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Review

Management of spinal dural arterio-venous fistulas. Report of 12 cases and review of literature

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ABSTRACT

Introduction: Spinal cord arteriovenous malformations and fistulae are rare vascular lesions than can lead to myelopathy that is at many instances overlooked during diagnosing the cause of progressive myelopathy and weakness. Treatment options involve either endovascular embolization, surgical disconnection or a combination of both. This study aims to evaluate various treatment methods for sDAVFs and the outcome of these methods.

Methods: This study involved 12 patients suffering from symptoms attributed to spinal dural arteriovenous fistulas; 11 were male and one was a female patient, with ages ranging between 50 years and 71 years. All patients presented with progressive spastic paraparesis of varying grades, and 6 had sphincter disturbances prior to treatment. Patients were evaluated by Aminoff-Logue motor disability scale.

Results: Three were managed by endovascular embolization and 9 by surgical disconnection. Three patients showed full recovery after treatment, 7 patients showed no change in their neurological status following treatment, and 2 patients showed partial recovery after treatment.

Conclusion: Spinal AVF is a rare curable cause of spinal myelopathy if managed promptly. Good angiographic studies prior to treatment decision are a must, in order to plan the best approach according to the angioarchitecture of the fistula whether it will allow endovascular embolization or will surgery be more feasible.

Contents

1. Introduction

Spine and spinal cord vascular lesions are rare vascular lesions, only representing 1–2% of the vascular neurologic pathologies [1], with spinal dural AVF being the most common representing 80% of the spinal vascular malformation [2–5].

Spinal dural AVFs classically present by progressive spastic motor weakness, other symptoms include sensory deficits, sphincter disturbances and back pain [3,6–9] with some patients presenting acutely due to hemorrhage or due to Foix-Alajouanine syndrome [6,7]. The pathophysiology of symptoms is typically venous hypertension from shunting of the arterial blood into the valveless venous system of the spinal cord, which causes a decrease in the arterial supply, arterial steal and ischemia, leading to progressive necrotizing myelopathy that, if not treated, is non-reversible [1,6,10,11].

Abbreviations: AVF, arterio-venous fistula; sdAVF, spinal dural arterio-venous fistula.

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Surgery is widely accepted as a treatment option for dural AVF, being technically easy and carrying a low morbidity and low recurrence rates. Advances in endovascular techniques and therapy led to the increasing number of patients being treated by embolization with good outcomes increasingly being reported [3,5,6,12–14].

In this article we report our experience with the diagnosis and management of 12 cases of spinal dural arterio-venous fistulas, with review of the literature covering the diagnosis, management and outcome of this rare vascular pathology.

2. Materials and methods

This study included 12 patients, managed for spinal fistulas between 2006 and 2013 for spinal dural AVFs (Table 1). Patients were all males, except 1, with age ranging from 50 years to 71 years, with median age of 56 years. All patients presented with progressive spastic motor weakness with or without sphincter disturbances.

Clinical evaluation: Patients were evaluated by Aminouff-Louge score at the time of hospitalization and at follow-up (Tables 1 and 2) [15].

Diagnostic workup: Upon clinical suspicion of the presence of spinal vascular pathology patients were evaluated by MRI with and without contrast. Typical features of spinal fistulae were present in all cases as signal voids, cord hyperintensity on T2 images, and cord enhancement with gadolinium. Upon recognition of these features on MRI, patients were referred for spinal angiography.

Spinal angiography: Spinal angiography was performed under either local, general anaesthesia or under sedation, depending on the co-operativity of the patient, as it is a lengthy procedure examining all the spinal vascular accesses. A 5 or 6 french femoral sheath is introduced, and a 5 or 4 french diagnostic catheter is used. Variable shapes of catheters are usually available during the procedures, the most commonly utilized shapes were the C-shape, SIM I and the shepherd hook, as these shapes can easily be introduced into the radicular branches supplying the spinal cord. The whole spinal vascular access is usually examined, starting from the internal iliac arteries, going up examining the right and left radicular arteries, both vertebrals and both thyrocervical trunks. This protocol is followed even if the fistula is observed at the lower levels, in order to diagnose associated lesions that can be missed. We also emphasize on examining the levels above and below the fistula on both sides so any additional feeders can be diagnosed and properly addressed.

Follow-up: Patients were followed clinically and by radiological investigations, the duration of follow-up ranged between 3 months and 2 years. In cases when the patient was not able to show up for examination, phone interview was conducted and it involved questioning the patient about his motor power, sensory changes, sphincter control, and ability to conduct daily activities. Patient's answers were compared with his last follow-up and so a chart of patient progression could be postulated.

Table 1
All cases included in the study.

No	Age	Sex	Presentation	Diagnosis	Treatment	ALS		MO	O	SO
						Pre-op	Post-op			
1	61	M	Paraplegia, myelopathy, sphincter disturbances	Left dural AVF at D9	Surgical disconnection	5	5	G0–G1	P	NI
2	71	M	Progressive spastic paraparesis, sphincter disturbances	Right dural AVF at D12	Endovascular embolization with glue	4	4	G3–G3	M	NI
3	50	M	Progressive spastic paraparesis	Left dural AVF at D10	Endovascular embolization (at another institute) → recanalization via right D11 → surgical disconnection	3	0	G4–G5	G	–
4	54	M	Progressive spastic paraparesis, sphincter disturbances	Right dural AVF at D11	Surgical disconnection	5	4	G2–G3	M	I
5	67	M	Progressive spastic paraparesis, sphincter disturbances	Right dural AVF at L5 (origination from right lateral sacral artery from right internal iliac artery)	Surgical disconnection	4	4	G3–G3	M	NI
6	54	M	Progressive spastic paraparesis	Left dural AVF at D9	Surgical disconnection	3	3	G4–G4	M	–
7	50	M	Progressive weakness, paraplegic, sphincter disturbances	Right dural AVF at D10	Surgical disconnection	5	5	G0–G0	p	NI
8	50	M	Spastic paraplegia, sphincter disturbances	Left dural AVF at D9	Endovascular embolization with Onyx → recanalization from left D10	5	5	G0–G0	P	NI
9	60	F	Spastic paraparesis, sphincter disturbances	Right dural AVF at S1 (origination from right lateral sacral artery from right internal iliac artery)	Surgical disconnection	5	5	G2–G2	P	NI
10	53	M	Progressive spastic paraparesis	Right dural AVF at L1	Surgical disconnection	3	0	G4–G5	G	–
11	53	M	Progressive spastic paraparesis, sphincter disturbances	Right dural AVF at L1	Surgical disconnection	5	4	G2–G3	M	I
12	50	M	Progressive spastic paraparesis	Left dural AVF at L1	Surgical disconnection	3	3	G4–G4	M	–

MO: motor outcome; G: motor power grade; O: outcome; P: poor, M: moderate, G: good; SO: sphincter outcome; I: improved, NI: not improved.