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Efficacy of Preoperative Embolization in Management of Carotid Body Tumours – a pilot study

Short Communication

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Abstract: Henoch The aim of the study was to evaluate the efficacy of preoperative embolization in the management of carotid body tumours. Of the 15 patients admitted to the Department of Vascular Surgery (General Surgery Unit II), Christian Medical College, Vellore, from January 1st 2002 to December 31st 2006 for management of carotid body tumours, 4 patients underwent preoperative embolization and were grouped together. Of the remaining 9 patients who underwent surgical excision, there were 5 with comparable tumour size and these were grouped together into the control group. Surgical outcome of both the groups were compared in terms of operating time, intraoperative blood loss, nerve injury, postoperative morbidity and mortality. There was statistically significant reduction in blood loss and duration of surgery in patients who underwent preoperative embolization. In conclusion, the preoperative embolization is effective in the management of Shamblin type III carotid body tumours.

Keywords: *Carotid body tumour • Preoperative embolization*

1. Introduction

Carotid body tumour (CBT) arises from accumulation of chemoreceptor cells or glomera (non-chromaffin staining paraganglion cells). Complete surgical excision is the only curative treatment but carries inherent risks of injury to the carotid artery, cranial nerves and other structures as well as excessive blood loss. We analyzed our experience with preoperative embolization (PE) to assess its usefulness in the treatment of Shamblin type III tumours.

2. Material and Methods

A retrospective analysis of inpatient and outpatient charts and radiology records were analyzed between January 1st 2002 and December 31st 2006 for management of CBT. During this period, 15 patients were diagnosed to have CBT. Two were inoperable tumors. Both extended up to the base of the skull with encasement of the bifurcation and the internal carotid artery and hence were managed non-operatively. Of the 13 patients operated, 4 underwent PE and they were grouped under the embolization group and were classified as Shamblin type III. Of the remaining 9 patients, there were 5 with comparable tumour size and they were the control group. Surgical outcome was compared with respect to operative time, intraoperative blood loss, nerve injury, postoperative morbidity and mortality, and angiographic assessment of reduction in vascularity.

2.1. Pre-operative embolization

The procedure was performed through right transfemoral arterial access under local anesthesia. Selective cannulation of the feeding arteries was done

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using a microcatheter (SP Terumo 3F). Embolization was performed using gel foam in 2 cases and PVA (polyvenyl alcohol particles 300-450 microns) in the other two. Check angiogram was taken at the end to assess the reduction in vascularity. Success was judged by diminution of the angiographic blush. The patients were all operated on the day after embolization.

3. Results

The distribution of patients as shown in Table 1 was similar in the embolization and non-embolization groups.

Table 1. Characteristics of the patients.

Total	No Embolization group (N=5)	Embolization group (N=4)
Mean age (Range) (in years)	40.2 (20 - 55)	49 (39 - 69)
Sex distribution	3 men 2 women	2 men 2 women
Preoperative Cranial Nerve involvement	nil	1
Average size of the tumour (Shamblin type III)	6.8 cm x 6 cm	7.75 cm x 6.5 cm

The feeding vessel from the external carotid artery was embolized in all the patients. The extent of embolization was 75% to 85% as assessed by visual inspection of the reduction in vascularity of the tumour (Figure 1 and 2).

As shown in Table 2, there was significant reduction in blood loss (p=0.02) and operative time (p=0.02) in the post-embolization group. In the control group, two patients had hypoglossal nerve palsy and one required internal carotid artery reconstruction. These numbers are too small to prove statistical significance but they do show the trend towards comparatively higher morbidity in the non-embolization group. The surgeon described the tumours in the PE group to be firmer in consistency and thus easier to dissect. There was no stroke or mortality.

4. Discussion

In 1743, Von Haller described the carotid body, a chemoreceptor buried in the adventitia on the posteromedial aspect of the carotid bifurcation. Lushka identified a tumour arising from the carotid body in 1862. Though Maydl attempted removal of a carotid body tumour as early as in 1886, the patient developed aphasia and hemiplegia. Scudder in 1903 successfully removed a carotid body tumour without neural injury and sparing the carotid vessels. However as recently as 1957, mortality and morbidity remained so dismal that Hayes Martin, in his textbook on head and neck tumours, recommended abandonment of resection of difficult (now known as Shamblin type III) tumours.

Figure 1. Pre-embolisation.

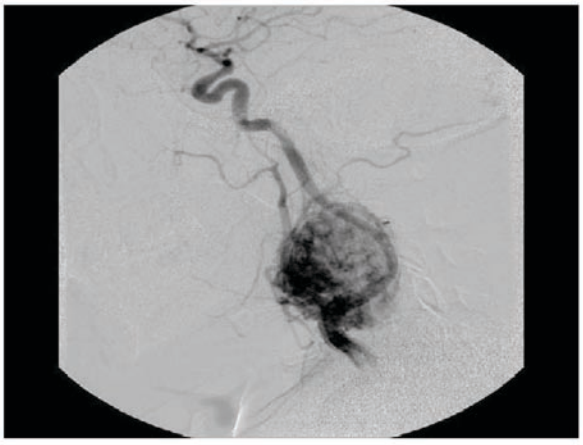

Figure 2. Post-embolisation with reduction in vascularity.

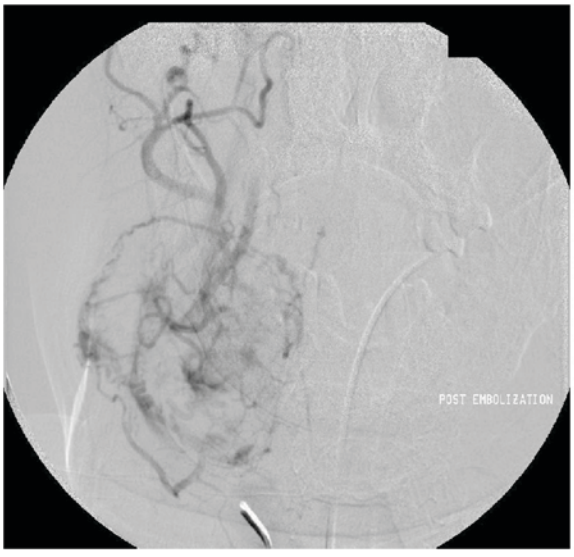

Table 2. Post-operative outcome.

Postoperative outcome	Group with embolization (N=5)	Group without embolization (N=4)	
Median operative time (min)	180	127	p=0.02
Median blood loss (ml)	700	150	p=0.02
Vascular reconstruction	1	nil	
Postoperative cranial nerve palsy	2	nil	

Progressive increase in the Shamblin group of tumours dramatically increases the likelihood of regional cranial nerve involvement as well as intraoperative and postoperative neural and vascular complications. Observation of these tumours is not recommended because progressive growth is associated with increased risk of neurological deficits. The treatment of choice is surgical excision.

Surgical excision involves sub-adventitial dissection. Every effort should be made to identify and preserve the vagus, hypoglossal, and spinal accessory nerves. Hemorrhage due to the highly vascular nature of the tumour often makes this difficult. It is important to reduce the vascularity of the tumour bed to avoid injuring these structures. This can be achieved by preoperative embolization of the tumour. Thus, preoperative embolization is an important adjunct in treatment of patients with large CBTs. It results in a smoother process of surgical exploration, minimizes blood loss and lowers postoperative morbidity [1-3]. It helps to lower the risk of intraoperative iatrogenic injury to the important vessels and nerves around the tumor and allows for complete resection. However, Litle et al found in their series of 22 patients that there were no differences in blood loss, units of blood transfused, operative time or perioperative morbidity between the two groups. They concluded that preoperative embolization did not significantly improve the outcome for tumours measuring 4 to 5 cm [4,5].

In our study we found that preoperative embolization was effective in improving the surgical outcome in terms of minimizing the blood loss, operative time and postoperative morbidity with respect to cranial nerve injuries in large tumours (Shamblin type III) involving surrounding structures. It made it easier to dissect the tumour as it was less vascular and could be separated from the carotid vessels conveniently. The length of stay was similar in both groups as preoperative embolization was followed by surgery the next day. The cost of treatment was three times more ($400) in patients who underwent preoperative embolization as compared to patients who underwent direct excision. Considering the significant improvement in surgical outcome, preoperative embolization is recommended in carotid body tumours.

In conclusion, preoperative embolization significantly reduces blood loss and operative time in the excision of carotid body tumours and facilitates easy resection without injuring the cranial nerves. However, as it increases the cost of treatment significantly, it should be used in the management of Shamblin type III CBTs only. A prospective study of the histopathologic changes after PE within the tumor is being conducted.

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