

Spontaneous thrombus migration during mechanical thrombectomy : A case report

Jude Charles¹

¹University of Miami Hospital and Clinics

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Abstract

Mechanical thrombectomy is the standard of care for acute large vessel occlusion stroke since 2015 . Many studies report pre-intervention distal thrombus migration, especially after intravenous thrombolysis. We report a case of spontaneous intraprocedural thrombus migration during mechanical Thrombectomy with a review of conditions favoring the phenomenon.

Spontaneous thrombus migration during mechanical thrombectomy: A case report

Corresponding Author

Jude Hassan Charles, MD, MSHI

University of Miami Hospital and Clinics

Department of Neurology

267 357 9584

Judehassancharles@gmail.com

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy

Background

Mechanical thrombectomy is the standard of care for acute large vessel occlusion stroke since 2015 with a powerful efficacy and excellent safety. Many studies report pre-intervention distal thrombus migration, especially after intravenous thrombolysis. The reported factors associated with this phenomenon are clot burden, extent of collateral circulation, thrombus histology and hemodynamic changes. In addition, with advent of mechanical thrombectomy, distal thrombus migration or embolization can occur during contact aspiration and, or stent-retriever use, but spontaneous migration of thrombus during the procedure without intracranial manipulation is not well-reported.¹ We report a case of spontaneous intraprocedural thrombus migration in the posterior circulation after the unaffected right vertebral artery was selectively catheterized, likely causing hemodynamic imbalance leading to spontaneous migration of the clot from contralateral left V4 segment to the basilar artery.

Case report

The patient is an 83-year-old right-handed male with coronary artery disease, hypertension and hyperlipidemia who was brought to the hospital after a witnessed unprovoked collapse. On arrival, He was found to have right facial palsy, right hemiparesis, and right gaze deviation. Reported baseline modified Rankin Score is 0. Initial non-contrast CT brain revealed large established left inferior cerebellar hypodensity suggestive

of subacute left Posterior Inferior Cerebellar Artery (PICA) territory ischemic stroke. During imaging, the patient exam was fluctuating between mild right dysmetria and severe right hemiparesis. No thrombolytics were administered. CT angiography head/neck with contrast showed complete occlusion of left V4 segment with concern for a subocclusive clot extending into the proximal basilar artery. The left V1-proximal V3 segments were filling. The subocclusive thrombus in the proximal basilar artery was felt to be the likely cause of clinical exam fluctuation. CTP and MRI brain showed established infarct in the left PICA territory and no other areas of restricted diffusion. Given the fluctuating exam, the decision was made to take the patient to the neuro-angiography suite for thrombectomy. The right subclavian artery was accessed first, and a non-selective right subclavian artery angiogram using a 5 French catheter showed the basilar artery filling well except for the subocclusive filling defect in the left lateral wall in the proximal basilar extending into the left V4 segment confirming the suspicion of this finding on CTA (figure1). There was a brisk filling of cervical and cerebral segments of the right vertebral artery as well without occlusion. After the right vertebral artery was selectively catheterized and an injection was performed, the cerebral run showed a complete occlusion of the proximal basilar artery and a retrograde complete filling of the previously occluded left V4 segment. This indicated that the thrombus had migrated from the left V4 segment into the proximal basilar artery causing its complete occlusion. Successful mechanical thrombectomy of proximal basilar occlusion using ADAPT technique with Sofia Plus 070 aspiration catheter was performed. TIC1-3 was achieved after 1 pass. (Figure 2)

Discussion

Our case reports a not well-reported phenomenon of spontaneous thrombus migration in an intracranial large artery during angiographic injections during the initial diagnostic part of the thrombectomy procedure. This likely happened due to the decreased flow from the right vertebral artery due to its selective catheterization leading to the acute thrombus in the left vertebral artery V4 segment migrating spontaneously into the basilar artery. This spontaneous migration is the result of complex interaction between flow dynamic, geometry of the vertebrobasilar circulation and wall shear stress in addition to transient changes due to selective catheterization of the contralateral vertebral artery.¹ Although unequal vertebral arteries are seen in as much as seventy to eighty percent of the population, Hong et al were the first to report that such difference in diameter might contribute to relevant changes in hemodynamic.² Such difference may reveal to be significant in instances like this.

Thrombus migration risks

Thrombus migration is common in the ischemic stroke population. For instance, in the MR CLEAN registry (Multicenter Randomized Clinical Trial of Endovascular Treatment of Acute Ischemic Stroke) that include more than 1300 patients, up to 22% of the patients showed thrombus migration in the anterior circulation when compare initial noninvasive imaging with digital subtraction angiography.² Similar incidence has been reported elsewhere and seem to be fairly constant and equally affect both anterior and posterior circulation.³ Although thrombus fragmentation and distal embolization are reported to be more prevalent in the anterior circulation.⁴ Usually this leads to secondary medium vessels occlusion that is difficult to chase with current mechanical retrieval devices.⁵ Those occlusions are usually seen as moving target as they are seen more distally on DSA compared to prior noninvasive imaging and seem to happen spontaneously.^{6,7} Interestingly some specific factors are found to be associated with higher likelihood of thrombus migration. Those factors include but are not limited to thrombus size, thrombus composition, presence or absence of robust collateral circulation, and underlying hemodynamics. For instance, in a retrospective study of 163 patients Sporns et al. found that higher clot burden, smaller size of thrombus, erythrocytes rich clots and minimal collateral vessels are associated with higher rate of thrombus migration.⁸ One study reports that erythrocyte-rich thrombus is up to seven times more prone to migration.⁹ This is seen as the direct result of molecular interaction of clots with endothelium and existing hemodynamics related pressure. As one can expect higher turbulence in hemodynamic can lead to higher risk of clots dislodgement and migration as reported in anemia.¹⁰

IV thrombolysis and risk of thrombus migration

Intravenous thrombolysis and thrombus migration has been linked in many studies. While thrombolytics show effectiveness in dissolving clots, it is to be noted that this treatment is also associated with higher risk of clot migration. This is due to de-anchorage of fibrin complexes that are attached to the endothelium. For instance, data from the INTERSECT study (Identifying New Approaches to Optimize Thrombus Characterization for Predicting Early Recanalization and Reperfusion with IV Alteplase and Other Treatments Using Serial CT Angiography) revealed incidence as high as 54% in terms of thrombus migration and fragmentation with distal embolization within the first two hours post IV thrombolysis on repeat imaging.¹¹ Intravenous thrombolytic was not administered in the presented case, therefore suggesting a mechanical or hemodynamic change as a potential reason for clot migration.

Mechanical thrombectomy devices and thrombus migration

Another important factor that can lead to distal embolization is the thrombus manipulation with thrombectomy devices. Although this has not been studied in vivo, the experimental model has demonstrated that the complex interactions of MT devices with the thrombus is worth considering. Liu et al (2021) demonstrated that uniaxial tension exerted by aspiration MT device on the thrombus lead to deformation, elongation, thinning, fracture, and embolization. The result depends mostly on the thrombus composition and three different forces that are resistance, retrieval and embologenicity respectively.^{12,13}

Reperfusion and outcome

In our case, the thrombus migration was witnessed and retrieved immediately with a good outcome. In fact, thrombus migration has not been associated with worse outcomes or increased infarct burden. In fact, almost all the above-mentioned studies report improved outcomes at ninety days evaluation in terms of functional status using the modified Rankin scale. The reason why there is improved functional outcome after clot migration might be related to earlier blood supply to the penumbra following thrombectomy.^{2,3,7,8,11} Except for one case report where worse outcome was reported although it was only in terms of radiographic findings after intra-arterial thrombolysis.⁶ It is also important to note that generally such findings lead to lower rate of recanalization but does not interfere with outcome. Therefore, rapid deterioration, stuttering onset, and fluctuating exam might be due to thrombus migration and can potentially lead to fatality contrary to what is considered seemingly only positive findings. Our case also illustrates the pattern of travel of thrombi in posterior circulation. They travel in a stuttering fashion correlating with the stuttering clinical presentations in posterior circulation symptoms. This could hypothetically be explained by the anatomy of posterior circulation in which each vessel minimal variation in diameter for their entire length on morphometric analysis.¹⁵

Conclusion

As many as 22% of thrombus migrate in acute embolic ischemic stroke on repeat imaging and seems to be spontaneous. This number is 2 to 3 times higher after IV thrombolytics administration. Although such findings are associated with lower rate of successful recanalization, they do seem to positively affect outcomes. Both anterior and posterior circulation can be involved. However, although anterior circulation distal embolization can be bad, posterior circulation involvement can be fatal. This case report showed how a posterior circulation thrombus migration could be fatal at the contrary of what is reported. We suggest that providers maintain low threshold of chasing posterior sub-occlusive clots on a case-by-case approach, especially when better outcome can be potentially expected.

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