Journal of Clinical Neuroscience xxx (2018) xxx–xxx

Contents lists available at ScienceDirect

Journal of Clinical Neuroscience

journal homepage: www.elsevier.com/locate/jocn

Clinical commentary

Comparison between frontolateral approach and pterional approach in the surgical treatment of paraclinoid aneurysms

Jiantao Wang [a,b], Jun Wu [b], Yong Cao [b], Zhisheng Kan [a], Shuo Wang [b,*]

[a] Department of Neurosurgery, Beijing Anzhen Hospital, Capital Medical University, Beijing 100029 China
[b] Department of Neurosurgery, Beijing Tiantan Hospital, Capital Medical University, Beijing 100050 China

ARTICLE INFO

Article history:
Received 28 January 2018
Accepted 11 March 2018
Available online xxxx

Keywords:
Paraclinoid aneurysms
Clipping
Frontolateral approach
Pterional approach

ABSTRACT

Objective: To compare the pterional and frontolateral approach to determine the most effective route for paraclinoid aneurysm surgery.
Methods: Between June 2010 and December 2015, a total of 176 patients with paraclinoid aneurysm underwent surgical clipping, 96 through the pterional and 80 through the frontolateral approach. We analyzed the two groups and compared demographic, radiologic, and clinical variables including age, sex, aneurysm type,intraoperative rupture rates, operative time,anatomical obstacles,outcome and post-operative complications.
Results: The 2 groups were comparable with respect to baseline characteristics. The mean operation time was also signifcantly shorter in frontolateral group than in the pterion group (204.3 min vs. 264.1 min, $p < 0.05$). Furthermore, the mean craniotomy area was much smaller in the frontolateral group (1255.4 mm^2 vs. 2758.5 mm^2, $p < 0.05$). No patient experienced rebleeding in either group. In the frontolateral group, the exploration allows enough room for intracranial manipulation with maximal protection of the brain and other intracranial structures.
Conclusion: The frontolateral approach is a simple, reliable, and efficient procedure. The frontolateral approach could be a good alternative to the classic pterional approach for the treatment of paraclinoid aneurysms.

1. Introduction

Ophthalmic internal carotid artery (ICA) aneurysms are a challenging subset of intracranial aneurysms. The ophthalmic (C6) segment extends from the distal dural ring to the origin of the posterior communicating artery [1]. The segment is known as the carotid-ophthalmic segment [2], and the paraclinoid segment [3]. Microsurgery retains a fundamentally important role in the management of paraclinoid aneurysms although endovascular techniques have replaced open surgery to a considerable extent. The standard pterional craniotomy approach (PtCA), which was described by Yasargil in the 1970s, is the gold standard for approaching lesions in the sellar and suprasellar region, circle of Willis, sylvian fissure, and even the superior portion of the clivus [4]. Recent advancements in microsurgical techniques and instrumentation have allowed the development of the minimally invasive approach in aneurysm surgery. Frontolateral craniotomy approach (FLA), is a modified method of the PtCA and it has advantages compared with the PtCA. Although scattered case reports involving tumors of the anterior fossa or the sellar region surgery using this method are available in the literature [5,6]. The ideal intracerebral aneurysm clipping technique would be easy to perform with a small incision, cause minimal damage to normal structures, and have a relatively wide surgical field. We designed this study for comparison of the clinical differences, procedural safety, efficacy, clinical outcome, cosmetic outcomes, intraoperative and postoperative complications between the FLA and the PtCA for clipping of paraclinoid aneurysms in a cohort of 176 consecutive patients treated in our institution.

2. Material and methods

2.1. Patients

From June 2010 to December 2015, a total of 176 patients harboring 192 paraclinoid aneurysms underwent clipping surgery by a single surgeon at Beijing Tiantan hospital. A retrospective review of clinical records, neuroimaging findings, and operative records, was conducted to collect information on patient age, sex, Hunt and

* Corresponding author at: No. 6 Tiantanxili, Dongcheng District, Beijing, China.
E-mail address: captain9858@vip.sina.com (S. Wang).

https://doi.org/10.1016/j.jocn.2018.03.027
0967-5868/

Hess grades, aneurysm size and location, surgical approach, and intraoperative findings. To clarify, the operation time was measured from the time of skin incision to closure.

2.2. Preoperative and postoperative examinations

Each patient underwent digital subtraction angiography (DSA) and computed tomography angiography (CTA) before the operation to examine the orientation, size, neck width, and exact morphology of the aneurysm. Patients then underwent DSA or CTA after the operation 1 week later. Visual examination were conducted before and after the operation.

2.3. Classification

The paraclinoid aneurysms could be classified into three groups according to a method reported by Barami et al. [7] (Fig. 1). Type Ia and Ib aneurysms (Barami classification) were merged into a single group (Type I). Type II aneurysms arising from the ventral paraclinoid segment. Type III aneurysms arising from the medial paraclinoid segment. Size of the aneurysm was categorized by International Study of Unruptured Intracranial Aneurysms (ISUIA) criteria (small, <10 mm; large, 10 to <25 mm; giant, ≥25 mm) [8].

2.4. Approach selection

From June 2010 to September 2012,the paraclinoid aneurysms were treated via the pterional approach. After that, the lesions were mainly treated via the FLA. The choice between the 2 approaches was based on operator's preferences and, to some extent, on aneurysm size and characteristics.

2.5. Surgical technique

FLA: Surgery was performed under general endotracheal anesthesia and neurophysiological monitoring. The patient is placed in a supine position. The patient's head is turned to the opposite side at a 20 to 50 degree angle, and slightly retroflected. Neck incision was planned. Minimal hair shaving was performed and the skin incision was behind the hairline (Fig. 2A). The temporal muscle was split only in its superior and anterior part (Fig. 2B). Only a burr hole is drilled at the superior temporal line just above the frontal base (Fig. 2C). The craniotomy is prepared by using a craniotome at the site of the burr hole (Fig. 2D). The mean bone flap size was 3 × 4 cm. In cases in which the frontal sinus has been opened, the sinus is treated locally with antibiotics and covered with fascia. The dura was opened in a C-shaped, semilunar fashion with its base toward the supraorbital rim. Then, the microscope was brought into place, followed by opening of the sylvian fissure and the carotid cisterns for cerebrospinal fluid drainage. It is sometimes necessary to open Liliequist's membrane by penetrating the spaces between the optic nerve and the internal carotid artery or between the oculomotor nerve and the carotid artery. After frontolateral craniotomy, a portion of the anterior clinoid process (ACP), sphenoid ridge and the lateral part of the superior orbit wall is drilled intradurally. Resection of the falciform ligament and optic strut will improve mobilization of the optic nerve, and provide a larger space for temporary occlusion and placement of the clip. After the optic nerve was dissected away the underlying aneurysm was visualized and then the distal dural ring was resected to gain proximal control. Complete occlusion of the aneurysm with preservation of ICA flow was confirmed by indocyanine green (ICG). The dura is closed in watertight fashion and the wound was closed.

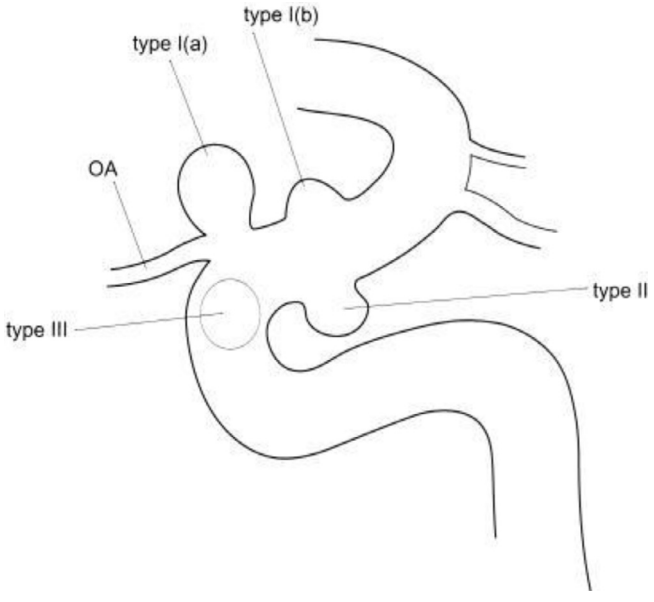

Fig. 1. The paraclinoid aneurysms are subdivided based on the classification proposed by Barami et al. [7]: Types Ia and Ib variants arise from the dorsal surface of the C6 segment of the carotid artery type Ia aneurysms are closely related to the ophthalmic artery (OA) origin. Ib aneurysms have no branch relation and are often sessile. Type II variants arise from the ventral surface of the C6 segment without any branch relation. Type III aneurysms project medially.

2.6. Outcomes assessment

Outcomes were assessed at the time of discharge and 1 year postoperatively, using the Glasgow Outcome Scale (GOS) [9], in which a GOS score of 5 represents an excellent outcome, 4 represents a good outcome with moderate disability, 3 represents a fair outcome with severe disability, 2 represents a poor outcome (vegetative), and 1 is dead.

2.7. Statistical methods

Statistical analyses were performed using SPSS Statistics 17th version for Windows (SPSS, Inc., Chicago, IL, USA). T test was used for continuous variables and Chisquare test or Fisher's exact test was used for categorical variables as appropriate. Statistical significance was defined as a $p < 0.05\%$ for a 95% confidence interval.

3. Results

There were 96 (54.6.0%) patients in the PtCA group and 80 (45.4%) in the FLA group. Clinical data of 176 microsurgical treated paraclinoid aneurysms were presented in Table 1. The mean age of patients in the two groups was 61.2 years (FLA group) and 64.5 years (PtCA group) ($t = 6.237$, $p < 0.01$). The proportion of female patients was 69.8% (67/96) in the PtCA group and 67.5% (54/80) in the FLA group ($x^2 = 0.107$, $P > 0.05$). The 2 groups showed no significant difference in age or sex.

The 176 paraclinoid aneurysms were classified into three groups. The locations proportions of the paraclinoid aneurysms type I (dorsal projection), type II (ventral) and type III (medial projection) were, respectively, 57.3%, 22.9%, and 19.8% in the PtAC vs 52.5%, 25.0%, and 22.5% in the FLA. No statistical significance existed between the location of the paraclinoid aneurysm ($x^2 = 0.405$, $P > 0.05$) in comparison with the approach selected. not differ significantly between 2 groups ($x^2 = 0.063$, $P > 0.05$). Hunt and Hess grade, and Fisher grade were, respectively, show no difference between the two approach ($x^2 = 2.288$; $x^2 = 0.426$, $P > 0.05$). The proportions of small (<10 mm), medium (10–25 mm), and large

Please cite this article in press as: Wang J et al. Comparison between frontolateral approach and pterional approach in the surgical treatment of paraclinoid aneurysms. J Clin Neurosci (2018), https://doi.org/10.1016/j.jocn.2018.03.027