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Androgen response of cryptorchid and intact rams to ovine LH

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Summary. Surgically induced cryptorchidism in rams resulted in elevated serum concentrations of LH but near-normal concentrations of androgen (testosterone and 5 α -DHT). Injections of ovine LH (2 $\times$ 50 μ g; 2 $\times$ 500 μ g) resulted in maximal androgen secretion in the intact rams and similar but lower concentrations in cryptorchid rams. Peak concentrations were 14.9 and 8.5 ng/ml in the intact and cryptorchid rams respectively ($P < 0.05$).

Introduction

The ability of the cryptorchid testis to secrete testosterone is thought to be impaired relative to that of the normal scrotal testis because serum levels of testosterone in cryptorchid rats are normal or below normal when serum levels of LH are significantly increased (Swerdloff, Walsh, Jacobs & Odell, 1971; Rager, Zarzycki, Eichner & Gupta, 1975; Gomes & Jain, 1976; Sharpe, Kerr & de Kretser, 1978). Similar findings have been reported for cryptorchid rams (Schanbacher & Ford, 1977) and bulls (Schanbacher, 1978, 1979). Furthermore, the cryptorchid testis of the rat (Llaurado & Dominquez, 1963), dog (Eik-Nes, 1966) and bull (Schanbacher, 1979) responds poorly to exogenous gonadotrophin. The present study was to determine the ability of the testes of the cryptorchid ram to secrete testosterone in response to LH.

Materials and Methods

The rams were of mixed breeding and were 2–3 years of age at the time of the study: 5 were sham-operated and left intact and 5 had been surgically made cryptorchid at 6 weeks of age. The rams were transferred from pasture to a small holding area and indwelling jugular catheters were inserted. After acquaintance with the 2 individuals taking the blood samples, each ram received 4 intravenous injections of purified LH (NIH-LH-S18). The protocol was similar to that described by Amann, Nett & Niswender (1978) in that 50 μ g LH were given at 10:00 and 10:30 h and 500 μ g LH were given at 11:00 and 11:30 h. Blood samples (~4 ml each) were collected at 20-min intervals starting at 08:20 h and ending at 15:00 h. The samples were allowed to clot, and then centrifuged at 1500 g for 30 min (4°C). The serum was frozen at –20°C until assayed for concentrations of LH and testosterone.

LH was determined by the double-antibody radioimmunoassay procedure described by Schanbacher & Ford (1976). All samples were assayed in duplicate within a single assay and NIH-LH-S18 was used as the reference standard. The intra-assay coefficient of variation was <10% for each duplicate and assay sensitivity was 0.5 ng/ml.

Testosterone was determined by radioimmunoassay after ether extraction (Schanbacher, 1976). Samples were assayed in duplicate, and chromatography was omitted. The testosterone antiserum cross-reacts with 5 α -dihydrotestosterone approximately 70%; therefore, assay values reflect concentrations of both androgens. The intra-assay coefficient of variation was <12% for each duplicate and assay sensitivity was 0.2 ng/ml.

Differences in specified means were tested statistically by Student's *t* test.

Results

The results are shown in Text-fig. 1. Before injection, serum LH ranged from 1.3 to 1.6 ng/ml in intact rams and 4.3 to 6.5 ng/ml in cryptorchid rams. Although LH was consistently elevated ($P < 0.01$) in cryptorchid rams, serum androgen concentrations were similar ($P > 0.10$). Androgen decreased from 6.4 to 2.0 ng/ml for no apparent reason during the period before LH injection in intact rams and fluctuated between 3.3 and 4.4 ng/ml in cryptorchid rams.

Text-fig. 1. Serum concentrations of LH and androgen in intact (●) and cryptorchid (○) rams injected with 50 μ g ovine LH (small arrows) and 500 μ g ovine LH (large arrows). Each point represents the mean $\pm$ s.e.m. for 5 animals.

Serum LH concentrations increased markedly after the first 2 LH injections and still further after the next 2 injections. Maximum concentrations (intact rams: 62.9 ± 13.8 ng/ml; cryptorchid rams: 115.0 ± 19.5 ng/ml) were observed immediately after the last injection.

Androgen response by the intact rams to injected LH was more rapid and of greater magnitude. Serum values were significantly elevated ($P < 0.01$) 40 min after LH injection in intact rams, but the peak concentration at 140 min (14.9 ± 1.4 ng/ml) was not significantly greater than that at 60 min. In the cryptorchid rams the peak concentration at 140 min (8.5 ± 1.9 ng/ml) was significantly lower ($P < 0.05$) than that in the intact rams.

Discussion

Maintenance of normal serum androgen concentrations in cryptorchid rams appears to be dependent on elevated concentrations of serum LH. Previous investigators have reported elevated LH for natural and surgically induced cryptorchid rams (Hillard & Bindon, 1975; Schanbacher & Ford, 1977). Results from this study and those published previously (Schanbacher & Ford, 1977) show that the cryptorchid ram testis responds to gonadotrophic stimulation, but maintains normal serum testosterone inefficiently.

The androgen response to two 50- μ g injections of LH appears near maximal because the incremental increase in serum androgen was not appreciably changed when intact rams were treated with two additional 500- μ g injections of LH. Response of the cryptorchid ram to LH was significantly reduced at all time intervals studied, even though the secretory profile was parallel to that of intact rams. This suggests an effect of cryptorchidism on the interstitial cells involved in androgen production as well as the germinal components of the testes.

The cryptorchid bull maintains near-normal serum testosterone concentrations but fails to respond to exogenous gonadotrophin (Schanbacher, 1979). The consequences of cryptorchidism have been most extensively studied in the rat (Kerr, Rich & de Kretser, 1979; Schanbacher, 1980), but the specific lesion, whether primary or secondary to the Leydig cell, has not been identified. Evidence from several species shows that cryptorchidism alters Leydig cell function and upsets the normal pituitary–testicular endocrine axis.

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