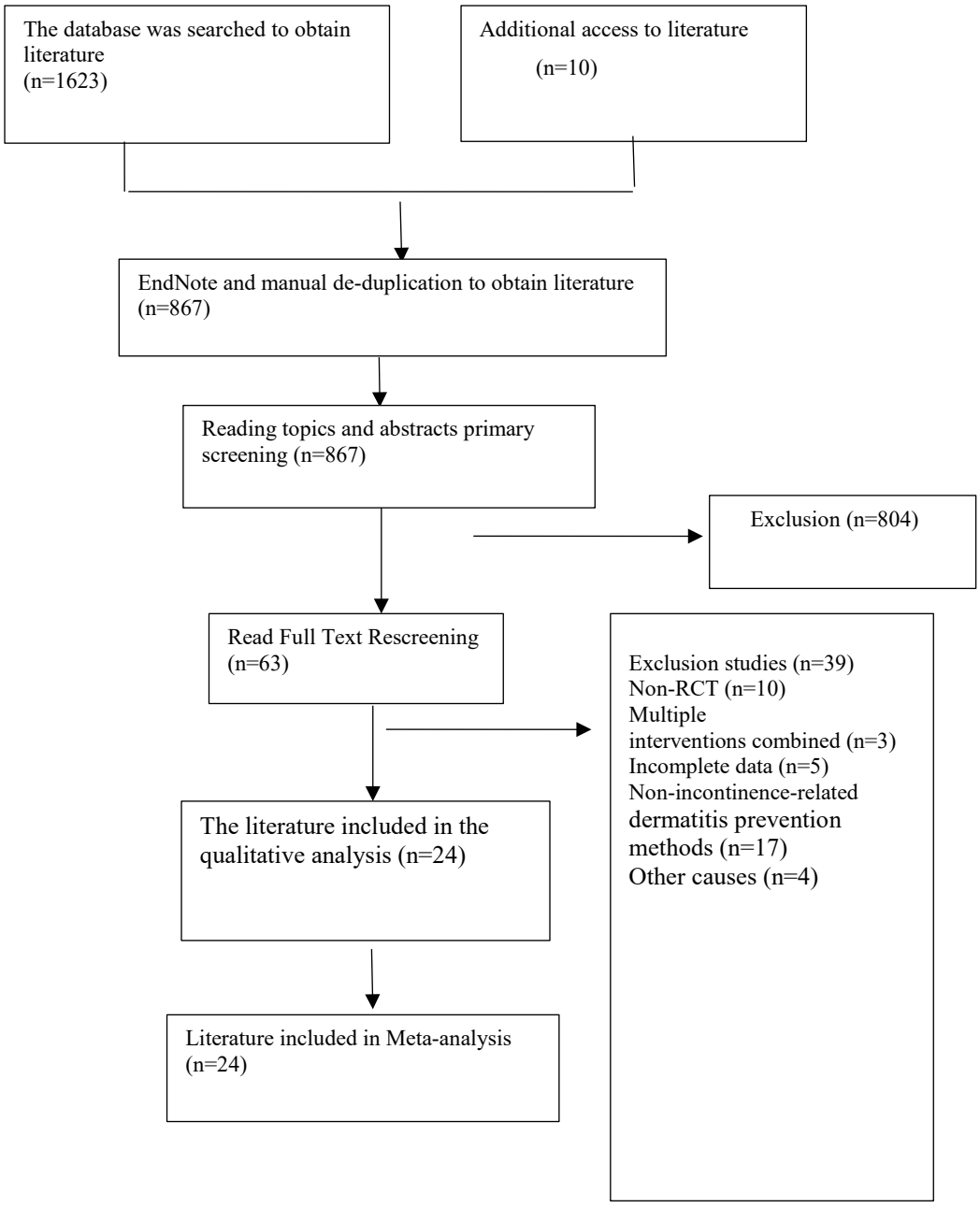

Figure 1. Document screening process and results

3.2 Basic characteristics of the included studies

Of the 24 articles selected [12-35], 20 were in Chinese,4 in English and contained 8 different prophylaxis methods, specifically skin protectant, ostomy bag combined with drainage device, ostomy bag, ostomy bag combined with skin protectant, drainage device, built-in tampon, absorbent product, and routine care. The basic characteristics are shown in Table 1, and the mesh relationship diagram of different prevention methods is shown in Figure 2.

3.3 Literature quality evaluation results

The quality of these 24 literatures was B. Sixteen of them were randomized analyses using random number tables, and the other two used allocation concealment and blinding methods, respectively. All studies had good data integrity and no missing visits (Figure 3).

Table 1. basic characteristics of included studies

Researchers and Publication Date	Number of cases		Average age (years)		Interventions		Ending indicators
	T	C	T	C	T	C	
Chen, C.Y. 2015	32	31	65.06 ± 8.25	65.06 ± 8.25	Skin Protectant	Routine Care	Incidence
Meng, Xia 2017	45	45	55.16±6.27	55.16±6.27	Skin Protectant	Routine Care	Incidence
Yang WJ 2017	20	20	61.02	61.02	Skin Protectant	Routine Care	Incidence
Cen Yan 2017	28	28	68.5±0.3	68.5±0.3	Skin Protectant	Routine Care	Incidence
Dimitri Beeckman 2011	73	68	86.3	85.9	Skin Protectant	Routine Care	Incidence
Pam Cooper 2001	44	49	85	79	Combined drainage device for ostomy bag	Drainage device	Incidence
Wenjuan Wu 2015	33	33	30-75	30-75	Combined drainage device for ostomy bag	Routine Care	Incidence
Jiezhen Feng 2010	32	30	28-86	28-86	Combined drainage device for ostomy bag	Routine Care	Incidence
Die-Lian Ye 2014	32	31	67.38±14.89	65.82±14.62	Combined drainage device for ostomy bag	Routine Care	Incidence
Yıldız Denat 2011	15	15	Not reported	Not reported	Ostomy bag	Routine Care	Incidence
Fu Jing 2015	72	71	72±9.5	70±9.4	Ostomy bag	Routine Care	Incidence
Sun Lingli 2013	50	41	33-88	28-84	Ostomy bag	Routine Care	Incidence
Li Hui 2015	36	32	71.02±5.23	71.02±5.23	Ostomy bag	Routine Care	Incidence
Wang Fang 2012	63	63	33-88	41-84	Ostomy bag	Drainage device	Incidence
Chen Jinwen 2011	50	50	31-92	31-92	Ostomy bag	Routine Care	Incidence
Shi Yun 2011	32	32	62.5	62.5	Ostomy bag	Routine Care	Incidence
Sun, Lingli 2013	50	50	33-88	31-81	Ostomy bag	Built-in tampons	Incidence
Ye Dielian 2014	33	31	64.88±15.64	65.82±14.62	Stoma bag combined with skin protector	Routine Care	Incidence
Huang Yunxin 2014	55	45	49.16±18.57	46.82±19.42	Stoma bag combined with skin protector	Routine Care	Incidence
Sun Lingli 2013	50	41	31-81	28-84	Built-in tampons	Routine Care	Incidence
Yu Ying 2018	50	50	63.10±8.16	62.72±8.72	Built-in tampons	Routine Care	Incidence
Pakeeza A.Alam 2018	51	51	55.5±14.8	55.5±14.8	Absorption type products	Routine Care	Incidence
Li Hui 2015	41	32	71.02 ± 5.23	71.02 ± 5.23	Stoma bag combined with skin protector	Routine Care	Incidence
Chuan-Li Luo 2013	30	30	63.25±12.43	65.25±11.23	Stoma bag combined with skin protector	Routine Care	Incidence
Bao-Ling Dang 2015	40	40	64.1±12.7	64.1±12.7	Stoma bag combined with skin protector	Routine Care	Incidence
Jiu Qi Shan 2013	18	18	82.4±14.2	82.4±14.2	Stoma bag combined with skin protector	Routine Care	Incidence
Yu Yanping 2017	32	31	56.5±2	56.5±2	Combined drainage device for ostomy bag	Routine Care	Incidence
Huang Zixia 2013	100	100	67.23±8.77	67.23±8.77	Combined drainage device for ostomy bag	Ostomy bag	Incidence

Note: T: experimental group; C: control group

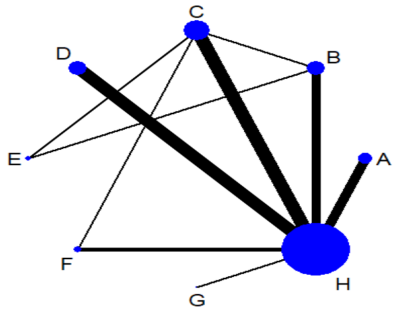

Figure 2. Incidence network relationship diagram

A: Skin protector B: Ostomy bag combined with drainage device C: Ostomy bag D: Ostomy bag combined with skin protector E: Drainage device F: Built-in tampon G: Absorbent product H: Routine care.

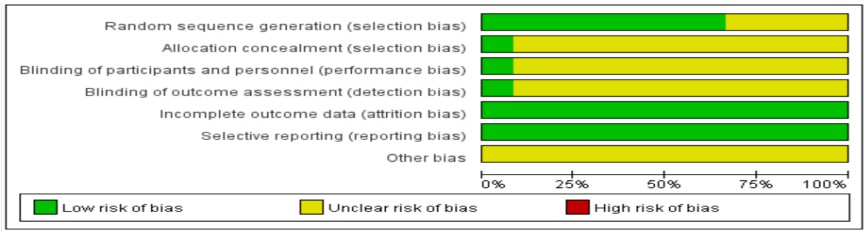

Figure 3. Risk of bias evaluation results for the inclusion of RCTs

3.4 Results of reticulated Meta-analysis of Incidence of Incontinence-Related Dermatitis

3.4.1 Convergence assessment

The PSRF value converged to 1 and reached stability after 50,000 iterations of calculation, and the median value of the reduction factor was 97.5%, indicating good convergence of the consistency model and high reliability of the analysis results (Figure 4).

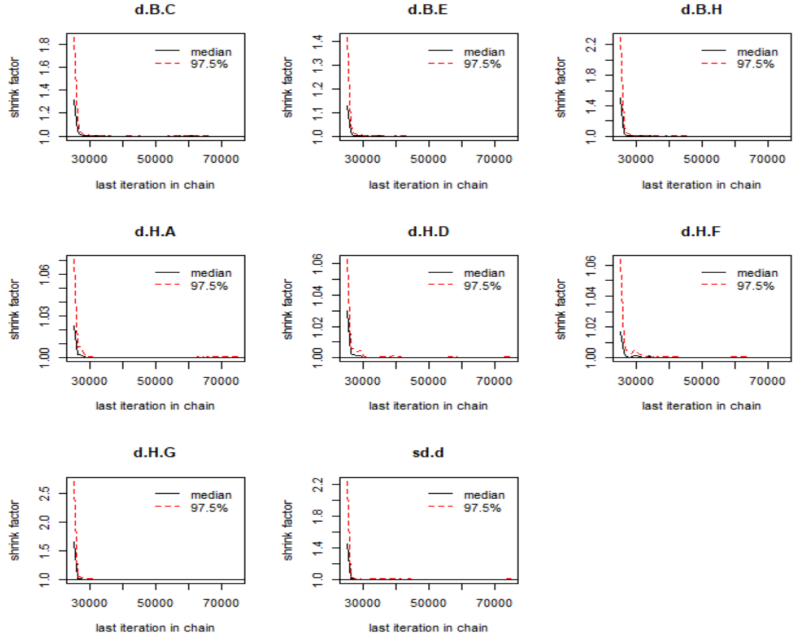

Figure 4. Convergent diagnostic map for reticulation analysis of the incidence of incontinence-associated dermatitis

A: Skin protector B: Ostomy bag combined with drainage device C: Ostomy bag D: Ostomy bag combined with skin protector E: Drainage device F: Built-in tampon G: Absorbent product H: Routine care

3.4.2 Consistency test

The results of the node-splitting model showed that the direct comparison was consistent with the indirect comparison results ($p>0.05$).

3.4.3 Results of reticulated Meta-analysis

The results of the reticulated Meta-analysis showed that relative to conventional care, skin protectant, ostomy bag combined with drainage device, ostomy bag, ostomy bag combined with skin protectant, and built-in tampon could reduce the incidence of incontinence-related dermatitis, and their prevention effect was better; the effect of ostomy bag combined with drainage device and ostomy bag in preventing the incidence of incontinence-related dermatitis was better than that of drainage device and built-in tampon; the effect of ostomy bag combined with skin protectant in preventing the incidence of incontinence-related dermatitis was better than that of built-in tampon; the differences among the remaining prevention methods were not statistically significant (Figure 5).

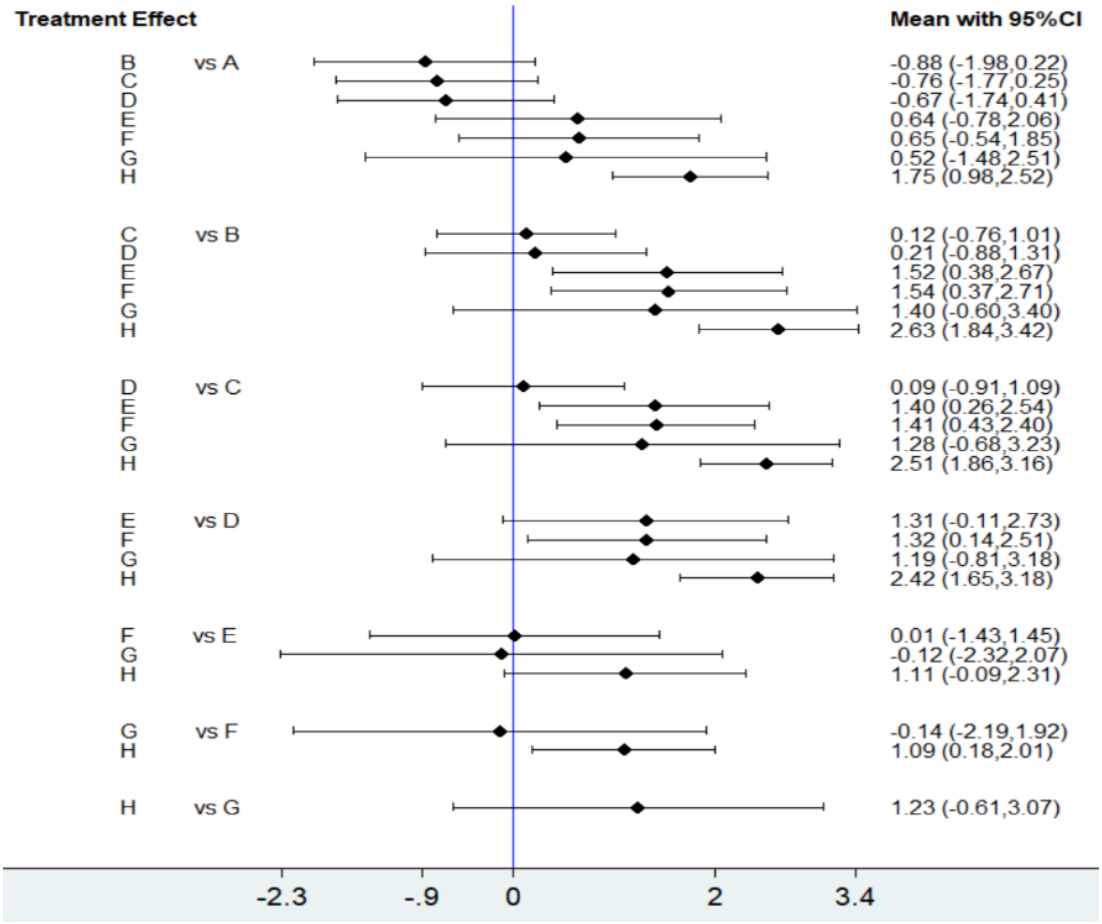

Figure 5. Results of reticulated Meta-analysis of the incidence of incontinence-associated dermatitis

A: Skin protector B: Ostomy pouch combined with drainage device C: Ostomy pouch D: Ostomy pouch combined with skin protector E: Drainage device F: Built-in tampon G: Absorbent product H: Routine care

3.4.4 Ranking of results

The results of the ranked probability plot showed that the order of preference of different methods to prevent the incidence of incontinence-related dermatitis was: ostomy bag combined with drainage device, ostomy bag, ostomy bag combined with skin protector, skin protector, drainage device, built-in tampon, absorbent product, and routine care (Figure 6).

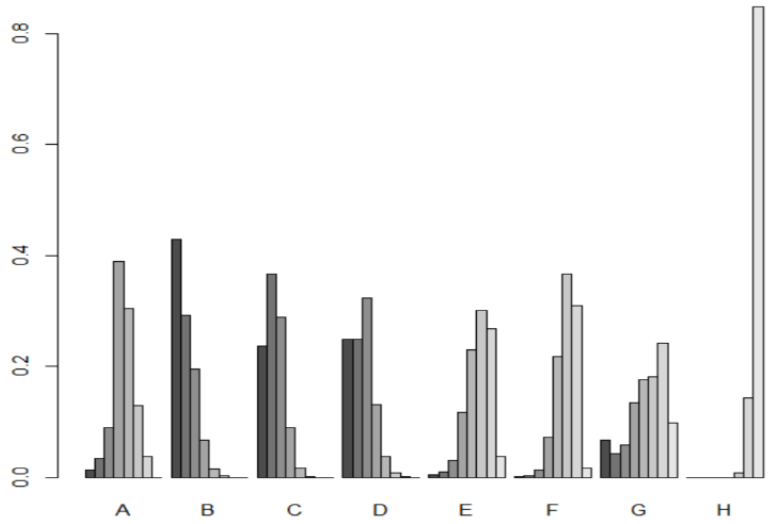

Figure 6. Ranking probability plot for the incidence of different methods to prevent incontinence-related dermatitis

A: Skin protector B: Ostomy bag combined with drainage device C: Ostomy bag D: Ostomy bag combined with skin protector E: Drainage device F: Built-in tampon G: Absorbent product H: Routine care

3.4.5 Publication bias test

The included studies were symmetrically distributed on both sides of the X=0 vertical line, suggesting a low likelihood of publication bias (Figure 7).

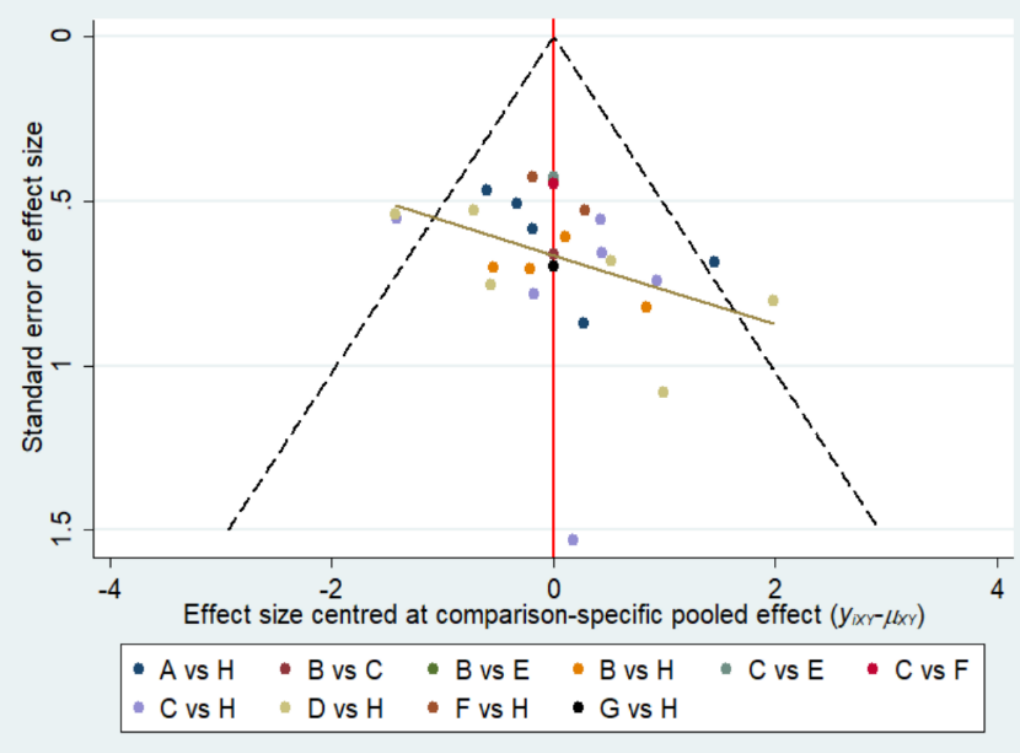

Figure 7. Funnel plot of publication bias test for incidence of incontinence-related dermatitis prevention by different methods

A: Skin protector B: Ostomy bag combined with drainage device C: Ostomy bag D: Ostomy bag combined with skin protector E: Drainage device F: Built-in tampon G: Absorbent product H: Routine care

4. Discussion

4.1 Methodological quality of the included studies

The 24 included papers were of moderate quality, all with a grade of B. Sixteen papers used computer-generated random number tables for randomization, eight papers only mentioned randomization without a detailed description of the random assignment method, two papers used allocation concealment and blinding, and the rest were not mentioned.

4.2 Best results for incontinence-related dermatitis prevention with combined drainage devices for ostomy bags

Defecation and stool control are a complex series of physiological processes in the normal movement of the anorectum and pelvic floor and the functional regulation of rectal smooth muscle and pelvic floor transverse muscle movement by nerves and body fluids . Studies have reported that formed feces contain less active enzymes and have a pH close to neutral, thus causing less damage to the skin. Post-fecal incontinence stools with high content of active enzymes and alkaline pH are more damaging to the skin: (1) the perineal and perianal skin is moist and eroded by metabolites; (2) the perianal skin is chemically irritated for a long time, resulting in damage to the stratum corneum, increased permeability, and decreased resistance. Intact skin has a role in preventing bacterial invasion and protecting the organism, but after the onset of IAD, patients present with erythema, edema, exfoliation, erosion and increased pain, which are caused by fragile skin and incorrect scrubbing methods that damage the epidermis and dermis of the skin, and in the case of secondary fungal infections, patients develop localized skin rashes with increased itching .

It is clinically important to take proactive and effective preventive measures before serious skin complications occur in patients with IAD, as it is believed that "prevention" is better than "cure" to reduce skin problems . In this study, the probability ranking chart showed that the combination of an ostomy bag and drainage device was the most likely to be the best preventive measure for incontinence-related dermatitis. The advantages are (1) the stoma bag is noninvasive, easy to handle , has a soft base and can record the amount of fecal excretion, which not only has a protective effect on the skin but also provides a basis for treatment ; (2) the use of the stoma bag combined drainage device can drain gas and stool into the drainage device in a timely manner, which can prevent the rupture of the stoma bag caused by excessive anal venting and prevent the foul odor of excrement from permeating the air in the air; (3) it effectively avoids the stimulation of perianal and sacrococcygeal skin by excreta, thus reducing the occurrence of perianal dermatitis; (4) it can avoid the distension of the stoma bag that has to be exhausted, the excessive contents that have to be replaced, the breakage of perianal skin caused by improper operation and the discomfort caused by the use of the stoma bag , which reduces the nursing workload, the cost of nursing materials and the number of patient moves, increasing the efficiency of nursing services and patient comfort.

4.3 Limitations of this study

(1) The methodological quality of the 24 included documents was moderate, and only two documents used allocation concealment and blinding, which may exaggerate the clinical efficacy and increase the heterogeneity among studies; (2) Although a comprehensive search of Chinese and English databases was conducted, fewer English documents met the inclusion criteria because the outcome indicator was the incidence of incontinence-related dermatitis; (3) Only Chinese and English documents were included in this study, and documents in other languages may be missed; (4) In addition to the incidence of incontinence-related dermatitis, the results should also consider the length of stay, comfort of patients, and the use of nursing material costs.

5. Conclusion

The results of this study showed that the combination of an ostomy bag and drainage device was the most effective in preventing the incidence of incontinence-associated dermatitis. However, as the differences between most of the prevention methods included in the analysis were not significant. Therefore, based on this study, it is recommended that more high-quality RCTs directly comparing different methods for the prevention of incontinence-related dermatitis should be conducted in the future to compensate for the shortcomings of indirect comparisons, and that economic effects should be considered with a view to selecting appropriate prevention methods according to patients' conditions and needs in clinical work.

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