



Prevention of secondary injury of the brain after penetrating injury

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Abstract

There are very limited therapeutic options for medical services during the shooting skull injuries treatment. Only few hours after the severe head trauma are available for detecting the damaged locating, rescue, stabilization and transport of hospital condition. During this time, the brain tissue at the molecular level processes are started which are progressing according to complex laws of causing further damage and demolish the damaged prospects and the chances of healing. My aim was to emphasize that I compiled solution above the normal level of total antioxidant capacity, thereby achieving a reduction in post-traumatic cerebral edema. I performed to verify the above, the following tests on animals weighing from 300 g Vistar female rats. My first goal is to measure the total antioxidant capacity of the animals, using a simple and cheap method. This value indicates the total capacity of the organization, which is suitable for the resultant free radical conclusion, that an exact assessment of the pre-treatment. The second goal was to verify the methodology described above, compiled by the dietary supplement able to increase total antioxidant capacity of healthy animals. Based on the results of animal experiments I carried out, it stated that the organization's total antioxidant capacity of blood and urine samples can be determined using the method I have described.

Keywords: brain injury, edema, neurological damage

Introduction

There are very limited therapeutic options for medical services during the shooting skull injuries treatment. Only few hours after the severe head trauma are available for detecting the damaged locating, rescue, stabilization and transport of hospital condition. During this time, the brain tissue at the molecular level processes are started which are progressing according to complex laws of causing further damage and demolish the damaged prospects and the chances of healing.

Above is a summary of secondary brain injury called a distinction between the primary trauma caused damage [1].

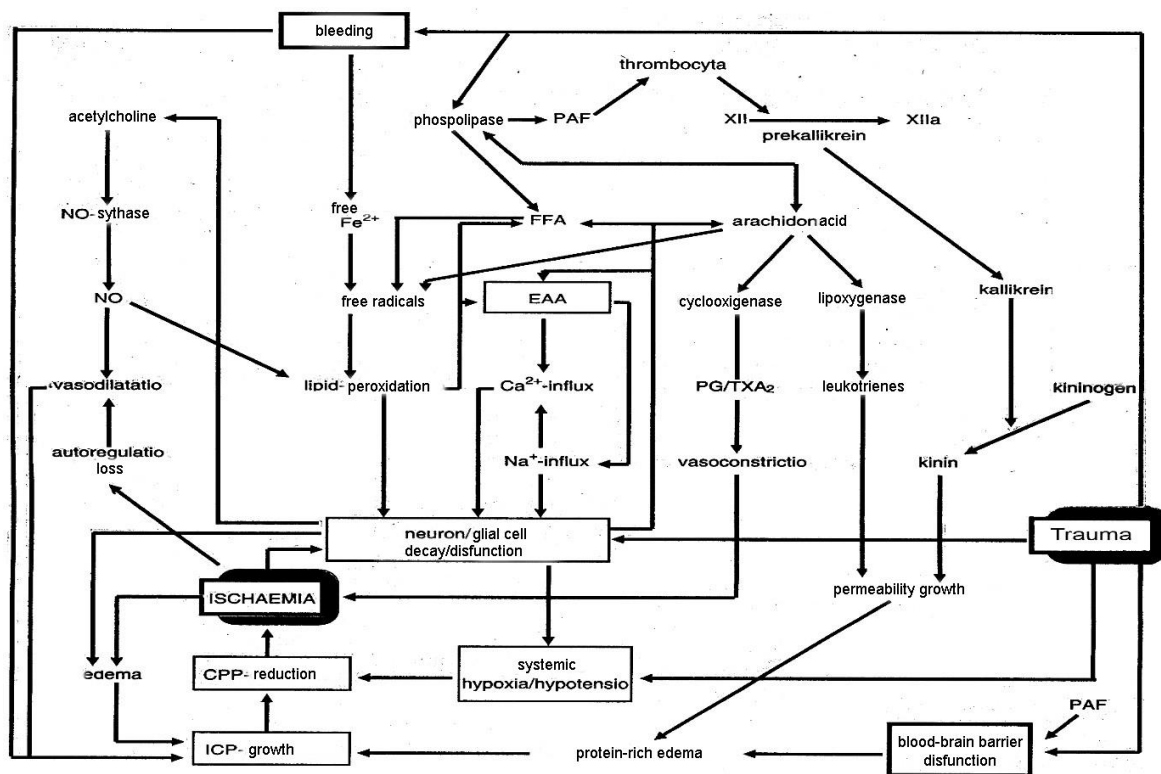


Figure 1: The secondary nerve tissue damage, Ed.: Kóródi Gyula

The primary lesions and after the moment of the trauma are formed directly over the brain as a result of mechanical insult. Surgical intervention can be removed as the projectile, the bone fragments and all the foreign matter, the damaged nervous tissue, hematomas and restored the continuity of dura but ongoing disease processes at the molecular level is not influenced at this level. The medication in the ongoing attempts to reduce secondary brain damage, so just expect new results are from the methods that is able to turn up somewhat in advance against damage in the physiological process.

Analysis of the problem

The primary neurological damage

The primary damage to the moment of the trauma, and then immediately occurs, the nerve tissue has a mechanical insult consequence; hemorrhages, contusions and diffuse axonal injury, excluded [1]. Examining the effect of penetrating gunshot injuries Damage prominent tissue damage caused by the kinetic energy of the projectile passed tissue. This kinetic energy is proportional to the square of projectile weight and proportional to its speed [2]. Ballistics this foundation, it follows from the harmful impacts in terms of the speed of the projectile parameters that define. 800-900 m / sec speeds - the majority of injuries can range shooting war - is gradually beginning to dominate the "hydrodynamic" effect, with devastating effect fabric over 1500 m / sec speeds even higher [2]. The incoming projectile at high speed and cause high water content closed cranial shock wave, which not only damages the path of tissues, but multi beyond the direct trauma effect. The shock waves occur instantaneously transmitted to the nervous tissue traced down from the same stem from the transition cavities as well [3].

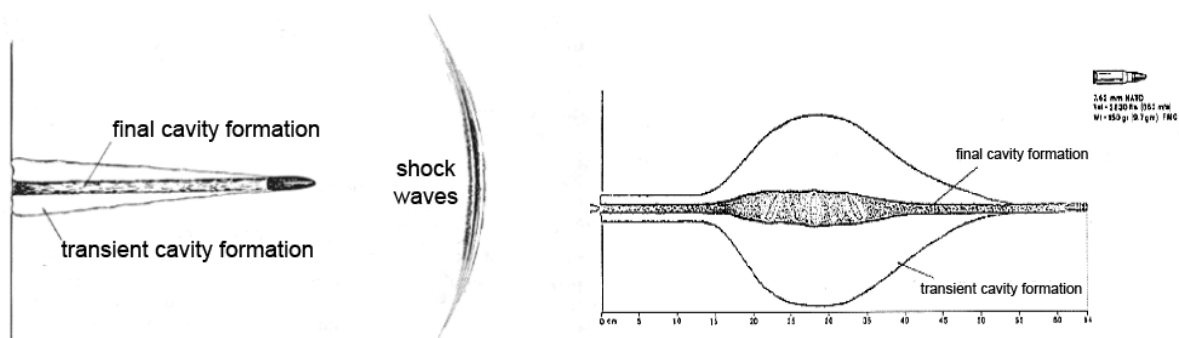


Figure 2a, 2b: The bullet tissue cavity-forming effect Ed.: Kóródi Gyula, Source: Williams A.: *Characterization of the Rat Penetrating Brain Injury in: Histopathology and Behavior, Advanced Technology Applications for Combat Casualty Care 2004 Conference August 18, 2004 in St. Pete Beach, Florida*

The primary cause of cavities is tissue-damaging effect [4], but it plays a significant role in the development of infectious complications following a gunshot injury, as the cavity instantaneously discontinued dirt from the outside of the heart shooting channel. Ballistics further details of the analysis of disregard, for treatment to reduce secondary brain injury is not affected. The tissue destructive effects are highlighted above, it follows that suffered the direct destruction of nerve cells

to regenerate no hope, while the far - Definitive did not cause an exposure of up - to rescue areas ("penumbra") may open opportunities. In a decisive role previously discussed in detail in cerebral blood flow and oxygen permanent control and optimization.

The secondary neurological damage

The high rate of mortality suffered gunshot injuries to the skull examining the causes accurate knowledge is essential to clarify the physical and chemical processes that take place between the shot and the moment of death. In the third chapter, I analyzed the intracranial pressure and cerebral blood flow regularities of the physical, so here I study the neurological damage secondary to mitigate used chemical mechanisms, including processes I search for edema of the brain tissue after trauma decreasing.

Ongoing dynamic balance of the body, oxidation and reductive processes are one of the biochemical basis of physiological functions. In the intermediate metabolism of free radicals are generated continuously - acting to "oxidative stress" [5] status - which is a kind of antioxidant mechanisms of the body's defense is concluded [6].

Free radicals

- hydrogen peroxide
- superoxide radical
- hidroxyl radical
- peroxy radical
- Nitric oxide
- singlet oxygen
- Hem proteins
- peroxy nitrit
- hypochloric acid

Scavenger antioxidants

Enzymes-Small molecules

- | | |
|-----------------------|---------------|
| - superoxide | - glutation |
| - dismutase | - vitamin C |
| - glutation | - vitamin E |
| - peroxidase | - bilirubin |
| - glutation reductase | - carotionids |
| - catalase | - flavonoids |
| - metallo proteines | |
| enzymes | |

Table 1: Source: Noseworthy-Bray: *Effect of oxidative stress on brain damage detected by MRI and in vivo 31P-NMR*, *Free Radic. Biol. Med.* 1998 Apr.; 24(6):942-51.

All chemical potential of free radicals conclusion that can be mobilized as a "total antioxidant capacity" measurable parameters [7]. As the nerve tissue after a gunshot injury to a major free radical formation starts, instant tissue-damaging effect can only be compensated if the antioxidant capacity has been able to increase prior to the injury. My working elevated antioxidant capacity as previously used occur as a result of trauma caused by the release of free radicals to reduce brain edema. If the intense antioxidant capacity capable warrior has vasogenic brain edema resulting from gunshot

injuries mitigate - so damaged compensation has a reservoir in the early stage when the therapeutic prehospital accessibility minimal. The vasogenic brain edema following the trauma has already occurred and the fourth peak hours [8], one of the reasons - the blood-brain barrier opening up, in the vein exiting fluid between cells during the first hour after the injury [9].

Methods, Scientific objectives

My aim was to emphasize that I compiled solution above the normal level of total antioxidant capacity, thereby achieving a reduction in post-traumatic cerebral edema. I performed to verify the above, the following tests on animals weighing from 300 g Vistar female rats.

New method to measure the total antioxidant capacity

My first goal is to measure the total antioxidant capacity of the animals, using a simple and cheap method. This value indicates the total capacity of the organization, which is suitable for the resultant free radical conclusion, that an exact assessment of the pre-treatment. The animals were placed in metabolic cages and urine is collected daily both supplied the sample. The urine and serum total antioxidant capacity as well correlated [10], and therefore simpler and bloodless sampling chosen. I defined this method of free fluid intake and food intake of 20 healthy, Vistar female rats weighing 300 g, total antioxidant capacity addition.

The supra-normal total antioxidant capacity levels

The second goal was to verify the methodology described above, compiled by the dietary supplement able to increase total antioxidant capacity of healthy animals.

The liquid introduced was a red grape juice concentrate, the components of which were shown in Figure 3. As a nutritional supplement, the mix of 40 mg of "Resveratrol" and 35mg of "Granavita" per bodyweight in kilogram per day were gauged. The active ingredients of Granavita are barbipolisaccharide, ellagic acid and zeaxanthin, and the Resveratrol is 98% t-resveratrol (polygonum cuspidatum) was.

Red grape Juice Concentrate 65 Brix (clear)

Analytical values of Concentrate	Unit	Average	Range
Soluble solids refract.	°Brix (20 °C)	65,0	62,5-66,5
Total acids as citric acid	g/kg (pH 8,1)	11,6	4,7-23,3
Total acids as tartaric acid	g/kg (pH 7,0)	12,5	5,0-25,0
pH-value			2,8-4,1
relative density (20°/20°C)		1,319	1,303-1,328

Analytical values after reconstitution to single strength juice	Unit	Average	Range
Soluble solids refract	°Brix (20°C)	17,0	16,0-18,0
Total acids as tartaric acid	g/l (pH 7,0)	3,5	1,7-4,0
Total acids as citric acid	g/l (pH 8,1)	3,2	1,3-6,5
Colour Unit at 435 nm *			0,035-0,150
relative density (20°/20°C)			1,065-1,074

*(1g conc. + 99g H2O bidest.)

Microbiological values	(Values refer to unopened aseptic packages)
Total plate count	< 100/g
Yeast	<10/g
Mould	<10/g
E-coli and other coliforms	neg./g

Shelf life (from date of production)		
aseptically packed goods (BIB** and BID***, not opened)	recommended at 0°C to +4°C	24 months

BIB= Bag In Box, *BID= Bag In Drum

Figure 3: product specification, based on Manufacturer's information

Participating in the first experiment, murine, or 10 days for 5 animals dosed solely to the above solution in place of drinking water, free liquid intake and food intake was unchanged secured. The remaining 10 animals were used as controls unaltered food and water consumption. The animals were kept in cages metabolic continuously collected after the start for all individuals and urine twice daily (every 12 hours) were determined in total antioxidant capacity.

Results

The measurement data of 10 control animals did not differ from the previous ones, but the rats treated with 10 values of the initial 100% to 117% in increased, so managed to achieve a significant increase. The assembled solution capable of increasing the antioxidant levels in normal and where the ability to lower blood-brain barrier disruption, may be suitable for vasogenic edema "prophylactic treatment".

Reducing secondary brain injury antioxidant effect of „pre-treatment”

10-10-treated and control animals used in previous measurements, the fifth day of the trial - ie when treated with higher antioxidant capacity was proven - freeze lesion cerebral edema dropping experiment was carried out [11]. My question was that if the constant cortical insult to the large amount of animals treated with radical binding capacity of blood-brain barrier disruption will be minor compared to the control. The animals' halothane and oxygen / nitrogen oxide using 30/70% narcosis anesthetized skulls were recorded over the frontal lobe and dropped straight skin incision, high-speed drill with a diameter of 0.5 cm bone window opened skulls. After opening the dura mater acetone using carbon dioxide snow-chilling -50 degrees Celsius cooled to 3 mm in diameter, flat-soled copper cylinder 5 seconds of exposure time violations dropped by freezing the cortical surface. After closing of the skin wound on the right femoral vein in 1 ml of 2% Evans blue was injected & albumin. This is an insult to the paint as the site of the blood-brain goes outside the vein, and the edema is proportional to the degree of discoloration due to damage caused by the dam. After an hour after the intravenous injection the animals were sacrificed and their brains were performed emphasizing digital interface shooting. The photos can be seen painted area biometric T-test processed got the following results:

Number	Untreated	Treated
1	30,70	16,70
2	24,04	21,40
3	21,93	10,50
4	41,60	14,20
5	26,30	12,50
6	19,40	14,10
7	32,70	19,50
8	34,10	11,70
9	43,60	10,20
10	23,10	21,80
Average:	29,75	15,26
SD:	08,29	04,37

T probe: 0,000117392

Table 2.: The extent of cerebral edema in rats mm²

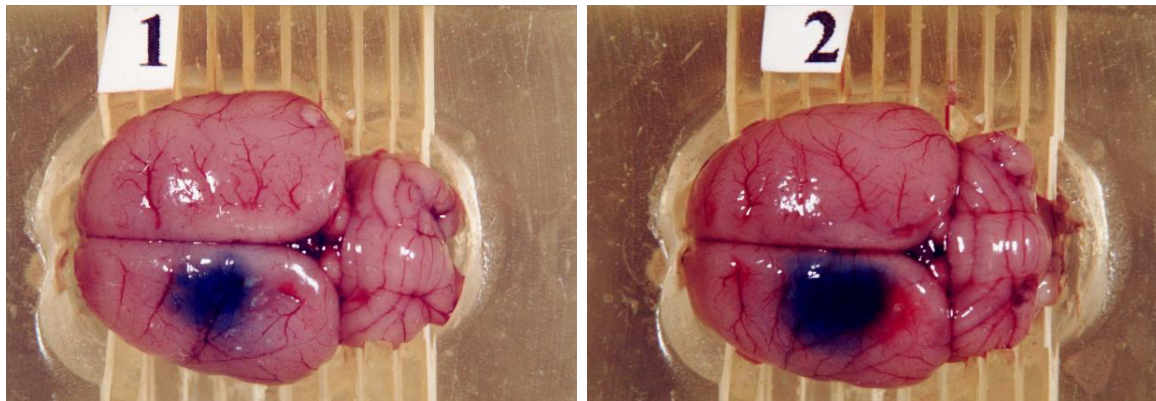


Figure 4.: Brain edema of the antioxidant preconditioned (1) and the untreated (2) rats

Discussion

New method to determine the total antioxidant capacity of the body in urine and blood

Based on the results of animal experiments I carried out, it stated that the organization's total antioxidant capacity of blood and urine samples can be determined using the method I have described. The latter option sampling easier, faster, and is not associated with blood inconveniences. Only three microliters of urine samples sufficient to 620 nm to determine the total antioxidant capacity. Another advantage of the developed method that is very cost-effective, high series of human use is therefore no financial considerations, nor to limit the inconveniences associated with the blood test does not.

Description of increasing the total antioxidant capacity suitable method - preconditioning treatment

Experimental results it can state that the total antioxidant capacity of healthy animals kept on a normal diet did not increase the parameters useless, but proper supplements can be increased. This "trapping" in a few days measurements proven feasible. The individual components were compiled using your existing itself can add up to free radical binding capacity was capable of total antioxidant capacity of the healthy, animals mixed diet have increased supra-normal level.

The blood-brain barrier damage and reduce the vasogenic edema applicable pretreatment

It managed to raise the solution was compiled using the antioxidant capacity and thus preconditioned animals treated rat cerebral edema caused standardized "cold insult" method was significantly lower compared to the untreated control. The post-traumatic cerebral edema, increased intracranial pressure decreases can be held liable is a key factor. The interventions in order to provide oxygen and blood supply to the brain - airway, respiration, bleeding, fluid resuscitation, cerebral blood flow pressure (CPP) maintain - a biochemical approach, supplemented. interventions in order



to reduce the intracranial pressure (ICP), the efficiency can be improved if we act against pre-treatment of cerebral edema.

Workability, suggestions

Of course, results are not adaptable animal suffered a brain injury fighter shot and scope of the problem can not be drawn from them have far-reaching consequences not human. Based on promising animal results in the method and the assembled solution seeks to involve proprietary. To begin human trials by the National Laboratory Institute (OLI) plan filed with the methodology, in order to validate its official.

The medication targets a traditionally been developed to reverse the disease process. In contrast, the preconditioning treatment I have described can be achieved by a variety of molecular-level protection from the secondary neurodegenerative damage. As a human therapeutic legacy at this stage of the research, approximately neither be predicted, but other possibilities inherent in the method of work trying to exploit.

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