STUDIES ON THE MORPHOLOGY OF ABDUCENT NUCLEUS IN THE BUFFALO (Bubalus bubalis)

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ABSTRACT

The morphology of the abducent nucleus of the buffalo has been described by materials collected from eight buffalos. Nissl and myelin stained serial and semi serial sections of brain stem were used for the study. The abducent nucleus in the buffalo extended from the cranial pole of the rostral cochlear nucleus to the caudal pole of the motor nucleus of the trigeminal nerve. An accessory abducent nucleus which is present in amphibians, reptiles, birds and some mammals could not be identified in the buffalo. The nucleus appeared as a rounded body in its caudal pole and was roughly triangular at rostral pole in transverse sections. The average length of motor nucleus of abducent nerve in the buffalo was 2.4 mm. The average maximum width and height of the nucleus was 1.48mm and 1.75 mm respectively.

Key words: Buffalo, Cytoarchitecture, Abducent nucleus

INTRODUCTION

The sense of vision in animals and human beings depends in part on the oculomotor system. The oculomotor system helps in quick localization of target objects and then to follow it during movement relative to the surrounding environment. The nuclei and nerves of oculomotor, trochlear and abducent are the integral part of this system. Information on detailed morphology, extent and cytoarchitecture of abducent nucleus though extensive in man (Olszewski and Baxter, 1954), cat (Taber, 1961), sheep (Rao, 1964) and pig (Breazile, 1967), studies are meager in buffaloes. Hence, the present investigation was undertaken. The studies on morphology of the abducent nucleus not only helps in understanding the control of normal ocular movements, but also helps in diagnosing the various pathological conditions encountered in animals.

MATERIALS AND METHODS

Brains of eight buffaloes, obtained from the corporation slaughter house, formed the material used in this study. The heads were collected immediately after slaughter and were perfused with 10 per cent buffered formalin through the common carotid artery till a clean fluid came out from the nostrils. Perfused heads were kept

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for two weeks in 10 percent buffered formalin. The cranium was broken carefully and the brain along with the brainstem were removed and preserved in 10 percent buffered formalin for a further period of two weeks. The brainstems were removed and processed for routine paraffin technique.

Transverse serial sections of 20 μm thickness were prepared from six brainstems from the level of trapezoid body to mammilary body. The sections were stained with Weil Weigerts (Lillie, 1954) and Luxol fast blue (Luna, 1968) as myelin stain. One brain was used to prepare sagittal sections and one for horizontal sections. The rostrocacudal limits and shape of the abducent nucleus was studied in the transverse, sagittal and horizontal sections. The length and width of the nucleus was measured in horizontal sections with an ocular micrometer. The height of the nucleus was measured in sagittal and transverse sections.

RESULTS AND DISCUSSION

Location and extent of the motor abducent nucleus

The motor nucleus of abducent nerve in the buffalo was located 9.6 mm cranial to the obex and 0.8 mm caudal to the pons, 2 mm away form the midline (Figs.1&3). The nucleus extended from the cranial pole of the rostral cochlear nucleus to the caudal pole of the motor nucleus of the trigeminal nerve. As in the horse (Salam, 1971) and the cat (Taber, 1961) the nucleus in the buffalo was related to the facial genu throughout its length (Figs. 1,2&3). Similar observations were made by Kakade and Salam (1988) in the buffalo. The ventral part was related to the reticular formation.

Shape of the nucleus

The motor nucleus of abducent nerve of the buffalo had a rounded appearance in its caudal pole and a roughly triangular shape at its rostral pole. In sagittal and horizontal sections, the nucleus appeared as an oval shaped body (Figs. 1,2&3). But in man (Olszewski and Baxter, 1954) and the cat (Taber, 1961) the nucleus appeared as an ovoid body in its caudorostral poles. The difference in shape of the nucleus between the animals may be because of the difference in the orientation of the genu of the facial nerve.

Dimensions of the nucleus

The average length of motor nucleus of abducent nerve in the buffalo was 2.35 mm while in man (Olszewski and Baxter, 1954) it was 3 mm, in cat (Taber, 1961) 1.3 mm, in the Gorilla (Noback and Goss, 1959) 2.5 mm and in sheep (Rao, 1964) 1.0 mm. The average maximum width and height of the nucleus was 1.48 mm and 1.75 mm respectively in the buffalo.

The abducent nucleus is said to be well developed in pig to facilitate movement of the eyeball compensatory to the poor mobility of the neck in this animal (Chomiak, 1951). In keeping with the considerable mobility of the eyeball, the nucleus was well developed in the buffalo.

Subdivisions of the nucleus

In the ox and the pig the caudal end of the abducent nucleus was divided into a dorsal and a ventral group (Chomiak, 1951). In the pigeon, other than the major nucleus a smaller subgroup, further from the midline formed a sort of cap surrounding the larger subgroup (Cabrera et al., 1989). But the motor nucleus of the abducent nerve in the buffalo did not show any subdivisions.

The existence of an accessory abducent nucleus have been unambiguously shown with tracer techniques in frogs (Matesz and Szekely, 1977), reptiles, birds (Kuhlenbeck, 1975) and in the cat (Grant et al., 1979, Hutson et al., 1979 and Spencer et al., 1980) which supplies the muscles of the nictitating membrane and retractor muscle of eye. But such an accessory nuclei could not be identified in the buffalo. Thus it seems that the

absence of accessory abducent nuclei may account for the underdeveloped nictitating membrane in the buffalo.

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Fig. 1

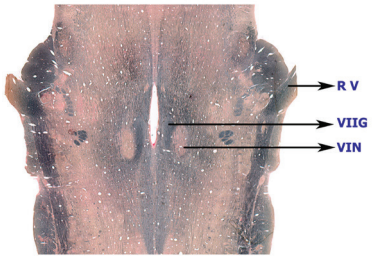

Fig. 1 : Photomicrograph of horizontal section of pons and medulla oblangata through the motor nucleus of abducent nerve (Weil Weigerts- 4X)
RV- Root of Trigeminal nerve, VII G- Genu of Facial nerve,
VI N- Motor nucleus of Abducent nerve

Fig. 2

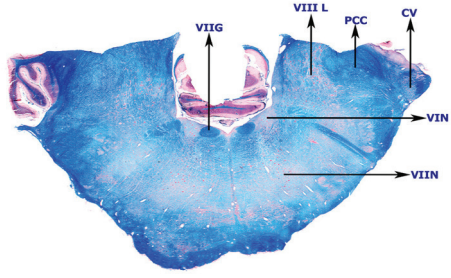

Fig. 2 : Photomicrograph of transverse section of medulla oblangata at the level of corpus trapezoidum to show the motor nucleus of abducet nerve (Luxol Fast Blue with Neutral Red- 4X)
VII G- Genu of Facial nerve, VIII L- Lateral Vestibular nucleus,
PCC- Peduncularis Cerebellaris Caudalis, CV- Ventral Cochlear nucleus,
VI N- Motor nucleus of Abducent nerve, VII N- Nucleus of Facial nerve

Fig. 3

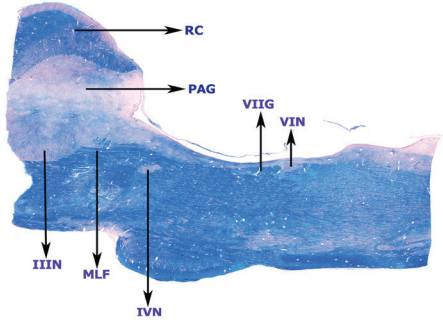

Fig. 3: Photomicrograph of sagittal section of the brain stem (Luxol Fast Blue with Neutral Red- 4X)
RC- Rostral Colliculus, PAG- Peri Aqueductal Gray, VII G- Genu of Facial nerve,
VI N- Motor nucleus of Abducent nerve, III N- Nucleus of Oculomotor nerve,
MLF- Medial Longitudinal Fasciculus, IV N- Motor nucleus of Trochlear nerve