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Original article:

Morphometric Image Analysis as a Tool in the Diagnosis of Transected Squamous Neoplasms

Siddiqui Faiza Bano[1], Yadav Megha Omprakash[2]

[1]Assistant Professor, Department of Anatomy, Mamata Medical College, Khammam, Andhra Pradesh, India.

[2]Assistant Professor, Department of Pathology, Chalmeda AnandRao Institute of Medical Sciences, Karimnagar, Andhra Pradesh, India.

Corresponding Author: Dr. Yadav Megha Omprakash, Assistant Professor, Department of Pathology, Chalmeda AnandRao Institute of Medical Sciences, Karimnagar, Andhra Pradesh, India.

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Abstract

Background: The widespread use of Computer-assisted diagnosis (CAD) can be traced back to the emergence of digital mammography in the early 1990's. Recently, CAD has become a part of routine clinical detection of cancer at many screening sites and hospitals. The present study was conducted for carrying out morphometric image analysis as a tool in the diagnosis of transected squamous neoplasms.

Materials & Methods: A total of 20 cases were enrolled. These were 5 cases each of well-differentiated squamous cell carcinomas (SCC), hypertrophic actinic keratoses (HAK), irritated seborrheic keratoses (ISK), and verruca vulgaris (VV). SCC and HAK formed the malignant/premalignant group while ISK and VV formed the benign group. Representative images of the neoplasms (H&E slides) were taken and images were anlayzed by adobe photoshop software. A representative area of the stratum spinosum was selected and evaluated. Mean nuclear sizes (NS), pleomorphism and cellularity were determined on the known neoplasms. Chart review and clinical follow-up information was obtained on the transected neoplasms to confirm our diagnostic categorizations.

Results: Analyzing NS and cellularity revealed statistically significant differences between the pre-malignant/malignant neoplasms (HAK and SCC) and the benign neoplasms (ISK and VV). There was a gradual rise in both the NS and pleomorphism from ISK, VV, HAK, and SCC. It was shown that the pleomorphism range was the most helpful for diagnosis. Of them, one was pre-malignant/malignant and the other was clinically benign.

Conclusion: As digital pathology advances, the speed will surely increase and clinical studies such as ours will help form the basis of the diagnostic ranges needed for accurate diagnosis.

Key words: Morphometric, Image, Squamous, Neoplasm.

INTRODUCTION

The widespread use of Computer-assisted diagnosis (CAD) can be traced back to the emergence of digital mammography in the early 1990's. Recently, CAD has become a part of routine clinical detection of cancer at many screening sites and hospitals.[1, 2] In fact, CAD has become one of the major research subjects in medical imaging and diagnostic radiology. Given recent advances in high-throughput tissue bank and archiving of digitized histological studies, it is now possible to use histological tissue patterns with computer-aided image analysis to facilitate disease classification. There is also a pressing need for CAD to relieve the workload on pathologists by sieving out obviously benign areas, so that pathologist can focus on the more difficult-to-diagnose suspicious cases.[3- 5]

Morphometric analysis of epidermal biopsies permits an objective study of several diseases. Morphology of diseased tissue in patients under treatment can be accurately analyzed by means of image processing techniques, avoiding less reliable methods such as visual inspection. In this paper, we present a morphological scheme for the analysis of epidermal biopsy samples. The target is the detection of the main transitions that are visible on the sample. Such transitions separate the different skin layers whose associated morphometric parameters have to be measured.[6,7] Hence; the present study was conducted for carrying out morphometric image analysis as a tool in the diagnosis of transected squamous neoplasms.

MATERIALS & METHODS

A total of 20 cases were enrolled. These were 5 cases each of well-differentiated squamous cell carcinomas (SCC), hypertrophic actinic keratoses (HAK), irritated seborrheic keratoses (ISK), and verruca vulgaris (VV). SCC and HAK formed the malignant/premalignant group while ISK and VV formed the benign group. Representative images of the neoplasms (H&E slides) were taken and images were anlayzed by adobe photoshop software. A representative area of the stratum spinosum was selected and evaluated. Mean nuclear sizes (NS), pleomorphism and cellularity were determined on the known neoplasms. Chart review and clinical follow-up information was obtained on the transected neoplasms to confirm our diagnostic categorizations. All the results were analyzed by SPSS software.

RESULTS

Analyzing NS and cellularity revealed statistically significant differences between the pre-malignant/malignant neoplasms (HAK and SCC) and the benign neoplasms (ISK and VV). There was a gradual rise in both the NS and pleomorphism from ISK, VV, HAK, and SCC. It was shown that the pleomorphism range was the most helpful for diagnosis. Of them, one was pre-malignant/malignant and the other was clinically benign.

Table 1: Image analysis

Neoplasm	Mean NS	Pleomorphism	Cellularity
ISK	136	63	432
VV	236	96	135
HAK	249	121	76
SCC	252	129	53

Table 2: Diagnostics ranges

Neoplasm	NS range	Pleomorphism range	Cellularity range
ISK	60 to 161	45 to 73	208 to 612
VV	121 to 321	69 to 123	45 to 216
HAK	120 to 346	75 to 141	47 to 123
SCC	111 to 342	88 to 163	35 to 102

DISCUSSION

Malignant melanoma and squamous cell carcinoma most commonly arise on background of exposure to sunlight in somewhat similar patient populations. Recently, has been described in the pathology literature neoplasm with features of both malignant melanoma and squamous cell carcinoma and named dermal squamomelanocytic tumor. Biphasic heterologous tumor with epithelial and melanocytic components is an exceedingly rare and present difficulty in diagnosis and histogenesis. Until now has been reported only five cases of this neoplasm. All reported cases were presented with brown or purple-black facial nodules measuring up to 10 mm in diameter. The age ranged in 44-87 years and there have been three males and two females in up to date documented cases. Follow-up information (mean 3,5 years) has shown no evidence of recurrence or metastasis. Independently, squamous cell carcinoma and malignant melanoma arise from the epidermis, while squamomelanocytic tumor may be presented as nodule in upper dermis independently of any epidermal connection.[7- 9] Hence; the present study was conducted for carrying out morphometric image analysis as a tool in the diagnosis of transected squamous neoplasms.

Analyzing NS and cellularity revealed statistically significant differences between the pre-malignant/malignant neoplasms (HAK and SCC) and the benign neoplasms (ISK and VV). There was a gradual rise in both the NS and pleomorphism from ISK, VV, HAK, and SCC. It was shown that the pleomorphism range was the most helpful for diagnosis. Of them, one was pre-malignant/malignant and the other was clinically benign. Rho NK et al attempted both quantitative and qualitative analyses of the naevus of Ota to find out relations between histological patterns or parameters of melanin/melanocytes and lesion colours. Lesion colours were determined by one of the authors and were confirmed by a separate panel of dermatologists. Forty biopsy specimens of naevus of Ota were evaluated by both computer-assisted quantitative image analysis and a previously proposed conventional pattern analysis. The mean area fraction (AFmean) of melanin, the depth of the maximum area fraction of melanin (level of AFmax) and the depth of the deepest infiltrating melanocyte were significantly greater or deeper for bluish lesions than brownish lesions. Based on the qualitative pattern analysis we found that all the brownish lesions demonstrated superficial dermal melanin pigments, whereas bluish lesions tended to show more heterogeneous histological patterns. Eyelid lesions, all of which were bluish, revealed greater AF(mean) value than cheek lesions, presenting as either brownish or bluish colours. Quantitative analysis indicated that pigment density measures such as AFmean could be as important as the depth of melanocytes in the explanation of the lesion colours in naevus of Ota.[9]

Martin et al performed skin biopsies in 71 patients affected by the following disorders: ceroid-lipofuscinoses (17 cases), mucopolysaccharidoses (13 cases) mucolipidoses (seven cases), lipidoses (18 cases), metabolic diseases to be further classified (seven cases), acid maltase deficiency (nine cases). After a survey of semithin sections, the skin specimens were examined with an electron microscope. In most of the cases, epithelial cells, hair follicles, fibroblasts, eccrine sweat glands, smooth muscle cells, sebaceous glands, and nerve bundles were available. In 62 cases (87.3%), positive diagnostic information was obtained while in seven other cases (9.9%) suggestive features were discovered which could support the final diagnosis. In only two cases (2.8%) were the results negative. We conclude that, in association with enzymatic assays in the cultured fibroblasts, a skin biopsy specimen provides a simple opportunity for the combination of both morphological and biochemical diagnosis of storage disorders, precluding major surgical procedures.[10] In another study conducted by Godeau G et al, authors evaluated efficacy of selective histochemical method for the quantitative estimation of elastic fibers by computerized morphometric analysis. The study of elastic fibers in the dermis of 30 patients, before and after six months of treatment with Colchicin, was carried out with a Quantimet 720 system. Preelastic (oxytalan and elaunin) fibers and mature elastic fibers were quantitated separately. Compared to the average volume fraction (surface occupied by the elastic fibers) before treatment with Colchicin (1.449 +/- 0.64%), the mean values after treatment were significantly increased (2.076 +/- 0.61%). The same results were found for the preelastic fibers: 0.807 +/- 0.51% before treatment and 1.025 +/- 0.54% after treatment. These results demonstrate the advantages of our monochromatic staining method for automatic quantitation of elastic fibers as well as the possibilities of the quantitative study of the elastic fibers in human dermis.[11]

CONCLUSION

As digital pathology advances, the speed will surely increase and clinical studies such as ours will help form the basis of the diagnostic ranges needed for accurate diagnosis.

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