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# Role of CT and MRI in the Diagnosis of Vertebrobasilar Dolichoectasia

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**Abstract:** ***Objective: To evaluate the role of CT and MRI in the diagnosis of vertebrobasilar dolichoectasia. Methods and Materials: A Prospective study was done in the Department of Radiodiagnosis, GSLMC, Rajahmundry. This study was done in 25 patients with suspected symptoms of vertebrobasilar dolichoectasia who were referred to department of Radiodiagnosis between 2022 January and 2022 December. Informed consent was taken from all patients. This study was done on Philips Achieva 1.5 tesla. Results: A total of 25 cases were included in the study. Of these 25 cases, 18 were male and 7 were female. The most common age group involved was 40 - 50 years in 12 cases followed by 50 - 60 years in 8 cases and 30 - 40 years in 5 cases. Hypertension was seen to be associated in 13 cases, atherosclerosis was seen to be associated in 7 cases and collagen vascular diseases in 5 cases. Symptoms of ischemic stroke was seen in 18cases, symptoms related to cranial nerve compression was seen in 4 cases and head ache was found in 3 cases. Conclusion: CT and MRI helps in the early diagnosis of vertebrobasilar dolichoectasia thereby providing the appropriate approach in the management of this complex entity and its related complications.***

**Keywords:** Dolichoectasia, Vertebral artery, Basilarartery, Dilatation**,** Compression

## 1. Introduction

Vertebrobasilar dolichoectasia, a rare progressive arteriopathy characterized by elongated, dilated and tortuous vertebrobasilar arteries. The exact etiology is not known clearly however it is seen in association with several diseaseslike hypertension, atherosclerosis, collagen vascular diseases, sickle cell anemia.

The posterior cerebral arteries are found to be more susceptible to Dolichoectasia than anterior cerebral arteries.1

Symptomatic patients mostly present with complaints of transient episodes of ischemic attacks, subarachnoid hemorrhage, and ischemic stroke or with symptoms related to compression of brain stem and cranial nerves.1In some cases, hydrocephalus can be seen.

It can be diagnosed on CT, MRI and Conventional Angiography. Mostly it is diagnosed incidentally in many cases. Conventional angiography is considered as gold standard.

## 2. Methods and Materials

A prospective study was done in the Department of radiodiagnosis, GSLMC, Rajahmundry. This study was done in 25 patients with suspected synptoms of vertebrobasilar dolichoectasia who were referred to department of Radiodiagnosis between 2022 January and 2022December. Informed consent was taken from all patients. This study was done on Philips achieva 1.5 tesla.

**Study Design:** Prospective study.

**Study Location:** This study was done in department of Radiodiagnosis, GSLMC, Rajahmundry.

**Study Duration:** January 2022 to December 2022.

**Sample Size:** 25 Patients.

**Inclusion Criterea:**

Patients with suspected symptoms of vertebrobasilar dolichoectasia like ischemic stroke, headache and symptoms related to cranial nerve compression.

**Exclusion Criterea:**

1) Cerebral trauma.
2) Cerebral neoplasms.
3) Cerebral infective and inflammatory conditions.

## 3. Results

A total of 25 cases were included in the study.

**Age distribution**: The most common age group involved was 40 - 50 years in 12 cases followed by 50 - 60 years in 8 cases and 30 - 40 years in 3 cases and 60 - 70 years in 2 cases.

**Table: 1:** Showing age distribution

| Age group | Cases |
|---|---|
| 30 - 40 | 3 |
| 40 - 50 | 12 |
| 50 - 60 | 8 |
| 60 - 70 | 2 |

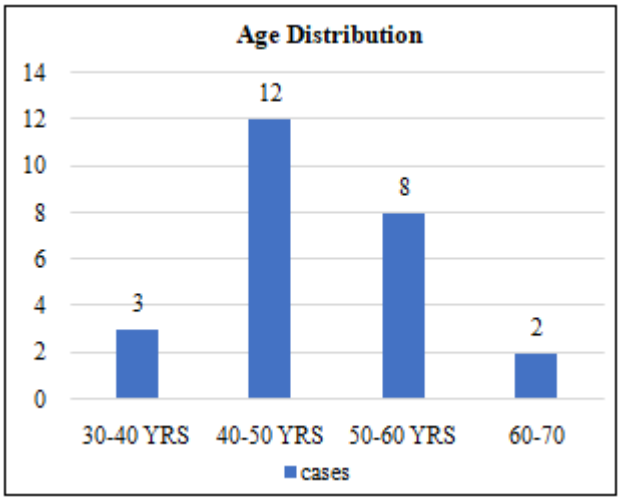


**Chart 1:** Showing Age Distribution

**Sex distribution**: Of the25 cases, 18 were male and 7 were female.

**Table 2:** Showing sex distribution

| Sex | Cases |
|---|---|
| Male | 18 |
| Female | **7** |

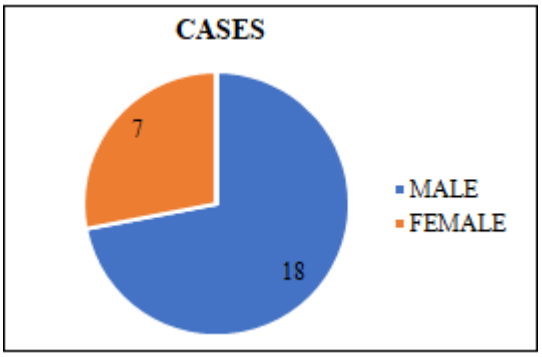


**Chart 2:** Showing Sex Distribution

**Association with systemic disease:** Hypertension was seen to be associated in 13 cases, atherosclerosis was seen to be associated in 7 cases and collagen vascular diseases in 5 cases.

**Table 3:** Association with systemic disease.

| Systemic disease | Number of cases |
|---|---|
| Hypertension | 13 |
| Atherosclerosis | 7 |
| Collagen vascular diseases | 5 |

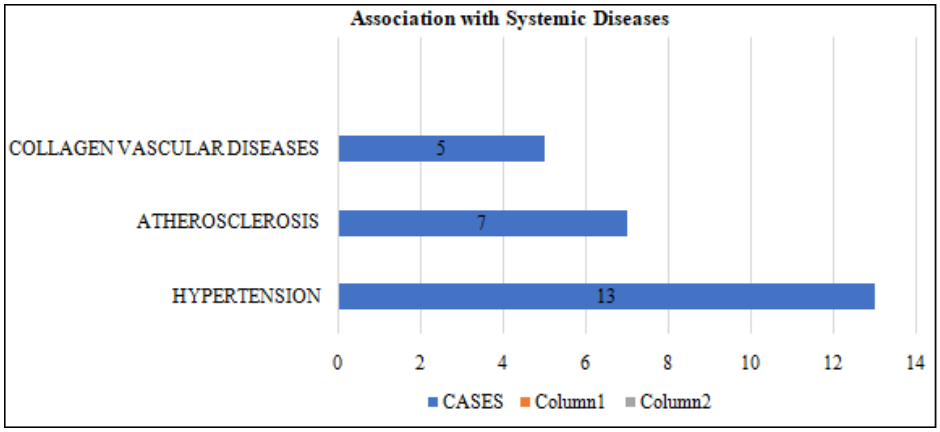


**Chart 3:** Association with systemic disease

**Distribution of Symptoms:** Ischemic stroke was seen in 18 cases and symptoms related to cranial nerve compression was seen in 4 cases and headache was seen in 3 patients out of 25 patients included in the study.

**Table 4:** Showing distribution of symptoms.

| Symptoms | Cases |
|---|---|
| Ischemic stroke | 18 |
| Cranial nerve compression | 4 |
| Head ache | 3 |

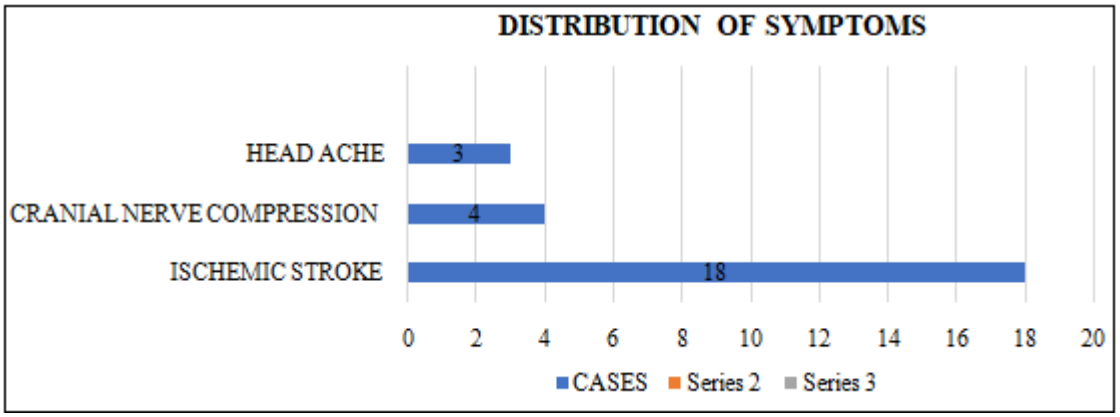


**Chart 4:** Showing distribution of symptoms

**Involvement:** Dilated and tortuous vertebral artery and basilar artery found in 18 cases on left side and in 7 cases on right side.

**Table 5:** Showing side wise distribution.

| Side wise involvement | Cases |
|---|---|
| Right | 7 |
| Left | 18 |

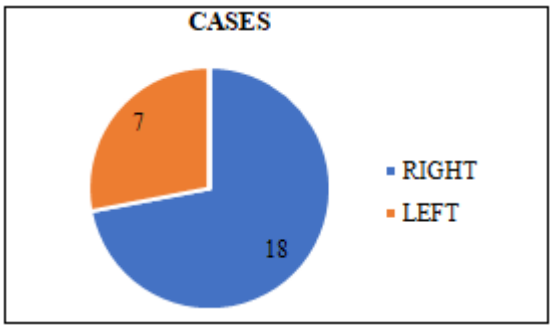


**Chart 5: Showing side wise distribution**

**Distribution of imaging findings:**

BA is seen within the SSC, medial to lateral margin of clivus or dorsum sellae in 12 cases, at the level of floor of third ventricle, lateral to lateral margin of clivus in 7 cases and indenting and elevating the floor of third ventricle in the cerebellopontine angle in 6 cases. Non dominant right vertebral artery noted in 18 cases.

Acute infarcts seen in 18 cases due to compressive effect.

Compression of left $7^{th}$ and $8^{th}$ cranial nerves was seen in 4 cases.

**Table: 6:** Showing spectrum of imaging findings on CT and MRI.

| | Imaging finding | Number of cases | Percentage |
|---|---|---|---|
| I | Basilar artery within SSC medial to lateral margin of clivus | 12 | 48% |
| II | II. Basilar artery lateral to lateral margin of clivus | 7 | 28% |
| III | III. Basilar artery indenting and elevating the floor of third ventricle | 6 | 24% |
| IV | IV. Non dominant right vertebral artery | 18 | 45% |
| V | VAcute infarcts | 18 | 45% |
| VI | VI.$7^{th}$nad $8^{th}$ cranial nerve compression | 4 | 16% |

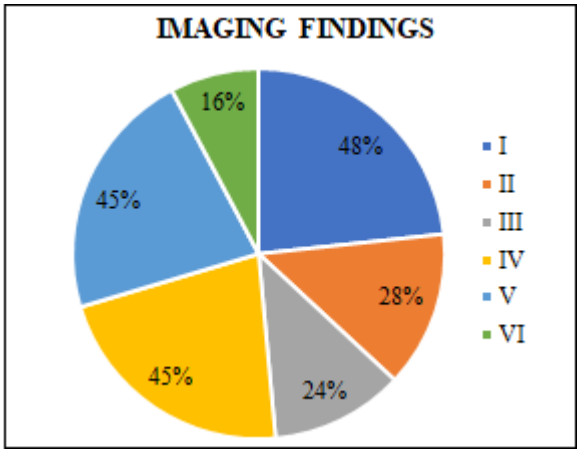


**Chart 6:** Showing spectrum of imaging findings on CT and MRI

**Spectrum of imaging findings on CT and MRI Brain**

Dilated and tortuous vertebral artery and basilararteryfound in 18 cases on left side and in 7 cases on right side.

BA is seen within the SSC, medial to lateral margin of clivus or dorsum sellae in 12 cases (48%), at the level of floor of third ventricle, lateral to lateral margin of clivus in 7 cases (28%) and indenting and elevating the floor of third ventricle in the cerebellopontine angle in 6 cases (24%).

Non dominant right vertebral artery noted in 18 cases (45%).

Acuteinfarcts seen in 18 cases (45%) due to compressive effect. Compression of left 7$^{th}$ and8$^{th}$ cranial nerves was seen in 4 cases (16%).

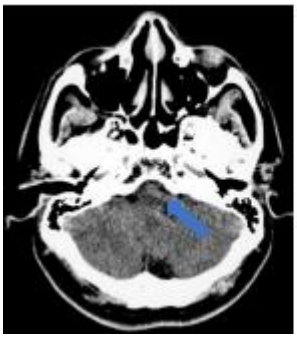

**Figure 1 (a)**

**Figure 1 (b)**

**Figure 1a:** Axial CT image showing dilated and tortuous left vertebral artery (Blue arrow). in the left lateral cerebellomedullary cistern, compressing and displacing the medulla to the right side.

**Figure 1b:** Axial CT image showing dilated Basilar artery (orange arrow) in the prepontine cistern mildly compressing the right pons with adjacent chronic lacunar infarct.

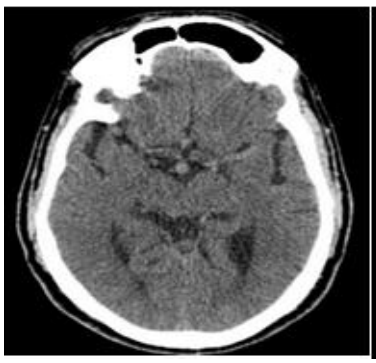

**Figure 2 (a)**

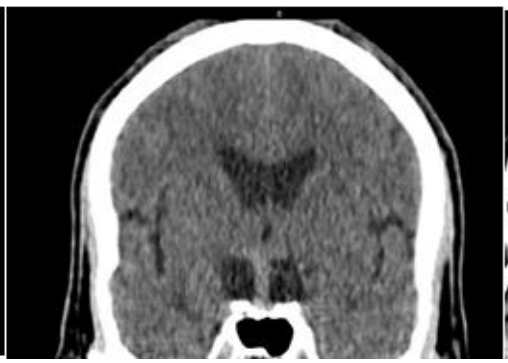

**Figure 2 (b)**

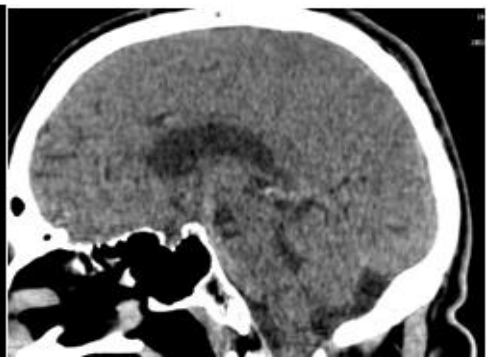

**Figure 2 (c)**

**Figure 2:** CT Images: **2a** (axial), **2b** (coronal) and **2c** (sagittal) images showing dilated basilar artery. The tip of basilar artery and its bifurcation are noted to rise above the level of dorsum sellae & the suprasellar cistern, indenting and mildly elevating the floor of third ventricle (Green arrow).

**Figure 3 (a)** **Figure 3 (b)** **Figure 3 (c)**

**Figure 3:** MR Cerebral AngiogramTOFMIP Images - **3a** (Inferior view) **3b** (Anterior view) **3c** (lateral view) showing tortuous &dilated V4 segment of left vertebral artery (orange arrow) and dilated ICA. Note made of absent right vertebral artery (white arrow).

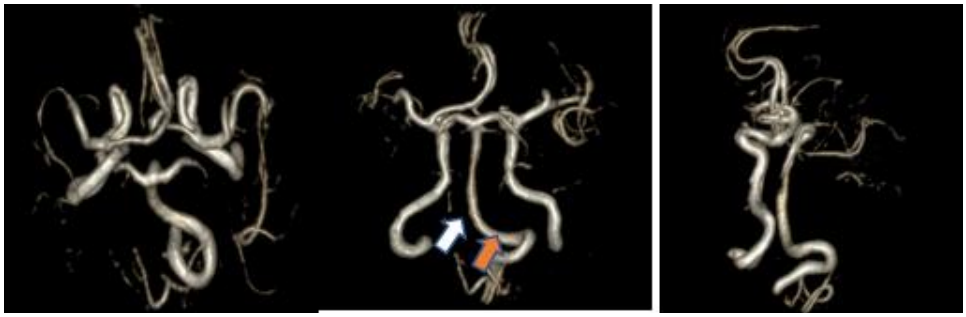

**Figure 4 (a)** **Figure 4 (b)** **Figure 4 (c)**

**Figure 4:** MR Cerebral Angiogram 3D SSD VR Images **4a** (Inferior), **4b** (Anterior), **4c** (lateral) showing tortuous& dilated V4 segment of left vertebral artery (orange arrow) and dilated ICA. Note made of absent right vertebral artery (white arrow).

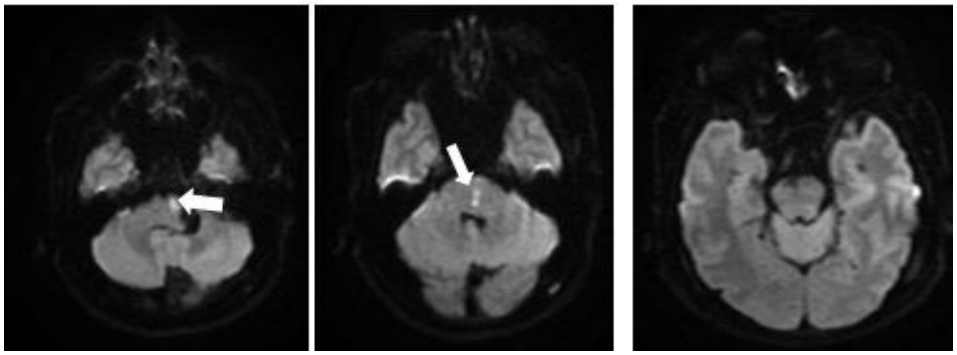

**Figure 5 (a)** **Figure 5 (b)** **Figure 5 (c)**

**Figure 5:** MRI – Axial DWI Images **Fig 5a** and **5b** showing focal infarcts (White arrows) in the anterior and medial aspect of the left medulla. **Fig5c** showing chronic focal infarct in the right pons.

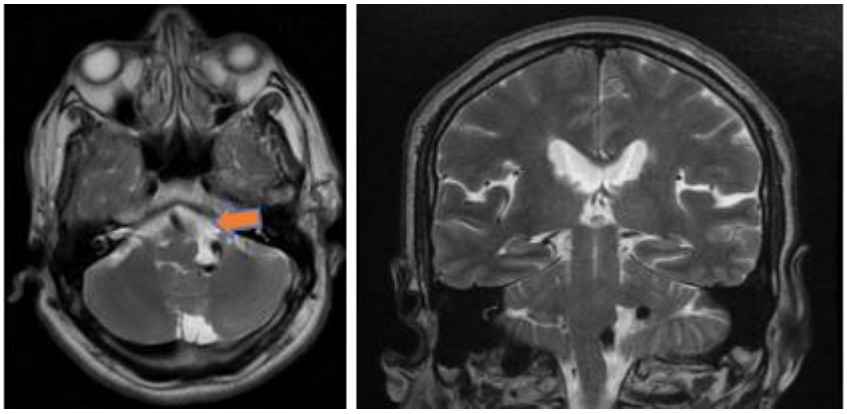

**Figure 6 (a)** **Figure 6 (b)**

**Figure 6:** T2W MRI Images –Fig 6a (axial), 6b (coronal) showing left Vertebral artery compressing the medulla and displacing it towards the right side, compressing the left cerebellum, causing widening of the left lateral cerebellomedullary cistern (orange arrow).

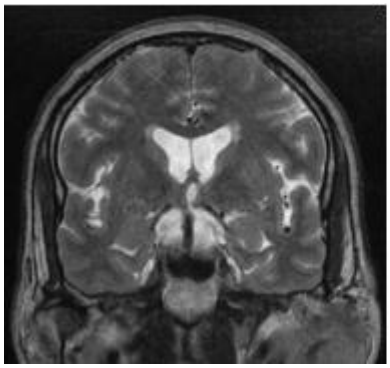
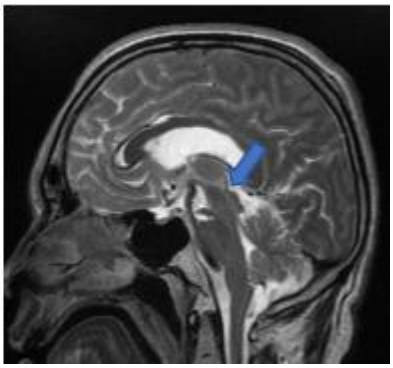

**Figure 6 (c)** **Figure 6 (d)**

**Figure 6:** T2W MRI Images –**Fig 6c** (coronal), **6d** (sagittal) showing the tip of basilar artery indenting the floor of third ventricle (Blue arrow).

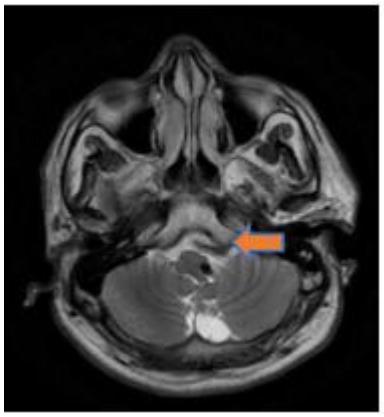

**Figure 7:** Axial T2 W Image showing left vertebral artery compressing the medulla and displacing it towards the right side, also compressing the left cerebellum, causing widening of the left lateral cerebellomedullar cistern and distortion of fourth ventricle and causing mild compression of left 7th and 8th cranial nerves (Orange arrow).

## 4. Discussion

Of the 25 cases included in the study, 18 were male (72%) and 7 (28%) were female. The most common age group involved was 40 - 50 years in 12 cases (48%) followed by 50 - 60 years in 8 (32%) cases and 30 - 40 years in 3 (12%) cases and 60 - 70 years in 2 cases (8%).

Hypertension was seen to be associated in 13 (52%) cases, atherosclerosis was seen to be associated in 7 cases (28%) and collagen vascular diseases in 5 cases (20%).

Ischemic stroke was seen in 18 cases (72%) and symptoms related to cranial nerve compression was seen in 4 cases (16%) and headache was seen in 3 patients (12%) out of 25 patients included in the study.

Imaging findings in the present study shows dilated and tortuous vertebral artery and basilar artery found in 18 cases (72%) on left side and in 7 cases (28%) on right side.

BA is seen within the SSC, medial to lateral margin of clivus or dorsum sellae in 12 cases (48%), at the level of floor of third ventricle, lateral to lateral margin of clivus in 7 cases (28%) and indenting and elevating the floor of third ventricle in the cerebellopontine angle in 6 cases (24%).

Non dominant right vertebral artery noted in 18 cases (45%). Acute infarcts seen in 18 cases (45%) due to compressive effect. Compression of left 7th and 8th cranial nerves was seen in 4 cases (16%). VBD (Vertebrobasilar dolichoectasia) rare progressive arteriopathy characterized by elongated, dilated and tortuous VBA (vertebrobasilar arteries). Posterior cerebral arteries more susceptable to Dolichoectasia than anterior cerebral arteries because posterior circulation has less sympathetic innervation than anterior circulation making them more prone to the deformity when exposed to the changes in blood pressure and flow [2] Imbalance between anti protease activity and matrix metalloproteinases within the connective tissue of arterial wall leading to aberrant vascular remodelling and defective connective tissue formation is thought to be the causative mechanism [2] Exact etiology is not known clearly. Close relationship exists between VBA &cranial nerves any change in diameter of VB artery can lead to compression of cranial nerves [4]Symptoms can be vascular events or compressive symptoms. Vascular symptoms are ischemic stroke, transient ischemic attacks, sub arachnoid hemorrhage [3] Compressive symptoms are mainly because of the brain stem and cranial nerve involvement. Commonly involved are fifth, seventh, and eighth cranial nerves. Most common symptoms are trigeminal neuralgia and hemifacial spasm. Other symptoms include nystagmus, tinnitus, and hearing loss, hoarseness and dysphagia related to compression of the medullary pyramids. ICA Dolichoectasia can be rarely seen in association with VBA. Smoker`s criteria include three quantitative measures of BA morphology: Laterality score and the height of bifurcation as measures for tortuosity and elongation, respectively, and the BA diameter. The laterality

and height of the BA are graded from 0 to 3 based on the severity [2]

**CT&MRI Diagnostic Criteria and Grading [**2]

Luminal diameter ≥4.5 mm

| Grade | CT/MRI |
|---|---|
| 0 | At or below the dorsum sellae, in the midline |
| 1 | Within the SSC, medial to lateral margin of clivus or dorsum sellae midline or questionably off midline |
| 2 | At the level of floor of third ventricle, lateral to lateral margin of clivus or dorsum sella with definite displacement to side |
| 3 | Indenting and elevating the floor of third ventricle in the cerebellopontine angle cistern |

Currently there is no effective treatment for VBD because of the location and long length of vertebrobasilar artery. The available treatment options are only meant to treat VBD related complications.

## 5. Conclusion

VBD is a progressive arterial disease characterized by ectasia, elongation, and tortuosity of the vertebrobasilar arteries. It has a complex pathogenesis, that needs further investigation. Associated ICA Dolichoectasia can be a rare possibility as in this case. Main clinical manifestations include stroke, the most common cause of death, and compressive symptoms. In the presence of VBD, nonsurgical, surgical and endovascular management options for compressive and vascular manifestations may differ from the standard treatment options. Therefore, the radiologist must be familiar with radiologic findings and the appropriate approach, related complications, and the role of multimodality imaging in evaluation and management of the VBD.

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**Abbrevations**:
BA: Basilar Artery.
VBD: Vertebrobasilar Dolichoectasia.
ICA - Internal Carotid Artery.
DWI - Diffusion Weighted Imaging.
TOF - Time Of Flight.
MIP - Maximum Intensity Projection.
SSD - Shaded Surface Display.