Complex carotid artery stenosis via enhanced anterior cervical triangle posterior vena jugularisinterna approach

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Abstract: The paper discuss the surgical techniques and clinical curative effects of CEA (Carotid Endarterectomy, CEA) under a microscope via anterior cervical triangle posterior vena jugularisinterna approach combining with suspended carotid artery on the treatment of high level and complex carotid artery stenosis. Retrospective analysis was conducted on the clinical data of 21 cases of patients. The far end of carotid artery stenosis section is located above the lower edge of the second cervical vertebra centrum. The carotid artery stenosis section of three cases is located at the middle lower edge of the first cervical vertebrae. Clinical evaluation was performed from surgical process, time of postoperative drainage tube removal, perioperative complications and follow-up survey on the serious numbness at the surgical site one month, three months and six months after the surgery. There are 0 cases of postoperative death, 0 cases of cerebral hemorrhage cerebral infarction, 1 case of myocardial infarction, 2 cases of Hypoglossal nerve temporary injury, 0 case of infection of incisional wound and incidence rates of serious numbness in postoperative follow-up surgical area one month, 3 months and 6 months are 23.81%, 19.05% and 9.52% respectively. The cranial nerves and surrounding muscle groups at the far end of carotid artery stenosis and carotid artery can be fully disposed via anterior cervical triangle posterior vena jugularisinterna by utilizing microsurgery-technique and suspended carotid artery technology conveniently and completely to avoid cutting the corresponding branches of vena jugularisinterna and too much anatomy of anterior triangle lymph fatty tissue to properly avoid postoperative edema at the surgical area, cranial nerve injuries and other complications. It is a convenient, efficient, safe and effective CEA approach.

Keywords: Anterior cervical triangle, posterior vena jugularisinterna, suspended carotid artery, CEA under a microscope, high level and complex carotid artery stenosis.

INTRODUCTION

In recent years, carotid surgery has been developing rapidly in China. Especially on the aspect of carotid atherosclerotic stenosis, scientific research and clinical levels have been constantly improving. CEA (Carotid Endarterectomy, CEA) relying on microscope surgical techniques has received high attention from clinical surgeons (Rabbani *et al*., 2018). Specific to high level and complex carotid artery stenosis, anterior cervical triangle vena jugularisinterna approach via the front edge of sternocleidomastoid is generally adopted. Conventional separation is required to cut off the anterior cervical triangle lymphoid tissue to separate the middle thyroid veins of vena jugularisinterna, superior thyroid vein, lingual vein or even facial vein and other branches, and separate cervical ansa etc. The surgical anatomy time is long and the dissection is difficult with high incidence of postoperative edema, numbness and subcutaneous hydrops. The postoperative carotid triangle area is characterized of large amount of negative pressure drainage and long negative pressure drainage placing duration which has always been challenges for clinical surgeons. The Neurosurgery of Shengli Oilfield Central Hospital carries out more than 110 cases of CEA under a microscope annually. The paper summarized the clinical data of 21 cases of patients with high level and complex carotid artery stenosis by CEA under a microscope via anterior cervical triangle posterior vena jugularisinterna approach combining with suspended carotid artery among the patients diagnosed as carotid artery stenosis at the Neurosurgery of Shengli Oilfield Central Hospital from Jan. 2015 to Oct. 2016.

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MATERIALS AND METHODS

General Information

Clinical data

13 male patients and 8 female patients; the average age is (68.3±12.2 years old). The patients with far end of carotid artery stenosis section is located above the lower edge of the second cervical vertebra centrum are diagnosed as high carotid stenosis (Nepali *et al*., 2019; Fanxing and Zhou 2016). And the carotid artery stenosis section of three cases is located at the middle lower edge of the first cervical vertebrae (fig. 1-1, fig. 1-2). More than 70% of the patients were suffered from severe stenosis of carotid artery including 16 cases of unilateral severe stenosis, 5 cases of bilateral severe stenosis, 16 cases combined with hypertension, 9 cases combined with diabetes, 12 cases combined with coronary heart disease, 5 cases combined with atrial fibrillation; 7 cases accepted intracoronary stent implantation in the past, 11 cases with transient

ischemic attack history, 4 cases with acute and subacute cerebral infarction history and 13 cases with obsolete cerebral infarction.

Fig. 1-1

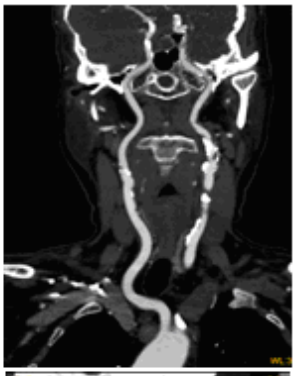

Fig. 1-2

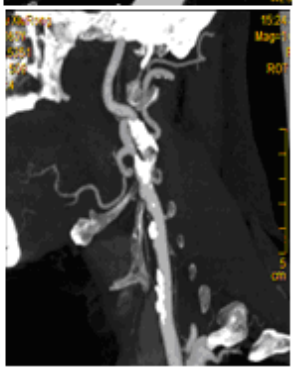

Fig. 1-2: The carotid artery stenosis section is located at the middle lower edge of the first cervical vertebrae

Fig. 2-1

Fig.2-2

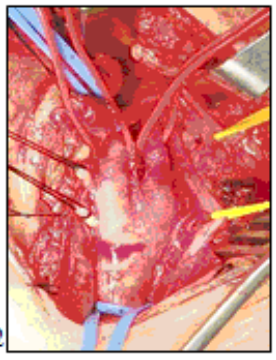

Fig. 2-2: CEA under a microscope via anterior cervical triangle posterior vena jugularisinternaapproach combining with suspended carotid artery

Treatment measures

Preoperative Performed regular routine blood, blood type, biochemical, blood coagulation, infectious disease screening, routine urine, myocardial enzyme spectrum, muscle calcium trigeminy, B-type natriuretic peptide, immune indexes, chest X-ray, electrocardiogram (ecg), UCG, TCD, head and neck CTA + perfusion, crania-cerebral MRI and other examinations. Full range brain angiography was performed if necessary; homocysteine, hypertension four items, renal artery color doppler ultrasound and other examinations were additionally performed for patients with hypertension; 24 hour dynamic electrocardiogram was performed for patients with previous cardiac arrhythmia history; for patients combined with dizziness, invited the doctors of the E.N.T. Department to exclude Meniere's disease and other dizziness sources, applied cervical vertebra 3D CT+MRI, and invited Spinal Surgery to exclude dizziness arising from cervical vertebra lesion; applied moderate cardiac, diuresis and ventricular ejection fraction score etc.; invited the Anesthesiology Dept. to discuss before the surgery to develop a strict therapeutic plan of individuality; applied oxygen inhalation, antiplatelet, nutrition cranial nerve, brain protection and other treatment to improve cerebral circulation.

Fig. 3-1: Standard excision of thickening internal carotid artery intima via anterior cervical triangle posterior vena jugularisinterna

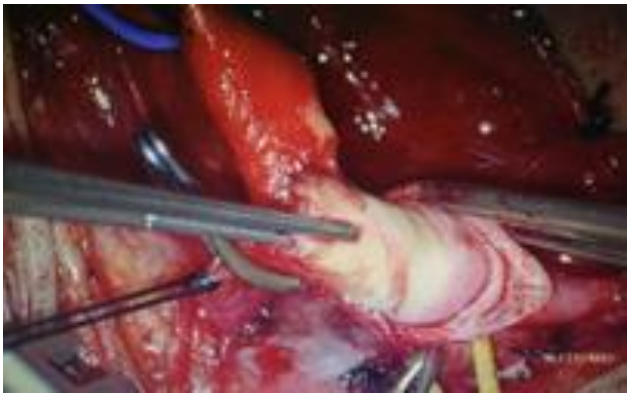

Fig. 3-2: Tilting excision of thickening internal carotid artery intima

Fig. 4-1: Reexamination of head and neck CTA showed that the internal carotid artery had smooth blood flow and the stenosis disappeared

Fig. 4-2: The carotid artery thickened plaque was completely resected

Intranperative

Endotracheal intubation anesthesia was adopted: Surgical operation under microscope was adopted intranperatively at Neurosurgery Dept. to reduce the incision and fine operation to reduce surgical trauma; anterior cervical triangle posterior vena jugularisinterna was adopted during surgery and carried out conventional suspended carotid artery (fig. 2-1, fig. 2-2) at the operation; pulled the vena jugularisinterna to forward and carefully separate the gap along vena jugularisinterna and carotid artery. Carefully observed the exposure, suspension, hypoglossal nerve protection and ansacervicalista upper and lower root, glossopharyngeal nerve, vagus nerve, accessory nerve, and the place close to the skull; carefully observed the exposure, suspension, middle thyroid veins protecting vena jugularisinterna, superior thyroid vein, lingual vein, facial vein and other branches; carefully observe the exposure, suspension, middle thyroid veins protecting vena jugularisinterna, lingual artery, facial vein and other branches (fig. 3-1, fig. 3-2); 15 cases accepted standard excision of thickening internal carotid artery intima via anterior cervical triangle posterior vena jugularisinterna; and 6 cases accepted tilting excision of thickening internal carotid artery intima; 4 cases accepted carotid artery flow pipe protection during the surgery process since the reflux pressure at the far end of internal carotid is less than 40mmHg; skin suture of incision adopted continuous intradermal suture with fast absorption suture to reduce surgical scar to the maximum degree.

Postoperative

Performed conventional antiplatelet, short term anticoagulant therapy, blood routine examination re-examination, biochemistry, coagulation, myocardial enzymes, muscle calcium trigeminy, B-type natriuretic peptide, head and neck CTA (fig. 4-1, fig. 4-2) and other examinations. Carried out DSA cerebral angiography examination and crania-cerebral MRI etc.

Evaluation method

Performed follow-up survey on surgical operation (length of the incision, surgical operation time, temporary blocking time of carotid artery and blood loss volume during the operation), postoperative average negative pressure drainage tube removal, perioperative complications (postoperative death, cerebral hemorrhage, cerebral infarction, myocardial infarction, cranial nerve injuries, incision subcutaneous hematoma effusion and incision infection) and follow-up survey on the serious numbness at the surgical site one month, three months and six months after the surgery. Clinical assessment was performed.

RESULTS

The average length of surgery is (5.53±1.71)cm; average surgery duration is (75.48±14.73) min.; average carotid artery blocking time is (15.37±5.64) min.; the average amount of operative bleeding is (16.19±4.63) ml; the postoperative average negative pressure drainage tube removal at carotid triangle area is (48.78±11.38) hour; there are 0 cases of postoperative death, 0 case of cerebral hemorrhage cerebral infarction, 1 case of myocardial infarction, 2 cases of Hypoglossal nerve temporary injury, 0 case of infection of incisional wound, and incidence rates of serious numbness in postoperative follow-up surgical area one month, 3 months and 6 months are 23.81%, 19.05% and 9.52% respectively. Patients with dizziness complained that they have obviously turned better preoperatively.

DISCUSSION

Etiology and pathogenesis

The main cause for carotid artery stenosis is atherosclerosis (Guanhang and Zhen 2015). accounting about 90% of pathogenesis. The formation mechanism and process of atherosclerosis are quite complex. There are multiple factors, including age, gender, blood pressure, blood glucose, blood fat, cardiac function, hemodynamics and blood vessel elasticity etc. The above factors can lead to vascular endothelial damage and intravascular macrophages to ingest low density lipoprotein formation of foam cells thus to induce carotid artery atherosclerosis. In addition, artery inflammation, artery dissection, fibromuscular dysplasia, radiation causes, exogenous oppression and vascular circuity etc. may lead to different degrees of carotid artery stenosis. (Hira Munir *et al*., 2018). The mechanism for cerebral infarction arising from carotid artery stenosis is mostly caused by arterial embolism and local low perfusion. Embolus is mostly originated from the atheromatous plaques or broken embolus on narrow carotid artery walls. In addition, it can be originated from neoplasm in heart. (Jianhua Xiong *et al*., 2018). Carotid artery stenosis can be treated through surgical interventions.

Indications of CEA

Symptomatic patients

Patients with low and medium surgical risk of non-disabling ischemic stroke or transient ischemic symptoms (TIA or oversize amaurosis) in six months, with over 70% noninvasive imaging narrowing or over 50% of radiography detected narrowing, stroke or death at expected perioperative period less than 6%. Asymptomatic patients: Angiography stenosis degree is above 70%, the stroke or death at expected perioperative period less than 3%. It is not suggested to perform surgery when the narrowing rate is lower than 50%. Patients with chronic occlusion: Not recommended. Try to perform surgery (Klosek and Rungruang, 2008). Symptomatic patients: Implement at an experienced center or physicians.

Surgical improvement

High level and complex carotid artery stenosis is prone to be exposed at the far end comparatively via anterior cervical triangle and posterior vena jugularisinterna. (Humaun *et al*., 2018). Drift away from the gap along vena jugularisinterna and carotid artery to make the carotid artery dissection more intuitive and safer thus to avoid cutting off vena jugularisinterna branches and loops dropping thus to save operative time, avoid postoperative complications and improve the postoperative satisfaction of the patients.

Tissue injury can be properly reduced by utilizing microsurgical technique thus to decrease the possibility of cranial nerve and muscle tissue around carotid artery; in addition, the internal carotid with deep carotid artery sheath suspension technology can become shallow and put the internal carotid behind the external carotid artery thus to enlarge the surgical space and facilitate surgical operation (Alvi *et al*., 2018).

Mini block clamp of intracranial aneurysm adopted in the surgery can be used for internal carotid and external carotid artery; for patients with internal carotid narrowing far end closing to apertura externa canaliscarotici, carotid artery balloon can be adopted to perform temporary arterial occlusion of internal carotid closing to basis cranii blood thus to reserve more sufficient surgical operation space (Xianwei *et al*., 2016; Longde *et al*., 2016).

For patients combined with carotid artery circuity, turning over carotid artery excision can be adopted. Treat the carotid artery circuity and carotid artery stenosis simultaneously (Longde *et al.,* 2016). The guideline of various carotid endarterectomy at home and abroad takes the rate of stenosis as standard. The property of carotid plaque is not considered (Tingting, 2015). As a matter of fact, for vulnerable plaque (unstable plaque, soft plaque and noncalcified plaque), or plaque with anabrosis and hemorrhage below the plaque, surgical treatment shall be considered actively (Chen *et al*., 2018; Xianwei *et al*., 2016).

CONCLUSION

The cranial nerves and surrounding muscle groups at the far end of carotid artery stenosis and carotid artery can be fully disposed via anterior cervical triangle posterior vena jugularisinterna by utilizing microsurgery-technique and suspended carotid artery technology conviniently and completely to avoid postoperative edema in surgical area, lymphatic fistula, shoulders shrugging disability, bucking at water drinking, hoarseness and other cranial nerve injuries as well as other complications, and shorten the LOS. It is a convenient, time saving, safe and effective CEA approaching. It creates more surgery opportunities for high and complex CEA difficult for interventional therapy requiring surgery, place carotid artery balloon, carotid artery flow tube and carotid distortion.

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