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Is There A Subgroup of Kinking

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ABSTRACT

Vertebral and carotid artery kinking which are categorized inside dolicoarteriopathies, linked to various cerebrovascular dysfunctions. Moderate and severe kinking reduced blood flow, contributing to hemodynamic instability and cerebrovascular insufficiency. While most symptomatic cases undergo endovascular or surgical correction, some patients with severe kinking remain asymptomatic, questioning current understanding. In over 120 cases of carotid or vertebral artery kinking, we observed stenosis in symptomatic patients, differing from the expected arterial enlargement seen in dolicoarteriopathies. This suggests two potential kinking types: stenotic and enlarged.

Keywords: Dolicoarteriopathies, Kinging, Carotid artery, Vertebral artery, Vertebrobasilar insufficiency, Cerebrovascular insufficiency

1. Kinking

Vertebral artery and carotid artery kinks are classified according to Metz et al., Grade 1:90-60 degrees (mild kinking), Grade 2: 60- 30 (moderate kinking), Grade 3: < 30 degrees (severe kinking)[1-3]. Especially, in moderate and severe kinking, there is a reduction in blood flow, which escalates the risk of ischemic events[4]. Such vascular anomalies can lead to hemodynamic disturbances and are implicated in vertebrobasilar and cerebrovascular insufficiency pathophysiology. Endovascular or surgical procedures are tailored to address these kinkings, offering alternative avenues for restoring cerebral hemodynamics and alleviating the associated neurological symptoms[5-7].

However in clinical practise most of us have seen that some patients with grade 2 or 3 kinking have no neurological symptoms. After operating over 120 cases due to carotid or vertebral artery kinking we have observed that in all of these symptomatic cases, the kinking area was stenotic. All surgeries were performed by the senior surgeon (M.E.U), with informed consent obtained from all participants. The local ethics committee approved the study, documented under approval number 2/12 dated 03.30.2022. From the literature we know that in dolicoarteriopathies the arteries are enlarged even in kinking cases. But in our cases they were stenotic. Therefore in our operations we used a technique that has been used for the first time in kinking. After arteriolysis (releasing the artery from surrounding fibrotic tissue and thickened adventitia) we cut the sympathetic fibers around the vessel under microscopic magnification which we named as perivascular sympathectomy[8-11] (Figure 1A and 1B). The dilatation of the vessel with this technique showed us that the main pathology was outside the vessel (Figure 2A and 2B). This observation raises an important question do kinkings have two types as stenotic and enlarged/normal diameter or in other

terms as symptomatic and asymptomatic, where the stenotics are symptomatic. Before operation beside brain Magnetic Resonance (MR) and MR angiography, we also obtained cervical MR/ Computed Tomographic (CT) angiography (Figure 3A and 3B) and also postoperatively (Figur 4A and 4B). We also obtained brain CT /MR perfusion images pre and postoperatively. (Figure 5A and 5B). During the operation after arteriolysis, the stenosis at the kinking artery become more apparent than the Magnetic Resonance (MR)/ Computed Tomoraphic (CT) angiography. The perfusion studies showed mild to moderate hypoperfusion at the kinking side with stenosis, but was normal postoperatively (Figure 6A,B and C,D).

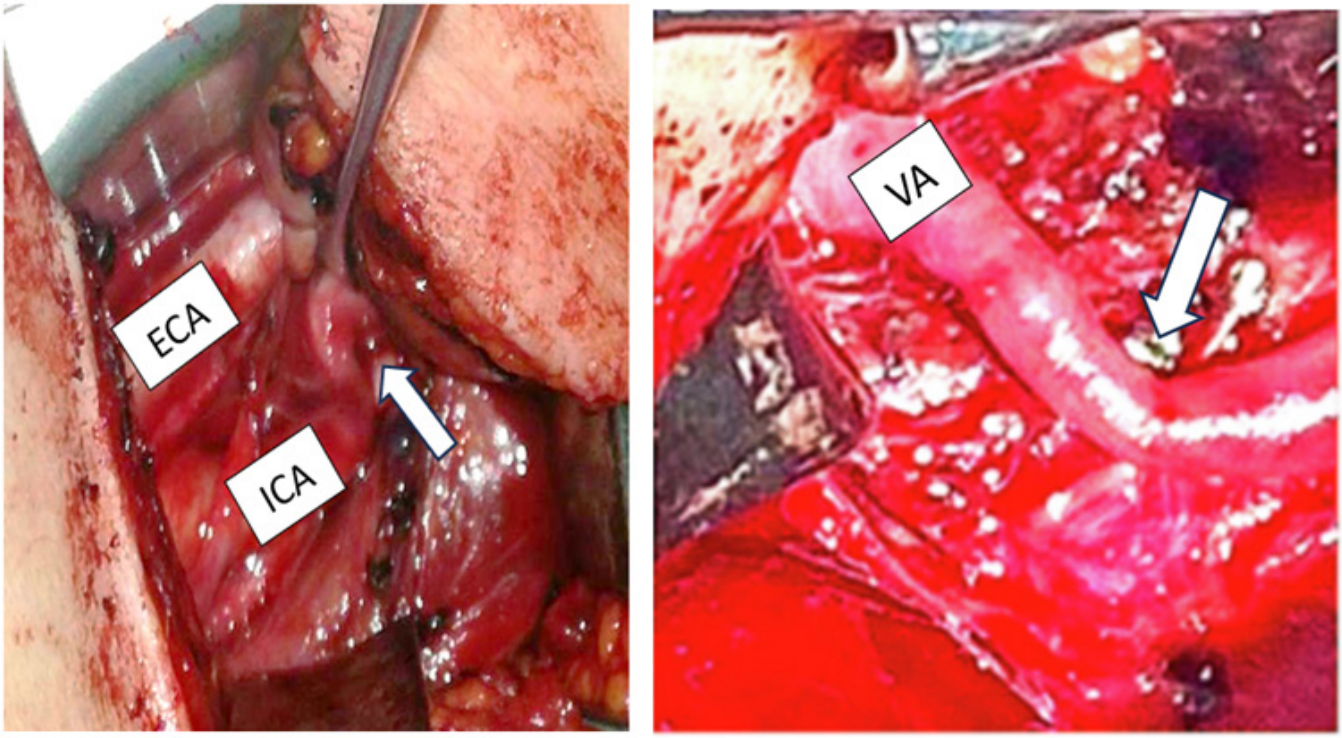


Figure 1A: Intraoperative vie w; White arrow shows the stenotic left internal carotid artery (ICA) when compared with external carotid artery (ECA).
Figure 1B: Intraoperative vie w; White arrow shows the stenotic left vertebral artery (VA).

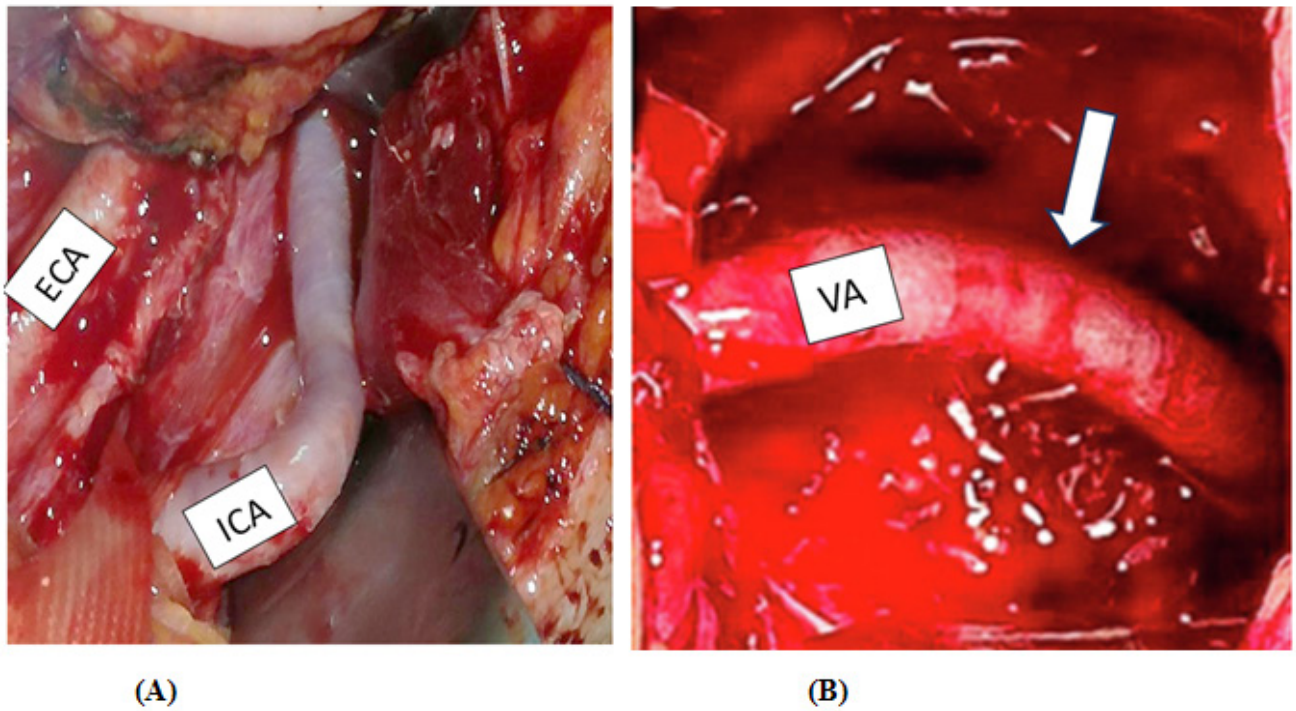
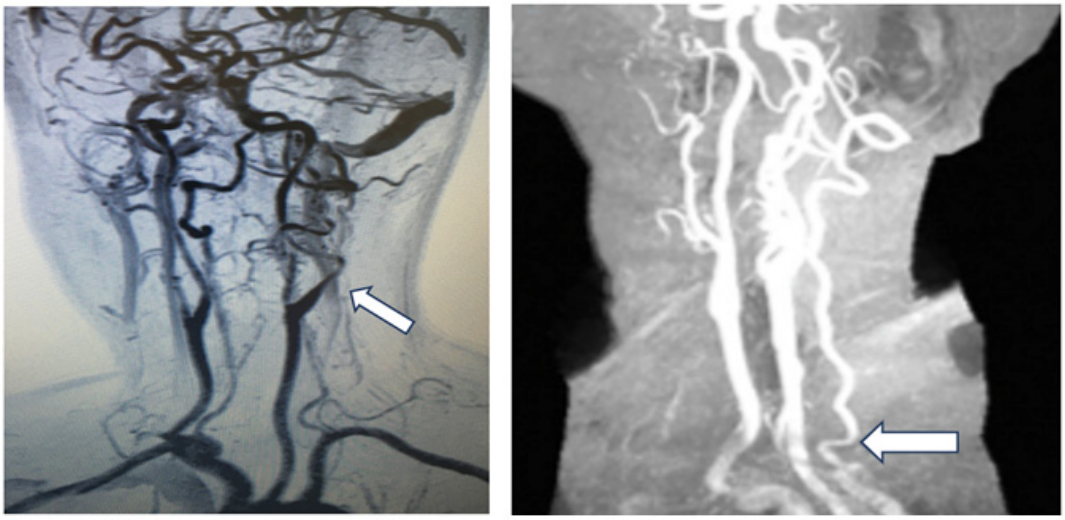
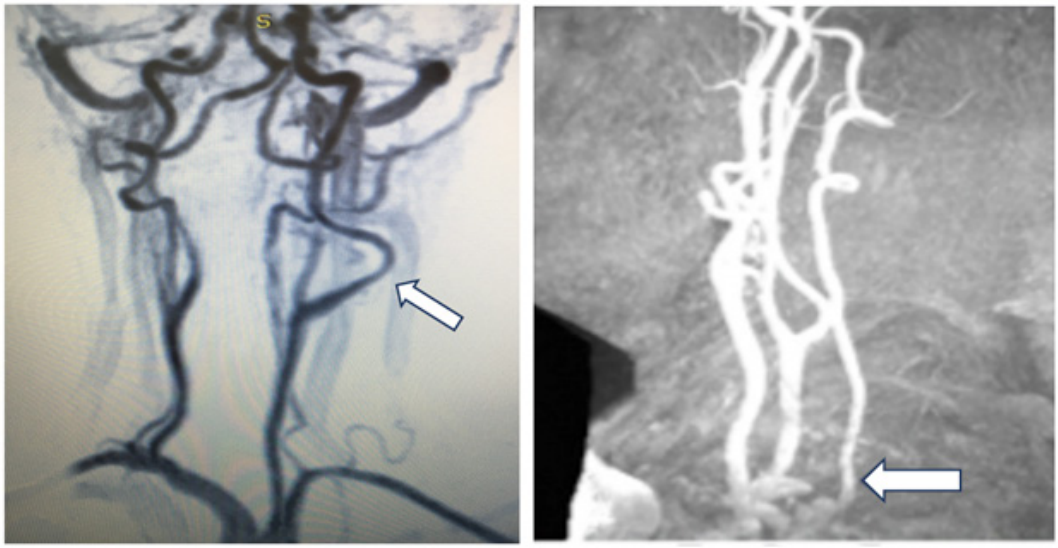


Figure 2A: Intraoperative view; After perivascular sympathectomy the left internal carotid artery (ICA) is enlarged and its diameter is approximately the same with external carotid artery (ECA).
Figure 2B: Intraoperative view; After perivascular sympathectomy the left vertebral artery (VA) is enlarged.



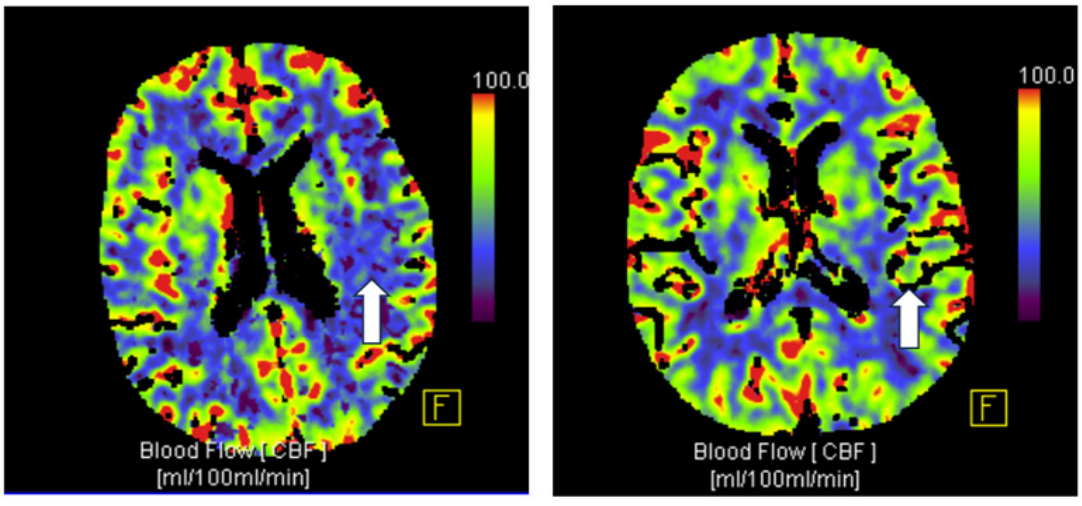
(A) (B)

Figure 3(A&B): Preoperative magnetic resonance (MR) angiography; White arrow shows the stenotic segment.



(A) (B)

Figure 4(A&B): Postoperative magnetic resonance (MR) angiography; White arrow shows the dilated segment after perivascular sympathectomy.



(A) (B)

Figure 5A: Preoperative brain perfusion computed tomography; White arrow shows the frontoparietal hypoperfusion area.
Figure 5B: Postoperative brain perfusion computed tomography; White arrow shows the disappearance of the hypoperfusion area.

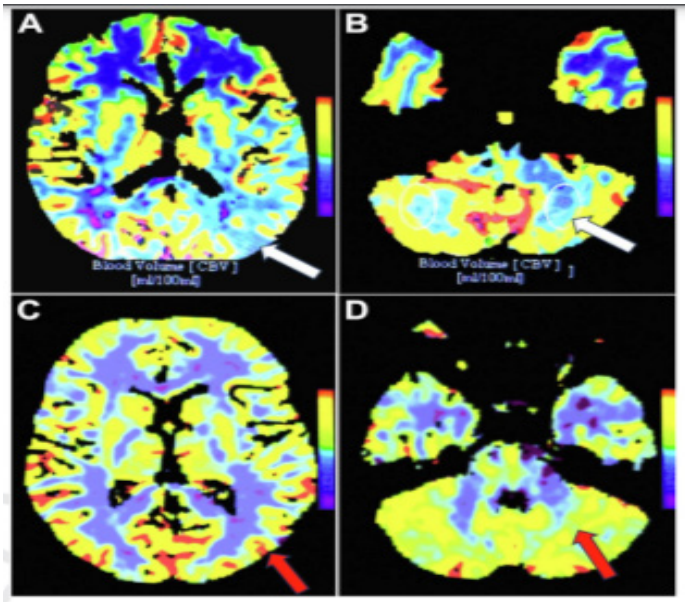


Figure 6A: Preoperative brain perfusion computed tomography; White arrow shows the left occipitoparietal (posterior watershed zone) hypoperfusion area.

Figure 6B: Preoperative brain perfusion computed tomography; White arrow shows the left cerebellar hypoperfusion area.

Figure 6C: Postoperative brain perfusion computed tomography; Red arrow shows the disappearance of the left occipitoparietal (posterior watershed zone) hypoperfusion area.

Figure 6D: Postoperative brain perfusion computed tomography; Red arrow shows the disappearance of the left cerebellar hypoperfusion area.

2. Conclusion

Our observations challenge the prevailing understanding that kinking primarily involve arterial enlargement. In a series of 120 cases, we found that symptomatic patients often exhibited arterial stenosis at the kinking site, which were corrected with a new technique named as perivascular sympathectomy, suggesting the existence of two distinct types of kinking: stenotic and enlarged. Grading of the kinking as grade 2 or 3 may worsen the symptoms if they are stenotic. These results highlight the need for re-evaluating the clinical approach to dolicoarteriopathies, particularly regarding the differentiation of kinking types and suggest a potential shift in treatment strategies based on hemodynamic profiles rather than anatomical classification alone.

3. References

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