

## Vertebral Arteriovenous Fistula: Report Of Two Cases

HAMİT Z. GÖKALP, MEHMET E. ÜSTÜN, NURULLAH YÜCEER

Ankara University, Faculty of Medicine, Department of Neurosurgery, Ankara, Türkiye

**Abstract :** Two cases of vertebral arteriovenous fistula (VAF) one caused by an angiographic catheter during coronary angiography and other due to a gunshot wound are presented. Preoperative and postoperative angiographic verification of the lesions was

demonstrated. Both patients were treated by direct surgical trapping of the fistula.

**Key Words:** Angiography, arteriovenous fistula, surgery, trauma, vertebral artery.

### INTRODUCTION

The vertebral artery (VA) is rarely injured because of its deep location, relatively small calibre, and the protection afforded by overlying bone through most of its course (1,2,5,11,12,15).

Posttraumatic fistulae between the VA and internal jugular vein may cause neurological symptoms, bothersome tinnitus and, occasionally, high output cardiac failure (10).

The therapeutic options that have been used, alone or in combination, include excision of the fistula, surgical trapping of the VA and / or endovascular obliterative procedures (1,11).

We report two cases of VAF one caused during coronary angiography and other by a gunshot wound.

### CASE 1:

This 51yearold man had suffered from a roaring noise in his right ear for 14 months before admission in September 1989. He also complained of blurred vision in his right eye and a sensation of burning pain on the right side of his face. His symptoms had began after receiving a gunshot wound. Physical examination revealed a bruit in the right retroauricular area

with evidence of penetrating injury and no definite neurological deficit. Digital subtraction angiography and selective right vertebral angiography by retrograde femoral catheterization, demonstrated an arterio venous fistula at the foramen magnum level between the VA and the internal jugular vein and basilar venous plexus (Fig.1) The right posterior

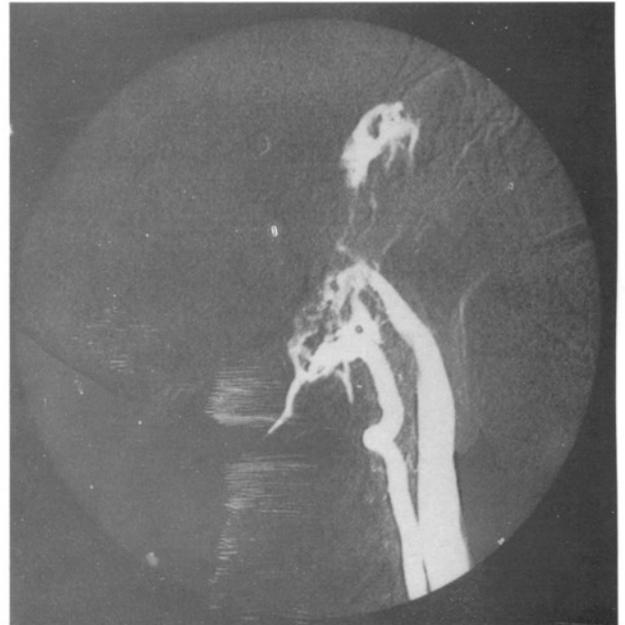


Fig. 1 : Digital subtraction angiography showed arteriovenous fistula at C1 level between VA and internal jugular vein.

inferior cerebellar artery (PICA) and the vertebrobasilar system was filling through the left VA (Fig.2).

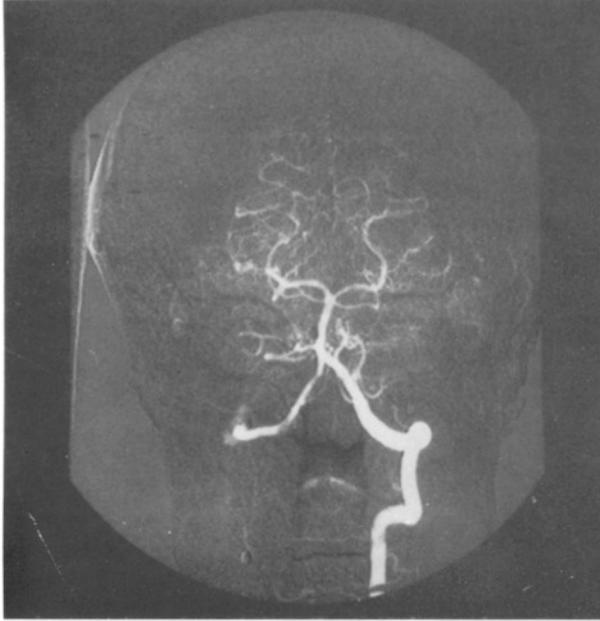


Fig. 2 : Left vertebral angiography: Posterior circulation was filling through the left VA.

**Operation:** Under general anaesthesia in a semi-Fowler position, the head was turned 20 degrees to the right side. After a right paramedian suboccipital craniectomy, the right VA was seen and by dissection was followed and exposed to the atlantooccipital membrane, where it enters the intracranial cavity. Continuing the dissection, the right transverse foramina of the cervical 1 (C1) laminae was encountered and the right VA was exposed above the foramina. A right C1 hemilaminectomy was performed. Opening the dura the VAF was seen proximal to the origin of the PICA. Proximal to the PICA, a temporary clip was applied to the right VA. Observing that the right PICA was filling through cross-circulation the VAF was trapped with two smooth Yaşargil clips, one applied proximally to the origin of PICA and the other distal to the transverse foramen of the C1. Two feeders of the fistula were also occluded with silver clips. After trapping, the fistula was excised.

The postoperative course was uneventful. The bruit and the noise in the right ear disappeared. Neurological examination was normal. One week after the operation, the vertebral angiogram was

repeated. The right VA was occluded above the C1 level and the posterior circulation was filling through the left VA. There was no evidence of the arteriovenous fistula (Fig.3).

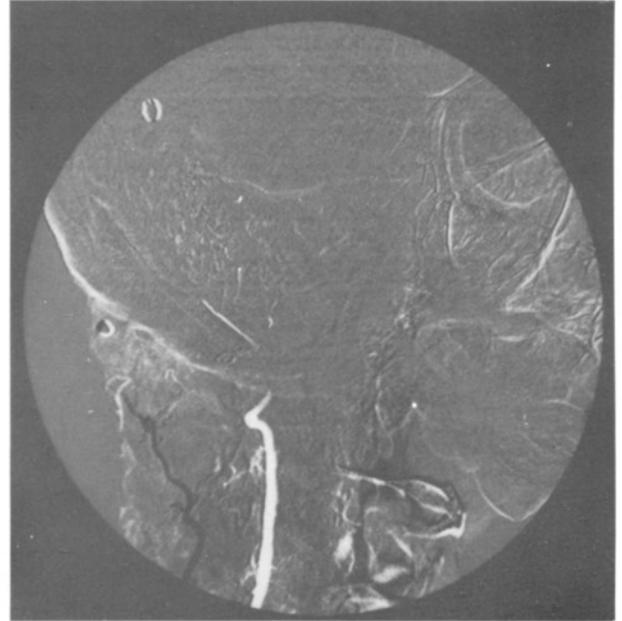


Fig. 3 : Postoperative right vertebral angiography of the first case.

#### CASE 2:

A 30-year-old female was admitted to Avicenna Hospital in August, 1991, because of a roaring noise in her left ear and headache. The symptoms had begun six months prior to admission, when immediately after coronary angiography the patient complained of a bruit synchronous with the arterial pulse. The bruit gradually increased. Carotid arterial compression did not influence the bruit. Physical examination revealed left retroauricular bruit and no evidence of penetrating injury. There was no definite neurological deficit. Digital subtraction angiography and selective left vertebral angiography by retrograde femoral catheterization demonstrated an arteriovenous fistula at C2 level between the VA and the internal jugular vein and posterior vertebral venous plexus (Fig.4). The posterior circulation was filling through the right VA.

**Operation:** Under general anaesthesia, in the right lateral decubit position, a hockey stick incision was used to expose the left suboccipital region and upper three cervical laminae on the left. The left VA, internal jugular vein and posterior vertebral venous plexus were exposed between the atlas and the

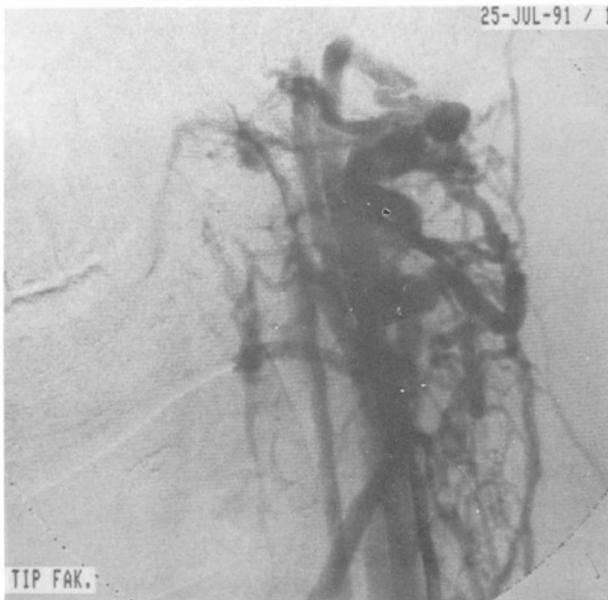


Fig. 4 : Left vertebral angiography showed arteriovenous fistula at C2 level between VA and internal jugular vein.

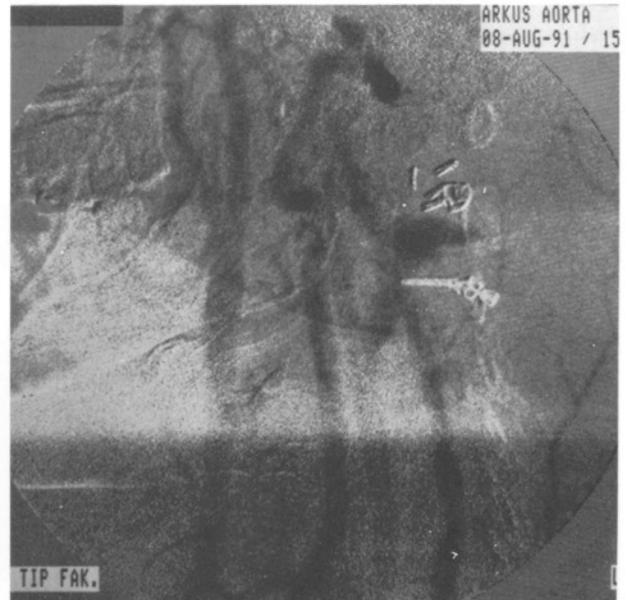


Fig. 5 : Postoperative digital subtraction angiography of case two.

transverse process of the axis. The segment of VA proximal to the VAF was enlarged in diameter while the internal jugular vein and posterior vertebral venous plexus were quite dilated. The fistula involved the second portion of the vertebral artery; the VAF was fed by the vertebral artery. Venous drainage was through the internal jugular vein and posterior vertebral venous plexus. There were multiple channels and most of these were not well defined. Therefore instead of the excision of the fistula, the left VA distal to C2 and proximal to C3 laminae was entrapped with two Mc Fadden clips. Though the posterior circulation was filling through the right VA, before applying the permanent clips, we had clipped the left VA distal to C2 with a temporary clip and saw that the VA stump was filling. The postoperative course was uneventful. The bruit and the noise in the left ear disappeared. Neurological examination was normal. One day after the operation, control angiography revealed no evidence of the arteriovenous fistula (Fig.5).

**DISCUSSION**

The first report of a VAF was made by Küttner in 1917 (1). His case was secondary to a gunshot wound and was successfully treated by excision of the fistula after proximal ligation of the VA. The first

angiographic demonstration of a VAF was by Aronson in 1961 (1,2).

Numerous reports of VAF have appeared in the literature since Küttner's (1,3,5,6,9). However, the rarity of this condition is attested by the fact that among all the published series only two contain more than 10 patients (1), and only 3 % of traumatic arteriovenous fistulae in the civilian population involve the VA (1). There have been reports of VAF associated with fibromuscular dysplasia, neurofibromatosis and idiopathic and congenital cases (1,18,19).

Penetrating neck wounds, either gunshot or stab wounds are present in most cases (1,4,14,21) while blunt or iatrogenic trauma such as following neck surgery, percutaneous vertebral or carotid angiography or central venous catheter placement involves only a minority of cases (1,7,12,15,17,20,21). But, no case of VAF caused by angiography catheter was found in the literature. It is especially interesting that our VAF was due to coronary angiography.

The second portion of the VA is affected more often than the other segments probably due to its length and the plexiform nature of the vertebral vein which completely surrounds the artery (1) along this second part of its course. In our first case, the fistula involved the fourth portion of the vertebral artery and in the second, the second portion.

In VAF, systolic neck bruit variably radiating cranially and caudally is usually present. Both our patients had retroauricular systolic bruit. The diagnosis was confirmed by angiography.

The primary goal of treatment should be eliminating the fistula together with preservation of the VA (1,6, 11,16). This may be more easily attempted when there are well defined, single or multiple channels connecting the artery and veins. These channels may be occluded by an endovascular approach using detachable balloons or by a direct surgical approach (1,6,11,16,22). In our first case, as the other VA was patent, the fistula was excised without trying to maintain VA patency.

But when the channels are not well defined as in our second case, trapping the fistula may be performed endovascularly using detachable balloons (1,5,8,9,10,11,16) or by a direct surgical approach (1,11,17,21).

VAF are relatively benign lesions with a favourable outcome, when diagnosed in time and treated. When diagnosis and/or treatment are delayed their management becomes more complicated and risky.

**Correspondance** : Prof. Dr. Hamit Z. Gökalp  
Ankara Üniversitesi Tıp Fakültesi  
Nöroşirurji Anabilim Dalı  
Samanpazarı / 06100 ANKARA  
Tel : 310 33 33 / 2934

## REFERENCES

1. Ammirati M, Mirzai Sh and Samii M: Vertebral Arteriovenous Fistulae. Report of Two Cases and Review of the Literature. *Acta Neurochir* 99: 122-126, 1989
2. Aronson NI: Traumatic arteriovenous fistula of the vertebral of the vertebral vessels. *Neurology* 11: 818-823, 1961
3. BaleriauxWaha D, Jeanmart L, Brihaye J and Henneaux J: Traumatic arteriovenous fistulas of the vertebral artery. *Neuroradiology* 11: 83-85, 1976
4. Berguer R, Feldman J, Wilner HI and Lazo A: Arteriovenous vertebral fistulae. Cure by combination of operation and detachable intravascular balloon. *Ann Surg* 196: 65-68, 1982
5. Chou SN, French LA: Arteriovenous fistula of vertebral vessels in the neck. *J Neurosurg* 22: 77-80, 1965
6. Chou SN, Story JL, Seljeskog E and French LA: Further experience With arteriovenous fistulas of the vertebral artery in the neck. *Surgery* 62: 779-788, 1967
7. Dodson T, Quindlen E, Crowell R and McEnany MT: Vertebral arteriovenous fistulas following insertion of central monitoring catheters. *Surgery* 87: 343-346, 1980
8. Freitag HJ, Grzyska U and Zeumer H: The use of the "cross over technique" in the management of a traumatic vertebrovertebral fistula. *Neuroradiology* 31: 174-176, 1989
9. Golueke P, Sclafani S, Phillips T, Goldstein A, Scalea T and Duncan A: Vertebral artery injury diagnosis and management. *J Trauma* 27: 856-865, 1987
10. Goodman SJ, Hasso A, and Kirkpatrick D: Treatment of vertebrojugular fistula by balloon occlusion. Case report. *J Neurosurg* 43: 362-367, 1975
11. Halbach Van V, Higashida RT and Hieshima GB: Treatment of Vertebral Arteriovenous Fistulas. *AJR* 150: 405-412, 1988
12. Jamieson KG: Vertebral arteriovenous fistula caused by angiography needle. Report of case. *J Neurosurg* 23: 620-621, 1965
13. Kollmeyer KR, Hunt JL, Ellman BA and Fry WJ: Acute and chronic traumatic arteriovenous fistulae in civilians. *Arch Surg* 116: 697-702, 1981
14. Leape LL and Palacios E: Acute traumatic vertebral arteriovenous fistula. *Ann Surg* 174: 908-910, 1971
15. Markham JW: Spontaneous arteriovenous fistula of the vertebral artery and vein. *J Neurosurg* 31: 220-223, 1969
16. Miller RE, Hieshima GB, Giannotta SL, Grinnell VS, Mark Mehringer C and Kerin DS: Acute traumatic vertebral arteriovenous fistula. Balloon occlusion with the use of a contralateral approach. *Neurosurg* 14: 225-229, 1984
17. Olsen RW, Baker HL and Svien HJ: Arteriovenous fistula: a complication of vertebral angiography. Report of a case. *J Neurosurg* 20: 7375, 1963
18. Quatromoni JC, Johnson JM and MacDonald Wood: Vertebral arteriovenous fistulas. *Am J Surg* 138: 907-911, 1979
19. Ramana Reddy SV, Karnes WE, Earnest F and Sundt TM: Spontaneous extracranial vertebral arteriovenous fistula with fibromuscular dysplasia. Case report. *J Neurosurg* 54: 399-402, 1981
20. Rockett JF, Moinuddin M, Robertson JT and Bernhard SC: Vertebral artery fistula detected by radionuclide angiography. Case report. *J Nucl Med* 17: 24-25, 1976
21. Svetilas C and Dean DC: Intermittent vertebral arteriovenous fistula due to cervical stab wound. *NY State J Med* 735-738, 1972
22. Weinberg PE and Floom RA: Traumatic vertebral arteriovenous fistula. *Surg Neurol* 1: 162-167, 1973