EMBOLIZATION OF THE FIRST THREE SPINAL CORD AVM-CASES IN THAILAND

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ABSTRACT

PURPOSE : To embolize the spinal cord arterio-venous malformation (SCAVM), by transarterial superselective microcatheterization and injection of N-butyl cyano-acrylate (NBCA) as the permanent embolic material; were performed under prompt anatomical analysis. PATIENTS; MATERIALS AND METHODS: Three patients with SCAVM were treated with NBCA embolization into the arterial feeders as close to the nidus or shunt as possible. Superselective catheterization with microcatheter in co-axial system technique was used. Immediate control post embolization angiogram were performed in all cases with pre and post embolization evaluation of signs and symptoms. RESULTS: All three SCAVMs were technically successful embolized with good anatomical post embolization controlled angiogram. Clinical signs and symptoms were improved without any complications in two patients. A patient got immediate complication of the weakness of upper extremities with remaining minor motor deficit of the right hand at 1 year follow up. CONCLUSION: Transarterial superselective embolization of the SCAVM using NBCA as permanent liquid embolic material; under prompt anatomical and hemodynamic analysis; has recently been one of the most appropriate and effective way for the treatment of SCAVM; which most of them are non surgical lesions.

Key Words **SCAVM,** spinal cord arterio-venous malformation, Embolization.

PATIENTS , MATERIALS AND METHODS .

PATIENT 1:

A 34 years old woman; presented with numbness of right arm since the age of nine. She also have had slightly progressive hyperesthesia of the same extremity during the last 6 years. Diagnosis was made with spinal MRI and angiogram to be SCAVM at C5-7 level which feeders were from both vertebral arteries and the veins drained both upward and downward. (Fig. 1-3).

The first embolization was performed 2 years ago into the right vertebral arterial feeder with the technique of co-axial superselective microcatheterization so that the tip of the microcathter was as close to as the nidus as possible; then the mixture of Histoacryl 1.5 ml. and lipiodal 0.6 ml. were injected into the nidus until a good filling was obtained. After that, approximately 50% of the vascularity in the nidus were disconnected as shown in Fig 4-6. Follow up angiogram study in 3 months showed that the residual nidus was still supplied by the left vertebral arterial feeder but the anterior spinal artery was also visualized in the same injection. (Fig 7). Dicision to perform second embolization had been made and again the same technique of catheterization was performed but this time with some difficulty to pass the microcatheter tip into the feeder

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far enough from the anterior spinal artery. During the glue injection (mixture of Histoacryl 1.5 ml. and lipiodol 0.4 ml.) the uncontrolable respiratory artifact in AP view was observed (Fig. 8). The controlled angiogram was performed immediately in which the complete occlusion of the nidus had been shown. (Fig. 9). Five minutes after that, the patient had got the motor deficit of both upper extreminities as

wrist extensor	grade II/V
Hand grip	grade II/V

Immediate treatment of the spinal shock was given. One day later, the neurological evaluation were upper extremities grade III/V except hand grip gr I-II/V

lower extremities grade II/V with foot drop

MRI C spine obtained and showed enlargement of the cervicle spinal cord with some increase SI in T2W image which were compatable with the spinal infarction.

After one year follow up, the patient gained normal motor power except the hand grip were still in grade III-IV/V. The rest of the motor weakness were all fully recovered. Physical therapy has still been continued.

PATIENT II

A 32 years old female; has had first symptoms 2 years ago during her pregnancy; with pain and numbness of the right frank that radiated down to her right leg and foot.

One year later; the symptoms increased with aggravation during walking and excrcise. Neurological examination revealed spastic of both lower extremities, Sensory loss below T10 level, Babinski upward right side with positive clonus was noted.

MRI and diagnostic angiography were performed. The studies revealed that there was the SCAVM locating at dorsal aspect of the conus medullaris with right L2 radiculo-pial artery as the main feeder (Fig. 10-13). Another small dural shunt or radicular AVM was accidentally found from right L3 injection. (Fig. 14) The anterior spinal artery was definitely found at left T10 injection. (Fig. 15)

Embolization was performed using the same technique that had been previously decribed except that the mixture of Histoacryl 1 ml. and Lipiodol 1.4 ml. had been used. This caused 75% of the vascularity in the nidus to disconnect (Fig. 16).

Immediately controlled angiogram had shown that there was total occlusion of the right L2 feeder and the good patency of the Adam-Kiewicz artery with minimally remained feeder (Fig. 16).

At one month follow up, the MRI and the clinical evaluation had shown no more spasticity of the lower extremities. However, the minimal extensor of right big toe weakness was remained without any pain or definite sensory abnormalities. The MRI showed that the glue cast and thrombosis had filled up about half of the nidus.

PATIENT III

A 13 year old boy presented with acute right subcostal pain following by the numbness of both feet which extended up to the umbilical level. The paraplegia had also occurred within a few hours after the beginning of other symptoms. At the hospital; neurological examination were

motor: lower extremities-paraplegia; flaccid tone
sensory: decrease from feet to T8 level; with sacral sparing

DTR: knee and ankle-0/0 both sides; clonus negative
MRI study revealed that there was an acute intramedullary hemorrhage from SCAVM at the level of T6-7 level. (Fig. 17). Diagnostic spinal angiogram was then performed which revealed that the SCAVM was located at the ventro-medial aspect of the cord with the right T8 radiculo-pial artery as the main feeder. (Fig. 18). The anterior spinal artery was identified by the left T10 injection. (Fig. 19-21).

Embolization was performed with the same previously mentioned technique but this time the mixture of Histoacryl 1 ml. and Lipiodol 1.4 ml. were used. About 70% of the vascularity in the nidus was disconnected. (Fig. 22-23).

At one month clinical follow up the improvement of the motor up to grade IV of all extremities was shown and the patient could have normal urination.

MATERIALS AND METHODS

All three patients with clinically suspected SCAVMs were diagnosed with MRI. The good quality subtraction spinal angiography had been performed. In this report; superselective distal catheterization was achieved by a 5F thin wall guiding catheter; spinal curve; and a variable stiffness microcatheter ≺ Minitorquer or Magic (BALT)≻. Superselective guide wire had also been used i.e. (Schnider 010). Permanent liquid embolic agent of NBCA was prepared using lipiodol to make variable mixture concentration and to increase the opacity during fluoroscopy. Therefore, the type of the mixture depended on the hemodynamics and the way to make the distal catheterization.

RESULTS

Among the three cases of SCAVMs in this study, two of them have got immediate clinical improvement even partial embolization achieved (50-70%) until 1 month follow up. The other one had also got the clinical improvement after the 1st session of partial embolization but she had still got neurological deficit after the attempt to get total occlusion in the 2nd session. At 1.5 year follow up she still have had handgrip muscle paresis Gr III.

DISCUSSION

Vascular malformation of the spine and spinal cord are considered to be an uncommon lesion, the incidence ranges from 3-16% of total spinal occupying lesion; and in relation to brain AVMs is 1:4 to 1:8. Treatment of the SCAVMs needs good understanding of the anatomy and hemodynamics; good diagnostic imaging quality and proper technique and materials. All SCAVMs symptomatic patients are indicated to be treated.

We have presented three cases of SCAVMs with endovascular treatment: transarterial superselective distal catheterization in co-axial system; with the use of permanent liquid agent which was known to yield definitive and stable results. There have been numerous previous reports on the use of other materials which usually led to incomplete and transient occlusion. Good analysis of the anatomy, especially the anterior spinal artery and the exact arterial feeders and hemodynamics, are needed in decision making for the treatment. Eventhough the total cure is still the ideal goal; but the partial treatment focused on the weak points would lead to clinical stabilization or improvement. One of our complication supports these hypothesis. Surgery should be reserved for the cases where embolization has failed in that a radiculo-medullary or radiculo-pial artery arises at the same level as the pathologic feeders or the superselective distal catheterization to the safety point is not possible. Alternatively stereotactic focused radiation might play role in the near future.

REFERENCES

1. Berenstein A, Lasjaunias P. Treatment of spine and spinal cord lesion in Surgical neuroangiography. Berlin. Springer-Verlags: 10-45.
2. Horton J, Latchaw R, Gold LH, Rang D Embolization of intramedullary arteriovenous malformations of the spinal cord AJNR 1986; 7: 113-118.
3. Garcia-Monaco R., Lasjaunias P Embolization of spinal AVMs and tumors. Current practice of intervention Radiology. Toronto, Decker: 1990; 154.-161.
4. Rodesch G, Lasjaunias. P Bereutein A. Interventional Neuro-radiology Embolization of Arteriovenous malformations of the spinal cord. Berlin Springer-Verlag, 1990: 135-150.

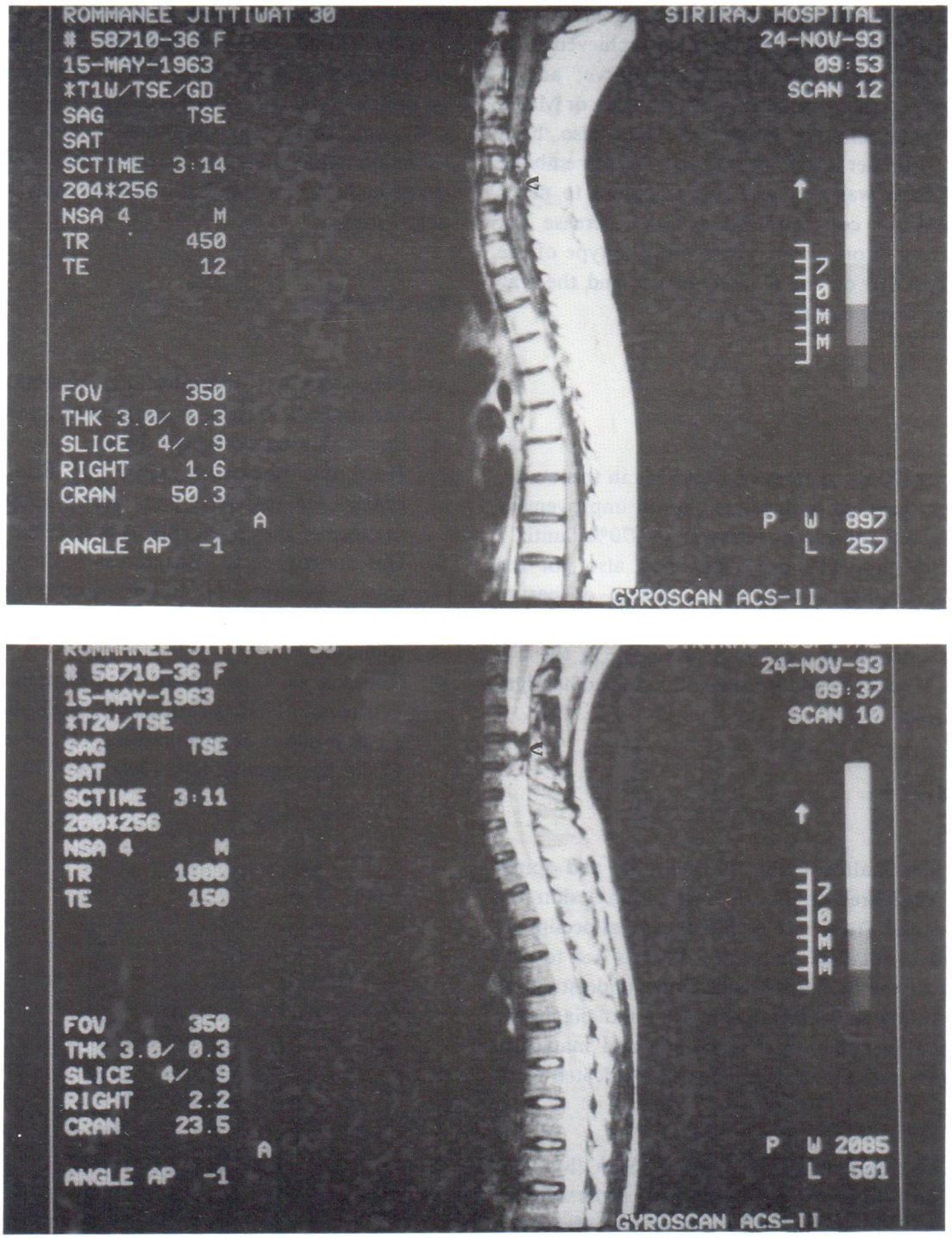

Fig. 1 (A-B) Sagittal MRI T1W, T2W image showed hemorrhage within the AVM lesion at level of C 5-7 (arrow).

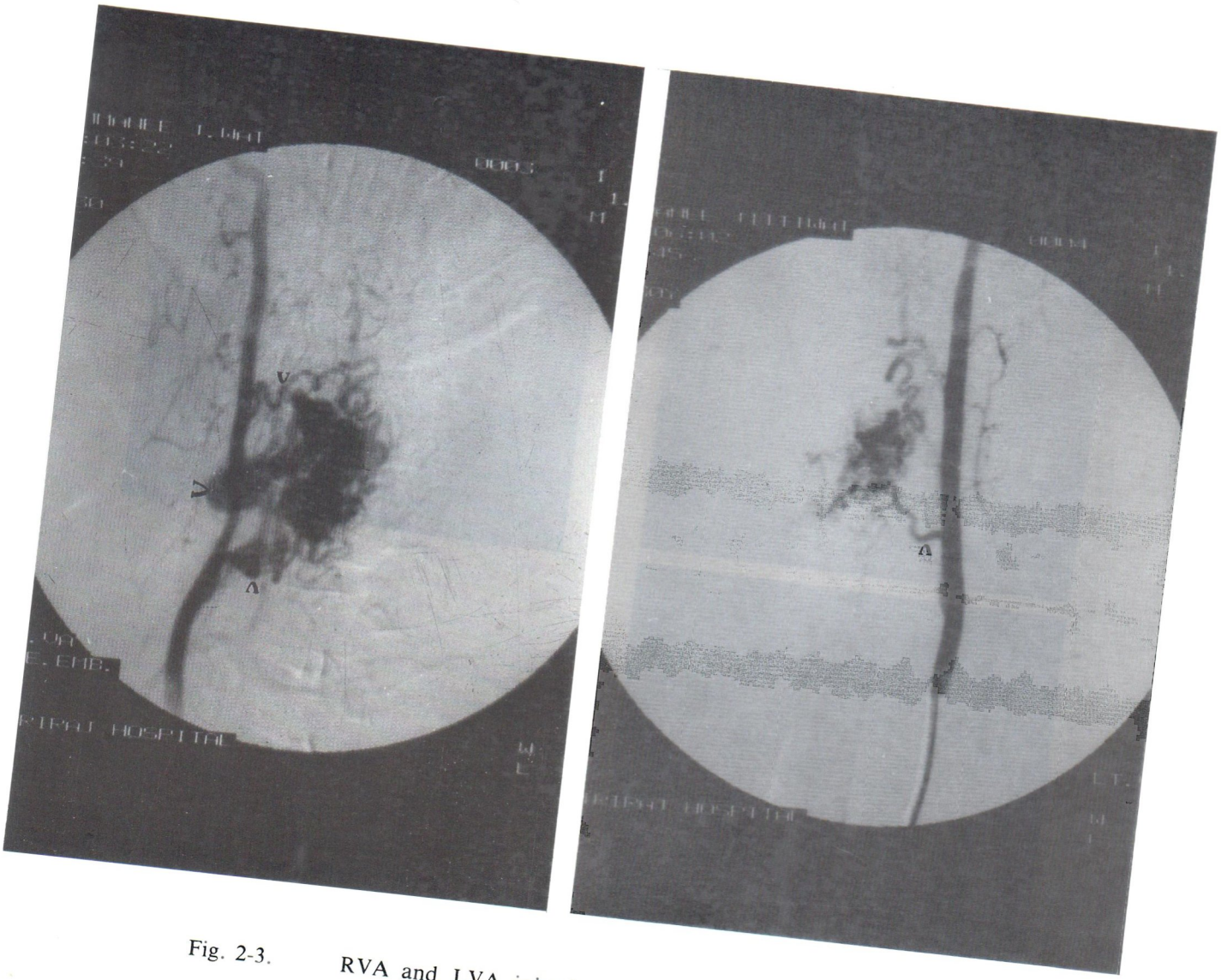

Fig. 2-3. RVA and LVA injection showed at least three feeders (arrows) to the nidus with venous pouches seen from the RVA injection (arrow head).

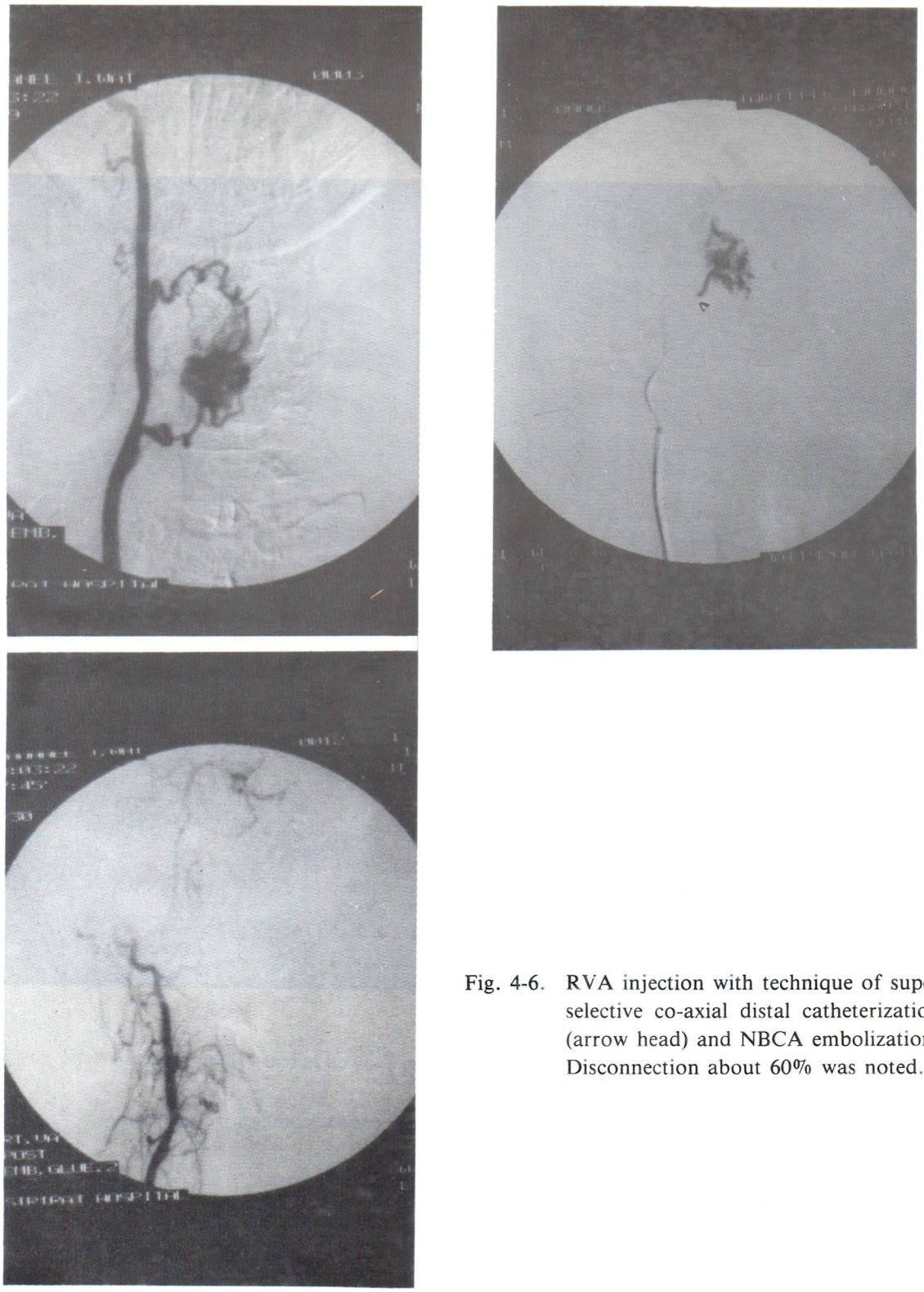

Fig. 4-6. RVA injection with technique of super selective co-axial distal catheterization (arrow head) and NBCA embolization. Disconnection about 60% was noted.

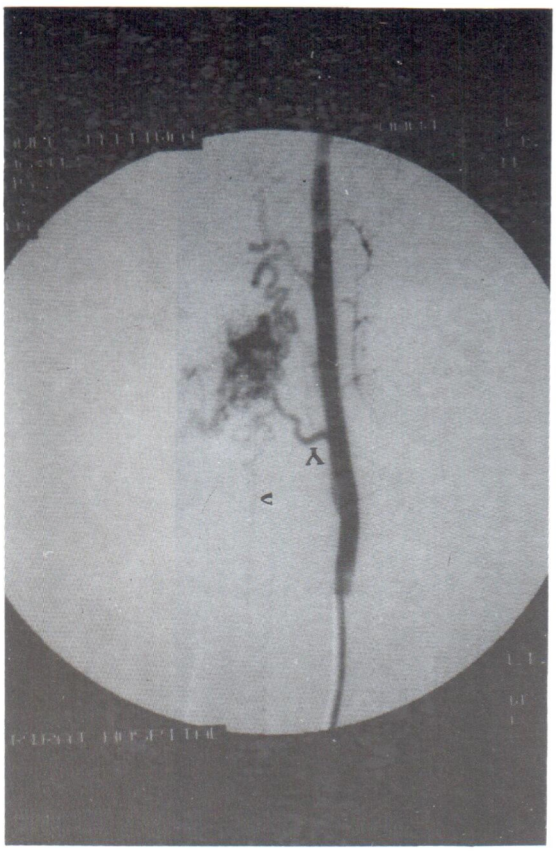

Fig. 7 LVA injection showed another feeder (arrow) with also the Anterior spinal artery visualized (arrow head)

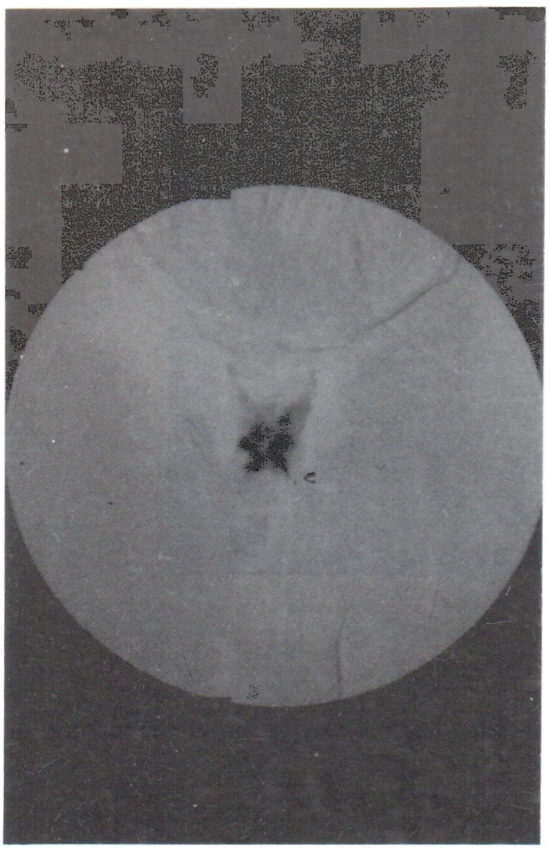

Fig. 8 During NBCA injection; uncontrolled respiratory and swollowing artifact occurred. Tip of the microcatheter was seen (arrow).

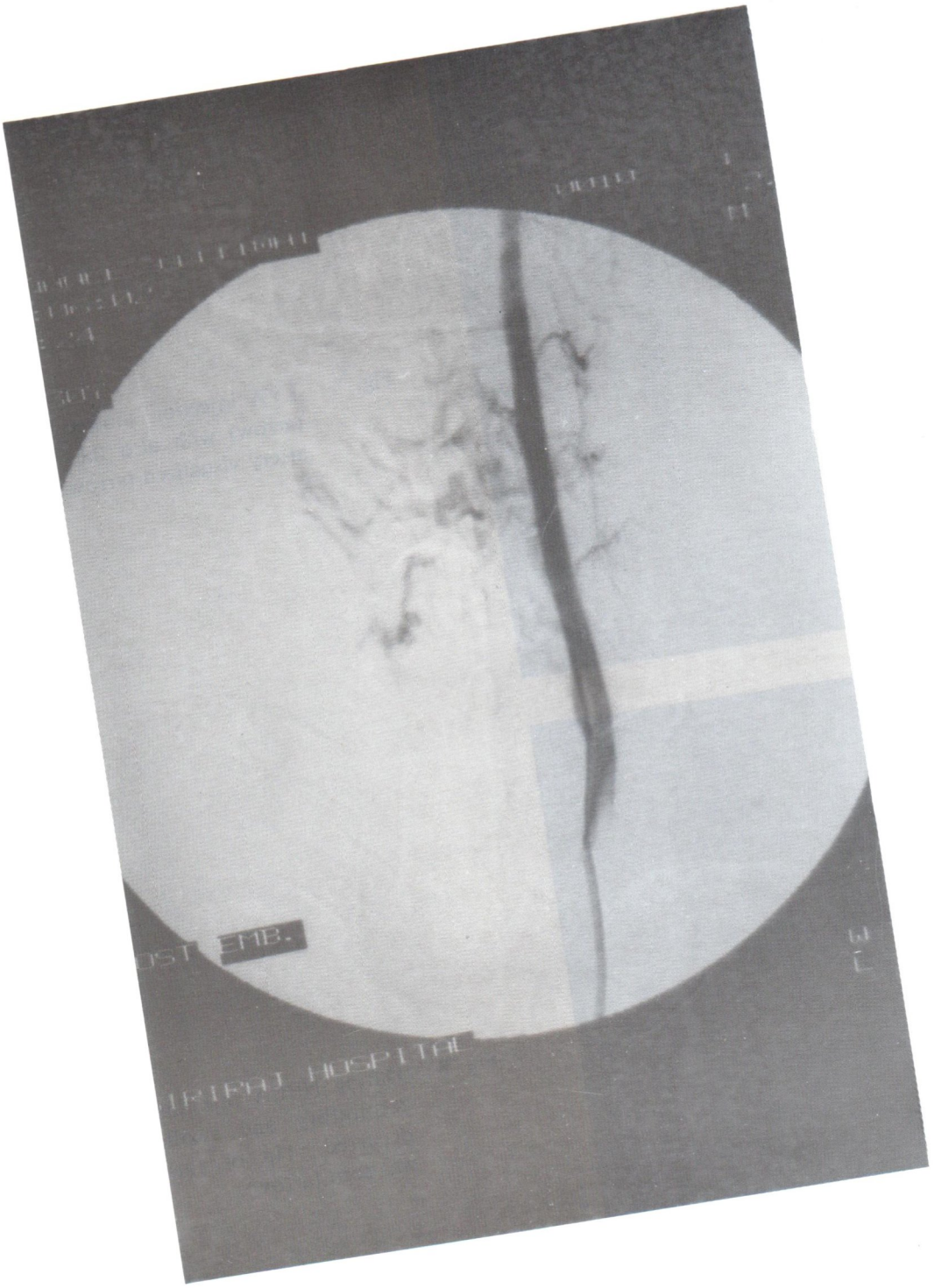

Fig. 9 LVA Post-Embolization showed complete occlusion of the nidus.

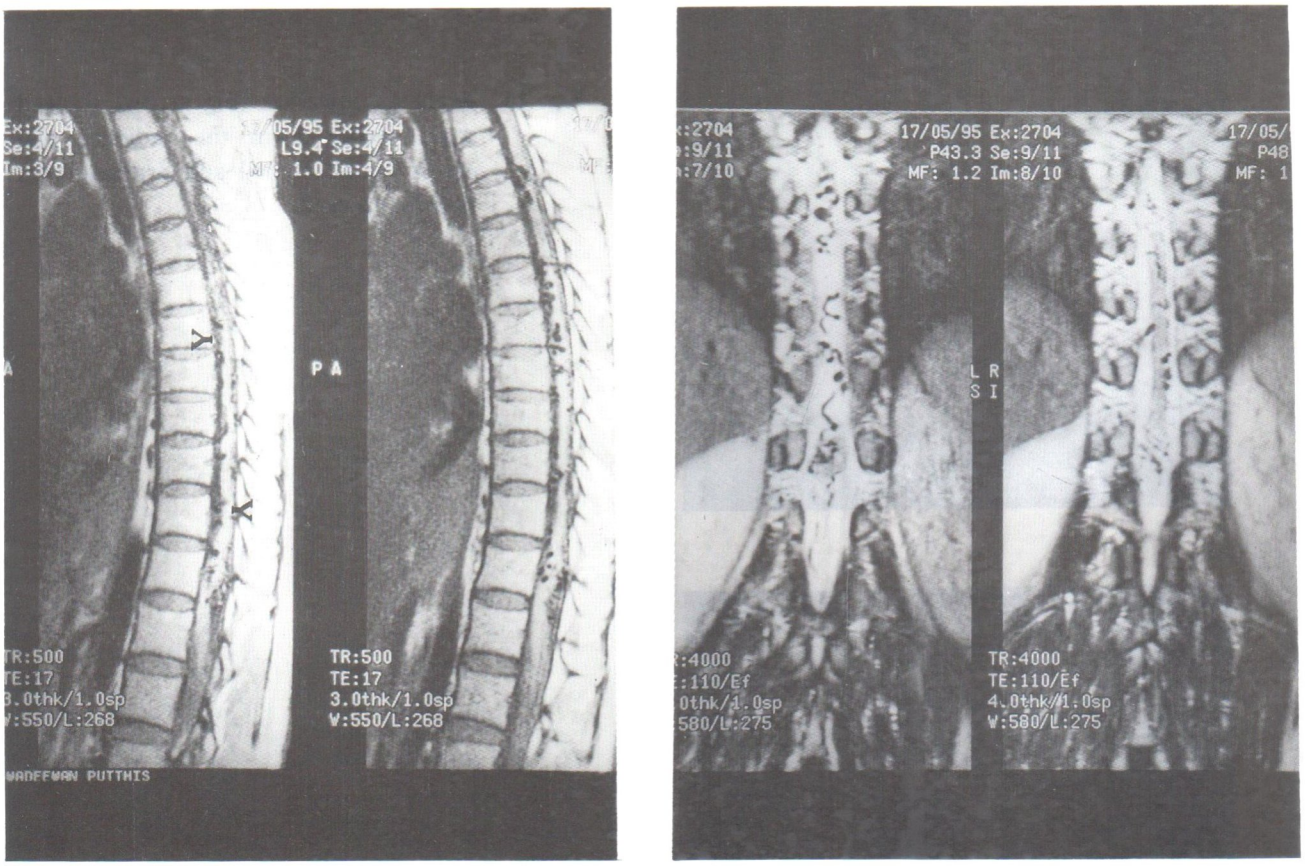

Fig. 10-11. MRI in sagittal and coronal view showed serpigenous flow void tubular structures along ventral and dorsal aspect of the cord down to conus medullaris (arrows).

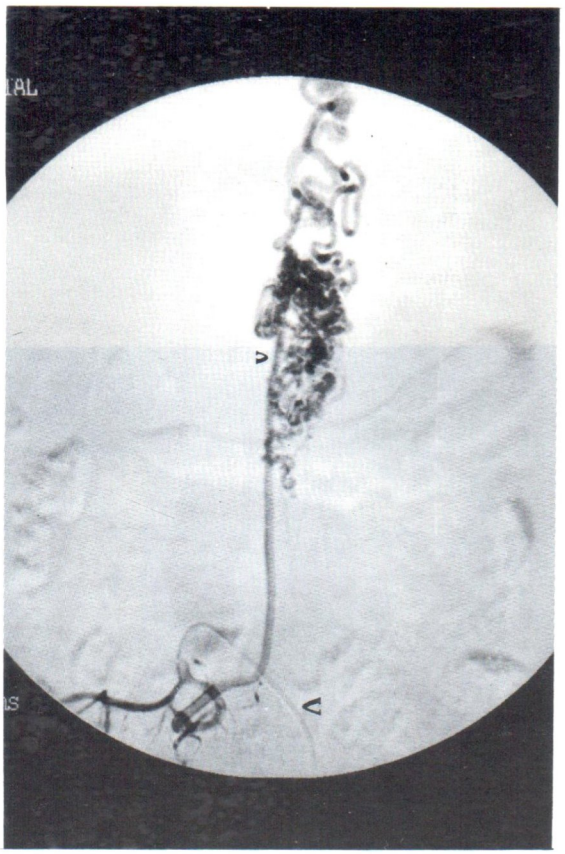

Fig. 12 Right L_2 injection (big arrow) showed main feeder from the radiculo pial artery (small arrow) and draining vein mainly upward.

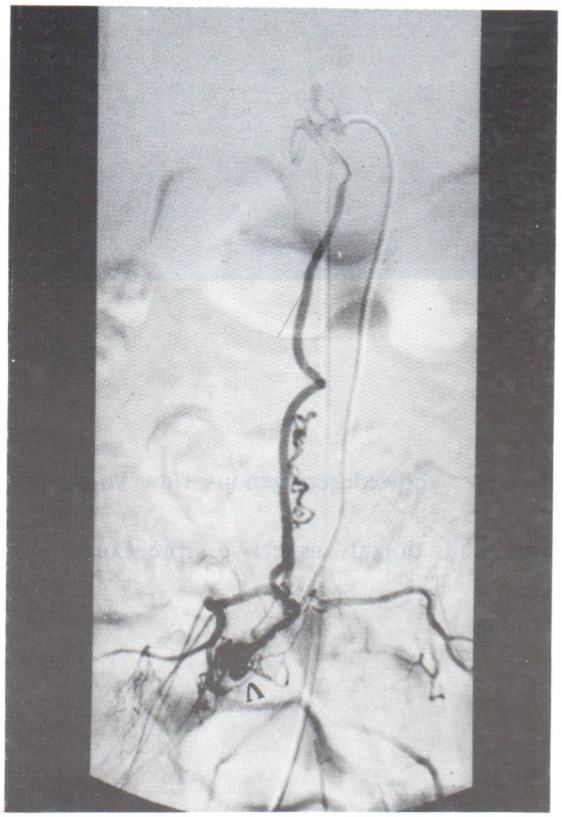

Fig. 13 Another small right L_3 radicular AVM (arrow) with also upward draining vein seen.

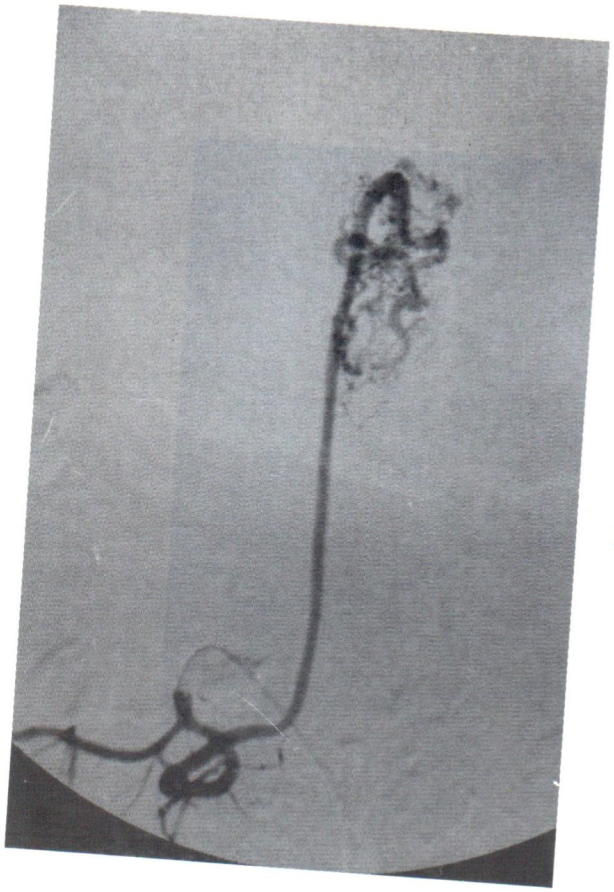

Fig. 14. Right L_3 superselectic injection during microcatheter place.

Fig. 15. During NBCA injection via Microcatheter tip (arrow) placed just above the nidus.

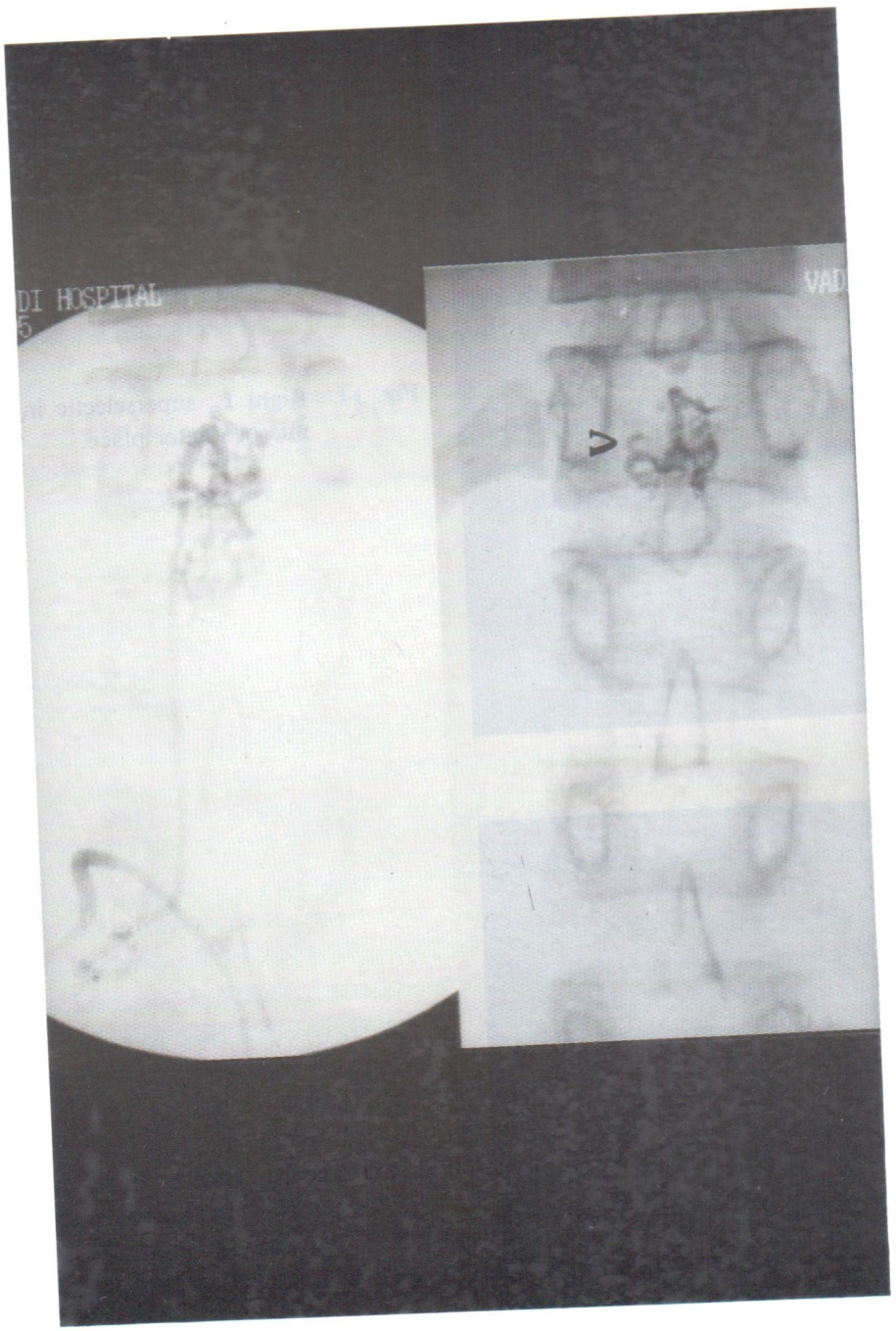

Fig. 16. Before and after NBCA deposition in main part of the nidus. (arrow showed opacity of the NBCA as permanent material).

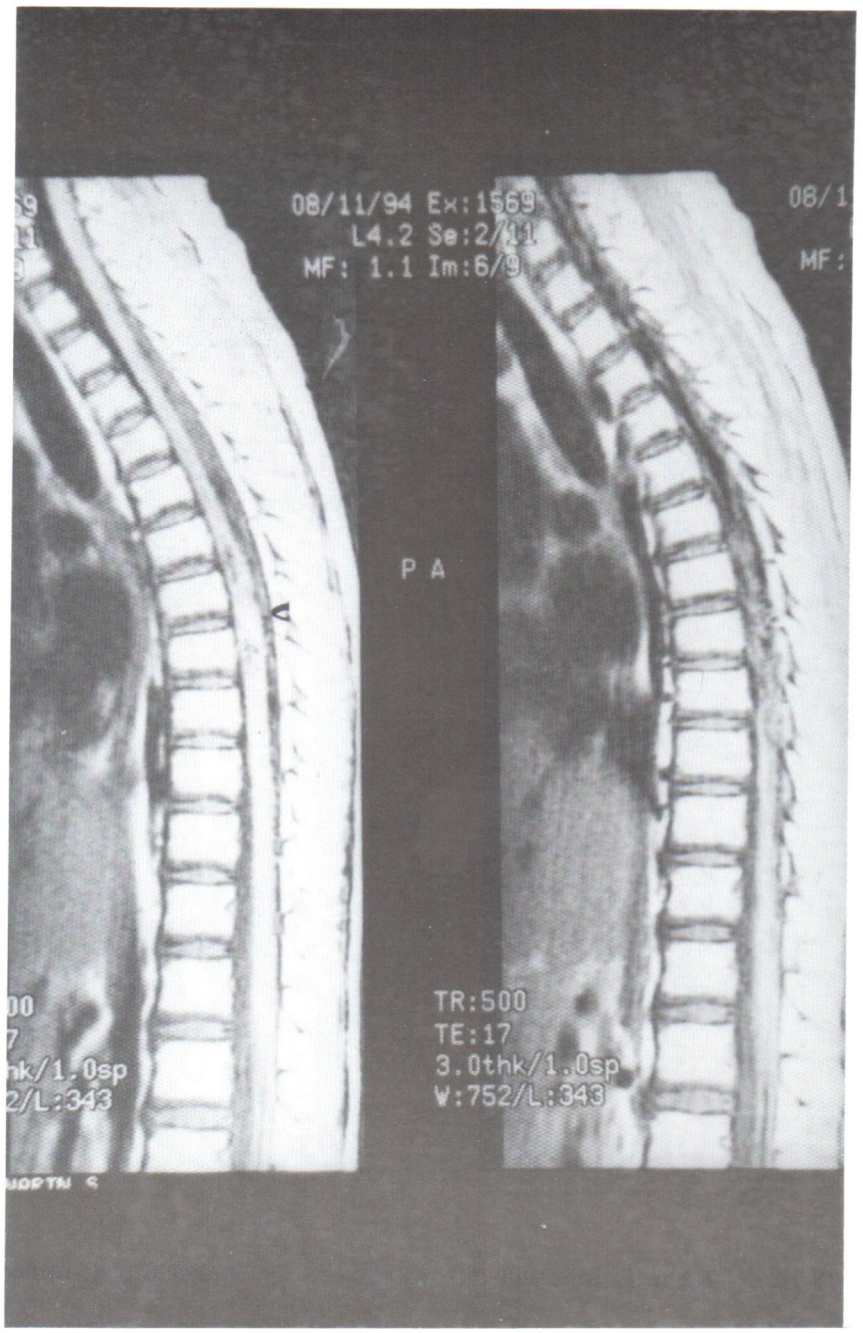

Fig. 17. MRI sagittal T1W showed hemorrhage within the cord at level of T_{6-7} (arrow) with dorsal tubular longitudinal flow void structures of draining veins.

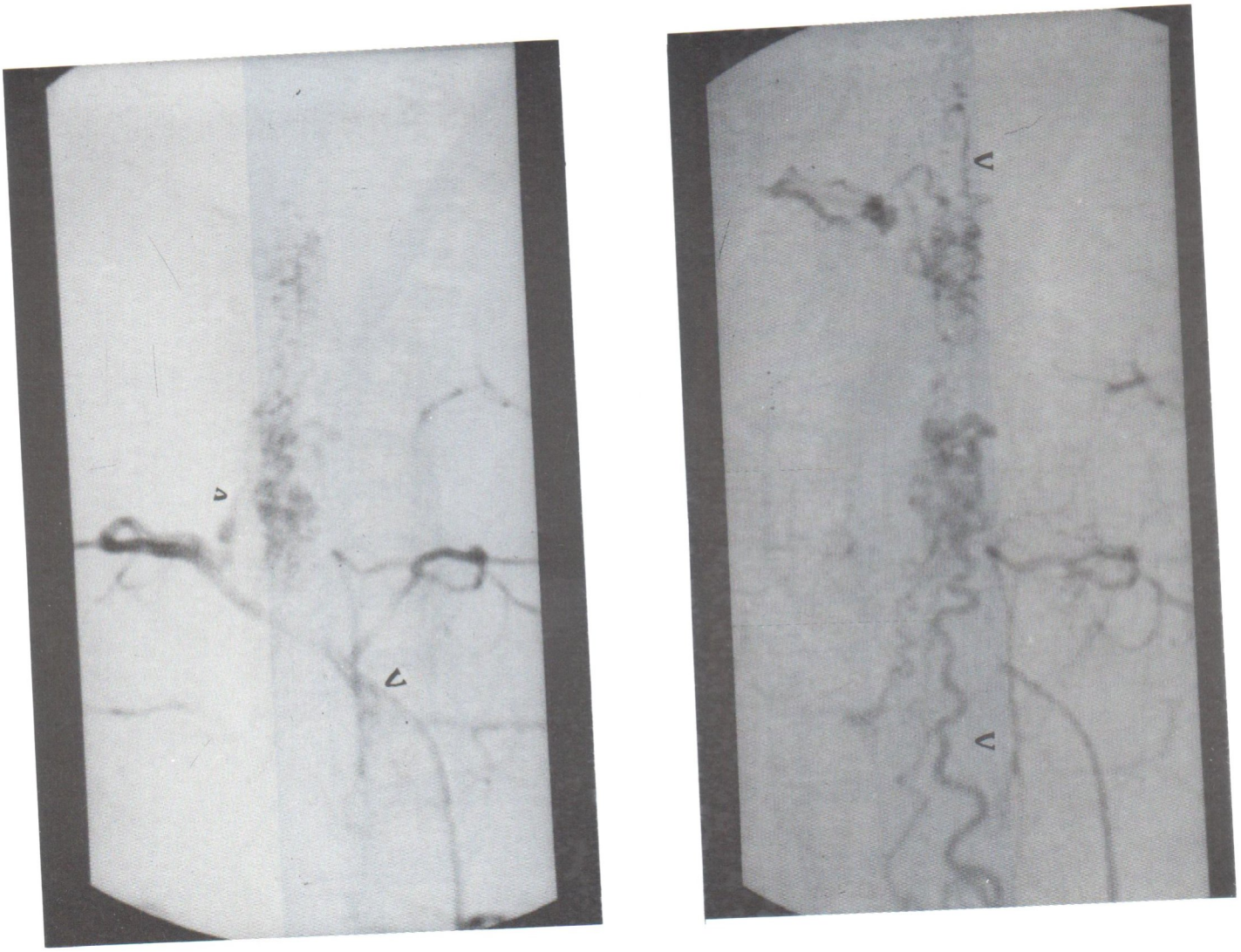

Fig. 18-19. Right T_8 injection (arrow) showed the radiculo-pial feeder (small arrow) to the nidus with both cephalad and caudad draining veins. (big arrow heads)

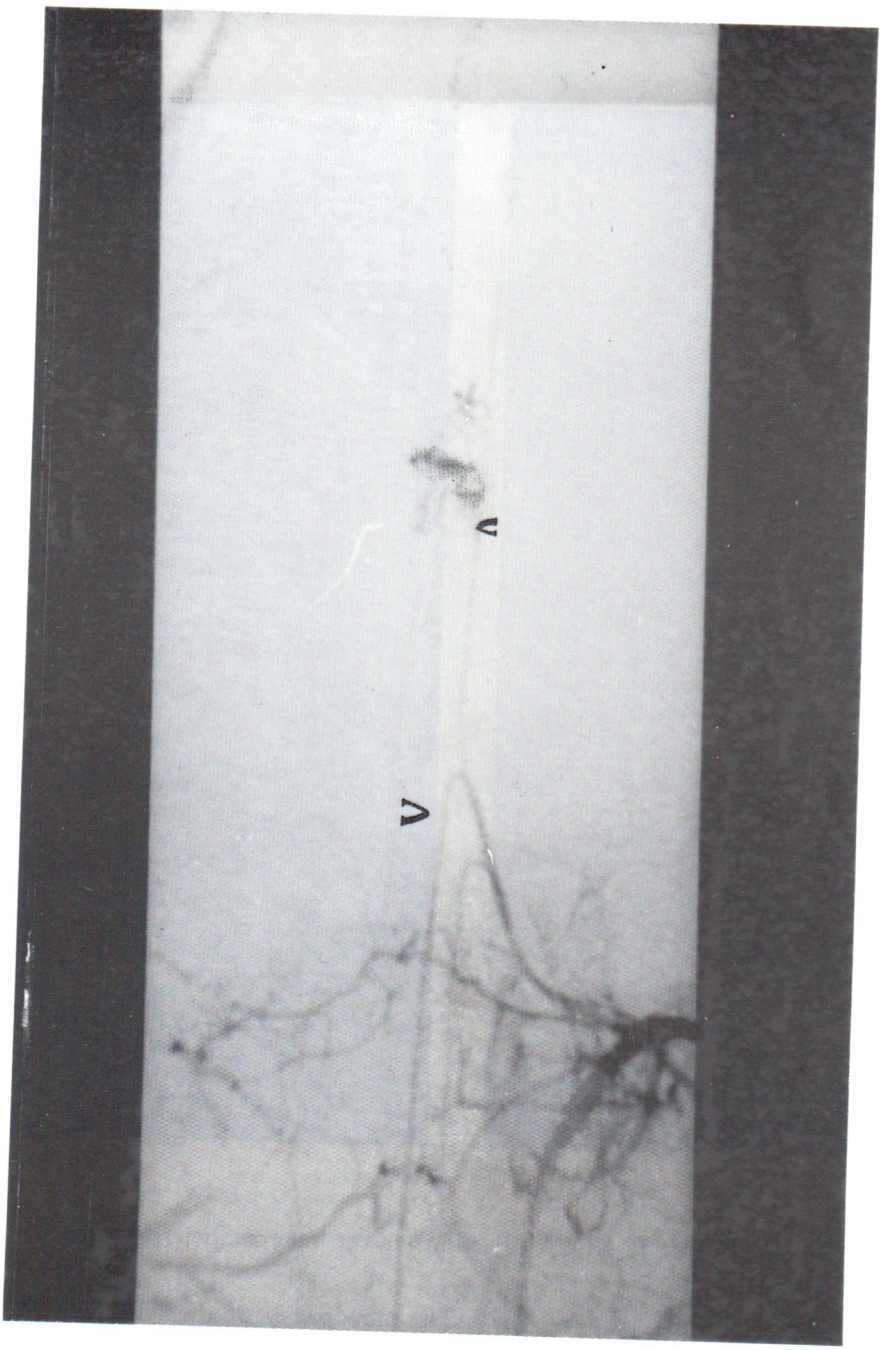

Fig. 20. The left T_{10} injection showed the anterior spinal artery (big arrow) with minimal feeders to the nidus too. (small arrowhead)

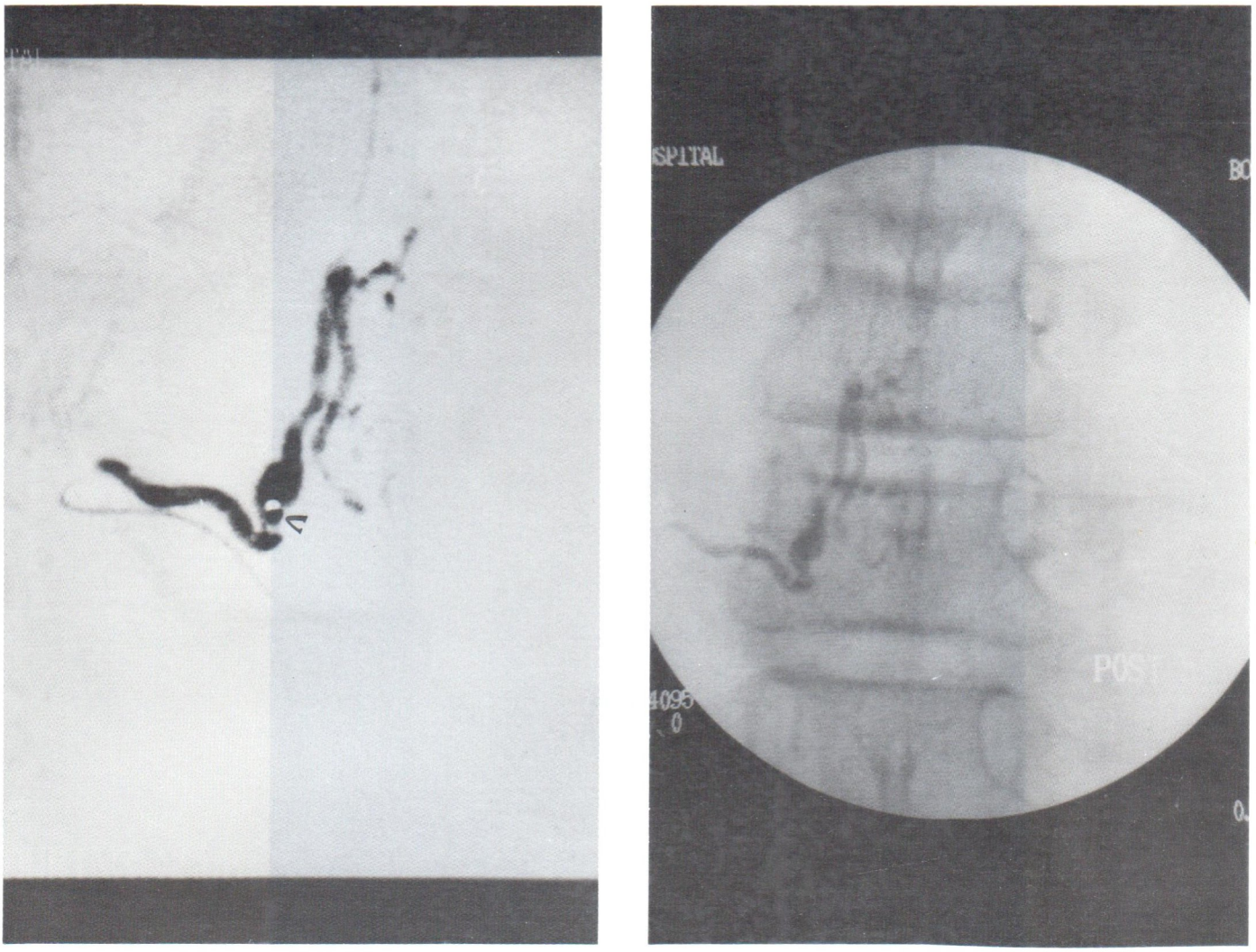

Fig. 21-22. During NBCA injection via the microcatheter tip (arrow) into part of the nidus and opacity of the NBCA after embolization.

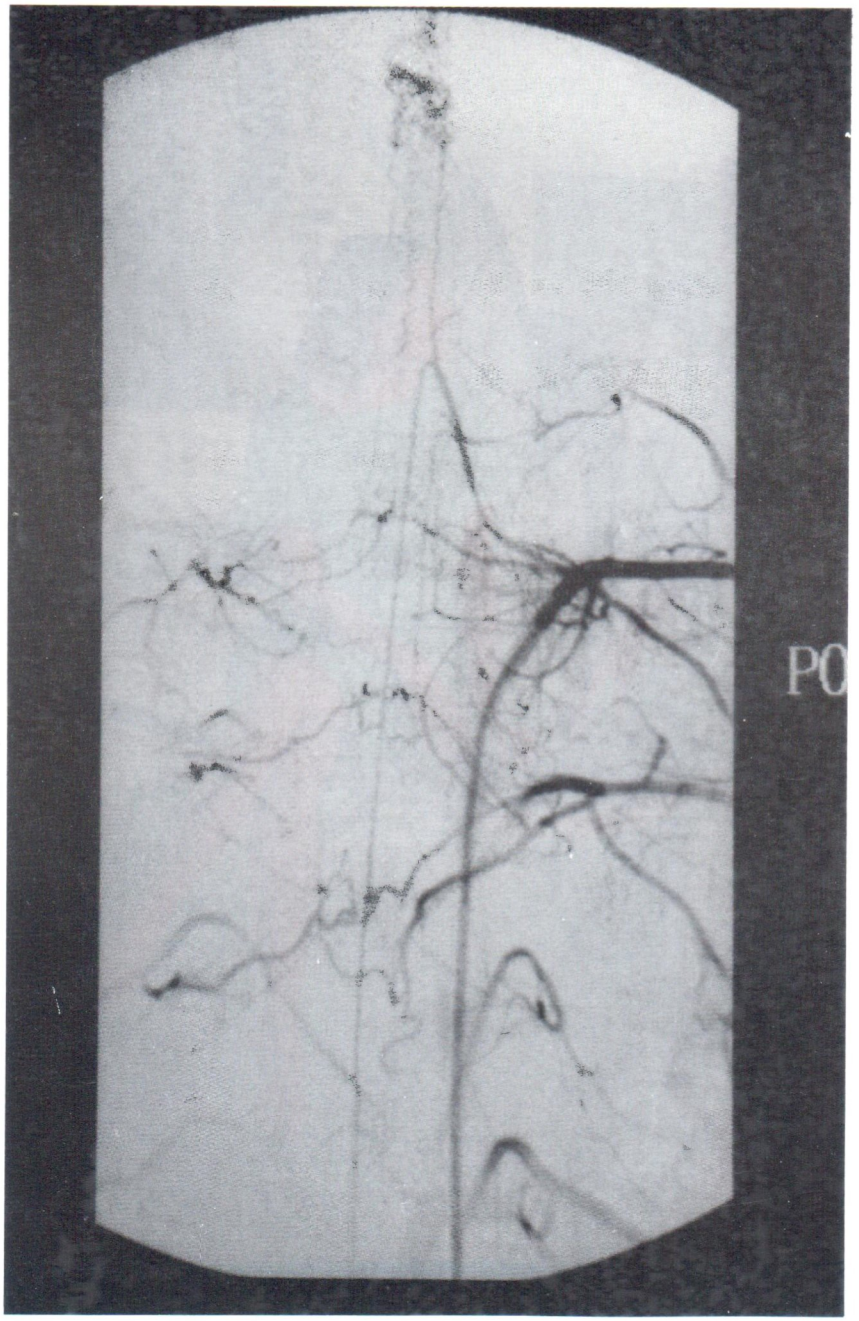

Fig. 23 Post Embolization immediate control left T_{10} injection showed good patency of the ASA with residual minimal feeder to the nidus.