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Opinion

The Method of Opening the Skull and Extraction of the Brain in Fetuses and Newborns

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Abstract

The article describes the technique of opening the skull with the extraction of the brain in deceased fetuses and newborns. The author emphasizes the importance of prevention artificially damage very vulnerable brain children to improve the quality of further research. A preliminary movement of the brain from the skull in the water and not on the sectional table, with its subsequent transfer for fixation in formalin solution. When extracting the brain and moving it into water, the force of universal gravitation is used. It is recommended to study in detail the Tentorium Cerebelli (TC) after extraction of the cerebral hemispheres, and only then to remove the cerebellum with Pons and medulla oblongata.

Keywords: *Method of Opening the Skulls; The Technique of Brain Extraction from the Skull; Brain; Tentorium Cerebelli; Intraventricular Hemorrhage; Birth Trauma; Fetus; Newborn*

Abbreviations

TC: Tentorium Cerebelli; IVH: Intraventricular Hemorrhage; RPC: Region of Periosteal Blood Congestion

The study protocols pathologist and forensic autopsies of fetuses and newborns often shows the lack of quality opening the skull and studies of the brain, which complicates the diagnosis and establishing the cause of death. Currently, newborns sometimes there are cases of "circular" opening of the skull (circular cutting). Well enough investigated tentorium cerebelli (TC), not often considered intradural hemorrhage, are important for diagnosis of birth trauma, poorly researched brain. In the present age, nor any other, there is a clear correlation between the quality of diagnostics of pathological processes and, on the other hand, the character opening the skull and extracting the brain from the skull. The brain of fetuses, newborns and miscarriages is very vulnerable, flabby and requires a very careful attitude. Simple extraction of the brain from the skull using the fingers or instruments (especially preterm children) with the placement of the brain on the autopsy table, and a further turning and cutting, lead to separation of the membranes from the cortex and the brain turning to pasty mass, which is very difficult to find foci of necrosis and periventricular leukomalacia, cysts and pseudocysts, clearly localize the brain structures, damages, etc.

Long there is an understanding that the skull of the newborn can't be opened circularly by a circular cut of the skull, as in adults, and should be cut with scissors the side of the roof of the skull with dural sheath near the superior sagittal sinus (the Fisher method [1]). Through the resulting "window" is removed each hemisphere separately (pre-cut the corpus callosum and the trunk). Then trimmed the edges of the TC and remove the brain from the posterior cranial fossa. There are modifications to this method in which the bony plates of the skull roof is not fully cut and maintain a connection with the skull at the level of the sagittal suture (modification of M. K. Dahl [2]) or at the level of the lambdoid suture (modification H Essbach, E Khrushchevsky, G Shperl-Zeyfridova [3,4]), which allows to reduce the

deformation of the skull after sewing up the scalp and to facilitate the preparation of the corpse for burial. In the guidelines on autopsy of fetuses and newborns, 1976 [5] and "The Autopsy of stillborn and dead newborn infants weighing 500 to 1000 g", 1992 [6] described the technique of preserving the connection of the cut part of the skull roof at the level of the scales of the temporal bone. This is the third modification of the method of Fischer, which has no special advantages over the others. The best conditions for study of the surface of the brain, blood vessels and Dura mater occur when fragments of the skull roof completely cut off, do not hang, do not interfere with the observation, measurement, photographing and further removing the brain from the cranial cavity. The differences of the considered modifications are ways to extract the brain from the skull. If the first two models assume separate allocation for each of the hemispheres of the brain, in the third modification after crossing a falx cerebri at the level of the anterior fontanel and clipping TC at the top of the pyramid of the temporal bone is removed the brain entirely. IS Dergachev rightly believes that after removal of the cerebral hemispheres creates a good environment for studying TC [7].

The disadvantages of these methods are: 1) well enough investigated TC, which prevent lying on the back departments of hemispheres of the brain 2) brain applied artificial damage when removing it by hand or with tools, when placed on the dissecting table and turned upside-down, 3) the separate extraction of each of the cerebral hemispheres having a more significant artificial damage, difficult to estimate the symmetric lesions of the two hemispheres and intraventricular hemorrhages (IVH). The TC is the most important object for the diagnosis of birth injury of the skull [8,9]. I call it the mirror of a birth trauma. It should identify the types of damage (ruptures and hemorrhages), classify them, determine the size, compare the damage in two halves. This can't be done qualitatively if we study the TC through the hole formed when the occipital lobes of the brain are pushed back. Cutting TC for the subsequent extraction of the brain makes it difficult to qualitatively investigate further.

The brain of children, especially in prematurity, consists of a large amount of water 88 - 91% [9] (in adults 70 - 76%), is in the process of development, basically not myelinated and easily damaged by any touch, pressure, friction. It seems that after extraction from the skull, the brain should not be placed on the dissecting table or on any hard surface to its fixation in formalin solution. It is advisable to extract the brain without touching it with hands and tools.

To overcome the first of these drawbacks I consider it expedient to first separate extraction of the two cerebral hemispheres, then the cerebellum and brainstem from the posterior cranial fossa. To overcome the second drawback, the brain does not fall on the hard surface (section table) when it is removed, but into the water. In addition, thanks to the action of the force of universal gravity, the hemispheres of the brain are extracted without touching their fingers or instruments. The proposed method for extraction of brain in water was first described in 2009 [10].

Thus, the opening of the skull and the extraction of the brain are performed by me as follows. After studying the skin and soft tissues of the head, periosteum, - region of periosteal blood congestion (RPC), bones and their displacement on relative to each other (the configuration) can produce punctures in the lateral corners of the anterior fontanel (Figure 1). In the puncture, the lower scissor jaw is inserted, and then the incisions are parallel to the sagittal suture to the lambdoid and coronal sutures, then downward with the intersection of the scales of the occipital bone and the cutting of the "window". Cut out fragment of the roof of the skull captures part of the frontal and temporal bones (Figure 2, 3) and at first remains in contact with the skull at the level of the lambdoid suture. When cutting bone plate in the left parietal bone is recommended to cover the right brain the right bone plate (Figure 3). In the context of the skull is required to comply with the following conditions: not to cut the sinuses, not to damage the branches of bridge veins flowing into the superior sagittal and transverse sinuses, and the lower jaws of the scissors be careful not to damage shell and the substance of the brain. After studying the contents of a subdural space, the search of signs of compression of the hemispheres of the brain (presence of stairs) at the going down of the bones in the coronal and sagittal sutures, bridge veins, surfaces of the hemispheres of the brain, the falciform process and the TC is removal of the bone plates of the skull cap, then cross the brainstem (at the level of the corpora quadrigemina) and cerebral falx with a bone plate (before connecting with TC). The corpse must be held by the neck face down, then tilt your head the crown of the head down with a light shake of the head the occipital lobes of the hemispheres of the brain are lowered, separated from the upper surface of the TC

and the conditions for preliminary study. We also study the falx cerebri, bridge veins, the contents of the middle cranial fossa. Then cut the brain stem and the falx cerebri with of the osseous lamina (Figure 4-6). The head is positioned over a prepared a water vessel, the bottom of which is placed a piece of gauze. The exposed skull with bowed head next to the water: the cerebral hemispheres because of their gravity gradually descend into the water (this does not require them to hold with a hand; you can combine lowering the brain into the water with cutting the brain's stem). In the water brain is floating, it can be rotated, to explore the bottom surface, and can be used to diagnose IVH. A small incision of the corpus callosum allows the identification and preparation of stemming the blood from the lateral ventricles. It is also necessary to pay attention to the aqueduct of Sylvius, where in the case tanatogenesis significant IVH detected blood. Then (Figure 7) on a piece of gauze hemispheres of the brain transferred to 10% neutral formalin solution. On the 3rd day of fixing (maximum fixing period of 10 days, formalin is desirable to change and increase its concentration to 15 - 20%), the brain can explore. After fixation, the brain becomes dense and does not break and does not suffer in his hands or flip on the table, it becomes a convenient object for further research, can be cut to the plane-parallel plate through two hemispheres.

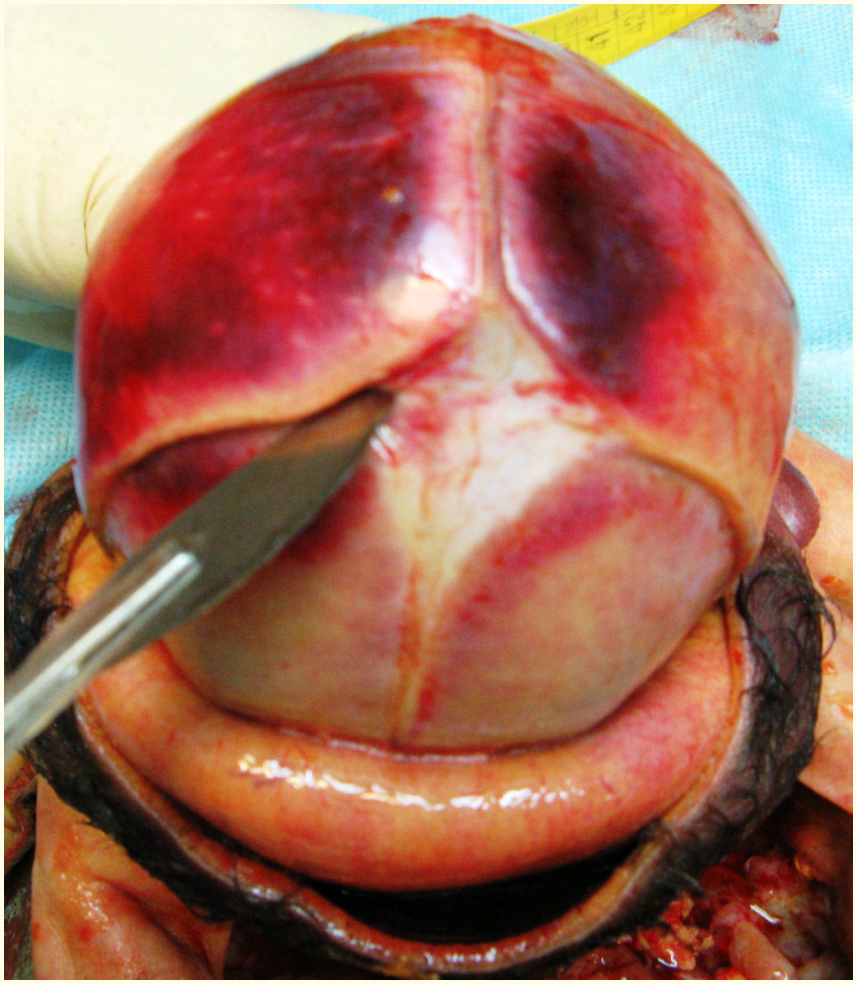

Figure 1: *An autopsy of the skull. Puncture using a scalpel in the region of the right lateral corner of anterior fontanel of skull cap.*

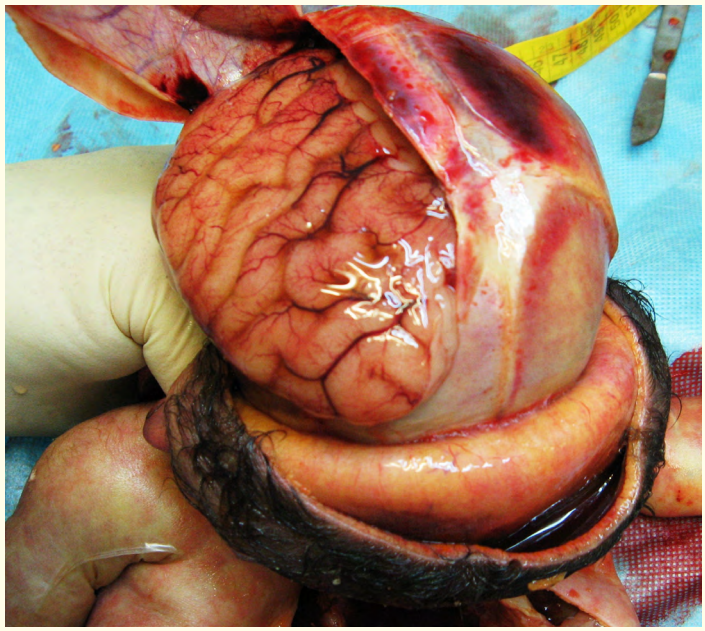

Figure 2: *An autopsy of the skull. After making a "window" by cutting skull cap bones, the cut out fragment attached to occipital bone is lifted.*

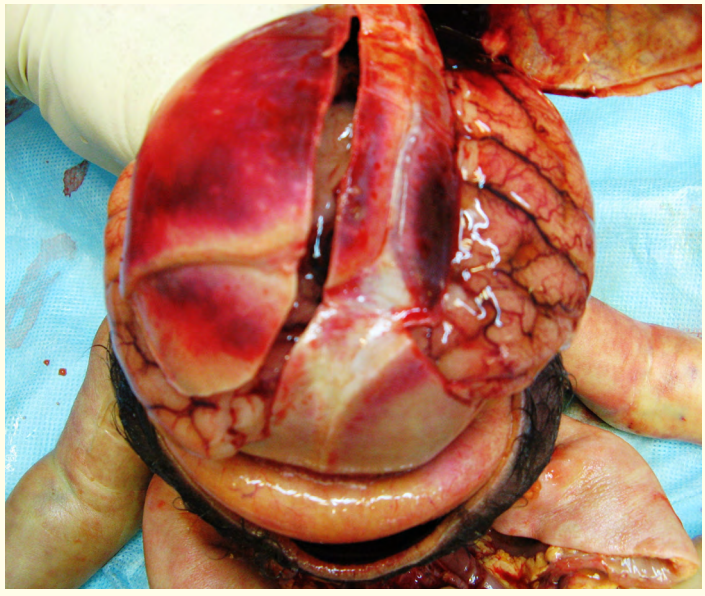

Figure 3: *An autopsy of the skull. Analogically, a fragment over the left cerebral hemisphere was cut out; the right hemisphere is covered with a bone fragment.*

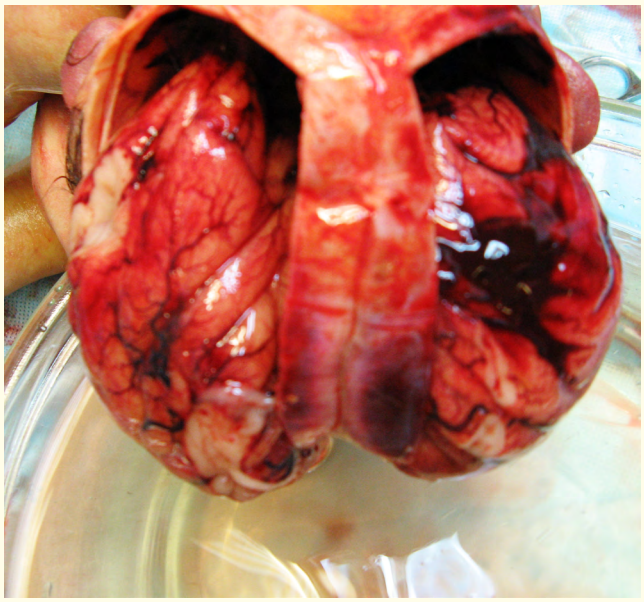

Figure 4: *Extraction of the brain. Bone plates above the cerebral hemispheres are removed, the head is moved with the face down to exsiccator with water; brain tends to sink thanks to its mass.*

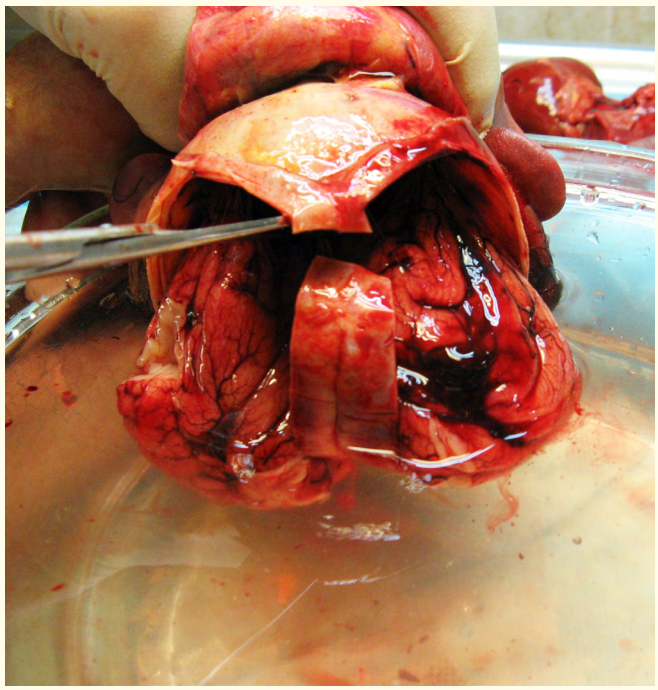

Figure 5: *Extraction of the brain. The cerebral hemispheres are put down into water, the cerebral falx together with a bone fragment in front of the connection with the TC is cut.*

Figure 6: *Extraction of the brain. Bone fragment with falx cerebri is displaced anteriorly, the cerebral hemispheres under the influence of gravity fall into the water.*

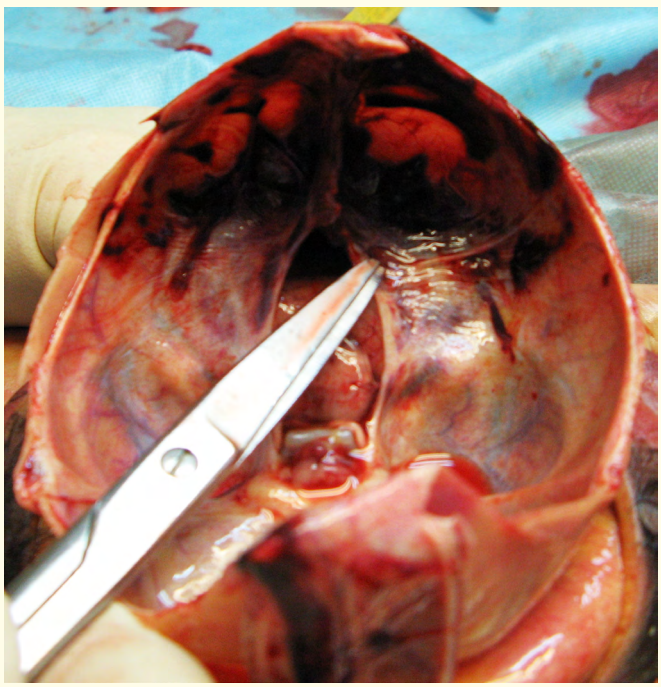

Figure 7: *The study of TC. After cutting through the cerebral stems, the cerebral hemispheres are in water at the level of the quadrigeminal plate tubercles. A detailed examinated of the cerebellar tentorium is carried out. A right-sided rupture in the superior folium of TC is found.*

After extraction of the brain hemispheres is a detailed study of the two halves of the TC (Figure 8) with the classification of the identified injuries (rupture and hemorrhage) [9], its comparison with the localization of the RPC. Then TC is cut at the edges, studied the posterior cranial fossa, aqueduct of Sylvius, crossed the spinal cord, nerves and retrieves the cerebellum with medulla oblongata and the bridge. Studied the 4th ventricle of the brain. After fixation the brain was cut in frontal plane-parallel plates, which are studied, detectable lesions are excised and sent for histological examination.

Figure 8: *Extraction of the brain from the water. After examining, the cerebral hemispheres are transferred for fixation into a 10% formalin solution on a piece of gauze.*

Thus, it is suggested to put brain not onto a dissection table, but into water, with subsequent transfer into a formalin solution for fixation. The universal gravity is used when extracting brain and putting it into water. After extracting the cerebral hemispheres, it is recommended to examine the cerebellar tentorium in detail, and only then extract the cerebellum together with the pons varolii and medulla oblongata.

The proposed method of opening the skull and extracting the brain for further study allows the fullest to identify brain damage and overcome the artificial damage it.

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Conflict of Interest

The author declare no conflict of interest.

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