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Research Article

CAN PATIENTS WITH EYE DEVIATION AND CONTRALATERAL HEMIPARESIS BE TAKEN DIRECTLY TO THE ANGIOGRAPHY SUITE?

GÖZ DEVİASYONU VE KONTRALATERAL HEMİPAREZİSİ OLAN HASTALAR DOĞRUDAN ANJİYOGRAFİ ODASINA ALINABİLİR Mİ?

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ABSTRACT

Objective: Eye or head deviation accompanied by contralateral hemiparesis or hemiplegia is common in patients with large vessel occlusion, as it indicates frontoparietal lobe damage. This study aimed to investigate the frequency of large vessel occlusion in patients presenting with eye or head deviation accompanied by contralateral hemiparesis or hemiplegia.
Materials and Methods: Patients with contralateral hemiparesis or hemiplegia accompanied by eye or head deviation who were admitted to our emergency department between January 2018 and January 2020 were retrospectively evaluated and included in the study. Patients diagnosed with ischemic stroke due to large vessel occlusion and who underwent mechanical thrombectomy were identified.
Results: A total of 164 patients were included in the study, eight of whom were diagnosed with intracranial hemorrhage. Thus, 95.1% of patients presenting with these symptoms had an ischemic stroke. Mechanical thrombectomy was performed in 93.9% of patients presenting with these symptoms to the emergency department and in 98.7% of patients diagnosed with ischemic stroke. Successful reperfusion (mTICI ≥ 2b) was achieved in 92.8% of patients, and good functional outcomes (mRS ≤ 2) were observed in 39.6% of patients at discharge. The symptomatic intracranial hemorrhage rate was 5.1%, while mortality was 14.2%.
Conclusions: This study suggests that contralateral hemiparesis or hemiplegia accompanied by eye or head deviation is highly indicative of large vessel occlusion. Patients with these symptoms can be admitted directly to the angiography suite in appropriate centers.

Keywords: Acute Stroke, Angiography Suite, Cerebral Angiography, Thrombectomy

ÖZET

Amaç: Kontralateral hemiparezi/hemiplejinin eşlik ettiği göz/baş deviasyonu, frontoparietal lob hasarına işaret etmesi nedeniyle büyük damar tıkanıklığı olan hastalarda sık görülür. Bu çalışmada kontralateral hemiparezi/hemiplejinin eşlik ettiği göz/baş deviasyonu olan hastalarda büyük damar tıkanıklığı sıklığını araştırmayı amaçladık.
Materyal ve Metot: Ocak 2018 ile Ocak 2020 tarihleri arasında acil servisimize başvuran kontralateral hemiparezi/hemipleji ile birlikte göz/baş deviasyonu olan hastalar retrospektif olarak değerlendirildi ve

çalışmaya dahil edildi. Büyük damar tıkanıklığına bağlı iskemik inme tanısı ile mekanik trombektomi uygulanan hastalar belirlendi.
Bulgular: 164 hasta çalışmaya dahil edildi. Sekiz hastaya intrakraniyal kanama tanısı konuldu. Bu nedenle bu klinikle başvuran hastaların %95,1'i iskemik inme geçirmişti. Acil servise bu semptomlarla başvuran hastaların %93,9'una, iskemik inme tanısı alan hastaların ise %98.7'sine mekanik trombektomi işlemi uygulandı. İşlem sonunda hastaların %92,8'inde başarılı reperfüzyon (mTICI ≥ 2b) sağlandı ve taburculukta hastaların %39,6'sında iyi fonksiyonel sonuçlar (mRS ≤ 2) gözlendi. Semptomatik intrakraniyal kanama oranı %5,1 iken, mortalite %14,2 idi.
Sonuçlar: Bu çalışmada, göz ve/veya baş deviasyonunun eşlik ettiği kontralateral hemiparezi/hemiplejinin yüksek oranda büyük damar tıkanıklığının göstergesi olabileceği ve bu kliniğe sahip hastaların uygun merkezlerde doğrudan anjiyografi odasına alınabileceği kanaatindeyiz.

Anahtar kelimeler: Akut inme, Anjiografi odası, Serebral anjiografi, Trombektomi

Introduction

Mechanical thrombectomy is the most important treatment for ischemic stroke due to large vessel occlusion (LVO) and early recanalization produces good results (1). Although door-to-puncture (DTP) and puncture-to-recanalization (PTR) times have decreased over the past 15 years, there has been no significant change in symptom onset-to-door (OTD) time (2). Despite all efforts, the lack of expected improvement in OTD time has led to a focus on door-to-recanalization (DTR) time. As the symptom-recanalization time increases, the probability of regaining a good functional outcome gradually decreases, resulting in an approximately 26% decrease in good functional outcome for every 30 minutes of delay (3). Therefore, rapid transfer to the angiography suit will contribute to improvement in functional results.

Contralateral hemiparesis/hemiplegia accompanied by eye/head deviation suggests frontoparietal lobe damage and an indicator of larger hemispheric damage (4-6). It is noteworthy that the rate of LVO detection increases in scales on which eye deviation and hemiparesis are present together, among the scales used for pre-hospital LVO detection (7-10). In the literature, studies aiming to investigate direct transfer to the angiography unit have mostly focused on the 'The Rapid Arterial Occlusion Evaluation Scale' (RACE) (9) and National Institutes of Health Stroke Scale (NIHSS) (11-15). Although these scales include eye deviation and motor weakness, there is limited literature suggesting that contralateral hemiparesis/hemiplegia accompanied by eye/head deviation may indicate large vessel occlusion independent of other findings.

There is a need for an indicator of large vessel occlusion that can be easily and quickly detected in the emergency department. Therefore, we aimed to investigate whether contralateral hemiparesis/hemiplegia accompanied by eye and/or head deviation can indicate large vessel occlusion.

Material and method

In this retrospective cohort study, cases admitted to the emergency department within the first 24 hours from the onset of symptoms in the last 2 years (1 January 2018 - 1 January 2020) with contralateral hemiparesis/hemiplegia accompanied by eye/head deviation were evaluated. Patients who did not present within the first 24 hours of symptom onset, patients with a previous history of stroke, patients with previously known eye movement defects were excluded from the study. One stroke neurologist and one interventional neurologist independently reviewed the neurological examination of all patients to determine the presence of eye/head deviation and contralateral hemiparesis/hemiplegia at admission. All patients included in the study received a non-contrast brain computed tomography (CT), and if no bleeding was detected, then they underwent contrast-enhanced brain and neck CT angiography (CTA). LVO was detected in CTA and digital substruction angiography (DSA). Demographic data including age, sex, medical history, risk factors and baseline NIHSS, onset-to-admission imaging time, onset-to-treatment time, presence of clinical eye or/and head deviation and moderate or severe hemiplegia on the baseline neurologic examination, modified Rankin Scales (mRS) at 90 days were collected from the interventional database.

The patients who underwent thrombectomy were divided into four groups regarding their presentation (eye deviation and moderate hemiparesis (3/5 muscle strength on neurological examination), eye-head deviation and moderate hemiparesis, eye deviation and severe hemiparesis (0-2/5 muscle strength on neurological examination), eye-head deviation and severe hemiparesis.

After the data obtained from the study were coded, they were analyzed using the SPSS (Version 22.0, SPSS Inc., Chicago, IL, USA) package program. Continuous variables with normal distribution were expressed as mean ± standard deviation, while continuous variables with non-normal distribution were expressed as median (minimum- maximum), and

categorical data were expressed as numbers (%). In statistical analyses, the conformity of the measurement variables to the normal distribution was evaluated with the Kolmogorov-Smirnov test. Kruskal-Wallis and Mann-Whitney U tests were used to compare continuous variables that did not fit the normal distribution. Correlation coefficients were determined by Spearman correlation test. Statistical significance level was accepted as $p < 0.05$ for all tests.
This study was approved by the local ethics committee.

Results

A total of 164 patients with contralateral hemiparesis/ hemiplegia accompanied by eye and/or head deviation who presented to the emergency department within the specified date range were included in the study. Among 164 of these patients, eight of them were diagnosed with intracranial hemorrhage. Moreover, two of these patients had M3 occlusion and were not eligible for endovascular treatment. IV tPA was administered for two cases with M3 occlusion.
A total of 154 acute ischemic stroke (AIS) patients (age, 70.7 ± 9.8 years; men, 85 (55.2%) treated with mechanical thrombectomy were identified. There was a higher proportion of males in the LVO group (55.2% versus 44.8%), but this difference was not statistically significant. Median NIHSS at admission was 14 (range: 5–25), and initial median CT ASPECT score was 8. Successful reperfusion (mTICI 2b-3) at the end of the procedure was achieved in 143 patients (92.8%). Functional independence (mRS 0–2) at 90 days was achieved in 39.6% (61/154) patients. Intravenous (IV) tissue plasminogen activator (tPA) was given in 72/154 patients (46.7%). Average symptom onset to door time, door to groin puncture time and procedure time from groin puncture to recanalization were seen 201.5 ± 70.4 min, 26.7 ± 16.7 min, 25.7 ± 12.6 min, respectively. Eight patients (5.1%) had a symptomatic hemorrhage, and 50 cases (32.4%) had an asymptomatic hemorrhage. The mortality rate was 14.2%. The cardioembolic source was the cause of stroke in 55.1% (85/154) of the cases, large vessel atherosclerosis in 12.7% (20/154) and cryptogenic or other causes were observed in 31.8% (49/154) of the cases. We identified internal carotid artery or / and MCA M1 occlusion in 138 (89.6%) of the patients and M2 occlusion in 12 (7.7%) patients, M3 occlusion in 2 (1.2%) patients, basilar artery occlusion in 2 (1.2%) patients and PCA P1 occlusion in 2 (1.2%) patients. Eye/head deviation and hemiparesis/hemiplegia relation with the occlusion region are indicated in Table 1. No statistical difference was found between these groups. Eight patients with intracranial hemorrhage. Of the 154 patients, 150 presented with eye/head deviation and simultaneous contralateral hemiparesis/ hemiplegia due to an anterior system stroke, while four patients had a posterior system stroke. 4% of the anterior system strokes were right-hemispheric, and 46% of them presented with a left hemisphere stroke. No statistically significant difference was detected between right and left hemispherical strokes. The demographic and clinical characteristics of the study population are summarized in Table 2.

Discussion

A total of 164 patients presenting to the emergency service within the first 24 hours of onset and who presented with contralateral hemiparesis / hemiplegia accompanied by eye / head deviation on examination were determined. Among these 164 patients, eight were diagnosed with intracranial hemorrhage. Therefore 95.1% of patients presenting with this clinic had an ischemic stroke. Moreover, two of these patients had M3 occlusion and were not eligible for endovascular treatment. Besides, a mechanical thrombectomy procedure was performed in 93.9% of these patients who were admitted with these symptoms to the emergency department and 98.7% of patients with ischemic stroke presenting with this symptoms. Patients with eye deviation and contralateral hemiparesis upon admission to the emergency department, can be transfer directly to the angiography suit to improve workflow times, including door-to-groin and onset-to-groin time.
Time to reperfusion is one of the most important indicators of good clinical outcome and mortality after thrombectomy (1,16). Several targets have been defined to regulate system processes in the implementation of mechanical thrombectomy, including symptom onset to door, door-to-puncture (DTP), imaging to puncture, and procedure times. Despite these efforts, delays in pre-hospital care from the onset of symptoms to arrival at the hospital door time still persist (2). Some scores have been developed to predict stroke due to large vessel occlusion and it has been reported that these scores can be used for rapid transfer of patients to appropriate stroke centres. Direct transfer of patients with suspected LVO to stroke centres where mechanical thrombectomy can be performed may shorten the LVO (10). On the other hand, in recent years, the idea of referring patients with suspected large vessel occlusion directly to the angiography unit without computed tomography has emerged, thus shortening the DTP time. According to recent literature, direct transfer to the angiography unit seems to be a feasible and safe strategy to improve functional outcomes in patients undergoing endovascular treatment (12-15). In studies evaluating direct transfer to the angiography suite, the NIHSS and RACE scores were mostly used in patient selection (13-16). Pfaff et al. evaluated the effect of direct transfer to the angiography suite in patients with NIHSS > 7 (13). On the other hand, Requena et al. defined the inclusion criteria as RACE > 4 and NIHSS > 10 in their study (14). Race score is a scale that can be used by paramedics in the prehospital period to predict large vessel occlusion and was first

described in 2014. It includes facial paralysis (score 0-2), arm motor function (0-2), leg motor function (0-2), gaze (0-1) and aphasia or agnosia (0-2) (9). Both NIHSS and RACE scores include eye deviation and limb weakness. However, they also include additional findings such as facial weakness and difficult to understand findings such as aphasia. On the other hand, scoring varies according to the severity of eye deviation and weakness. This multi-subtitled and severity-dependent version of the NIHSS and Race score may be confusing for emergency healthcare professionals who do not routinely use these scoring systems in the busy emergency department. The same problems may be encountered in the pre-hospital period by paramedics.

It has been known for many years that the frontal cortex is involved in eye movements. However, recent studies have reported that frontal, parietal, temporal, occipital lobes and subcortical fibres connecting them with the brain stem and cerebellum have very important roles in the motor control of eye movements (17). Although the medial frontal lobe is primarily responsible for conjugated eye movements, eye deviation can be observed in case of damage to this region or its connections, including cortico-pontin projections, thalamus, parietal lobe, or para-pontine reticular formation (18). Eye deviation which can be observed in both anterior and posterior system strokes, has been reported between 14-33% in patients with acute stroke, which may be associated with LVO (18,19). In a study by Tijssen CC et al., eye deviation is reported to be associated with the serious neurological deficit (20). Furthermore, hemiparesis is one of the most important findings for the NIHSS assessing stroke severity. Eye deviation can also be seen in intracranial hemorrhage with a rate of approximately 45% (21). However, hemorrhagic stroke accounts for only 13% of all strokes. Thus, only 5% of patients with a diagnosis of stroke and eye deviation will be diagnosed with hemorrhagic stroke. In our study, this rate was found to be 4.9% as expected. In our study, both the presence or absence of head deviation accompanying eye deviation and the severity of hemiparesis were not statistically associated with the occlusion region. In the light of previous studies and our current observation, contralateral hemiparesis/hemiplegia accompanied by eye/head deviation may be indicative of ischemic stroke due to LVO. Currently, it would be reasonable to recommend that patients with acute stroke be transferred directly to the angiography suite in the early setting, and this approach may reduce door-to-groin and door-to-recanalization time (15). Patients with eye deviation and contralateral hemiparesis upon admission to the emergency department, transferring directly to the angiography unit will significantly shorten the recanalization time.

There are some limitations of our study. The retrospective design of the current study is one of the limitations. Due to a small sample size we could not perform sensitivity or specificity analysis. In addition, a selection bias could not be ruled out and larger studies may be needed.

Conclusion

The clinical eye/head deviation concomitant with contralateral hemiparesis/ hemiplegia may be a clinical indicator of a large vessel occlusion. These findings are easy to recognise by paramedics and patients with these findings can be transferred directly to a comprehensive stroke centre. On the other hand, these patients may be transferred directly from the emergency department to the angiography suite.

TABLES

Table 1: Eye / head deviation and hemiparesis / hemiplegia relationship with occlusion region

ICA: internal carotid artery, MCA: middle cerebral artery, PCA: posterior cerebral artery, $p<0.05$

Occlusion region	Eye deviation and moderate hemiparesis	Eye/head de-via-tion and mod-erate hemiparesis	Eye deviation and severe hemipare-sis	Eye/head de-vi-ation and severe hemi-paresis	P
ICA or/and MCA M1 (n=138)	28 (17.9 %)	44 (28.2%)	32 (20.5%)	34 (21.8%)	0.056
MCA M2 (n=12)	6 (3.8 %)	4 (2.5 %)	2 (1.2 %)	-	0.062
MCA M3 (n=2)	2 (1.2 %)	-	-	-	-
Basilar (n=2)	-	1 (0.6 %)	1 (0.6%)	-	0.072
PCA (n=2)	2 (1.2 %)	-	-	-	-

Table 2: Comparison of demographic and procedural data of groups with and without eye deviation

	Performed Mechanical Thrombectomy (n=154)	Without Mechanical Thrombectomy (n=10)	p
Age (year)	70.8 ± 10	70.2 ± 6.4	0.859
Sex (Male/Female)	69/85	3/7	0.368
Admission NIHSS score	14.5 ± 4.4	14 ± 4.5	0.743
Thrombolysis (n) (%)	60 (28.4%)	0	0.467
Admission ASPECT	8.3 ± 1.3	-	
Right cerebral hemispheric affect (n) (%)	81(52.6%)	6 (60.0%)	0.372
Left cerebral hemispheric affect (n) (%)	69 (44.8%)	4 (40.0%)	0.376
3. months mRS	2.9 ± 2.28	3 ± 2.4	0.137
Hypertension (n) (%)	85 (55.1%)	5 (50.0%)	0.896
Diabetes mellitus (n) (%)	38 (24.6%)	2 (20.0%)	0.290
Hyperlipidemia (n) (%)	65 (42.2%)	4 (40.0%)	0.630
Smoke (n) (%)	31 (20.1%)	2 (20.0%)	0.992
Atrial Fibrillation (n) (%)	45 (29.2%)	1 (10.0%)	0.564
Stroke (n) (%)	12 (7.8%)	1 (10.0%)	0.430
Heart failure (n) (%)	34 (22.0%)	2 (20.0%)	0.803

NIHSS: National Institutes of Health Stroke Scale, ASPECT: The Alberta Stroke Program Early CT score mRS: Modified Rankin Scale

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