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ORIGINAL ARTICLE

Dermatopathological Analysis of Common Skin Lesions Encountered in Cadavers

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Abstract

This study served as a purpose for medical students to gain experience in both dermatology and pathology, which is a common barrier that prevents first and second year medical students from refining skills that are not later taught until residency. This prompted a study to develop gross differential diagnostic skills and how to analyze histopathology slides to diagnose common skin lesions (photomicrographs) to refine skills in both clinical and histology presentation.

A cadaveric case series was designed to examine multiple shave biopsies on all abnormal skin lesions observed from nine cadavers used for the first-year medical students gross anatomy lab during the year 2022-2023. Biopsies were stained using hematoxylin and eosin. Photomicrographs, though initially viewed by medical students, were confirmed by a pathologist later.

A total of 25 samples were collected from 9 cadavers. The most encountered lesion was seborrheic keratosis (SK) at 14 out of 25 (56%) lesions. Five of the sample lesions (20%) were actinic keratosis (AK). Three of the 25 samples (12%) were identified as intradermal nevus. Two sample lesions (8.0%) from the same cadaver were a milium and one sample lesion (4%) from a separate cadaver indicated epidermal inclusion cyst.

Common dermatological lesions were identified among the nine cadavers used for analysis. This provided opportunities to develop and refine skills in dermatopathology. A further increase in sample size is needed to gain exposure to a larger variety of lesions and to identify common dermatological lesions grossly based on differing race, age, and gender.

Key Words: *Seborrheic keratoses; Actinic keratoses; Milia; Epidermal inclusion cysts; Dermatopathology; Dermatology; Histology; Cadaver; Medical students*

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Introduction

Skin cancer and dermatology lesions are very commonly encountered in clinical practice [1-3]. However, many physicians find themselves inadequately trained for dermatology diagnosis, as most medical schools only offer a limited time allocated to hands-on training in dermatology and pathology during the initial years of medical school. This lack of exposure is reflected in the comfortableness level of practicing physicians, in family medicine and internal medicine, to be able to recognize and diagnose skin lesions [1]; and prevents first and second year medical students from refining analytical skills not taught late until residency.

To overcome this common barrier, second-year osteopathic medical students at the Philadelphia College of Osteopathic Medicine (PCOM) South Georgia (SGA) campus, aspiring to specialize in dermatopathology, with the support and guidance of a professor in pathology at PCOM SGA, initiated a plan. The goal of this study was to analyze and use diagnostic skills to identify common skin lesions in elderly cadavers based on clinical and histopathology findings. Students performed multiple biopsies on all the abnormal skin lesions observed in the head and face regions on the nine cadavers in the gross anatomy lab during the academic year 2022-2023. Photomicrographs, initially viewed by medical students, were later reviewed and reported by the pathologist. The micrograph and photomicrograph findings of the common dermatological conditions are discussed, including the analysis on diagnostic accuracy by medical students.

Materials and Methods

The sample population consisted of nine cadavers that were donated to the anatomy lab at PCOM SGA as part of the Body Donor Program in support of the anatomy education of first year medical students during the year 2022 - 2023. Through the Body Donor Program at PCOM SGA, the Director of Anatomical Donor Services was able to provide the age at death for each cadaver and known cause of death, although approximately 90% of cadavers had cause of death labeled as “unknown”. Shave biopsies were performed on all abnormal skin lesions observed in the face and head region, with a total number of 25 samples collected. The location and size for each sample were recorded along with photographic samples taken to document gross appearance. With the study remaining localized to the head and face, the most common location that lesions were sampled from included the lateral sides of the mouth and eyes, the temple and cheek. Students recorded their initial clinical diagnosis based on gross appearance and measurements, before excising the sample, placing each micrograph in a labeled specimen cup filled with formalin.

Samples were sent to Colquitt Regional Medical Center for processing, which involved histological processing and staining of the tissue specimens with hematoxylin and eosin (H&E) [4]. The prepared slides were reviewed by the medical students where they recorded and finalized their diagnosis for each micrograph. Images of each photomicrograph were taken, with magnification level recorded. The slides were then reviewed by the professor in pathology who determined the final diagnosis. Results were reviewed by the students and calculated to determine percent of accuracy in diagnosing, common lesions observed, and how the results differed based on demographics of the cadavers. This study was previously presented as a Poster Presentation at 2023 American Association of Clinical Anatomists on July 11, 2023. This article’s abstract was previously accepted for electronic publication in Clinical Anatomy 2023.

Results

A total of 25 samples were collected from nine cadavers. Medical students were accurate in diagnosing 60% of the total 25 lesions sampled. Distribution of the identified skin lesions is

represented in (Figures 1 and 2). The most encountered lesion was SK, making up 14 of the 25 sample lesions (56%).

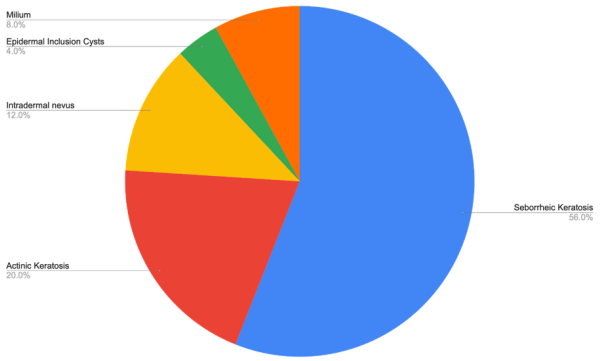

Figure 1) *Distribution of the type of skin lesions.*

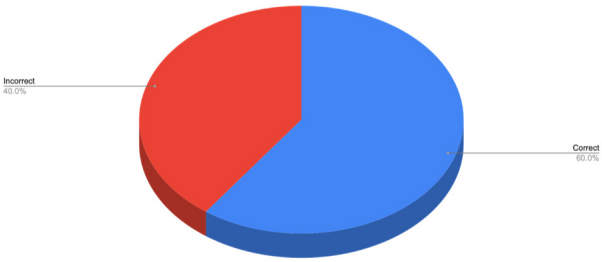

Figure 2) ***Distribution of diagnostic accuracy by medical students:*** *Medical students were accurate in diagnosing 60% of the total 25 lesions sampled.*

Diagnosis of SK lesions was established by the identification of horn cysts and pseudohorn cysts filled with keratin as seen in the histology findings of Figure 3. Five of the sample lesions (20%) were AK which revealed acanthosis, atypia of basal keratinocytes, and dermal solar elastosis. Three sample lesions (12%) showed an intradermal nevus. Pigmented, raised lesions as seen in Figure 4 on gross evaluation were clinically diagnosed as melanocytic nevi. The diagnosis of intradermal nevus was determined by recognizing nests of nevus cells in the dermis along with multinucleated cells and few pigmented cells (Figure 4B). Two sample lesions (8%) from the same cadaver were a milium and one lesion (4%) from another cadaver was an epidermal inclusion cyst. Diagnosis of a milium was done by evaluating the gross lesion seen in Figure 5A and the histology showed an intradermal cyst filled with lamellated keratin with a complete epithelial lining (Figure 5B).

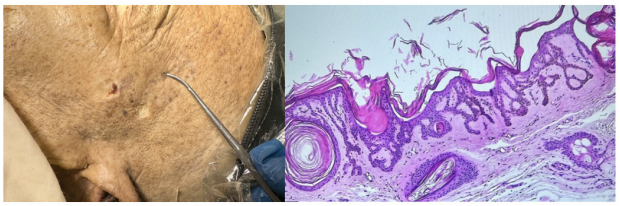

Figure 3A and 3B) *Biopsy of medial aspect of left superior temple.*
Gross examination shows sharply circumscribed elevated pigmented lesions measuring (4.0 mm x 3.0 mm; Figure 3A). Photomicrograph shows horn cysts and pseudohorn cysts filled with keratin; Magnification 100x, H&E staining (Figure 3B).

Figure 4A and 4B) *Melanocytic Nevus: Biopsy of lateral aspect of right oral commissure.*
Gross examination shows a pigmented papule measuring 3.5 mm x 3.0 mm x 1.5 mm diagnosed clinically as a melanocytic nevus. Photomicrograph confirms a pigmented intradermal type of nevus. Figure 4B illustrates nests of nevus cells in dermis with multinucleated cells and few pigmented cells and no junctional activity is seen. Magnification: 40x, H&E staining (Figure 4B).

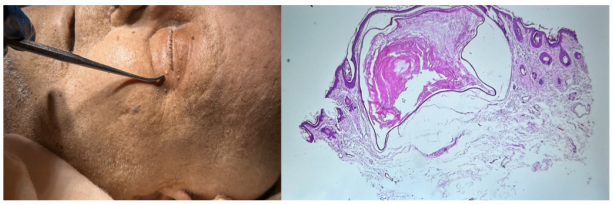

Figure 5A and 5B) *Milium: Biopsy of left inferior canthal angle.*
5A is identified grossly and histologically as milium. Gross examination shows pearly white cystic lesions measuring 2.0 mm x 1.0 mm x 0.5 mm. Photomicrograph in 5B reveals an intradermal cyst filled with lamellated keratin with complete epithelial lining seen; Magnification: 40x, H&E staining Figure 5B.

Analyzing the cadaver demographics, 55.6% cadavers sampled were male (5/9) and 44.4% were female (4/9) as shown in Figure 6. Age distribution is shown in Figure 7. The ages of the nine cadavers ranged between 62 - 79, with the majority (44.4%) cadavers within the 70 - 74 years old age range (4/9) followed by 33.3% in the 75 - 79 age range (3/9).

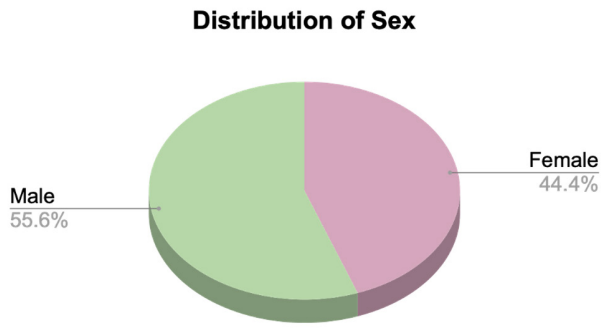

Figure 6) *Sex Distribution of the 9 cadavers sampled, 5 (55.6%) are male and 4 (44.4%) are female.*

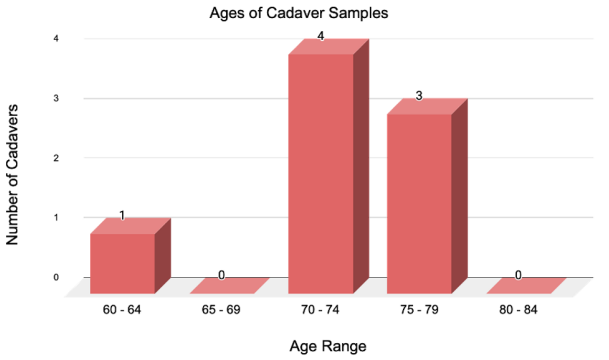

Figure 7) ***Cadaveric Age Distribution:*** *Sampled cadaveric ages range from 62 to 79 years; majority between 70-74 years (44.4%).*

Students evaluated how many cadavers a specific lesion was biopsied from, to determine the age range that produced the most samples (Figure 8). Majority skin lesions biopsied came from cadavers in the 75 - 79 age range (7/9), followed by the 70 - 74 age range (6/9).

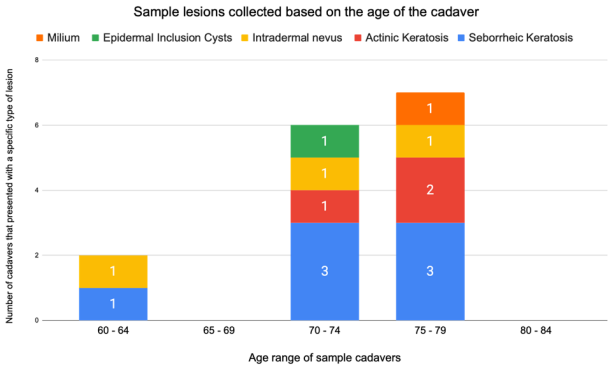

Figure 8) *Age Range: Age range of the nine cadavers is 62 - 79 years old. The identified lesions in each age category are demonstrated, with seborrheic keratoses (6 total lesions) and intradermal nevi (3 total lesions) across all age groups. If a lesion is identified more than once in the same cadaver, the lesion is only counted once.*

Discussion

This study provided two medical students at PCOM SGA the opportunity to develop and refine diagnostic skills to evaluate common lesions grossly and histologically in the cadaveric population. This cadaveric series proved to be essential to the medical students involved when it came to reviewing the incorrect clinical and histological diagnosis that were made during the study. Both medical students attributed the time spent on this research as a crucial part for enhancing board test taking skills when it comes to dermatology questions, as many of the skin lesions identified in this study (i.e. actinic keratoses, seborrheic keratoses, intradermal nevi, milia, etc.) can be encountered when taking the USMLE and COMLEX exams during second and third year at both allopathic and osteopathic medical schools.

In this study, SK was the most commonly biopsied lesion within this cadaveric population at 56% (14/25). SK was biopsied within every age range of the cadavers, from 62 to 79 years old. It is the most common benign skin lesion in the elderly population and can vary in appearance, location, and quantity [2]. SK can be found throughout the body, including mucous membranes, with the most common locations being those directly exposed to sunlight such as head, neck and trunk [5]. As seen in Figure 3, an SK lesion tends to have a “stuck-on”, waxy appearance, and can be raised or flat. Being able to confidently identify and diagnose this lesion would prove a useful skill for a practicing physician, regardless of specialty, due to the commonality amongst the elderly patient population. AK was the second most commonly biopsied lesion at 20% (4/25). AK is an important lesion to identify as it is the most common premalignant skin lesion with an increased risk of progressing to squamous cell carcinoma [5]. AK is more commonly found in areas of the body with prolonged exposure to UV light such as the scalp, ears, face, neck and

dorsal aspect of the hands, with a predominance in light skinned individuals [5]. The medical students incorrectly identified all four of the actinic keratosis lesions. Another lesion that was incorrectly identified by the medical students was the epidermal inclusion cyst. These skin lesions are commonly found on the head and upper trunk, such as it was with the lesion identified to be on the lateral side of the left eye [5]. These lesions are more common in men as compared to women, with the lesion in the case being identified on a male cadaver [5]. The association of this skin lesion with sex is limited in this study due to the sample size and location used for sampling lesions, as the study remained localized to the head. A reason for the incorrect diagnoses by medical students may be due to the fact that the students conducted this study prior to their dermatology unit in their second year of medical school. It is difficult to know whether this is due to the limited education provided or because that part of their education had not yet occurred. This demonstrates the importance of students doing studies such as this one to gain more exposure to these common lesions and to be aware of their appearance across different ethnic and racial groups, as well as age and sex.

3 of the 25 skin lesions identified were intradermal nevi. As with the other lesions identified, an intradermal nevus is commonly identified in the more sun-exposed areas of the body, such as the head, neck, and trunk [5]. As stated with the other lesions, the study is unable to determine any associations of a lesion to the clinically identified common locations due to limitations of the study remaining localized to the head and excluding examinations of the whole cadaver. The reason for this, was that the study was initiated during the first-year medical student's head, eyes, ears, nose and throat (HEENT) block which is the final block of the anatomy course in which all other systems had been previously dissected. Future studies should perform skin exams & biopsies for dermatopathology research prior to the start of first year cadaver dissection to be able to analyze the entirety of the cutaneous surface.

It should be discussed that the photomicrographs were vital to the final diagnosis. It also provided an opportunity to teach the medical students to recognize and appreciate the presence of an artifact, which can occur during processing of the lesion. It is crucial to identify the presence of artifacts when examining photomicrographs and medical imaging (i.e. CT, X-ray, MRI). Figure 3 demonstrated a shave biopsy of a brown, waxy papule taken from the medial aspect of the left superior temple that was diagnosed and confirmed as a SK and Figure 4 was a shave biopsy of the right oral commissure that was diagnosed and confirmed as an intradermal nevus. Both figures were shown to have artifacts present on the epidermal surface. Artifact on a photomicrograph is an alteration to the tissue structure by an outside factor during preparation of the slide, not related to the tissue itself [6]. There are different classifications of artifacts, ranging from changes to due handling of the tissue with a tool to how the tissue is prepared and mounted on a slide. With these skin lesions being prepared by an outside source and not by the students directly, it is difficult to determine what stage of preparation led to these specific artifacts. This is an area that would benefit from further exploration by the students performing the staining themselves to be aware of the handling process of the tissue samples and be able to separate extraneous changes to the tissue from pathologic changes. Lastly, Figure 4 was a shave biopsy of the left inferior canthal angle that was diagnosed and confirmed as milium. Artifact can be seen surrounding the cyst wall as well as within the cyst creating an irregular space.

There are some limitations to this study that the medical students encountered and would be important to address before further studies are to be done. One limitation would be the small

sample size of only nine cadavers. Increasing the sample size would help diversify the demographics of the cadaveric population, as well as increase the variety of skin lesions that could be possibly identified. A limitation in the demographics faced by the medical students was limited background information on each of the cadavers involved. For example, the race and ethnicity were not included in the demographics, and it would not have been appropriate for the medical students to assume based on appearance. For future studies, it would be important to work with the anatomy lab to obtain a more detailed history on the cadavers to better assess differences in demographics. Another limitation is the limited number of both the pathologist and medical students involved. If we were able to increase the number of medical students involved, we would potentially increase the probability of having more collaborative discussions on possible differential diagnoses that could have increased the percentage of correct final diagnoses of the lesions. Additionally, having an increased number of pathologists in the study to aid in determining the correct final diagnosis could help with the accuracy of the data due to decreased interpreter bias. To better develop diagnostic skills, further studies should be conducted in which the students themselves are the ones to process the lesions and stain using H&E. This would help students gain this knowledge of a technique they do not get hands-on experience with until clinical rotations, residency, or not at all. This would allow the students to be aware of any changes or errors that might occur in the staining process that could affect the final stain.

It is well known that dermatology, histology of skin, and dermatopathology are under taught in many physician training programs. With other medical schools recognizing this limitation within their curriculum, select medical schools have begun to identify where these limitations are in the curriculum and how to make changes that better address the lack of dermatopathology education during pre-clinical years for medical students. With there being an interest in further exploring specialties such as dermatology and histology, medical students are realizing the limited exposure they are receiving in these areas during the preclinical years [7]. Students are still largely offered rotations in dermatology during third and fourth year, but education in dermatology during first and second have shown to be unchanged or on the decline as many medical schools do not emphasize its instruction. Some schools are working towards improving on this lack of adequate education in order to provide students with better exposure to dermatology during preclinical years. One example is The Cadaveric Skin Biopsy Project from the University of Virginia School of Medicine that provided an opportunity for students in the class of 2016 to work in groups to identify skin lesions on cadavers, biopsy these lesions, and work together to analyze the photomicrographs with later presentation of their findings to the class [7]. Findings such as this presented by Baker et al, in part helped inspire the current study to help medical students utilize their current resources to develop the skills necessary to identify and diagnose common skin lesions. Although the study by Baker et al evaluated the learning experience by the medical student and not the skin lesions identified as this paper has done, similarities can be drawn from Baker et al to this paper with SK being the most identified skin lesion [3]. Further studies by other medical schools would help in the generalization of common lesions and the region of the body they are most common to be identified in, by age, sex, race, and ethnicity. Additionally, movements towards making skin disorders more understandable, some physicians have begun implementing web-based adaptive learning modules for dermatopathology for medical students, residents and fellows [8,9].

This study provided an opportunity to two medical students to further expand their knowledge in diagnosing common skin lesions

and to experience a more hands-on approach to collecting and analyzing samples under the microscope. Although this experience proved to be beneficial in the future studies of both medical students involved, there is an added hope that initiatives like this one might inspire other medical students to be curious and seek out opportunities to further expand their own education.

Conclusion

Common dermatological lesions sampled from the head and face, commonly located lateral to the eyes, mouth, and temple region, were identified among the nine cadavers used for analysis. This study provided an opportunity to develop and refine skills in identifying common lesions grossly and through the use of photomicrographs. A further increase in sample size is needed to gain exposure to a larger variety of lesions and to identify common dermatological lesions grossly based on differing race, age, and gender. The larger impact of a study like this one is to express the importance of physicians to be able to recognize and identify common lesions within the patient population. This is especially important within the osteopathic medical school education since students tend to enter fields such as family medicine and internal medicine more so than to specialize.

Acknowledgement

We would like to thank PCOM SGA for allowing us to take samples from the cadavers donated from the cadaver donor program. We would like to thank Colquitt Regional Medical Center for processing the shave biopsies and providing H&E staining for histological diagnosis. We would like to thank the families that donated to PCOM SGA's cadaver donor program that contributes immensely to the medical education of Osteopathic Medical Students at PCOM SGA.

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