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Toward to Explain of Working Principles of Blood-Brain Barriers Like X-Ray Devices: A Neurophysical Hypothesis

X-Ray Cihazına Benzeyen Kan-Beyin Bariyerlerinin Çalışma Prensiplerini Açıklamaya Doğru: Bir Nörofizik Hipotez

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Abstract

Aim: The blood-brain barrier is an electromagnetic mechanism on a neurophysical basis. In this study, we compared the X-Ray device, which shows similarity to the blood-brain barrier.

Material and Method: We collected brain samples from deep temporal cortex sections of ten rats, stained them via the glial fibrillary acidic protein (GFAP) technique, visualized the architectural structures of the blood-brain barriers, and compared them with X-ray devices.

Results: With the arterioles forming the tube blood-brain barrier in the X-ray device, the anode-cathode that provides the electric current and determines the direction of the current flow corresponds to the astrocytes surrounding the anode-cathode vessel, the cooling system to the cerebrospinal fluid circulating the vessel, and the electrons emitted from the cathode to the particles flowing in the vessel.

Conclusion: With the architecture presented by the blood-brain barrier, we envision it functioning as an X-Ray and optical reader that display objects in passenger baggage and direct them according to barcode numbers.

Keywords: Astrocyte, blood-brain barrier, glial fibrillary acidic protein technique, rat, X-ray devices

Öz

Amaç: Kan-beyin bariyeri, nörofiziksel temelde elektromanyetik bir mekanizmadır. Bu çalışmada kan-beyin bariyerini, ona birçok yönden benzeyen X-Ray cihazı ile karşılaştırdık.

Gereç ve Yöntem: On sıçanın derin temporal korteks bölümlerinden beyin örnekleri topladık. Daha sonra glial fibriler asidik protein (GFAP) tekniği ile boyadık. Akabinde kan-beyin bariyerlerinin mimari yapılarını görselleştirdik ve X-ray cihazlarıyla karşılaştırdık.

Bulgular: X-ray cihazında tüp kan-beyin bariyerini oluşturan arterioller ile elektrik akımını sağlayan ve akımın yönünü belirleyen anot-katot; damarları çevreleyen astrositlere, damarlar için soğutma sistemi örevi gören beyin omurilik sıvısına ve katottan damarda akan parçacıklara yayılan elektronlara karşılık gelir.

Sonuç: Kan-beyin bariyerinin sunduğu mimari yapısı sayesinde yolcu bagajındaki nesneleri görüntüleyen ve barkod numaralarına göre yönlendiren bir X-Ray ve optik okuyucu olarak işlev gördüğünü düşünüyoruz.

Anahtar Kelimeler: Astrosit, kan-beyin bariyeri, glial fibriler asidik protein tekniği, sıçan, X-ray cihazı

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INTRODUCTION

X-rays have electromagnetic wave identity and polarization features. Electrons of the scattering medium emit electromagnetic waves at the same frequency by vibrating with the effect of the electric field vector of the X-rays on it. Anode and cathode electrodes are placed in a glass vacuum tube. The heated cathode takes the system in the old fluorescent lamp. Electrons are scattered when the cathode, passed through a high electric current, heats up. Electron jump has appeared, and photons belonging to energy have a high energy capacity. These are what we call X-ray photons. [1] X-rays are formed due to the interaction of rapidly moving electron current with atoms of the target material.[2] They are thrown from a fixed source to the photodiodes opposite. The images projected on the screen may be of different colors depending on the model of X-ray baggage scanning devices.

The blood-brain barrier separates the circulating blood from the extracellular fluid in the central nervous system. [3] This structure is formed by endothelial cells connected by tight junctions.[4] The blood-brain barrier does not allow the passage of many microorganisms and neurotoxins. Astrocytes are essential for the formation and proper functioning of the blood-brain barrier.[5] There are plenty of capillaries above the blood-brain barrier. Tight connections around them are not seen in average blood circulation. Endothelial cells prevent the diffusion of even tiny creatures such as bacteria.[6] Many proteins are used during active transport.[3]

In our opinion, the neural network surrounding the blood-brain barrier resembles the electrical setup of X-Ray devices. Just as X-ray scanners and barcode readers used in international transportation detect harmful substances and the direction of passenger connections, the blood-brain barrier may similarly regulate the course of atoms and molecules inside the brain arteries.

MATERIAL AND METHOD

Animal Selection and Study Groups

The data studied brains in the study were obtained from ten healthy male rats 18 months old age, and 350±20 gr (n=10). Hippocampus samples were examined by stereological methods to determine histological architectures of blood-brain barriers. The study protocol and permissions were reviewed and approved by the Ethics Committee for Animal Experiments, Medical Faculty, Ataturk University of Turkey. The management of the animals and the experiments themselves were done according to the guidelines set forth by the same ethics committee. A balanced, injectable anesthetics was preferred to reduce the pain and mortality. Anesthesia was triggered with isoflurane applied by a face mask, 0.2 mL/kg of the anesthetic combination (Ketamine HCL, 150 mg/1.5 mL; Xylazine HCL, 30 mg/1.5 mL; and distilled water, 1 mL) was subcutaneously injected before surgery. Following the experimental procedures, the animals were decapitated humanely under general anesthesia.

Histopathological Procedures

Brain tissue samples were stored in 10% formalin solutions for seven days after required cleaning procedures for retrograde histologic evaluation. The brain samples were subjected to a graded alcohol series embedded in liquid paraffin. Deep temporal sections were analyzed stereologically to evaluate similarities between X-ray devices and rat blood-brain barriers. The brain sections at the deep levels of temporal sections were stained with the glial fibrillary acidic protein (GFAP) method for examination. Twenty consecutive sections were taken at 5-micron intervals, and the BBB morphologies were examined.

Histopathological Findings

The blood-brain barrier is found in sensitive areas of the brain. It consists of a multi-functional endothelium, a dense innervated smooth muscle layer, and a neurovascular structure surrounded by a dense network of astrocytes surrounding the adventitia. Glial cells determine and direct the flow direction of the particles flowing in the vessel by producing negative and positive currents, just like the X-Ray device.

Mechanical and Anatomical Similarities Are as Follows:

The main components of the blood-brain barrier consist of arterioles like an X-ray tube, basal lamina, endothelium, astrocytes, end-feet of astrocytes, and pericytes, all of them like as anode (A)-cathode (K) (**Figure 1**). An X-ray tube is a high voltage cathode ray tube (B). The tube consists of a glass sheath that has been evacuated at a high vacuum. It has an anode (positive electrode, A) on one end and a cathode (negative electrode, C) on the other, tightly sealed with solder. The electrical energy of the X-Ray Tube is supplied from two poles (Uh-Ua). The cathode is a streamer made of tungsten material that releases electrons when heated. The anode consists of a thick rod and a metal target at the end of this rod. Electrons are emitted in the cathode filament when high voltage is applied between the anode and cathode. These electrons are accelerated towards the anode under high voltage and reach high speeds before hitting the target. A photon is emitted when high-speed electrons hit the metal target, transferring their energy. An X-ray beam consisting of glass passes through the narrow glass window inside the envelope. Some tubes use a filter to obtain single wavelength X-rays. X-Ray Tube: As the X-ray tube generates high heat, a coolant flows into the tube to make it enter (Win) and exit (Wout) to cool it. In our blood-brain barrier pictures, the astrocyte marked as K on the left shows the cathode, which is the mainstream generator, and the collector anode on the opposite astrocyte is marked as A. Electromagnetic waves originating from the anode to the particles signaled by the K astrocyte may be performing identity control (**Figure 2**).

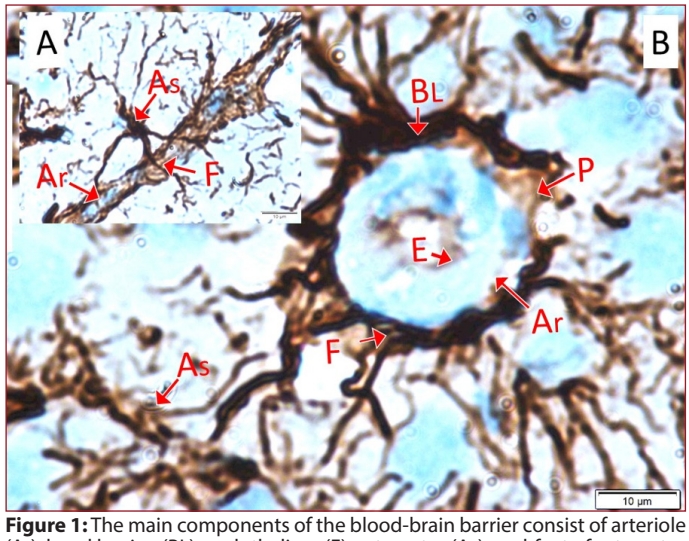

Figure 1: The main components of the blood-brain barrier consist of arteriole (Ar), basal lamina (BL), endothelium (E), astrocytes (As), end-feet of astrocytes (F) and pericytes (P) are seen (LM, GFAP, x10/A-Longitudinal section; x100/B-Transverse section).

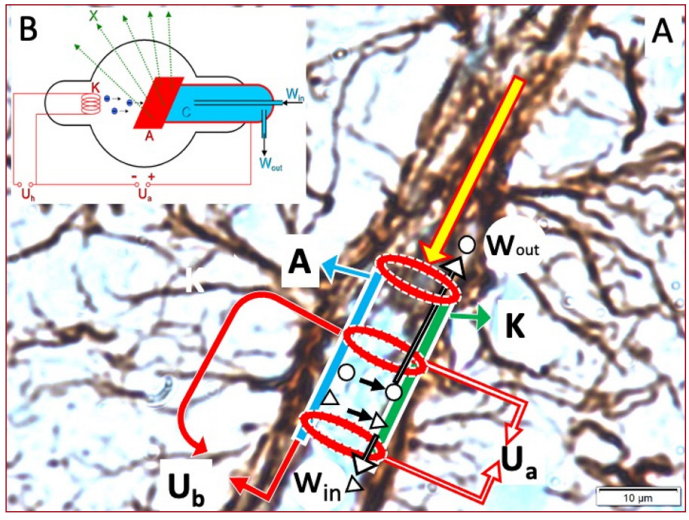

Figure 2: X-Ray Tube: X-ray tube is a high voltage cathode ray tube. The tube consists of a glass sheath that has been evacuated at high vacuum. It has an anode (positive electrode, A) on one end and a cathode (negative electrode, C) on the other, both of which are tightly sealed with solder. The electrical energy of the X-Ray Tube is supplied from two different poles (Uh-Ua). The cathode is a streamer made of tungsten material that releases electrons when heated. The anode consists of a thick rod and a metal target at the end of this rod. When high voltage is applied between the anode and cathode, electrons are emitted in the cathode filament. These electrons are accelerated towards the anode under high voltage and reach high speeds before hitting the target. When high-speed electrons hit the metal target, a photon is emitted, transferring their energy. X-ray beam consisting of glass it passes through the thin glass window inside the envelope. Some tubes use a filter to obtain single wavelength X-rays. X-Ray Tube: As the X-ray tube generates high heat, a coolant flows into the tube to make it enter (Win) and exit (Wout) to cool it. In our blood brain barrier pictures, the astrocyte marked as K on the left shows the cathode, which is the mainstream generator, and the collector anode on the opposite astrocyte marked as A. Electromagnetic waves originating from the anode to the particles signaled by the K astrocyte may be performing identity control.

The blood-brain barrier is found in sensitive areas of the brain. It consists of a multi-functional endothelium, a dense innervated smooth muscle layer, and a neurovascular structure surrounded by a dense network of astrocytes surrounding the adventitia. Glial cells determine and direct the flow direction of the particles flowing in the vessel by producing negative and positive currents, just like the X-Ray device.

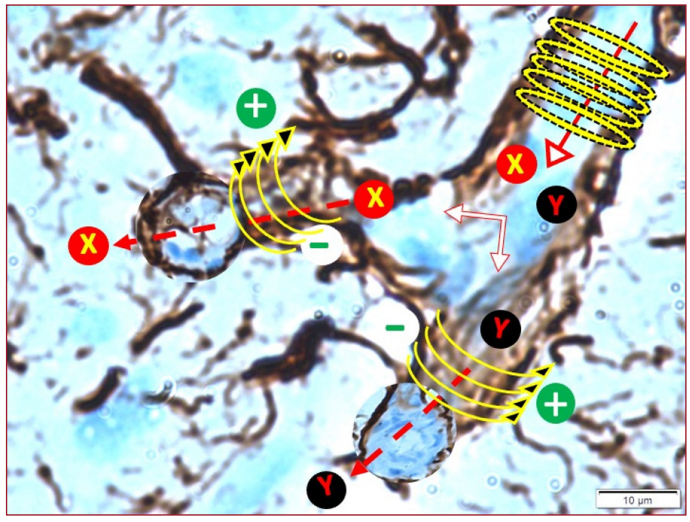

Figure 3: The blood brain barrier is found in sensitive areas of the brain. It consists of a multi-functional endothelium, a dense innervated smooth muscle layer, and a neurovascular structure surrounded by a dense network of astrocytes surrounding the adventitia. Glial cells determine and direct the flow direction of the particles flowing in the vessel by producing negative and positive currents just like the X-Ray device. In the figure, while XY particles flow distally, positive, and negative charges direct the X and Y particles to separate channels. Some of the astrocytes surrounding the artery may be acting as anode, and the opposite astrocyte cluster may also act as a cathode. This mechanism, which is viewed individually in two dimensions in the cross-section, exhibits a spiral structure. This neuroelectromagnetic mechanism may direct the particles in the vasculature to the neural, humoral, endocrine, and immune components of the brain according to their load and electromagnetic properties.

DISCUSSION

Working Principles of Blood-Brain Barrier

The blood-brain barrier separates the circulating blood from the extracellular fluid in the central nervous system.[3] This barrier is a highly permeable structure. Endothelial cells connected by tight junctions form this structure.[4] The blood-brain barrier allows the passive diffusion of water, some gases, and fat-soluble molecules. The transport of glucose and amino acids is done by active transport. The blood-brain barrier does not allow the passage of many microorganisms and neurotoxins. Astrocytes are essential for the formation and proper functioning of the blood-brain barrier. This structure encompasses the entire brain but is absent in a small brain section called circumventricular organs. This area immediately becomes an alarm if various toxic substances are detected in the blood. Various behaviors are seen to expel the poison, such as vomiting.

There are plenty of capillaries above the blood-brain barrier. Tight connections around them are not seen in average blood circulation. Endothelial cells prevent the diffusion of even tiny creatures such as bacteria. In addition, the passage of hydrophilic or structurally massive molecules into the cerebrospinal fluid is also prevented. Only diffusion of hydrophobic substances, including oxygen, carbon dioxide, and hormones, is allowed. Cells in the blood-brain barrier take metabolic products such as glucose by active transport. Many proteins are used during active transport. In our opinion, the neural network surrounding the blood-brain

barrier resembles the electrical setup of X-Ray devices. Just as X-ray scanners and barcode readers used in international transportation detect harmful substances and the direction of passenger connections, the blood-brain barrier may similarly regulate the course of atoms and molecules inside the brain arteries.

Tight junctions among the endothelial cells that make up the brain capillaries have a so-called tight connection, and a continuous they have a basement membrane. These connections are the blood-brain barrier endothelium. They create a high electrical resistance between their cells and 3.33 W / cm² in other tissues and 1500.2000 in K-BB W / cm².[7] As a result, paracellular permeability falls. The molecular weight of molecules below 10,000 absences of pores and fenestrations that allow passage differ from peripheral capillaries.[8]

The blood-brain barrier is found in sensitive areas of the brain. It consists of a multi-functional endothelium, a dense innervated smooth muscle layer, and a neurovascular structure surrounded by a dense network of astrocytes surrounding the adventitia. Glial cells determine and direct the flow direction of the particles flowing in the vessel by producing negative and positive currents, just like the X-Ray device.

Lymphatic System

CSF secretion, circulation, and absorption are dynamic processes modulated by different autonomic networks.[9] CSF can cool the brain like water in X-Ray devices. The brain is protected by barriers such as the blood-brain barrier that prevents foreign materials from accessing the brain. CSF flow into the pericapillary Virchow-Robin space (VRS) through the astrocytic aquaporin-4 (AQP-4) system is essential in cooling, nourishing, and detoxifying the brain. This structure also provides CSF dynamics in the subarachnoid space and ventricles.[10] Cerebral microglia also carry out essential activities in the synthesis and function of molecules variably modulated by astrocytes and choroid plexus epithelial cells and play essential roles in neuroinflammatory processes.[11] Therefore, the glymphatic fluid circulation can be considered the brain's lymphatic system. AQPs play crucial roles in the system.[12]

Similarities Between BBB and Barcode Reading X-Ray Devices

When current information is analyzed, it is evident that there is a close similarity between BBB and baggage reader systems. The working principles of current baggage scanners are based on measuring the energy loss between X-rays sent from a source and returned by hitting that source. When particles with different X-ray absorption properties are exposed to different X-ray spectra, unique images appear on the X-ray screen.[13] According to our theory, the BBB might work like baggage scanners and barcode readers used at airports or customs gates. The endothelium and blood vessels are surrounded by the dendrites of astrocytes, which produce and conduct electric current, forming a coiled tube.[6] Many astrocyte foot processes radiating along the vessel wall[7] produce an electric current. They may act as an anode-cathode, reading the particles passing through the vessel like barcode readers, ensuring the passage of beneficial particles to the brain, and eliminating harmful ones.

CONCLUSION

Suppose we comment on the summary X-Ray device in the literature and the pictures of the blood-brain barrier we have obtained. In that case, some of the astrocytes surrounding the artery may act as an anode, and the opposite astrocyte cluster may act as a cathode. This neuroelectromagnetic mechanism may direct the vessels' particles to the brain's neural, humoral, endocrine, and immune components according to their load and electromagnetic properties. This mechanism, viewed individually in two dimensions in the cross-section, has a spiral structure.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study protocol and permissions were reviewed and approved by the Ethics Committee for Animal Experiments, Medical Faculty, Ataturk University of Turkey. The management of the animals and the experiments themselves were done according to the guidelines set forth by the same ethics committee.

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