

# Superior Sagittal Sinus Bifurcation Variation



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## ABSTRACT

*It is important to define the dural sinuses during assessment of the clinical presentations in neurosurgery and neurology and especially before performing surgical interventions involving the brain. Variations of dural sinuses are frequently seen in confluence of the sinuses. In our case, cranial venous MRI angiography of a 49-year-old male patient demonstrated that the superior sagittal sinus bifurcated near sutura lambdoidea of the cranium. These coursed as two separate branches and drained into the transverse sinus without forming the confluence of the sinuses. Sinus rectus joined to the left transverse sinus. We think that this unusual variation which was not reported before will contribute to the assessment of the neurologic presentations and also to the surgical interventions*

**Key words:** Variation, MR angiography, superior sagittal sinus, straight sinus

## Superiör Sagittal Sinüs Bifürkasyon Varyasyonu

### ÖZET

*Nöroşirürji ve nöroloji ve özellikle beyin ile ilgili cerrahi müdahaleler öncesindeki klinik değerlendirmede, dural sinüsleri tanımlamak önemlidir. Dural sinüs varyasyonları, confluens sinuum içinde sık olarak görülür. Olgumuzda, 49 yaşındaki erkek hastanın çekilen kraniyal venöz MR anjiyografisinde süperior sagittal sinüs, kafatasındaki sutura lambdoidea hizasında çatallaştığı gösterilmektedir. Bunlar, iki ayrı dal şeklinde ve confluens sinuum'u oluşturmadan transvers sinüs'e drene olmaktadır. Sinüs rektus, sol transvers sinüs'e katılmaktadır. Biz, daha önce bildirilmemiş bu sıradışı varyasyonun, nörolojik prezentasyonlar ve de cerrahi müdahaleleri değerlendirmede katkı sağlayacağı düşünülmektedir.*

**Anahtar kelimeler:** varyasyon, MR anjiyografi, superiör sagittal sinüs, düz sinüs,

## INTRODUCTION

Superior sagittal sinus, which begins posterior to the foramen caecum in the frontal bone and courses backwards along the superior margin of falx cerebri, widens near the internal occipital protuberance and is referred to as the confluence of the sinuses. During embryonic development, the superior sagittal sinus is formed from the marginal sinus of each side, which becomes approximated toward the midline to form the superior sagittal plexus. Posteriorly, the superior sagittal sinus may remain sepa-

rated into the two limbs that drain laterally to join the transverse sinus of each side. The two limbs usually join to form the confluence of sinuses during the sixth fetal month (1). The embryonic superior sagittal sinus drains chiefly to the right jugular. The adult configuration is usually not completed at birth, when cerebral and cerebellar veins drain to the junction of the transverse and sigmoid sinuses. Adult pattern of the confluence of sinuses emerging from the tentorial plexus is usually asymmetrical. Variations of dural sinuses are frequently seen in confluence of the sinuses (2). It is important to define the dural

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sinuses during assessment of the clinical presentations in neurosurgery and neurology and especially before performing surgical interventions involving the brain. The anatomy of the sinuses in this region must be known when assessing the patient complaints and conducting tests in the follow-up.

### CASE

AA 49-year-old male patient with numbness in his hands and headache was admitted to Neurosurgery Department of Afyonkarahisar Kocatepe University Hospital. Cranial venous magnetic resonance angiography (MRA) was performed using a 1.5-T MR machine with phase contrast angiography sequence (20 cm/s of velocity encoding). Thereafter, the obtained data were evaluated on the workstation using source and maximum intensity projection images. Venous MRA of the patient demonstrated that superior sagittal sinus bifurcated 53.3 mm above the hypothetical line connecting transvers sinuses, coursed as two separate branches and continued as the corresponding transverse sinuses without forming the confluence of the sinuses. The right branch of the superior sagittal sinus was dominant. Straight sinus joined to the left transverse sinus.

### DISCUSSION

In a study by Kobayashi et al. (3) the patterns of the confluence of the sinuses were classified according to the results obtained from contrast-enhanced 3D venous MRA in 549 consecutive patients. In their study, Type 3, which was observed in 18.9% of cases, was defined as superior sagittal sinus and straight sinus branching into the bilateral transverse sinuses. This type is similar to the variation our case. However straight sinus in our case drains into left transverse sinus which makes it similar to type 4b. This subtype was observed in 4.4% in the study by Kobayashi et al. In the same study, the communication between the right and left transverse sinuses was classified into four types. No communication was defined as Type C which was seen in 0.4% of patients. In our case, superior sagittal sinuses continue as the corresponding transverse sinuses which course as two separate branches as in Type C. Singh et al. (4) examined the impressions on the inner surface of the occipital bone in 160 dried skulls. The impression patterns were classified into four types. The bifurcation type, which was seen in 22 (14%) cases, was defined as superior sagittal sinus groove dividing into the grooves of bilateral transverse sinuses. This type is similar to the variation in our case. Widjaja et al (1). studied normal venous anatomy and anatomic variants by using MR venography in a series of 50 pediatric patients. They found that straight sinus drained into left trans-

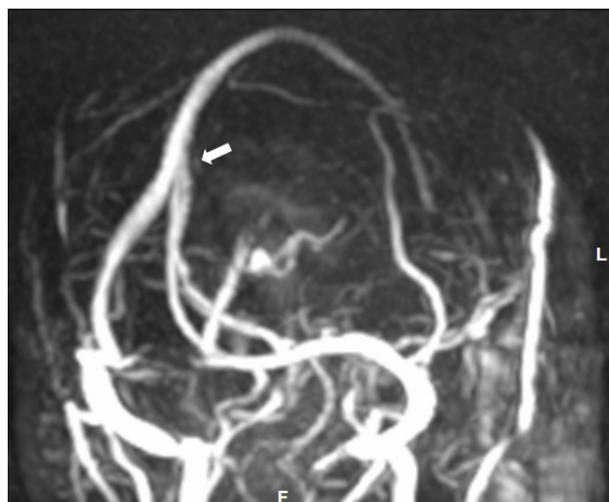


Figure 1. Superior sagittal sinus branching into two separate branches (arrow)

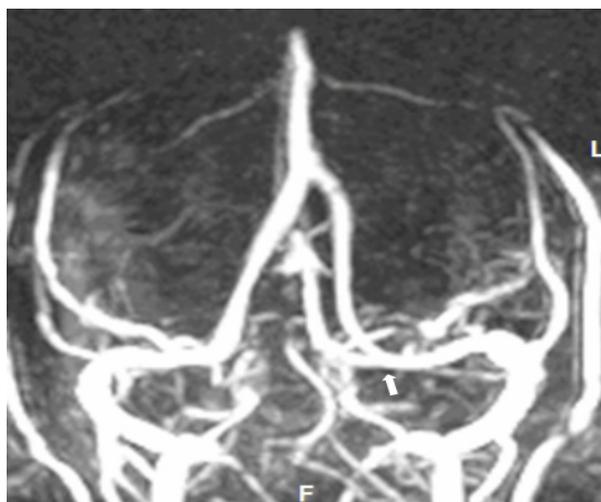


Figure 2. Straight sinus joins into the left transverse sinus. (arrow)

verse sinus in 34% of cases which was the second most encountered pattern. In a study of 100 patients by using 3D phase contrast MR angiography, Surendrababu et al (5) showed that the predominant drainage of the straight sinus was to the left transverse sinus (21%), to a lesser extent to the right transverse sinus (13%) and remaining into the confluence of the sinuses. Likewise, straight sinus drained into left transverse sinus in our case. In the studies by Widjaja et al. (1) and Surendrababu et al. (5), partial split of the superior sagittal sinus was observed in 2 (4%) and 12 cases (12%), respectively. However, in these studies no measurement data were given concerning the distance between the bifurcation and the hypothetical line connecting transvers sinuses. Therefore we could not make comparisons of the distances.

The identification of dural sinus variations are important during surgical interventions. In a study by Hwang et al. (6) it was shown that the drainage pattern of the confluence of sinuses was important for clinical decision making in the surgical removal of the large petroclival meningiomas. Fiumara et al. (7) reported a case of multiple dural arteriovenous fistulas of the transverse sinuses which was treated surgically. These demonstrate the significance of pre-operative evaluation of dural sinus anatomy. Zouaoui et al. (8) demonstrated that some radiological findings, which are mistakenly regarded as venous thrombosis, are actually the result of anatomical variations. We think that the lack of adequate knowledge about dural sinus variations may lead to erroneous interpretation of imaging of the posterior cranial fossa.

We think that this unusual variation which was not reported before will contribute to the assessment of the neurologic presentations and also to the surgical interventions.

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