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Case report

Combined thrombolysis in posterior circulation stroke caused by bilateral vertebral artery dissection in squash player

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ABSTRACT

Background and purpose: Growing number of vertebral artery dissection has been detected due to higher awareness and improved imaging techniques, even after seemingly minor head turning in young- or middle-aged adults without predisposing risk factors for cerebrovascular disease. Treatment options for this condition at this time are limited and there is a troubling shortage of controlled studies.

Summary of case: Our patient suffered a bilateral vertebral artery dissection complicated by posterior circulation stroke. We decided to treat acute stroke with intravenous thrombolytic therapy. Patient's condition worsened despite the treatment so emergency angiography was performed to assess the arterial patency. Additional dose of recombinant tissue plasminogen activator together with mechanical thrombectomy was administered using intraarterial route. The patient recovered well and at 12-month follow-up visit he had only right marginal incomplete hemianopia.

Conclusions: Vertebral artery dissection should be taken into consideration in differential diagnosis of posterior circulation stroke or TIA in young patients with a history of even as subtle precipitating events as forceful head movements. Combined thrombolytic therapy may provide safe and effective treatment of stroke-complicated cases. This case report shows that expanded diagnostic protocol for acute ischemic stroke, including computed tomography perfusion study and angiography of cervical and cranial vessels, assures rapid and correct diagnosis.

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1. Introduction

The incidence of VAD has not been well defined. Yet, growing number of this pathology has been detected due to higher awareness and improved imaging techniques, after even seemingly minor head turning in young or middle-aged adults without predisposing risk factors for cerebrovascular disease [1].

Prognosis in VAD is generally favorable. It depends on contralateral vessel patency, extent of ischemic changes and early treatment. Many reports show that neurologic deficits can subside over time even without any treatment, but VAD carries a risk of complications that can be fatal if not treated appropriately. Most patients with VAD receive early treatment with heparin to prevent cerebral embolism from the stenotic artery and stroke.

We present the case of a patient with acute ischemic stroke caused by bilateral VAD treated with combined intravenous and intraarterial thrombolysis.

The report has been approved by the Institutional Review Board of our institution. We obtained patient informed consent.

2. Case report

A 33-year-old male presented with sudden onset of headache and visual symptoms that started during the game of squash without direct trauma. Patient experienced also nausea and

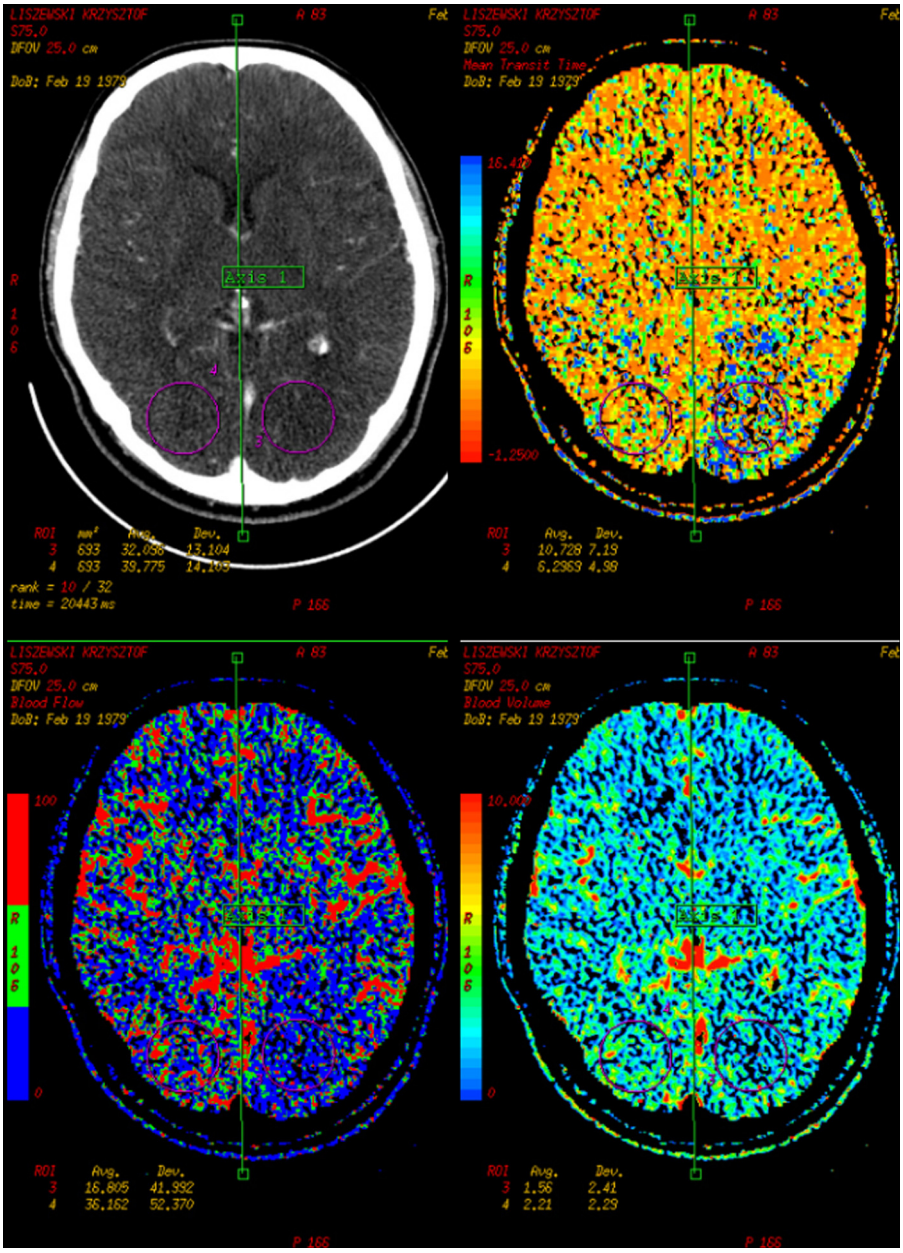

Fig. 1 – CT perfusion scans. Perfusion abnormalities in left occipital lobe consistent with penumbra: blood flow and blood volume deficits, prolongation of mean transit time.

vomiting. Neurologic examination revealed right homonymous hemianopia. Medical history was negative for previous or current health problems. Family history was insignificant. Blood tests were within normal ranges.

Patient underwent a standard acute stroke diagnostic protocol that consisted of head CT (computed tomography), brain CT perfusion and CTA (CT angiography) of cervical and cranial vessels. Head CT was unremarkable. Perfusion CT scans showed ischemic areas of blood flow and blood volume deficits with prolongation of mean transit time in left occipital lobe [Fig. 1]. Perfusion changes were consistent with penumbra. Additionally small area of infarction was detected in left cerebellar hemisphere. CTA demonstrated bilateral intraluminal filling defects in segment V3 of vertebral arteries. Right vertebral artery was occluded, while left was irregular and narrowed. Medial occipital artery (P4 segment of posterior cerebral artery) was also occluded.

The patient was diagnosed with acute cerebellar and occipital stroke. Within 3 h from symptoms onset intravenous thrombolytic therapy was started. rt-PA in the standard dose of 0.9 mg/kg was given (10% of a total dose as a bolus, and the remaining dose over 60 min). After 30 min of the treatment visual symptoms worsened, therefore an emergency angiography was performed. Digital subtracted angiography (DSA) confirmed initial tomographic findings [Fig. 2]. Right VA was occluded. A thrombus was seen within the tip of basilar artery and in the irregularly narrowed left VA. Suction thrombectomy was performed in segment V3 of left VA using Progreat catheter 0.027″ (Terumo Medical Corporation, Somerset, NJ, USA). Intraarterial bolus of 7 mg of rt-PA was administered 6 h after first stroke symptoms. Small, self-limiting bleeding from dissected left VA precluded further thrombolytic therapy. Despite incomplete systemic thrombolysis we achieved significant reduction of thrombotic material in the VA and partial normalization of its lumen [Fig. 3]. Visual disturbances have not changed significantly following treatment. 24-h control CT examination excluded intracranial and cervical hemorrhage and anticoagulant therapy was started (1 mg/kg of low-molecular-weight heparin).

MR study conducted 2 days post ictus showed left occipital lobe infarct and multiple small infarct areas bilaterally in cerebellum and in left thalamus [Fig. 4]. T1-weighted sequence with fat saturation demonstrated signs of dissection in both VA with persistent occlusion of right VA and narrowing of left VA [Fig. 5].

In subsequent MR follow-up examinations performed 1 week, 3 weeks and 2 months after stroke the lumen of left VA gradually returned to normal. Occlusion of right VA remained. Oral anticoagulant replaced low-molecular-weight heparin after 1 month and continued for 6 months. The patient recovered well and at 12-month follow-up visit he had only right marginal incomplete hemianopia.

Fig. 2 – Selective DSA of vertebral arteries, anterior view. (a) Occluded V3 segment of right VA. (b) Irregular lumen of dissected V3 segment of left VA. Thrombotic material is visible in the distal part of the basilar artery and distal to the dissected VA segment.

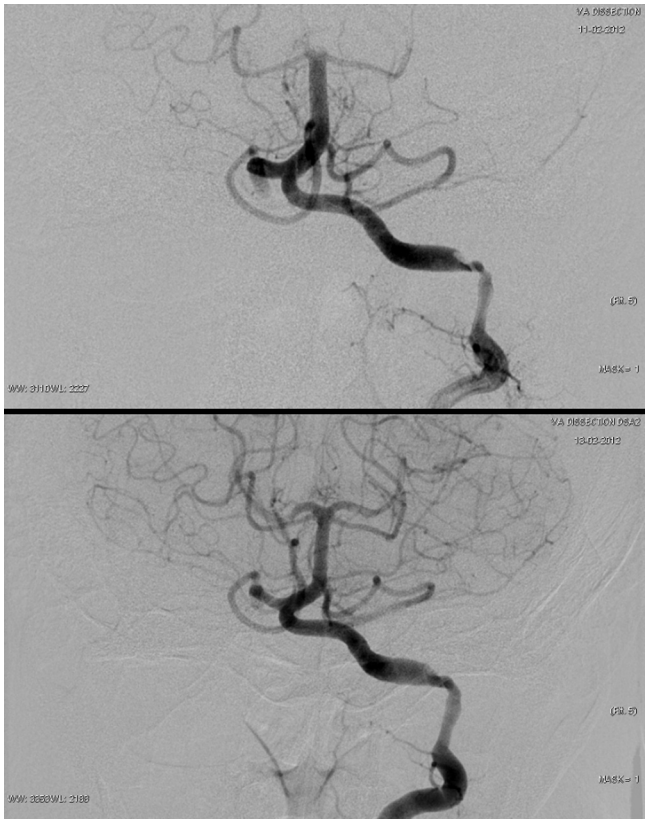

Fig. 3 – Selective DSA of left vertebral artery, anterior view before (a) and after (b) endovascular treatment (suction thrombectomy and intra-arterial thrombolysis).

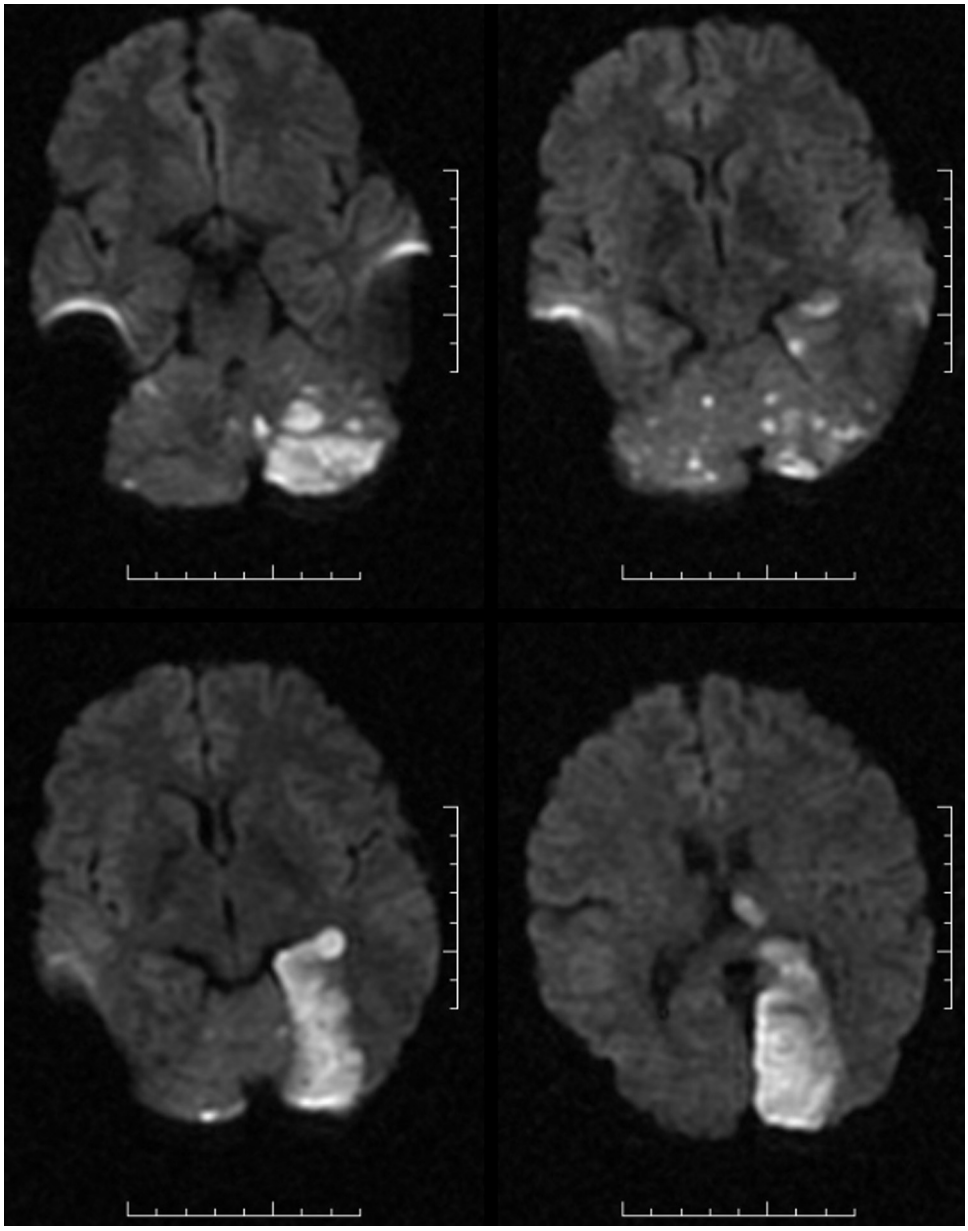

Fig. 4 – MR diffusion-weighted axial images (a)–(d) two days after stroke show infarct territory in left occipital lobe and smaller scattered infarct areas in the left thalamus and both cerebellar hemispheres.

3. Discussion

VAD is without doubt underreported because dissection may be asymptomatic or associated with mild symptoms [2]. However this condition is an important cause of brain stem stroke, especially in the young. Cervical dissections of carotid and vertebral arteries account for about 20% of strokes in young compared with 2.5% in the elderly [3].

Two segments of the VA are highly vulnerable to mechanical damage: junction of V1 and V2 segment (as it enters the C6 transverse foramen) and V3 segment (as it crosses the atlanto-axial level).

In described case the patient presented with nausea, vomiting, headache and visual symptoms of right homonymous hemianopia. He neither experienced a direct severe neck trauma nor had any of the concomitant risk factors mentioned above.

Catheter-based DSA, contrast-enhanced CTA, MRA and ultrasound are useful diagnostic tools for cervical arteries dissection. The most common angiographic findings are irregular stenosis, occlusion, pseudoaneurysm, irregular dilatation, intimal flap and double lumen [4]. DSA remains the gold standard for diagnosis of VAD. However, DSA visualizes only vessel lumen so other diagnostic modalities are needed to complete the imaging. Both MRA and CTA examinations may

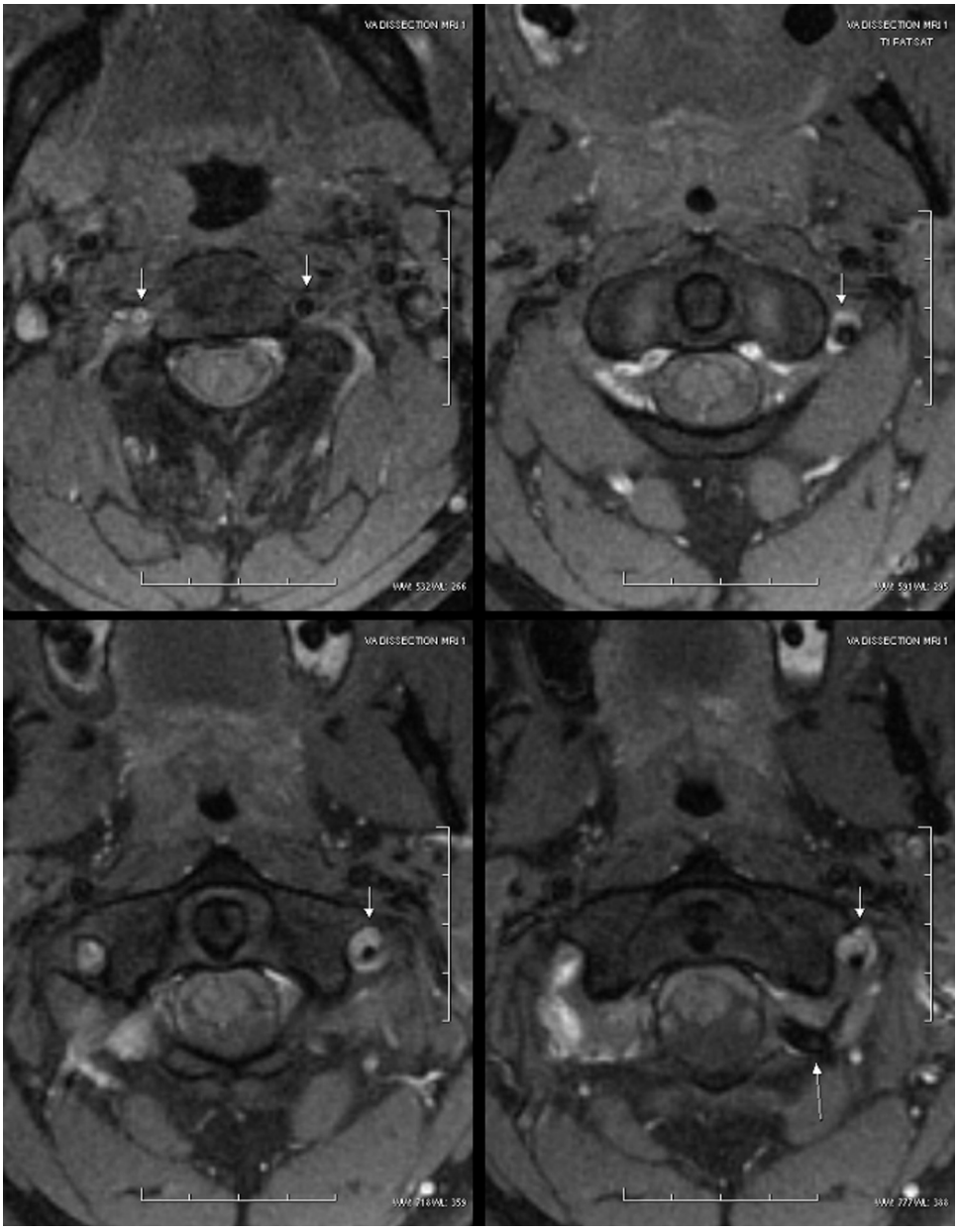

Fig. 5 – MR T1-weighted axial images with fat suppression (a)–(d). Hyperintensity of the vessel wall in both vertebral arteries consistent with the intramural hematoma (arrows). Loss of flow void signal in the right vertebral artery due to occlusion.

clearly show arterial lumen abnormalities, but MR is more sensitive for detecting intramural and peri-arterial pathologies. Hematoma of the arterial wall can be visualized on T1-weighted images with fat suppression as hyperintensity of the vessel wall [4]. MRI is also preferable for detecting cerebellar or brain stem infarction. Color Doppler ultrasound is a reliable method for evaluation of VA stenosis. It can detect non-specific abnormalities like severely reduced flow, absence of flow, and absence of diastolic flow as well as a specific finding of intramural hematoma [4,5].

Treatment options for VAD at this time are limited and there is troubling shortage of controlled studies. Guidelines released in 2011 [6] state that antithrombotic treatment with either an anticoagulant or a platelet inhibitor for at least 3–6 months is reasonable for patients with extracranial vertebral arterial dissection associated with ischemic stroke or TIA. Intravenous thrombolysis for acute ischemic stroke using recombinant tissue plasminogen activator has been shown to be safe, efficacious and independent of the underlying stroke mechanism. Small case series studies reported that intravenous rt-PA can be effective and safe in patients with carotid artery dissection [7,8]. Intraarterial thrombolysis in combination with other endovascular treatments has been reported occasionally in patients with cervical artery dissection [9]. Treatment consisted of combination of intraarterial thrombolysis with different techniques: stent placement, mechanical thrombectomy, mechanical thrombectomy with stent placement, or surgical procedures. Best to our knowledge

only one case of mechanical thrombectomy and intraarterial thrombolysis has been reported so far [10].

Our patient suffered a bilateral VAD complicated by posterior circulation stroke. We decided to treat acute stroke with intravenous thrombolytic therapy. Patient's condition worsened despite the treatment so emergency angiography was performed to assess the arterial patency. Additional dose of rt-PA together with mechanical thrombectomy were administered using intraarterial route.

Thrombolytic treatment in the setting of bleeding into dissected arterial wall may carry a potential risk of propagation of the dissection. Yet, there are no reports of clinical deterioration in patients with cervical artery dissection treated with anticoagulation. During intraarterial fibrinolysis we observed small bleeding from dissected left VA. It was self-limiting and no other hemorrhagic complications occurred. The treatment proved effective for preventing subsequent thromboembolic events and caused improvement of clinical condition.

Endovascular treatment for VAD is controversial. Because the vast number of vertebral artery dissections resolve spontaneously the risk of intervention should be justified. Stenting with or without coiling should be considered in cases of persistent pseudoaneurysm or in patients who remain symptomatic due to thromboembolic events or show progression of symptoms despite anticoagulation [2].

We want to highlight the importance of taking VAD into consideration in differential diagnosis of posterior circulation stroke or TIA in young patients with a history of even as subtle precipitating events as forceful head movements. Combined thrombolytic therapy may provide safe and effective treatment for patients with VAD-related stroke. Rapid and correct diagnosis of VAD is therefore decisive in making proper treatment decisions and assuring good outcomes. This case study shows that expanded diagnostic protocol for acute ischemic stroke makes it possible to diagnose underlining conditions.

Conflict of interest

None declared.

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The undersigned authors certify that they have no commercial associations (e.g., consultancies, stock ownership, equity interest, patent-licensing arrangements) that may pose a conflict of interests in connection with the submitted article, except as disclosed on a separate attachment. All funding sources supporting the work and all institutional or corporate affiliations of the authors should be acknowledged in the article.

Ethics

The work described in this article has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans; Uniform Requirements for manuscripts submitted to Biomedical journals.

REFERENCES

[1] Glauser J, Hastings OM, Mervart M, Volk MA, Bahntge M. Dissection of the vertebral arteries: case report and discussion. J Emerg Med 1995;12(3):307–15.
[2] Pelkonen O, Tikkakoski T, Leinonen S, Pyhtinen J, Lepojärvi M, Sotaniemi K. Extracranial internal carotid and vertebral artery dissections: angiographic spectrum, course and prognosis. Neuroradiology 2003;45(February (2)):71–7.
[3] Prabhakar S, Bhatia R, Khandelwal N, Lal V, Das CP. Vertebral artery dissection due to indirect neck trauma: an underrecognised entity. Neurol India 2001;49(December (4)): 384–90.
[4] Maroon JC, Gardner P, Abla AA, El-Kadi H, Bost J. ''Golfer's stroke'': golf-induced stroke from vertebral artery dissection. Surg Neurol 2007;67(February (2)):163–8 [discussion 168].
[5] Lu CJ, Sun Y, Jeng JS, Huang KM, Hwang BS, Lin WH, et al. Imaging in the diagnosis and follow-up evaluation of vertebral artery dissection. J Ultrasound Med 2000;19(April (4)):263–70.
[6] Brott TG, Halperin JL, Abbara S, Bacharach JM, Barr JD, Bush RL, et al. 2011 ASA/ACCF/AHA/AANN/AANS/ACR/ASNR/CNS/SAIP/SCAI/SIR/SNIS/SM/SVS guideline on the management of patients with extracranial carotid and vertebral artery disease. Catheter Cardiovasc Interv 2013;81 (January (1)):E76–123. http://dx.doi.org/10.1002/ccd.22983.
[7] Engelter ST1, Rutgers MP, Hatz F, Georgiadis D, Fluri F, Sekoranja L, et al. Intravenous thrombolysis in stroke attributable to cervical artery dissection. Stroke 2009;40:3772–6.
[8] Zinkstok SM, Vergouwen MD, Engelter ST, Lyrer PA, Bonati LH, Arnold M, et al. Safety and functional outcome of thrombolysis in dissection-related ischemic stroke: a meta-analysis of individual patient data. Stroke 2011; 42(September (9)):2515–20. Review.
[9] Zinkstok SM, Nederkoorn PJ, Vergouwen MDI. Safety of thrombolysis in patients with acute ischemic stroke caused by cervical artery dissection—a review. Eur Neurol J 2010; 2(1):65–72.
[10] Sugrue PA1, Hage ZA, Surdell DL, Foroohar M, Liu J, Bendok BR. Basilar artery occlusion following C1 lateral mass fracture managed by mechanical and pharmacological thrombolysis. Neurocrit Care 2008;11(2):255–60.