ORIGINALS

The Zonal Anatomy of the Prostate in Man and in the Rhesus Monkey (Macaca Mulatta)

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Summary. Study of whole sections of human prostate has confirmed McNeal's (4) concept of a dual morphology of the external glands (2) in the terms of a central zone cranially and a peripheral zone caudal to this. A study of the non-human primate, Macaca Mulatta, has shown cranial and caudal prostatic entities in this animal whose anatomical relationships and histological characteristics suggest homology with the central and peripheral zones of the human.

Key words: Prostate - Morphology - Human - Monkey - Central zone - Peripheral zone.

THE HUMAN PROSTATE

McNeal (4), in describing the anatomical subdivisions of the parenchyma of the functional prostate, or external glands (2), designated these as "zones" and in so doing helped to distinguish normal anatomy from areas of focal pathology within the gland. These zones are identified both by morphological differences and by differential susceptibility to inflammation, degeneration and neoplasia. He defined two subdivisions of the prostate which are comparable in many respects with those described by Hutch (3). The central zone is a wedge of glandular tissue of variable size with its apex at the verumontanum and its base superiorly behind the bladder neck. In contrast to other descriptions, however, this zone surrounds the common ejaculatory ducts and distal extremities of the vas deferens and ducts of the seminal vesicles (1). The acini of the central zone constitute the base of the prostate whilst those of the peripheral zone caudally form the remainder of the parenchyma and partially enclose the apex or lower part of the central zone. The central zone comprises about one third of the external gland mass.

THE PROSTATE OF THE NON-HUMAN PRIMATE

Price (6) described the monkey prostate as lying entirely on the dorsal aspect of the urethra and neck of the bladder (Fig. 1) and having two discrete lobes. The cranial entity had a furrowed surface which closely resembled that of the seminal vesicles in external appearance. The caudal lobe was smooth on its external surface and again lay on the dorso-lateral aspect of the urethra (Figs. 2, 3, and 4). Price noted that the two lobes differed histologically. Van Wagenen (8) found the secretion from the cranial lobe to coagulate the secretion of the seminal vesicles and in this respect it appeared to have similar properties to the secretion of the coagulating gland of the rodent. Schoonees et al. (7) in describing a similar general anatomy in the baboon, found differential zinc concentration between the two parts of the gland. There was a significantly greater concentration of zinc in the caudal lobe and, furthermore, both castration and exogenous testosterone appeared to influence the zinc content of the caudal entity more than that of the cranial. More recent work has shown very high acid phosphatase content of the caudal lobe of the baboon prostate and greater susceptibility of this lobe to antiprostatic drugs (5).

MATERIAL AND METHODS

The bladder, prostate and membranous urethra were removed from human cadavers at post-mortem in various age ranges. The bladder, seminal vesicles, prostatic complex and upper urethra were removed from 13 rhesus monkeys.
(Macaca mulatta), both mature and immature, under terminal anaesthesia. Specimens were sectioned in the fresh condition either in the coronal or sagittal plane and fixed in formol-saline. Whole histological sections were made and stained with a variety of tissue stains.

RESULTS

The Human Prostate

There was confirmation of McNeal's description both in sagittal (Fig. 5) and coronal (Fig. 6) sections of the prostate. A cranial zone corresponding with McNeal's central zone was defined occupying the base of the gland behind and below the bladder neck and enclosing the common ejaculatory ducts, terminal vas deferens, ducts of the seminal vesicles and the utriculus masculinus. The demarcation between this zone and the peripheral zone caudally was sometimes well-defined by a condensation of fibromuscular stroma (Fig. 6).

Before puberty, the central and peripheral zone acini are morphologically indistinguishable and consist of simple straight tubules, widely separated by a coarse fibromuscular stroma and lined by a stratified cuboidal epithelium. Following puberty, the acini in the two zones develop distinct histological differences.

Fig. 1. Cross section of rhesus monkey prostate

Fig. 2. Anterior view of bladder, urethra, seminal vesicles and prostate of rhesus monkey

Fig. 3. Lateral view of bladder, urethra, seminal vesicles and prostate of rhesus monkey

Fig. 4. Posterior aspect of bladder, urethra, seminal vesicles and prostate of rhesus monkey