Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 27s (2025)
https://www.jneonatalsurg.com

Cognard Type III Dural Arteriovenous Fistula – Specific Physiotherapy Intervention - A Case Report

Sumaiya[1], Rajeswari Muthusamy[2]

[1]Fellowship in Neuromotor Rehabilitation in Cerebral Lesions, Sri Ramachandra Institute of Higher Education and Research (Deemed to be University), Chennai 600116, India

[2]Associate Professor, Faculty of Physiotherapy, Sri Ramachandra Institute of Higher Education and Research (Deemed to be University), Chennai 600116, India

***Corresponding Author:**

Dr. Rajeswari Muthusamy

Email ID: rajeswari@sriramachandra.edu.in

Cite this paper as: Sumaiya, Rajeswari Muthusamy, (2025) Cognard Type III Dural Arteriovenous Fistula – Specific Physiotherapy Intervention - A Case Report. *Journal of Neonatal Surgery*, 14 (27s), 278-282.

ABSTRACT

Dural arteriovenous fistulas (DAVF), particularly those with cortical venous drainage such as Cognard Type III, pose significant risks for intracranial haemorrhage and neurological deficits. This case-based perspective emphasizes the critical role of early, individualized physical therapy in managing post-haemorrhagic motor and functional impairments. Highlighting the complexities of rehabilitation in unstable vascular pathologies, this report underscores the value of physiotherapy care and contributes to the limited literature guiding neurorehabilitation strategies for DAVF patient.

1. INTRODUCTION

Dural arteriovenous fistulas (DAVF) are uncommon intracranial vascular malformations characterized by aberrant shunting between meningeal arteries and dural venous sinuses or cortical veins, representing approximately 10–15% of all intracranial arteriovenous anomalies (1). The clinical prognosis of DAVF is primarily influenced by the venous drainage patterns, with those exhibiting cortical venous drainage, particularly Cognard Type III and higher, posing a significantly greater risk for intracranial haemorrhage and neurological dysfunctions (2). These lesions, by directly engaging cortical veins, often precipitate severe neurological deficits, further complicating the management and rehabilitation processes.

From a rehabilitation perspective, DAVF involving cortical venous drainage commonly lead to impairments in motor control, balance, coordination, and overall functional mobility due to the localized brain injury caused by venous congestion or haemorrhagic events (3). While surgical and endovascular treatments target the vascular malformations themselves, physical therapy remains integral in addressing the functional sequelae. Neurorehabilitation techniques aim to mitigate post-stroke-like impairments, including hemiparesis, spasticity, and gait dysfunctions, thereby enhancing overall patient recovery (4). These rehabilitation efforts must be tailored to the unique challenges posed by DAVF, considering both the structural damage and the neuroplastic potential of the patient.

Cognard Type III DAVF, present a distinctive challenge to physiotherapists, as early-stage rehabilitation must strike a delicate balance between encouraging neuroplastic changes and maintaining caution due to the ongoing risk of neurological deterioration from unstable vascular pathology (5). The high likelihood of complications, such as re-bleeding or incomplete embolization, necessitates close monitoring and individualized treatment approaches to ensure optimal recovery and minimize further injury.

A case report detailing a Cognard Type III DAVF from a physical therapy perspective is invaluable due to the scarcity of literature addressing the rehabilitation of such rare and complex conditions. Patients with cortical venous drainage often exhibit neurological impairments related to those seen in stroke patients, including hemiparesis, coordination difficulties, and gait disturbances, which require careful and specialized rehabilitation strategies (1). This report highlights the importance of a multidisciplinary approach, emphasizing the role of early, individualized physical therapy in improving functional recovery. The report underscores how coordinated interventions, ranging from early functional mobilization to personalized therapy plans, can effectively manage fluctuating symptoms, minimize complications, and enhance long-term functional outcomes and quality of life for such patients (3). In addition, documenting such cases helps raise awareness among healthcare providers about this rare diagnosis, potentially facilitating earlier recognition and referral for physical therapy, and contributes to the growing body of evidence that may inform future rehabilitation protocols for patients with DAVF (5).

2. CASE REPORT

SUBJECTIVE HISTORY

A 51-year-old male with a known history of diabetes mellitus was brought to Sri Ramachandra hospital with complaints indicative of increased intracranial pressure and altered levels of consciousness. Family members reported a progressive decline in responsiveness, prompting immediate medical attention. A transfemoral digital subtraction angiography (DSA) was conducted followed by endovascular embolization to occlude the fistula and restore cerebral hemodynamic stability. The patient was admitted to the Neuro-ICU with respiratory support for further evaluation and management.

CLINICAL INVESTIGATIONS

Neuroimaging, including MRI and angiographic studies revealed a DAVF involving the anterior and middle portions of the superior sagittal sinus. Findings were accompanied by near-total venous occlusion and evidence of chronic cerebral venous thrombosis.

CLINICAL FINDINGS

Post-intervention, the patient's level of consciousness remained impaired, fluctuating within the low to mid-range on the Glasgow Coma Scale. Neurological status necessitated intensive monitoring and supportive care. On observation in lying position, patient had adducted and mildly internally rotated shoulders, extended elbows and neutral wrist and hand positions. He had adducted and externally rotated right hips with extended knee and plantar flexed ankle in lying position with poor spontaneous movement. On examination, the patient exhibited reduced responsiveness to verbal and painful stimuli and generalized hypertonia. Basic reflexes were preserved but brisk on both sides. Auscultatory findings showed secretions all over left lung fields and mild to moderate secretion in right middle and lower lobes. Given the neurological compromise, the patient required a comprehensive neurorehabilitation plan. Outcome measures like Rancho Los Amigos for cognitive functioning and Modified Rankin scale were evaluated pre and post -intervention.

PHYSIOTHERAPY INTERVENTION

Physiotherapy intervention focused on early neurorehabilitation strategies aimed at preventing complications of immobility, promoting arousal and responsiveness, and improving postural control. The protocol included passive range of motion exercises, sensory stimulation techniques, positioning for tone management and pulmonary hygiene along with progressive functional training as consciousness improved. Therapy sessions were tailored daily, with the intensity adjusted based on the patient's arousal level and tolerance. Continued rehabilitation was planned to support cognitive and motor recovery.

3. RESULTS

Over the five-week rehabilitation period, the patient demonstrated significant improvements across multiple domains. Notable gains were observed in lower limb voluntary motor control, trunk stability, respiratory function and cognitive engagement. Reflex modulation and enhanced postural responses indicated ongoing neuroplastic changes while functional assessments revealed a transition from severe to moderately severe disability. These findings reflect the positive impact of early, structured physiotherapeutic intervention on both neurological and functional recovery. Pre and post intervention scores of RLA showed a change from level III to level VII and Modified Rankin scale showed a change from 5 to 3 as shown in Table 2.

Table:1 Outcome Measures

	Pre - Intervention	**Post - Intervention**
RLA	Level III	Level VII
Modified Rankin Scale	5	3

Table:2 Goal-based Interventions

Goals	Interventions
Preventing Secondary Complications	- Passive range of motion exercises - Chest Physiotherapy
Maintaining joint mobility and preventing spasticity	- Active assisted ROM Exercises - Passive Stretching - Positioning
Improve Arousal	- Multimodal stimulation - Upright Positioning
Early Motor patterns and postural patterns	- Rocking - Rolling - Sitting upright with trunk support
Upright positioning and early weight bearing	- Tilt table standing

4. DISCUSSION

The rehabilitation approach was structured around individualized, goal-driven therapy, aimed at both preventing secondary complications and fostering early motor recovery following neurological insult. In the acute and early subacute phases, passive range of motion exercises were introduced early on to prevent contractures, joint stiffness, and other musculoskeletal issues linked to immobility (6). Simultaneously, chest physiotherapy was implemented to manage pulmonary hygiene as patient had reduced mobility and auscultatory signs suggestive of secretion retention. This helped lower the risk of respiratory infections and improved ventilation-perfusion dynamics and wean out of additional respiratory support (7).

As the patient progressed in RLA levels, maintaining joint mobility and spasticity was addressed as the patient gradually progressed to active-assisted ROM exercises with passive stretching. These interventions were critical in maintaining optimal muscle length and reducing hypertonicity achieved through sustained, gentle elongation of spastic muscle groups, supporting better motor recruitment over time (8)

In line with neurodevelopmental treatment principles, early motor facilitation techniques like rocking and rolling were incorporated. These helped stimulate central pattern generators and supported sensory integration, particularly through vestibular and proprioceptive input (9). Supported sitting postures further promoted midline orientation and trunk control, essential components for regaining balance and stability along with stimulation of reticular activating system (10). Arousal levels were improved with multimodal stimulation and upright positioning. Tilt table was used to safely introduce vertical positioning, allowing gradual weight-bearing and postural re-orientation. This upright acclimatization plays a key role in enhancing arousal levels, improving orthostatic tolerance, and providing necessary afferent feedback for motor relearning (11).

The patient’s presentation reflected a complex central nervous system involvement, with prominent upper motor neuron signs. Over a five-week rehabilitation period, there were meaningful changes in reflex patterns, voluntary movement, muscle tone, and postural control, pointing to active neuroplastic adaptations (12). Initially, deep tendon reflexes were globally hyper reflexic, most notably in the quadriceps, ankles, biceps, and triceps bilaterally, consistent with UMN involvement. By Week 5, there was a mild reduction in hyperreflexia, especially in the left biceps and right quadriceps, possibly reflecting early descending pathway modulation or the tapering of spinal shock effects (13). Despite improvements, the bilateral Babinski sign remained positive, indicating persistent disruption of the corticospinal tract. Muscle tone in the lower limbs remained mildly spastic (Modified Ashworth Scale Grade 1), while tone assessment in the upper limbs was less clear due to patient resistance and limited cooperation. This non-cooperation could reflect underlying pain, altered sensory processing, or behavioural resistance (14).

Voluntary motor control, particularly in the lower limbs, showed measurable improvement. The right lower limb advanced from Stage 2 to Stage 4 on the Brunnstrom scale, indicating emerging selective motor control outside of synergistic patterns. Upper limb recovery was more delayed, with minimal volitional movement that gradually progressed by the fifth week. The right hand showed considerable impairment, which is consistent with the typical recovery pattern, where proximal functions improve before distal ones. Balance and postural control were initially untestable due to low cognitive engagement. However, by Week 5, the patient demonstrated improved sitting balance and postural transitions with less external support, highlighting gains in central sensory integration and trunk stability (15).

Therapeutic effectiveness was evaluated using the Rancho Los Amigos Scale (RLA), and the Modified Rankin Scale (mRS), providing a multidimensional overview of cognitive, functional, and neurological recovery (16). Initially, the patient was assessed at Level III on the RLA, displaying confused and agitated behaviour with minimal treatment engagement. By Week 5, they progressed to Level VII, demonstrating improved cognitive clarity, purposeful actions, and better command-following, marking a significant step in cognitive rehabilitation (17). Functionally, mRS scores improved from Grade 5 to Grade 3, suggesting a shift from severe to moderately disability (18). This reflected better mobility with assistance and emerging participation in basic daily tasks. These changes highlight the real-world impact of consistent, structured physiotherapy in improving autonomy and quality of life.

5. CONCLUSION

We conclude that providing specific physiotherapy interventions of motor facilitation techniques with strategies to improve mobility and arousal levels resulted in increased cognitive level and functional performance of patient with DAVF. The positive outcome of this patient encourages to plan and incorporate interventions based on specific techniques to attain better functional recovery.

REFERENCES

[1] Valentino WL, Stout C, Bui D. A case report of a multi-arterial dural arteriovenous fistula. Radiol Case Rep. 2022 Aug;17(8):2790–4. doi: 10.1016/j.radcr.2022.05.009.

[2] Gandhi D, Chen J, Pearl M, Huang J, Gemmete JJ, Kathuria S. Intracranial dural arteriovenous fistulas: classification, imaging findings, and treatment. AJNR Am J Neuroradiol. 2012 Jun;33(6):1007–13. doi: 10.3174/ajnr.A2798.

[3] Sim SY. Pathophysiology and classification of intracranial and spinal dural AVF. J Cerebrovasc Endovasc Neurosurg. 2022 Sep;24(3):203–9. doi: 10.7461/jcen.2022.E2021.04.001.

[4] Miller L. Rehabilitation following stroke: The role of physical therapy. Neurol Clin. 2004;22(3):681-694. doi:10.1016/j.ncl.2004.04.003.

[5] Peto I, Abou-Al-Shaar H, Dehdashti AR. Multimodal treatment of occipital tentorial dural arteriovenous fistula Cognard III. World Neurosurg. 2019 Jun;126:e1034–e1038. doi: 10.1016/j.wneu.2019.03.194.

[6] Guccione AA, Wong RA. Geriatric Physical Therapy. 4th ed. St. Louis: Elsevier Health Sciences; 2020.

[7] Stiller K. Physiotherapy in intensive care: towards an evidence-based practice. Chest. 2000;118(6):1801-13.

[8] Harvey LA, Herbert RD. Stretching to prevent or reduce contracture: a systematic review. Arch Phys Med Rehabil. 2002;83(5):661-8.

[9] Bobath B. Adult Hemiplegia: Evaluation and Treatment. 3rd ed. Oxford: Heinemann Medical; 1990

[10] Shumway-Cook A, Woollacott MH. Motor Control: Translating Research into Clinical Practice. 5th ed. Philadelphia: Lippincott Williams & Wilkins; 2016.

[11] Luther MS, Krewer C, Müller F, Koenig E. Comparison of orthostatic reactions in tilt table training with and without functional electrical stimulation in early rehabilitation. Clin Rehabil. 2008;22(4):316-24.

[12] Kleim JA, Jones TA. Principles of experience-dependent neural plasticity: implications for rehabilitation after brain damage. J Speech Lang Hear Res. 2008;51(1):S225-39.

[13] Campbell WW. DeJong's The Neurologic Examination. 8th ed. Philadelphia: Wolters Kluwer; 2020.

[14] Bohannon RW, Smith MB. Interrater reliability of a Modified Ashworth Scale of muscle spasticity. Phys Ther. 1987;67(2):206-7.

[15] Horak FB. Postural orientation and equilibrium: what do we need to know about neural control of balance to prevent falls? Age Ageing. 2006;35(suppl_2):ii7-11

[16] Quinn TJ, Dawson J, Walters MR, Lees KR. Reliability of the modified Rankin Scale: a systematic review. Stroke. 2009; 40(10):3393-5. doi:10.1161/STROKEAHA.109.557256.

[17] Giacino JT, Katz DI, Schiff ND, Whyte J, Ashman EJ, Ashwal S, et al. Practice guideline update

recommendations summary: Disorders of consciousness: Report of the Guideline Development, Dissemination, and Implementation Subcommittee of the American Academy of Neurology; the American Congress of Rehabilitation Medicine; and the National Institute on Disability, Independent Living, and Rehabilitation Research. Neurology. 2018;91(10):450-60. doi:10.1212/WNL.0000000000005926

[18] van Swieten JC, Koudstaal PJ, Visser MC, Schouten HJ, van Gijn J. Interobserver agreement for the assessment of handicap in stroke patients. Stroke. 1988;19(5):604-7. doi:10.1161/01.str.19.5.604