Medica Hospitalia
Journal of Clinical Medicine
Med Hosp 2023; vol 10 (3) : 283–288

OPEN ACCESS

Original Article

The Effectiveness of Skin Barrier Acrylate Terpolymer on Medical Adhesive Related to Skin Injury (MARSI) in Children at Pediatric Intensive Care Unit Dr. Cipto Mangunkusumo Hospital

Juanda Mutifa,Nani Nurhaeni, Efa Apriyanti

Nursing Master Program University of Indonesia, Depok Indonesia

p-ISSN: 2301-4369 e-ISSN: 2685-7898
https://doi.org/10.36408/mhjcm.v10i3.928

Accepted: May 10th, 2023
Approved: August 08th, 2023

Author Affiliation:
Nursing Master Program
University of Indonesia, Depok
Indonesia

Author Correspondence:
Juanda Mutifa
Prof. DR. Sudjono D. Pusponegoro Street,
Pondok Cina, Beji, Depok, West Java16424,
Indonesia

E-mail:
Mutifa.irwan@gmail.com

Abstract

Background : For a long time, the use of medical adhesives in invasive device installation procedures can cause medical adhesive related to skin injury (MARSI) in children; in order to minimize the risk of MARSI incidents, so that a skin barrier is needed before applying the adhesive. The purpose of this study is to determine the effectiveness of acrylate terpolymer skin barrier against medical adhesive related to skin injury (MARSI) prevention in children who are treated at the intensive care unit.
Methods : This study used a true experimental design which involved 46 children; it was divided into an intervention group of 24 respondents and a control group of 22 respondents who were treated by using medical adhesive due to the procedure for inserting an endotracheal tube and nasogastric tube. Samples were taken by using random sampling technique. The risk level of skin injury was assessed by using the Braden Q scale and the MARSI incidents were observed by using the observational format.
Results : The results showed that the acrylate terpolymer skin barrier was effective in reducing the MARSI in children who were treated at the intensive care unit with having a p-value of 0.03 (α <0.05). The use of an acrylate terpolymer skin barrier can be recommended to minimize the incidence of MARSI in children.
Conclusion : The use of acrylate terpolymer skin barrier significantly minimizes the incidence of MARSI in children.

Keywords : Skin Barrier, MARSI, Skin injury, Children

INTRODUCTION

PICU as an intensive care service which has various superior facilities and infrastructures, as well as the competent human resources in the field of intensive nursing. Firstly, PICU facilities and infrastructures are equipped by the continuous patient monitoring devices, both invasive (inserted directly into the body) and non-invasive (only attached to the body surface).[7] PICU is also equipped by life support equipment, namely a ventilator machine which is a breathing assistance machine.[15] Children care in PICU services requires the medical devices to support children life. Medical devices are placed in the PICU for various indications, ranging from prevention (eg, sequential compression), treatment or therapeutic (eg, tubing, surgical drains, nasogastric tube (NGT), oropharyngeal tube (OGT), endotracheal tube (ETT) and for diagnostic purposes) (eg sphygmomanometer, thermometer). NGT and ETT are often associated with the risk of skin injury (skin injury) as a result of the fixation technique performed.[16]

MARSI has many causes and it is related to the development of the patients disease, the knowledge, and the nursing staff experience.[14] Medical Adhesive Related Skin injury (MARSI) is a dermatological disorder in which erythema or other skin disorders are including vesicles, bullae, erosions or tears, appear and persist for 30 minutes or more after adhesive removal.[4] The repeated release may result in changes to skin barrier function and it increases the likelihood of MARSI. Skin irritation and abrasions are caused by MARSI, it can create conditions under the film for infection.[9] MARSI is known to have a significant effect on the quality of life of patients.[16] MARSI can occur in the pediatric population at intensive care units who frequently use medical adhesives.[15]

The skin barrier is a protective part between the skin and the adhesive, thereby reducing the risk of adhesive trauma.[5] The skin barrier is a very influential part of skin integrity and the outer skin barrier.[9] It is really needed and protected, so that it is not damaged and it has a functions properly. Damaging to the skin barrier, it can be triggered by internal and external factors, including medical adhesives.[2] The skin barrier is a protective layer between the epidermis and the adhesive which can reduce the risk of Medical Adhesive Related Skin Injury (MARSI), as well as protect the skin from body fluids, exudate, urine and feces.[3] Skin barriers are available in the form of acrylate terpolymers in water or organic solvents in the form of liquids and silicone barriers, and it is in the form of tissues, creams, applicators or sprays too. Liquid skin barriers are available in formats, such as foam applicators, wet wipes and sprays.[8] An alcohol-free skin barrier is highly recommended because alcohol can cause pain when it is applied to sore skin, broken skin, irritated skin, and the skin around wounds.[18] Skin damage to children will cause discomfort and affect the treatment process. Based on Consensus AWHONN (Association of Women Health, Obstetric and Neonatal Nurses) in 2007 recommended that medical adhesive choice and skin barrier application are as alternative to reduce MARSI.[16]

The high incidents of medical adhesive related skin injury (MARSI) to children who are treated at intensive care becomes a phenomenon to be studied because it is one patients safety indicators in hospital. The insidents of MARSI need to get a serious concern from the health workers to ensure the patients safety during the treatment at hospital. The aim of this study is to know the effectivity of giving skin barrier acrylate terpolymer towards the incidents of medical adhesive related skin injury (MARSI) in children who are treated at intensive room. Besides that, the researcher also want to know the relationship of respondents characteristic, the risk of *skin injury* and the *injury* and adhesive of substitution frequency against MARSI incidents.

METHODS

The design of this study was a true experimental with having a post-test control group design approach. Independent variable of this study was skin barrier acrylate terpolymer, while the dependent variable was the incidence of medical adhesive related skin injury (MARSI). The study involved 46 samples which had fulfilled for the criteria inclusion: the children with having the age of 1 month – 18 years old, installed of ETT and or NGT, treated at PICU Dr Cipto Mangunkusumo Hospital with the minimum length of stay were 3 days and it did not experience of MARSI. Then the respondents were divided into the intervention group and the control group by using a random sampling method. The total number of respondents obtained was 23 respondents from the intervention group and 23 respondents from the control group with an age range of 1 month to 18 years. The data collection technique used in this study was the anxiety level observation format of the Braden Q scale to assess the risk of skin injury which had been tested for validity and reliability by the previous researchers and an observation sheets to assess the MARSI category.[17] The data collection process was carried out on the third day of treatment by assessing the incidence of MARSI in the intervention group and the control group by a wound consultant (post-test). Data analysis was performed by using statistical tests with univariate and bivariate analysis methods. This research determines the Mann Whitney test for unpaired group data analysis because the data was not the requirements of the Chi Square test.

RESULTS

Univariate

Table 1 shows that the average of data distribution is based on the characteristics of the respondents age in the

TABLE 1
Characteristics of Respondents Age in the Intervention and Control Group

Body mass index	Average	Median (Minimum – Maximum)	IK 95%
Age			
Intervention	79.96	75.96 (4–207)	47.88–112.04
Control	47.68	49.16 (3–157)	25.89–69.48

TABLE 2
Characteristics of Respondents by Gender, Main Diagnosis, Installation Area of Acrylate Terpolymer Skin Barrier, Adhesive Replacement, Risk of Skin Injury Intervention and Control Group

Variable		Intervention group		Control Group	
		N	%	N	%
Gender	Boy	18	75	4	18.1
	Girl	6	25	18	81.9
Skin Barrier Installation Area	ETT	9	37.5	12	54.5
	NGT	15	62.5	10	45.5
Main Diagnostics	Medical diagnosis	15	62.5	18	81.9
	Surgical diagnosis	9	37.5	4	18.1
Risk of Skin Injury	No Risk	0	0	0	0
	Low Risk	13	54.2	7	30.4
	Moderate Risk	3	13	7	30.4
	High Risk	6	26.1	7	30.4
	Very High Risk	2	8.6	1	4.3
MARSI	Yes	3	12.5	9	40.9
	No	21	87.5	13	59.1

intervention group who has value of 79.9 months with an age range of 4 to 207 months, and the value of the confidence interval (CI) is 47.88–112.04. In the control group has a mean value of 47.6 months with an age range of 3 to 167 months and a CI value 25.89–69,48.

Table 2 explains that the analysis of univariate gender on intervention group is dominated by boys which are 18 people (75%) and in control group are 18 girls (81.9%). For the most installation area of skin barrier acrylate terpolimer on intervention group is on the NGT area 15 people (62.5%) and fixation area of ETT is on control group 12 people (54.5%). The main diagnosis of the most respondents is from intervention and control group which is medical diagnosis with the amount of 15 respondents (62.5%) for intervention group and 18 respondents (81.9%) for control group. The risk's characteristic of skin injury to 46 respondents in this study is dominated by respondents with having a low risk of skin injury which are 20 respondents. Those low risks of skin injury for 13 respondents (54.2%) from intervention group and 7 respondents (30.4%) from control group. On the tabel explains that the risk of skin injury: low risk and moderate risk; the moderate risk gets the same result for 7 respondents (30.4%). The distribution of MARSI category can be seen from the frequency of MARSI incidents on intervention group which is 21 respondents (87.5%) who do not experience MARSI after using skin barrier acrylate terpolymer. For control, there are 9 repsondents (40.9%) who get having MARSI while 13 respondents (59.1%) is not.

Data showed on Table 3, it can be explained that the replacement of skin barrier is assesed during 3 days of observation period after giving intervention of skin barrier acrylate terpolimer installation on intervention

TABLE 3
Variable Identification of Skin Barrier Replacement and Skin Injury Risk in the Intervention and Control Group)

Variable	N	Minimum	Maximum	Means	Median	SD
Replacement Frequency Skin Barrier (Control group)	22	3	6	4.05	4.00	0.899
Replacement Frequency Skin Barrier (Intervention Group)	24	3	6	3.83	3.00	1.007

TABLE 4
Differences in MARSI Incidence between the Control Group and the Intervention Group

Variable	Mean / Mean Ranking	Z Count	P value
The MARSI event			
Control Group	26.91	-2.168	0.030
Intervention Group	20.38		

*Mann Whitney, *Sig <0.05

TABLE 5
The Relationship between Age, Gender, Frequency of Adhesive Replacement, Risk of Skin Injury and Area of Installation of Skin Barrier Acrylate Terpolymer Against MARSI

Variable	N	Correlation Coefficient (r)	P value
Age	46	-0.207	0.167
Gender	46	0.070	0.643
Adhesive Replacement Frequency	46	0.216	0.149
Risk of skin injury	46	0.071	0.637
Installation Area Skin barrier acrylate terpolymer	46	-0.048	0.754
Main diagnosis	46	0.015	0.923

*Spearman, *Sig <0.05

group, and the installation is appropriate to hospitals standard : skin barrier hidrokoloid on control group. The replacement of skin barrier to respondents is conducted every day, with the number of adhesive replacement is obtained 3, 4, 5, and 6 times. From the analysis result is obtained the most replacement frequency of skin barrier for 3 times; in which 13 respondents (54.2%) are on intervention group. In control group is obtained the most total replacement result which is the same is 3 and 4 times with 8 respondents (34.7%).

Bivariate

Analysis bivariate using the Mann Whitney test explains that the effectiveness of giving skins barrier acrylic terpolymer to the MARSI incidents inchildren which are treated at intensive room.

Table 4 describes the results of the Mann Whitney statistical test, the MARSI incidents explained that both intervention and control group showed in first group (intervention), the average was 20.38 this value was lower than the mean of the second group (control) was 26.91. The sig value in this test is 0.030 this value is smaller than the critical limit of 0.05 there is a significant difference between the two group.

Table 5 explains that there is no significant relationship between the variables of age, gender, frequency of adhesive replacement, risk of skin injury and the area of installation of the acrylate terpolymer skin

barrier to the incidence of MARSI. In this study, it can be concluded that there were no variable characteristics of the respondents who contributed to MARSI incidents in children who are being treated at the PICU Dr. Cipto Mangunkusumo Hospital.

DISCUSSION

Characteristics of Respondents

Based on the analysis result is the average of respondents age for intervention group which is 79.96% (75.96) months and for control group is 47.68% (49.16) months. The homogenity test result of respondents age show that all research variables have a same variety, it is proven by the sig value > p value 0.05; it means that the obtained data is the same or homogenous. Some studies are related to the insident number of skin injury to children is in United States which reported approximately to 1.4%,[17] in Spain with having the same of incidents number to children from 23 hospitals are 3.31%, in which 1.79% happened at pediatric general care unit especially for children, and 9.39% happened at pediatric intensive care unit. The highest insidents number of skin injury was happened to children with having the age of 1 year (4.77%) then the age of 1–3 years (2.89%). The majority of gender of each intervention group is boy and for control group is girl.[12]

In theory, it is not found that gender influences to damage skin integrity. The study was observed by Alfiyanti (2012) stated that there was no significant relationship of gender with the insidence of pressure sores in treated children at PICU. These studies showed that the factor of gender do not influence to the damage sk integrity.[1] The study conducted by Wang *et al*, found that the significant distinction on gender, age, long hospitalization, oedema, infection, score of Braden Q, and erythema or skin injury.[19]

In this study, the main diagnosis of patients is categorized into 2 large groups: medical and surgical diagnosis. The majority of children diagnosis on each group is medical. In this study, the installation area of medical adhesive and the installation of skin barrier at once are fixation area of ETT and or NGT. For the highest of installation area of skin barrier acrylate terpolimer is on intervention group which is NGT area 15 people (62.5%) and fixation area of ETT on control group 12 people (54.5%). This study result is appropriate to the study of Kim *et al*, (2019) who had a study of MARSI at pediatric intensive care unit. The purpose of using fixation in this study are: fixation of CVC, fixation of ESD, fixation of NGT, fixation of ETT, fixation of urinary catheter, fixation of NTT, fixation of line artery, fixation of blindfold, fixation of iv peripheral, and etc. From this study, it can be obtained the main reason of using medical adhesive, which is fixation of ETT, surgical wound dressing, fixation of urinary catheter, fixation of nasal cannula. It is also reported for the common of fixation area are face area, chest area, and legs area. Another study evaluated the daily usage of medical adhesive at 2 non-intensive of inpatient care unit is medical-surgical unit and heart unit. The study result reports that the highest daily usage of Medical Adeshive is for electrode of EKG, (90.3 cases per day), dressing IV peripheral (35.6 cases per day) and surgical dressing (13.6% case per day). The conclusion of Medical Adhesive usage at pediatric intensive and non-intensive care units are quite high needed a proper skin care.[6]

The Characteristics of Respondent with MARSI Incidents

This study also analysis the connection characteristics of respondent and the variable confounders of MARSI incidents; it is derived from the bivariate test results by using the Spearman test. The analysis results states that there are no significant relationship with having the P value <0.05. It means that the age variable of gender, diagnosis main, area installation, category MARSI, frequency replacement adhesive and risk skins injuries relate to significant with MARSI incidents in children treated at PICU of Cipto Mangunkuusmo Hospital. The study results are obtained that the factor uses decontamination during CVC and early detection by nurses in assessing risk skin allergies to the use of adhesives when changing dressings can affect skin injury incident.[13] While the factors of age, gender, medical diagnosis and area installation adhesive do not give contribution on incident skins injury.

Another researches that support to this research is study to find out MARSI incidents in oncology patients which consists of 156 attached respondents of peripheral IV catheter and they are given intervention of risk assessment, risk prevention and management risk of MARSI on group intervention; it is proven effective in controlling MARSI incidents in oncology patients with peripheral IV catheters. While the characteristics of respondents are age, gender, medical diagnosis, frequency of adhesive replacement does not affect to MARSI insidents.[20]

The Effectiveness of Skin barrier Acrylate Terpolymer to MARSI Incidents

The bivariat test of this study conducted to get know the effectiveness of skin barrier acrylate terpolimer usage againts MARSI incidents by conducting the data analysis of intervention and control group with using Mann Whitney test. From the test, it is known that there is significant relationship between the use of skin barrier acrylate terpolimer to MARSI incidents in children at intensive room installed by ETT and or NGT with having the value of p Value < 0.030. The supporting reearches for this study is the study to know MARSI incidents in children who treated at PICU. This study involves to

232 patients with MARSI category such as skin tear, skin stripping, tension injury, blisters, dermatitis contact and maceration which are given an adhesive dressing treatment made from acrylate that is proven to be effective in the wound healing process.[19] Another parallel researches with the study conducted to 98 patients of ICU who installed by central venous catheter (CVC) and it is maintained by using skin barrier acrylate terpolimer to be effective to protect skin, improve skin power, maintain skin integrity, and reduce the incidents of skin tears to patients who installed of CVC at ICU with having the value (P value 0.01). In this study, the reasercher categorizes regularly in perpheral skin care to patients who installed of CVC to avoid the occurance of MARSI.

CONCLUSION

Based on study result and the discussion of the effectivity skin barrier acrylate terpolimer againts medical adhesive related skin injury (MARSI) incidents in children who treated intensive room at Dr. Cipto Mangunkusumo Hospital, so it can be concluded that there is a significant distinction to MARSI incidents between control and intervention group with the p value 0.030 means that the administration of skin barrier acrylate terpolimer is effective in avoiding MARSI incidents to children who treated at intensive room Dr. Cipto Mangunkusumo Hospital.

REFERENCES

1. Alfiyanti, D., Nurhaeni, N., & Eryando, T. Pengaruh Perawatan Kulit Berdasarkan Skor Skala Braden Q terhadap Kejadian Luka Tekan Anak di Pediatric Intensive Care Unit (PICU) RS Tugurejo dan RS Roemani Semarang. Prosiding Seminar Nasional, 1(1); 2012
2. Arisanty, I. P. Konsep Dasar Manajemen Perawatan Luka. Penerbit Buku Kedokteran. ISBN 978-979-044-387-7; 2016
3. Barton, A. Prevention of medical adhesive-related skin injury (MARSI) during vascular access. British Journal of Nursing. 2021;30(6):1–7. https://doi.org/10.12968/bjon.2021.30.Sup2.1
4. Black J. M., Cuddigan J. E., Walko M. A., *et al*. Medical Device Related Pressure Ulcers in Hospitalized Patients. Int Wound J. 2010;7: 358–365.
5. Bryant RA. Types of Skin Damage And Di-Erential Diagnosis. In: Bryant R, Nix D, eds. Acute and Chronic Wounds: Current Management Concepts. 4th ed. St Louis, MO: Elsevier Mosby. 2012: 83–107.
6. Ferreira, D. H., Teixeira, M. L. O., Branco, E. M. S. C. Nursing Care in The Prevention of Adhesive-Related Skin Injuries in Surgical Wounds. Cienc Cuid Saude. 2017;16(2). https://doi.org/ 10.4025/Cienccuidsaude.V16i2.33421.
7. Fumarola S, Allaway R, Callaghan R, Collier M, Downie F, Geraghty J, Kiernan S, Spratt F. Overlooked and Underestimated: Medical Adhesive-Related Skin Injuries. Best Practice Consensus Document on Prevention. J Wound Care 29(Suppl 3c). 2020:S1–S24.
8. George M, Pal U, Guduri V, Smith G. Use of a barrier film (3M Cavilon No Sting Barrier Film) to reduce local skin complications around peripherally inserted central catheter lines: a randomised prospective controlled study. WCET J. 2016;36(4):8–13.
9. Habiballah, L. Prevalence of Neonate Adhesive Skin Injuries in a Jordanian Intensive Care Unit. Nursing Children and Young People. 2017;29(10): 42–46. https://doi.org/ 10.7748/ncyp.2017.e966.
10. Handayani, S., Budiman, A., & Adawiah, R. The Damages of Medical Records in the Outpatient Room in Dr. R. Soeharsono Lv. III Hospital Banjarmasin. Formosa Journal of Sustainable Research. 2022;1(5): 671–680.
11. Hsu MY. Skin-related Damage Care. The New Concepts of Wound Care. 3rd ed. Taipei City, Taiwan, Republic of China: Farseeing; 2017:217–50.
12. Kim, M. J., Jang, J. M., Kim, H. K., Heo, H. J., Jeong, I. S. Medical Adhesives-Related Skin Injury in A Pediatric Intensive Care Unit: A Single-Center Observational Study. Journal of Wound, Ostomy and Continence Nursing. 2019;6(11): 491–6. https://doi.org/ 10.1097/WON.0000000000000592.
13. Kutzscher, L. Management of irritant contact dermatitis and peripherally inserted central catheters. Clinical Journal of Oncology Nursing. 2012;16(2). https://doi.org/10.1188/12.CJON.E48-E55
14. LeBlanc, K., Baranoski, S., Christensen, D., Langemo, D., Sammon, M. A., Edwards, K., ... & Regan, M. International Skin Tear Advisory Panel: a tool kit to aid in the prevention, assessment, and treatment of skin tears using a Simplified Classification System©. Advances in skin & wound care. 2019;26(10): 459–476.
15. Marcato, J. O, Santos, A. S., Oliveira, A. J. F., Costa, A. C. L., Regne, G. R. S., Trindade, R. E., Noronha, K. V. M. S., Andrade, M. V. Medical Adhesive-Related Skin Injuries in The Neonatology Department of a Teaching Hospital. British Association of Critical Care Nurses. 2021. https://doi.org/ 10.1111/Nicc.12621.
16. Mcnichol, L., Lund, C., Rosen T., Gray, M. Medical Adhesive and Patient Safety: State of The Science: Consensus Statement for The Assessment, Prevention, and Treatment of Adhesive-Related Skin Injuries. J Wound Ostomy Continience Nurs. 2013;40 (4): 365–380.
17. Noonan, C., Quigley, S., & Curley, M. A. Q. Using the Braden Q Scale to Predict Pressure Ulcer Risk in Pediatric Patients. Journal of Pediatric Nursing. 2011;26(6): 566–575. https://doi.org/10.1016/j.pedn.2010.07.006
18. Voegeli, D. Moisture-Associated Skin Damage: Aetiology, Prevention and Treatment. British Journal of Nursing. 2021;21(9). https://doi.org/10.12968/bjon.2012.21.9.517.
19. Wang, D., Xu, H., Chen, S., Lou, X., Tan, J., Xu, Y. Medical Adhesive-Related Skin Injuries and Associated Risk Factors in a Pediatric Intensive Care Unit. Advances in Ski& Wound Care. 2019;32(4): 176–182. https://doi.org/ 10.1097/01.ASW.0000553601.05196.fb.
20. Zhao, Y., Bian, L., & Yang, J. Intervention efficacy of MARSI nursing management on skin injury at peripherally inserted central catheter insertion site on oncological patients. International Wound Journal. 2022;12 :2055–2061. https://doi.org/10.1111/iwj.13805