


# Application of Best Evidence-Based in Neonatal Medical Adhesive-Related Skin Injuries

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## Abstract

**Objective:** In the Healthy Child Action Enhancement Program (2021-2025), it is proposed to ensure the safety and health of newborns and to promote high-quality development of health. Our department established risk assessment criteria for medical adhesives in neonates by applying the best evidence in the management program for the reduction of medical adhesive-associated skin injuries in neonates, in terms of the use and removal of adhesives. **Methods:** A systematic search and quality assessment of topics related to medical adhesive-related skin injury in neonates was conducted to summarize the best evidence and to conduct a quality review in the neonatal unit. **Results:** After 2 rounds of review, medical and nursing staff in the neonatal unit had a 98% compliance rate for the knowledge of neonatal medical adhesive-related skin injury and a satisfactory compliance rate for the other 9 indicators; after the application of the evidence, the incidence of neonatal medical adhesive-related skin injury was significantly lower than that before the application of the evidence, and the differences were statistically significant ( $P < 0.05$ ). **Conclusion:** The application of the best evidence-based management program in neonatal medical adhesive-associated skin injury can reduce the incidence of neonatal medical adhesive-associated skin injury, reduce neonatal infections, and improve the integrity of the protective skin barrier in neonates.

## Keywords

Evidence-Based, Nursing Management, Neonates, Medical Adhesive-Related Skin Injury, Satisfaction

## 1. Introduction

With the continuous development of high-quality care for newborns and the

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Healthy Child Action Enhancement Program (2021-2025), it is proposed to promote high-quality development of health by ensuring the safety and health of newborns. In our department, the best evidence of the management program of standardizing the use and removal of adhesive to reduce the medical adhesive-related skin injury in newborns is clinically applied to establish the risk assessment criteria and nursing process of medical adhesive in newborns. MARSIs refers to the manifestation of skin erythema, blisters, vesicles, and avulsion injuries that occur after the removal of medical adhesive, and last for at least 30 min. Overseas scholars [1] [2] showed that the Medical adhesive-induced skin injury is the main type of skin injury in neonates, with an incidence of 8% to 17% [3] according to relevant literature reports [4]. The occurrence of MARSIs in neonates is due to their own and external factors, such as their own skin characteristics, small gestational age, malnutrition, infection, systemic dehydration, skin condition (edema, dryness, excessive humidity), inappropriate temperature and humidity, blue-light therapy, the use of strong antiseptics, over-bathing, the use of antibiotics and anticoagulants, the nurses' lack of awareness of MARSIs, and incorrect selection of adhesive products and the methods of application and removal incorrect, etc. [5]-[8], coupled with the immaturity of the development of various systems, the need for medical care to support the treatment, a variety of operations require the use of medical adhesive, paste under the confined environment to promote the overgrowth of bacteria and microorganisms, prompting the overgrowth of yeasts and saprophytic fungi, prone to cause infiltration, vesiculitis, and damage [9]. The occurrence of MARSIs not only increases neonatal pain but also raises the risk of skin infections, affecting the treatment of neonatal diseases and increasing clinical medical burdens [10]. This study aims to summarize the best evidence for reducing neonatal medical adhesive-related skin injuries, resulting in nine quality review criteria, which are applied in neonatal clinical nursing practice. The present study is aimed at reducing the best evidence for medical adhesive-associated skin injuries in newborn infants to be applied to neonatal units Clinical nursing practice, through the risk assessment criteria and care of neonatal MARSIs, prognosis and warning to reduce the key aspects of MARSIs occurrence, in order to improve the management ability of nurses and to reduce nurses' incidence, and at the same time to improve the satisfaction of the doctor-patient-nursing-degree tripartite, and ultimately to improve the quality of high-quality services.

## 2. Methods

### 2.1. Evidence Retrieval

PIPOST was used to construct evidence-based questions, in the neonatal unit, through the training and assessment of nurses with a 100% pass rate, the risk assessment of MARSIs in hospitalized neonates, to ensure that the skin of neonates using medical adhesive is intact, with the keyword "medical adhesive-related skin injury" as the Chinese search term, to search the Chinese Biomedical Literature Database. The keyword "medical adhesive-associated skin injury" was used as the

search term to retrieve the guidelines and expert consensus in the Chinese Biomedical Literature Database, and to summarize the evidence, systematic evaluation, and randomized controlled trials. The search period was from January 2010 to May 2021. Inclusion criteria: clinical decision support systems, clinical practice guidelines, expert consensus and evidence summaries based on original studies. Exclusion criteria: traditional reviews, not based on expertise in the field, interventions outside the hospital context. A total of 216 articles were retrieved from Wanfang, VIP, and CNKI websites. By using EndNote management software, 116 articles were excluded. After re-screening through reading titles and abstracts, another 64 unrelated articles were excluded. Finally, after reading the full texts, 20 more unrelated articles were excluded, leaving 16 articles included.

## 2.2. Inclusion of Evidence

1) Included Literature A total of 16 relevant literatures were included in this study, including 1 clinical practice guideline, 1 expert consensus, and 14 clinical decision support systems.

2) Expert consensus evaluation After extracting the information by 2 researchers of the project team, the marker credibility level was evaluated according to JBI's credibility scale for the Authenticity Evaluation Tool for Articles in the Consensus of Opinion Category (2016).

3) Clinical Decision Support System The information was extracted by 2 members of the project team and defaulted to the credibility level.

## 2.3. Evidence-Based Best Evidence

The evidence is as follows: 1) Assess and document the child's skin condition prior to the use of adhesive products, and at the time of removal and replacement of adhesive products (Level 5, Grade A recommendation); 2) Educate healthcare professionals about MARS, including skin preparation, medical adhesive application and removal techniques, and the use of skin protectors and/or adhesive removers (Level 5, Grade A recommendation); 3) Educate healthcare professionals about MARS, including skin preparations, application and removal techniques, and use of skin protectors and/or adhesive removers (Level 5, Grade A recommendation). Adhesive products should be selected based on the results of the skin assessment, intended use, risk of skin damage, and whether the adhesive product will be removed repeatedly (Level 1, Level A); 4) Follow appropriate adhesive product removal techniques, removing slowly, in the direction of hair growth, and in parallel at 0° or 180° (Level 2, Level A); 5) Apply skin protectors and adhesive removers, as appropriate (Level 1, Level A). 6) Use of skin protectors and adhesive removers as appropriate (level 1 evidence, level B recommendation) [11].

## 3. Application of Best Evidence for Neonatal MARS Management

From January 2021 to May 2020, a clinical study was conducted in our neonatal

unit, with a baseline review phase before evidence application, an evidence application phase, and an outcome evaluation phase after evidence application.

### 3.1. Baseline Review Phase

1) Establishment of the review team. The quality review team consisted of 9 members, including the head nurse of the department as the project leader, who was responsible for the process promotion and supervision of the evidence-based project, the coordination of various departments, and the training of medical and nursing staff in the department as well as quality control; the deputy head nurse and a quality control nurse as the deputy leader, who was responsible for the design of the program, the control of the process and the promotion of the program; a doctor and two senior nurses were responsible for the search of evidence and the evaluation of literature quality; the medical and nursing staff in the department were responsible for the application of evidence, data collection and analysis. A doctor and two senior nurses were responsible for evidence retrieval and literature quality evaluation; medical and nursing staff in the department were responsible for evidence application, data collection and analysis to summarize the project; a master's degree supervisor was also responsible for counseling the project, reviewing the best evidence, and providing methodological guidance throughout the project.

2) Constructing review criteria. Based on the above summary of evidence, members of the project team evaluated the feasibility, appropriateness, clinical significance and effectiveness of the evidence according to the FAME principle, and constructed a total of nine quality review indicators. a) There is a training assessment for the prevention of neonatal medical adhesive-related skin injury; b) Neonatal electrode sheet with a diameter of 2.5 cm is appropriate, and the use time is  $\leq 2d$ ; c) Transparent auxiliary material use time is  $\leq 7d$ ; d) Hydrocolloid auxiliary material use time is  $\leq 7d$ ; e) Proper application of medical adhesive tape: puncture point as the center, parallel to the skin cleavage line, tension-free paste, and skin fit tightly to avoid gaps or wrinkles; f) Proper shaping of transparent materials: pinch pressure catheter protrusion, film seal isolation plug; g) Effectively apply transparent dressing: from the center of the flat piece of excipients around the edge of the side of the pressure to remove the border, to prevent the edge of the roll; h) Properly securing an indwelling needle with medical adhesive:  $\Omega$  method of adhesive tape to extend the tube  $\cup$  fixation, the connector is higher than the end of the head of the needle hose; i) Correct method for removing adhesive: Avoid rapid tearing or excessive angle, remove the adhesive slowly along the hairs at a  $0^\circ$  or  $180^\circ$  angle, horizontally along the skin.

3) Developing a review of data collection methods. The project team used the following methods for baseline data collection. a) Check whether there is a relevant training program for healthcare workers in the department as well as training records, and check and assess the healthcare workers' mastery of knowledge related to neonatal hypoglycemia. b) To check whether the department has a

neonatal MARSİ risk assessment [12] and nursing routines; c) To review the table: to design a neonatal MARSİ quality control form, cluster verification, indicator data monitoring, and information summary table. d) View nursing paperwork: through nursing records to understand whether nurses conduct risk assessment and preventive care for all neonatal MARSİ populations admitted to the unit and nana. e) Viewing the medical prescription system: through viewing the medical prescriptions, we know whether the nurse reminds the doctor to issue medical prescriptions for risk assessment for the neonatal MARSİ high-risk population. f) Observation method: Responsible nurses checked each other on-site every day to see if the measures to prevent neonatal MARSİ were correctly implemented, and data reporting nurses recorded data on the occurrence of neonatal MARSİ on a daily basis, and summarized and analyzed the data on a monthly basis.

4) Development of the baseline review population. The study population of this baseline review was the neonates in the neonatal unit of the First People's Hospital of Jingzhou City from January 2021 to October 2021, 248 children admitted from January to May as the control group, and 270 patients admitted to the neonatal unit in June to October as the experimental group. Inclusion criteria: a) The age of children < 28 days at the time of admission; b) The use of medical adhesive products for children. Exclusion criteria: i) Congenital skin defects, poor regeneration, ii) Skin infection or damage at the time of admission. Eight neonatal nurses and one neonatologist were also included as study participants in this baseline review to evaluate healthcare professionals' knowledge of medical care related to neonatal MARSİ management.

### 3.2. Evidence Application Phase

The evidence application phase was implemented from January 2021 to May 2021. The project staff analyzed and summarized five main barriers and developed corresponding countermeasures.

Barrier factor 1: Lack of MARSİ-related knowledge Action strategy: the teaching team in the department develops a training assessment, conducts theoretical and practical training, and the training assessment is 100%.

Barrier factor 2: lack of MARSİ assessment scale, action strategy: with the project team leader and the neonatology attending physician is responsible for organizing the literature search, interpretation of evidence; set up a quality evaluation team, joint discussion, according to the evidence obtained and the characteristics of the neonatal skin, the development of "neonatal MARSİ risk assessment scale".

Barrier factor 3: Irregular use of medical adhesive. Action strategy: Systematic study of the evidence related to the prevention of neonatal MARSİ, incorporating it into the content of pre-service training, and standardized training and regular assessment for rotating nurses.

Barrier 4: Unstandardized removal techniques, Action strategy: Use vegetable oils or 3M adhesive remover to avoid rapid tearing or excessive angles, and remove the hairs slowly along the skin horizontally, at a 0° or 180° angle, and in a

smooth manner. Use ensures prevention of neonatal MARSI and reduces the incidence of neonatal MARSI.

Barrier factor 5: Daily quality control is not standardized, action strategy: the department did not use the quality control form and verification form for nurses to manage neonatal MARSI for quality control, and the corresponding action strategy formulated: each shift of the nurse in charge of the use of prevention of neonatal MARSI clustered verification form are carried out to evaluate the implementation of measures. Establishment of a neonatal MARSI risk assessment scale by general condition, skin condition, type of adhesive, and use, and giving bedside markings based on the assessment of mild, moderate, and severe MARSI risk to warn healthcare workers of the risk management of proper use and removal of medical adhesives. An evaluation mechanism led by the head nurse was established to develop a specialty quality control form and a cluster care verification form for prevention of neonatal medical adhesive-related skin injury, authorizing the responsible team leader to conduct self-inspection, the head nurse to conduct daily inspections, and the head nurse of the department to supervise at any time.

### 3.3. Effectiveness Evaluation Stage

Twenty-nine nurses in the neonatal unit and seven doctors in the neonatal unit, as well as 270 included neonates who met the inclusion criteria, were used as study subjects. The clinical review before and after the application of the best evidence 9 review indicators were reviewed. By applying the checklist developed by the project team to reduce the incidence of neonatal MARSI, the incidence of neonatal MARSI, the implementation rate of measures to verify the prevention of neonatal MARSI, and the satisfaction of the three parties, namely, doctors, nurses, and patients, with the nursing care and management of preventing neonatal MARSI, were all significantly improved before and after the application of the evidence.

### 3.4. Statistical Methods

SPSS 23.0 statistical software was used to statistically analyze all data. Quantitative data that conformed to normal distribution were expressed as mean  $\pm$  standard deviation ( $\bar{x} \pm s$ ), and t-test was used for comparison between groups.

## 4. Results

1) Clinical application of the 9 review indicators before and after evidence application Before evidence application, the attainment rate of indicator 1, indicator 1, 2, 3, 4, and 9 was 0, and the attainment rate of indicator 5, 6, 7, and 8 was 59.5%, 41.4%, 62.5%, 29.5%; after reviewing the evidence, the compliance rate of indicators 8 and 9 increased to 98.2% and 98%, and the compliance rate of the remaining 7 indicators reached 100%.

Clinical application of the 9 indicators before and after the use of evidence:

Indicators	Before applying evidence	After applying evidence
There is a training assessment for the prevention of neonatal medical adhesive-related skin injury	0	100%
Neonatal electrode sheet with a diameter of 2.5 cm is appropriate, and the use time is $\leq 2d$	0	100%
Transparent auxiliary material use time is $\leq 7d$	0	100%
Hydrocolloid auxiliary material use time is $\leq 7d$	0	100%
Proper application of medical adhesive tape	59.5%	100%
Proper shaping of transparent materials	41.4%	100%
Effectively apply transparent dressing	62.5%	100%
Properly securing an indwelling needle with medical adhesive	29.5%	98.2%
Correct method for removing adhesive	0	98%

2) The rate of tertiary indicators of neonatal MARSIs before and after the application of evidence, some studies show that the current hospitalized neonates have a chance of MARSIs of 8% to 17%. Taking into account the actual situation of the department, the first-level indicator was established: the incidence rate of neonatal MARSIs  $< 2\%$  (see **Table 1**); the second-level indicator: the qualified rate of MARSIs-related knowledge assessment  $> 97\%$  (see **Table 2**); and the third-level indicator: the rate of implementation of MARSIs preventive measures  $> 99\%$  (see **Table 3**).

**Table 1.** Level 1 indicators before and after evidence application: Incidence of neonatal MARSIs sites.

Time	Number of people	Total number of adhesive application sites	Number of sites	Incidence of MARSIs
Before application of evidence	248	2323	129	5.55%
After application of evidence	270	4653	70	1.50%

Note:  $P < 0.01$ .

**Table 2.** Secondary indicator: MARSIs related knowledge test pass rate before and after evidence application.

Time	Number of people	Number of participants	Number of eligible persons	Assessment pass rate
Before application of evidence	36	36	11	30.55%
After application of evidence	36	36	35	97.22%

Note:  $P < 0.01$ .

**Table 3.** Tertiary indicators before and after the application of evidence: implementation rate of MARSII preventive measures.

Time	Number of people	Total number of entries for preventive measures	Total number of entries implemented	implementation rate
Before application of evidence	248	3720	2015	54.16%
After application of evidence	270	4050	4012	99.06%

Note:  $P < 0.01$ .

3) The tripartite satisfaction of doctors, nurses, and patients before and after the application of evidence was significantly improved, from 75%, 82.7%, and 90% before implementation to 91.6%, 96.5%, and 98%, respectively (see **Table 4**).

**Table 4.** Tripartite satisfaction of doctors, nurses and patients before and after the application of evidence.

groups	doctor		physiotherapists		Patient's family	
	number of persons	satisfaction rate	number of persons	satisfaction rate	number of persons	satisfaction rate
control subjects	7	75%	29	82.7%	100	90%
Observation Group	7	91.6%	29	96.5%	100	98%
X <sup>2</sup>	4.699*		5.497		5.556	
P-value	0.037 < 0.05		0.021 < 0.05		0.016	

Note: \*Calculated using Fisher's exact probability method.

## 5. Discussion

This project is a continuous quality improvement based on the application of best evidence in neonatal medical adhesive-related skin injury, applying the latest evidence of neonatal MARSII to neonatal skin care practice, which led to a significant reduction in the incidence of neonatal MARSII, and the differences are statistically significant ( $P < 0.01$ ). The application of this best evidence to solve the actual clinical problems as a starting point, to monitor the data indicators as a summary analysis, starting from the management level, the implementation level, the quality control level, to form a closed-loop management with a beginning and an end, under the premise of the standardized nursing operating instructions, to take personalized nursing interventions, to reduce the incidence of neonatal MARSII, to improve the integrity of the largest protective barrier of newborn infants, and to standardize the use of, removal of medical adhesive nursing behavior, improving the satisfaction of the three parties: doctor, patient and nurse as well as prevent the occurrence of complications effectively.

## 6. Summary

Clinical application of neonatal MARSİ high-risk population guided by the best evidence can effectively and accurately include the neonatal MARSİ high-risk population into the supervision of the first level of quality control, cluster prevention management, and monitoring data indicators. Under the premise of standardized nursing operation instructions, personalized nursing interventions are adopted to ultimately reduce the incidence of neonatal MARSİ, standardize the nursing behavior of using and removing medical adhesive, protect the integrity of the neonate's largest barrier, enhance the ability of healthcare personnel to manage neonatal MARSİ, improve the importance of medical care and patient tripartite attention as well as satisfaction with neonatal MARSİ, and reduce the incidence of neonatal MARSİ. The incidence of MARSİ in neonates will be reduced, and the aim of combining the best evidence with clinical care and improving the quality of medical and nursing services will be finally achieved.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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