

Common Carotid Artery Occlusion: A Single-Center Experience in 40 Cases

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Abstract

The incidence of common carotid artery occlusion (CCAO) is approximately 3% in patients who undergo angiography for symptomatic cerebrovascular disease; however, few studies have reported on management of this condition. The objective of this article was to analyze risk factors, therapeutic options, and clinical benefits of surgical treatment at a hospital in the city of São Paulo, Brazil. Data were collected from medical records of 40 patients with CCAO who were treated from June 2002 to October 2013. Results were analyzed retrospectively. Most of the patients were men (63.0%), who were significantly younger than women. Most of the participants had hypertension (90.0%), and more than half had a history of smoking (52.5%). The mean number of coexisting comorbidities/risk factors was 2.9 ± 1.0 . Half of our sample had ipsilateral patent internal and external carotid artery, and 32.5% presented with an occluded internal carotid artery and a patent external artery. Patients with both an internal and an external occluded carotid artery (12.5%) were significantly older. Contralateral arteriosclerosis was observed in 65% of the patients, mainly represented by 50 to 90% stenosis. Most patients were symptomatic (67.5%), and hemiparesis was the most common symptom (55.0%) found. Most (77.5%) of the patients underwent the medical treatment; one out of three endovascular approaches failed. During the mean follow-up of 55 ± 43 months (range, 2–136 months), 17.5% of the patients died within 4 days after surgical repair and after along 123 months of clinical follow-up. Coexisting comorbidities/risk factors were significantly associated with fatal outcomes, such as acute myocardial infarction. This study provides scientific evidences on treatment and outcomes of CCAO.

Keywords

- ▶ carotid revascularization
- ▶ common carotid artery occlusion
- ▶ Rile classification
- ▶ chronic stage
- ▶ open surgery

Common carotid artery occlusion (CCAO) has been little discussed in the literature compared with occlusion of the internal carotid artery (ICA). However, CCAO seems to be a different disease because of its presentation, treatment, and incidence.

CCAO is diagnosed in approximately 3% of the symptomatic patients undergoing carotid angiography¹ and in only 1 to 5% of the patients with symptomatic cerebrovascular

disease.^{2,3} The development of exuberant collateral circulation and patency of the carotid bifurcation seems to protect against ischemic brain lesions.³ However, several symptoms can occur, including hemispheric stroke, amaurosis fugax, and brain hypoperfusion.²

To date, no consensus exists for treatment of asymptomatic patients, and decisions for treatment of symptomatic patients are controversial and made according to each case.⁴

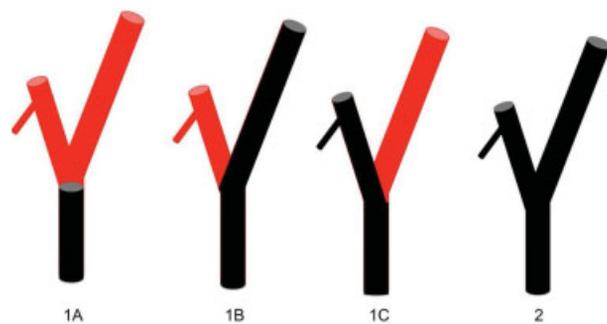


Fig. 1 Rile classification of common carotid artery occlusion.

The 2011 American Heart Association guidelines recommend open surgery or endovascular intervention to treat symptomatic ischemic lesions affecting the anterior cerebral circulation caused by CCAO.⁵ In contrast, the 2009 European Society of Cardiology Protocol has no specific recommendations on this matter,⁶ which emphasizes the need for further studies.

We studied symptoms, treatment options, and clinical evolution of 40 patients with CCAO in our ambulatory service for carotid disease. This study was intended to provide more data and promote discussion about this disease.

Methods

This study was conducted from June 2002 to October 2013 and included 40 patients diagnosed with CCAO and treated at a referral tertiary center, the hospital of the medical school of the São Paulo University in Brazil. Data collected from patients' medical records were gender, age, presence of comorbidities/risk factors, level of lesion severity based on the Rile classification (→ **Fig. 1**),⁷ diagnostic procedures, and presence of contralateral arteriosclerosis, ipsilateral and contralateral symptoms, treatment type, and clinical outcomes.

CCA0 diagnosis was confirmed by image investigation in symptomatic patients, and was a finding during diagnostic investigation of other conditions or during screening patients with atherosclerosis in other sites in asymptomatic patients.

We entered data into a standard form that was completed for all patients with carotid disease. Descriptive analysis was done by using Microsoft Excel (2010, Humacao, PR). After testing of ranges, an unpaired Student *t*-test was used to compare means and standard deviations. Frequencies were analyzed by using the chi-square test or Fisher exact test. Survival rates regarding associated comorbidities/risk factors, presence of symptoms, and type of treatment were calculated with the use of Kaplan–Meier method. Log-rank test was used

Table 1 Patient demographics, comorbidities/risk factors, and data on lesions in 40 CCAO patients

Parameters	Male (n = 25)	Female (n = 15)	Total (n = 40)	p-Value
Mean age (SD)	63.8 (7.6)	70.4 (6.9)	66.3 (4.7)	0.010
age range (y)	53–75	60–82	53–82	
Mean number of comorbidities (SD)	1.8 (1.2)	2.7 (0.9)	2.9 (1.0)	0.232
Comorbidities (%)				
Hypertension	88.0	93.3	90.0	1.000
Smoking	56.0	46.7	52.5	0.368
Diabetes	40.0	40.0	40.0	0.740
Dyslipidemia	28.0	33.3	30.0	1.000
PVD	28.0	6.7	20.0	0.061
Coronary artery disease	28.0	6.7	20.0	0.061
Chronic renal insufficiency	12.0	0.0	7.5	0.628
Hypothyroidism	0.0	13.3	5.0	0.261
Side of the lesion (%)				
Left	56.0	60.0	57.5	
Right	44.0	33.3	40.0	
Bilateral	0.0	6.7	2.5	0.404
Rile classes (%)				
1A	48.0	53.3	50.0	
1B	36.0	26.7	32.5	
1C	8.0	0.0	2.5	
2	8.0	20.0	12.5	0.564

Abbreviations: CCAO, common carotid artery occlusion; PVD, peripheral vascular disease; SD, standard deviation.

to compare survival distributions. Significant differences were established with $p < 0.05$.

Results

Patient demographic characteristics and comorbidities are described in ►Table 1. Women (37.0%) were significantly older than men (63.0%). We found an isolated comorbidity up to six comorbidities/risk factors associated, but without significant differences between genders concerning the mean number of risk factors. Most patients had hypertension, and more than half of the patients were smokers (52.5%). No significant differences for any comorbidity were found between men and women.

We observed equal numbers of right- and left-sided lesions in both the genders. Half of the sample had 1A lesions based on the Rile classification. Women tended to have more class 2 lesions based on the Rile classification. The mean age of patients in Rile class 2 (71.8 ± 3.9 years) was significantly higher ($p = 0.030$) than that of patients in classes 1A (66.0 ± 9.2 years) and 1B (64.8 ± 6.5 years).

Arteriography was used from 2005 to 2007, computed tomography angiography between 2008 and 2011, and Doppler ultrasonography from the middle of 2012 to 2013 in 100% of the cases.

Contralateral arteriosclerosis was found in 65.0% of the patients (►Fig. 2). Presence of contralateral arteriosclerosis showed nonsignificant negative correlations with age ($r = -0.17$) and number of comorbidities/risk factors ($r = -0.21$).

No ipsilateral symptoms were observed in 50% of the patients overall (55.0% of men and 45.0% of women). Among patients with ipsilateral symptoms (70.0% of men and 30.0% of women; $p = 0.512$), hemiparesis was the most frequent (55.0%), followed by syncope and dizziness (10.0%), hemiplegia (15.0%), amaurosis (10.0%), aphasia (5.0%), and mental confusion after three strokes (5.0%). Contralateral symptoms, in turn, occurred in 17.5% of the patients, including vertebrobasilar symptoms (5.0%), amaurosis (5.0%), syncope (2.5%), transient ischemic attack (TIA, 2.5%), and mental confusion (2.5%). Patients with contralateral symptoms (mean age, 67.6 ± 7.8 years) were significantly ($p = 0.019$) older than those without such symptoms (60.0 ± 5.7 years).

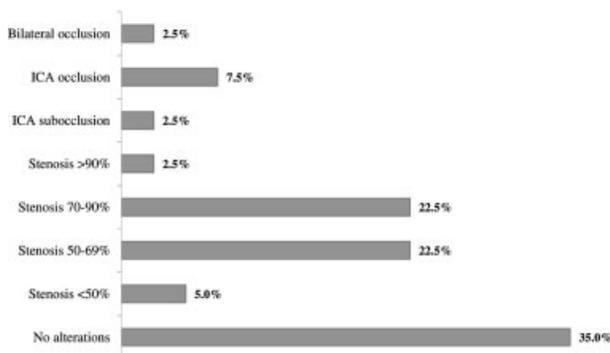


Fig. 2 Contralateral atherosclerosis observed in 40 CCAO patients. CCAO, common carotid artery occlusion.

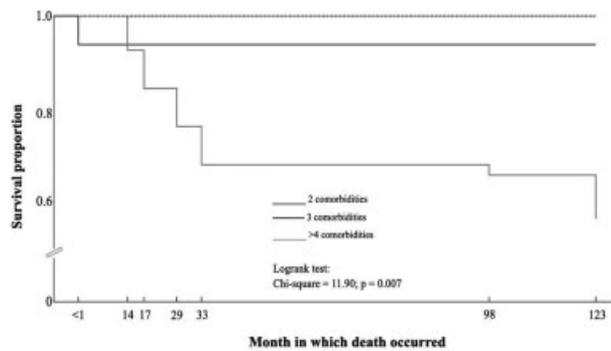


Fig. 3 Kaplan–Meier curves comparing survival proportions according to the number of coexisting comorbidities/risk factors.

Patients were predominantly treated with a medical approach (77.5%). One of these patients declined to undergo the recommended surgical procedure. Eight symptomatic patients (20.0%) had conventional surgical intervention (including conventional endarterectomy [four patients], subclavian-carotid grafts [three patients], and aortic-carotid graft [1 patient]). One of the surgical cases involved bilateral treatment. Neurological symptoms remained stable after surgical treatment. In one patient, an endovascular approach was not successful.

Mean duration of follow-up was 55 ± 43 months (range, 2–136 months). During follow-up, 17.5% of the patients died of different causes: one patient (2.5%) died after hemorrhagic cerebrovascular accident at 4 days after surgery; 7.5% died of acute myocardial infarction (at 23, 98, and 123 months of follow-up). Congestive cardiac insufficiency (2.5%) was the cause of a death at 14 months; ischemic cerebrovascular accident (2.5%), at 17 months; and advanced neoplasia (2.5%), at 29 months. The mean age of patients who died (67.4 ± 9.0 years) was not statistically different ($p = 0.678$) from that of patients who were alive at the end of data collection (66.0 ± 7.9 years). Patients who died had significantly more comorbidities than those who were alive (3.7 ± 0.8 and 2.8 ± 1.0 , respectively; $p = 0.026$), and this finding was confirmed by log-rank test ($p = 0.007$), as demonstrated in ►Fig. 3. Symptoms (►Fig. 4) and type of treatment (►Fig. 5) did not influence patients' risk of death.

Discussion

CCAO is a relatively rare condition, and both its natural history⁷ and recommendations for treatment are still unclear.^{5,6} Few clinical studies have addressed CCAO, and the number of patients studied so far has been insufficient to establish any recommendations. Among the 21 published studies on CCAO treatment, 11 were case reports involving a total of 16 patients.^{8–17} The other 10 studies^{2,18–25} involved 6 to 24 patients, with a total of 130 patients.

Klonaris et al⁷ recently reported that the prevalence of CCAO is higher in men (73%) than in women, a finding similar to our results. The mean patient age in our study is very close to that in the literature (66.3 ± 4.7 [range 41–76 years] and

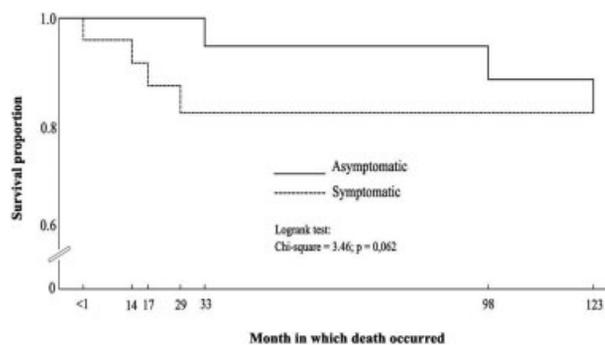


Fig. 4 Kaplan–Meier curves comparing survival proportions for symptomatic and asymptomatic patients.

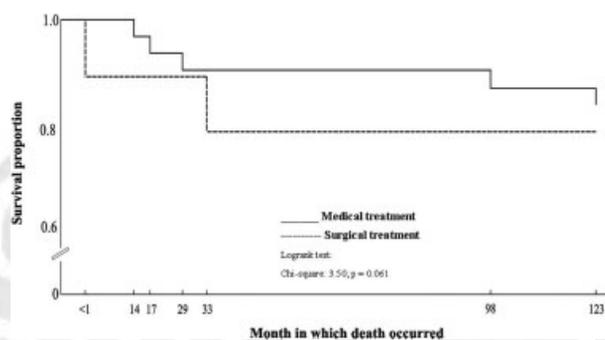


Fig. 5 Kaplan–Meier curves comparing survival proportions according to the type of treatment.

65 ± 6.9 years [range 53–82 years], respectively). We found out that women were significantly older than men, which constitutes a finding that deserves to be added to the current knowledge on CCAO. Almost all patients in our series were hypertensive, and more than half had a history of smoking. The association of such risk factors and extracranial carotid disease is well established.⁵ Our patients had a mean number of 2.9 ± 1.0 associated comorbidities/risk factors, primarily hypertension and smoking.

The majority (94.5%) of the patients reported in the literature⁷ were symptomatic at presentation; TIAs accounted for 57.8% of the cases. In our study, 67.5% of the patients had ipsilateral plus contralateral symptoms; only 2.5% presented with a TIA. Most studies ($n = 11$) were published before 2000, and diagnosis of CCAO has probably changed in the last decade. This can at least in part explain such discrepancies. In addition, studies have focused on surgical treatment of CCAO, which is recommended for symptomatic disease.

Some studies have reported a marked prevalence of left over right CCAO. This finding can be explained by hemodynamic differences between the two common carotid arteries, differences in arterial length, and direct encroachment of aortic plaque into the CCA origin on the left.^{2,3} Although we observed left CCAO in 57.5% of the patients and right CCAO in 40.0%, we could not corroborate such prevalent involvement of the left common carotid artery because no significant difference was found. In a study on the incidence

of anterograde ICA collateral flow in 10 patients with CCAO,³ the right side was occluded in 60%.

Regarding the Rile classification, we found a slightly lower percentage of patients in class 1A (50.0%) and a slightly higher percentage of those in class 1B (32.5%) compared with the literature (61.5 and 26.6%, respectively). This means that most patients with CCAO have patency in both the ipsilateral ICA and external carotid artery (ECA), while about one-third might present with an occluded ICA. Class 1C (an occluded ECA and a patent ICA) occurs far less frequently in both the literature (0%) and in our experience (2.5%). Finally, occlusion of both ipsilateral ICA and ECA has been observed in very similar percentages of approximately 12.0%. Patients of our series with Rile class 2 were significantly older than those with classes 1A and 1B, and female patients tended to have ipsilateral ICA and ECA occluded more frequently than did men. It makes some sense in our experience, as female patients were significantly older than male patients.

Medical treatment was the choice for 77.5% of our patients, as half of them were asymptomatic. Only eight patients underwent traditional revascularization procedures, and an endovascular approach failed in one case. As all available studies concern surgical treatment of CCAO, it is hard to establish a reliable comparison. Among the 146 patients described in the literature, only 2 underwent an endovascular procedure, showing that such approach has not yet been well established for the treatment of CCAO.⁷ In fact, technical difficulties to cross-occlusive lesions and the procedural risks observed with endovascular repair of a few cases of chronic ICA²⁶ allow exclusion of such approach in cases of CCAO, at least for now.

The mean duration of follow-up of this series was longer than that reported in a literature review⁷ (55 ± 43 months and 25.6 ± 11.2 months, respectively), although ranges were quite similar (2–136 months and 2–110 months, respectively). The literature reports only one fatal ipsilateral stroke 4 days after the surgical procedure. In our experience, 17.5% of the patients died between 4 days after surgery and 123 months of follow-up. Congestive cardiac insufficiency was the cause of one death in our series 4 days after traditional intervention as well. Acute myocardial infarction was the main cause of death (7.5%) at 23, 98, and 123 months of follow-up. Patients' age, symptoms, and type of treatment (medical or surgical) were not associated with the fatal outcomes. However, patients who died during follow-up had significantly more comorbidities/risk factors than did those alive at study end.

The clinical outcomes of asymptomatic patients is still unclear, and the traditional interventions recommended for symptomatic patients still bring questionable benefits for asymptomatic patients; although such interventions prevent neurologic events and improve cerebrovascular insufficiency, they are also associated with important rates of complications (6.6–11.1%).

Our study has limitations. This was a retrospective analysis, and the sample is from a tertiary center. It is likely that many patients remain asymptomatic without investigation.

Conclusion

CCAO is a condition strongly related to hypertensive and smoking in male patients. It affects female patients at a more advanced age. The worsening of the occlusion seems to be highly associated with advanced age. Only 50% of the cases are symptomatic, and the main ipsilateral symptom is the hemiparesis, with high frequency of contralateral arteriosclerosis at image examinations but lower frequency of contralateral symptoms. Patient outcomes are not influenced by age, gender, clinical symptoms, or type of treatment, but by the number of associated coexisting comorbidities/risk factors.

Scientific evidence on treatment and evolution of CCAO is still lacking, and extensive multicentric studies would be helpful in providing subsidies for the development of a procedural protocol for such cases.

Conflict of Interest/Funding

None of the authors has any conflict of interest or funding.

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