Histological study of neonatal testis

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Abstract

During prepubertal development in most species, normal testicular growth is associated with dramatic proliferation of Leydig cells in the interstitium and an increased number of Sertoli and germ cells within the seminiferous epithelium. The study was designed to study the histology of neonatal testis. Ten specimens of human neonatal testes their age range from 10 -45 days were prepared, fixed, sectioned and stained. In early postnatal life the human seminiferous tubules is composed of solid cords containing two cells, the precursors of sertoli cells and the cells of the germinal course.

Introduction

It is generally accepted that adult testis size is correlated with capacity to produce sperm and that total Sertoli cell numbers determine mature testis size in males of various mammalian species. It is also accepted that Sertoli cell proliferation occurs prepubertally and that total Sertoli cell numbers are established both prior to formation of the blood-testis barrier and prior to puberty. However, in swine, only two studies to our knowledge have enumerated Sertoli cells in mature and neonatal boars of conventional breeds, and no definitive studies have assessed changes in Sertoli cell numbers during postnatal testicular development in conventional boars. In Brazilian Piau boars, an exotic breed, one report states that Sertoli cell numbers increase dramatically between 1 and 4 mo of age. In contrast, another report states that Sertoli cell numbers per testis decline by 40% between 3 and 5 mo of age in conventional boars. Thus, enumeration and proliferation of porcine Sertoli cells during postnatal development remains to be clarified (1).

During prepubertal development in most species, normal testicular growth is associated with dramatic proliferation of Leydig cells in the interstitium and an increased number of Sertoli and germ cells within the seminiferous epithelium. Unilateral castration of prepubertal male mammals causes compensatory hypertrophy and increased size in the remaining testis, but hypertrophy generally occurs only if unilateral castration is performed in prepubertal males. In most species, this hypertrophy has been associated with increased diameter and length of the seminiferous tubules, increased numbers of germ and Sertoli cells, and increased sperm production per testis at maturity. Thus, the proliferative response to prepubertal unilateral castration is often used as a model for studying factors influencing testicular development. However, the few studies available regarding unilateral castration of boars have reported increased testis size some increase in Sertoli cell numbers after only short-term unilateral castration, or implied increases in Sertoli cell numbers inferred from increased mass of seminiferous tubules. In prepubertal boars, definitive studies regarding the effects of unilateral castration on compartmental hypertrophy, Leydig cell numbers, and Sertoli cell numbers remain to be conducted(1,2).

The number of Sertoli cells in the adult testis is recognized to be a major determinant of sperm output. In higher primates, two distinct periods of Sertoli cell proliferation have been described: the first beginning in fetal life and continuing throughout the prepubertal period, and the second occurring at puberty when spermatogenesis is initiated (3,4). The second, or pubertal, phase of primate Sertoli cell division is observed in association with

the rise in gonadotropin secretion that occurs at this stage of development and, in the juvenile rhesus monkey, may be induced precociously by the premature activation of endogenous LH and FSH secretion (4). The role of the gonadotropic hormones in stimulating Sertoli cell proliferation during the prepubertal phase of primate development is less clear, but two schemata of proliferation have been proposed (5). In the first, prepubertal proliferation of this somatic cell type is posited to be also gonadotropin dependent, and therefore to be restricted to the first 6 months of postnatal life (infancy), a period of development, which, like that of puberty, is characterized by robust LH and FSH secretion (6). In the second model, Sertoli cell division before puberty is argued to be gonadotropin independent and therefore to occur insidiously and at a relatively constant rate throughout both infancy and the protracted and relatively hypogonadotropic juvenile phase of development that, in higher primates, separates infancy from puberty (6).

Materials and Methods

Ten specimens of human neonatal testes their age range from 10 -45 days were included in this study. Testicular tissue removed and cleaned from other tissues and fixed in Bouins fixative for 16 hrs. After that, the tissue were dehydrated and embedded in paraffin. . Then the block were cut (5-µm thick) and stained with periodic acid-Schiff and hematoxylin for histological and morphometric analyses. The total number of Sertoli cells per testis, absolute volume, diameter, and length of the seminiferous cords were calculated (4).

Results

Table one shows the seminiferous tubules and testicular weight of testes tissue. It was found that the mean weight was 0.079g while the length of the cord was 13.6m. The section shows that the seminifrous tubules were contain gonocytes (figure.1). The gonocyte appeared as large pale cells. Also this figure shows that there were immature sertloi cells were present.

In early postnatal life the human seminiferous tubules is composed of soild cords containing two cells, the precursors of sertoli cells and the cells of the germinal course (figure.2). Figure.3 shows that the primordial germ cells which appear as a large cell with basophilic cytoplasm and contain one or two large nuclei. Compositions of basement membarane were illustrated in figure.4. It composed from fibroblasts and one layer of collagen fibers and interstitial cells were present in connective tissues that full the spaces between the seminiferous tubules.

Discussion

The testis has two major functions, production of spermatozoa that transmit the male genes to the embryo and the androgens required for completion of masculinization. Spermatozoa develop within the tubules while androgens are synthesized between the tubules. Germ cell which produced by a process known as spermatogenesis from the seminiferous tubules. At day 21 of embryonic life, the primordial cells (gonocytes) of seminiferous tubules were originated from the yolk sac endoderm. The epithelium of these tubules was composed of two distinct cell types, the supporting cells precursors of sertoli cells and gonocytes. Allen were reported that the definitive germinal cell line is formed from undifferentiated epithelial like cells while Clermont and Perey reported that the definite germ cell line dose arises from gonocytes and supporting cells precursors of sertoli cells. Many other investigators were report the same result.

Müller and Skakkebaek (9) studied human testis growth during the first 10 yr of life. They found that median weight of testes, in 53 boys who suffered from sudden death, increased from 0.57 during the first year of life to 1.5 g during the 5- to 9.9-yr period. In the present study, our subject material allowed for an analysis during the first year of life separating newborns from the rest of infancy. We found a vigorous testicular growth during the first 3 wk of life that waned during the rest the first year. In fact, we could not detect further growth during

early childhood. Therefore, we conclude that testis size doubles during the first month of life and then remains practicably stable for at least 5 years.

The most exhaustive study of Sertoli cell number during development in man has been provided by Cortes et al. (3), who used autopsy specimens collected from stillborn fetuses and from boys and men after sudden death. Their results indicate that the number of Sertoli cells in testes of infants, 3 months to 1 yr or so of age, was markedly greater than that observed in 28- to 40-wk-old fetuses. Moreover, Sertoli cell number in adults was 2-fold greater than that in prepubertal boys. Thus, although the relative contribution of the infantile and pubertal phases of proliferation to the adult complement of this cell type may differ in man and monkey, it seems reasonable to conclude that the postnatal ontogeny of Sertoli cell number in these higher primates is similar.

The foregoing schemata proposed for the postnatal proliferation of Sertoli cells in higher primates; however, do not appear to be applicable to New World monkeys. In the marmoset and cebus monkey, a pubertal increase in Sertoli cell number has not been observed, and the postnatal proliferation of Sertoli cells appears to be restricted to the neonate and infant phases of development (10, 11). Thus, although others (11,12,13) have argued that rodent and New World primate models of human Sertoli cell development are superior to those based on the rhesus monkey, this view now needs to be reevaluated.

References

1. Orth JM, Gunsalus GL, Lamperti AA 1988 Evidence from Sertoli cell-depleted rats indicates that spermatid number in adults depends on numbers of Sertoli cells produced during perinatal development. Endocrinology 122:787–794
2. Sharpe RM 1994 Regulation of spermatogenesis. In: Knobil E, Neill JD, eds. The physiology of reproduction. Vol 1, 2nd ed. New York: Raven Press; 1363–1434
3. Cortes D, Muller J, Skakkebaek NE 1987 Proliferation of Sertoli cells during development of the human testis assessed by stereological methods. Int J Androl 10:589–596
4. Marshall GR, Plant TM 1996 Puberty occurring either spontaneously or induced precociously in rhesus monkey (*Macaca mulatta*) is associated with a marked proliferation of Sertoli cells. Biol Reprod 54:1192–1199
5. Plant TM, Marshall GR 2001 The functional significance of FSH in spermatogenesis and the control of its secretion in male primates. Endo Rev 22:764–786
6. Plant TM 1994 Puberty in primates. In: Knobil E, Neill J, eds. The physiology of reproduction. Vol 2, 2nd ed. New York: Raven Press; 453–485
7. Rey RA, Campo SM, Bedecarras P, Nagle CA, Chemes HE 1993 Is infancy a quiescent period of testicular development? Histological, morphometric and functional study of the seminiferous tubule of the cebus monkey from birth to the end of puberty. J Clin Endocrinol Metab 76:1325–1331.
8. Sharpe RM, Walker M, Millar MR, Atanassova N, Morris K, McKinnell C, Saunders PTK, Fraser HM 2000 Effect of neonatal gonadotropin-releasing hormone antagonist administration on Sertoli cell number and testicular development in the marmoset: comparison with the rat. Biol Reprod 62:1685–1693
9. Müller J, Skakkebaek NE 1983 Quantification of germ cells and seminiferous tubules by stereological examination of testicles from 50 boys who suffered from sudden death. Int J Androl 6:143–156
10. Rey RA, Campo SM, Bedecarras P, Nagle CA, Chemes HE 1993 Is infancy a quiescent period of

testicular development? Histological, morphometric and functional study of the seminiferous tubule of the cebus monkey from birth to the end of puberty. J Clin Endocrinol Metab 76:1325–1331

11. Sharpe RM, Walker M, Millar MR, Atanassova N, Morris K, McKinnell C, Saunders PTK, Fraser HM 2000 Effect of neonatal gonadotropin-releasing hormone antagonist administration on Sertoli cell number and testicular development in the marmoset: comparison with the rat. Biol Reprod 62:1685–1693.
12. Joyce KL, Porcelli J, Cooke PS 1993 Neonatal goitrogen treatment increases adult testis size and sperm production in the mouse. J Androl 14:448–455.
13. Kirby JD, Jetton AE, Cooke PS, Hess RA, Bunick D, Ackland JF, Turek FW, Schwartz NB 1992 Developmental hormonal profiles accompanying the neonatal hypothyroidism-induced increase in adult testicular size and sperm production in the rat. Endocrinology 131:559–565

Table (1) seminiferous cord and testicular weight

Parameters	Neonate
Weight of testis	0.079+0.027
Volume of cord (cm)	0.021-3
Diameter of cord (cm)	43-1
Length of cord (m)	13.6-2.1

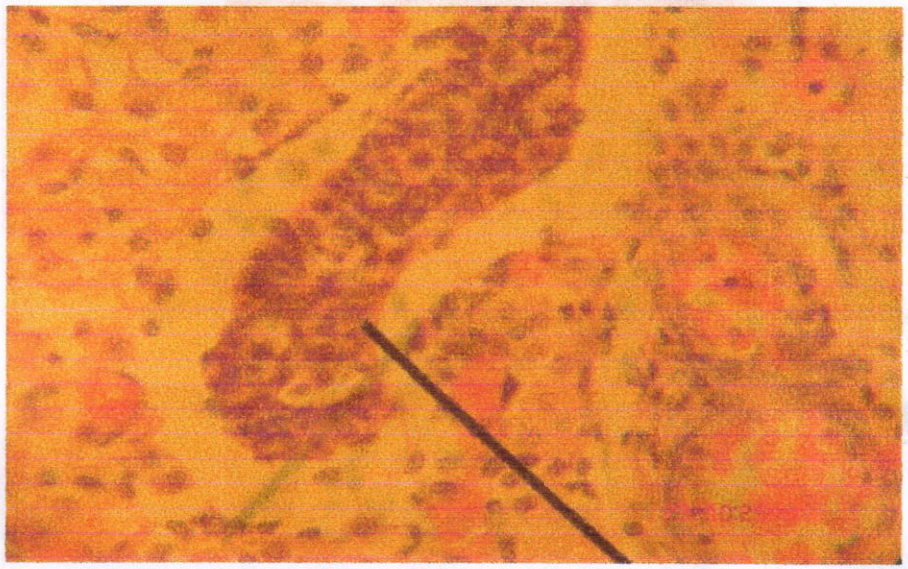

Fig.1-The section shows that the seminifrous tubules were contain gonocytes as large pale cells

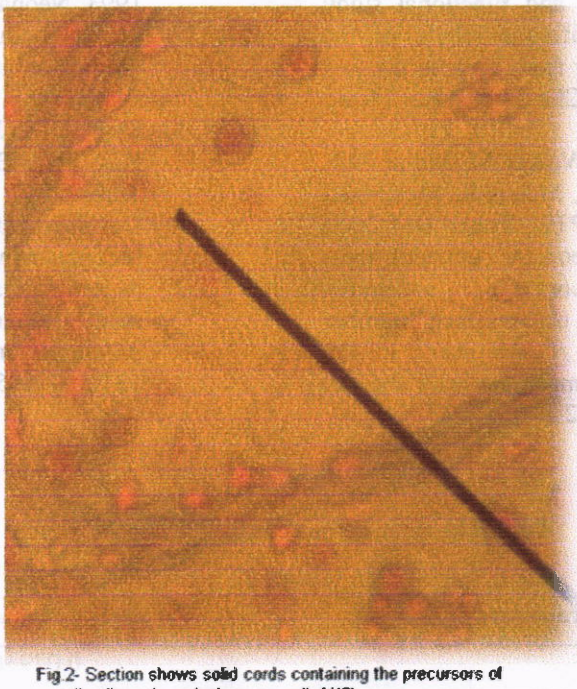

Fig.2- Section shows solid cords containing the precursors of sertoli cells and geminal course cells(X40)

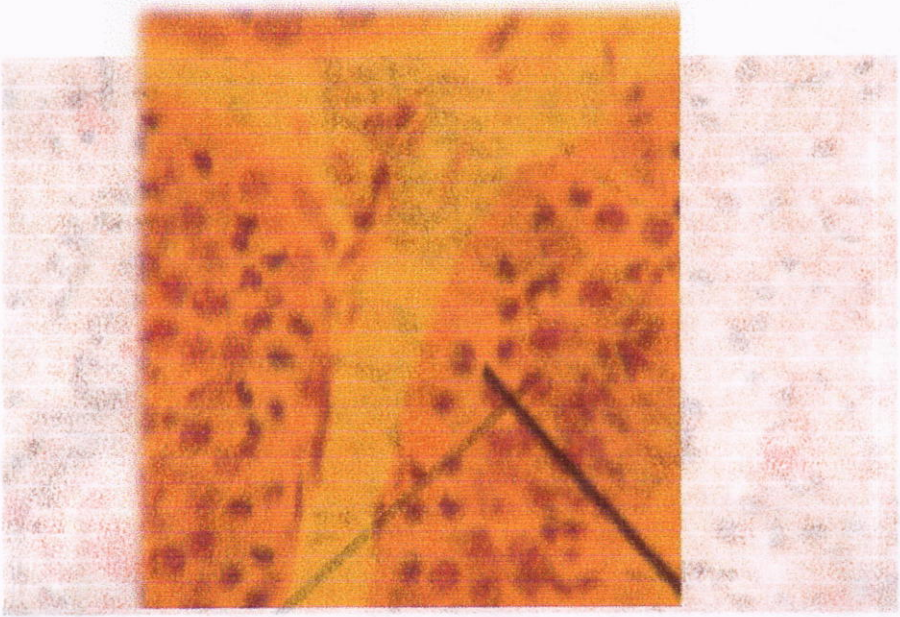

Fig.3- Section shows the primordial germ cell which appear as large cell and contain ond or two large nuclei

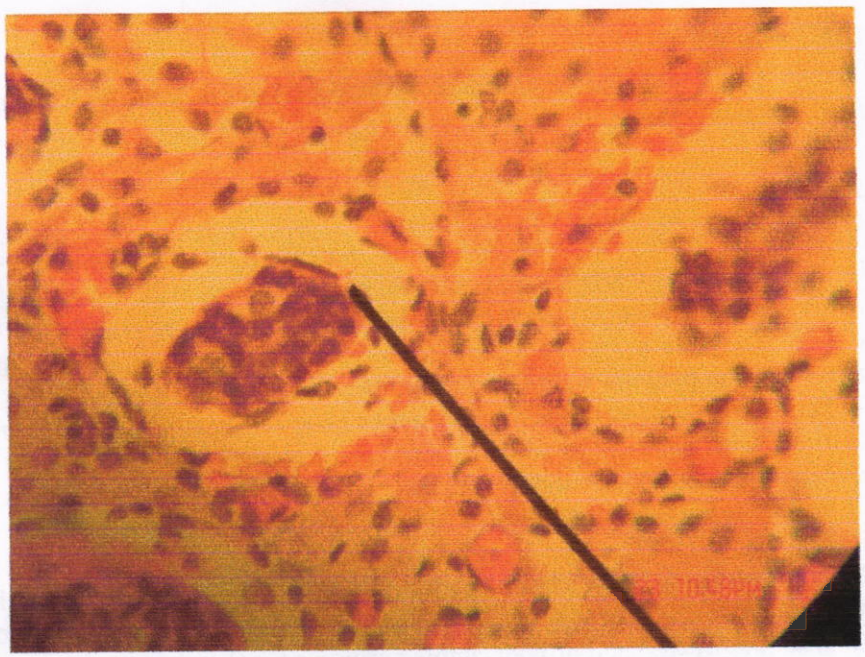

Fig.4- Section shows the basement membrane which co
from fibroblast, collagen fibers and interdtitial cells(X40)