قسم التشريح والهستولوجيا

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تنسج الأغماد الشعرية والغدد الدهنية والأنبيبية في الكلاب

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أجريت هذه الدراسة على ٢١ جنينا تتراوح أطوالها من ٢٠ الى ٢٦٠ ملليمترا ، جمعت من اناث في مراحل مختلفة من الحمل . ثبتت الأجنة التي تتراوح أطوالها من ٢٠ الى ٦٠ ملليمترا في محلول ١٠٪ فورمالين متعادل ومحلول بوان ، ثم قطعت منها قطاعات رقيقة بسمك ٧ ميكرون تقريبا . كذلك أخذت عينات من جلد الأجنة التي تتراوح أطوالها من ٧٠ الى ٢٦٠ ملليمترا وشملت مناطق الجبهه ، الرقبة ، الابط ، الصدر ، البطن ، الخاصرة ، الفخذ ثم ثبتت هذه العينات في محلول ١٠٪ فورمالين متعادل ومحلول بوان ثم جهزت للفحص الميكروسكوبي .

بدأت بشائر الأغماد الشعرية في جلد الأجنة التي تراوحت أطوالها من ٥٠ الى ٦٠ ملليمترا ثم تميزت هذه البشائر الى تراكيب خلوية مسطحة تمت بزاوية مائلة على مستوى البشرة داخل الأدمة في الأجنة التي بلغت أطوالها من ٧٠ الى ٩٠ ملليمترا . كما شوهدت المراحل الاولى من تكوين حلمة الشعرة في المنطقة الظهرية للأجنة التي قاربت أطوالها ٩٠ ملليمترا . تميزت أغماد الشعر الى أغماد أولية مركزية وأغماد أوليه وحشية وظهر الغـــلاف الداخلي للأغماد الاولية المركزية ، كما تميز الشعر الى ثلاث طبقات وهي النخاع والقشـــرة والقرنية في الأجنة التي بلغت أطوالها ١٣٠ ملليمترا .

بدأ تكوين الغدد الأنبيبية والدهنية في الأجنة التي بلغ طولها ١٣٠ ملليمترا وتمـــيزت الغدد الأنبيبية الى قناه وجزء غدي في الوقت الذي تكونت فيه الغدد الدهنية من فص أو فصين وشوهدت بوضوح عضلات انتصاب الشعر في الأجنة التي تراوحت أطوالها من ٢٠٠ الى ٢٢٠ مم .

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HISTOGENESIS OF THE PILOSEBACEOUS APPARATUS IN DOGS
(With 14 Figures)

By

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SUMMARY

Chronological histomorphological studies on the dog foetal skin were performed on 21 dog foetuses (Egyptian land race) ranging from 20-260 mm CVR length. The premordia of the hair follicle started to appear at 50-60 mm CVR length. The hair follicles were distinguished into central and lateral primary follicles at 130mm CVR length.

The primary elements of the tubular and sebaceous glands were demonstrated in foetuses of 130 mm CVR length. At 200-220 mm CVR length, the tubular glands were differentiated into duct and secretory end-piece which showed an apocrine activity. The sebaceous glands were designed into one or two lobules on each side of both types of the hair follicles.

INTRODUCTION

The increasing importance of veterinary dermatology encouraged the histologists to study the normal structure of the integumentary system of domestic and laboratory animals. Although several investigations had been devoted to the histomorphological features of the skin in adult dogs, a complete and accurate information about the embryological development of the dog skin is not available (MULLER and KIRK, 1976). Therefore, the present investigation was carried out to study the chronological events concerning the micromorphological features of the skin in dog foetuses at various stages of pregnancy.

MATERIAL and METHODS

The material used in the present work originated from the skin of 21 dog foetuses obtained from bitches (Egyptian land race) sacrificed at various periods of gestation. The foetuses were removed shortly after evisceration, weighed and the crown-to-rump (CVR) length was measured to the nearest millimeter. The entire foetuses of 20, 30, 50 and 60 mm CVR length as well as skin specimens from the forehead, neck, axilla, thorax, back, belly flank and thigh regions of the foetuses ranging from 70-260 mm CVR length were fixed in 10% neutral buffer formalin and Bouin's fluid. After proper fixation, the material was dehydrated, cleared and embedded in paraffin wax. Serial vertical and horizontal sections of about 7 um were cut and stained with Haematoxylin and Eosin, Van Gieson's stain, Crossman's trichrome, Foot's silver impregnantion stain, Weighert's elastica stain and PAS technique (DRURY and WALLINGTON, 1980).

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RESULTS

In foetuses of 50 to 60 mm CVR length, the primordia of hair follicles were observed at the neck, back and occasionally the belly regions. They were represented by epidermal thickenings at various intervals which bulged on the deep surface of the epidermis constituting the primitive hair germ (Fig. 1). At these regions the cells of the basal layer appeared columnar with elongated basal nuclei which underwent mitotic activities. The primitive hair germ evaginated within the underlying dermis where they became surrounded by a condensation of fibroblasts.

In foetuses of 70-90 mm CVR length, the primordia of the hair follicles increased substantially in number and were represented by follicle plugs. They developed to about 1/4 or 1/3 the depth of the dermis. Few follicle plugs pursued a tubular form in dog foetuses of 90 mm CVR length (Fig. 2).

In foetuses of 130 mm CVR length, the rate of development of the hair follicles varied in the different regions of the body. They reached their maximal size and density at the forehead, neck and thorax regions and their minimal size and density at the thigh region. The largest follicles formed the elements of the central primary hair follicle, however, the smallest ones formed the lateral primary hair follicle. The central primary hair follicle consisted of connective tissue sheath, outer and inner root sheathes (Fig. 3). The connective tissue sheath was represented by a single layer of flattened cells containing compressed darkly stained nuclei. The outer root sheath was consisted of 4 to 5 cell layers. The outer 2-3 layers were formed of large polyhedral cells with eccentric rounded or oval nuclei Their cytoplasm presented PAS-positive granules. These cells decreased in size towards the hair canal, where they became oval with oval vesicular nuclei and then followed with one layer of flat cells containing flat dark nuclei. The inner root sheath could be demonstrated in some relatively well developd central primary hair follicles. It is represented as a 1-3 cells thick layer which extended outwards between the hair and the outer root sheath. It decreased gradually in thickness till it disappeared at the junction between the lower and middle thirds of the hair follicle. The cells of the inner root sheath were relatively small, polyhedral with large oval vesicular nuclei which occasionally underwent mitotic activity. The cells of the inner root sheath presented several deeply acidophilic granules (trichohyalin granules) which reacted negatively to PAS technique.

Few hairs emerged to little extent from the epidermis. The hairs could be distinguished into cuticle, cortex and medulla (Fig. 4). Several follicles showed a hair papilla and a hair matrix. The hair matrix was composed of a single layer of cuboidal cells with basophilic cytoplasm and large vesicular nucleus which was frequently demonstrated undergoing mitotic divisions. The hair papilla was represented by a pyriform or oval pale area centrally located within the hair bulb and was capped by the hair matrix (Fig. 5). It contained several large cells which presented large vesicular nuclei. Several pigment cells were scattered at the hair bulb.

The lateral primary follicles were relatively thinner and shorter than the central primary follicles (Fig. 6). They were consisted of elongated and enlarged terminal portions. The elongated portion consisted of two layers, a peripheral layer which was formed of a single row of cuboidal cells with oval basophilic nuclei arranged perpendicular on the longitudinal axis of the follicle, and a central layer formed of 4 to 5 rows of polyhedral cells with large oval nuclei. The enlarged terminal portion was composed of a collection of darkly stained cells.

The primordia of tubular glands were demonstrated as cord-like outgrowths which extended from the lower side of both types of hair follicles The primordia of the tubular glands of the central primary follicles could be differentiated into 2 portions; an outer narrow

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long portion which was composed of cord-like 2 to 3 cells thick-structure; and an inner rounded portion at the terminal end of the first one. The latter portion was formed of 3-4 dark cells. The rate of development of tubular glands of the central primary follicles varied in the different regions of the body. It reached its maximum at the neck and belly regions, however it showed a minimal rate of development at the thigh, forehead and back regions. The primordia of the tubular glands of the lateral follicles were represented by oval outgrowths which bulged beyond the hair follicles and consisted of several basophilic cells with large deeply stained nuclei. These glands were more frequent at the forehead, neck and thorax regions and relatively few at the thigh region.

The primary elements of the sebaceous glands developed from the cells of the hair follicle. They were demonstrated at the neck, thorax, back and belly regions, and represented by 1 to 3 large polyhedral cells with large vesicular, rounded, centrally located nuclei (Fig. 7). The primordia of the sebaceous glands developed from the primary central follicle at one or both sides, on a level lower than that of the tubular glands and were invested with one layer of flattened cells derived from the outer root sheath.

The primordium of the arrector pili muscle could be demonstrated as a short thread of a single row of smooth muscle fibers on the obtuse angle of the central primary hair follicles (Fig. 6).

In foetuses of 150 mm CVR length, the central primary follicles were larger in size at the forehead, back and reached their maximum at the flank region. These follicles were relatively fewer in number and smaller in size at the neck, thorax, belly and thigh regions. The lateral primary follicles were increased both in depth and size where they demonstrated the hair papilla and matrix and showed the primary elements of the hair at the flank and back regions (Fig. 8). The hair groups were more or less loosely arranged at the thorax, flank and thigh regions. However, they were more compactly disposed at the back and neck regions (Fig.9). The tubular glands of both types of hair follicles were relatively more developed at the neck, flank, belly and thorax regions (Fig. 10). However, they were less developed at the forehead and thigh regions. The sebaceous glands were large at most of the regions, however these glands were relatively smaller at the thigh region. Moreover, the lateral primary follicles at the flank region did demonstrate the primorida of the sebaceous glands unilaterally.

In foetuses of 200 to 220 mm CVR length, the tubular glands were recognizably differentiated into two portions; namely the presumptive duct and glandular portion. These presumptive ducts were canalized and lined with double cell-layer consisted of inner cuboidal and outer flat cells. The glandular portion appeared as a elongated pyriform sacculation lined by one layer of cuboidal cells. The primordium of the myoepithelial cells could be recognized in most of the regions of the body.

The sebaceous glands designed into one or two lobules on each side of the hair follicles. Each lobule was composed of several cells of various sizes and shapes. These cells showed a gradient holocrine activity. The Arrector pili muscle was well differentiated at the obtuse angle of the central primary follicles. Each muscle unit was composed of 3-5 smooth muscle fibers (Fig. 11).

In the full term foetuses (240 to 260 mm CVR length) the tubular glands were accompanied with both types of the hair follicles (Fig. 12). These glands were numerous with obvious apocrine activity at the axilla, neck and belly regions, fewer at the thorax, back and flank regions and scarce with small sized end-pieces of low activity at the forehead and medial aspect of the thigh. The secretory end-pieces were more spiral at the axilla, but showed less spiral pattern at the belly region (Fig. 13).

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The sebaceous glands were relatively large in size and demonstrable at the sides of both types of hair follicles in most of the regions (Fig. 14). They reached their maximal size at the back region, however, they were more prevalent at the neck region. The sebaceous glands were relatively small at the flank and the lateral aspect of thigh. The holocrine activity of the sebaceous glands was demonstrable at the forehead, axilla, neck, thorax and back regions.

DISCUSSION

The present study revealed that the development of the hair follicles is asynchoronous i.e., differs in density from one region to another, a phenomenon which was also recorded in man by MONTAGNA and PARAKKAL (1974). In addition, as a general fact differentiation induced only when all the component parts of the pilosebaceous units had been established.

The arrangement of the hair follicles in the skin of the full term dog foetuses coincided with that observed by BAKER (1966) in neonatal dogs. An arrangement of triads of simple follicles was present, each triad was consisted of a large central primary follicle bounded on either side by two smaller lateral primary follicles, each contained a single hair. Similary, the first hair follicle formed in sheep was termed the central primary follicle and later on, a smaller follicle termed lateral primaries was formed on each side of the central one (CARTER and HARDY, 1947). The description provided with the present investigation dealing with the formation of the hair canal could be supported by the findings of DIEM (1907) who described the formation of hair canals as a function of both the sebaceous gland cells, which were degenerated in the neck region of the follicle, and the epidermal cells which became keratinized some distance above them. However, the latter author considered that the sebaceous gland cells were only secondary for the formation of the epidermal portion of the lumen of hair canals, where they possibly widened the canal by means of the secretion introduced into the lumen. In addition DUERDEN and RITCHIE (1924) added that these canals were formed by disintegration of both cells of the wall of the hair canals and the sebaceous gland cells. On the other hand, MARKS (1895), SPOTTEL & TANZER (1923) & WILDMAN (1932) attributed the origin of the hair canals to the activity of the cells alone.

The present study showed that by 130 mm CVR length, the hairs were fully developed and had emerged from the surface. The act of emergence of the hairs was interpreted by AREY (1974) who mentioned that the hairs do not penitrate the periderm of the epidermis but loosen or break it. Hence in mammals this layer is known as epitrichium. Desquamated epitrichial and epidermal cells mingle with cast-off lanugo hairs and sebaceous secretions to form the pasty vernix caseosa which smears the foetal skin. This material is said to protect the epidermis against macerating influence that otherwise would be exerted by the amniotic fluid. As a lubricant, it also prevents chafing injuries from the amnion as the growing foetus becomes progressively confined in its fluid-filled sac.

The tubular gland primordium appeared as a solid structure from the ental side of the hair follicle nearly at its upper third; a pheomenon which was also recorded in other mammals and man (LYNE and HEIDEMANN, 1959, in cattle, EL-SAKHAWY, 1973, in buffaloes, HELWIG & MOSTOFI, 1971 and MONTAGNA and PARAKKAL, 1974 in man). HAFEZ, BADERALDIN and SHAFEI (1955) in cattel and buffaloes, SAR and CALHOUN (1966) in goats and MARCARIAN and CALHOUN (1966) in swines, mentioned that the tubular glands in these animals are hetero-genous with two phases: an apocrine and merocrine phases. In the present study the latter phase was not observed. This is in accord with the findings of EL-SAKHAWY (1973) in buffalo foetuses and DUOGBAG and BERG (1983) in camel fotuses. The tubular glands in the hairy skin of the dog do not participate actively in the central thermoregulatory mechanism, but serve chiefly for the protection of the skin against excessive rise of temperature (AOKI

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and WADA, 1951). Contrary to what was stated by ROY (1954) that the apocrine function of the tubular glands in dogs is not completely developed until seven to ten months of age, the present study revealed, that the tubular glands demonstrated apocrine activity in dog foetuses of 200-220 mm CVR length and predominated in the full term feotuses.

The present work showed that the development of the sebaceous glands are similar to that described in other mammals (LYNE and HEIDEMANN, 1959; TRAUTMANN and FIEBIGER, 1960; FOWLER and CALHOUN, 1964 and EL-SAKHAWY, 1973). In addition DOUGBAG and BERG (1983) in camel foetuses and EL-SAKHAWY (1973) in buffalo foetuses, mentioned that the sebaceous glands were considered as functional glands nearly from its early development. However, MULLER and KIRK (1976) mentioned that the sebaceous glands of dogs are probably functional before birth. The sebum secreated by the foetal sebaceous glands smears the foetal skin and prevents chafing injuries from the amnion as the growing foetus become progressively confined in its fluid-filled sac (EL-SAKHAWY, 1973). Moreover, the oily secretion produced by sebaceous glands tends to keep the skin soft and pliable by forming a surface emulsion which spreads over the surface of the horny layer to retain moisture and thus maintain proper hydration (MULLER and KIRK, 1976).

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LEGEND OF FIGURES

Fig. (1): Skin of dog foetus (60) mm CVR length showing the primitive hair germ. (Hx. & E. X 400).

Fig. (2): Skin of dog foetus (90 mm CVR length) at the axilla, showing the hair plugs. (Hx. & E. X 250).

Fig. (3): Longitudinal section into a central primary hair follicle of dog foetus (130 mm CVR length). (Hx. & E. X 400).

Fig. (4): Cross section into a hair follicle of dog foetus (130 mm CVR length) at the thorax region. (Hx. & E. X 400).

Fig. (5): Section into the hair bulb of dog foetus (130 mm CVR length). (Hx. & E. X 400).

Fig. (6): Skin of dog foetus (130 mm CVR length) at the thorax region, showing a central (C), lateral (L) primary follicles and their accompanying tubular glands (T). (PAS technique, X 160).

Fig. (7): Vertical section on the skin of dog foetus (130 mm CVR length), showing the primordia of the sebaceous glands (arrow). (Hx. & E. X 400).

Fig. (8): Skin of dog foetus (150 mm CVR length) at the flank region. (Hx. & E. X 160).

Fig. (9): Cross section through the dermis of dog foetus (150 mm CVR length) at the back region. (Hx. & E. x 160).

Fig. (10 a,b): Vertical section through the skin of dog foetus (150 mm CVR length) at the flank and thorax regions, showing the tubular gland accompanying the central primary follicle (a) and the lateral primary follicle (b). (Hx. & E. X 160).

Fig. (11): Vertical section through the skin of dog foetus (220 mm CVR length) at the neck region showing, the Arector pili muscle (M), ad the Sebaceous gland (S). (Hx. & E. X 250).

Fig. (12): Cross section into a hair group of full term dog foetus, at the forehead region, demonstrating tubular glands (T) at both types of hair follicles. (Hx. & E. X 400).

Fig. (13): The tubular glands in the skin of full term dog foetus at the axilla. (Hx. & E. X 160).

Fig. (14): Vertical section into the skin of full term dog foetus, at the back region, demonstrating sebaceous glands (S) at both types of hair follicles. (PAS technique X 250).

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