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Original Article

Diagnostic performance of dermoscopy in cutaneous tumors: A retrospective analysis

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Abstract

Background Misdiagnosis of cutaneous tumors leads to inappropriate management, morbidity or mortality. Highly sensitive and specific diagnostic tools are needed. Dermoscopy evaluates surface of tumors rapidly and noninvasively but is limited to depth of dermal papillae. Histopathology is gold standard diagnostic of cutaneous tumors, but is invasive and time-consuming. This study evaluated diagnostic performance of clinical examination and dermoscopy compared to histopathology in determining diagnosis and nature of cutaneous tumors.

Methods This retrospective study included cutaneous tumor patients examined clinically, dermoscopically and histopathologically at Dermatooncology and Dermatosurgery Division, Dermatology and Venereology Outpatient Clinic, Dr. Soetomo General Academic Hospital, Surabaya in 2019-2020. Clinical, dermoscopic and histopathological diagnosis were obtained from medical record. Clinical diagnosis was established by board-certified dermatologists. Dermoscopic diagnoses were established from revised two-step algorithm. Histopathological diagnoses were established by board-certified pathologists. Clinical, dermoscopic and histopathologic nature were determined from respective diagnoses. Concordance, sensitivity and specificity of clinical examination and dermoscopy were calculated with histopathology as gold standard examination.

Results There were 27 subjects. Ten subjects had malignant tumors including basal cell carcinoma (7 subjects), squamous cell carcinoma, Bowen's disease, and Kaposi's sarcoma (1 subject each). Seventeen subjects had benign tumors including seborrheic keratosis (4 subjects), verruca vulgaris and lymphangioma (2 subjects each), solar lentigo, melanocytic nevi, pyogenic granuloma, hemangioma, pilomatrixoma, sebaceous gland hyperplasia, steatocystoma, neurofibroma and fibroepithelial polyp (1 subject each). Clinical and histopathological diagnosis showed moderate concordance (Cohen's Kappa (κ)=0.447). Dermoscopic and histopathological diagnosis showed fair concordance (κ=0.346). Clinical examination showed sensitivity 70.0%, specificity 70.6%, and fair concordance (κ=0.390) while dermoscopy showed sensitivity 100.0%, specificity 82.4%, and substantial concordance (κ=0.776) compared with histopathology in determining malignant nature of tumors.

Conclusion Dermoscopy is a valuable tool to support clinical examination, but cannot replace clinical or histopathologic examination in determining nature and diagnosis of cutaneous tumors.

Key words
Cutaneous tumors; Dermoscopy; Histopathology; Concordance; Human and health.

Introduction

Cutaneous tumors are overgrowth of some or all components of the skin.[1,2] They are classified into malignant or benign according to their growth nature.[2] Misdiagnosis of cutaneous tumors will lead to inappropriate management and increased morbidity and mortality, such as missed curative treatment for malignant tumors, or unnecessary excision of benign tumors.

Therefore, highly sensitive, specific and accurate diagnostic tools are needed.[3]

Cutaneous tumors can be diagnosed clinically, dermoscopically or histopathologically.[3,4] Histopathology is still the gold standard diagnostic of cutaneous tumors.[5] It evaluates tumors on cellular level and vertical dimension. However, it is invasive, requires protracted time and only evaluates less than 1% of tumor's volume. Thus, inaccurate sectioning may miss the focal area containing malignant cells.[4,6]

Dermoscopy is a rapid noninvasive tool to evaluate structures and colors on horizontal surface of skin lesions.[7–9] Dermoscopy showed better sensitivity (82.6 to 100%) than clinical examination (72.5%) and good specificity (96.2%) in diagnosing malignant cutaneous tumors. Dermoscopy may bridge clinical and histopathological examination to detect malignant nature and reduce misdiagnosis of cutaneous tumors.[4,7,10,11] However, dermoscopy is not able to evaluate history, consistency, elevation, depth beyond dermal papillae and cellular level of cutaneous tumors.[4]

Dermoscopy has been used in our institution since 2019 for examining cutaneous tumors. This study aimed to evaluate the diagnostic performance of clinical examination and dermoscopy compared to histopathology in determining diagnosis and nature of cutaneous tumors.

Methods

This study has been approved by Ethical Committee at our institution on September 2, 2021 with reference number of 0569/LOE/301.4.2/IX/2021. This retrospective study evaluated medical records and photographic database of new cutaneous tumor patients at Dermatooncology and Dermatosurgery Division, Dermatology and Venereology Outpatient Clinic, Dr. Soetomo General Academic Hospital, Surabaya in 2019-2020. Inclusion criteria were patients examined clinically, dermoscopically and histopathologically. Exclusion criteria were incomplete data or histopathological diagnosis other than cutaneous tumors.

Clinical, dermoscopic and histopathological diagnosis were obtained from medical record. Clinical diagnosis was established by board-certified dermatologists. Dermoscopic examination was done by board-certified dermatologists using cross-polarized dermoscope (DermLite II Pro HR®, 3Gen LLC, San Juan Capistrano, California) and findings were recorded. Dermoscopic diagnosis were established based on revised two-step algorithm by Marghoob *et al*. and Togawa.[12,13] Histopathological diagnosis were established by board-certified pathologists. Clinical, dermoscopic and histopathologic nature of cutaneous tumors were determined from respective diagnoses and stated as either malignant (including premalignant) or benign.

Cohen's Kappa (κ) were calculated to determine the concordance of clinical or dermoscopic diagnosis with histopathological diagnosis, also the concordance of clinical or dermoscopic nature with histopathological nature of cutaneous tumors. Interpretation of κ were: no to slight (κ=0.00-0.20), fair (κ=0.21-0.40), moderate (κ=0.41-0.60), substantial (κ=0.61-0.80) and almost perfect agreement (κ=0.81-1.00). Sensitivity and specificity of clinical examination and dermoscopy in determining

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nature of cutaneous tumors were calculated, using histopathology as gold standard examination.

Results

There were 27 subjects which fulfilled the inclusion criteria of this study. **Table 1** showed the clinical, dermoscopic and histopathologic diagnosis and nature of each subjects (in numerical order). Ten subjects had histopathological diagnoses of malignant cutaneous tumors, namely: seven subjects with basal cell carcinoma (BCC), and one subject each with squamous cell carcinoma (SCC), Bowen's disease and Kaposi's sarcoma. Seventeen subjects had histopathological diagnoses of benign cutaneous tumors, namely: four subjects with seborrheic keratosis (SK), two subjects each with verruca vulgaris and lymphangioma, and one subject each with solar lentigo, melanocytic nevi, sebaceous gland hyperplasia, steatocystoma, pilomatrixoma, pyogenic granuloma, hemangioma, neurofibroma and fibroepithelial polyp. Clinical and histopathological diagnosis showed moderate agreement (κ=0.447) with 14 subjects having discordant clinical and histopathological diagnosis. Dermoscopic and histopathological diagnosis showed fair agreement (κ=0.346) with 16 subjects having discordant dermoscopic and histopathological diagnosis.

Table 2 showed the dermoscopic findings and dermoscopic diagnosis of each subjects (in numerical order).

Table 1 Clinical, dermoscopic and histopathologic diagnosis and nature of the subjects (in numerical order).

No.	*Clinical diagnosis (nature)*	*Dermoscopic diagnosis* (nature)*	*Histopathological diagnosis (nature)*
1	BCC (malignant)	BCC (malignant)	BCC (malignant)
2	BCC (malignant)	BCC (malignant)	BCC (malignant)
3	BCC (malignant)	BCC (malignant)	BCC (malignant)
4	BCC (malignant)	BCC (malignant)	BCC (malignant)
5	MM (malignant)	BCC (malignant)	BCC (malignant)
6	SK (benign)	BCC (malignant)	BCC (malignant)
7	Melanocytic nevus (benign)	MM (malignant)	BCC (malignant)
8	SCC (malignant)	Keratoacanthoma (malignant)	SCC (malignant)
9	BCC (malignant)	BCC (malignant)	Bowen's disease (malignant)
10	Angiokeratoma (benign)	BCC (malignant)	Kaposi's sarcoma (malignant)
11	Epidermoid cyst (benign)	BCC (malignant)	Pilomatrixoma (benign)
12	Hemangioma (benign)	BCC (malignant)	Hemangioma (benign)
13	MM (malignant)	MM (malignant)	Solar lentigo (benign)
14	BCC (malignant)	SK (benign)	SK (benign)
15	BCC (malignant)	SK (benign)	SK (benign)
16	MM (malignant)	SK (benign)	SK (benign)
17	AK (malignant)	SK (benign)	SK (benign)
18	Epidermal nevus (benign)	SK (benign)	Verruca vulgaris (benign)
19	Verruca vulgaris (benign)	SK (benign)	Verruca vulgaris (benign)
20	Epidermal nevus (benign)	SK (benign)	Sebaceous gland hyperplasia (benign)
21	Fibroepithelial polyp (benign)	SK (benign)	Fibroepithelial polyp (benign)
22	Verruca vulgaris (benign)	Hemangioma (benign)	Lymphangioma (benign)
23	Lymphangioma (benign)	Hemangioma (benign)	Lymphangioma (benign)
24	Pyogenic granuloma (benign)	Hemangioma (benign)	Pyogenic granuloma (benign)
25	Steatocystoma (benign)	Nevus (benign)	Steatocystoma (benign)
26	Neurofibroma (benign)	Nevus (benign)	Neurofibroma (benign)
27	Melanocytic nevus (benign)	Melanocytic nevus (benign)	Melanocytic nevus (benign)

*Dermoscopic diagnosis was established according to revised two-step algorithm, BCC=basal cell carcinoma, MM=malignant melanoma, SCC=squamous cell carcinoma, SK=seborrheic keratosis.

Table 2 Dermoscopic findings and dermoscopic diagnosis of the subjects (in numerical order).

No.	*Dermoscopic findings*			*Dermoscopic Diagnosis**
	Step 1	*Step 2*	*Others*	
1	Lv.2 (multiple irregular blue-gray globules, ulceration)	Two axes asymmetry, blue-white veil	Linear straight vessel, crust	BCC
2	Lv.2 (leaf-like area, multiple irregular blue-gray globules, blue-gray ovoid nest, ulceration)	One axis asymmetry, multiple irregular blue-gray dots	Crust	BCC
3	Lv.2 (multiple irregular blue-gray globules, arborizing vessel, ulceration)	Undefined symmetry	Crust, erosion	BCC
4	Lv.2 (multiple irregular blue-gray globules, blue-gray ovoid nest, arborizing vessel, ulceration, shiny white areas)	Undefined symmetry	Shiny white strands and blotches, milky red areas, SFT, crust, erosion	BCC
5	Lv.2 (multiple irregular blue-gray globules, blue-gray ovoid nest)	One axis asymmetry	Brown SLA	BCC
6	Lv.2 (leaf-like area, multiple irregular blue-gray globules, shiny white area, ulceration)	Undefined symmetry	Crust	BCC
7	Lv.1 (streaks), Lv.2 (leaf-like area, multiple irregular blue-gray globules)	Two axes asymmetry, multicomponent pattern, multiple irregular blue-gray dots, radial streaming, scar-like depigmentation	-	MM
8	Lv.5 (peripheral hairpin vessel)	Undefined symmetry	Blood spots within amorphous keratin mass (scales)	Kerato-acanthoma
9	Lv.2 (ulceration)	Full symmetry, PSC	Erosion	BCC
10	Lv.2 (multiple irregular blue-gray globules, ulceration), Lv.4 (red to purple lacunae)	One axis asymmetry	White rail lines, crust, erosion	BCC
11	Lv.2 (ulceration), Lv.6 (linear irregular vessels)	Full symmetry, linear irregular vessels	Central white, peripheral pink and blue SLAs, white scales, crust, erosion	BCC
12	Lv.2 (multiple irregular blue-gray globules), Lv.3 (milia-like cysts, black network-like structures), Lv.6 (milky red globules)	Undefined symmetry, multiple irregular blue-gray dots	Whitish veil, umbilicated polilobular whitish SLA, milky red areas	BCC
13	Lv.1 (pigment network, irregular aggregated globules), Lv.6 (dotted vessels)	Undefined symmetry, multicomponent pattern, atypical pigment network, irregular blue-gray and brown dots, irregular globules, scar-like depigmentation, irregular dotted vessels	White scales, crust	MM
14	Lv.3 (comedo-like opening)	Full symmetry, PSC	-	SK
15	Lv.3 (comedo-like opening, crypts)	Full symmetry, PSC	-	SK
16	Lv.3 (comedo-like opening, cerebriform pattern)	Full symmetry, PSC	-	SK

No.	*Dermoscopic findings*			*Dermoscopic Diagnosis**
	Step 1	*Step 2*	*Others*	
17	Lv.3 (cerebriform pattern), Lv.4 (red lacunae)	Full symmetry	White rail lines, white scales	SK
18	Lv.3 (cerebriform pattern)	Full symmetry, PSC	Thick adherent scales	SK
19	Lv.3 (cerebriform pattern, crypts)	Full symmetry, PSC	White scales	SK
20	Lv.3 (milia-like cysts) Lv.5 (crown vessels)	Undefined symmetry, PSC	Yellowish SLA, milky red areas, SFT	SK
21	Lv.3 (cerebriform pattern, light brown fingerprint-like structures)	Full symmetry, PSC	White scales	SK
22	Lv.4 (Red to pink lacunae)	Undefined symmetry, PSC	Yellow lacunae, thin purple fluid levels	Hemangioma
23	Lv.4 (dark red lacunae)	Undefined symmetry, PSC	Whitish veil	Hemangioma
24	Lv.4 (red lacunae)	Full symmetry, PSC	White rail lines	Hemangioma
25	Lv.7 (featureless lesion)	Full symmetry, PSC, homogenous pattern	Yellowish SLA	Nevus
26	Lv.7 (featureless lesion)	Full symmetry, PSC, homogenous pattern	White scar-like area, white fingerprint-like structure	Nevus
27	Lv.1 (aggregated brown-black globules), Lv.2 (multiple regular aggregated blue-gray globules), Lv.3 (milia-like cysts, moth-eaten borders)	Full symmetry, PSC, cobblestone pattern	Multifocal perifollicular whitish SLA	Melanocytic nevus

*Dermoscopic diagnosis was established according to revised two-step algorithm, BCC = basal cell carcinoma, Lv = level, MM = malignant melanoma, PSC = presence of single color, SCC = squamous cell carcinoma, SFT = short fine telangiectasia, SK = seborrheic keratosis, SLA = structureless area

Subject with BCC (No. 7) and solar lentigo (No. 13) were misdiagnosed dermoscopically due to presence of step 1-level 1 and step 2 criteria of malignant melanoma, such as atypical pigment network, irregular aggregated globules, dots, streaks, or dotted vessels, radial streaming, scar-like depigmentation or multicomponent pattern. Four subjects, namely with BD (No. 9), Kaposi's sarcoma (No. 10), pilomatricoma (No. 11) or hemangioma (No. 12) were misdiagnosed dermoscopically due to presence of step 1-level 2 criteria of BCC (ulceration or multiple irregular blue-gray globules). Subjects with verruca vulgaris (No. 18 and 19), sebaceous gland hyperplasia (No.20), and fibroepithelial polyp (No. 21) were misdiagnosed dermoscopically due to presence of step 1-level 3 criteria of SK (cerebriform pattern or milia-like cysts). Subjects with lymphangioma (No. 22 and 23) and pyogenic granuloma (No. 24) were misdiagnosed dermoscopically due to presence of step 1-level 4 criteria of hemangioma (red lacunae). Subject with SCC (No. 8) was misdiagnosed dermoscopically due to presence of step 1-level 5 criteria of keratoacanthoma (peripheral hairpin vessels). Subjects with steatocystoma (No. 25) or neurofibroma (No. 26) were misdiagnosed dermoscopically as nevus due to presence of step 1-level 7 criteria of featureless lesions and absence of step 2 criteria of malignant melanocytic lesions.

Clinical and histopathological nature of cutaneous tumors showed fair agreement (κ=0.390), while dermoscopic and histopathological nature of cutaneous tumors showed showed substantial agreement (κ=0.776).

Table 3 Concordance, sensitivity and specificity of clinical, dermoscopic and histopathological examination in determining nature of cutaneous tumors.

Nature of cutaneous tumors	*Histopathological*		*κ*	*Sn**	*Sp**
	Malignant (N=10)	*Benign (N=17)*			
Clinical					
Malignant	7 (70.0%)	5 (29.4%)	0.390	70.0%	70.6%
Benign	3 (30.0%)	12 (70.6%)			
Dermoscopic					
Malignant	10 (100.0%)	3 (17.6%)	0.776	100.0%	82.4%
Benign	0 (0.0%)	14 (82.4%)			

κ = Cohen's Kappa, Sn = sensitivity, Sp = specificity, *for malignant nature

Clinical examination showed Sn 70.0% and Sp 70.6%, while dermoscopy showed Sn 100.0% and Sp 82.4% in determining malignant nature of cutaneous tumors compared with histopathology **(Table 3)**.

Discussion

From 2019 to 2020, only 27 patients were examined clinically, dermoscopically and histopathologically. This low number is because histopathological examination was only done on suspected malignant lesions and clearly benign lesions were exempted from this examination. Furthermore, COVID-19 pandemic on 2020 hampered dermoscopic and histopathological examination which required close contact with patients.

In this study, concordance of dermoscopic and histopathologic diagnosis showed fair agreement (κ=0.346). Study in Egypt reported better concordance between dermoscopic and histopathological diagnosis, with κ=0.859.[11] This difference may be due to different number of subjects, type of tumors and dermoscopic algorithm used which was not mentioned in the study. The concordance of dermoscopic and histopathologic diagnosis is also less than concordance of clinical and histopathological diagnosis showing moderate agreement (κ=0.447). This may be due to limited number of possible diagnosis in revised two-step algorithm, which only included malignant tumors such as malignant melanoma, BCC, SCC, keratoacanthoma and BD, and benign tumors such as melanocytic nevus, SK, solar lentigines, dermatofibroma, hemangioma, angiokeratoma, sebaceous gland hyperplasia, molluscum contagiosum and clear cell acanthoma.[12,13] In this study, there were 10 subjects with histopathological diagnosis not included in this algorithm and were certainly misdiagnosed dermoscopically, namely Kaposi's sarcoma, verruca vulgaris, pyogenic granuloma, lymphangioma, pilomatrixoma, fibroepithelial polyp, neurofibroma and steatocystoma. However, these 10 subjects may still be diagnosed clinically.

Chen *et al*. reported that dermoscopic misdiagnosis commonly resulted from misclassification of nonmelanocytic lesion as malignant melanoma, such as in regressing solar lentigines.[14] Papageorgiou *et al*. also reported that solar lentigines were misdiagnosed as malignant melanoma due to difficulty to differentiate broad network of solar lentigines and pigment network of malignant melanoma and presence of regression structures (multiple blue-gray dots and scar like depigmentation), as also seen in this study.[15] Misdiagnosis may also be caused by overlapping dermoscopic structures in several cutaneous tumors.[14] Papageorgiou *et al*. reported that follicular adnexal tumors were commonly misdiagnosed as BCC due to presence of blue-gray dots or globules and linear branching vessels.[15]

Pilomatrixoma, a follicular adnexal tumor, was also misdiagnosed as BCC in this study due to ulceration. Popadic reported that blurred lacunae may mimic blue-gray ovoid nests resulting in misdiagnosis of hemangioma as pigmented BCC, as also seen in this study.[16] Misdiagnosis may also be due to observer or technical error, like excessive pressure which compressed vessels rendering this structures invisible.[14] Chen *et al*. reported that prebiopsy diagnostic accuracy was not the primary goal, but was secondary goal of two-step algorithm, which may explain the fair concordance between dermoscopic and histopathologic diagnosis in this study.[14]

In this study, dermoscopy showed Sn 100,0%, Sp 82.4% and substantial agreement (κ=0,776) in determining malignant nature of cutaneous tumors. Study in Iran reported lower Sn (85.42%) and Sp (70.59%) in determining malignant nature of tumors, but study in Egypt reported higher Sn (100%), Sp (96.2%), and κ (0.859) than this study.[11,17] However, both studies did not state the algorithm used. Presence of false positive diagnosis in this study highlighted another limitation of revised two-step algorithm in which this algorithm does not consider all dermoscopic features to establish diagnosis. This algorithm can establish dermoscopic diagnosis based on presence of only one among several criteria in the first step. If a tumor showed dermoscopic features of several different level of the first step, the algorithm will select diagnosis based on the earlier level, which commonly resulted in diagnosis of malignant tumor. However, this study showed that dermoscopy successfully avoided false negative diagnosis in which malignant tumors are classified dermoscopically as benign. These false negative diagnosis is relatively more important than false positive diagnosis.[14]

This study also showed that concordance between dermoscopic and histopathologic nature of cutaneous tumors were better than concordance between dermoscopic and histopathological diagnosis. This is in accordance with primary goal of revised two-step algorithm, which is to determine malignant or benign nature of cutaneous tumors to decide whether to do biopsy.[14] This study also showed that dermoscopy had better diagnostic value and concordance than clinical examination in determining malignant nature of tumors. Therefore, dermoscopy is a valuable supporting tool for clinical examination in determining the nature of cutaneous tumors.

Our study has several limitations including its retrospective nature, relatively small number of subjects, and absence of malignant melanoma which is an important tumor in the development of dermoscopy algorithm. Other studies in Indonesia also reported absence of melanoma among skin cancer patients which may be due to rarity of melanoma in darker skin type.[1,18–20] Another limitation in this study is the use of only cross-polarized dermoscope which renders some dermoscopic structures less visible such as milia-like cysts or blue-white veil and partial dermoscopic examination in subjects with large lesions.[10]

Conclusion

In conclusion, dermoscopy is a valuable tool to support clinical examination in determining malignant nature of cutaneous tumors. Dermoscopy is also a fairly useful tool in establishing diagnosis of cutaneous tumors. However, dermoscopy cannot replace clinical examination because of its inability to evaluate history, consistency and elevation of lesions or histopathology as gold standard diagnostic because of its inability to evaluate tumors in cellular level and depth beyond dermal papillae.

Future prospective studies with both polarized and nonpolarized dermoscope, larger sample size or focusing on a specific type of cutaneous tumor are recommended.

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