STUDIES ON PUBERTAL DEVELOPMENT IN BOARS AND RAMS: EFFECTS OF HEMICASTRATION AND ARTIFICIAL CRYPTORCHIDISM ON HORMONE SECRETORY PATTERNS AND DEVELOPMENT OF REPRODUCTIVE ORGANS

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ABSTRACT

STUDIES ON PUBERTAL DEVELOPMENT IN BOARS AND RAMS: EFFECTS OF HEMICASTRATION AND ARTIFICIAL CRYPTORCHIDISM ON HORMONE SECRETORY PATTERNS AND DEVELOPMENT OF REPRODUCTIVE ORGANS

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Experiments described in this thesis were designed to reinvestigate longitudinal patterns of secretion of LH and testosterone in boars and rams; also to determine the effects of hemicastration of boars and the effects of hemicastration and artificially induced cryptorchidism of rams on longitudinal and acute hormone secretion patterns, as well as some parameters of reproductive organ development.

Plasma LH and testosterone levels of spring and autumn born Large White x Landrace boars were relatively high at birth, but declined from about the 4th postnatal week. Autumn born boars showed a distinct prepubertal LH peak, but in spring born animals there was no such peak. LH concentrations of barrows were high throughout the period of study. Plasma testosterone levels were low between 4 and 12 weeks of age then increased progressively until the end of study. Season of birth had little influence on the longitudinal profiles of secretion of either hormone.

Intensive bleeding experiments with entire and hemicastrated boars confirmed that LH and testosterone were secreted in a pulsatile manner; hemicastration had no significant effect on pulsatile secretion, mean hormonal concentrations, nor LH or testosterone responses following injection of GnRH. On the other hand, while LH responses to GnRH administration were not affected by advancing age, the subsequent testosterone output increased with sexual maturation.

Compensatory hypertrophy in testicular and epididymal weights and in seminiferous tubular diameters was noted in organs recovered from hemicastrates. However, qualitative histological analyses of testicular samples revealed that the cellular changes observed in all animals were of maturational nature and entirely age-related. From these observations it was concluded that hemicastration of developing boars did not result in any acceleration of the onset of spermatogenesis nor any advancement of puberty.

In ram lambs LH concentrations were low at birth, increased to peak levels at around 10 weeks of age, then declined to low values between 16 and 30 weeks of age when the experiment ended. In contrast plasma testosterone values were low at birth but increased steadily, particularly from about 18 weeks of age.

Mean LH and testosterone concentrations recorded from longitudinal, acute profile and pre-GnRH plasma samples of hemicastrated ram lambs confirmed the observations recorded from hemicastrated boars that the remaining testes were capable of secreting near normal quantities of testosterone and hence maintaining virtually unchanged plasma LH levels. On the other hand, a transient but significant increase in plasma FSH levels was detected following hemicastration of ram lambs. Conversely, cryptorchidism caused an elevation of LH and FSH secretion throughout the period of study. Neither surgical treatment had any influence on longitudinal or acute prolactin or testosterone secretory patterns. Mean plasma prolactin levels recorded from all animals were high initially then declined steadily throughout the period of study. That decline in prolactin levels coincided with the seasonal decrease in daily photoperiod. Plasma testosterone levels recorded from all three treatment groups increased steadily from birth to reach peak concentrations at 30 weeks of age.

Short term profile studies with entires, hemicastrates and cryptorchids confirmed the episodic mode of secretion of LH, prolactin and testosterone, and to less extent FSH. Hemicastration had no significant effect on episodic secretion of any of these hormones. Cryptorchidism caused a significant increase in number of LH peaks and a decrease in number of testosterone peaks, but had no effect on patterns of prolactin or testosterone secretion.

GnRH administration caused an increase in plasma LH, FSH and testosterone secretion in entires and responses were unaffected by hemicastration. However, exaggerated gonadotrophin responses were noted from cryptorchids, while the testosterone responses recorded from these animals tended to be lower (but not significantly so) than those of entires and hemicastrates. Mean plasma gonadotrophin levels recorded from each group were reduced by testosterone propionate pre-treatment; that result gave support to the concept that hypoandrogenism may have been the major reason for the elevation of plasma LH levels in cryptorchids. While total LH responses declined with age and maximal FSH responses of all three treatment groups were noted at 24 weeks of age, testosterone responses increased with sexual maturation.

Testicular and epididymal weights and seminiferous tubular diameter data obtained from hemicastrate rams confirmed that this treatment resulted in compensatory hypertrophy of the remaining organs. As recorded from hemicastrated boars there was no major alteration in cell populations of the germinal epithelium or Leydig cells. The changes observed were entirely of a maturational nature and age-related. Testes and epididymides obtained from cryptorchids showed no increase in weight during the experiment and thus were smaller than those of age-matched entires. It was apparent that intra-abdominal temperature prevented normal development of these organs. Qualitative histological examination showed that there was complete arrest of all maturational changes, both in the germinal epithelium and interstitial tissue of cryptorchid testes.

On the basis of hormonal and organ data obtained from experiments described in this thesis it was concluded that LH, FSH and possibly testosterone were responsible for compensatory hypertrophy of the remaining testes of hemicastrates. The transient elevation of plasma FSH levels which occurred following this treatment probably was due to an overall decrease in production of testicular inhibin, the major regulator of FSH secretion. Presumably the remaining testis subsequently produced sufficient inhibin to reduce FSH secretion back to normal levels. These observations add weight to the hypothesis that following hemicastration, the compensatory increase in testicular androgen secretion occurs more rapidly than does the increase in rate of secretion of FSH inhibitory products. In contrast the increased secretion of LH and FSH in the cryptorchids resulted from reduced testicular production of androgens and inhibin, respectively. Those changes in testicular secretion persist throughout the period of cryptorchidism.

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