A MORPHOLOGICAL, HISTOLOGICAL AND HISTOCHEMICAL STUDIES OF CHOROID PLEXUS IN SHEEP

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ABSTRACT

As per vascular engineering, the horizontal ventricle choroid plexus can be parted into three sections: rostral, caudal and center. Under binocular magnifying instrument, the two tight groups that shaped from the choroid plexuses of the sidelong ventricles got through the interventricular foramen, framing the choroid plexus of the third ventricle; each band looked as down collapsing liner tufts arriving at the level of the pineal body. The choroid plexuses of the third and fourth ventricles were comprised of an immense number of foliate-like cycles joined by a stem to a more basal center of the stromal tissue. Essential foliate may create optional leaf-like rises. The stromal tissue choroid plexus became bigger and exceptionally vascular in its construction covered with a solitary layer of ciliated cuboidal epithelium. The veins were isolated from the epithelium by a somewhat high measure of connective tissue. The sidelong ventricle's blood channels were long, expansive, marginally tangled, and reasonably equal.

Key words: choroid plexus, histochemistry, histology, morphology, sheep

Introduction

Sheep *Ovis aries* are quadrupedal warm blooded ruminant that are generally raised as meat animals. Domestic sheep has population of more than one billion (Alberto *et al*., 2018). Sheep are main source of meat and fleece, and additionally milk (Adams and Cornje, 2003). Galeno credited Herophilus (335-280 A.D.) for discovering the choroid plexus of the encephalic ventricles and naming them "choroids menix". The word "choroids tunic" is used to describe the ependyma as the choroid plexus (Dohrmann, 1970). The choroid plexuses comprised of vascular folds from the pia mater that were ostensibly covered by an epithelium got from the ventricle's ependymal covering (Webster, 1976). The ventricles are four interconnected cylinders inside the center locales of the cerebrum that are loaded with cerebrospinal liquid (CSF). The choroid plexuses, which produce CSF and fill in as a remarkable interface between the fringe blood and the CSF, are found inside these ventricles (Jeon *et al*., 2005; Christopher and Dwaine, 2007). The choroid plexus has two essential capacities: it delivers and directs CSF parts and it keeps unfamiliar substances from entering the cerebrum (Bill et al., 2008, and Kaiser and Bryia 2020). The objective of this review was to compare the choroid plexuses of sheep with different species.

Ethics statement

The study was conducted according to the national guidelines for the Care and Use of Animals. All protocols were approved by the High Committee for Review and Approval of Research Proposals of the Faculty in the University of Qadisiyah college of Veterinary Medicine.

Materials and Methods

Ten grown-up sheep of both genders were used in this review. The samples were gathered from the Diwaniyah slaughter house. All brain samples of sheep were fixed by intra normal carotid vein mixture containing 10% non partisan cradled formalin from which five were utilized for the morphological review also. Choroid plexuses were studied from the other five samples and utilized for the histological investigations. In the morphological examination five brain samples were infused with an equivalent combination of Indian ink and cow-like serum (1:1) through the carotid courses in the wake of being perfuse with a warm typical saline arrangement. The infused samples were fixed in 10% neutral formalin solution for weeks. The choroid plexuses were examined by microscope. Samples preserved for histological examination were washed carefully with 0.9 % normal saline and kept in clean plastic container. The half part of samples was fixed in 10% neutral formalin and the other half was fixed in Bouin's solution (Fox *et al*., 1985) where they were kept for two days and got dried out by progressive concentrated alcohol (70%, 80%, 90%, 95%, and 100%) for two hours in each. The samples were washed twice with xylen for one hour and blocks were made by liquid paraffin wax. Areas of 5îm thickness were cut with help of microtome (Series MRS3500, Histo-Line research facilities Ltd, Italy). These areas were mounted on clean slides and stained with Mayer's Hematoxylin and Eosin to exhibit the overall histological parts of the tissues. All stained segments were seen under epifluorescence magnifying lens (Model MT4300, MEIJI TECHNO, Japan) and pictures were taken with an Ordinance advanced camera (DS126371, Group INC, Japan) and (LCD Computerized Magnifying instrument (micros) with inserted Android based PC framework, AUSTRIA).

Results and Discussion

The choroid plexus in ventricle shows up as a fragile radiant red strip around 3.5 mm wide and 20 mm long at the transient horn. Then, at that point, it twists anterio-dorsally at the ventro-parallel piece of the horizontal ventricle and curved ventrally to touch the rostral end of the hippocampus, ventral to the corpus callosum and dorsolateral to the caudate core. It closes around 5 mm before the rostral end of the horizontal ventricles (Fig. 1 and 2).

The arterioles and venules in the focal point of the choroid

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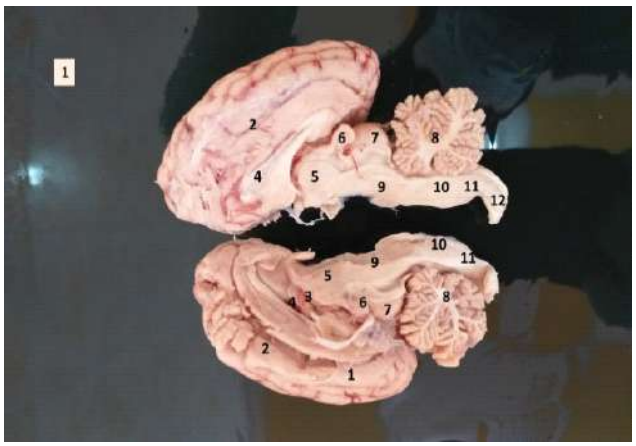

Fig. 1: Sagittal view of the brain of sheep, showing meninges (1), the cerebral hemispheres (2), choroid plexus of the lateral ventricle (3), lateral ventricale (4), thalamus (5), pineal gland (6), superior colliculus (7), cerebellum (8), midbrain (9), pons (10), medulla oblongata (11), spinal cord (12)

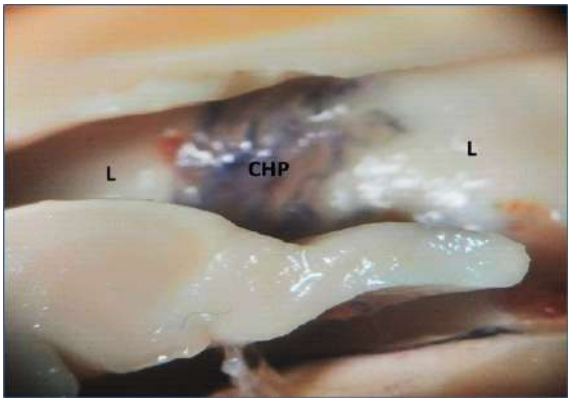

Fig. 2: Showing, choroid plexus (chp) of the lateral ventricle (L) appears thin and flat.

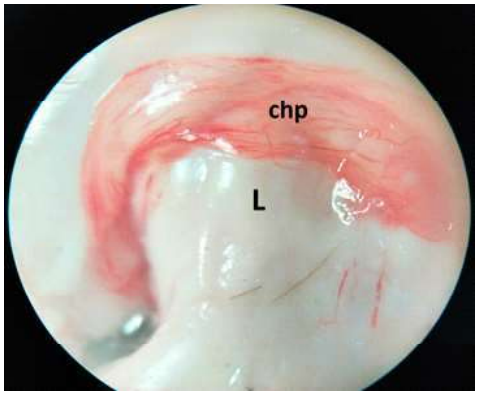

Fig. 3: Macrograph photo of Indian ink injected sample showing the middle part of the lateral ventricle choroid plexus with straight, parallel and sinuous blood vessels. stereomicroscope X 8.

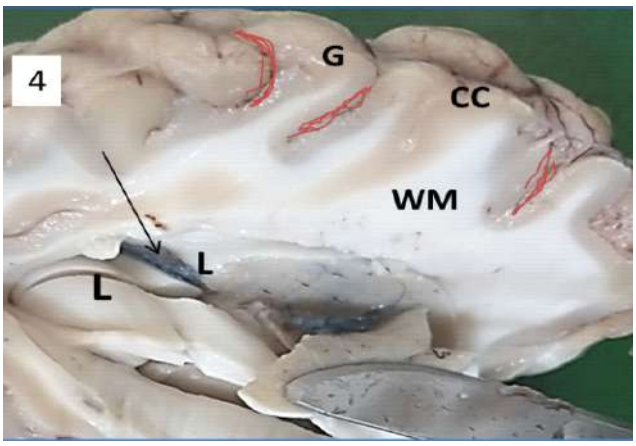

Fig. 4: Indian ink serum injected sample showing the region of the narrow band of the lateral ventricle choroid plexus (arrow), note the densely packed blood vessels, lateral ventricle (L), cerebral cortex (cc), white mater (WM), sulcus (red lines), Gyrus (G).

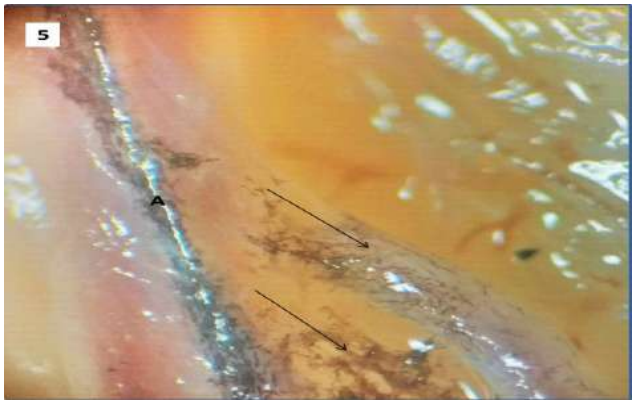

Fig. 5: Indian ink serum injected sample showing third ventricle choroid plexus (black arrow), basal stem (A) . Using stereomicroscope X10.

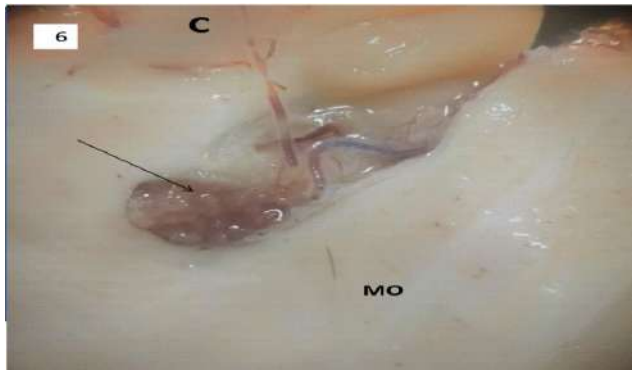

Fig. 6: Indian ink serum injected sample showing fourth ventricle choroid plexus (black arrow), basal stem (red arrow),medulla oblongata (MO), cerebellum (c). Using stereomicroscope X10.

plexus appear to be more tangled, thickly loaded with differing breadth, and brief anastomosis between the veins are seldom seen (Fig. 3). The veins become not so much tangled but rather more thickly stuffed rostrally, framing a restricted band that gets throughout the ventricular foramen and joins the choroid plexus of the third ventricle on the antagonistic side (Fig.4). Two tight groups that create from the horizontal ventricle choroid plexuses enter through the between ventricular foramen between the thalamus and the front finish of the hippocampus, crossing the last to acquire admittance to

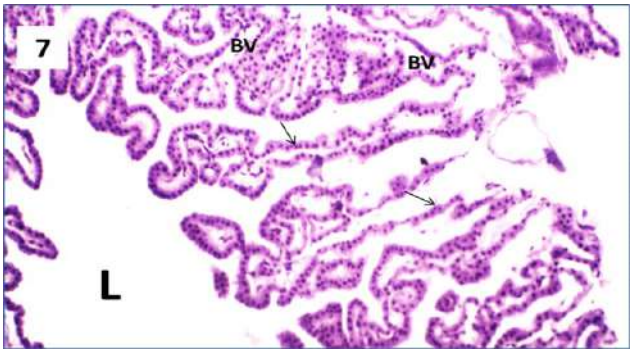

Fig. 7: H & E stain section: of the choroid plexus of the lateral ventricle showing long tantamount folds, covered with cuboidal epithelium (arrows), blood vessels (BV) and the lumen of the lateral ventricle (L)

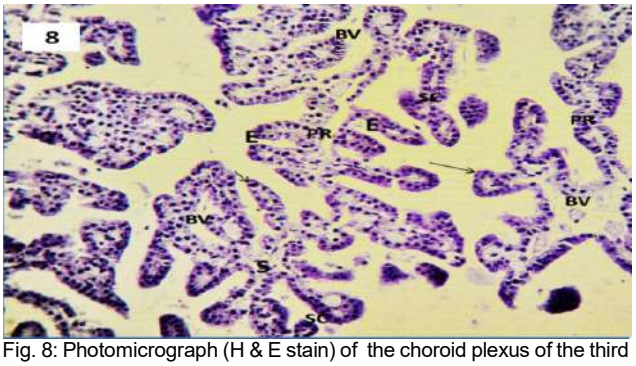

Fig. 8: Photomicrograph (H & E stain) of the choroid plexus of the third ventricle showing primary leaves (PR), secondary leaves (SC), leaves-like process (arrows), covering epithelium (E), connective tissue stroma (S) and blood vessels (BV).

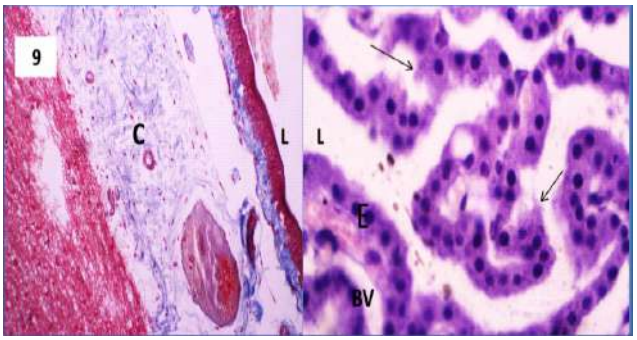

Fig. 9: Higher magnification of choroid plexus of the . d the lumen of the third ventricle (L).

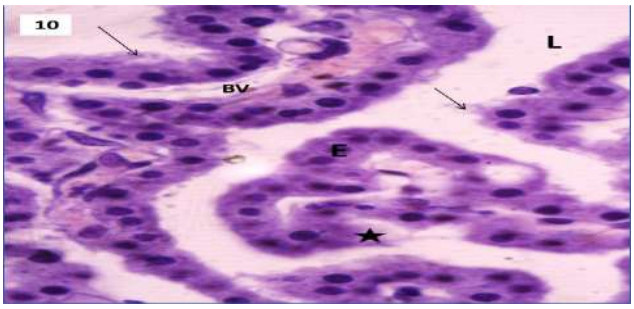

Fig. 10: Photomicrograph (H&E stain) of the choroid plexus of the lateral ventricle showing the cuboidal choroidal epithelium (E), with tuft of cilia (arrow) and bulged luminal border (asterisk) and the lumen of the third ventricle (L).

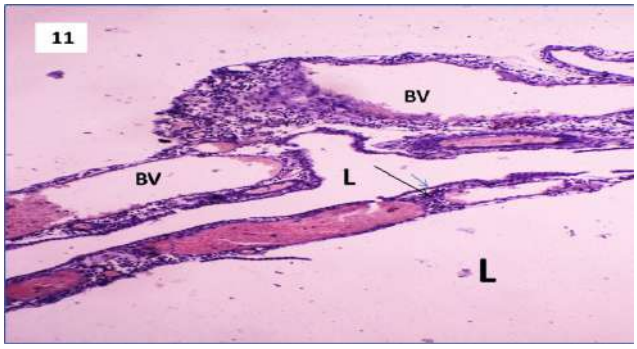

Fig. 11: H & E stained section: of the choroid plexus of the lateral ventricle showing, the covering cuboidal epithelium (blue arrow), the endothelial lining (black arrow) of the blood vessels (BV), and the lumen of the lateral ventricle (L).

the third ventricle, where they structure the choroid plexus of the third ventricle. The two groups that make up the third ventricle's choroid plexus are thin rostrally and isolated dorsally by a tacky thick notch and completely joined caudally. The choroid plexus of the third ventricle is situated in the dorsal portion of the ventricle, connected dorsally to the corpus callosum's body, and ventrally to the thalamus and horizontal geniculate body (Fig. 1).

Under microscope each band of the plexus showed up as a bundle of linear drops collapsing at the level of the pineal organ (Fig. 3). In cisterna cerebello-medullaris, the choroid plexuses of the fourth ventricle are noticeable between the caudal segment of the cerebellum and the medulla oblongata. It is connected and joined dorsally to the cerebellum's lobus dorsalis para follicularis, ventrally to the caudal cerbellar peduncle, and back to the caudal third of the fourth ventricle, and front to the lobulus follicularis (Fig. 1 and 6). The choroid plexus of the fourth ventricle has arbor-like stretching, with countless foliate-like cycles attach to the basal stem (Fig. 6).

At low magnification histologically, the choroid plexus of the sidelong ventricle is portrayed by correspondent folds of variable sizes (Fig. 7). The third and fourth choroid plexuses were comprised of countless foliate - like cycles that were joined by a stem to a more basal center of stromal tissue.

Essential foliate may create optional heights (Fig. 8). In the body of the foliate, stromal tissue infiltrates into the leaves, joined by vessels that split up into slim plexuses. The choroid plexus' profoundly vascularized tissue is covered by a solitary layer of cuboidal to low columnar epithelia with a normal stature of 8.35 ìm (Fig. 8). However, the epithelial covering of the third and fourth ventricle choroid plexuses gave off an impression of being greater than that of the parallel ventricle plexus because of their arbor-like spreading. The cuboidal epithelium's cytoplasm looks totally stained with eosin and seems granular, especially in the tiny region. A few cells have microvilli and cilia on their apical lines, though others have secretory stick (Fig. 9 and 10). Second type of cell can be found along the luminal edge of the choroidal plexus covering epithelium, with meager cytoplasm and a somewhat thick unpredictable core. Its long hub runs corresponding to the choroidal cells' luminal surface (Fig.11 and Fig. 12). The choroidal epithelium is isolated from the veins by a significant measure of connective tissue. Collagen packs are the most

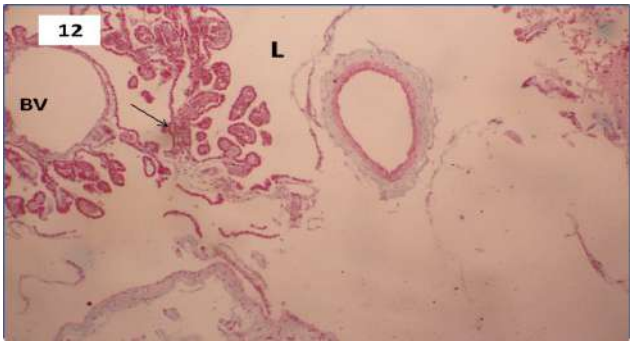

Fig. 12: PAS-stained section: of the choroid plexus of the fourth ventricle showing that the epithelium (arrow) is faintly stained except for its apical border. The lumen of the fourth ventricle (L) and the blood vessels (bv).

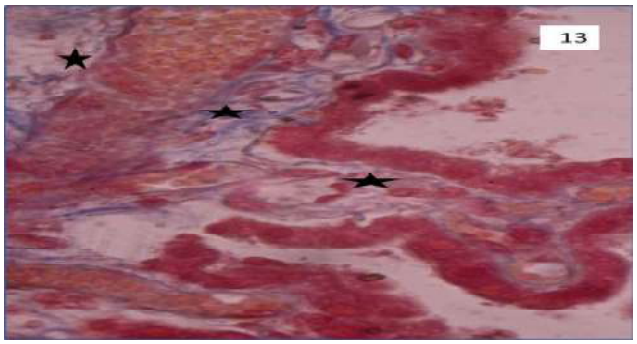

Fig. 13: The choroid plexus of the third ventricle displaying the blue-colored collagen bundles in the connective tissue stroma (asterisk) (Masson's trichrom stain).

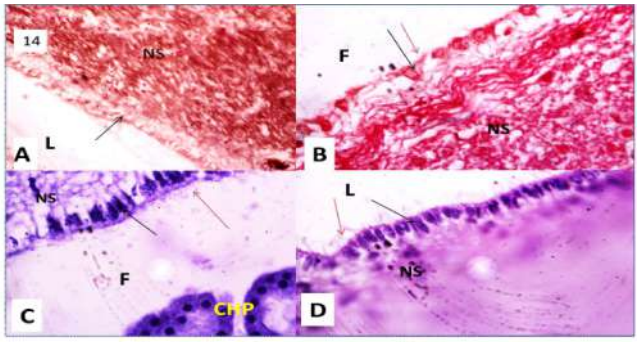

Fig. 14: Photomicrograph (Silver nitrate stain(A),Masson's stain(B), H & E stain (C), combined AB_ PAS stain (D) of ependymal cell of lateral (L) and forth(F) ventricles showing these cells with cuboidal to columnar (black arrows) and have cilia (red arrows) on their surfaces, nervous tissue (NS), choroid plexus (CHP).

significant stromal part (Fig. 13). The connective tissue stroma can be extremely thin that the endothelium of the courses can join to the choroidal epithelium's cellar layer (Fig. 9 and 11). The connective tissue is represented by the presence of overflowing veins, these vessels in sidelong ventricle's seemed immense long, marginally twisted, and equal (Fig.7). The horizontal ventricle's choroid plexus has a high vascular thickness. Ependymal cell shapes the epithelial covering of the ventricles (Fig.14). Reticulum fiber of choroid plexus was stained with silver nitrate stain (Fig.15).

In people (Snell, 2010 and Wilkinson, 1998), dairy cattle,

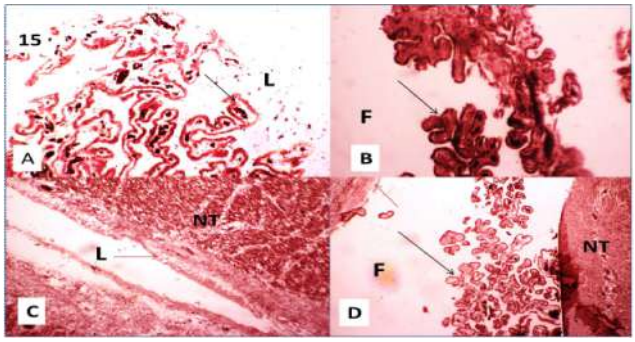

Fig. 15: Photomicrograph (Silver nitrate stain) of choroid plexus of lateral and fourth ventricles showing choroid plexus epithelium (black arrows) of lateral ventricle (A) and fourth ventricle(B) & (D), lumen of lateral ventricle (L), lumen of fourth ventricle (F), nervous tissue (NT), ependymal cells (red arrows).

ponies, and canines (Dyce *et al*., 2002, Ebada *et al*., 2011), and monkeys (Dyce *et al*., 2002) are generally well evolved creatures that are like one another (Testut and Latarjet, 1990). The choroid plexuses of the horizontal ventricles, third ventricle, and fourth ventricle make up the choroid plexus of goat. The choroid plexus of the parallel ventricle arises at the ventral horn of the sidelong ventricle, then, at that point, runs caudo-dorsally through the rostral limit of the hippocampus and dorsolateral to the caudate nucleus, like the discoveries in the dromedary (Mansour, 1983).

Prior to the front horn of the sidelong ventricle, its choroid plexus goes to a slip by. This is steady with what Young and Young (1997) and Strazielle and Ghersi-Egea (2000) found in people. It possesses the front facing part of the sidelong ventricle in monkeys, as per Testut and Latarjat (1990). The choroid plexus structure in goat is equivalent to that found by Banks (1993). The choroid plexus of the sidelong ventricle displayed as collimated folds with differed measurements when analyzed under a light magnifying lens, as per our discoveries which collaborate with Ebada *et al*. (2011) in goat, and Tamega *et al*. (2000) in monkey under filtering electron magnifying instrument at low amplification.

As indicated by the discoveries, not many cells show in the vertex borders microvilli and cilia, while others seem swell or have secretory extend. The discoveries of Rajtova (2002) in sheep, Adam *et al*. (2005) in pony, and De Spiagelaere *et al*. (2008) in pig utilizing electron microscopy back up this end.

The choroid plexus surface morphology in grown-up goat varies essentially from that of kid. On the choroid plexus surface of sheep and goat kid, there are normal cilia not withstanding microvilli scattered or coordinated in brain (Rajtova, 1997).

Our discoveries uncover that the horizontal ventricle has more vascularization than the third and fourth ventricles, which we disclose to the choroid plexus expanded secretory action in the parallel ventricle.

The presence of little round or stretched secretory stick recognized uniquely in the horizontal ventricle choroid plexus under filtering electron microscopy in goats is deciphered thusly (Rajtova, 2000).

The cells that found on the choroid plexus epithelial surface were bothering to epiplexus cells with cytoplasmic prolongations (Rajtova, 2002) in sheep, or perikaryon

expansions, (Tamega *et al*. 2000) in monkey and in pig (De Spiagelaere *et al*. 2008). These cells are gotten from connective tissue stroma cell constituents in people (Dohrmann, 1970).

Carpenter *et al*. (1970) in felines, then again, guaranteed that monocytes navigated the choroid veins prior to infiltrating the choroid and created to macrophages and thus, these cells penetrate the connective tissue space transform into epiplexus cells which arose subsequent to intersection the choroid epithelium. The outside grown-up sheep epiplexal cell morphology (Rajtova, 2002) and goat Ebada *et al*. (2011), just as fetal tissue from the two species (Rajtova, 2000). The same can be said for (Rajtova, 1997).

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