

# **HaemoCer, a hemostatic agent for bleeding control in Neurosurgery**

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## **USE OF HEMOSTATIC AGENTS IN NEUROSURGERY**

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**Abstract**

Profuse bleeding during vascular, tumoral or traumatic intervention in brain or spine are controlled using different haemostatic products and techniques.

Unfortunately sometimes the bleeding cannot be controlled because the bleeding site cannot be fully visualized which often results in post-surgical bleeding necessitating re-intervention.

We present an alternative technique to control bleeding using a plant based polysaccharide haemostat (Haemocer).

Following effective bleeding control we did not observe any adverse reaction.

**Key words**

Haemocer, Bleeding, haemostat, polysaccharide, hemostat, plant based.

## **Introduction**

Haemostasis is the human body's response to control bloodloss when there is vessel injury and bleeding. During surgical procedures hemostasis is vital, and the surgeon never proceeds to complete the surgery until bloodloss is controlled through proper hemostasis. Uncontrolled bloodloss may result in serious complications and increased patient morbidity.

Haemostasis as a natural physiological process and involves a coordinated effort between platelets and numerous blood clotting proteins (or factors), resulting in the formation of a blood clot to stop the bleeding, repair the damage and finally dissolve the clot.

Haemostasis has several defined phases, initially the "vascular constriction phase" which occurs delaying bleeding, the primary phase in where the hemostatic plug or the plaquetary plug is created, the secondary phase or coagulation and the fibrinolysis phase.

Haemostatic agents used during surgeries are actively involved in various phases of haemostasis contributing to the repair of vascular damage that causes bleeding.

The use of contact hemostasis agents in neurosurgery allows us to obtain better results in the surgical treatment of patients with vascular, tumoral and traumatic pathologies in the brain, spinal cord and spinal column. Haemostic agents are applied directly to the bleeding site often obtaining either a physical, chemical or combined action.

## Technique

Amongst the agents we have used are gelatin sponge made from bovine skin, oxygenated regenerated cellulose, natural fibers and polymers, biomolecules like vegetal polysaccharides, thrombin obtained from the deep flexor bovine tendon, fibrinogen concentrates, fibrinogen with thrombin combinations, etc. Each one of these agents has advantages and disadvantages. The advantages we have noted in our surgical practice are that when applied directly to the bleeding area, some products being low in PH are bactericidal, with minimal tissue reaction, while others activate coagulation factors like VII thus facilitating the initiation of the extrinsic pathway or short coagulation path and/or factor III that promotes platelet aggregation.

Among the disadvantages certain products have are that they can take 10 weeks to be reabsorbed, they can generate granuloma and foreign body reactions, they can promote scarring or adhesions to other tissues, it is sometimes necessary to remove in case of infection, they can generate pressure over adjacent structures, they can produce an edema, burning or encapsulation, they must not be used on contaminated wounds because they can intensify the infection factors, they can produce emboli, they are not available worldwide, there can be a risk of viral transmission. Certain haemostatic agents are contraindicated in neurological procedural applications.

The hemostatic agent HaemoCer is an absorbable polysaccharide polymer sourced from plant material. Upon contact with the blood HaemoCer accelerates the natural coagulation cascade by a rapid dehydration of the blood and the rapid aggregation of platelets, red blood cells and clotting proteins at the bleeding site. Further a robust gelled matrix is formed at the wound site providing a mechanical barrier to further bleeding. This material is rapidly degraded naturally with 24 - 48hrs. HaemoCer has minimal contraindications and is available to be used in Neurosurgery.

## Conclusions

We have been using Haemocer technology since last year (2012) with positive results in our Neurology Department. In a number greater than 50 cases we used HaemoCer intraoperatively in patients with cerebral vascular disease like aneurysms and / or AVMs (Arteriovenous malformation), in patients with brain tumor pathologies either benign (meningiomas or pituitary tumors) or malignant (gliomas and particularly multiforme glioblastoma), in cranial brain trauma patients (sub dural and epidural hematomas) and in pathologies of the spine column (fractures) and spinal cord (tumors) mainly.

- Using HaemoCer in operated patients being diagnosed with Brain Benign Tumor: we apply the product in the surgical bed in order to generate hemostasis in areas where the tumor has been implanted in the brain parenchyma and / or the dura and / or falx cerebri obtaining quick and favorable response. Considering that in these cases the brain tumor is outside the parenchymal but its strongly attached to it by a large quantity of blood vessels that are feeding the tumor, at the moment of resecting the tumor, it bleeds during the intra tumor decompression and during the moment they separate it from the brain; in both cases the use of haemostatic agent is critical
- Using HaemoCer in patients being operated on with the diagnosis of Malignant Brain Tumor: we apply the agent during the resection procedure, considering that in these cases the tumor is infiltrating the brain parenchyma within it, and during the resection using forceps or ultrasonic aspirator generated bleeding in the surgical area, so we use bipolar coagulation for clotting blood vessels from small to larger caliber, but still there is always surface bleeding in which HaemoCer plays a decisive role.
- A third group of patients are those that are operated for Resection of Arteriovenous Malformation on Brain and Spinal Cord in where the bleeding is permanent which is characteristic to this type of pathology; the use of HaemoCer is to contribute to the cascade of hemostasis during resection and sealing of the surgical site.

The benefits we have seen are those that enable HaemoCer for use in conjunction with other hemostatic tools such as electro bipolar coagulation, gelatin sponge and oxidized regenerated cellulose. We incorporate it as mandatory equipment for the neurosurgeon to perform a surgery which provides security and trust in the intra-operative and postoperative fields.

Another advantage is the property of this agent as a powder allowing us to take it to places inaccessible to gelatin sponges or cellulose sheets, the fact that it is non-pyrogenic, that it is absorbed quickly and its mode of action is clearly perceived by the neurosurgeon eyes

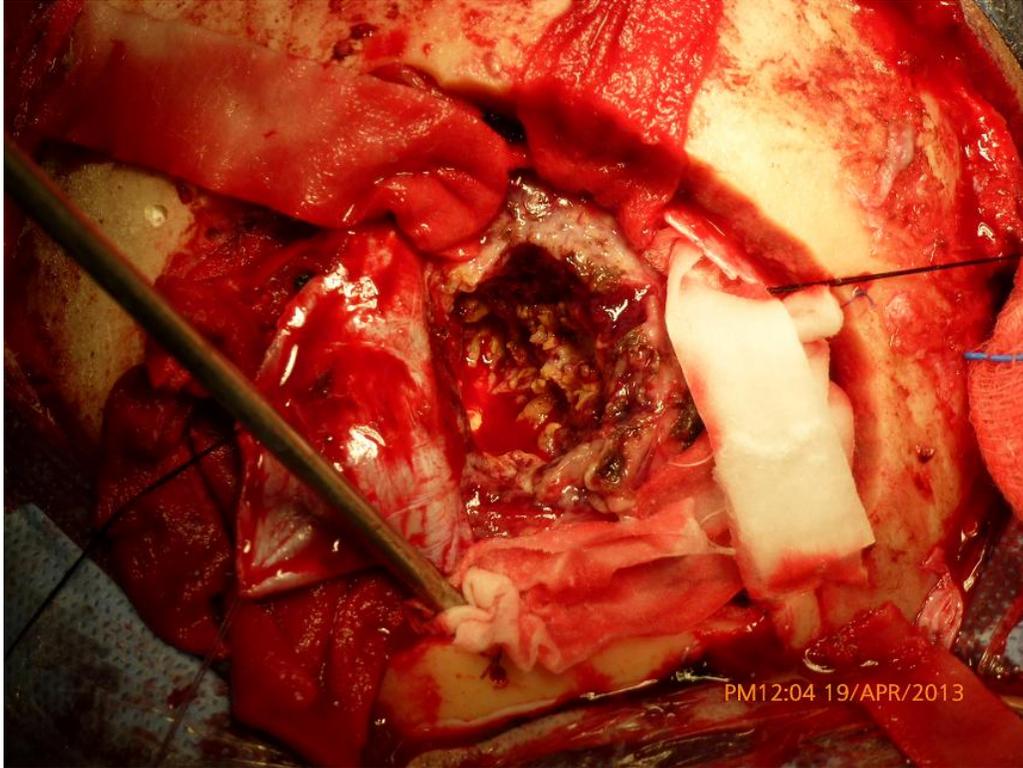
HaemoCer demonstrates security as it does not contain any human or animal component that can promote infection, granuloma and foreign body reaction, it shows efficacy for its hydrophilic nature which enhances the natural physiological coagulation cascade via rapid platelet aggregation and secondly the formation of a gelled matrix which constitutes a mechanical barrier for bleeding.

During the use of HaemoCer we have not detected any adverse events.

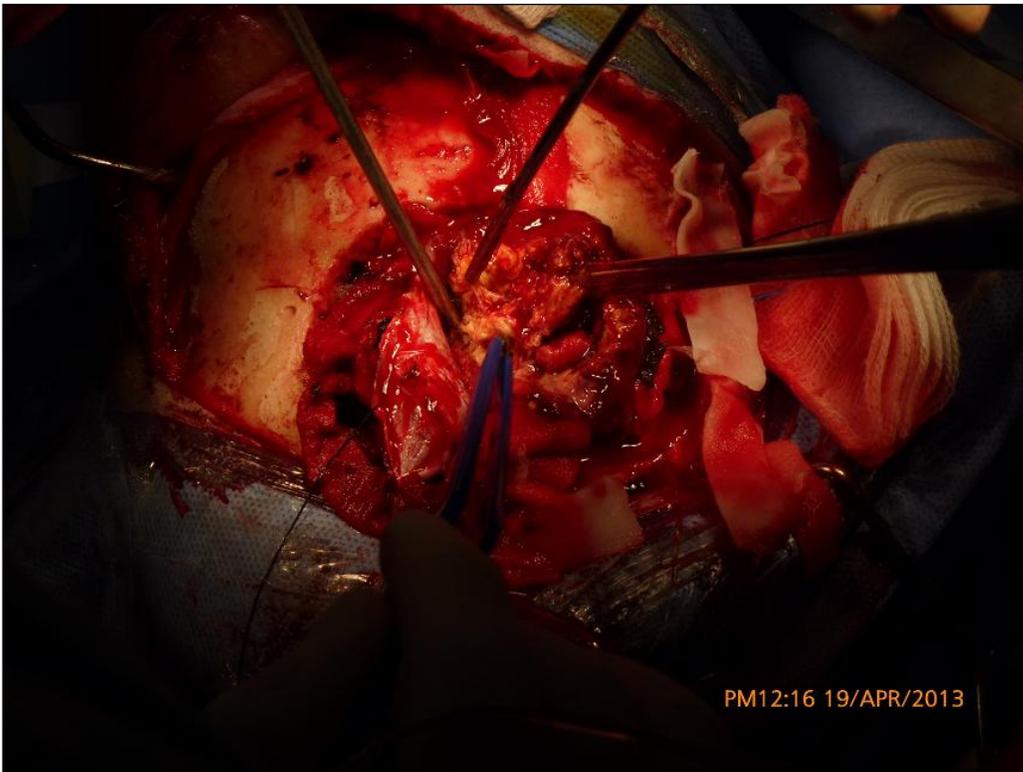
A handwritten signature in blue ink, appearing to read "Luis Bromley Coloma". The signature is stylized and includes a large, sweeping flourish at the end.

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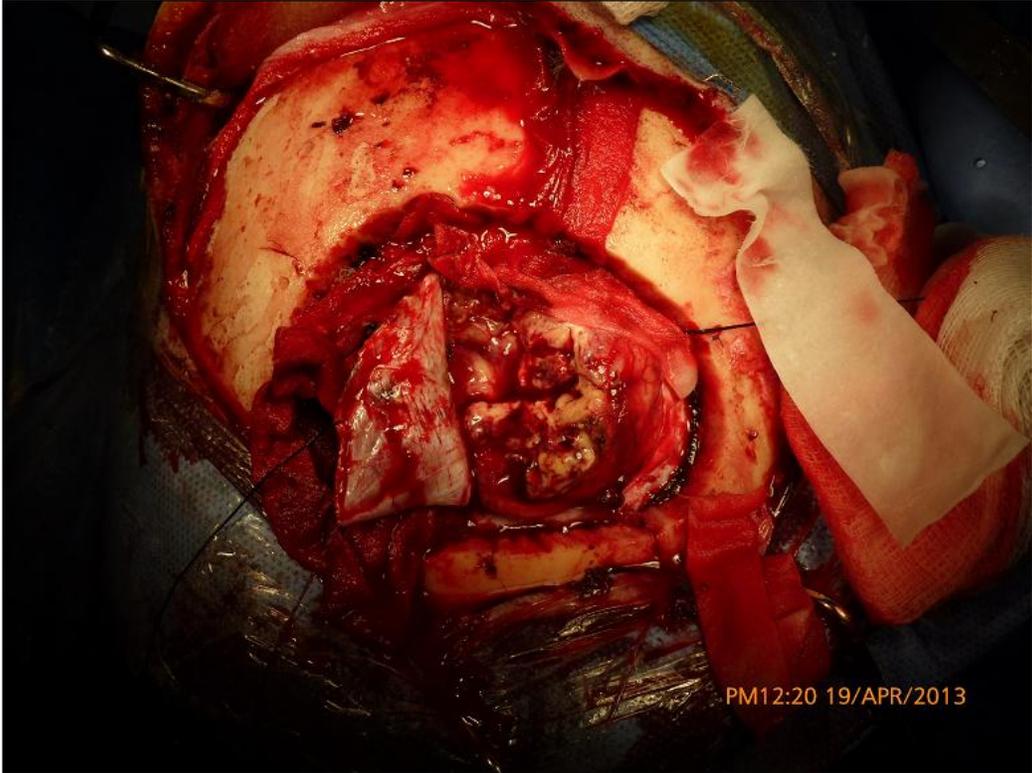
USE OF HAEMOCER IN G. ALMENARA HOSPITAL



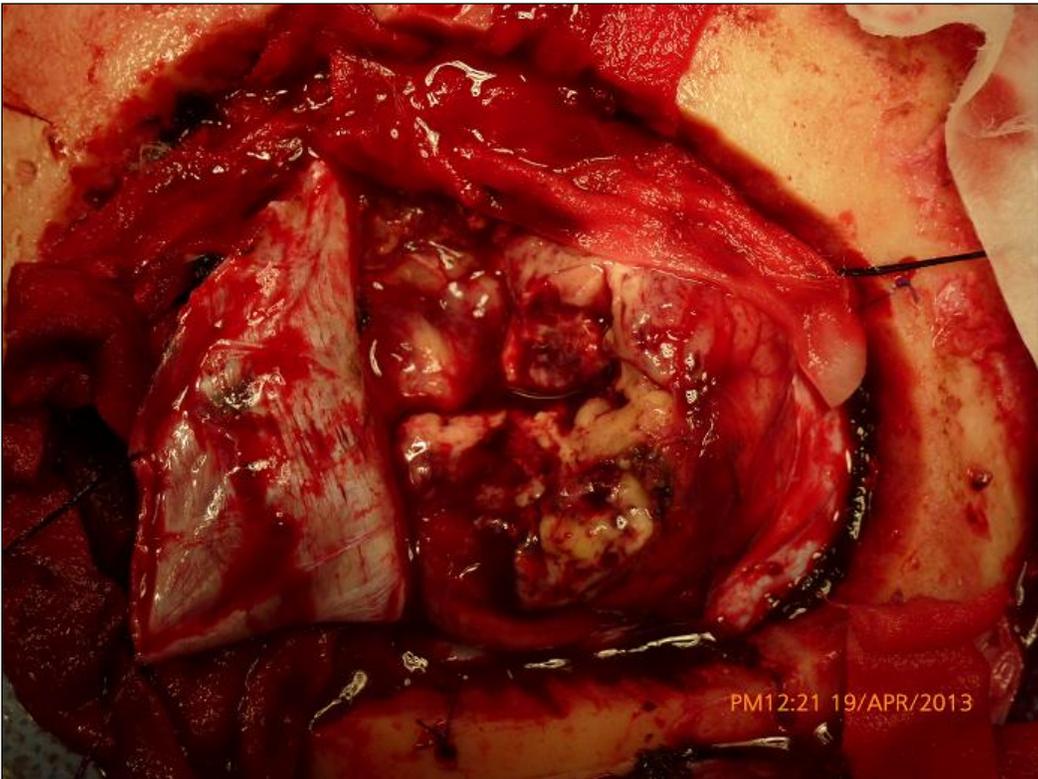
Bleeding during a tumor resection surgery



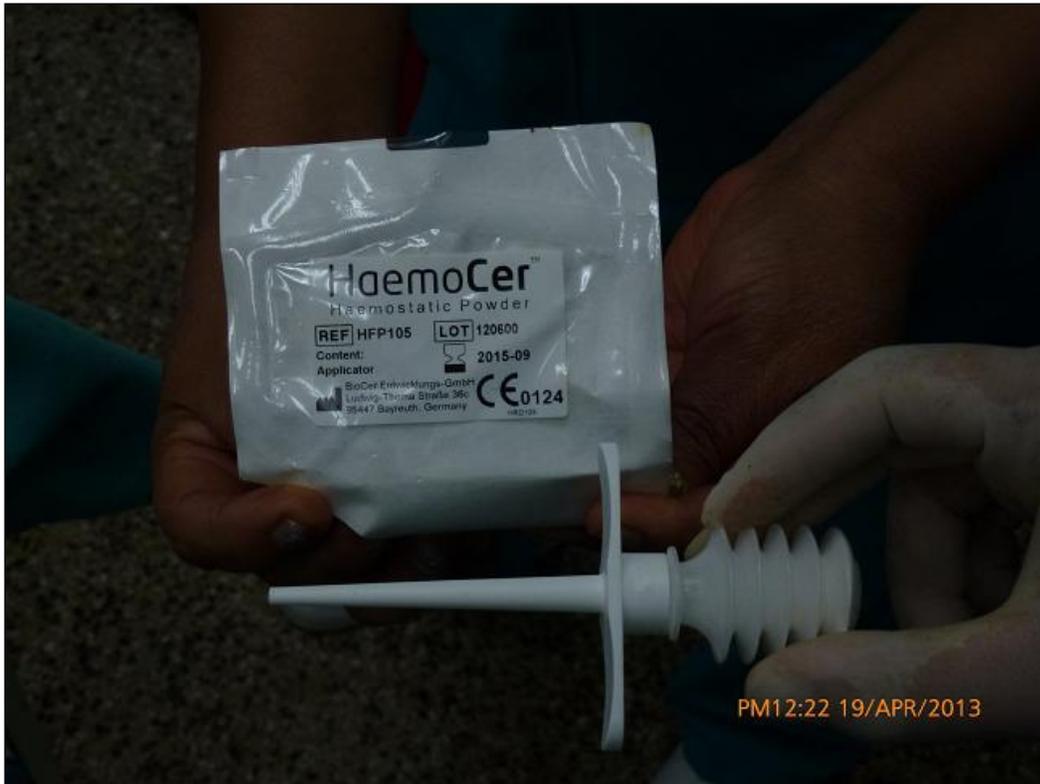
Use of electro bipolar coagulation to control bleeding during the resection



Brain prior to HaemoCer application



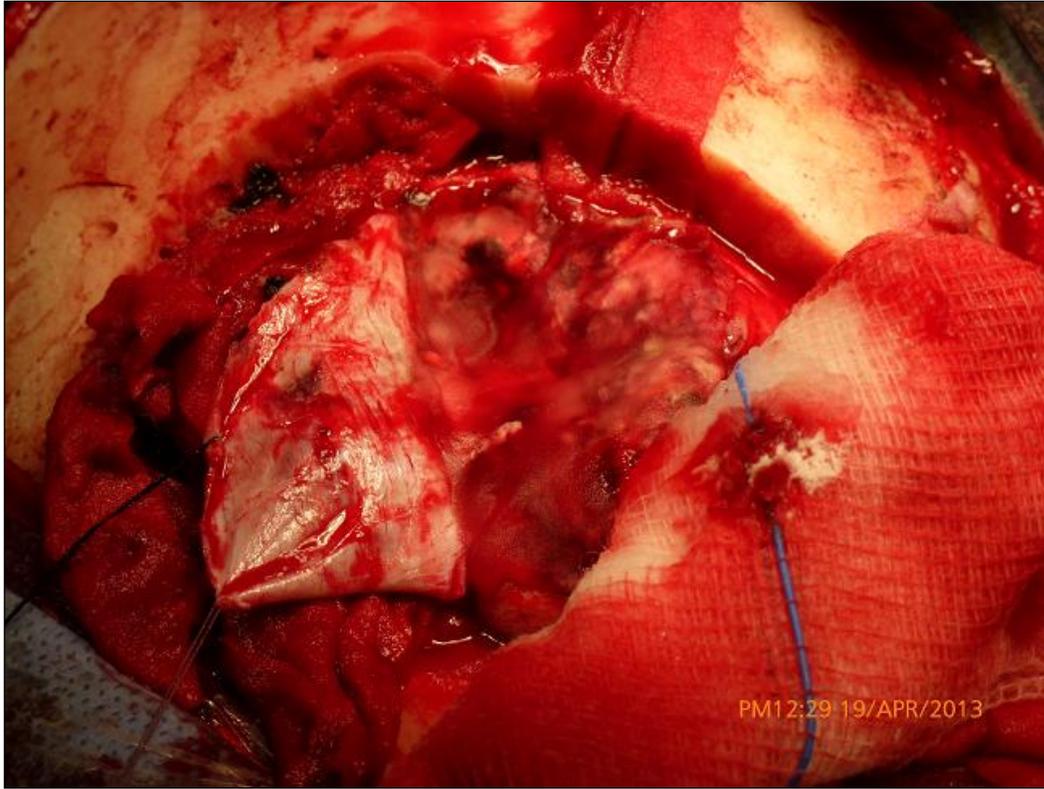
Bleeding must be stopped prior to closing



Using HaemoCer



Applying HaemoCer to achieve haemostasis.



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Formation of the gelled matrix as a mechanical barrier