



## Ozone treatment for post-operative cerebral edema

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The ozone has been used in medicine for hundreds of years, in recent years, emphasis and attention has been focused on the use of medical ozone in neurosurgery, especially for the treatment of cerebral edema. Now, 12000 cases has received ozone treatment with significant improvement of cerebral edema in our department since August, 2010. Herein, some cases have been proposed as the following.

### 1、Treatment for cerebral edema after resection of hemisphere tumor

Zhang xx, male, 56-year-old, ID: 505471, was admitted to us on July 12, 2010. He was diagnosed as left thalamencephal glioma. Surgical removal of tumor was performed on July 14, then he received ozone treatment since July 16, twice per day. Repeated CT showed the significant improvement of the edema, without any shift of middle line. The following course was uneventful, he was on the mannitol routinely, twice per day.

### 2、Occlusion of middle cerebral artery

Feng xx, male, 74-year-old, ID: 410260, he suffered from an occlusion of left middle cerebral artery and was admitted on July 12, 2010. Ozone treatment started on July 17, twice per day, edema was significantly improved as demonstrated by CT scan on July 21. Mannitol treatment did not continue in the following course as a result of improved states.

### 3、Treatment for cerebral infarction after MCA aneurysms surgery

Guo xx, ID: 504316, male, 38-year-old, on July 23, 2010, was hospitalized with sudden headache for one day, he lost consciousness with dilated pupilla, diagnosed as left temple hemorrhage, cerebral hernia as a result of rupture of aneurysms. Surgery of clipping aneurysms and hemorrhage removal was immediately carried out. However, the cerebral infarction occurred on 4 days after operation, the bone was removed to decompress the brain on July 23, 2010. The ozone treatment was following on July 16 (one, per day). CT showed significant improvement of the cerebral edema. Following course was stable, he fully recovered from illness when he was discharged.

## Discussion

Ozone, also known as activated oxygen or trivalent oxygen, is an extremely reactive oxidizing agent. Ozone facilitates an increase in the partial oxygen pressure of arterial blood through the oxygen saturation of both plasma and erythrocyte hemoglobin, which can induce a decrease in both general and local tissue hypoxia, activation of gas metabolism in the zone of ischemia. Ozone is able to stimulate glucose metabolism in the erythrocytes, formation of 2,3-diphosphoglycerate - substance contributing to the more complete oxygen release by oxyhemoglobin and shift of oxyhemoglobin dissociation curve to the right. Thus, more oxygen is released to the tissues, particularly affected by ischemia. Owing to the interaction with corpuscle membrane lipids, ozone increases the deformability of the erythrocytes and decreases their aggregation and thus improves fluidity of blood in micro flow bed. Ozone can decrease platelet aggregation and activate of fibrinolysis, ozone is able to prevent thrombosis at the areas of decelerated blood

flow and facilitates the lysis of produced small thromboses thus improving the rheological properties of blood. Ozone can facilitate a decrease in arteriolar spasm and opening of non-functional capillaries thus activating microcirculation in the ischemized tissues.

Vasogenic edema occurs after brain operation which is the most common type of brain edema, it is characterized by the influx of fluid and solutes into the brain through an incompetent blood-brain-barrier (BBB). which has been demonstrated by the increased EB content in the animal test.

Pathophysiology of cerebral edema is complex. Damaged cells swell, injured blood vessels leak. Cellular and blood vessel damage follows activation of an injury cascade. The cascade begins with glutamate release into the extracellular space. Calcium and sodium entry channels on cell membranes are opened by glutamate stimulation. Finally, hypoxia depletes the cells' energy stores and decrease ATPase activity and reducing the deformability of the erythrocytes, increase the risk of arteriolar spasm, resulting in the microcirculation disturbance, these injury cascade can be target of Ozone as mentioned above, it is also proved to be effective by our clinical data. Our data has suggested that ET play a key role in the pathophysiology of cerebral edema. However, the relationship of Ozone and ET are still not well understood, it will be explored in our further study.

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