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Comparative Analysis of Dermoscopy and Histopathology in the Diagnosis of Melanocytic Lesions in Bangladesh

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Skin cancer, particularly melanoma, is a growing global health concern, with its incidence steadily rising over the past few decades. In Bangladesh, like many other parts of the world, melanoma poses a significant public health challenge due to its potentially aggressive nature and associated morbidity and mortality. Early diagnosis is paramount in managing melanocytic lesions, as delayed detection can result in a more advanced stage at presentation, making treatment less effective. Traditionally, melanocytic lesions have been diagnosed through histopathology, which requires removing tissue samples and microscopic examination. However, in recent years, dermoscopy has emerged as a non-invasive, highly effective diagnostic tool that complements histopathology in evaluating skin lesions.

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Aim of the Study: This study aims to assess the sensitivity and specificity of clinical examination and dermoscopic assessment in diagnosing melanocytic lesions compared to histopathological results.

Methods: This prospective study was conducted at the Department of Dermatology in Department of Dermatology, Holy Family Red Crescent Medical College Hospital, Dhaka, Bangladesh. 90 patients were recruited for skin cancer screening. The study duration was one year from June2022 to July 2023. The study's sample comprised all melanocytic lesions exhibiting clinical or dermoscopic atypia and lesions of patients who opted for excision for aesthetic or functional reasons. Demographic and clinical data for each patient, including age, gender, lesion location, diameter, border characteristics, symmetry, colours, phototype, and personal or family history of malignant melanoma, were taken.

Result: The study involved individuals categorized by age groups, with 14.44% below 20 years, 61.11% between 20 and 39, and 24.44% aged 40 and above. Gender distribution was 46.67% male and 53.33% female. Diagnoses in the study included Benign Common Nevi (53.33%), Dysplastic Nevi (34.44%), and Cutaneous Melanomas (12.22%). The study compared the accuracy of naked eye examination and dermoscopy for identifying atypical cases based on histopathological results. The naked eye examination had a sensitivity of 77.78% and specificity of 71.11%, while dermoscopy had a higher sensitivity of 88.89% and specificity of 93.33%. Dermoscopy also showed a higher positive predictive value (PPV) at 92.22% and a negative predictive value (NPV) at 91.11%.

Conclusion: The comparative analysis of dermoscopy and histopathology has highlighted the complementary nature of these diagnostic tools in evaluating melanocytic lesions. Their combined use enhances accuracy and aids in early detection. This collaborative approach promises improved patient outcomes and more precise clinical management of melanocytic lesions.

Keywords: Comparative analysis; dermoscopy; histopathology; diagnosis and melanocytic lesions.

1. INTRODUCTION

Melanocytic lesions encompass diverse skin conditions and hold great significance in dermatology and dermatopathology. This spectrum includes benign nevi and malignant melanomas, with substantial clinical and therapeutic implications. Malignant melanoma, a potentially fatal form of cancer, is on the rise globally, posing a growing concern, particularly among white populations [1]. Bangladesh, like many other regions, faces significant public health challenges due to the aggressive nature of melanoma, which can result in substantial morbidity and mortality. Early detection plays a pivotal role in managing melanocytic lesions, as delayed identification often leads to more advanced stages at presentation, reducing treatment efficacy. Ensuring precise diagnosis and differentiation of these lesions is crucial, as misclassification can result in underdiagnosis or overtreatment, ranging from unnecessary excisions to delayed intervention for melanoma, a potentially life-threatening malignancy [2]. Consequently, the medical community is actively focused on developing early melanoma detection strategies, aiming to enhance patient survival and reduce treatment costs. Melanocytic nevi can be found in the epidermis, dermis, or both, comprising accumulations of benign nevomelanocytes in cohesive nests or as individual cells. Atypical melanocytic nevi are typically larger than five mm and exhibit an asymmetric outline, indistinct borders, and variable pigmentation, often displaying both papular and macular components simultaneously [3]. In this context, two essential diagnostic tools have emerged as invaluable assets in the arsenal of dermatologists and dermatopathologists: dermoscopy and histopathology. Dermoscopy, also known as dermatoscopy or chemiluminescence microscopy, has revolutionized non-invasive skin examination by providing magnified views of skin lesions, revealing structures that are not visible to the naked eye. Dermoscopy employs a handheld device with a polarized or non-polarized light source, enabling dermatologists to assess pigmented lesions with enhanced clarity. This technique has facilitated the identification of critical dermoscopic patterns associated with different melanocytic lesions, thereby improving the ability to differentiate between benign and malignant lesions [4]. Histopathology, on the other hand, remains the definitive gold standard for diagnosis. It involves excising a skin lesion and examining tissue sections stained with hematoxylin and eosin under a microscope.

Cellular and architectural features observed in histopathology provide essential information for accurate diagnosis, including tumour thickness, ulceration, mitotic rate, and other criteria used in the staging and prognosis of melanoma [5]. “Dermoscopy is a practical, straightforward, and non-invasive examination that enhances diagnostic precision when evaluating pigmented lesions. It allows for pattern visualization not discernible to the naked eye, thus contributing to early melanoma detection and reducing unnecessary biopsies” [6]. “However, it remains an intermediate step between clinical diagnosis and histopathological examination of melanocytic lesions, with the latter remaining the gold standard for diagnosis” [3]. This study aims to assess the sensitivity and specificity of clinical examination and dermoscopic assessment in diagnosing melanocytic lesions compared to histopathological results.

2. METHODOLOGY AND MATERIALS

This comparative analysis involved the enrollment and examination of 90 patients at the Department of Dermatology in Department of Dermatology, Holy Family Red Crescent Medical College Hospital, Dhaka, Bangladesh. These patients were prospectively recruited for skin cancer screening. The study was conducted over one year, spanning from June 2022 to July 2023. The study's sample comprised all melanocytic lesions exhibiting clinical or dermoscopic atypia and lesions of patients who opted for excision due to aesthetic or functional reasons. Before enrollment and examination, patients provided informed verbal consent, followed by written consent before the excision of skin lesions. Patients with lesions located on mucosal areas were excluded from the study.

Two dermatologists, each with at least five years of experience, independently conducted clinical and dermoscopic examinations of all participants. Demographic and clinical data for each patient included age, gender, lesion location, diameter, border characteristics, symmetry, colors, phototype, and personal or family history of malignant melanoma. Lesions were considered atypical if, during clinical examination, they exhibited at least three of the following characteristics:

1. Asymmetric shape
2. Poorly defined and irregular borders
3. Presence of erythema or variable shades of brown
4. A diameter equal to or greater than five mm
5. Simultaneous presentation of popular and macular components

“Subsequently, the lesions were analyzed dermoscopically using the Pattern Analysis Methodology. In the first step, the global dermoscopic pattern of each lesion, including reticular, globular, homogeneous, parallel, starburst, multi-component, atypical, and nonspecific patterns, was examined, and each lesion was classified as either melanocytic or non-melanocytic. Melanocytic lesions were assessed for benign or malignant features in the second step. Lesions with regular borders and outlines, a pigment network thinning out at the periphery, and without radial streaming or pseudopods were classified as benign melanocytic nevi. Lesions with irregular borders, a pigment network that stopped abruptly at the periphery, and peripheral aggregation of brown globules without radial streaming or pseudopods were classified as atypical nevi. On the other hand, the presence of pseudopods and radial streaming and the features mentioned above suggested melanoma (in situ or invasive)” [7].

All data were presented in appropriate tables and graphs based on relevance, with descriptions provided to enhance clarity. Statistical analysis was done using the Statistical Package for the Social Sciences (SPSS) software on the Windows platform. Continuous parameters were expressed as categorical parameters were presented as frequency and percentage.

3. RESULTS

Table 1 illustrates the breakdown of individuals in the study sample by age group. There were 13 (14.44%) patients aged below 20 years, 55 (61.11%) patients were from the age range of 20 to 39, and 22 (24.44%) patients aged 40 years and above. Among the study participants, 46.67% were male, while 53.33% were female (Fig. 1). Fig. 2 provides an overview of the distribution of diagnoses within the study population. Benign Common Nevi accounted for 53.33% of the cases, Dysplastic Nevi accounted for 34.44%, and Cutaneous Melanomas accounted for 12.22%. Table 2 presents a detailed comparison between diagnoses made through naked-eye examination and dermoscopy concerning histopathological results. Among the cases with positive histopathological findings (N=42), naked-eye examination correctly

Table 1. Age distribution of the study population (N=90)

Age range (year)	Frequency (n)	Percentage (%)
<20	13	14.44
20-39	55	61.11
>40	22	24.44
Total	90	100.00

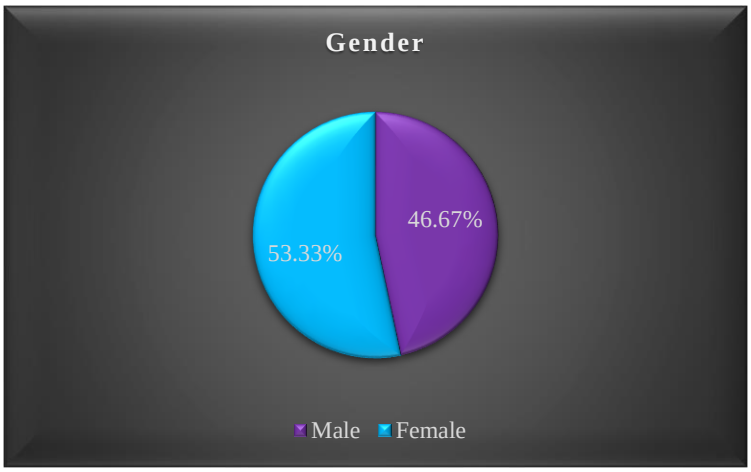

Fig. 1. Gender distribution of the study population (N=90)

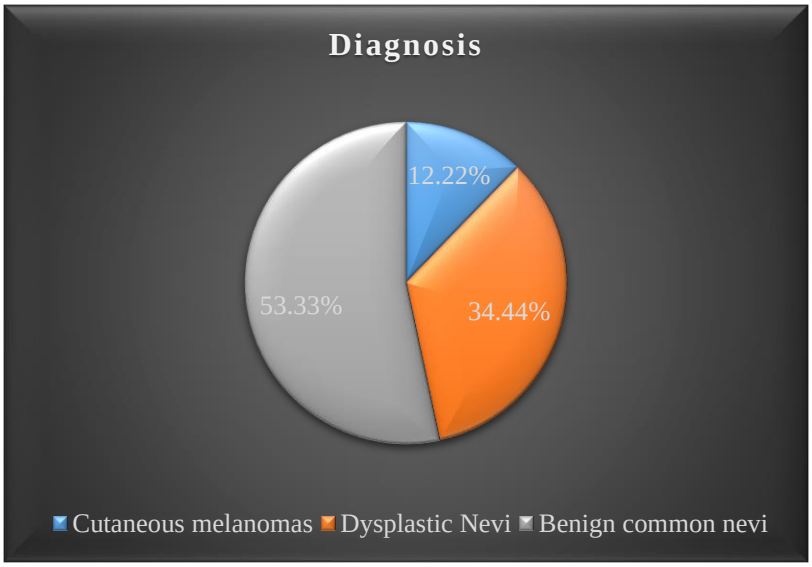

Fig. 2. Diagnosis of the study population (N=90)

identified 33 cases (78.57%) as positive for atypia and 9 cases (21.43%) as unfavourable. Conversely, dermoscopy correctly identified 37 cases (88.10%) as positive for atypia and 5 cases (11.90%) as negative. For cases with negative histopathological findings (N=48), naked-eye examination identified 14 cases (29.17%) as positive for atypia and 34 cases (70.83%) as negative. In contrast, dermoscopy identified only 3 cases (6.25%) as positive for atypia and 45 cases (93.75%) as negative (Table 2). Table 3 presents the diagnostic performance

metrics, including sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) for both naked-eye examination and dermoscopy methods. In the naked-eye examination, the sensitivity was 77.78%, indicating the percentage of true positive results

Table 2. Diagnoses through naked-eye examination and dermoscopy, in comparison to the histopathological results

Variables	Histopathologically positive (N=42)		Histopathologically negative (N=48)	
	n	%	n	%
Naked-eye examination				
Atypia - positive	33	78.57	14	29.17
Atypia - negative	9	21.43	34	70.83
Dermoscopy				
Atypia - positive	37	88.10	3	6.25
Atypia - negative	5	11.90	45	93.75

Table 3. Sensitivity, specificity, positive predictive value, and negative predictive value for both diagnostic methods (naked-eye examination and dermoscopy)

Examination	Sensitivity		Specificity		PPV		NPV	
	n	%	n	%	n	%	n	%
Naked-eye	70	77.78	64	71.11	63	70.00	71	78.89
Dermoscopy	80	88.89	84	93.33	83	92.22	82	91.11

among all actual positive cases. The specificity was 71.11% for the naked-eye examination. The positive predictive value (PPV) was 70.00%, and the negative predictive value (NPV) was 78.89% for this method. For dermoscopy, the sensitivity was 88.89%, and the specificity was 93.33%, indicating a high percentage of true negative results. The positive predictive value (PPV) was 92.22%, representing a high probability of correct positive diagnoses, and the negative predictive value (NPV) was 91.11% (Table 3).

4. DISCUSSION

“Malignant melanoma ranks as the fifth most prevalent cancer in men and the sixth most common malignancy in women in the United States. Its incidence and mortality rate have been consistently rising worldwide” [8]. “The early detection of malignant melanoma is crucial in enhancing patients' survival and overall prognosis. Atypical nevi, a relatively common clinical condition, account for 5% of skin histopathology diagnoses and exhibit dynamic behavior in adulthood, distinguishing them from acquired common nevi” [9]. “It is important to note that the term 'atypical' nevus refers to the clinical characteristics of pigmented lesions, in contrast to 'dysplastic' nevus, which pertains to their histological features. It is a well-established fact that lesions without atypical clinical features can still show histopathological dysplasia” [10]. “The presence of dysplastic nevi is linked to an increased risk of sporadic melanoma, underscoring the need to differentiate between the clinical designation of atypical nevi and the definitive histological diagnosis” [11]. “Clinical evaluation of melanocytic lesions through a naked-eye examination using the ABCD rule (Asymmetry, Border irregularity, Color variation, and Diameter >6 mm), as introduced by Kopf et al., is a widely used method for distinguishing malignant from benign lesions” [12]. “However, it has demonstrated limitations, especially in detecting de novo melanomas, which are typically smaller than six mm, and it lacks specificity as these features can also be seen in benign lesions” [13]. “Dermoscopy, on the other hand, is a practical, non-invasive, and easy-to-use auxiliary tool that allows clinicians to visualize morphological features and patterns not visible to the naked eye, significantly improving the accuracy of diagnosing melanocytic lesions” [14]. Research by Kittler et al. found that “dermoscopy increases diagnostic accuracy by 49%, with specificity and sensitivity increasing by 6% and 19%, respectively” [15]. “In contrast, a randomized study by Carli et al. showed that dermoscopy to assess pigmented lesions significantly reduces unnecessary biopsies” [16]. A meta-analysis by Vestergaard et al., which included only prospective studies with 8,487 non-melanocytic and melanocytic lesions, documented a diagnostic odds ratio for dermoscopy that was 15.6 times higher than visual inspection [17]. More recently, Dinnes et al. conducted a “comprehensive meta-analysis involving 104 studies, revealing that dermoscopy, when added to naked-eye examination, substantially improves the sensitivity and specificity in identifying atypical intraepidermal melanocytic variants and invasive melanomas”

[18]. “In contrast, dermoscopy based on in-person evaluations outperformed teledermatology (image-based assessments)” [18]. Recent data from the literature reveal that “dermoscopy exhibits a high sensitivity of 74.5% in detecting challenging cases of verrucous melanomas” [19]. “However, like all diagnostic tools, the effectiveness of dermoscopy relies on the examiner's experience” [20]. For instance, Piccolo et al. reported “a sensitivity of 92% and specificity of 99% in diagnosing melanoma from dermoscopic images when examined by dermatologists with five years of experience, compared to 69% sensitivity and 94% specificity for clinicians lacking such experience” [21]. “Training in dermoscopy can enhance melanoma detection rates, making it a valuable tool for primary care physicians and inexperienced dermatologists” [22,23]. “Various dermoscopic algorithms diagnose melanocytic lesions, including pattern analysis, the ABCD rule, the 7-point checklist, and the Menzies method” [6]. In this study, we chose pattern analysis due to the examiners' familiarity with this approach. All lesions were clinically evaluated with or without dermoscopy by two experienced dermatologists to improve the study's accuracy. In cases of disagreement, a third expert dermatologist assessed the obtained images. The results of this study showed relatively low values for sensitivity (77.78%) and specificity (71.11%) in naked-eye examinations, which are consistent with existing literature data. The sensitivity for differentiating melanoma from non-melanoma typically ranges from 4 to 86%, with specificity ranging from 71 to 99% [23-26]. For example, Bono et al. reported “an exceptionally low sensitivity of 43%, possibly due to their inclusion criteria, which focused on smaller than three mm pigmented lesions, making them more challenging to assess” [25]. The high sensitivity and specificity values in our study support dermoscopy as an effective modality for distinguishing atypical lesions, demonstrating its superiority over unaided visual inspection. These findings align with a meta-analysis by Vestergaard et al., which included “nine studies and directly compared naked-eye examination with dermoscopy, revealing a summary estimate of specificity and sensitivity at 90% for dermoscopy in differentiating melanoma and non-melanoma” [17]. Our results also corroborate a recent review by Harrington et al, which evaluated clinical prediction rules in 43 studies at the primary healthcare level, documenting relatively high estimates of sensitivity (77-86%) for dermoscopic diagnostic modalities [27]. “It is important to note that existing studies show heterogeneity in defining a positive test result, ranging from any malignant melanoma to only melanoma in situ or invasive cutaneous melanoma and atypical intraepidermal melanocytic variants (e.g., lentigo maligna)” [17,18,25-28]. In our study, we included atypical nevi in the positive test results, along with invasive or in situ melanomas. A recent study from Brazil with a similar sample size (106 lesions) used the exact definition and demonstrated comparable sensitivity (93%) for dermoscopy in recognizing atypical nevi but low specificity (42%) [29]. Differences in specificity between the two studies may be attributed to variations in clinicians' expertise. However, our study has limitations, including a relatively small ratio of melanomas to the total number of lesions. Additionally, the study population comprises only Greek patients from a single institution rather than being drawn from multiple referral centers. A future study with a larger sample size from multiple institutions would enhance the reliability of the results.

5. LIMITATIONS OF THE STUDY

Every hospital-based study has limitations. The study has several limitations. First, it may be subject to selection bias, as the sample size and patient demographics could affect the generalizability of the findings. Second, the accuracy of dermoscopy and histopathology can vary depending on the expertise of the dermatologist and pathologist, which may introduce observer bias. Additionally, the study's retrospective design could lead to incomplete or missing data, affecting the overall validity of the comparison. Finally, the study may need to consider the influence of other diagnostic modalities, potentially limiting the comprehensive understanding of melanocytic lesion diagnosis.

6. CONCLUSION AND RECOMMENDA-TIONS

The data presented in this study underscore the effectiveness of dermoscopy as a superior diagnostic tool for detecting atypical lesions in their early stages, primarily when conducted by skilled healthcare professionals. While dermoscopy does not replace the need for clinical examination, it significantly reduces the likelihood of unnecessary biopsies. It improves the outlook for patients with malignant melanoma, thereby reducing mortality rates and healthcare expenses.

CONSENT

As per international standards or university standards, patients' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standards or university standards guideline participant consent and ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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