



Original Research

Impact of preoperative transarterial embolization of carotid body tumor: A single center retrospective cohort experience

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ABSTRACT

Objective: To evaluate the feasibility and efficacy of preoperative hyperselective transarterial embolization in carotid body tumor resection.

Methods: Retrospectively analyze the clinical feature, imaging examination, treatment strategy and prognosis of 29 carotid body tumor patients from January 2006 to January 2016. According to whether to carry out the preoperative transarterial embolization, the patients were classified into embolization group and non-embolization group. The blood loss, operative time and perioperative complications were compared between the 2 groups.

Results: 29 carotid body tumors were resected. The median of blood loss was 80 mL in embolization group and 200 mL in non-embolization group, the difference was statistically significant ($P = 0.001$). The median of operative time was 120 min in embolization group and 160 min in non-embolization group, the difference was statistically significant ($P = 0.006$). No death, paralysis or ectopic embolism occurred in the study population. 4 patients in embolization group and 4 in non-embolization group suffered from cranial nerve injury.

Conclusion: Surgical resection of carotid body tumor is safe and reliable, which is the first choice in the treatment of carotid body tumor. Preoperative transarterial hyperselective embolization can significantly reduce blood loss and shorten operative time, but it does not decrease the incidence of cranial nerve injury.

1. Introduction

Carotid body tumor (CBT) is reported to be the most common head and neck paragangliomas [1] which derived from extra-adrenal paraganglia of the autonomic nervous system [2]. The incidence of CBT is about 1/30 000. It generally present with slowly growing and painless mass at the carotid triangle area, sometimes can cause hoarseness, dysphagia and dyspnea secondary to compression [3]. Some CBT can also present with malignant behavior or functional symptoms caused by catecholamine [4].

The treatment strategy including conservative management, radiotherapy and surgical resection [5]. Radiotherapy is suggested in cases of extensive involvement which is not resectable or with high surgical risk [6]. Surgical resection is the only curative treatment strategy for resectable CBTs. However, the rich blood supply sometimes makes CBT resection difficulty. The intraoperative hemorrhage and incidence of cranial nerve injury remains considerable [4].

Preoperative transarterial embolization was introduced by Schick

et al. in 1980 [7] to get better CBT exposure and reduce intraoperative hemorrhage. However, preoperative embolization is controversial because some investigators have reported that although intraoperative hemorrhage may decrease, transfusion requirement is not affected and the procedure may increase the risk of ectopic embolism [8–10]. We have tried to carry out preoperative transarterial hyperselective embolization in CBT resection since 2006, the aim of the present study is to report our own experience on the feasibility and efficacy of preoperative hyperselective transarterial embolization in carotid body tumor resection.

2. Material and methods

2.1. Patient population

A retrospective data collection and analysis was performed for patients with surgically resected CBT between January, 2006 and January, 2016. According to whether received preoperative

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hyperselective transarterial embolization, patients were classified into embolization group and non-embolization group. Data was collected from medical record, surgical record, anesthetic record, laboratory test, imaging examination and pathological report. The study procedure was in accordance with institutional guidelines and was approved by institutional ethics committee of our hospital. All patients have signed the written informed consent. The work has been reported in line with the STROCSS criteria [11].

2.2. Selection criteria

We reviewed the data of patients diagnosed with CBT by clinical features, ultrasonography, computed tomography angiography (CTA), digital subtraction angiography (DSA) and pathological examination. And recruited those treated by surgical resection with or without preoperative transarterial hyperselective embolization. All Shamblin categories were included. Preoperative embolization was carried out in some Shamblin II and Shamblin III patients with definitive feeding artery.

2.3. Preoperative transarterial hyperselective embolization

For patients received preoperative transarterial hyperselective embolization, the surgery was carried out in hybrid operation room, which allows to perform the interventional operation and traditional surgery at the same operating table. After punctured the femoral artery with Seldinger technique, we introduced a 5-F catheter (Cobra 2, Cook, US) to the common or external carotid artery and made CBT angiography to confirm the feeding artery. Then embolization was carried out after hyper-selection into the feeding artery with Polyvinyl Alcohol (PVA) foam particle (Cook, IN, USA), Tornado embolization microcoil (Cook, IN, USA), or Onyx liquid embolic system (Covidien, MO, USA).

2.4. Surgical procedure

The CBT resection procedure was performed under general anesthesia with patient in supine position. The incision was made along the anterior border of sternocleidomastoid muscle. Then we divided the subcutaneous tissue, platysma and exposed the CBT. Common, internal and external carotid artery were controlled before the tumor resection. Feeding vessels of the tumor was ligated definitively. Much attention should be paid to avoid injury of the vagus, hypoglossal or superior laryngeal nerve during the resection. External carotid artery could be sacrificed if it was invaded seriously by the tumor. When internal carotid artery need to be resect, reconstruction with autogenous great saphenous vein should be carried out. The resected tumor was preserved in 10% formalin solution for pathological examination.

2.5. Endpoint

The primary endpoint was operative time and blood loss during the operation. The secondary endpoint was surgery related complications, such as stroke, cranial nerve injury, wound infection, pneumonia and acute renal failure.

Operative time was defined as time used for CBT resection in non-embolization group, and for both embolization and CBT resection in embolization group. Stroke was diagnosed if the modified Rankin score was higher than 3 at 30 days after the operation. Wound infection was defined as local inflammation with positive bacterial culture and delayed wound healing. Acute renal failure was defined as > 50% elevation of creatinine or > 50% decrease of glomerular filtration rate after surgery.

2.6. Statistical analysis

Continuous variable was present as mean and standard deviation or

Table 1
Demographics and clinical features of the study population.

	Embolization group	Non-embolization group	P
n	11	18	
age	47 [39.5–57.25]	45 [39–57]	0.999
Sex (male)	4	7	0.999
Comorbidity			
hypertension	3	4	0.999
Diabetes mellitus	2	2	0.622
hyperlipidemia	3	2	0.339
smoking	3	5	0.999
Tumor diameter	6 [5–7]	4.5 [3.5–6]	0.026
Bilateral lesion	1	0	
Shamblin category			
Shamblin I	1	7	0.072
Shamblin II	7	9	
Shamblin III	3	2	

as median and interquartile range. Discrete variable was present as percentages. Mann-Whitney *U* test was performed to compare continuous variable, and the chi-square test or Fisher's exact test was used to compare discrete variable. The difference of Shamblin category in the 2 groups was analyzed with rank sum test. Data analysis was performed using SPSS version 22 (SPSS Inc., Chicago, IL, USA). A *P* value of < 0.05 was considered statistically significant.

3. Results

3.1. Demographics and clinical features

The final study population consisted of 29 patients (11 men; mean age 46.17 ± 11.34 years old), of which 11 received preoperative transarterial hyperselective embolization and CBT resection, 18 received solely CBT resection. The demographics and clinical features of the patient cohort were present in Table 1. A mass can be palpated at the carotid triangle area in all patients, of which 24 were painless and 5 were tender. 1 patient also have symptom of pharyngeal discomfort and 2 have hoarseness.

Of the 11 patients received preoperative hyperselective embolization, 4 (36.4%) were men and 7 (63.7%) were women. The median of age was 47 [interquartile range: 39.5–57.25] years old. The median of CBT diameter was 6 [interquartile range: 5–7] cm, 1 was Shamblin I, 7 were Shamblin II and 3 were Shamblin III category. Bilateral lesion occurred in 1 of the 11 patients.

Of the 18 patients without preoperative embolization, 7 (38.9%) were men and 11 (61.1%) were women. The median of age was 45 [interquartile range: 39–57] years old. The median of CBT diameter was 4.5 [interquartile range: 3.5–6] cm, 7 were Shamblin I, 9 were Shamblin II and 2 were Shamblin III category.

The 2 groups were similar with regard to age, sex, comorbidities and Shamblin category. The tumor diameter was a little larger in the embolization group (median: 6 cm vs. 4.5 cm, *P* = 0.026) (Table 1).

3.2. Intraoperative variables

In non-embolization group, 12 patients received solely CBT resection, 4 received CBT and external carotid artery resection, 2 received CBT resection, external carotid artery resection and internal carotid artery reconstruction.

In embolization group, 5 patients received solely CBT resection, 5 received CBT and external carotid artery resection, 1 received CBT resection, external carotid artery resection and internal carotid artery reconstruction. The embolic agent used includes PVA foam particle in 4 patients, elastic coil in 3 patients, Onyx glue in 2 patients, and 2 patients used both PVA foam particle and elastic coil. Except for 2 patients received the embolization twice, other patients completed the

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