The Innervation of the Conjunctiva in Monkeys
An Electron Microscopic and Nerve Degeneration Study*

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Summary. The ultrastructure of conjunctival nerve fibres was studied in control material from two species of monkey. Nerve fibres reached the conjunctiva either in small nerves or in the adventitia of arterioles. A few myelinated nerve fibres were found within the nerves but the great majority of their fibres were unmyelinated. Bundles of unmyelinated nerve fibres were found in the interstices of the lamina propria up to the epithelial basement membrane and nerve fibres were traced into the epithelium. Other unmyelinated nerve fibre bundles lay adjacent to the walls of capillaries. Nerve fibre terminals exhibited varicosities and three types of terminals were recognised; those having varicosities packed with mitochondria, those having varicosities containing vesicles without any small granules and those having varicosities with vesicles, some with small granules.

Following experimental nerve lesions induced changes were observed in the nerve fibres, and from these changes it was determined that nerve fibres from three sources were present in the conjunctiva. Nerves and interstitial nerve fibre bundles contained ophthalmic and pterygopalatine nerve fibres, from which the epithelium was supplied. Arteriolar nerve fibre bundles contained superior cervical and pterygopalatine nerve fibres which were joined by ophthalmic nerve fibres in capillary nerve fibre bundles.

The combined results of electron-microscopy of control and experimental material suggested that nerve fibres from different sources innervating the conjunctiva had ultrastructurally distinct terminals.


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Die kombinierten Ergebnisse von elektronenmikroskopischen Untersuchungen an Experimentaltieren und Kontrollmaterial legte die Vermutung nahe, daß die von verschiedenen Quellen stammenden Nervenfasern für die Versorgung der Conjunctiva ultrastrukturell unterschiedliche Endigungen haben.

Introduction

The ultrastructure of nerve fibres has previously been described in a variety of mucous membranes, in monkeys (Leela et al., 1971) and man (Cauna et al., 1968; Matsuda, 1968). Although the ultrastructure of the primate conjunctiva has been described (Suzuki, 1956; Wanko et al., 1964; Hogan et al., 1971) no account of the ultrastructure of conjunctival nerve fibres could be traced.

In man the innervation of the conjunctiva is described as being derived from trigeminal nerve, which supplies somatic afferent nerve fibres, and from the superior cervical ganglion, which supplies sympathetic vasomotor nerve fibres, (Duke-Elder and Wybar, 1961). In man and monkeys nerve fibres from the pterygopalatine ganglion pass to the eye and orbit (Ruskell, 1970) and so it is possible that some of these fibres may contribute a parasym pathetic supply to the conjunctiva.

This study was undertaken to determine the ultrastructure of conjunctival nerve fibres in monkeys and to identify their source.

Material and Methods

Material was taken from three rhesus (Macaca mulatta) and six cynomologous (Macaca fascicularis) monkeys. Sedation was with 10 mg Sernylan i.m. and anaesthesia was with 24–35 mg Nembutal i.p. To enhance the preservation of granules in sympathetic nerve terminal vesicles between 150 and 300 mg iproniazid was administered i.p. roughly 24 hrs and 1 hr before fixation (Pellegrino de Iraldi et al., 1963).

Operations. In one cynomolgus and two rhesus monkeys the left ophthalmic nerve was approached intracranially by removing the calvarium and raising the left cerebral hemisphere. An attempt was made to sever the nerve and the animals were then fixed 5, 7 and 16 days after operation when dissection revealed that the nerve had been partially severed in the first, completely severed in the second and severely crushed in the third respectively.

In one rhesus and two cynomolgous monkeys a curved seeker was used to probe into the left pterygopalatine fossa after removing the zygomatic arch and reflecting the temporalis muscle. Animals were fixed 6, 7 and 14 days after operation when dissection showed that in each case the pterygopalatine ganglion had sustained gross damage and that the maxillary nerve and artery were severed.