INTERSEXUALITY IN THE HORSE

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ABSTRACT


A cytogenetic and clinical study of an intersexual Arabian horse revealed it to be a genetic female but a gonadal male intersex. This corresponds in general to previously reported cases, which have been genetic females despite the presence of male gonads (or ovotestes). The reliability and ease of polymorph sexing in the horse as a method of determining the genetic sex has been confirmed. Once this is known an easy decision can be made as to the feasibility of castration or not. In the case described castration resulted in an improved feminine appearance.

INTRODUCTION

Chromosome studies have given a new incentive to studies on intersexuality. Formerly these studies were mainly morphological (Levens, 1911; Howell, 1938; Krediet, 1939) but now, since the advent of cytogenetics, they can actually be correlated with the gonorx in could be erected, 1967; Kraus & Widmaier, 1960). According to Gerneke (1967) the latter may be determined in two ways:

(a) by direct chromosomal visualization in which the male or female sex chromosomes can be identified microscopically [Plate 1 (4)], or

(b) by nuclear sexing in which either the Barr body, representing one condensed x-chromosome, is determined in nervous tissue [Plate 2 (6 and 7)] or other cells, or the presence or absence of drumsticks in polymorphonuclear leucocytes [Plate 1 (5)] in blood smears is ascertained; their presence indicates the female sex. Although polymorph sexing, as the latter method is called, is unreliable in ruminants and pigs it is unquestionably applicable to the horse (Zaorslek, 1959) and the dog (Gerneke, de Boom & Heinichen, 1968).

The intersex state in the horse is very rare indeed. Between 1909 and 1938 Krediet (cited by Bornstein, 1967) only encountered 17 cases some of which were incompletely described. All had a penis-like clitoris [Plate 2 (6 and 9)], a pair of hypoplastic testes [Plate 1 (1)] and revealed male libido. Some regularly came on heat every 3 weeks. The penis-like phallic, directed caudally, erected when in the presence of a mare on heat. Internal sexual organs were female. Krediet (1939), however, described one horse having ovotestes. Levens (1911) examined 15 foals with defective developed sexual organs; they had been sired by the same stallion bred to different mares. He found spermatzoza in the better developed testes of some cases. Bornstein (1967) described two equine intersexes both with female karyotype and the same morphology as the 17 cases above. He found that the phallus on erection discharged a slimy, watery fluid from which spermatozoa were absent. Howell (1938) also mentioned a 4 year old hermaphrodite horse in which the enlarged clitoris could be erected. Kogalski (1960), in a recent case report, described an intersex horse ("Nord Sevensk" breed) morphologically similar to the case described below and to some of those described by earlier workers; it exhibited intense libido and emitted an azospermic discharge in drops during sexual excitement. White & Parbrother (1969), in a similar case, found evidence of a bulbourethral gland but no prostate or seminal vesicles. Two subcutaneous testicles were present in the midline with small and under-developed seminiferous tubules, between which Leydig cells were numerous. The genetic sex was not determined.

By means of nuclear sexing Franz & Widmaier (1960) were able to identify their gonadal male intersex as a genetic female. In an attempt to explain the phenomenon, they raised the possibility of a Klinefelter type syndrome but lacked definite chromosomal proof, as chromosome spreads were not made. Morphologically and histologically it resembled the above 17 cases but in addition a small prostate and bulbourethral gland were present. Freundenberg (1960) described a female-like intersexual foal (freemartin) born as a twin to a male. Allantochorionic anastomoses between twin horse foetuses were mentioned by Keller (1934).

In view of the rarity of the intersex state in horses and the limited number of sex determinations done, it was considered worthwhile to describe a case which we have encountered and to compare its features with those of previous cases in order to assess similarities in morphology of the sexual tract of the equine intersex and its relation to genetic sex. This condition is always associated with cryptorchidism and should not be confused with uncomplicated cryptorchidism frequently encountered in the horse.

DESCRIPTION OF CASE AND METHOD OF EXAMINATION

An Arabian filly, about 1 year old, with an enlarged penis-like clitoris was referred to the Genetics Department of this Faculty for clitorectomy for aesthetic reasons. For her age the filly was poorly grown out. Clinical examination of the external genitalia [Plate 2 (9)] revealed a rudimentary vulva with an enlarged penis-like clitoris within the labia. The clitoris measured about 4 cm in length and was 3 cm in diameter at the glans. The dorsal commissure of the vulva was connected to the ventral part of the anus by a firm fimbriated raphé, measuring about 12 cm in length. Smegma was found within the fossa clitoris. The urethral opening was situated slightly towards the dorsal half of the caudal surface of the glands [arrow, Plate 2 (9)]. Two small, hard structures, apparently testes, were palpated at the opening of the external inguinal canal. Two well developed tests were present and rudimentary mammary tissue could be palpated [Plate 2 (8)].

For ethical reasons clitorectomy was not performed but bilateral castration was carried out instead. Both testes moved freely within the inguinal canal; a very strong retractile cremaster response did not facilitate surgery.

During her stay at the clinic the filly showed no distinctive behavioural pattern.

Chromosome spreads were prepared according to a previously described method (Gerneke, 1967) in which
FIG. 1 The testis of the Arabian filly immediately after its removal. T, testis; H, head of epididymis; B, body of epididymis; L, tail of epididymis; D, ductus deferens cut; M, torn mesorchium; S, spermatic cord; ST, sinus testicularis.

FIG. 2 The histological appearance of the testis: Numerous atrophic seminiferous tubules arranged in fibrous tissue in which pigment-rich Leydig cells are numerous.
Fig. 3 The neuroidroma in which fibrous connective tissue and adipose tissue is intermingled with nerve cells and nerve fibres. A few mitotic figures revealing proliferation of nerve cells were identified.

Fig. 4 A chromosome spread revealing the two x-chromosomes (at arrows) and a total of 64 chromosomes, the normal diploid number for the horse.

Fig. 5 The neutrophil on the right shows a distinct “drumstick” attached to the nucleus whereas the red blood cells reveal “rouleaux” formation typical for the horse.

Fig. 6 and 7 Some nerve cells with sex-chromatin bodies of Barr distinctly seen lying against the nuclear membranes.

Fig. 8 The inguinal region revealing an immature udder with two distinct teats and the penis-like clitoris in ventral view. The arrows indicate the subcutaneous position of the testes.

Fig. 9 The photograph shows the penis-like clitoris in the vulva, the latter being joined to the anus by a median raphe. The arrow points to the urethral opening on the clitoris.
bone marrow cells obtained by sternal puncture were the source of actively dividing cells.

Polymorph sexing was done on blood smears stained with Giemsa solution.

When examined about a year after castration, the animal had grown out well with a distinct feminine habitus. The labia of the vulva, although shorter in length than in a normal mare, were more closely opposed, and slightly better defined than before. The penis-like structure had not changed appreciably in size. In relation to the normal growth of the body and surrounding structures, however, it had become smaller and lay concealed within the vestibulum. On urination a well defined stream instead of the normal female "gush" was still very distinctive. After urination the labia closed satisfactorily. Mammary and test development was similar to that which would be expected in a 17 month old filly.

Pathological Observations

Both testes were very small (diameter 1.5 cm, length 2.5 cm) and compact [Plate 1 (1)]. Of a dark brown color, consisting mainly of connective tissue and hypoplastic seminiferous tubules [Plate 1 (2)]. The latter were lined by Sertoli cells amongst which occasional Leydig cells were present. The interstitial connective tissue was increased in amount and contained numerous lymphatics present. An occasional small, brown granular pigment assumed to be lipofuscin. The numerous nerve cells present contained numerous lymphocytes present. An occasional artery was hyperplastic.

The left testis contained a compact nodule about 1 cm in diameter and of a white laminated appearance and hard consistency [Plate 1 (3)]. On histological examination it was diagnosed as an early neurofibroma. The numerous nerve cells present contained many Barr bodies, thus indicating the female genetic sex of the animal [Plate 2 (5 & 7)].

Immature and hypoplastic efferent and epididymal ducts were present, supported by a relatively increased amount of fibrous tissue. No sign of any ovarian tissue was encountered. In the lining cells of the numerous lymphatics present. An occasional artery was hyperplastic.

The presence of the neurofibroma is an interesting feature as it represents continued growth of nervous tissue in the absence of tissue to be innervated — giving thereby origin to the concentric arrangement. Krediet [cited by Bornstein, 1967] has also reported finding nodules in the testis of a hermaphrodite horse, but he did not present the histological picture. The effect of age on these nodules has not been studied.

With suppressed gonadal development, interstitial cells, normally present in the foetus in great numbers, are also suppressed, giving rise to the large, pigment-containing cells with ovoid nuclei. The presence of such large, lipofuscin-filled cells are suggestive of foetal testicular degeneration. It is doubtful whether the interstitial cells in our case could ever have reached the massive degree of development that is normally present in the foetus — regressive changes could be expected to be preponderant.

The beneficial effect of castration on the subsequent feminine development may have been due to the absence of the suppressing influence that any male hormone produced by the testes would have had. The earlier the castration, therefore, the greater the expected aesthetic effect thereof.

Summary

A brief review of the literature on intersexuality in the horse is given with a description of an intersex encountered in the Arabian breed. All intersexes of which the genotype has so far been described, have been found to be genetic females, notwithstanding the presence of male gonads. Polymorph sexing, in which drumsticks are found in polymorph of the female, is an ideal and rapid method for determining the genetic sex in doubtful cases. Castration of the intersex resulted in an improved feminine appearance.

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REFERENCES


