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RESEARCH ARTICLE

CRYOPRESERVATION OF THE AUTOLOGOUS BONE FLAP AFTER DECOMPRESSIVE CRANIECTOMY, INITIAL EXPERIENCE OF MOHAMMED THE 6TH UNIVERSITY HOSPITAL OF MARRAKECH

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Abstract

Cranial bone flaps are removed urgently by neurosurgeons when a cerebral decompressive craniectomy is necessary. They can be preserved either in subcutaneous abdominal tissue, or by cryopreservation. In the latter case, the flaps are packed dry in a sterile container and transported to the human tissue bank. After checking the sterility of a bone sample, the cranial flaps are kept dry and frozen at -80 ° C while waiting subsequent implantation when the patient's clinical condition improves. In this report, we present the first two cases of autologous bone cranioplasty after cryopreservation of the cranial flap in the human tissue bank of Mohammed the VI University Hospital of Marrakech.

Introduction:-

Decompressive craniectomies are commonly practiced in several neurosurgical centers in the treatment of intracranial hypertension secondary to head trauma, stroke or refractory brain swilling (Sahuquillo 2006). The preservation of the cranial bone flap while waiting for the subsequent cranioplasty calls for different methods. We present the two first patients that benefited from a cryopreservation of their bone flap in the human tissue bank of Mohammed the VI University Hospital Center of Marrakech.

Observation 1:

The first patient is a 12-year-old child who underwent a liver transplant following hepatocellular insufficiency with stage 2 encephalopathy. He had developed a refractory intracranial hypertension five days post-operatively. The CT scan showed significant brain swilling and an emergency decompressive craniectomy was performed. The bone flap was prepared and packaged in a sterile container and immediately transported to the human tissue bank where it was kept dry at -80 ° C. Thirty-six days after the craniectomy, the patient's neurological condition improved, and the control CT scan noticed a significant regression of the cerebral swilling. A cranioplasty with the preserved autologous bone flap was then performed after 40 days of cryopreservation. No germ was found at the bacterial examination of a bone sample withdrawn during the cranioplasty. The patient unfortunately dyed 2 months after because of a worsening of his hepatic condition.

Observation 2:

The second patient is a 6-year-old child, with no particular pathological history, victim of traffic accident causing him a polytrauma with craniofacial and thoracic impact. The child was initially admitted to the intensive care unit with a glasgow coma scale of 4 and a right anisocoria. The cerebral CT showed a fronto-temporo-parietal subdural

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hematoma and diffuse brain swilling. The child was therefore urgently admitted to the operating room for evacuation of the subdural hematoma and realization of a decompressive craniectomy. The flap was rinsed with salted serum, prepared, packaged in a sterile container and taken to the human tissue bank for cryopreservation.
The child's consciousness improved gradually and the control CT at fifteen days post-operatively showed a regression of the brain swelling. A cranioplasty was then performed with replacement of the autologous cranial flap which was fixed with trans-bone point. The post-operative period was simple and the 6-month follow-up did not notice any infectious complications.

Figure 1:- The autologous cranial flap is stored in a refrigerator at -80 ° C (A) and a sterile storage jar which can contain the cranial flap (B).

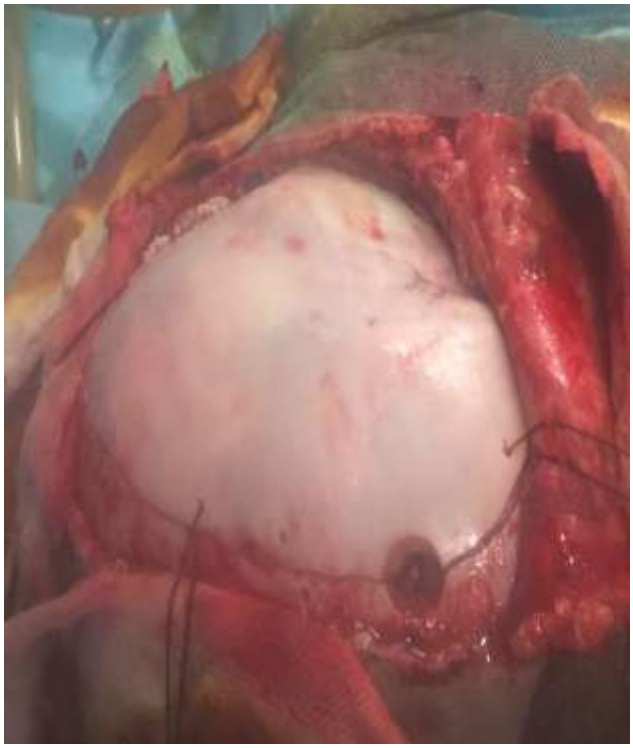

Figure 2:- intraoperative view of the cranioplasty after replacement of the autologous cranial flap.

Discussion:-

The use of a decompressive craniectomy in the treatment of severe intracranial hypertension following a head trauma, cancer surgery or stroke has expanded since the 1990s (Guerra *et al.* 1999). If the patient survives from its pathology, a cranioplasty is necessary to fill the bony defect. This is most often performed using the autologous cranial flap and more rarely using reconstruction material. The autologous cranial flap has the enormous advantage of its lower cost, its viability and its perfect molding to bone defect(Lemée *et al.* 2013). It must be able to be preserved in a sterile manner for several weeks or months while waiting for the cranioplasty. To this end, different methods are proposed: it can be stored in subcutaneous in the abdomen, or it can be stored frozen in a human tissue bank(Cheng *et al.* 2014). The different studies did not find significant differences between these two methods in terms of risk of infection of the operating site or bone resorption after cranioplasty(Lee *et al.* 2012, Cheng *et al.* 2014). However, several neurosurgical teams prefer cryopreservation to conservation under the skin, because the latter involves a double surgical approach (Fan *et al.* 2018).

To be successful, cryopreservation must obey to certain rules. After a decompressive craniectomy, the cranial flap should be cleaned and prepared by resecting soft tissue, bone powder, blood clots and bone spicules. It is then advisable to wash the shutter with a saline solution containing gentamycin and vancomycin (Morton *et al.* 2016). After drying, the flap can be wrapped in sterile tissue and then placed in a sterile container duly labeled. The transport to the tissue bank is done in a cooler at 4 ° C and must not exceed a period of 6 hours. The cranial flap is then stored in a refrigerator at -80 ° C for several weeks or months until the cranioplasty is performed. Additional sterilization methods are proposed, such as autoclaving, gamma irradiation, ethylene oxide gas or hydrogen peroxide(Takeuchi *et al.* 2016) (Bhaskar *et al.* 2011).

At the time of reimplantation, the cranial flap must be brought to room temperature and washed with a sterile saline solution containing an antibiotic. It is recommended to take a bone sample for microbiological examination beforehand. After reviving its edges, the cranial flap can be fixed to the arch using titanium plates, craniofix or screws according to the surgeon's preferences(Bhaskar *et al.* 2011). The aesthetic results are very satisfactory, and the risks of infection or absorption of the shutters are minimal in most of the series(Morton *et al.* 2016, Fan *et al.* 2018). Thus, due to the new availability of human tissue banks in our teaching hospitals in Morocco, we recommend the use of cryopreservation as a method of autologous cranial flaps preservation.

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