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Gross Anatomy of Cerebral Ventricles and Septum Pellucidum of Brain of Surti Buffalo (*Bubalus bubalis*)

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Abstract

The objective of the present work was to study the cerebral ventricles and its associated parts of brain of Surti buffalo (n=12), The cerebral ventricles included two lateral ventricles and third ventricle. The lateral ventricles were curved cavities presented large central part and three horns within the cerebral hemispheres. The third ventricle was an annular space on the periphery of inter-thalamic adhesion between two thalami. The mean length and width of central part of lateral ventricle were 4.78±0.07 and 1.49±0.07 cm, respectively. The septum pellucidum was thin translucent membrane of two laminae which separates two lateral ventricles. The mean values of length and height of septum pellucidum were 3.6±0.12 and 0.52±0.04 cm, respectively. The cavum septum pellucidum was a small space found between two laminae of septum pellucidum.

Introduction

The ventricular system of the brain is a set of four interconnected cavities (ventricles), where the cerebrospinal fluid (CSF) is produced from the choroid plexus which bathes the central nervous system (Crisan and Chawla, 2016). The ventricular system is composed of the two largest lateral ventricles in the cerebrum; the third ventricle is in the diencephalon of the forebrain between the right and left thalamus; and the fourth ventricle is located at the back of the pons and upper half of the medulla oblongata of the hind brain (Mortazavi *et al*., 2014). The ventricles are concerned with the production and circulation of cerebrospinal fluid. The Surti is a breed of water buffalo found in the Charottar tract of Gujarat (Banerjee, 2014). There is no data established on the topography and morphometry of cerebral ventricles and septum pellucidum of brain of these animals. Hence, the present work was aimed to study the cerebral ventricles and its associated parts of brain of Surti buffalo.

Materials and Methods

The study was carried out at the Department of Veterinary Anatomy & Histology, College of

Veterinary Science and A.H., Anand, Gujarat. The materials required for the study were collected from normal healthy adult Surti buffaloes (n=12) immediately after slaughter from the abattoir of Ahmedabad Municipal Corporation. The samples were preserved in 10 % neutral buffered formalin at least for 24 hours. The measurements like length and width of various cerebral ventricles and septum pellucidum of brain were taken with the digital Vernier callipers, non-stretchable thread and scale. The means, standard errors and coefficients of variance were worked out (Snedcor and Cochran, 1994).

Result and Discussion

Lateral Ventricles

The ventricular system was very well developed in the brain of Surti buffalo. There were four cavities, which were ventricles of brain, namely two laterals, third and fourth ventricle. Two lateral cavities were present in cerebral hemisphere, one circular groove like cavity was present surrounding the thalamus and the fourth one was present between the cerebellum above and medulla oblongata below. The lateral ventricles were curved cavities within the cerebral hemisphere. Each cavity presented a large central part and three horns. The central part of both the lateral ventricles was separated by septum pellucidum (Fig. 1). The anterior horn passed through the olfactory tract and reached up to olfactory bulb. The posterior horn was directed laterally, turned downward and forward and ended in piriform lobe. The roof of ventricle was formed by corpus callosum. The floor was formed by caudate nucleus on anterolateral aspect and by fornix on posteromedial aspect. The choroid plexuses were present in the groove formed by the caudate nucleus and fornix in the central cavity of lateral ventricle (Fig. 2). The foramen Monro was present between the fornix and thalamus dorsally, through which the lateral ventricles opened in the third ventricle (Fig. 4). These findings match well with the reports of Trotter and Lumb (1962) in bovine, Getty (1975) in horse, Lignereux *et al.* (1987) in Friesian cow, Lignereux *et al.* (1991) in ewe, Hagenlocher *et al.* (2013) in mammals and Akers and Denbow (2013) in domestic animals.

The overall mean value of the length of the lateral ventricle was 4.78±0.07 cm (range 4.5-4.85 cm), while the width of central part of lateral ventricle was 1.49±0.07 cm (range 1.25-1.8 cm). Malik *et al.* (1978) studied cerebral ventricles of goat and reported that each of the lateral ventricles measured 5.46 cm and 1.25 cm in greatest length and transverse linear

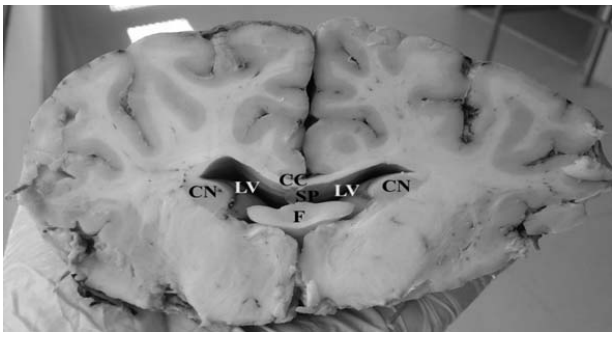

Fig. 1 : Coronal section of brain of Surti buffalo showing (LV) Lateral ventricle, (SP) Septum pellucidum, (CC) Corpus callosum, (F) Fornix and (CN) Caudate nucleus

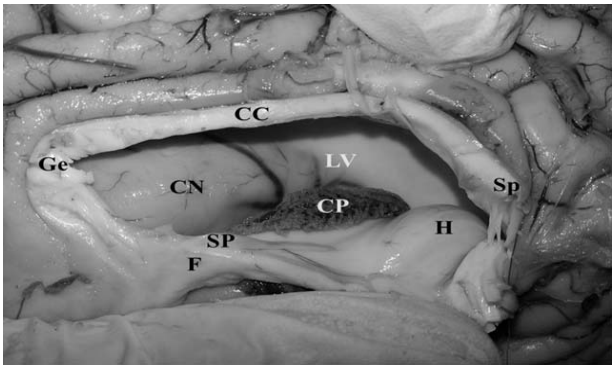

Fig. 2 : Mid sagittal section of brain of Surti buffalo showing (LV) Lateral ventricle, (CC) Corpus callosum, (CN) Caudate nucleus, (H) Hippocampus, (F) Fornix, (CP) Choroid plexus, (SP) Septum Pellucidum, (Ge) Genu and (Sp) Splenium

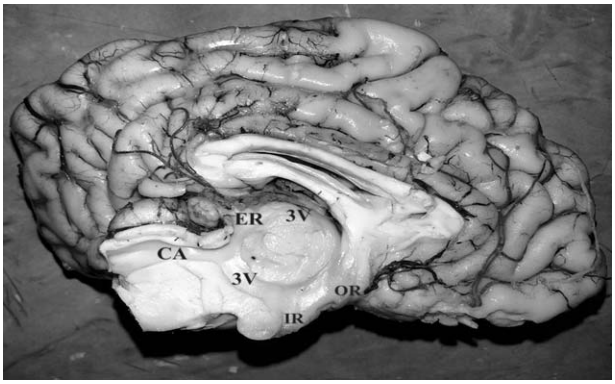

Fig. 3 : Mid Sagittal section of brain of surti buffalo showing (3V) Third ventricle, (ER) Epiphyseal Recess, (OR) Optic Recess, (IR) Infundibular Recess, and (CA) Cerebral aqueduct.

Fig. 4 : Photograph showing (T) Thalamus, (3V) Third Ventricle, (IVF) Interventricular Foramen , (AC) Anterior Commissure, (F) Fornix and (PG) Pineal Gland

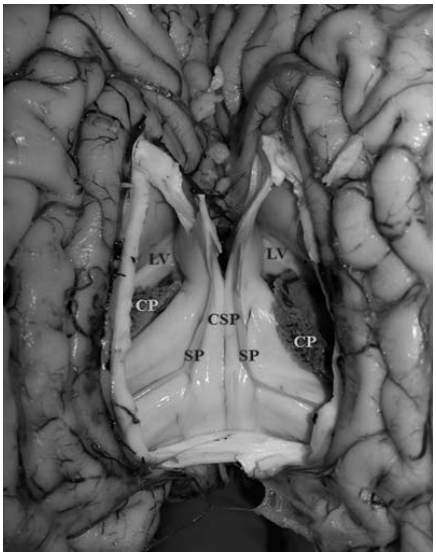

Fig. 5 : Photograph showing (SP) Septum pellucidum, (CSP) Cavum septum pellucidum (LV) Lateral ventricle and (CP) Choroid plexus

measurement. They further mentioned that each ventricle presented three parts rostral horn, body and temporal horn. The present results are lower in the length and higher in the width than the lateral ventricles of goat.

Third Ventricle

The third ventricle was an annular space on the periphery of inter-thalamic adhesion between two thalami. Two lateral ventricles opened into it through foramen Monro or inter-ventricular foramen (Fig. 4), while the third ventricle continued caudally with the fourth ventricle through aqueduct of sylvius. The cavity of third ventricle presented three recesses; the epiphyseal recess presented in the stalk of the pineal body, the infundibular recess which extended through the infundibulum to the pituitary body, and the optic recess above optic chiasms (Fig. 3). These findings match well with the reports of Trotter and Lumb (1962) in bovine, Getty (1975) in horse, and Thomas and Joanna (2002) in farm animals.

Septum Pellucidum

Septum pellucidum was thin translucent membrane of two laminae which separates the two lateral ventricles. The dorsal surface of it attached with corpus callosum, while ventral surface was attached with fornix (Fig. 1). The septum starts from the cranial parts of the corpus callosum, the genu and it ends at caudal end of corpus callosum, the splenium (Fig. 2). The cavum septum pellucidum is a closed triangular space between two laminae of the septum pellucidum. It lacks cerebrospinal fluid and choroid plexuses. The two leaves of septum pellucidum were apart from each other with little distance (Fig. 5). These findings are parallel with the observations of Trotter and Lumb (1962) and Srinivasan (2012) in bovine, Getty (1975) in horse, Sarwar (1989) and Sartori *et al*. (2015) in human, Lucy *et al.* (2008) in goat, who all mentioned that the septum pellucidum is a median partition which separates the lateral ventricles and remains attached to the corpus callosum dorsally and fornix ventrally, but they did not mention anything about cavum septum pellucidum in animals. However, Sarwar (1989) in human reviewed that the cavum septum pellucidum is not a part of subarachnoid space nor is a part of ventricular system.

The overall mean length of the septum pellucidum was 3.6±0.12 cm (range 3.0 to 4.3 cm) and height 0.52±0.04 cm (range 0.3 to 0.65 cm). Lignereux *et al.* (1987) measured the height of septum pellucidun from two different levels, at the inter-venticular foramen and above the hippocampus, which was 2.5 to 9 mm and 0 to 5-6 mm in Friesian cow. The values of length and width are higher in present study on Surti buffalo than the Friesian cow.

Acknowledgment

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Conflict of Interest

All authors declare no conflict of interest.

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