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Case Report

# Indirect Revascularization by Pial Synangiosis in Cerebrovascular Occlusive Disease in Adults: Case Report

## *Revascularización indirecta de la pialsinangiosis en enfermedad cerebrovascular oclusiva en adultos. Informe de Caso*

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***ABSTRACT***

***Objective:*** *Demonstrate the successful application of indirect revascularization techniques in an adult patient with a suspected cerebral circulatory insufficiency.* ***Methods:*** *A pial synangiosis procedure was performed according to the technique described by Adelson and Scott.* ***Results:*** *A total relief of the neurological deficits, with the disappearance of the arterio-arterial anastomosis and improvement of the parenchyma filling phase.* ***Conclusion:*** *The use of Pial synangiosis for treating cerebrovascular occlusive disorders remains under controversy, but it becomes an attractive option in adults due to the simplicity of the method.*

***Key words:*** *Moyamoya disease; Pial synangiosis; Cerebral revascularization.*

***RESUMEN***

*Muchos estudios demuestran la eficacia del tratamiento de la enfermedad de Moyamoya mediante técnicas de revascularización indirecta, y en nuestro medio la técnica más usada y con mejores resultados es la pialsinangiosis, principalmente para casos pediátricos con dicha patología. Si bien no existía evidencia en cuanto al uso de estas técnicas en un adulto con una insuficiencia circulatoria cerebral localizada causada por una enfermedad oclusiva de varias arterias cerebrales IC de origen ateromatoso, juzgamos válido intentar realizar la misma técnica de pialsinangiosis. Como resultado del procedimiento, pudimos observar una mejoría en la revascularización cerebral y una disminución objetiva del área cerebral comprometida, además de que la paciente permanece asintomática luego de un extenso seguimiento.*

***Palabras-clave:*** *Enfermedad de Moyamoya; Pialsynangiosis; Revascularización cerebral.*

## Clinical Case and Methods

A 54-year-old patient (O.H.) was treated at our Neurosurgery Department in the Hospital de Clínicas of Montevideo, Uruguay. Her initial signs and symptoms were hemorrhagic stroke with intracranial hypertension, right hemiparesia and hemianopsia. The skull CT scan revealed a left parieto-occipital hematoma.

This episode was interpreted as a cerebral hematoma due to arterial hypertension and, therefore, first submitted to medical treatment. The clinical signs disappeared almost completely. The neurological deficit was a right hemianopsia and a mild homolateral hemiparesia.

Two months later the patient presented symptoms similar to the previous ones and was readmitted into our hospital. A hematoma with ventricular hemorrhage was observed at the same localization (Fig. 1).

Brain angiography revealed stenosis of 40% of left supraclinoid internal carotid, filiform stenosis M1 segment of the middle cerebral artery and 60% of the left posterior cerebral artery at P1P2 (Fig. 2) presumably by atherosclerosis; a slowing down of homolateral sylvian branches with hypoperfusion of the temporoparietooccipital homolateral region.

The development of circulation and arterio-arterial anastomosis of the left M3 sylvian branch with the posterior cerebral branch is evidenced in Figure 3. The acetazolamide SPECT (single photon emission computed tomography) made to study brain perfusion confirmed that the brain hypoperfusion area was located at the left temporoparietooccipital junction.

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A pial synangiosis procedure was performed according to the technique described by Adelson and Scott[1], selecting this procedure in order to improve flow to the hypoperfused area based on previous successful experiences with this technique for different pathologies, such as Moyamoya disease.

The technique consists of a linear skin incision of 8 cm made directly over the superficial temporal artery. Once the artery has been identified and dissected, it smoothly retracts and an incision is made on the temporal muscle in order to expose the skull bone.

Two holes are made in the bone, just beneath the superficial temporal artery at a distance of approximately 5 cm. A free bone flap exposing the dura mater is drilled. The dura mater is opened and the arachnoid of the gyrus and sulcus are dissected as much as possible. The superficial temporal artery and the galea are directly apposed on the brain surface and sutured to the pia mater with a 10-0 nylon monofilament. The bone is then placed and fixed and the closure is made by planes[13].


**Figure 1**: Skull CT scan showing left parieto-occipital hematoma with ventricular hemorrhage.

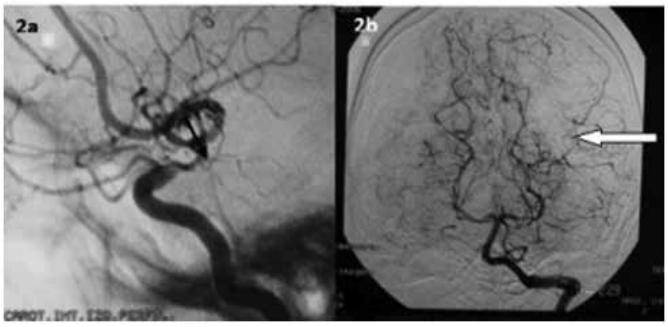


**Figure 2**: **a** Brain angiography by left internal carotid showing 40% stenosis of supraclinoid internal Artery; **b** Angiography of left vertebral showing 60% stenosis of left P1P2 posterior cerebral. Probably by atherosclerosis.

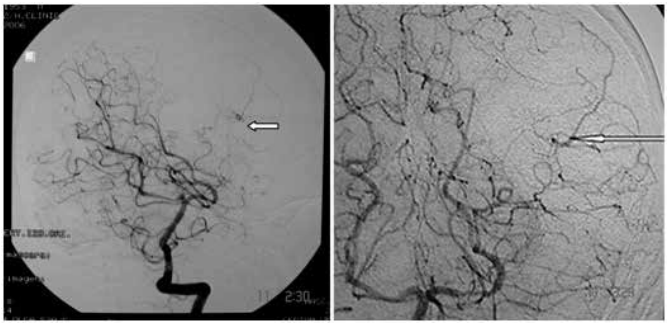

**Figure 3**: Angiography showing development of collateral circulation and arterio-arterial anastomosis of M3 sylvian branch with posterior cerebral artery (P3).

## Results

The patient showed a total relief of brain neurological deficits. She did not suffer any brain hemorrhagic episode during the follow-up period (8 months).

A control brain angiography was made (Fig. 4) six months after the surgical procedure. This study showed: disappearance of the arterio-arterial anastomosis image seen on the previous one and development of collateral circulation of intracranial replacement through branches of the left external carotid artery, improving the parenchyma filling phase in the affected area.

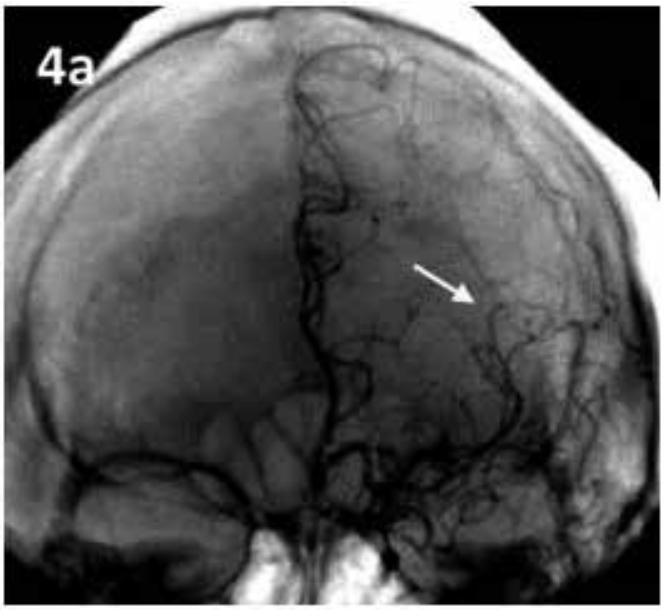


**Figure 4a**: Post-surgical angiography through left carotid artery shows the development of anastomotical circulation from the external carotid artery.

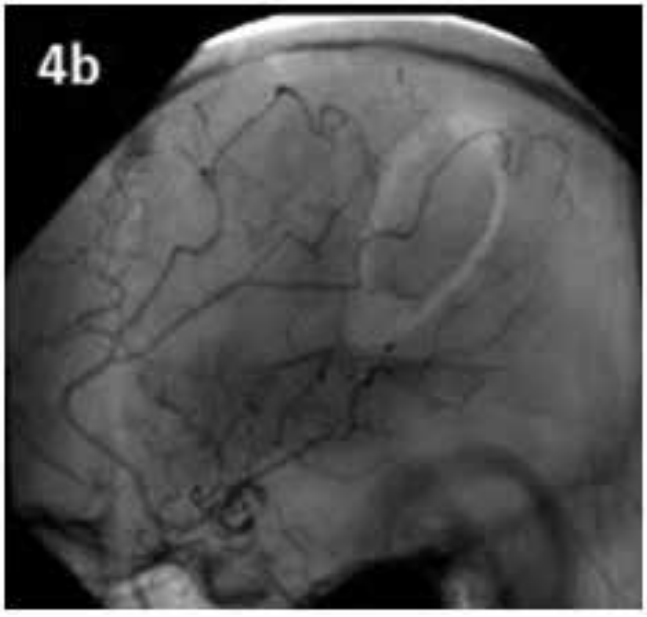


**Figure 4b**: Disappearance of the anastomosis between the sylvian artery and the posterior cerebral Artery.

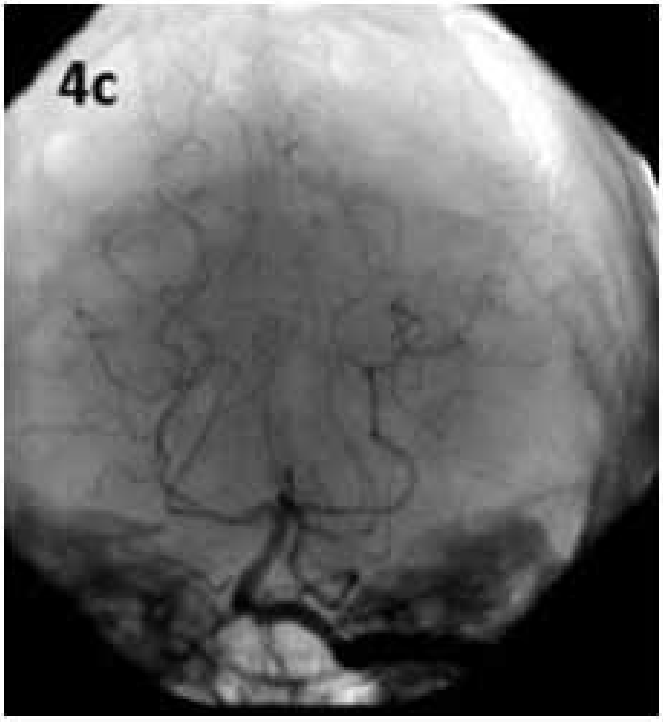


**Figure 4c**: Angiography by left vertebral artery showing the disappearance of the arterial anastomosis.

## Discussion

In 1995, Adelson and Scott described pial synangiosis, initially intended for Moyamoya patients[1]. The authors expressed that the direct contact of the "donor" vessel with the brain surface improves the results of indirect revascularization[11].

Other techniques for indirect revascularization have been described such as encephalo miosynangiosis (EMS), omental synangiosis (OS) and encephalo duro arterio synangiosis (EDAS); all of them are different surgical techniques which try to increase the development of anastomotic circulation between artery branches coming from the external carotid towards the intracranial circulation.

Although there are no studies comparing these different techniques in patients with cerebrovascular occlusive disease, there are papers which show better results for pial synangiosis as compared with EDAS in patients suffering from Moyamoya disease[11].

The main difference proposed between both techniques is the wide arachnoid opening and the apposition of the superficial

temporal artery on the pia arachnoid.

According to several authors, the basic fibroblastic growth factor (bFGF) is directly related to the best results obtained with pial synangiosis as compared with the other indirect revascularization techniques proposed[12]. It would act as a strong angiogenic inductor which would enhance the development of the arterio-arterial anastomoses seen in this kind of patients.

According to different studies, there is an increase in concentration of bFGF in patients suffering from occlusive cerebrovascular disease. Most papers on this issue deal with Moyamoya patients[2,4,5,8,9].

As we have emphasized, the use of these revascularization techniques has been mainly developed for the treatment of Moyamoya patients, showing excellent results in many cases. However, and following other studies, we believe it could be used in selected patients with non-Moyamoya occlusive cerebrovascular disease[6].

## Conclusion

We have studied the case of an adult patient suffering from atherosclerotic cerebrovascular disease –without Moyamoya– suffering from a recurrent brain hematoma. A pial synangiosis procedure was performed on the hyporperfused area revealed by the acetazolamide SPECT study.

This technique was intended to increase the development of circulation from the external carotid artery branches to branches of the intracranial internal carotid artery.

We were able to show in post-surgical studies that the objective had been reached, along with the disappearance of the anastomoses formed between the anterior and posterior circulations at intracranial level.

Although we cannot conclude on the basis of this case that pial synangiosis can be prescribed for all patients with this pathology, we believe that the good results obtained with our patient should encourage further studies on the subject.

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