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Development of mesonephros in paddle staged embryo of *Hipposideros Speoris* (Schnider), Chiroptera; Mammalia.

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ABSTRACT

Embryo of *Hipposideros speoris* at the paddle stage of the development with a body mass 0.022g and CR length of 5.2mm is characterized by the well developed mesonephri. At this stage the mesonephros consists of the well developed Bowman's capsules and the well developed mesonephric tubules opening into the mesonephric duct. Mesonephros shows the afferent glomerular vessel entering the glomerulus and the efferent glomerular vessel emerging out from the glomerulus and the mesonephric tubule originating from the glomerular lumen and leading into the mesonephric duct. In the mesonephri the dorsal large post cardinal vein and a ventral sub cardinal vein connected by the lateral collecting vein are also observed.

KEYWORDS

Bat; Embryo; Mesonephros; Histology; Renal tubule.

INTRODUCTION

In mammals the development of urinary system appears in succession. The formation of excretory organs arises from the intermediate mesoderm appear at early embryonic stages. The anterior embryonic kidneys called the pronephros appear first and degenerated soon in the early embryonic development. The middle embryonic kidneys, the mesonephros develops later to the pronephros. At the posterior to the mesonephri the third excretory organ develops as metanephros. The metanephros serves as the permanent functional kidneys in mammals. The pronephri are vestigial structures in the early mammalian embryos. Pronephros the most primitive organs is a exceedingly transitory structures appears and degenerated in the early embryonic stages in birds and mammals; while its functional role has been replace temporarily by the mesonephros. In early embryonic stages of mammals the mesonephros attain a considerable degree of development and are believe to be involved on the elimination of nitrogenous waste. The mesonephros implies the existence of pronephros and metanephros. All the three types of excretory organ are the paired structures and are concerned in collecting waste (Patten, 1968).

The development of kidneys at 21 somite stage embryo of *Rhinolophus hipposideros* and on older embryos of *Nyctalus* [= *Vesperugo*] *noctula* were noticed by Van der Strict (1913). He examined the structural relationship between the sclerotomes and mesonephric plaques in the embryo of *R. hipposideros* at 21 somite stage which according to him bears bimetameric relationship for each sclerotomes at the cranial end. This pattern was not consistent in the older embryos of *N. noctula*. The typical fetal furrows on the outer surface of embryonic kidneys of *Myotis* (with kidney 1.0 mm in length) and *Plecotus* were observed by Sperber (1944). He also reported that, in these embryonic stages the kidneys shows no differentiation of cortical and medullary components.

Patil *et al*., (2012a) described the developmental morphology of *Hipposideros speoris* (Microchiroptera) in 13 embryos at different stages. They observed distinct cervical flexure limb and tail buds and branchial arches in embryo of CR 5.2mm. In the paddle stages of CR 5.5mm and 5.7mm. and

the early phalange stage at CR 8mm; a fleshy developing uropatagium was noticed. The chiropatpgia, propatagia, plagiopatagia, uropatagia and the exeternal genitalia were noticed in the embryo at CR 8.5mm. They also examined different sitting postures at early term and later developmental stages. The embryo at late term and newborn gives the morphology of an adult but devoid of fur and the eyes were closed without eyelids. Patil *et al*., (2012b) also examined the structure of metanephros in *Megaderma lyra lyra* at phalange stage weighing 0.012g and 15mm CR length. The development of mesonephros and metanephros in Megachiropteran bat, *Rousettus leschenaulti* also examined by Patil *et al*., (2012c).

There is some species specific differentiation of the excretory organs during development. The structural and cellular details of mesonephros paddle stage of *Hipposideros speoris* are examined in this report as a mammalian type.

MATERIALS AND METHODS

The preserved embryos of *Hipposederos speoris* at paddle stage of embryonic development were used in this study. The specimens were previously collected from underground dilapidated dark rooms of an old fort at Ballarshah, Maharashtra, India. The colonies comprised of hundreds of bats. The body weight and crown rump length (CR) of selected embryos at paddle stage were recorded and then fixed in 10% Formalin for 24 hours. The embryos were washed overnight in running tap water and dehydrated by passing through different grades of ethyl alcohol, cleared in xylene and embedded in paraffin (58-60^{o}C). The embryos were cut at 5-7µm with the help of rotary microtome. For routine histology Himatoxyline-Eosin technique was used. The stained sections were observed under light microscope. The measurements of micro-structures were calculated with the help of ocular micrometer scale.

RESULTS

Embryo of *Hipposederos speoris* at the paddle stage of the development with a body mass 0.022g and CR length of 5.2mm (Fig. 1) is characterized by the well developed mesonephri (Figs. 2, 3 and 4). At this stage the mesonephros consists of the well developed Bowman's capsules and the well developed mesonephric tubules opening into the mesonephric duct. Mesonephros shows the afferent glomerular vessel entering the glomerulus (Fig. 2) and the efferent glomerular vessel emerging out from the glomerulus (Fig. 3). The mesonephric tubule originating from the glomerular lumen (Fig. 4) leads into the mesonephric duct. In the mesonephri the dorsal large post cardinal vein and a ventral sub cardinal vein connected by the lateral collecting vein are also observed (Figs. 3 and 4). The mesonephric tubules lined with cuboidal epithelial cells originate from the glomerular lumen and open into the wide mesonephric duct.

Note: *Measurements of Different Components of Mesonephros at Paddle stage are given in* ***Table 1.***

Table 1. Measurements of Different Components of Mesonephros at Paddle stage (CR length 5.2mm) of embryonic development of Hipposederos speoris (in µm).

Sr. No	Part of Renal Tubule	Component	Measurements
1	Mesonephric	Dimension of Mesonephros at T.S	418.6X225.4
2	Bowman's Capsule	External Diameter	57.14
		Diameter of Glomerulus	73.21
		Lumenal Diameter	4.46
		Diameter Cells	5.36
3	Mesonephric Tubule	External Diameter	46.43
		Luminal Diameter	21.43
		Height / Shape of Epithelial cells	14.29(Cuboidal)
4	Mesonephric Duct	External Diameter	28.27
		Luminal Diameter	7.14
		Height / Shape of Epithelial cells	11.14 (Columnar)

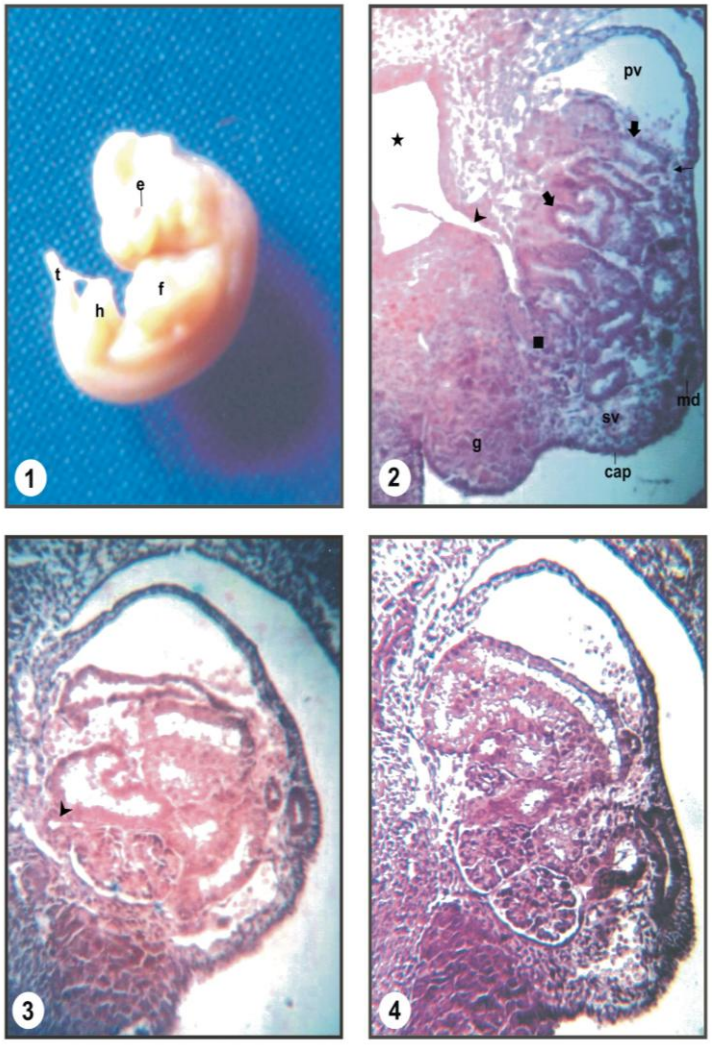

Figure 1: Potrait of the prenatal embryo of *H. speoris* at paddle stage collected on 14.03.99 with a body mass 0.0022g. (CR length, 5.2 mm). e: eye bud; f: fore limb-bud; h: hind limb-bud; n: nasal pit; t: tail bud.

Figure 2: Section of the left mesonephros of the prenatal embryo of *H. speoris* at paddle stage (CR length 5.2 mm) to show the well developed mesonephric tubules. The afferent glomerular vessel (arrowhead) from the dorsal aorta (★) enters the glomerulus (■). The thick arrows point towards the sections of the mesonephric tubule with a wide lumen lined by the cuboidal epithelial cells. A large post-cardinal vein (pv) is located in the dorsal region and the sub-cardinal vein (sv) located in the ventral region connected by a collecting vein (long arrow). The mesonephros is surrounded by the collagenous capsule (cap). md: mesonephric duct; g: gonad.

Figure 3: Section of the mesonephros of the paddle stage embryo of *H. speoris* to show the efferent glomerular vessel (arrowhead) which emerges out from the glomerulus.

Figure 4: Section passing through the mesonephros of the paddle stage embryo of *H. speoris* to show the beginning of the mesonephric tubule from the glomerulus (arrowhead).

DISCUSSION

In the vertebrates during the course of embryogenesis three types of distinct paired excretory organs develop viz, pronephros, mesonephros and metanephros. In mammals the pronephros, mesonephros and metanephros appears in succession. The pronephri and mesonephri are transitory excretory structures, while metanephri develops into the permanent kidney. The tubules of all the three organs arise from intermediate mesoderm which loses its original connection with the somites.

The well differentiated structures of mesonephrios are observed in the paddle stage of *Hipposederos speoris* with a body mass 0.022g and CR length of 5.2mm. At this stage of development the Bowman's capsule consisting of glomerulus with glomerular cells in between the capillary network surrounded by a lumen lined by the flattened epithelial cells. Adjacent to the Bowman's capsule are seen a few developing mesonephric tubules which open into the mesonephric duct. A few glomerular cells are observed in-between the glomerular capillary network. The mesonephric corpuscles undergo differentiation; a large post cardinal vein in the dorsal region and the sub cardinal vein in the ventral region of the mesonephros are observed. The megachiropteran bat, *Rousettus leschenaulti* also exhibit similar type of mesonephros development (Patil *et al*., 2012c).

The renal tubules in the mesonephros exhibit the similar structural components as observed in the metanephric kidneys (Gerhardt, 1911; Rosenbaum, 1970; Patil *et al*., 2011; Patil, 2013). But the length and the degree of differentiation of different parts of mesonephric tubules is less as

compare to metanephtic tubules. No sign of metanephric development was noticed at this embryonic stage. The development and structure of the mesonephri is similar to that in other vertebrates and mammals (Patten, 1968).

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