A Safe and Effective Technique for Harvesting the Occipital Artery for Posterior Fossa Bypass Surgery: A Cadaveric Study

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Key words
- Cadaver
- Microsurgical anatomy
- Occipital artery
- Posterior fossa bypass

Abbreviations and Acronyms
OA: Occipital artery
PICA: Posterior inferior cerebellar artery
SCM: Sternocleidomastoid
SNL: Superior nuchal line
SPC: Splenius capitis muscle
SSC: Semispinalis capitis muscle

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■ OBJECTIVE: **The occipital artery (OA) is an important donor artery for posterior fossa revascularization. Harvesting the OA is believed to be difficult and time consuming due to its 3-dimensional course through different suboccipital tissue layers. We propose a safe and effective means of dissecting the OA.**

■ METHODS: **The course of the OA was explored in 5 cadaveric heads (10 sides). The OA was divided into 3 segments based on the vertical muscle layer it ran through; subcutaneous, transitional, and intramuscular. Three different approaches were attempted, and their respective advantages and disadvantages were assessed.**

■ RESULTS: **The subcutaneous segment of the OA was found to run above the galea without traversing any vertical layers, and was thus easily dissected down to the superior nuchal line (SNL). The segment between the SNL and the digastric groove, traditionally the suboccipital segment, was divided into transitional and intramuscular segments. After detaching and retracting the suboccipital muscles, the OA was found to run in a single vertical layer of connective tissue. Dissection of the transitional segment was more involved as it ran between the SNL and the superior edge of the splenius capitis muscle, and vertically through the galea aponeurotica and the tendon of the sternocleidomastoid muscle.**

■ CONCLUSIONS: **This segmentation provided a safe and effective procedure for harvesting the OA, in which dissection of the transitional segment is a critical step. Although the course of the OA is complex, precise anatomical knowledge of the suboccipital muscles and a stepwise dissection make harvesting the OA relatively simple.**

INTRODUCTION

Posterior fossa extracranial–intracranial bypass is an important procedure for the treatment of ischemic disease affecting posterior circulation, skull base tumors involving the main arterial branches, and complex or giant posterior circulation aneurysms (3, 4, 7, 15). The occipital artery (OA) is an important donor artery for posterior fossa revascularization due to its size, anatomical proximity to target recipient vessels, and flow rate. The OA has been reported to provide a mean blood flow of 15 to 80 mL/min when used for posterior fossa bypass (11).

Harvesting the OA is believed to be difficult and time consuming due to its 3-dimensional course through different suboccipital tissue layers. We propose 3 different dissection methods for the safe and effective harvesting the OA.

METHODS

Five adult cadaveric heads with 10 OAs were injected with colored latex. The scalp and subcutaneous tissues were removed, and the OA, from the digastric groove to the vertex, was divided into three segments—intramuscular, transitional, and subcutaneous—based on the vertical anatomical layers traversed. The intramuscular segment was defined as the proximal part of the OA extending from the digastric groove to the superior edge of the splenius capitis muscle (SPC). The transitional segment was defined as the middle part of the OA extending from the superior edge of the SPC to the superior nuchal line (SNL), and the subcutaneous segment was defined as the most distal part of the OA above the SNL.

A conventional hockey-stick–shaped scalp incision was made, and the OA was harvested as a donor vessel. The incision, at the spinous process of C4, was extended to the midline above the external occipital protuberance and directed laterally 3 cm above the SNL. The incision was then directed inferiorly along the mastoid process, ending 1 cm below the mastoid tip (Figure 1A).

A distal-type hockey-stick–shaped incision and a proximal-type hockey-stick–shaped incision were performed according to the starting point of the incision. The distal-type hockey-stick incision first exposed the distal end of the OA and then proceeded proximally. The proximal-type hockey-stick incision first exposed the proximal portion of the OA near the mastoid process and then proceeded distally. A novel reverse-C incision was also assessed. The inferior and superior ends of the C-incision were located on the spinous process of C2 and above the external occipital protuberance, respectively. The apex of the C-incision was located on the mastoid process (Figure 1B).

The OA was harvested in each of these incisions based on its anatomical course. The subcutaneous segment was dissected from a reflected epigaleal layer, the transitional segment was carefully dissected from multiple muscle layers, and the intramuscular segment was harvested by uncovering the SPC from an underlying single connective tissue layer. In each specimen, the feasibility of an OA-posterior inferior cerebellar artery (PICA) bypass was assessed by grafting the end of the OA to the caudal loop of the PICA.

RESULTS

Segmentation of the OA

The scalp and subcutaneous tissue in the occipital region were dissected to visualize the course of the OA and the muscle layers it traversed. The OA originated from the posterior aspect of the external carotid artery, proximal to the origin of the facial artery. The OA ran posterosuperiorly along the medial surface of the posterior belly of the digastric muscle. Under the mastoid groove, the OA turned posteromedially and ran through multiple suboccipital muscles. Near the external occipital protuberance, the OA turned upward and terminated in 1 or 2 main terminal trunks. The OA provided arterial supply to most of the muscles of the upper posterior and lateral portion of the neck, the occipital muscles, and the posterior half of the scalp.

Upon our initial dissection, the OA, distal to the posterior belly of the digastric muscle, was divided into 3 segments, subcutaneous, transitional, and intramuscular, described earlier (Figure 2A). The proximal section of the OA, covered by the posterior belly of the digastric muscle, was not included in our investigation because harvesting this segment is rarely required for posterior fossa bypass surgery.

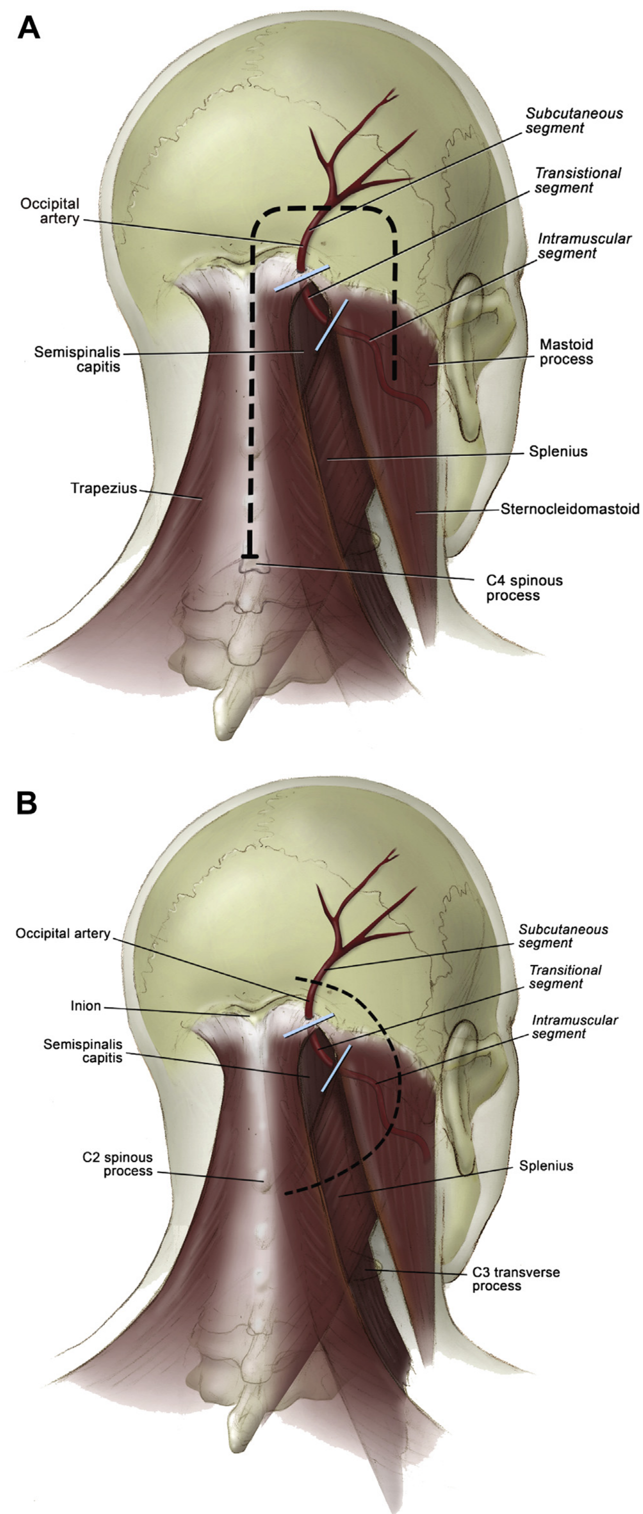

Figure 1. Skin incisions utilized to harvest the occipital artery. (**A**) A hockey-stick–shaped skin incision used for the distal and proximal hockey stick approaches. (**B**) A novel reverse-C skin incision.