Transsylvian and Transinsular Approach

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Abstract : The author describes two new microsurgical approaches to the insular cortex and putamen. With this new method we can revascularize the intraparenchymal territory of the lenticulostriate arteries.

Key Words : Sylvian fissure. Transsylvian approach. Transinsular approach.

INTRODUCTION

Occlusive type vascular lesions into the internal capsule and lentiform nucleus are frequent; however, clinical reports oriented to revascularizing these areas, are scarce.

Unilateral ischaemia or infarction of the intraparenchymal territory of lenticulostriate arteries, produce no extrapyramidal disorders, but pyramidal and occasionally sensory disturbances occur (1). Damage to the dominant cerebral hemisphere may be added, besides language problems. However, to date, these patients with hemiparesis or capsular hemiplegia only receive physiotherapy.

Recent clinical reports show it is possible to revascularize the lenticulostriate territory with omentum (13) and a dopaminergic graft implanted into the putamen (10). In this article we present a surgical method for approaching the insular cortex and lentiform nucleus.

OPERATIVE TECHNIQUE

After general neuroleptic anaesthesia, the patient is placed in the supine position on the operating table with the head slightly inclined to the left or right.

On the skin of the fronto-temporal region, a question mark is drawn. The skin incision extends superiorly from the zygomatic arch and anterior to the auricle, ascending 2 cm and then leaning backwards, upwards and forwards, in this way making a curve through the superior temporal line up to the implantation of the hair (Fig. 1). The skin incision is extended deep to the superficial fascia of the temporalis muscle, and then the skin flap may be reflected.

The craniotomy is centered over the Sylvian fissure. The temporalis muscle is incised in 4 or 5 places, and craniotomy is performed by means of equidistant burr holes. Between the two anteroinferior burr holes, the osteoplastic flap is broken and mobilized and placed under traction with ligatures. The area of craniotomy may vary in accordance with the purpose of the surgical approach. It may be anterior, fronto-temporo-sphenoidal (pterional approach) (16) or more posteriorly, fronto-parieto-temporal (transsylvian approach), asshown in Figure 2.

The dura is opened in a Y-shaped fashion with the posterior limb located over the Sylvian fissure and the anterior limbs extending on the frontal and temporal lobes. This creates a triangular area of the dura, with the base snugly draped over the frontal and temporal poles.

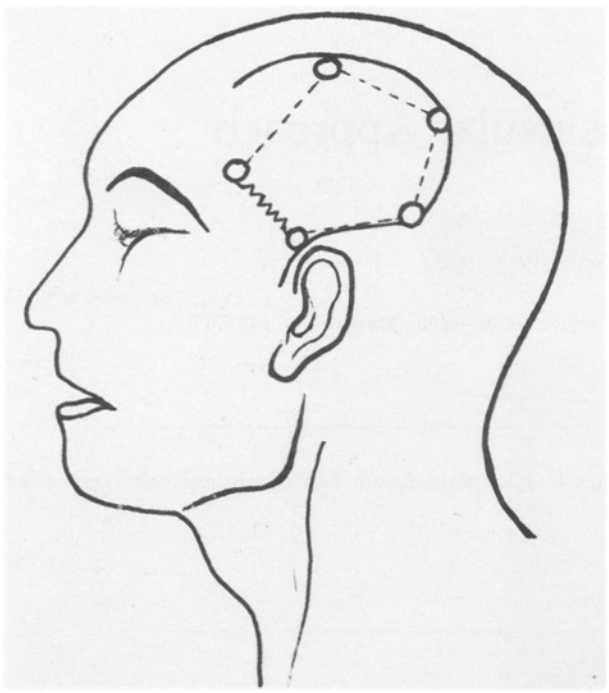

Fig. 1 : Skin incision for transsylvian approach. The craniotomy is centered over the sylvian fissure. Five burr holes outline a diamond shaped bone flap with its base at the pterion

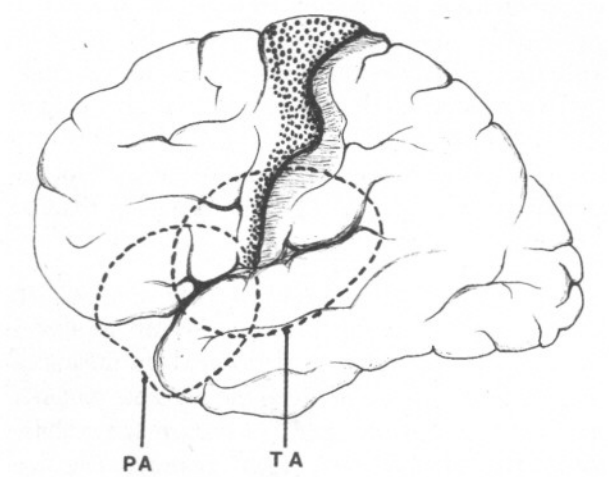

Fig. 2 : Pterional approach (PA) and Transinsular approach (TA). The TA provides excellent anatomical appreciation of the insular cortex, limen insulae and genu of the middle cerebral artery.

Over the Sylvian fissure and using a surgical microscope the neurosurgeon begins the transsylvian approach. The arachnoidal and middle cerebral vein dissection is carried out in front, on the point of union of the frontal and temporal lobes, and on the back, extending to the operculum (area 43). Exposure of the vessels and insular cortex within the Sylvian fissure is obtained by gentle retraction of both edges of the fissure, with the help of two cerebral spatulae on cottonoids.

Drainage of the cerebrospinal fluid (CSF) within the Sylvian fissure is obtained using a neurosurgical sucker placed on little cottonoids. On the insular cortex, it is fundamental to recognize the limen and central sulcus of the insula.

This transsylvian approach provides adequate space for exposure of the lateral lenticulostriate arteries and genu of the middle cerebral artery (MCA). Here, on the insular cortex, the omentum can be transplanted. By means of end-to-end microanastomosis by invagination (12), we performed anastomoses between the superficial temporal vessels and gastroepiploic vessels from the omentum.

Inside and in front of the central sulcus of the insula, there is a rectangle 30x20 mm projected directly on the external surface of the putamen. On this area, we performed the transinsular approach (8,9). Through this pathway, we can approach the putamen, globus pallidus and internal capsule. The external surface of the putamen is 9 to 15 mm (average, 11.8mm) from the insular surface (9,11).

In Parkinson's disease (PD), six to eight pieces (2x2x2 mm) of dopaminergic tissue are implanted into (or near) the putamen by this transinsular pathway. By means of a bayonet forceps, the grafts are deposited one by one with a separation of 3 to 5 mm. Withdrawing the forceps from each puncture, the cortical entrance orifice closes automatically, preventing continuity between the CSF and the graft.

After closure of the dura, the osteoplastic flap is secured in place with silk sutures and then the scalp is closed. However, during omental transplantation, we passed the anastomosed blood vessels (12), through a dural orifice in the shape of a button hole and an anteroinferior burr hole, protected with a segment of omentum.

DISCUSSION

In 1975, Yaşargil et. al. (16), were the first to describe the pterional approach for the surgical treatment of aneurysms in the anterior communicating artery (ACoA). Since then, other surgeons have utilized the same approach (4), because it provides

adequate access to the anterior aspect of the circle of Willis.

One year later, the same authors (17) published surgical results in 38 patients with basilar bifurcation aneurysms, including, that through this pterional approach, both mesencephalic arteries (MA), both posterior communicating arteries (PCoA), and both superior cerebellar arteries (SCA) can be visualized. Perforating arteries from the basilar, MA, and PCoA arteries are also well visualized.

On December 12, 1987, we first used (13) a transsylvian approach in a patient with capsular hemiparesis (degree, 0-3) and motor dysphasia, due to a microinfarct located between the lentiform nucleus and the posterior limb of the left internal capsule (Fig. 3). Through this pathway, we transplanted omental tissue over the lateral part of the anterior perforated substance (APS), limen insulae and insular cortex. Two days after the operation, there was progressive improvement and at present, the patient has right hemiparesis (degree, 2-4) and normal speech.

We believe that these results are due to increased blood flow in the intraparenchymal territory of the lenticulostriate arteries, secondary to: 1) vascular connections between the lenticulostriate arteries with the mental neovessels, and 2) vertical penetration of omental blood neovessels within the insular parenchyma (insular cortex, extreme capsule, claustrum and external capsule).

Based on clinical observation, as well as synthesis of the catecholamines (5,12) and omental functions (3,18), in February 1988, we performed the first double transplantation in PD (10,11): adrenal medulla and omentum. The first was implanted into the putamen by a transinsular pathway, and the omentum was laid over the lateral part of the APS, limen insulae, and insular and fronto-parieto-temporal cortex to revascularize the dopaminergic graft, from the surrounding tissue and prolong survival of the implant (11,12). In addition, the omentum may provide neurotransmitters (dopamine, noradrenaline, serotonin and acetylcholine) and neurotrophic factors (nerve growth and fibroblast growth factors) (14).

Our surgical technique is similar to that of Takeuchi et. al. (15), because both used the transsylvian approach and then to transinsular approach towards the putamen; but ours differed because our surgical transplant is omental tissue.

In the same way, we believe that through the transinsular pathway we can effect pallidotomies to improve Parkinsonian tremor (7) by injury of the

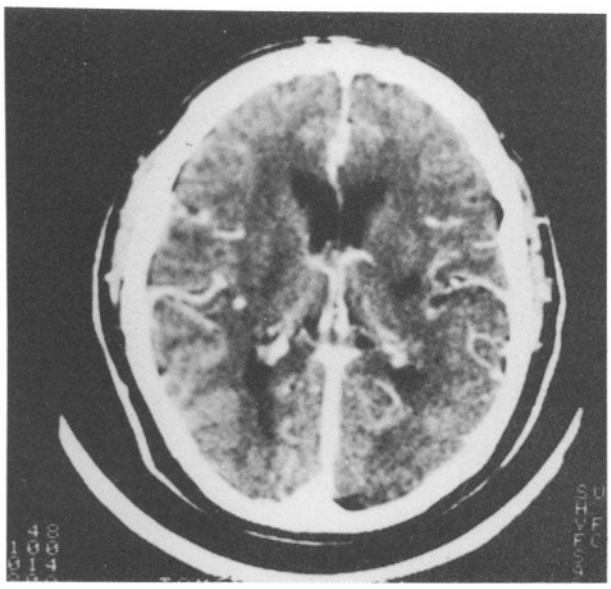

Fig. 3. A: Preoperative CT scan (venous phase) of an infarct located between the lenticular (lentiform) nucleus and posterior limb of the left internal capsule.

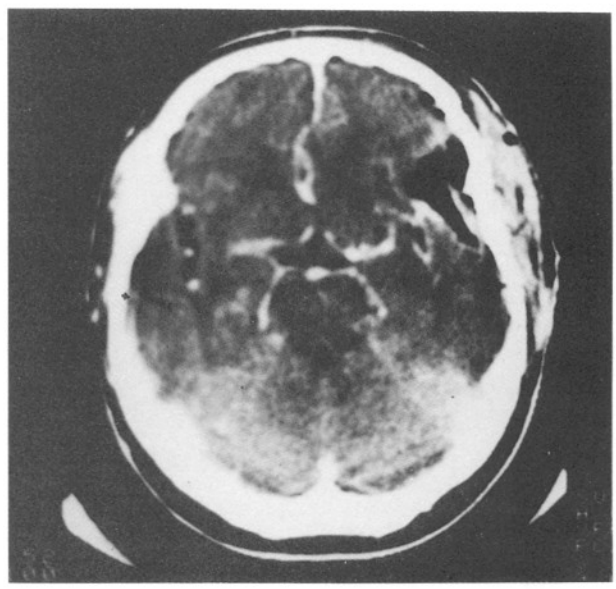

Fig. 3. B: Postoperative CT scan (arterial phase) of the same patient, showing to the omentum within the left pterional region and into contact with the limen insulae.

medial segment of the globus pallidus (2,6), located between 24 to 38 mm (average, 30 mm) from the insular surface (8,9).

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