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Emergency Stenting after Carotid Endarterectomy—A Case Report

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Abstract

Carotid disease is a cause of approximately 20% - 30% of all strokes, so the treatment of symptomatic carotid artery stenosis is an important method in secondary stroke prevention. The first-line treatment option for symptomatic carotid artery stenosis currently is a surgical procedure of carotid endarterectomy (CEA). While CEA is considered a safe and well-explored method of treatment, perioperative stroke has been reported in 3% - 4% of all CEA procedures. We report a case of a 75-year-old patient who was admitted to our department due to the recurrent transitory ischemic attacks, which presented as transitory weakness of right extremities. During initial work-up, MSCT angiography of head and neck vessels showed a subocclusive stenosis of the proximal part of left internal carotid artery (ICA) and two days after the symptom onset, the patient underwent an early CEA of left ICA. In immediate postprocedural period, the patient hyper-acutely developed right hemiplegia as well as sensomotor aphasia. MSCT perfusion showed hypoperfusion of most part of left cerebral hemisphere and MSCT angiography confirmed intraluminal thrombosis and subsequent subocclusion of the left ICA, due to the dissection of the treated part of the vessel and the patient underwent an urgent stenting procedure. Follow-up MSCT scan of the brain showed demarcation of acute ischemic lesion of left parietooccipital region, with small secondary hemorrhagic transition, while follow-up digital subtraction angiography (DSA) showed only marginal residual thrombosis, without significant stent stenosis. With continuous physical and logopedic therapy, satisfactory resolution of neurological deficit was achieved. The patient was discharged with only residual mild paresis of right arm and right homonymous hemianopsia. This case shows rare but possible complication of CEA, and while emergency CAS immediately after CEA may present additional risks and technical challenges, it offers an alternative yet efficient method in treating acute perioperative stroke.

Keywords

Carotid Stenosis, Carotid Endarterectomy, Carotid Artery Stenting, Ischemic Stroke

1. Introduction

Carotid disease is a cause of approximately 20% - 30% of all strokes [1], so the treatment of symptomatic carotid artery stenosis is an important method in secondary stroke prevention. Currently, there are two main treatment methods. The first-line treatment option for symptomatic carotid artery stenosis currently is a surgical procedure of carotid endarterectomy (CEA) [1]-[3]. The second is carotid artery stenting (CAS), an endovascular method usually reserved for patients with comorbidities that could not warrant surgical treatment, patients with unfavorable neck anatomy, patients with contralateral carotid occlusion and as an option in case of restenosis after CEA [2] [3]. While CEA is considered a safe and well-explored method of treatment, perioperative stroke has been reported in 3% - 4% of all CEA procedures [2]. We report a patient who underwent an emergency CAS following periprocedural stroke after CEA.

2. Case Presentation

We report a case of a 75-year-old patient who was admitted to our department due to the recurrent transitory ischemic attacks, which presented as transitory weakness of right extremities, repeated three times on the day of admission. The patient has arterial hypertension and hyperlipidemia in previous medical history. During initial work-up, a MSCT of the brain showed small hypodense aera, which may suggest a small area of hypoperfusion, while MSCT angiography of head and neck vessels showed a subocclusive stenosis of the proximal part of left internal carotid artery (ICA) (**Figure 1**). According to the current guidelines, CEA is the first-line treatment option for symptomatic, 70% - 99% ICA stenosis [3]. Since our patient had symptomatic, as well as hemodynamically significant stenosis, vascular surgeon was consulted, and on the second day of the hospitalization (*i.e.* two days after the symptoms onset), the patient underwent an early CEA of left ICA. Surgical procedure went without intraoperative complications and the patient was clinically without deficit in the first half an hour after the procedure. In immediate postprocedural period, the patient hyper-acutely developed right hemiplegia as well as sensomotor aphasia. Emergency MSCT scan of the brain showed ischemic core in left temporal, posterior frontal, parietal, and occipital region. MSCT perfusion showed hypoperfusion of most part of left cerebral hemisphere and MSCT angiography confirmed intraluminal thrombosis and subsequent subocclusion of the left ICA, due to the dissection of the treated part of the vessel, along with occlusion of left external carotid artery (ECA) (**Figure 2** and **Figure 3**). A multidisciplinary team consisting of neurologist, vascular surgeon and inter-

ventional neuroradiologist decided that the patient should undergo an urgent stenting procedure, which was subsequently done in less than an hour after symptom onset. With the use of two stents (Precise 6 × 30 and Xact 6 × 8 × 30), a complete recanalization of left ICA and ACC (common carotid artery) bifurcation was achieved (Figure 4). The next day, follow-up MSCT scan of the brain showed demarcation of acute ischemic lesion of left front parietooccipital region, with small secondary hemorrhagic transition (Figure 5), while follow-up digital subtraction angiography (DSA) showed only marginal residual thrombosis, without significant stent stenosis (Figure 5). Continuous ECG monitoring showed newly found paroxysmal atrial fibrillation. Because of hemorrhagic transition, the patient was discharged with single antiplatelet therapy of ticagrelor, along with statin and optimal antihypertensive medication. During hospitalization, continuous physical and logopedic therapy was done, with satisfactory resolution of neurological deficit. The patient was discharged hemodynamically stable to continue stationary physical therapy in another institution with only residual mild paresis of right arm and right homonymous hemianopsia.

Figure 1. Initial MSCT angiography: subocclusive stenosis of the proximal part of left internal carotid artery (ICA).

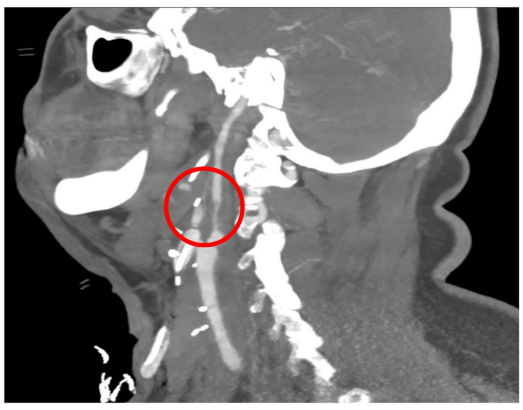

Figure 2. MSCT angiography after CEA: intraluminal thrombosis and subsequent subocclusion of the left ICA, due to the dissection of the treated part of the vessel, along with occlusion of left external carotid artery (ECA).

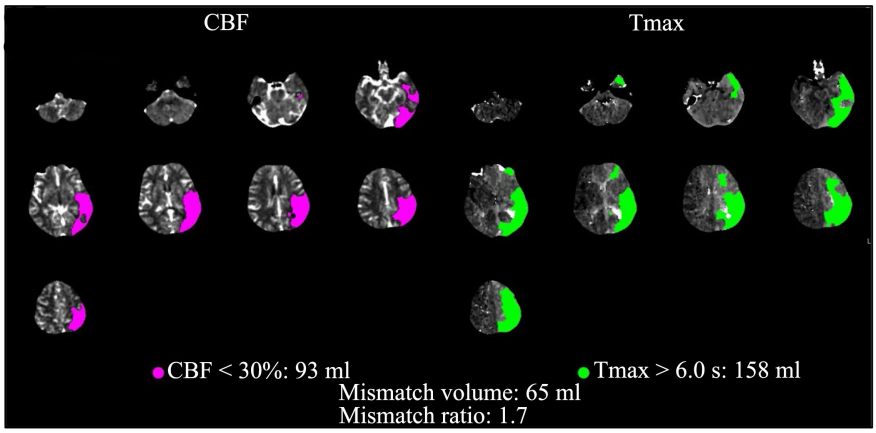

Figure 3. MSCT perfusion of the brain: hypoperfusion of most part of left cerebral hemisphere with good ratio of penumbra and core (mismatch ratio of 1.7).

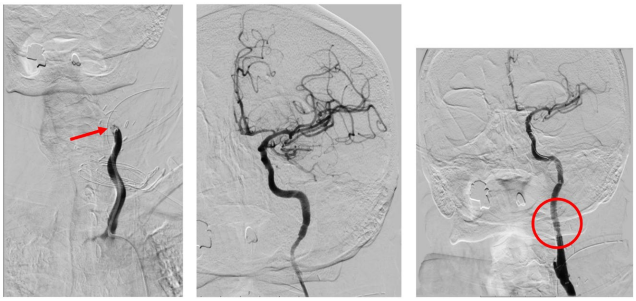

Figure 4. Digital subtraction angiography (DSA): 1) After CEA: periprocedural subocclusion in the treated left ICA (left image), 2) During CAS: after the passage through the occlusion site—intracranially without stenosis (middle image), 3) After CAS: good immediate postprocedural stent patency in the left ICA (right image).

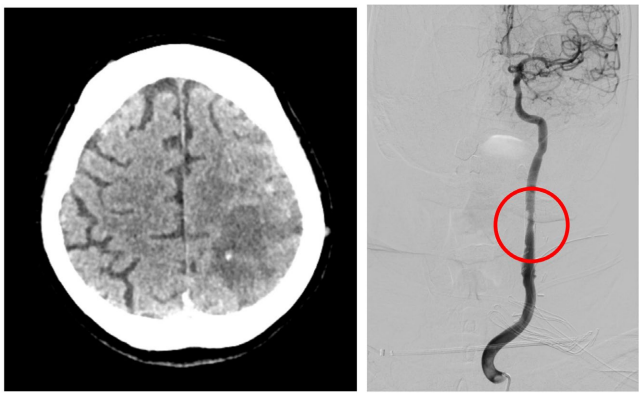

Figure 5. MSCT of the brain day after CAS: demarcation of acute ischemic lesion of left front parietooccipital region, with small secondary hemorrhagic transition (left image). Follow-up DSA day after CAS: only marginal residual thrombosis, without significant stent stenosis (right image).

3. Discussion

In current literature, CEA is deemed a safe, well-known, and effective method for treatment of symptomatic high-grade ICA stenosis [1] [2]. However, in some pa-

pers, perioperative stroke has been reported from 1.5% up to 9% of CEA [1], and in some studies, the percentages vary between 3% - 4% [2]. In terms of general risks of periprocedural stroke after CEA, one study reports the perioperative risk of periprocedural stroke (in the first 30 days) of 2.65% [4], while other studies report the rate of 2.74% [4] and 3.4% [5]. When considering the risk of periprocedural stroke after CEA, the timing of surgery after symptoms onset plays significant role. Various results are reported in current literature in attempt to find an optimal time for undergoing CEA in symptomatic patients. Current consensus is that CEA performed within 14 days of symptoms onset has proven to reduce risk of recurrent stroke [4] [6]. The current evidence suggests that there are slightly increased perioperative risks if CEA is preformed within the first 48 hours of symptom onset, in comparison to later preformed CEA [6] [7].

One study reports 3,1% of in-hospital stroke after ultra-early CEA (in first 2 days after symptoms occurrence), while CEA being performed in the period of 2 - 14 days after initial presentation, the rates of in-hospital stroke/death are 2.5% [7]. Moreover, a study from the Swedish National Registry reports that patients undergoing CEA in the first 48 hours had as much as 4 times increased odds of 30-day stroke or death outcome when compared to patients who underwent CEA between 3 - 7 days [7]. Other studies confirmed that symptomatic patients undergoing urgent CEA (≤2 days) had highest rates of combined stroke/death outcome, in comparison with early CEA done at 3 - 14 days and late CEA done beyond 14 days (urgent 4.1% vs early 3.4% vs late 1.9%), driven primarily by increased rates of stroke (urgent 3.2% vs early 3.0% vs late 1.4%) [6]. Urgent CEA patients had also increased odds of all adverse outcomes, when compared with late revascularization [6]. In contrast to this, there are studies that report that when CEA was done at 3 to 14 days in patients with the premorbid mRS score 0 to 1, they had a higher (although not statistically significant) incidence of stroke/death in comparison with CEA done within ≤2 days (3.6% vs 2.0%) [8]. However, one retrospective review did not report a significant difference in the 30-day risk of stroke/death for CEA performed at <48 hours (2.8%), 3 to 7 days (1.8%), 8 to 14 days (0.8%) and >14 days (0.8%), which was also concurred by other similar retrospective studies (4.4%, 1.8%, 4.4%, and 2.5%, respectively) [6]. In our case, due to the patient's frequently recurring TIA's and the risk of impending stroke being high, we decided, in consultation with surgeons, to preform and early CEA.

In terms of the cause of periprocedural stroke after CEA, study by Anzuini *et al.* reports that thrombosis is the most common cause (56%), while carotid dissection was the cause of 44% of perioperative strokes after CEA [1] [2], as was the case with our patient as well. ICA dissection after CEA occurs probably due to the intimal flap forming mostly due to the poor adherence of intimal endpoint to the outer wall layers [9]. Other possible causes for perioperative stroke after CEA are high (distal) lesions, inadequate distal tapering of endarterectomized plaque, stenosis from patch closure, severe kinking, the need for repair stiches at the distal suture line, etc. [10]. In study by Anzuini *et al.* found that CAS was more effective

than surgical re-exploration in the treatment of periprocedural stroke after CEA, especially if stroke was due to the dissection of the treated vessel, with authors reporting complete regression of neurological deficit in 84.65% of patients who underwent emergency stenting [1], and in our case as well CAS provided rapid successful revascularization and regression of neurological deficit. The main reason for CAS benefit in those cases most likely lays in reduced risk of distal embolization because thrombus was already removed [9] [10]. In addition, attempts at surgical correction can be technically difficult, time-consuming, requiring unnecessary prolonged anaesthesia time, as well as increasing the risk of complications, mostly regarding the higher risk for cranial nerve injury [10]. However, CAS is not without its risks and limitations. Current literature states that CAS bears higher risk of minor stroke in the periprocedural and early postprocedural period, as well as higher restenosis rate, as compared to CEA [11]. Also, stent placement is inadvisable in older patients, in case of severe vessel tortuosity, and in the presence of calcified carotid bifurcation, as well as long, complex lesions [12]. Nevertheless, one study reports excellent results in 13 cases of immediate CAS after unsatisfactory CEA results of total 316 CEA patients (4.1%), with no stenting complications at 30 days or significant restenosis during 15-month follow-up [2]. Similar results are reported in another study in which 14 patients underwent immediate CAS following stenosis (10) and dissection (4) after CEA. All 14 patients had no CAS-related complications [2].

Promising results of emergency CAS in a study by Anzuini *et al.* were also attributed to the fact that the time between onset of periprocedural stroke and stenting was only from 30 to 70 minutes, with this rapid revascularisation contributing to satisfactory results of emergency stenting [1]. In our case, CAS was done in the first hour after the onset of newly developed hemiplegia, which surely contributed to the satisfactory outcome for our patient. This corresponds to one large-scale study that reported results of 34 (0.6%) emergency CAS procedures (out of total of 5012 CEA surgeries over 8-year period) done patients in whom there was unsatisfactory result of CEA. With rapid intervention and limitation of ischemia time, at median of 12-month follow-up, none of the patients have had any neurological symptoms or hemodynamically significant stent stenosis [2].

4. Conclusion

In our center, both CEA and CAS are done routinely, and this is the first time we had this type of immediate complication after either of these procedures. This case shows rare but possible complication of CEA, highlights the importance of close monitoring of patients during immediate postoperative period and shows the benefit of prompt intervention in form of CAS in this acute setting. Both surgical re-exploration and CAS can be used to effectively treat stroke after CEA, and the decision should be made by a multidisciplinary team. While emergency CAS immediately after CEA may present additional risks and technical challenges, it offers an alternative yet efficient method in treating acute perioperative stroke. Nevertheless, more

research and bigger studies are needed in the future on this interesting topic to provide a clearer insight regarding the choice of the treatment method for stroke after CEA.

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Ethical Statement

The patient has given consent to publish this article.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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