

Accuracy Between Dermoscopy Overview And Moisture Checker In Assessing Skin Moisture Level On Pediatric Nephrotic Syndrome Patients

Ramayanti boru Simandjuntak*, Sri Wahyuni Purnama**, Irma Damayanti Roesyanto-Mahadi**

* Post graduate of Dermatology and Venereology, Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia

**Departement of Dermatology and Venereology, Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia

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Abstract- Background: Xerosis cutis (dry skin) is a common condition experienced by millions of people, influenced by exogenous and endogeneous factors. Excessive bathing as an exogenous factor can cause dry skin. Endogenous factors such as chronic diseases and the use of certain medications can also affect skin moisture. Nephrotic syndrome (SN) is a common kidney disease in children and is characterized by the presence of protein that is released from the blood vessels and into the urine due to glomerular damage. Manifestations of xerosis cutis in the form of dull-looking have also been linked to the use of high dose diuretics in SN. Skin moisture examination can be evaluated with dermoscopy and moisture checker. **Methods:** This is an observational study with cross sectional design which involved 40 research subjects in which patients with pediatric nephrotic syndrome who met the inclusion and exclusion criteria were examined for skin moisture using a moisture checker and then dermoscopy. The results of the study were then analyzed to determine the Kappa value. **Result:** The most subjects in this study were male, 27 people (67,5%) with the majority of the age group 10-15 years, as many as 17 people (42,5%) of a total of 40 research subjects. The results of the examination with a moisture checker showed as many as 24 people (60%) had normal skin moisture checker and as many as 26 people (65%) in the dermoscopy overview did not show any scale. The value of accuracy between dermoscopy overview and moisture checker in assessing skin moisture level on pediatric nephrotic syndrome shows a kappa value of 0,622. **Conclusion:** The value of accuracy between dermoscopy overview and moisture checker in assessing skin moisture level on pediatric nephrotic syndrome is good (kappa value = 0,622)

Index Terms- accuracy, dermoscopy, moisture checker, skin moisture.

I. BACKGROUND

Xerosis cutis or dry skin is a common condition experienced by millions of people. It could be an acute or chronic condition as the consequences of environment, drug consumption, aging or other diseases. Most people get dry skin in their life, with a wide range of moisture.¹ There are three important keys take part in dry skin. They are: bounding substance called natural

moisturizing factor (NMF), fat skin and ceramide, and viable network in epidermal layer mediated by aquaporin water channel.^{2,3}

There are two factors involved in dry skin. They are endogenous and exogenous factor. Winter and summer are exogenous factors contributing to dry skin. Excessive bath also contributes to dry skin.⁴⁻⁷ There are many skin cleansers containing surfactant that could extract and emulsify fat in skin surface and intercellular fat between corneocyte and epidermis resulting in disruption of skin barrier.⁸ Endogenous factors also contribute to dry skin. The prevalence of dry skin increases with aging. This is caused by disorder in keratinization and depletion of lipid content in corneal layer. On the other hand, a chronic disease and certain medications could evolve in dry skin.^{3,4,7}

Nephrotic syndrome is a common kidney disease found in children. It is marked with protein loss from blood to urin as the impact of glomerular disruption. Nephrotic syndrome is defined with proteinuria >40 mg/m²/hour or protein/creatinin ratio >200 mg/mL or protein +3 on urine dipstic test, hypoalbuminemia <25 g/L and edema.⁸

Nephrotic syndrome in paediatric group could occur congenitally in the first 3 months of life.^{8,9} In such condition, a genetic mutation is usually the culprit, affecting podocytes of glomerular basal membrane. Even rare, the condition could also be caused by cytomegalovirus infection congenitally. Nowadays, it is yet unknown the most common etiology underlying it (idiopathic). Glomerular disorder, vasculitis, infection, toxin, malignancy, and genetic mutation might be the causative agent. Some complications could occur as direct impact of the disease or related to its medication. One of the complications on skin integument system is dermatitis. Its effect on skin moisture is not rare. The lack of NMF or aquaporin are the theory proposed by some experts.^{8,10}

Until this day, there are still limited publications reporting the exact number of dry skin in nephrotic syndrome. The predicted prevalence of dry skin is 50-58% in kidney failure patient undergoing routine dialysis.^{11,12} It is stated that dry skin is the most common skin disorder found on patients with chronically ill kidney.¹³ One of the causes of dry skin is the decrease and disrupt of functions of sebaceous gland resulting in epithelial cell dehydration.^{13,14}

It has been proved dermatologically and histologically that uremia could reduce sweat volume.^{12,14} In such patients,

atrophy of sebaceous gland has also been revealed. Some patients even suffered from ichthyosis and was linked to the tiers of kidney damage. Dry skin has also been linked to the use of high dose diuretic and excessive ultrafiltration.^{12,13} Dry skin are related to the change of skin barrier where the dry skin will be more vulnerable to irritation.^{7,11,14} A lesion on skin could be the source of infection which will exaggerate the primary disease. Because of that, patients suffering from dry skin need emolient to moisten their skin.¹⁵ Patients also need to be informed not to bath using too much soap because it will irritate the skin.^{8,16} Lotion application containing urea 10% with dexpanthenol supposed to reduce eritema and scale on patients suffering dry skin.

Dry skin can be diagnosed clinically with additional tools. Arid and dull skin are the cardinal sign on clinical examination. Beside that, scale and fissure could be found also.¹⁷ The additional tools used in dry skin are dermoscopy and moisture checker. Dermoscopy is a non-invasif technique which can visualize the epidermal layer and structures underlying it with more magnification.¹⁸ However, dermoscopy is relatively more expensive and a long experience from the expertise is needed to get a more objective value. Contrary, moisture checker is relatively cheaper, more practical, and more objective.¹⁹

In this study, the moisture of the skin of children suffering from nephrotic syndrome will be evaluated by moisture checker. Thus, the accuracy with the feature of dermoscopy will be analyzed.

II. OBJECTIVE

To asses the accuracy between moisture checker and dermoscopy in evaluating skin moisture in children suffering from nephrotic syndrome.

III. MATERIALS AND METHODS

This is an observational study with cross sectional design. This study was done from April till December 2019 in nephrology division pediatric outpatient clinic and dermato-venereology outpatient clinic, Haji Adam Malik General Hospital Medan, Indonesia. The subjects are children suffering from

nephrotic syndrome who came to the clinics fulfilling the inclusion and exclusion criteria. The total of the subjects in this study are 40 people. They are taken with concecutive sampling method. All patients diagnosed with nephrotic syndrome in nephrology division pediatric and dermato-venereology outpatient clinic, Haji Adam Malik General Hospital are the inclusion criteria. While the exclusion criteria are patients that have been treated with emolient, have other keratinization disorders, and refused to participate in this study.

This study was begun with explanation of the disease to the patient and his/her family and the purpose, procedure, and benefit of the test. After obtaining the consent from his/her parent, the demographic features, history taking, clinical and dermatological examination of the patient will be recorded. Lastly, the moisture of the skin will be recorded by using dermoscopy and moisture checker. Moisture checker Scalar type MY-808S and dermoscopy with its brand *firefly* are the tools used in this study. The procedure was begun by swabbing the tested skin area with alcohol 70%, then the dermoscopy was put on the skin. Some aspects which was evaluated are scale, fissure, erythema, and wether the skin is arid or not. Moreover, a moisture checker was put on the skin measured. The results would be displayed on the form of percentage. The results would be classified into 3 interpretations which was adjusted with the part of skin test. The skin area choosen to be tested in this study was inner upper arm. The skin was classified as dry if the value of moisture checker was <37%, normal if the value was 37–45%, and moist if the value was >45%. The data obtained from this study will be analyzed statistically to get kappa value.

IV. RESULTS

All the subjects in this study was first diagnosed with nephrotic syndrome in the clinics stated above. All the subjects experienced history taking, clinical examination, dermatological examination using dermoscopy, and skin moisture measurement using moisture checker.

The demographic characteristics of the subjects were displayed based on gender and age.

Table 1. Subjects distribution based on gender

Gender	Subjects	
	n	%
Boy	27	67,5 %
Girl	13	32,5 %
Total	40	100%

The total number of the subjects was 40 people, with the proportion of boys are 27 people (67,5%) and the proportion of girls are 13 people (32,5%). The results show that boys suffering from nephrotic syndrome is more than girls.

Table 2. Subjects distribution based on age

Age (year)	Subjects	
	n	%

1 – 5	9	22,5%
6 – 10	13	32,5 %
10 – 15	17	42,5%
16 – 18	1	2,5%
Total	40	100%

The majority of subjects are in the age group 10 – 15 year, they are 17 people (42,5%), and the least subject is in the age group 16 -18 year, namely just 1 person (2,5%).

Table 3. Subjects distribution based on skin moisture measured by moisture checker

Skin moisture measured by <i>moisture checker</i>	Subjects	
	n	%
Normal	24	60 %
Dry	15	40 %
Total	40	100%

There are 24 people (60%) had normal skin and 15 people (40%) had dry skin measured by moisture checker.

Table 4. Subjects distribution based on dermoscopic features

Dermoscopic feature	Subjects	
	n	%
Scale negative	26	65 %
Scale positive	14	35 %
Total	40	100%

In this study, there are 26 people (65%) children who have no scale on dermoscopic feature and 14 people (35%) who have scale on dermoscopic feature.

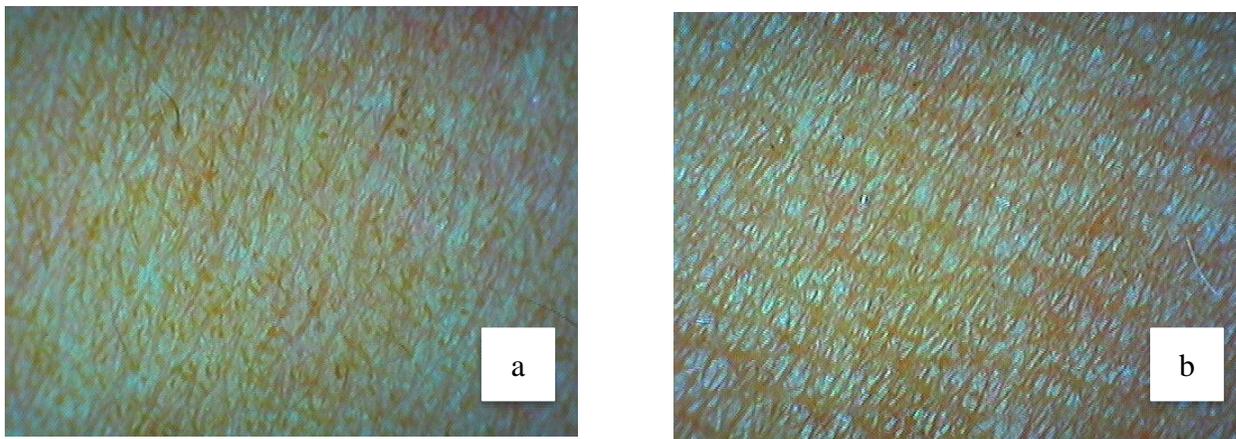


Figure 1a : Scale negative in dermoscopy examination and 1b scale positive in dermoscopy examination

Table 4. Accuracy between moisture checker and dermoscopy in evaluating skin moisture in paediatric nephrotic syndrome

		Dermoscopic feature			Kappa value
		Positive	Negative	Total	
Moisture checker	Positive	10 (71,42%)	5 (19,23%)	15 (37,5%)	0,622
	Negative	4 (28,58%)	21 (80,77%)	25 (62,5%)	
Total		14 (35%)	26 (65%)	40 (100%)	

It can be seen that there are 10 people (71,42%) whose tests are positive with moisture checker, 5 people whose tests are negative in dermoscopy (19,23%), and 21 people (80,77%) whose tests are negative in both dermoscopy and moisture checker.

V. DISCUSSION

Nephrotic syndrome affects 1-3/100.000 children less than 16 years old. In the literature, boys are twice more common affected than girl.^{20,23,24} The results are same with the study done in Dr. Kariadi General Hospital Semarang where the distribution of nephrotic syndrome for boys were 74,4%, girls were 25,6%, and the ratio was 2,9 : 1.²⁵ A study in Khartoum, Sudan held on 2001-2014 showed the same results, where boys are more common affected than girls, with the ratio 3:1.²⁴

Nephrotic syndrome is the most common kidney injury found in children. According to Kidney Disease Improving Global Outcomes (KDIGO), there are 1-3/100.000 children under 16 years old suffer from nephrotic syndrome.²⁵ The incidence of nephrotic syndrome in USA and UK were 2-7/100.000 children.²⁶ Five of 100.000 children per year in Japan suffer from nephrotic syndrome.²⁴ The prevalence of nephrotic syndrome in Indonesia were reported 6/100.000 children under 14 years old.²⁶

Fissure, fragile, and dry skin are common features found on dermoscopy. Scale can be found on dry skin, but sometimes do not on dermoscopy.¹⁸ Dry skin is an abnormality on the surface of skin caused by decreased of fluid or oil resulting in reduced skin moisture.²⁷ Dry skin is marked by decreased water content on corneal layer. Healthy skin should have >10% water content.²⁸ Increase of Trans Epidermal Water Loss (TEWL) caused by permeability defect on skin barrier could inflict dry skin. Defect on skin barrier can be caused by many factors. Disregulation of epidermal lipid content is one of the causes.^{17,28} Frequent bath with hot water and excessive soap usage are other factors contribute to skin barrier defect.^{1,29}

The cardinal sign of dry skin are dull skin, greyish white skin, and increased topographic skin markings.³⁰ The skin looks arid because it lacks its ability in refracting the light. When it becomes drier, scale could arise and the skin becomes rough.^{2,3}

Skin moisture could be evaluated by measuring TEWL with tewameter. While the hydration status of corneum layer could be measured by corneometer or moisture checker. TEWL measurement with tewameter is done by positioning the patient in

a chair at least 15 minutes before strating the measurement. The temperature of the room is set to be $21,9^0 \pm 2^0C$ with mean humidity 35,5% (28-38%). The patient then instructed not to applicate emolient or other applicants 4 hours before the examination.³¹ Moisture checker Scalar MY-808S is designed based on hydration status of corneal layer.¹⁷ It functions to give positive correlation between water content and dielectric percentage. Because of that, by measuring dielectric, the percentage of skin moisture could be measured.

Patients with nephrotic syndrome usually come with edema and hypertension.^{32,33} The treatment of edema in such patietnt is loop diuretic which will stimulate diuresis. It will in turn decrease intravascular volume and activate neuro-hormonal system. Hypertension could be found in the beginning of the disease or in the course of the disease because of steroid toxicity. Hypertension is first treated with Angiotensin Converting Enzyme (ACE) inhibitor, Angiotensin Receptor Blocker (ARB) or antagonist beta adrenergik. It is stated that anti-hypertension and diuretic also contribute to generate dry skin although the exact mechanism still unknown.²⁵

Accuracy test is evaluated by using the value of Kappa whose interpretations described by Cohen are as follows :

- Kappa $\leq 0,20$ means the accuracy is bad
- Kappa 0,21 - 0,40 means the accuracy is enough
- Kappa 0,41 - 0,60 means the accuracy is good enough
- Kappa 0,61 - 0,80 means the accuracy is good
- Kappa 0,81 - 1,00 means the accuracy is very good

The calculation of kappa value used in this study is processed by computer system. The Kappa value obtained is 0,622 which means that the accuracy between moisture checker and dermoscopy in evaluating skin moisture in children with nephrotic syndrome is good.

Dermoscopy is a non-invasive procedure which can visualize epidermal layer and structures underlying it with more magnification. Firstly, dermoscopy was used to evaluate and differentiate between melanoma and non-melanoma skin cancer.¹⁸ In the last decade, some studies have shown that dermoscopy is a non-invasive procedure which can help to diagnose other skin abnormality, like abnormality in hair (trichoscopy), nail (onicoscopy), infectious disease (entodermoscopy) and inflammatory dermatosis (inflamascopy).¹⁸ There are some prior studies which evaluate the accuracy between polarized and non-polarized dermoscopy on seborhoic keratosis lesion with a very good Kappa value 0,895.³⁴

Before this study was published, there was still no study assessing the accuracy between dermoscopic feature and moisture checker in evaluating skin moisture in children suffering from nephrotic syndrome. This study is the pilot study trying to look for their accuracy. In the end of this study, we found that moisture checker is a reliable, reproducible, sensitive, cheap, and practical tool for measuring skin moisture.

VI. CONCLUSION

The most subjects in this study are boys with 27 people (67,5%), while girls are 13 people (32,5%). The majority of the subjects are in the age group 10 – 15 year, with 17 out of 40 people (42,5%). Subjects with normal skin measured by moisture checker were 24 people (60%), while 15 people (40%) had dry skin. Accuracy value of dermoscopy and moisture checker in evaluating skin moisture in children suffering from nephrotic syndrome is 0,62 which means good accuracy. This result shows that moisture checker can be used to substitute dermoscopy in evaluating people suggestive of dry skin with lower cost.

VII. SUGGESTION

This study hopefully could be continued with diagnostic study comparing moisture checker with corneometer or tewameter to evaluate its sensitivity and specificity. The same thing can also be done to dermoscopy. In the next study, it is mandatory to avoid bias by performing the procedure sistematically, especially while measuring TEWL or hydration status of corneal layer.

ETHICAL ISSUE

This study was done after obtaining the ethical clearance letter from the ethical committee of Medical Faculty, North Sumatera University, Medan, Indonesia.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial, or otherwise.

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REFERENCES

- [1] White-Chu EF, Reddy M. Dry skin in the elderly: complexities of a common problem. *Clin Dermatol*. 2011;29(1):37–42.
- [2] Pons-Guiraud A. Dry skin in dermatology: a complex physiopathology. *J Eur Acad Dermatol Venereol*. 2007;21(2 suppl):1–4.
- [3] Draelos ZD. Clinical situations conducive to proactive skin health and anti-aging improvement. *J Investig Dermatol Symp Proc*. 2008;13(1):25–9.

- [4] Rawlings AV, Harding CR. Moisturization and skin barrier function. *Dermatol Ther*. 2004;17(1 suppl):43–48.
- [5] Jungersted JM, Hellgren LI, Jemec GB, Agner T. Lipids and skin barrier function—a clinical perspective. *Contact Dermatitis*. 2008;58(5):255–262.
- [6] Bonté F. Skin moisturization mechanisms: new data. *Ann Pharm Fr*. 2011;69(3):135–141.
- [7] Verdier-Sévrain S, Bonté F. Skin hydration: a review on its molecular mechanisms. *J Cosmet Dermatol*. 2007;6(2):75–82.
- [8] Draelos ZD. New channels for old cosmeceuticals: aquaporin modulation. *J Cosmet Dermatol*. 2008;7(2):83-7.
- [9] Kidney Disease : Improving Global Outcomes (KDIGO) Clinical Practice Guideline for Glomerulonephritis. *Kidney Int*. 2012;2:139-274.
- [10] Davison AM, Cameron JS, Grunfeld JP, Ponticelli C, Ritz E, Winearls CG, et al. Oxford textbook of clinical nephrology. 3rd ed. New York: Oxford university Press, 2005;42-8.
- [11] Markova A, Lester J, Wang J, Robinson-Bostom L. Diagnosis of common dermopathies in dialysis patients: a review and update. *Semin Dial*. 2012;25(4):408-18.
- [12] Szepletowski JC, Balaskas E, Taube KM, Taberly A, Dupuy P. Quality of life in patients with uremic xerosis and pruritus. *Acta Derm Venereol*. 2011;91(3):313-7.
- [13] Udayakumar P, Balasubramanian S, Ramalingam KS, Lakshmi C, Srinivas CR, Mathew AC. Cutaneous manifestation in patients with chronic renal failure on hemodialysis. *Indian J Dermatol Venereol Leprol*. 2006;72:119-25.
- [14] Khanna D, Singal A, Kalra OP. Comparison of cutaneous manifestations in chronic kidney disease with or without dialysis. *Postgrad Med J*. 2010;86:641-7.
- [15] Castello M, Milani M. Efficacy of topical hydrating and emollient lotion containing 10% urea ISDIN(R) plus dexpanthenol (Ureadin Rx 10) in the treatment of skin xerosis and pruritus in hemodialyzed patients: an open prospective pilot trial. *G Ital Dermatol Venereol*. 2011;146(5):321-5.
- [16] D. Barco, A. Giménez-Arnau. Xerosis: a Dysfunction of the Epidermal Barrier. *Actas Dermosifiliograficas* [internet]. 2008 [cited 2019 February 5]: 99(9): 671-682. Available from: ScienceDirect
- [17] Baumann L. Skin and moisturizer. In: *Cosmetic Dermatology. Principles and Practice*. Mc Graw Hill: New York. 2002: 29-32
- [18] Errichetti E, Stinco G. Dermoscopy in general dermoscopy: a practical overview. *Dermatol Ther*. 2016;6:471-507
- [19] Fathan H, Indriatmi W, Rihatmaja R, Krisanti I. The Role of Dermoscopy in Non-pigmented Skin Disorders. *J Gen Pro DVI*. 2016;1(2):44-53
- [20] Udayakumar P, Balasubramanian S, Ramalingam KS, Lakshmi C, Srinivas CR, Mathew AC. Cutaneous manifestations in patients with chronic renal failure on hemodialysis. *Indian J Dermatol Venereol Leprol* 2006;72:119-25.
- [21] Abdelbaqi-Salhab M, Shalhub S, Morgan MB: A current review of the cutaneous manifestations of renal disease. *J Cutan Pathol* 2003;30:527-38.
- [22] Brewster UC: Dermatologic manifestations of end-stage renal disease. *Hosp Phys* 2006;42:31-5.
- [23] Mettang T, Kremer AE: Uremic pruritus. *Kid Int* 2015;87:685-91.
- [24] Schwartz GJ, Work DF. Measurement and estimation of GFR in children and adolescents. *Clin J Am Soc Nephrol* [Internet]. 2009 [cited 2019 Apr 12];4(11):1832-43. Available from: Pubmed.
- [25] Lombel RM, Hodson EM, Gipson DS. Treatment of steroid-resistant nephrotic syndrome in children: new guidelines from KDIGO. *Pediatr Nephrol*. 2012:1-6
- [26] Serup J. EEMCO Guidance for the Assessment of Dry Skin (Xerosis) and Ichthyosis: Clinical Skoring System. *Skin Res Technol*. 2014;20:87-91.
- [27] Habif T. Principles of diagnosis and anatomy. *Clinical dermatology: a color guide to diagnosis and therapy*. 6th. Oxford:Elsevier;2016:1-5.
- [28] Vogt BA, Avner ED. Conditions particularly associated with proteinuria. Dalam: Kliegman RM, Stanton BF, Schor NF, Geme JWS, Behrman RE, penyunting. *Nelson textbook of pediatrics*. Edisi ke – 19. Philadelphia: Elsevier Inc. 2011:1755-7.
- [29] Kapoor S, Saraf S. Formulation and Evaluation of Moisturizer Containing Herbal Extracts for the Management of Dry Skin. *Pharmacognosy* [internet]. 2010 [cited 2019 March 19]: 2(11): 409-417. Available from: ScienceDirect
- [30] Kasma K, Marlinah. Karakteristik penderita sindrom nefrotik pada anak. *Journal of Pediatric Nursing*. 2014:99-103.

- [31] Ali E, Elhadi N, Abderlaheem M, Ellidir R. Childhood steroid-sensitive nephrotic syndrome: characteristics and predictors of relapses. *Sudan Journal of Medical Sciences*. 2018;13(3):133-43.
- [32] Hee Jin Byun, et al. Lipid Ingredients in Moisturizers can Modulate Skin Response to UV in Barrier-Disrupted Human Skin In Vivo. *Journal of Dermatological Science* [internet]. 2011 [cited 2019 Apr 1]: 65(2): 110-17. Available from: ScienceDirect
- [33] Draelos ZD. Therapeutic Moisturizers. In: *Draelos ZD Dermatologic Clinic*, vol. 18. No. 4 Philadelphia: WB Saunders co, Oktober 2000: 597-607
- [34] Bauman L. Dry Skin. In: *Cosmetic dermatology principles and practice*. Mc Graw Hill: New York. 2009: 83-93.

AUTHORS

First Author – Ramayanti boru Simandjuntak, Post graduate of Dermatology and Venereology, Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia, Phone: +62-81361764748; Email: ramayantibs@gmail.com

Second Author – Sri Wahyuni Purnama, Departement of Dermatology and Venereology, Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia

Third Author – Irma Damayanti Roesyanto-Mahadi, Departement of Dermatology and Venereology, Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia