

SHORT REPORT

KISA RAPOR

STRIATOCAPSULAR INFARCTS FOLLOWING MECHANICAL THROMBECTOMY

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ABSTRACT

The term striatocapsular infarct (SCI) is used for the large subcortical infarcts occurring in the areas supplied by more than one lenticulostriate artery (LSA). In recent years, especially with the successful treatment of intracranial large vessel occlusions with mechanical thrombectomy, the definition of isolated striatocapsular infarction (iSCI) has been used in the literature. iSCIs are defined as limited infarcts to the striatocapsular region, which are not accompanied by more distal ischemia areas supplied by the middle cerebral artery (MCA). With the observation of iSCI cases after successful mechanical thrombectomy studies, the question of "whether are these infarcts a deficiency of mechanical thrombectomy or an indication of successful recanalization" has come up. In this report, we present three cases of ischemic stroke with striatocapsular infarction who presented with a large vessel occlusion clinic and were treated successfully with mechanical thrombectomy.

Keywords: Mechanical thrombectomy, striatocapsular infarction, diffusion MRI.

MEKANİK TROMBEKTOMİ SONRASI GÖZLENEN STRİATOKAPSÜLER İNFARKTLAR

ÖZ

Striatokapsüler infarkt terimi (SCI) birden fazla lentikulostriat arter (LSA) sulama alanında meydana gelen geniş subkortikal infarktlar için kullanılmaktadır. Son yıllarda, özellikle de intrakraniyal büyük damar oklüzyonlarının mekanik trombektomi ile başarılı bir şekilde tedavi edilmesiyle birlikte, izole striatokapsüler infarkt (iSCI) tanımı da literatürde kullanılmaya başlanmıştır. iSCI'lar, orta serebral arterin (MCA) sulama alanının daha distalindeki iskemilerin eşlik etmediği, striatokapsüler bölgeye sınırlı infarktlar olarak tanımlanmaktadır. Başarılı mekanik trombektomi çalışmalarından sonra iSCI olgularının gözlenmesiyle birlikte "Bu infarktlar mekanik trombektominin bir yetersizliği mi veya başarılı rekanalizasyonun bir göstergesi mi?" sorusu gündeme gelmiştir. Bu yazımızda büyük damar oklüzyonu kliniği ile başvuran ve mekanik trombektomi ile başarılı bir şekilde tedavi edilmesine rağmen striatokapsüler infarkt gelişen üç iskemik inme olgusu tartışılmıştır.

Anahtar Sözcükler: Mekanik trombektomi, striatokapsüler infarkt, diffüzyon MRG.

INTRODUCTION

In stroke cases developed due to large vessel occlusion, blood supply to the brain tissue distal to occlusion may continue for a much longer time, if the individual has sufficient collateral circulation (1,2). Thus, preventing the development of time-dependent tissue injury, adequate collateral blood flow can increase the chance of effective mechanical thrombectomy (3). Unfortunately, not all regions of the brain have adequate collateral

blood flow support. For example, the basal ganglia, especially the striatum and its adjacent white matter, often provide blood flow from the lenticulostriate perforating arteries. These arteries are end arteries and do not anastomose with other vessels (4-6), and it is difficult to visualize them with CTA and MRA but they can be visualized with DSA. For such reasons, these arteries are very sensitive to vascular changes. If a thrombus in the

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proximal segment (in the origin of MCA M1) of the middle cerebral artery occludes the origin of the LSAs, it almost always results in SCI. Even if complete recanalization is achieved with mechanical thrombectomy, ischemia is high likely to develop in the striatocapsular region. Prospective randomized controlled studies on the success of mechanical thrombectomy in large vessel occlusions have shown that IV thrombolysis alone is superior (7-11). However, it has been suggested that mechanical thrombectomy has some limitations in the capacity to save ischemic tissue, regardless of the duration of the intervention. This especially applies for basal ganglia and surrounding subcortical tissue, which lack collateral circulation (12). However, it has been suggested that SCIs have a good clinical prognosis, even if they are observed before or after successful mechanical thrombectomy. Therefore, it has been suggested that SCIs may be an indicator of successful mechanical thrombectomy. In this article, cases of striatocapsular infarct that are increasingly defined in cases where complete recanalization is achieved with successful mechanical thrombectomy after large vessel occlusion are discussed. Informed consent was signed by all patients for this report.

CASE 1

A 54-year-old female patient presented to the emergency unit of another center with the complaints of right arm-leg weakness and lisp. The speech disorder complaint of the patient, whose lateral weakness recovered an hour after the onset, continued decreasingly. The patient with detected acute diffusion restriction was detected in left temporoparietal region on diffusion sequence MRI imaging was discharged with medical treatment (100mg acetylsalicylic acid). The next day, the patient with persistent speech disorder continued was admitted to the neurology outpatient clinic. The patient who was admitted to the ward with the diagnosis of acute ischemic stroke had complaints of right side weakness and inability to speak at around 8 pm on the second day of her hospitalization. On the same day, she was admitted to our clinic at 22.30 in the evening for mechanical thrombectomy. The preoperative neurological examination revealed that motor-speech was aphasic, the right nasolabial groove was obliterated, the muscle strength of the right

upper and lower extremities was 2/5, the right deep tendon reflexes (DTR) were intact and the right plantar response was extensor. The patient's preoperative NIHSS score was 17, and ASPECTS score was 8. The patient was transferred to the angiography unit two hours and forty-five minutes after the event. It was observed during the procedure that the M1 segment of the left MCA was totally occluded. Successful recanalization was achieved at the second pull with the retracted stent (Catch 4x20 mm). The general condition of the patient was good after the procedure, the neurological examination showed that the speech was dysarthric, the muscle strength of the right lower extremity was 4 + / 5, and the muscle strength of the other extremities was full (5/5). Diffusion restriction was detected in the left temporoparietal and striatocapsular region on the follow-up diffusion sequence MR imaging taken at the 24th hour after thrombectomy. The NIHSS score decreased to 4 postoperatively and to 1 at discharge; the MRS score was found to be 1 at the time of discharge. The patient was initiated on Clopidogrel 75 mg/g and acetylsalicylic acid 300 mg/d as the medical treatment. No additional neurological pathology was found at discharge. The patient's preoperative and postoperative classical angiography and diffusion MR images are shown in Figure 1.

CASE 2

A one-month pregnant 32-year-old female patient presented to our emergency unit with the complaints of right arm-leg weakness and inability to speak. Her relatives stated that the last time the patient was fine was around 13:50. The brain CT of the patient admitted to the emergency department within 15 minutes showed hyperdensity in the M1 segment of the left MCA (dense MCA sign) and her diffusion MR imaging showed acute diffusion restriction in the left basal ganglion area. The pre-procedure neurological examination revealed that speech-motor was aphasic, the right nasolabial groove was obliterated, the muscle strength of the right upper and lower extremities was 2/5, the right deep tendon reflexes (DTR) were intact, and the right plantar response was extensor. The patient's preoperative NIHSS score was 14, and ASPECTS score was 10. The patient was transferred to the angiography unit two hours after the event. It was observed during the



Figure 1. *Acute diffusion restriction is seen in the left temporoparietal and striatum on ADC (a) and Diffusion MR (b). On classical angiography, occlusion is seen in the left MCA M1 segment (c) before thrombectomy and recanalization is seen in the M1 segment (d) after thrombectomy.

procedure that the M1 segment of the left MCA was totally occluded. Successful recanalization was achieved at the second pull with the retracted stent (Catch 4x20 mm). The general condition of the patient was good after the procedure and on the neurological examination, her speech was slightly dysarthric, and the muscle strength of all extremities was found full (5/5). The current pregnancy status of the patient was consulted with the obstetrics, and pregnancy was terminated. Acute ischemic changes were noted in the left striatocapsular region on the follow-up brain CT scan taken at the 24th hour after thrombectomy. The NIHSS score decreased to 4 postoperatively and to 1 at discharge; the MRS score was found to be 1 at the time of discharge. The patient was initiated on Clopidogrel 75 mg/g and acetylsalicylic acid 300 mg/d as the medical treatment. No additional neurological pathology was found at discharge. Preoperative and postoperative classical angiography and unenhanced brain CT images, and preoperative diffusion MR images are shown in Figure 2.

CASE 3

A 58-year-old female patient presented to our emergency unit within 45 minutes with mental fog, speech disorder and right side weakness that suddenly developed at noon hours. The cranial tomography of the patient showed hyperdensity (dense MCA sign) in the M1 segment of the left MCA. The patient was transferred to the angiography unit one hour and 45 minutes after the event. The pre-procedure neurological examination revealed that speech-motor was aphasic, the right nasolabial sulcus was obliterated, the muscle strength of right upper and

lower extremities was 0/5, right hemihypoesthesia was present, and the right plantar response was extensor. The patient's preoperative NIHSS score was 16, and ASPECTS score was 10. It was observed during the procedure that the M1 segment of the left MCA was totally occluded. Successful recanalization was achieved at the second pull with the retracted stent (Catch 4x20 mm). The general condition of the patient was good after the procedure and on the neurological examination, her speech was normal, and the muscle strength of all extremities was full (5/5). Acute ischemic changes were noted in the left striatocapsular region on the in follow-up diffusion MR imaging taken at the 24th hour after thrombectomy. After the procedure, her NIHSS score and MRS score decreased to 0. Since the patient had rheumatic heart disease (moderate mitral stenosis) in her medical history, she was initiated on rivaroxaban 20 mg. No additional neurological pathology was found at discharge. Her preoperative and postoperative classical angiography images, preoperative unenhanced brain CT images, and postoperative diffusion MR images are shown in Figure 3.

DISCUSSION AND CONCLUSION

Here we presented three cases of SCI following successful thrombectomy performed using retracted stents.

Even with complete recanalization (TICI 3) after thrombectomy, ischemic injury may occur in some areas with insufficient collateral circulation, especially in and around the basal ganglia. While SCIs are rarely reported before thrombectomy, it has been stated in recent publications that the rate of its incidence is increasing with successful

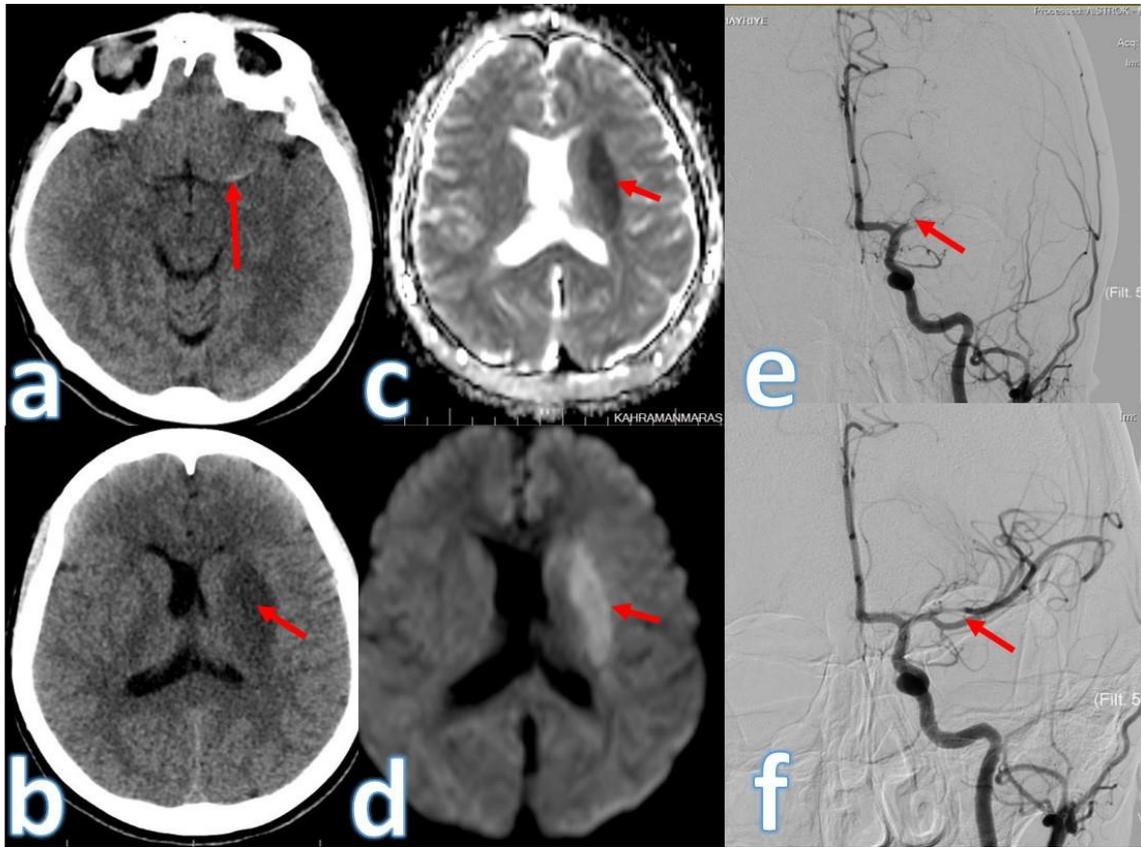


Figure 2. *Dense MCA sign (a) is seen on unenhanced cranial CT before thrombectomy and hypodense area is seen in left striatum (b) after thrombectomy. *Acute diffusion restriction is seen in the left temporoparietal and striatum on ADC (c) and Diffusion MR (d). *On classical angiography, occlusion is seen in the left MCA M1 segment (e) before thrombectomy and recanalization is seen in the M1 segment (f) after thrombectomy.

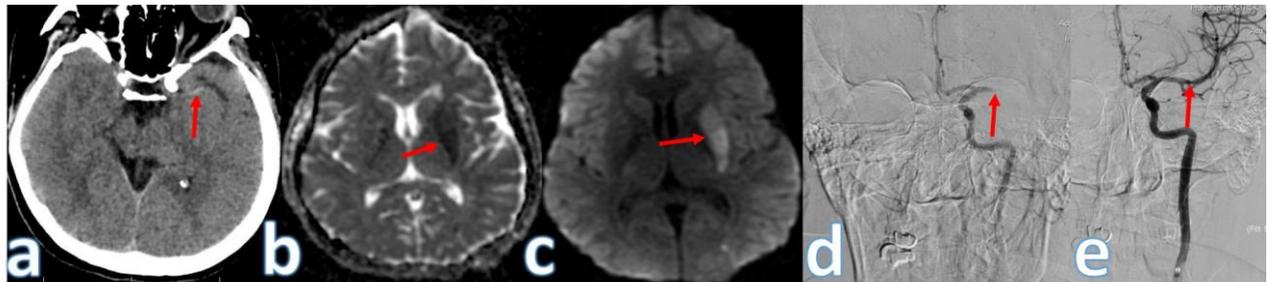


Figure 3. *Dense MCA sign (a) is seen on unenhanced cranial CT before thrombectomy. *Acute diffusion restriction is seen in the left temporoparietal and striatum on ADC (b) and Diffusion MR (c). *On classical angiography, occlusion is seen in the left MCA M1 segment (d) before thrombectomy, and recanalization is seen in the M1 (e) after thrombectomy.

thrombectomy studies. Striatocapsular infarcts occur as a result of ischemia of the LSAs, that is the end arteries, and they frequently accompany the proximal occlusion of middle cerebral arteries, as in our cases (13). They are divided into two groups as non-isolated striatocapsular infarcts (non-iSCI)

and isolated striatocapsular infarcts (iSCI) according to the presence or absence of ischemia further distal to the middle cerebral artery watershed area (14). Two of our patients had diffusion MRI findings consistent with iSCI one had diffusion MRI findings consistent with non-iSCI. In

addition, acute diffusion restriction was visualized in the striato capsular regions on diffusion MRI before mechanical thrombectomy in one of iSCI cases and after the procedure in the other.

While the development of infarct in the distal of the middle cerebral artery watershed area is dependent on both the reperfusion efficiency and the intervention time, striatocapsular infarcts occur dependent neither on the time nor on the reperfusion efficiency. Ischemic injury may occur in the origin of LSAs, depending on the extent of thrombus in the middle cerebral artery. In their study, Friedrich et al. measured the distance of the thrombus to the carotid-T region by CT and MR angiography in patients with middle cerebral artery occlusion. They suggested that the thrombus distance they obtained (DT: Distance to Thrombus) had high sensitivity and specificity in predicting the formation of striatocapsular infarct that may develop subsequently. According to this study, as the distance thrombus (DT) increases, the risk of ischemic affection of LSAs decreases; as the distance gets shorter, almost all of the LSAs are affected (15).

Considering the studies on iSCIs, it was found that these infarcts were rarely observed before successful mechanical thrombectomy treatment, and their prevalence was reported to be less than 0.01-6% (16,17). Although in recent studies, clinical researchers have reported that the prevalence of iSCI cases after thrombectomy is gradually increasing with the widespread use of mechanical thrombectomy, a large prevalence study has not yet been conducted. The fact that successful reperfusion is often accompanied by cases of iSCI, raised the idea that iSCIs could be an indicator of mechanical thrombectomy efficacy (14).

A retrospective study analyzed 206 patients with isolated middle cerebral artery infarct, who were successfully treated with mechanical thrombectomy but developed striatocapsular infarct due to LSA involvement. It was found that 53 (25.7%) of these patients had iSCI and 153 (74.3%) of them had non-iSCI. When patients with iSCI and patients with non-iSCI were compared in terms of treatment efficacy and prognosis, it was found that patients with iSCI had more successful reperfusion rates and better collateral circulation. In addition, it was determined that the short and mid-term clinical course of patients with iSCI was quite good and that this patient group had more

neurological improvement (14). Similar to this study, it was a notable finding that the clinical course of patients with iSCI was better in our cases.

Another important issue here is that the detection of ischemic changes in striatocapsular areas in imaging studies (in diffusion MRI) before mechanical thrombectomy is not an obstacle to the success of mechanical thrombectomy. In such cases, the goal is the parenchymal tissue distal to the watershed area of the middle cerebral artery, which are still recoverable areas. Therefore, initiating mechanical thrombectomy treatment as soon as possible affects mortality and morbidity significantly in these patients (12). In brief, as in our second case, the detection of iSCIs in pre-interventional imaging studies should not be considered as an absolute contraindication for mechanical thrombectomy.

In conclusion, iSCI formation in patients with proximal middle cerebral artery occlusion with intact collaterals can be considered both a deficiency of mechanical thrombectomy and an indicator of successful recanalization. Considering the widespread use of mechanical thrombectomy in clinical practice, it is high likely that the incidence of this stroke pattern, as well as its awareness by clinicians, is rapidly increasing. As in our patients, the prognosis is generally thought to be good.

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Sahin et al.

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Ethics

Informed Consent: Informed consent form was signed by the patients.

Copyright Transfer Form: Copyright Transfer Form was signed by the authors.

Peer-review: Internally peer-reviewed.

Authorship Contributions: Surgical and Medical Practices: HS, MG, Concept: TG, Design: TG, Data Collection or Processing: HS, MG, Analysis or Interpretation: HS, MG, Literature Search: HS, MG, Writing: HS, MG.

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