CRANIAL LOOP™ IN PEDIATRIC PATIENTS: CASES REVIEW

***Abstract*—This report presents three cases of pediatric patients who underwent brain surgery at the pediatric hospital "Sor María Ludovica" La Plata (Argentina) during 2016, in which Cranial LOOP™ cranial fixation devices were used for fixating the craniotomy performed. In all cases, craniotomy size and position, product combination, fixation strength, post-operative bone flap alignment and post-complications were evaluated. Additionally, most valuable features of the device and contraindications are presented according to surgeon's opinion.**

INTRODUCTION

Nowadays exists a wide range of systems and materials for cranial fixation devices that have emerged in the field of neurosurgery. Titanium plates and screws have been widely favored as the method of choice to achieve stable internal fixation for a long time, but several concerns have been raised when it is used in pediatric patients such as metal device translocation to the endocranial surface or abnormal cranial growth. Several studies [1] have demonstrated that rigid plates fixation may interfere with craniofacial growth in the pediatric skull and for this reason, the neurosurgeon's community has been focused in finding alternative systems and materials, such as resorbable cranial fixation systems or materials such as PEEK polymer, to provide a safe and secure stability during bone healing. Additionally, metal materials such as TI interferes with diagnostic imaging techniques, difficulting diagnosis and patient follow up.

This report presents three cases of pediatric patients who underwent brain surgery at the pediatric hospital "Sor María Ludovica" La Plata (Argentina) during 2016, in which Cranial LOOP™ cranial fixation devices were used for fixating the craniotomy performed. These surgeries were performed by doctor Marcelo D'Agustini, Head of Neurosurgery Department of the Hospital.

In all cases, different combination of Cranial LOOP™ and Cranial LOOP™ (L) were used adding a total of four devices per craniotomy. Non of the case was operated before and a 14mm perforator was used for drill the burr holes. In all cases a postoperative CT or MRI was acquired to be used for evaluating bone flap alignment.

CASE 1: IV VENTRICULAR MEDULLOBLASTOMA

A 2-year-old child was operated to remove a IV ventricular medulloblastoma with extensions in the pineal region. The craniotomy was performed in the sub occipital area with four burr holes, two of them above the lateral sinuses to facilitate supracerebellar access. The dimension of the bone flap was 6 cm length per 4 cm width. Two Cranial LOOP™ and two Cranial LOOP™ (L) were used to fixate the craniotomy because It was considered that posterior fossa craniotomies in pediatrics has more stable fixation with a product combination of sizes.

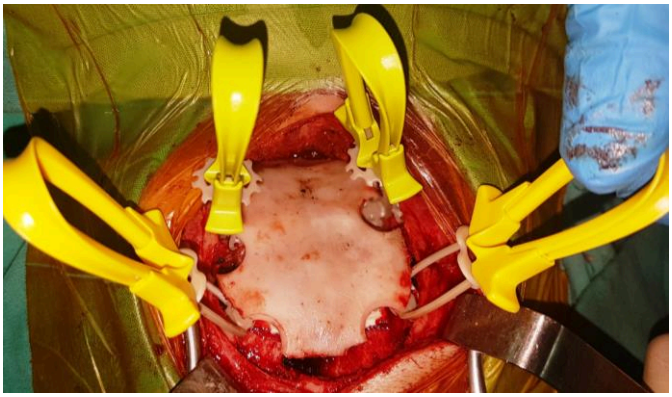

Fig. 1. Craniotomy with Cranial LOOP™ placed before tightening.

Once the devices were tightened, a firm fixation was observed, providing a secure and safe craniotomy closure. Post 3D CT scan image showed no complications and good alignment of the bone flap.

Fig. 2. Post 3D CT image.

CASE 2: DEMYELINATING DISEASE TUMORAL FORM

A 14-year-old child was operated to remove a tumoral form caused by demyelinating disease. The pre-MRI showed expansive lesion with annular enhancement located in supplementary motor area.

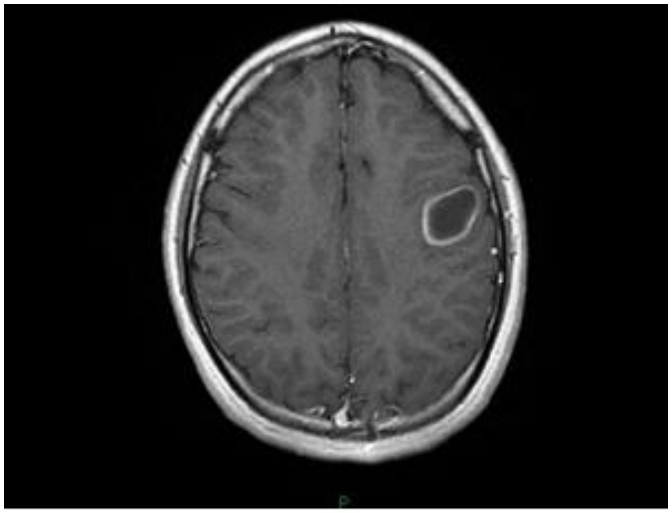

Fig. 3. Pre-MR image with contrast.

The surgery was performed by intraoperative ultrasound guidance. A frontoparietal left craniotomy was performed (10 cm length x 7 cm width) with four burr holes. The size of the craniotomy is proportional to the ecographic transductor used.

Four Cranial LOOP™ were used, equally distributed along the craniotomy perimeter and one in front of each other to close the craniotomy. According to the surgeon's opinions, the bone flap was securely fixated.

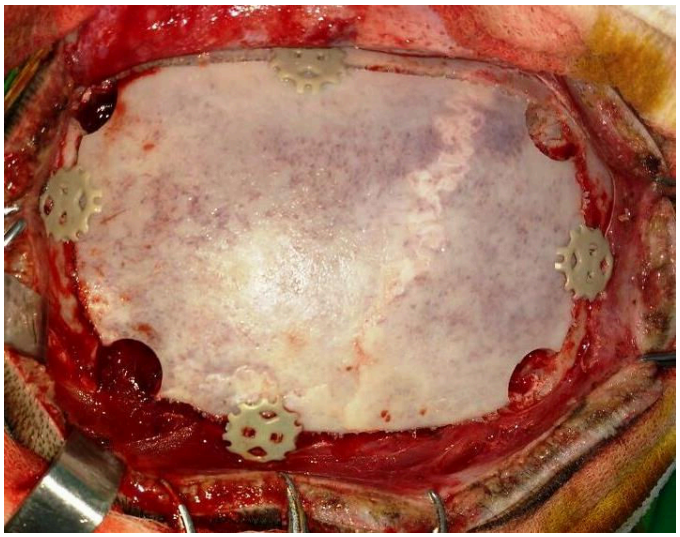

Fig. 4. Bone flap securely fixated.

Post CT scan showed good alignment and absence of any artifact due to the device material.

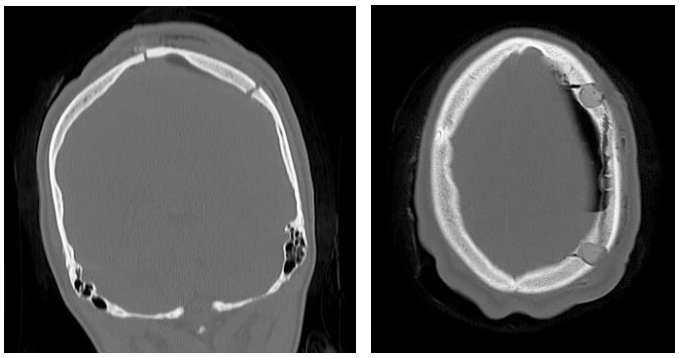

Fig. 5. Post CT scan.

CASE 3: EPENDYMOMA

A 6-year-old pediatric patient with an ependymoma in the left cerebellar hemisphere. The pre-MRI shows a solid-cystic left cerebellar hemisphere expansive lesion, with calcified areas.

The craniotomy was performed in the sub occipital left area and the size of the craniotomy was 4 cm length and 3,5 cm width.

The tumor was removed using microsurgical technique and assisted by ultrasonic aspiration.

A combination of two Cranial LOOP™ and two Cranial LOOP™ (L) were used. The larger sizes were used to provide a greater fixation in the upper end sides of the bone flap due to the size of the craniotomy and the posterior fossa location.

Fig 6. Bone flap fixated with Cranial LOOP™

In this case, even it is a posterior fossa craniotomy,

Cranial LOOP™ devices were easy to place due to its absence of specific instrumental which allows a fast and easy implantation in comparison with other NON-instrument-free fixation devices.

Post-CT scan image showed good alignment of the bone flap.

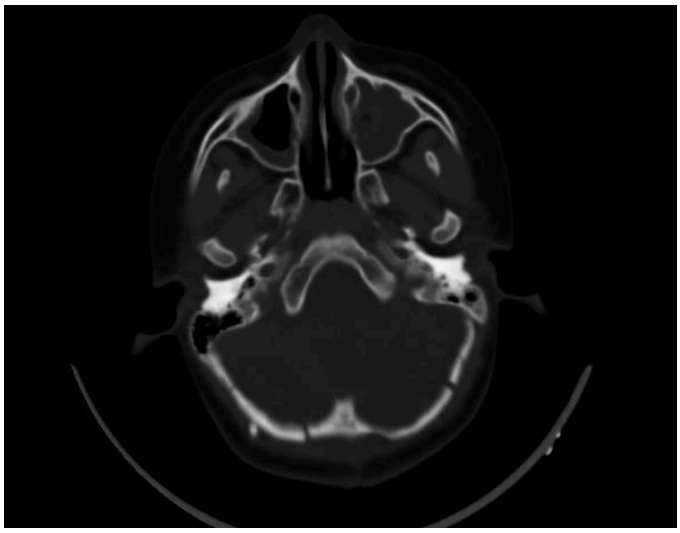

Fig 7. Post CT scan image.

CONCLUSIONS

The Cranial LOOP™ devices are a smart and suitable system for securely fixing bone flaps resulting from craniotomies in pediatric patients.

The most appreciable features are its ease to use, since It is completely instrument-free, and their low profile, even when devices must be placed in frontal areas, provides excellent cosmetic results. Additionally, its 3D adaption allows the product to be used in newborn patients adapting perfectly to the thinness of the skull of these children; and It can be used in all cases where a craniotomy is indicated independent of its location, even at the level of the posterior fossa, where in some cases other devices may be difficult to place.

In any of these case, an complications such as migration of the device were observed. Even in patients who had to be re-operated for their pathology, the devices remained intact.

The only contraindication that can be suggested, is in cases of bone infection processes near the bone flap, which is valid for any type of prosthesis.

REFERENCES

[1] Imola MJ, Hamlar DD, Shao W, Chowdhury K, Tatum S. Resorbable Plate Fixation in Pediatric Craniofacial Surgery. Long-term Outcome. Arch Facial Plast Surg. 2001;3(2):79–90. doi: