

Histogenetic and Histomorphometric Studies on Developing Skin of Human Foetuses

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ABSTRACT

Background: Gestational age can be estimated on the basis of histological appearance of foetal skin which makes it medicolegally important.

Materials & Methods: Fifty human foetuses were equally divided into five groups i.e. I (< 15 wks) / II (15-19 wks) / III (20-24 wks) / IV (25-29 wks) and V (> 29 wks) of ten each. 10µm thick sections of skin were taken from mid gluteal region of each foetus and H&E staining was done. Epidermal, dermal and skin thicknesses and glandular diameter and hair follicular diameters were measured in five groups separately.

Results & Conclusion: Foetuses in group I showed multilayered epidermis at 14 wks whereas hair follicles could be clearly defined 17 wks onwards. Elongated cords of eccrine glands were evident in 22 weeks old foetus. The most striking feature was apparent reduction in epidermal, dermal and total skin thicknesses in groups III fetuses compared to group II

ones. Stratification seems to be the reason for significant increase in thickness.

Key Words: Histogenesis, Histomorphometry, Gluteal Region, Skin, Foetus.

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INTRODUCTION

Observations of human foetal skin at light microscopic level have been the focus of large number of scientists.¹⁻⁵ Estimation of gestational age from histological appearance of foetal skin makes it of great medicolegal importance.⁶ Foetal and adult skin wound healing involve different mechanisms⁷⁻⁹ leaving normal skin in former and scar in latter enhancing further the scope of research. All the previous informations are based on microscopic observations making it purely subjective. Just like adult skin showing variable features in different parts of body, regional variations become evident in developing foetal skin during 3rd month of intrauterine life.¹⁰ Different scientists showed interest in different parts of foetal skin. Hashimoto et al¹¹ and Reigel¹² studied palm, sole and scalp. Hoyes procured skin from midback, forearm, face and leg and Erch and Stallmach⁶ considered abdominal skin. We have procured skin from gluteal region, untouched by previous researchers. We have also done histomorphometric evaluation in addition to subjective light microscopic observations to make the study more relevant.

MATERIALS AND METHODS

Fifty human foetuses preserved in the museum of department of anatomy, Jawaharlal Nehru Medical College, Aligarh Muslim University, Aligarh, U.P., India, were selected. Institutional Ethical

Committee has provided no objection certificate to conduct the study. Foetuses were equally divided into five groups i.e. I (< 15 wks) / II (15-19 wks) / III (20-24 wks) / IV (25-29 wks) and V (> 29 wks) of ten each (Table 1). Skin specimens were taken from mid gluteal region of each foetus and processed by wax embedding technique to get 10µm thick sections. The latter were stained by haematoxylin and eosin stains. Groupwise histogenesis with special emphasis to its stratification and appendages like hair follicles and eccrine glands were main features of observation. Time of appearance of said features were specially noticed. With the help of stage and ocular micrometers, epidermal, dermal and skin thicknesses and glandular diameter and hair follicular diameters were measured in five groups separately. Analysis was done using one-way ANOVA followed by post hoc Bonferroni test.

RESULTS

Histology

All foetuses of 1st groups were 14 weeks old and showed multilayered epidermis (Fig.1). Hair follicles were detected in foetuses as early as 17 weeks of intrauterine life (Fig. 2). Youngest foetus showing eccrine gland was 22 weeks old (Fig.3). In older fetuses, advanced stages of development were noticed. At the age of 27 weeks, well developed hair follicles showing all

the layers of epidermis except stratum granulosum were observed (Fig 4 and 5). At the age of 31 weeks, hair follicles were fairly developed with sebaceous gland (Fig 6) and elongated solid cords

of eccrine cells were going deep in dermis with many coiled sweat glands appeared (Fig 7). At places, pilosebaceous apparatus were evident in dermis (Fig. 8).

Table 1: Subgrouping of human foetuses

Groups	Age (wks)	Total Number of Foetuses
I	<15 wks	10
II	15-19	10
III	20-24	10
IV	25-29	10
V	> 29	10
Total no. of foetuses		50

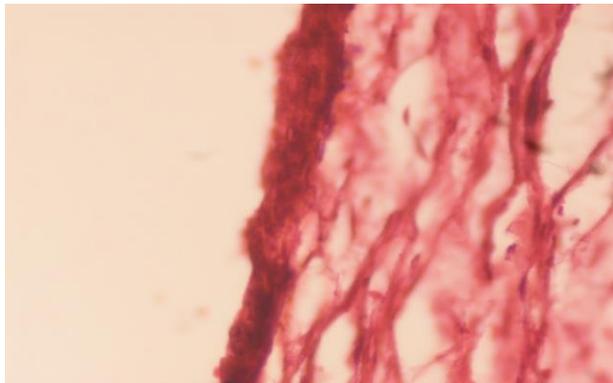


Fig 1: 14weeks; 40x multilayered epidermis. Small buds of basal cells with crowding of nuclei.

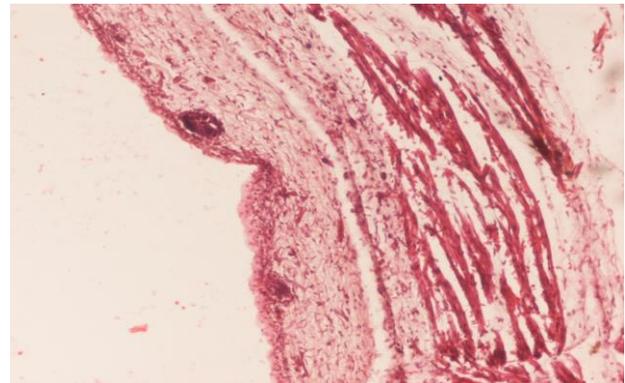


Fig. 2: 17 weeks; 10x elongation of solid hair follicles and budding of basal cells focally, epidermis, dermis, subcutaneous fat and skeletal muscles included in biopsy

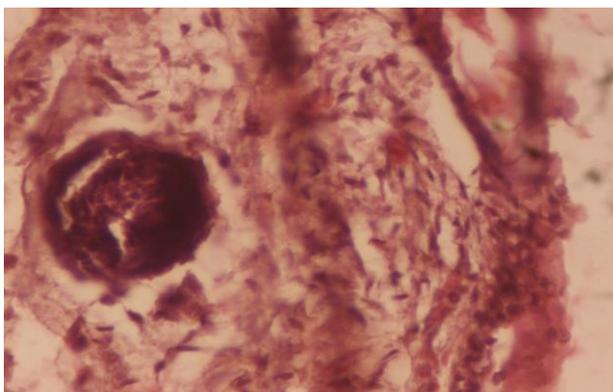


Fig. 3: 22 weeks; 40x hair follicle with sebaceous gland, elongated cord of eccrine gland with cells having oval nuclei

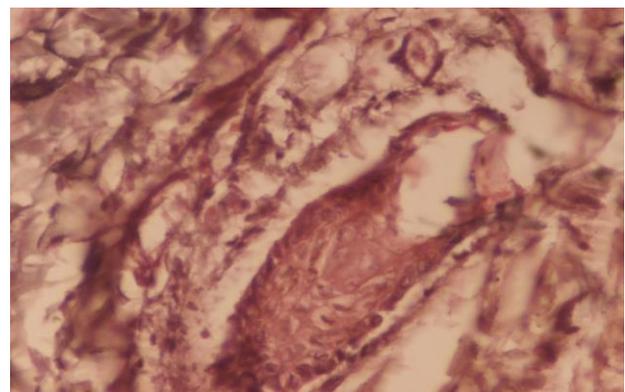


Fig. 4: 29 weeks; 40 x well developed hair follicle showing all layers of epidermis except stratum granulosum. Outer layer is pellucidating. Central cavity contain hair shaft.

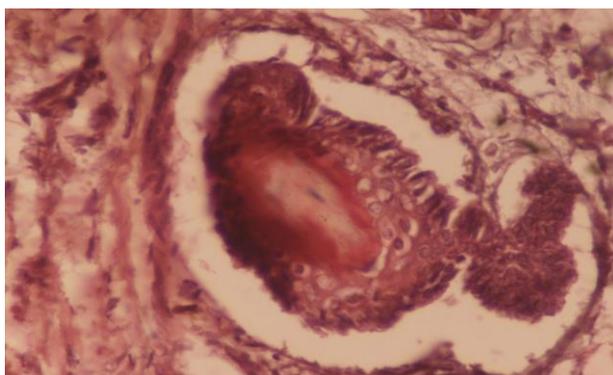


Fig. 5; 40x developing pilosebaceous apparatus. Hair follicles shows hair shaft in the center with longitudinally laminated fibres of light brown color.

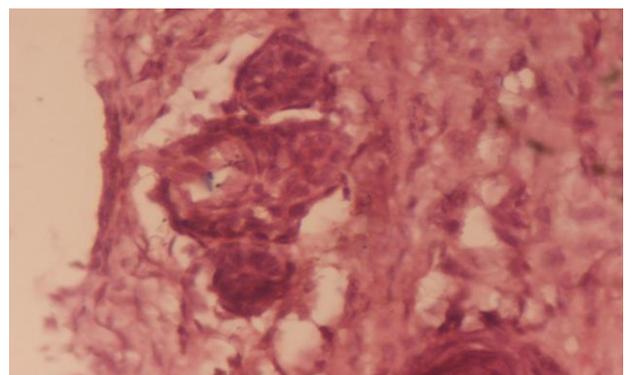


Fig 6: 31 weeks; 40 x fairly developed hair follicle with sebaceous gland seen in dermis. Hair follicles have all layers of epidermis except stratum granulosum, nuclei rounded to oval, cytoplasm is eosinophilic, sebaceous glands have polyhedral cells with central nuclei, foamy clear cytoplasm.

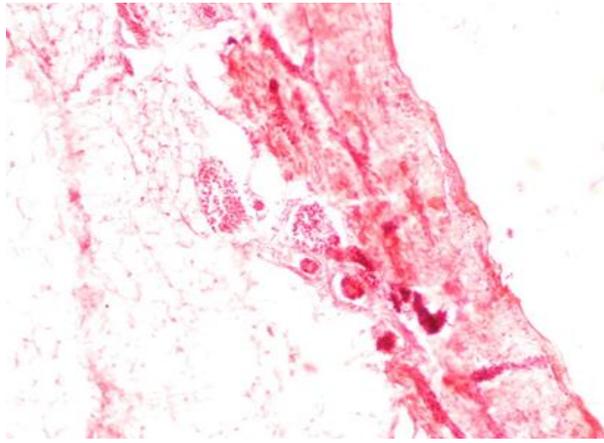


Fig. 7: 32 weeks; 10x pilosebaceous apparatus in dermis, elongated solid cord of eccrine cells arising from epidermis and going deep into dermis. Many coiled sweat gland appear as multiple clusture of small glands lined by double row of cells.

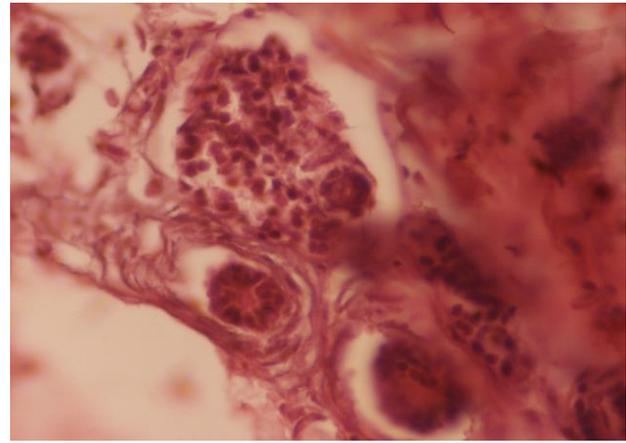


Fig 8: 40x pilosebaceous apparatus in dermis

Table 2: Comparison of human foetal skin parameters between between five groups of human foetuses

Parameter	Group I (n= 10) Mean ± SD (mm)	Group II (n= 10) Mean ± SD (mm)	Group III (n= 10) Mean ± SD (mm)	Group IV (n= 10) Mean ± SD (mm)	Group V (n= 10) Mean ± SD (mm)
Epidermal Thickness	• %# 1.0 ± 0.0	• ^%* 2.35 ± 0.58	• % 1.6 ± 0.52	• ^f## 3.2 ± 0.92	• %# 1.4 ± 0.52
Dermal Thickness	• ^% 10.9 ± 3.1	• ^% 9.7 ± 2.1	• ^% 10.1 ± 1.0	• f## 18.7 ± 3.3	• f## 17.3 ± 1.6
Skin Thickness	• ^% 11.9 ± 3.07	• ^% 12.05 ± 2.14	• ^% 11.7 ± 0.82	• ^f## 21.9 ± 3.73	• %f## 18.4 ± 1.5
Glandular Diameter	0.0	0.0	• ^ 3.0 ± 0.47	• ^ 3.2 ± 1.62	• %f 1.9 ± 0.32
Hair Follicular Diameter	0.0	0.0	• ^% 3.9 ± 0.61	• f 5.4 ± 0.69	• f 5.2 ± 1.06

Data were presented as mean ± standard deviation. Analysis was done using one – way ANOVA followed by post hoc Bonferroni test.

The * depicts comparison with Group I, # depicts comparison with Group II, f depicts comparison with Group III, % depicts comparison with Group IV, ^ depicts comparison with Group V; * / # / f / % / ^ = < 0.05 (Significant)

Histomorphometry (Table 2)

Epidermal thickness was 3.2 mm in group IV foetuses. In rest of groups, it ranged from 1 mm (Group I) to 2.35 mm (Group II) with no statistically significant differences. Dermal thickness was constant in 1st three groups (9.7 mm to 10.9 mm). Last two groups showed thicknesses of 18.7 mm (group IV) and 17 mm (group V) without significant alteration. The differences between former three groups and latter two groups were highly significant. Total thickness of skin followed dermal pattern, being constant in first three groups i.e. I, II and III (11.9 mm, 12.05 mm and 11.7 mm respectively) without any significant variations. The thickness increased greatly in group IV with a value of 21.9 mm and reducing slightly between group IV and V making it 18.4 mm. Both the aforementioned increment and decrement of values were statistically significant. Measurable hair follicles and eccrine glands were evident in group III onwards only. In groups III and IV specially, diameters of eccrine glands were 3.0 and 3.2 mm respectively, difference being statistically insignificant. In latter

group, the diameter was 3.9 mm in group III foetuses. The measurement was increased to 5.4 mm and 5.2 mm in groups IV and V foetuses respectively. The increment between group III and last two groups (IV and V) was statistically significant while no significant change was noticed among last two groups.

DISCUSSION

Reference periods in terms of foetal development are always of great medicolegal importance. Foetuses in I group of our study were 14 wks old and showed multilayered epidermis (Fig. 1). Holbrook and Odland¹³ in their foetal groups from 65-96 days (about 9 wks to 14 wks) reported clearly visible intermediate and basal cell layers deep to periderm without mentioning the exact period of stratification. McGrath et al¹⁴ similarly mentioned in his manuscript the presence of one or more intermediate layers in foetal group from 12-16 wks. According to Leung et al¹⁵, stratification becomes apparent in foetal skin of 13th week. This could not be confirmed due to lack of 13 week foetus in our

collection. As per previous data¹⁵, the presence of hair follicles was noticed as early as foetus of 14th week. We could clearly define hair follicles only at 17th week (Fig. 2) onwards. Elongated cords of eccrine glands were evident in 22 weeks old foetus (Fig 3) which was like previous finding¹⁵ about sweat gland but in younger (20 week old) foetus.

Our histomorphometric data (Table 2) for some parameters of foetal skin have no parallel reports. The most striking feature was apparent reduction in epidermal, dermal and total skin thicknesses in groups III fetuses compared to group II ones. This can be explained by the report of McGrath et al¹⁴ according to whom by 24 weeks, the periderm separate from embryo and contribute to vernix caseosa. Statistically significant increase in thickness afterwards can only be explained by phenomenon of stratification. By increasing the number of fetuses and procuring smaller ones in future study, the authenticity of statistical analysis and accuracy in time of appearance of skin appendages can be improved.

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