TRANSPORT OF UNEJACULATED SPERMATOZOA THROUGH THE PELVIC PART OF THE UROGENITAL TRACT IN THE RAM

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(Received 25th June 1970, revised 14th September 1970)

Investigations carried out on the transport and resorption of the unejaculated spermatozoa have failed to determine conclusively the percentage of the spermatozoa being produced which are expelled into the urethra. Among numerous authors dealing with the fate of the unejaculated spermatozoa, only Lino, Braden & Turnbull (1967) recorded a figure as high as 88% of the total number of spermatozoa being produced which were voided in the urine. Experiments in which we applied the method for urine collection described by Lino *et al.* (1967) demonstrated that rams were masturbating by rubbing the penis against a rubber funnel fastened under the prepuce. After masturbation had been prevented by tying the tunica albuginea of the penis to the skin, only small numbers of spermatozoa were found in the urine.

The urine was collected from rams by the method of Bielański & Wierzbowski (1961). The effluent from the cannulated urinary bladder was found to contain about 16% of the sperm yield from fistulae of the vasa deferentia (Bielański & Tischner, 1968). These results stimulated the present investigations which aimed both at a detailed examination of the morphological structure of the urogenital tract in the ram and at a quantitative estimation of the unejaculated spermatozoa passing into the urethra.

Morphological investigations of the urogenital tract were carried out on twenty-three Polish Mountain rams slaughtered between 16 and 17 months of age. The reproductive organs were isolated immediately after slaughter and latex corrosion casts were made of the urogenital tract (Plate 1).

In two 5-year-old Polish Mountain rams, the urinary bladder and the pelvic urethra were cannulated (Text-fig. 1). Before surgery, the urine was collected in Rams A and B for 32 and 18 days, respectively, in order to estimate the number of sperm cells voided in the urine/day.

The cannula was a polyethylene tube (length 20 to 24 cm, diameter 3.2 mm) provided with a polyethylene ring (diameter 6 mm) and lateral apertures in the ends inserted into the urinary bladder or the urethra. All cannulae were sterilized in 2% sterinol solution for 24 hr.

Surgery was performed under general and local anaesthesia—Evipan natrium and 2% polocaine. A 6- to 7-cm incision was made in the linea alba, close to the anterior base of the scrotum. After the urinary bladder had been

isolated and four auxiliary sutures had been placed in its walls, the urine was removed by means of a syringe. A cannula was then inserted into the urinary bladder through the aperture which was widely opened by blunt dissection. The end of the cannula without the ring was then passed through the urinary bladder and into the urethra as far as the ischial arch of the penis. Following the insertion of the cannula, the skin was incised 5 to 7 cm below the anal orifice and the urethra was divided between the corpora cavernosa. The cannula was found in the urethra and drawn out until some resistance was felt. The cannula then rested with its ring against the crura of the penis and blocked the channel of the urethra, while its end with lateral apertures remained in the duct of the prostatic urethra.

TEXT-FIG. 1. Diagrammatic representation of the placing of the cannulae in the urethra and urinary bladder of the ram.

Another cannula was passed into the urinary bladder with its end supplied with the ring and the walls of the bladder were secured with a silk thread around the cannula. Seven days after the operation, plastic bottles suspended on the rams were connected to the cannulae. The contents of the bottles were emptied into separate vessels several times a day. The total daily number of spermatozoa in the effluent from the cannulae was estimated by means of a haemocytometer over a period of 16 and 17 days respectively for Ram A and Ram B. Periodically, the fructose level in the fluid from the cannulated urethra was determined by the method of Mann (1946).

Examination of the latex casts (Plate 1) demonstrated that the urethra forms a characteristic dilatation with the maximum diameter of the lumen (12.3 mm) at the level of the colliculus seminalis. At the orifice of the urinary bladder, the

PLATE I

Latex cast of the urogenital tract of the ram. 1. Part of the urinary bladder. 2. Pelvic urethra. 3. Extrapelvic urethra. 4. Ampullae of the vasa deferentia. 5. Seminal vesicles. 6. Bulbo-urethral glands. a. Vesicle sphincter. b. Diverticulum urethrae.

pelvic urethra narrows slightly (7.0 mm) and at its distal end, it narrows more abruptly (3.8 mm). At the beginning of the ischial arch of the penis, a blank diverticulum urethrae is found which contains the orifices of the bulbo-urethral glands. This diverticulum is formed of a semilunar fold of mucous membrane protruding obliquely backwards from the dorsal part of the urethra. The penile urethra has a lumen of consistent diameter (2.5 mm). At the corona glandis, the urethral diameter enlarges to 4.0 mm and then gradually narrows to 1.4 mm at the end of the processus urethrae.

Before cannulation, spermatozoa were found in the urine of the experimental rams at irregular intervals. The daily yield of spermatozoa voided in the urine averaged 60×10^6 in these animals. After the cannulae had been established into the bladder and the urethra, a constant flow of numerous spermatozoa was observed. The fluid collected from the cannulated urethra was milky in appearance and its average volume was 28 ml/day. The daily yield of spermatozoa obtained in the fluid from Rams A and B averaged 3587×10^6 and 2275×10^6 , respectively (range 930 to 6000×10^6). In both rams, the freshly obtained fluid from the cannulated urethra contained 5 to 10% motile spermatozoa and 26 mg fructose/100 ml.

In the urine obtained from the cannulated bladder, the daily scores of spermatozoa averaged 288×10^6 for Ram A and 374×10^6 for Ram B (range 40 to 800×10^6). The total number of spermatozoa obtained daily from both cannulated organs was 3867×10^6 (Ram A) and 2622×10^6 (Ram B).

Summarizing the results, the characteristic dilatation of the pelvic urethra seems to indicate that this part of the urethra may store the spermatozoa and accessory gland secretions during the periods of sexual inactivity. About 3 to 4 ml of fluid may be stored in this segment which is partly closed by the vesical sphincter and by a distinct narrowing of the urethra which appears in the cast at the level of the diverticulum urethrae.

The total number of spermatozoa discharged through the two cannulae was much higher than the quantities found in the urine expelled in the natural way, both in the experimental rams and in cases previously described (Bielański & Wierzbowski, 1961). The total sperm number, however, approximated to the numbers obtained from the cannulated vasa deferentia.

The daily score of the spermatozoa collected from one cannulated vas deferens in other rams maintained under similar conditions varied between 1600 and 2600×10^6 , with cyclic intensifications occurring every 63 days (Tischner, 1967).

Spermatozoa flowing into the urinary bladder observed in previous experiments on rams with a cannula established into the urinary bladder only (Bielański & Tischner, 1968; Essenhig, Ardran, Hovell & Smith, 1969) indicated that the vesical sphincter is not a total barrier for spermatozoa. Presumably they are able to penetrate into the bladder owing to the retrogressive ejaculatory contractions of the pelvic urethra.

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