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Gross Anatomical Study of a Sheep Brain (*Ovisaries)*

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Abstract: ***Sheep brains are readily available from scientific vendors as dissection specimens, making them a popular choice in neuroanatomy classes, where the ultimate goal is to learn about the human brain. This is possible because the sheep brain and human brain are very similar. However, there are some key differences that should be kept in mind during dissection. The sheep brain and human brain are very similar in overall structure, as are all mammalian brains. Each contains a cerebrum, cerebellum, and brain stem. The purpose of the grossanatomical study of sheep brain is to familiarize with the three dimensional structure of the brain and teach one of the great methods of studying the brain looking at its structure. This present study emphasize on the sheep brain, observation and evolution indicate that there are many similarities between the sheep brain and the human brain. Even the differences are instructive and help us to learn about the brain. Being able to locate important structures in the sheep brain will be of great benefit in understanding how structures are related to each other in the human brain. If the same structure exists in both brains (and most structures are the same), they are in the same relative location.***

Keywords: Sheep brain, Human brain and dissection

1. Introduction

The nervous system is the part of an animal's body that coordinates its behaviour and transmits signals between different body areas. In vertebrates it consists of two main parts, called the central nervous system (CNS) and the peripheral nervous system (PNS). The CNS contains the brain and spinal cord. The PNS consists mainly of nerves, which are long fibres that connect the CNS to every other part of the body, but also includes other components such as peripheral ganglia, sympathetic and parasympathetic ganglia, and the enteric nervous system, a semi-independent part of the nervous system whose function is to control the gastrointestinal system. The central nervous system consists of the brain and the spinal cord. The peripheral nervous system consists of the extensions of neural structures beyond the central nervous system and includes somatic and autonomic divisions. The brain is composed of 3 main structural divisions: the cerebrum, the brainstem, and the cerebellum. At the base of the brain is the brainstem, which extends from the upper cervical spinal cord to the diencephalon of the cerebrum. The brainstem is divided into the medulla, pons, and midbrain. Posterior to the brainstem lies the cerebellum. The brain is one of the largest and most complex organs in the animal body. It is made up of more than 100 billion nerves that communicate in trillions of connections called synapses. The brain is made up of many specialized areas that work together: The cortex is the outermost layer of brain cells. Thinking and voluntary movements begin in the cortex. The brain stem is between the spinal cord and the rest of the brain. Basic functions like breathing and sleep are controlled here. The basal ganglia are a cluster of structures in the centre of the brain. The basal ganglia coordinate messages between multiple other brain areas. The cerebellum is at the base and the back of the brain. The cerebellum is responsible for coordination and balance. The brain is also divided into several lobes: The frontal lobes are responsible for problem solving and judgment and motor function. The parietal lobes manage sensation, handwriting, and body position. The temporal lobes are involved with memory and hearing. The occipital lobes contain the brain's visual processing system. The brain is surrounded by a layer of tissue called the meninges. The skull (cranium) helps protect the brain from injury.

2. Materials and Methods

Inspection and dissection of the sheep brain should be accompanied with the following materials on hand: dissection pan, dissection kit: brain, scalpel, probe, scissors. The sheep brains are stored in a preservative solution. To minimize the drying of hands, rinse the brain under a slow stream of running water before proceeding with the dissection. When not in use, the brains should be stored in preservative solution in the container and sealed tightly. Some structure that is quite in the middle can be lateral to another structure that is even closer to the middle of the brain. To summarize, anterior or rostral mean in the front or towards the front. Posterior or caudal is at or towards the back. Lateral means on the side or towards the side. Medial is at or towards the middle. Dorsal means on top, in the brain and head only, and ventral means on the bottom, in the brain and head only.

3. Results and Discussion

The exterior of the entire brain has three layers of the meninges, the dura mater, the arachnoid layer, and the pia mater. The meninges are the protective coverings (fig 1) which enclose the brain and spinal cord. The sheep brain is smaller, weighing around 140 grams, or about one-tenth of the weight of an adult human brain, though it is still large enough to be easily dissected as it was observed by (Thieme., 1938).

Figure 1: Meninges of sheep brain

The dura mater, the tough outer layer, mostly removed when the brains were prepared for the dissection; however, some of the dura mater may remain near the base of the brain as it was observed by (Thieme., 1938 and Wilike., 1938) in human and animal brain. The arachnoid layer, the middle layer, and pia mater, the inner layer, are still likely to cover the brain. Thepia mater follows the gyri and sulci and most likely is still on the specimen and may be indistinguishable from the brain. Blood vessels are between the arachnoid layer and the pia mater. These vessels and the arachnoid layer will obscure the view of the sulci making the identifications difficult and confusing. Before proceeding with the identification of structures on the surface of the brain, need to remove the arachnoid layer and the blood vessels.

Brain stem, is made up of the pons, medulla, and cerebellum (fig 2 and fig 3) as it was observed by (Wilike., 1938) in sheep brain also the root where the pituitary gland was attached to the brain (fig 2) as it was mentioned by (Thieme., 1938and Wilike., 1938) in human brain and sheep brain.

Figure 2

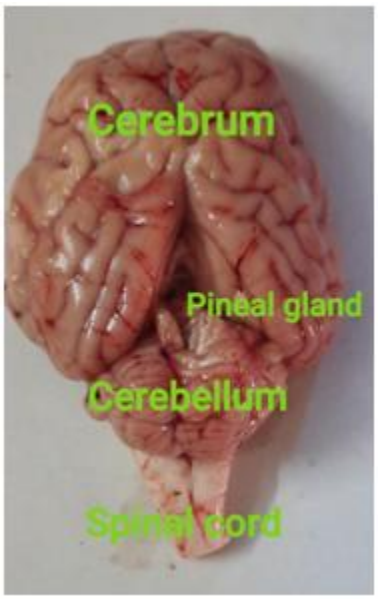

Figure 3

the ventral surface of the sheep brain has a pair of olfactory bulbs (fig 2) was seen, one under each lobe of the frontal cortex. The sheep, like many mammals, has a more developed sense of smell, or olfaction, than humans do. The olfactory bulb is the part of the brain located underneath the frontal lobe that is responsible for relaying sensory information from the nose to the rest of the brain. The olfactory bulb in sheep is two to three times the size of the human olfactory bulb, despite the sheep brain being much smaller overall. This reflects the importance of the sense of smell to the sheep. In addition to helping it understand its surroundings and avoid danger, sense of smell also plays a crucial role in establishing the bond between mother and infant, known as imprinting as it was reported by (Thieme., 1938) Several important parts of the visual system are visible in the ventral view of thebrain. Muscles, other nerves and fatty tissue surrounding the optic nerve on the specimen. The medulla oblongata which is an elongation below the pons (fig 2). Among the cranial nerves, the very large root of the trigeminal nerve. From the view below, both the superior colliculus and inferior colliculus was noticed (fig 4) as it was reported by (Kendrick., 1991) in animal and humans.

Figure 4

The superior and inferior colliculi are part of the midbrain and collectively known as the Tectum and the large gyrus called the Uncus. Posterior to the uncus Hippocampal gyrus. In the middle of the brain the Mamillary Bodies was noticed (fig 5) as it was observed by (Thieme., 1938) in sheep brain.

Figure 5

which are part of the limbic system and play a role in memory, also the Rhinal Fissure which defines one boundary of the limbic system. The four lobes of the cerebrum are frontal, parietal, temporal, and occipital (fig 6) as it was reported by (Wilike.,1938) in sheep. A major difference is that the frontal lobe in the sheep brain is much smaller relative to the overall brain size, accounting for only a few percent

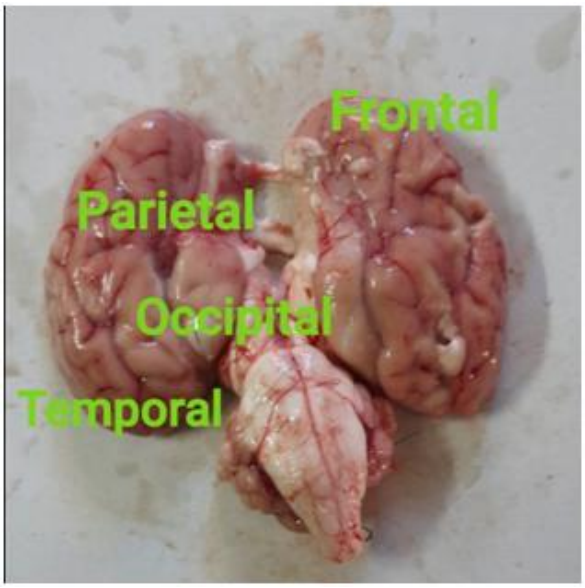

Figure 6

by volume compared to about 25 percent in the human case. The frontal lobe is connected with higher cognitive functions, such as abstract thinking and analysis. The relative size of the frontal lobe, as well as the number of ridges in the cortex, are indicators of species intelligence. Though the sheep has generally been regarded as an unintelligent animal, it is increasingly recognized that sheep are able to perform some advanced tasks, such as remembering the faces of other sheep and humans for two years or longer.

The Frontal Lobe is bounded by the Ansate Sulcus and the Pseudosylvian Sulcus. The Parietal Lobe is bounded by the Ansate Sulcus, the Suprasylvian Sulcus, and the Lateral Sulcus. The Temporal Lobe is bounded by the Pseudosylvian Sulcus and the Suprasylvian Sulcus. The Occiptial Lobe is inside the Lateral Sulcus as it was observed by (Kenderic., 1991) in animals and humans. In mid-saggital cut, the lateral ventricles (andseptum pellucidum), third ventricle, the cerebral acqueduct (which connects the third and fourth ventricle), and the tegmentum, the other part of the mid brain. (fig 7) as it was observed by (Kenderick., 1991) in animals and human.

Figure 7

Largest of all the commissures (a band of fibers that connects the two sides of the central nervous system) the corpus callosum (fig 8).In addition, the pineal body (fig 3), the hypothalamus (fig 8), and the Massaintermedia. Cerebellum has the pattern of grey and white matter and is called as Arbora vitae (fig 8) as it was mentioned by (Cooke., 2006) in humans.

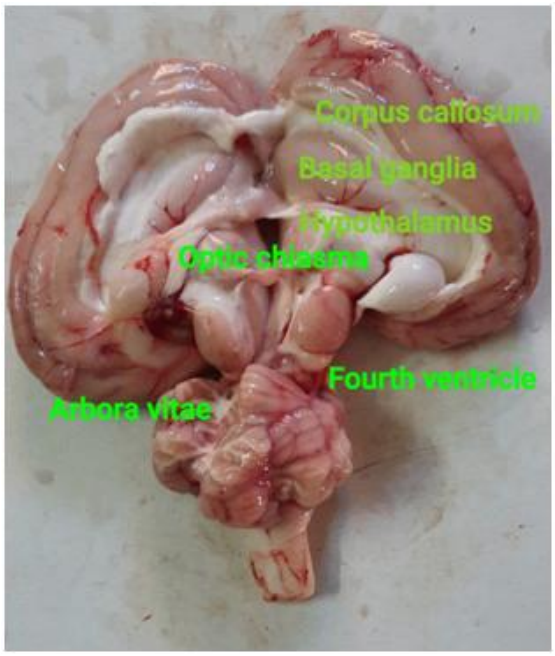

Figure 8

The putamen, globuspallidus, and caudate nucleus, these structures are collectively known as the Basal Ganglia (fig 8). In addition can notice the crossing of the anterior commissure right above the optic chiasm (fig 8) as it was reported by (Cooke, 2006) in human brain. The optic chiasm is a cross-shaped structure centrally located on the underside of the brain where the optic nerve fibers from each eye partially cross over to the corresponding optical tract on the other side of the brain. It is more pronounced in the sheep brain because sheep, like many prey animals, have eyes toward the sides of the head that operate more independently, giving the sheep a much wider field of vision. Therefore most of the visual information from each eye crosses over. Humans have more frontal eyes, and share information from each eye more evenly between the brain hemispheres to enable complex visual processing tasks, such as depth perception as it was reported by (Thieme., 1938).

4. Conclusion

The sheep brain is quite similar to the human brain except for proportion. The sheep has a smaller cerebrum. Also, the sheep brain is oriented anterior to posterior (more horizontally), while the human brain is oriented superior to interior (more vertically.)The cerebrum is more elongated in sheep than in humans, and the cerebellum and brain stem are located behind the cerebrum, instead of being tucked below it. This is because sheep, being four-legged animals, have a horizontal spine, while humans stand upright with their spines vertical.

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