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A less invasive suboccipital decompression-cranioplasty for Chiari type I malformation: Is it beneficial?

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ABSTRACT

This was a retrospective study of 10 Chiari Malformation type I patients who were treated by the author since 2010–2016. This study aims to elucidate the benefit of modified foramen magnum decompression by preserving the bone as propose upside down-inside out (UDIO). The principle of handling is posterior fossa decompression (suboccipital decompression), as an established procedure, and ensures craniocaudal cerebrospinal fluid flow. Many complications such as cerebrospinal fluid leak, pseudomeningocele, dural adhesion, herniation of cerebellar tissue and cerebellar sag after foramen magnum decompression and duraplasty have been reported. The author wanted to know if the suboccipital decompression with additional cranioplasty, by reinstalling the suboccipital bone upside down-inside out (UDIO), is beneficial in this malformation treatment? There were 10 patients in this report, consisting of 7 females and 3 males. All patients were decompressed using the UDIO technique and duraplasty. All patients improved and, 1 patient needed a syringosubarachnoid shunt. There was no clinical deterioration, nor acute surgical complication and none suffered of pseudomeningocele and cerebellar sag, in an at least 12-months period of observation (range 12 months to 67 months). This small study suggests that the UDIO technique is safe, less invasive, beneficial and may be used as an option for Chiari type I malformation.

1. Introduction

In 1891, Professor Hans Chiari of German University first introduced congenital hindbrain abnormalities consisting of brainstem abnormality, cerebellar abnormality, posterior fossa abnormality and or skull base abnormality. [1] In Chiari type I there is displaced cerebellar tonsils caudally into the foramen magnum (Fig. 1). Complaints are generally mild, such as headache, neck pain that is worsening when valsava, with or without long tract sign. [2] In more severe cases, symptoms include oropharyngeal dysfunction, motor impairment, sensory impairment, gait and balance disorders, and even spinal deformities. [3]

Handling of Chiari malformation is still debatable about the extent of sub-occipital decompression, with or without duraplasty, with or without laminectomy C1, with or without obex plugging, and much more. Post-decompression complications of the foramen magnum or suboccipital were frequently reported. The complications consist of acute cerebrospinal fluid leakage, infection, even hematoma; whereas the late complications are pseudomeningocele, scarring from the material of duraplasty, persistent symptoms of Chiari, hydrocephalus and also cerebellar herniation into the decompression cavity/cerebellar sag. [2]

Revision surgery is often done to improve the situation; such as closing dura leaks, repairing pseudomeningocele, releasing scar tissue, installing a ventriculoperitoneal shunt, installing a syringosubarachnoid shunt and even reconstructing suboccipital areas with cranioplasty due to cerebellar sag. [2, 4, 5] There are still few reports of reconstruction cranioplasty in the suboccipital area after the foramen magnum decompression. In this study, the author reports a new cranioplasty technique in Chiari type 1 patients with a minimum of 12 months of follow-up in 10 patients.

2. Methods

This was a retrospective study, based on 10 patients with Chiari malformation type I, treated by single author at Sanglah Hospital, Bali Royal Hospital and Surya Husadha Hospital in Bali, from 2010 to 2016. Radiographic evaluation performed using magnetic resonance imaging (MRI) to evaluate the type of Chiari malformation. The demographics of the patients, the types of Chiari, the presence of syringomyelia, the

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Fig. 1. Sagittal MRI T1WI image shows decensus of cerebellar tonsil into magnum foramen and formation of syringomyelia.

neurological sign and the symptoms before and after surgery and the side effects of surgery were recorded. Notable side effect included bleeding, a cerebrospinal fluid (CSF) leak, worsening of the neurologic condition or wound infection.

Neurological status was recorded using The Japanese Orthopaedic Association scoring system (JOA score) for the evaluation of cervical myelopathy after 12 months of follow-up and radiographic evaluation compared to preoperative status. Postoperative improvement was reported in a percentage of JOA score: [6, 7].

((postoperative score) − (preoperative score)/(29−(preoperative score)) × 100%

We considered the sagittal plane as the distance between the basion and the opisthion, known as McRae's line, and the distance between the basion and the cranioplasty bone after decompression, known as enlargement line. An independent evaluator evaluated the preoperative status and recorded the improvement. This study was approved by the ethics committee within the medical faculty at Udayana University.

2.1. Technical report

Under general anesthesia, the patient was positioned in the prone position and then a longitudinal median skin incision was made along the posterior nuchae from protuberant occipital extern (POE) to the spinous process of C2. After the skin incision, the fascia of the occipital and paraspinal muscle was incised along the skin incision, the multifidus muscle was dissected subperiostally and a spinal retractor was introduced. A pneumatic perforator was then used to open the suboccipital bone in reverse triangular shape (Fig. 2). A craniotomy is done very carefully using a craniotome to prevent bone breaking.

After opening the suboccipital bone by a whole continued by laminectomy of C1. The dura was opened in a standard “Y” shape fashion and duraplasty was performed while ensuring the absence of adhesion to the arachnoid until the cerebrospinal fluid flows normally by inspection and the durameter begins to pulsate normally. A fascia

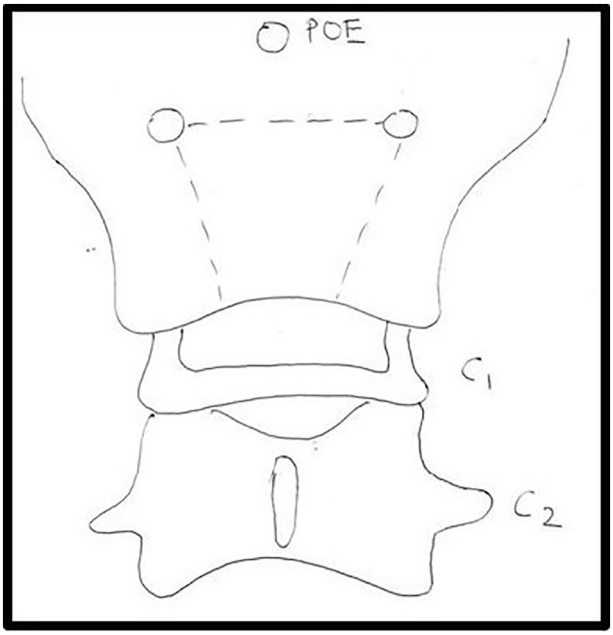

Fig. 2. Schematic drawing of suboccipital craniectomy (POE = protuberant occipital extern; C1 = cervical 1; C2 = cervical 2).

Fig. 3. Intraoperative view of foramen magnum decompression and duraplasty using duragen and fibrin glue before cranioplasty. (blackarrow refer to cephalad).

duramater patch was taken from around the nuchae region and stitched tightly with absorbable threads (size 2.0). Homeostasis was then ensured to be perfect. (Fig. 3).

The suboccipital bone was mounted upside down-inside out (UDIO) and fixed with a titanium miniplate and screws (Fig. 4). A vacuum drain was installed and the muscles were stitched one by one following the fascia. The subcutis was also stitched one by one with absorbable threads (size 3.0) and finally, the skin was stitched with a skin stapler.