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Case report

True hermaphroditism in a wistar rat

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Abstract

A rare case of true hermaphroditism was observed in a 9-week-old presumed female Wistar rat. This rat did not reveal any untoward clinical signs, food consumption, body weight gain and changes in haemato-biochemical parameters. Grossly, rat showed reduced size of the left ovary and shortened uterine horn. Microscopically, ovotestis was observed in the left ovarian tissue. Ovary consisted of numerous developing follicles at different stages of development with absence of corpora lutea. Developing testis contained seminiferous tubules lined with sertoli cells and sparse spermatogonial population. Left oviduct resembling developing epididymis consisting of tubules embedded in proliferating fibrous connective tissue, lined with multilayered ciliated columnar epithelial cells. Most of them were empty but, few had eosinophilic secretion and some of them contained exfoliated germ cells. Left uterine horn showed increased stromal connective tissue without proliferation of endometrial glands. A histopathological examination of left ovarian tissue implies a case of true hermaphroditism.

Key Words: Wistar rat, hermaphrodite, ovotestis, follicles, seminiferous tubules.

Introduction

The development of phenotypic sex is a complex process which depends upon the differentiation of bipotential gonads into the testes or ovaries (6). True hermaphroditism is an intersex condition in which the affected individual has elements of both ovarian and testicular tissue that may combine to form an ovotestis (2). The true hermaphroditism is further classified as bilateral (testis and ovary or ovotestes on each side), unilateral (ovotestis on one side and testis or ovary on the other) or lateral (testis on one side and ovary on the other) depending upon the nature and location of the gonads (2,6,7). Pseudohermaphrodites have only one type of gonadal tissue according to which they are classified as male or female pseudohermaphrodites. Development of true hermaphroditism is very rare in rats (1,3,4,7,8). In present case report, attempt has been made to elucidate the histopathology and haemato-biochemical alterations in a rare case of true hermaphroditism.

Case report

A 9-week-old presumed female Wistar rat (Crl:WI) from a repeat-dose toxicity study was subjected to scheduled sacrifice. This rat did not reveal any untoward clinical signs, changes in food consumption, body weight and gain throughout the experimental period. Haematological parameters were within the limits for this age and strain of rat viz., red blood cell count (7.52 x

10^6/mm³), haemoglobin (14.9 g/dl), absolute (6.9 x 10^3/mm³) and differential (lymphocytes - 81%, neutrophils - 14%, eosinophils - 3%, basophils - 0%, monocytes - 2%) leucocyte count, haematocrit (50.7%), reticulocyte count (1.63%), prothrombin time (9.5 s) and activated partial thromboplastin time (12.3 s).

The various plasma biochemical parameters level were glucose (93 mg/dl), total protein (6.8 g/dl), cholesterol (102 mg/dl), triglycerides (47 mg/dl), total (0.24 mg/dl) and direct bilirubin (0.11 mg/dl), blood urea nitrogen (18.1 mg/dl), creatinine (0.35 mg/dl), alanine transaminase (41.9 u/l), aspartate transaminase (75 u/l), alkaline phosphatase (94 u/l), gamma glutamyl transferase (3 u/l), creatinine kinase (169 u/l), lactate dehydrogenase (132 u/l), calcium (11.1 mg/dl), phosphorus (6.36 mg/dl), sodium (142.2 mmol/l), potassium (3.18 mmol/l) and chlorides (103.6 mmol/l) were within the limits. Bone marrow cytology did not reveal any abnormalities for myeloid to erythroid ratio.

Animal was sacrificed by carbondioxide asphyxiation followed by complete exsanguination and then subjected for detailed necropsy. Grossly, the rat showed unilaterally reduced size of the left ovary and shortened uterine horn (Fig.1). Surface of the ovary was smooth with no visible corpora lutea and oviduct. Gross observation of other organs appeared normal. Ovarian tissue was collected along with other protocol organs in 10% neutral buffered formalin. Tissues were processed and sectioned at 3-5µ thickness and stained with hematoxylin and eosin (HE).

Histologically, left ovarian tissue showed ovotestis (Fig. 2). Ovary consisted of numerous developing follicles at different stages of development, however no corpora lutea were observed (Fig. 3). Developing testis contained seminiferous tubules lined with sertoli cells and sparse spermatogonial population (Fig. 4). Neither spermatids nor spermatozoa were seen in the tubules however, interstitial cell proliferation was evident in between the seminiferous tubules (Fig. 4). Left oviduct resembling developing epididymis consisting of tubules lined with multilayered ciliated columnar epithelial cells (Fig. 5). Mostly, the tubules were empty except for a few, had eosinophilic secretion and some of them contained exfoliated germ cells (Fig. 5). These tubules were embedded in proliferating fibrous connective tissue (Fig. 5). Left uterine horn showed increased stromal connective tissue without proliferation of endometrial glands (Fig. 6). Right ovary and uterine horn, cervix, vagina, mammary gland, pituitary gland, long bones and other organs did not reveal any abnormality on histopathological examination.

Figure 1 – Wistar rat; Reduced size of the left ovary with smooth surface and no visible corpora lutea, and shortened uterine horn.

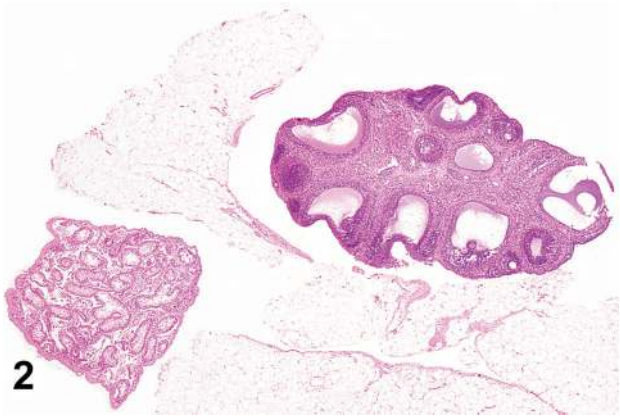

Figure 2 – Wistar rat; Histological section of the left ovarian tissue showed ovotestis comprised of ovary and testis. HE. 25x

Discussion

The true hermaphroditism was observed without any alterations in haemato-biochemical parameters. The microscopic observations reported earlier in the cervix, vagina and mammary gland were suggestive of consistent hyperestrinism (2,8) which was not evident in the present case and also reflected in the uterus as absence of endometrial gland. In addition, androgens secreted by the developing testes might not be adequate to influence external genitalia to exhibit masculinization (9). Moreover, hormonal imbalance manifested in the pituitary gland and long bones was not apparent microscopically (2).

Embryonal development of the genital ridge into either an ovary or a testis depends on the absence or presence of an intact Y-chromosome (2). For testicular differentiation, the SRY gene (sex determining region on the Y-chromosome) is essential and is responsible for the

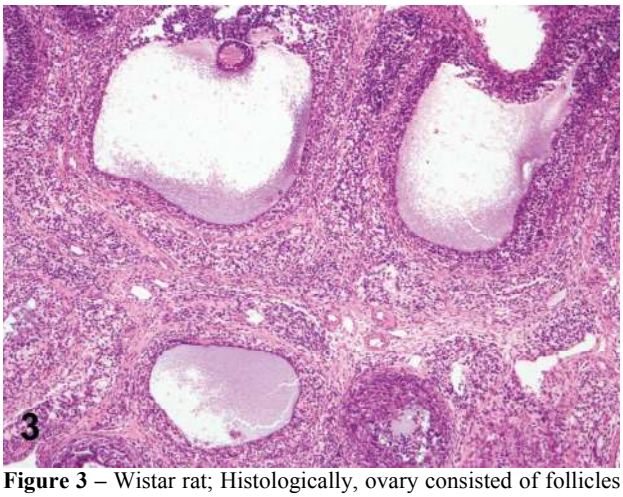

Figure 3 – Wistar rat; Histologically, ovary consisted of follicles at different stages of development and absence of corpora lutea. HE. 100x

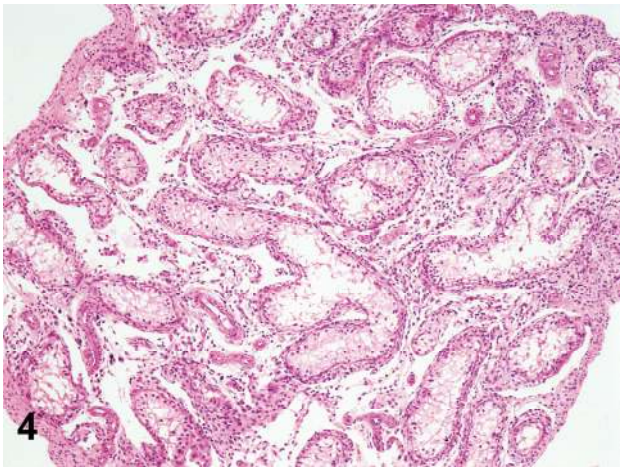

Figure 4 – Wistar rat; Histologically, testis contained seminiferous tubules lined with sertoli cells and sparse spermatogonial population and interstitial cell proliferation. Neither spermatids nor spermatozoa were seen in the tubules. HE. 100x

induction of testicular development (2). During sexual differentiation, development of wolffian duct system and concurrent regression of mullerian duct system depends on the androgens released by Leydig cells of the embryonic testes (1,5). Regression of mullerian duct system also depends on the effects of anti-mullerian hormone produced by Sertoli cells. (2). Hermaphrodites have ovotestis, thus estrogen from the embryonic ovary may permit the maintenance of the mullerian duct system (5). Ovotestis without haemato-biochemical alterations and unilateral genital organogenesis seen in this case were mainly attributed to the abnormal quantity of secretion of these hormones and their strength of stimuli during development (1,4,10). However, the hormonal assay may envisage the underlying mechanisms for the phenomenon of hermaphroditism.

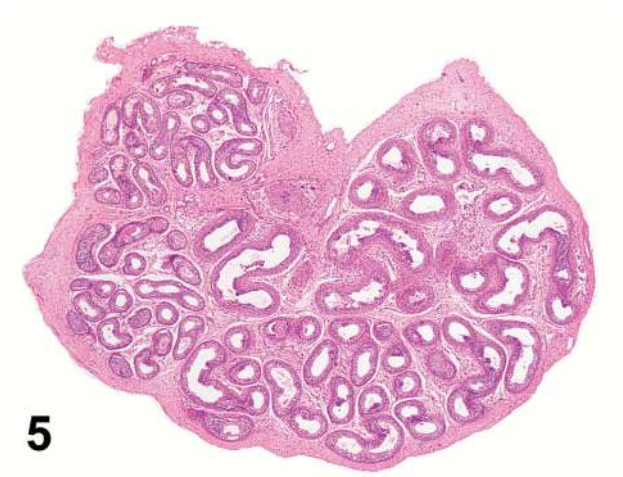

Figure 5 – Wistar rat; Histologically, epididymal tubules were embedded in proliferating connective tissue lined with multilayered ciliated columnar epithelial cells. Most of them were empty but, few had eosinophilic secretion and some of them contained exfoliated germ cells. HE. 25x

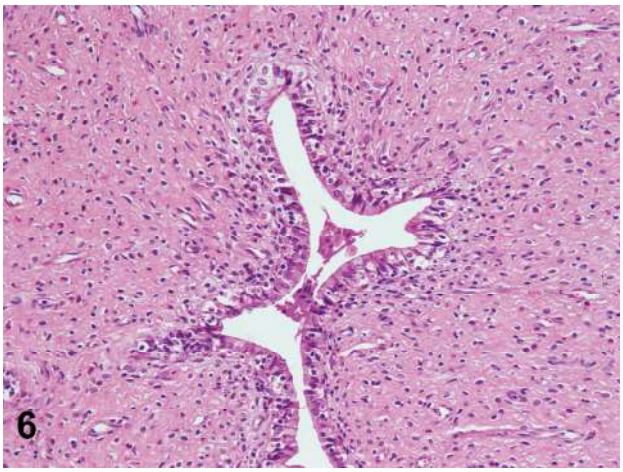

Figure 6 – Wistar rat; Histologically, left uterine horn showed absence of endometrial glands proliferation and increased stromal connective tissue. HE. 200x

Acknowledgements

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