



# A PALLIATIVE MANAGEMENT OF RESIDUAL NEUROLOGICAL SYMPTOMS THROUGH AYURVEDA IN A CASE OF DIFFUSE AXONAL INJURY: A CASE REPORT

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**Abstract:** Diffuse Axonal Injury(DAI) is a severe form of Traumatic Brain Injury(TBI) characterized by widespread damage to axons. While conventional treatments aim to manage acute symptoms, there is limited focus on addressing residual neurological deficits in the long term. In *Ayurveda*, TBI corresponds to *Shiro-marma Abhigata* and one among the *Nidana* of *Vata Vyadhi*.

**MATERIALS AND METHOD:** This case study was conducted on a 28-year-old female patient who met with a road traffic accident resulting in DAI and severe head injury four years earlier. Since the neurological deficits persisted, the patient underwent a 27-day *Ayurvedic* treatment which included internal medications and *Panchakarma* procedures.

**RESULTS:** The functional Independence Measurement(FIM) tool was used for the assessment. The patient improved her cognitive function, motor skills, and emotional well-being throughout the treatment. The FMI score recorded at the baseline and the end of the treatment showed a remarkable difference of 23 units thus improving the patient's QOL.

**DISCUSSION AND CONCLUSION:** Therapeutic procedures such as *Mrudhni taila*, *Madhutailika Basti*, and internal medications effectively manage such disabilities. This study highlights the potential of *Ayurvedic* medicine as an effective and safe integrative approach for palliative management of the residual symptoms due to DAI such as tremors, memory loss, imbalance, and weakness. Thus, personalized and holistic methods of *Ayurveda* offer a promising avenue for improving the quality of life in individuals with neurological impairments.

**Index Terms -** *Shiroabhigata*, Palliative care, Post Traumatic Care, Rehabilitation in *Ayurveda*, Case Report

**INTRODUCTION:** Road Traffic Accidents (RTA) represent a serious public health concern, significantly impacting global morbidity and mortality. Among the myriad consequences of RTAs, Traumatic Brain Injury (TBI) has emerged as a particularly challenging and widespread condition. Within the spectrum of TBIs, Diffuse Axonal Injury (DAI) stands out as a severe and often overlooked subtype, associated with prolonged and debilitating neurological deficits. The presence of scattered lesions throughout an extensive area encompassing both white matter tracts and grey matter regions characterizes DAI. [1] It constitutes a histopathological diagnosis; however, in clinical terms, it can be defined as a period of unconsciousness with a Glasgow coma scale (GCS) of less than 8 persisting for at least six hours following a TBI, while excluding cases that involve brain swelling or ischemic lesions. [2,3] It also results in behavioral, physical, and cognitive changes that impair patient's social and personal life and deterioration in the quality of life for patients and their families. Without immediate treatment, it has a high fatality rate and poor prognosis. Hence, after the

management of the acute phase, proficient, intense, and long-term rehabilitation is necessary for restoring normal functions. The most common etiology of diffuse axonal injury involves high-speed motor vehicle accidents. [4] RTAs resulting in TBI, and subsequently DAI, often result from high-velocity collisions, falls, or other traumatic incidents involving acceleration-deceleration forces. The sudden and forceful rotation or shaking of the head leads to shearing forces to the brain's white matter tracts, which can cause extensive microscopic and gross damage to axonal structures within the brain, leading to DAI. [5]

In Ayurveda, *Shiro-marma abhigata* can be co-related to TBI. It is explained that any injury to the *Shiras* may lead to *Manyastambha* (stiffness of neck), *Ardita* (hemiplegia with facial palsy), *Chakshuvibhrama* (improper movements of eyeball/lesions in sight), *Moha* (a state of confusion), *Udveshtana* (twisting pain in the head), *Cheshtanasha* (loss of body functions), *Kasa* (cough), *Shwasa* (breathlessness), *Hanugraha* (stiffness of jaw), *Muka* (dumbness), *Gadgada* (hoarseness of voice), *Akshinimilana* (ptosis), *Gandaspadana* (twitching in cheek), *Jrambhana* (excessive yawning), *Lalasarava* (dribbling of saliva), *Svarahani* (aphonia) and *Vadana jihmatva* (deviation of face) [6]. Further, the quotation from *Charaka Chikitsa Sthana, 28<sup>th</sup> Adhyaya – Marmāghātādgajōṣṭrāsvasīghrayānāpatāmsanāt* states that *Marma abhigata* and traveling in high speed can be one of the probable causes for the development of various *Vatavyadhi*. [7] Due to the vitiation of *Vata Dosh*a, the treatment modality that aims to nullify it can be incorporated into the management of the residual neurological deficits caused due to DAI.

### PATIENT INFORMATION:

A 28-year-old female with residual neurological symptoms reported to the Outpatient Department of Ramaiah Indic Specialty Ayurveda, Bengaluru, Karnataka on 17<sup>th</sup> April 2023 complaining of loss of memory, extreme temperament, slurred speech, tremors in upper and lower limbs, difficulty to stand/walk without support, difficulty holding an object in the right hand, and generalized body pain for 4 years. She was advised to be admitted for further management.

**PAST MEDICAL HISTORY:** The patient met with an RTA on 17/11/2019 around 6:30 am that resulted in a head injury when the car she was traveling on collided with a lorry on the Mysore-Tumkur highway. She was admitted to a private hospital on the outskirts of Bengaluru, Karnataka for the initial 24 hours. Due to a low GCS scale, the patient was intubated there and was then transferred to M.S. Ramaiah Memorial Hospital in Bengaluru on 18/11/2019 for further management of the condition. On admission, the patient was unconscious and unresponsive (under the effect of sedation) with normal vitals and GCS E1 VT M1. Motor System examination: The patient could not move the bilateral upper limb and lower limbs due to pain along with DTRs being 2+. The sensory system was normal. No cerebellar or meningeal signs were noticed. The cardiovascular system was normal with S1 S2 being heard and absence of murmurs, the respiratory system was normal with air entry being bilaterally equal and the per abdomen palpitation was soft with no sign of organomegaly.

The CT scan of the brain findings taken at the time of admission (19/11/2019) showed DAI with SAH with Left Tentorial SDH without MLS with fracture of the anterior wall of the maxillary sinus and posterior wall of the right maxillary sinus. A CT scan of the Abdomen and pelvis showed a Right acetabulum fracture with dislocation of the femur.

### PAST SURGICAL HISTORY:

- 1) Right acetabulum fracture with dislocation of the hip - treated with ORIF plating under General Anaesthesia on 21/11/2019 by the Orthopaedics Department.
- 2) Tracheostomy - performed under all aseptic precautions on 25/11/2019 by the ENT Department.
- 3) PEG Tube placement - done under all aseptic precautions on 6/12/2019 by the Gastro-Enterology Department.

Once the condition of the patient improved symptomatically, she was shifted to the Rehabilitation Centre and underwent rehabilitation for 3 months from 30/12/2019 to 13/3/2020. Later, she received Physiotherapy, Swallow therapy, Occupational therapy, and Speech therapy along with supportive care every day. Further, the patient underwent regular rehabilitative procedures and followed a routine follow-up with a conventional system of medicine with a good prognosis of the condition.

**PRESENT CLINICAL FINDINGS:** On admission and examination, the patient was conscious, oriented, and responding to vocal commands and the vitals were normal.

**DIAGNOSTIC ASSESSMENT:** The past medical history of the patient along with the present signs and symptoms were considered while arriving at the diagnosis. Seizures, Dementia, Alzheimer's disease, and Cranial nerve injury were considered for differential diagnosis. *In Ayurveda, Shiro-marma abhigata* can be co-related to TBI and *Marma abhigata*, and traveling at high speed may also be considered as the probable cause for the development of various *Vatavyadhi*. The Independence Measure score at the time of initiation of *Ayurvedic* treatment was noted in [Tables 1a and 1b].

**Table 1a: Levels of Scoring:**

<b>COMPLETE DEPENDENCE</b>	1	Total Assistance	Client 0% +
	2	Maximal Assistance	Client 25% +
<b>MODIFIED DEPENDENCE</b>	3	Moderate Assistance	Client 50% +
	4	Minimal Assistance	Client 75% +
	5	Supervision	
<b>INDEPENDENCE</b>	6	Modified Independence	
	7	Complete Independence	

**Table 1b: Functional Independence Measure before initiation of the treatment:**

	Admission (17/4/2023)
<b>Self-Care</b>	
• Eating	2
• Grooming	2
• Bathing	1
• Dressing – upper body	2
• Dressing – lower body	1
• Toileting	2
<b>Sphincter control</b>	
• Bladder Management	3
• Bowel Management	2
<b>Transfer</b>	
• Bed, chair, wheelchair	2
• Toilet	2
• Tub, shower	2
<b>Locomotion</b>	
• Walk/ wheelchair	3
• Stairs	1
<b>MOTOR SUBTOTAL SCORE</b>	<b>25</b>
<b>Communication</b>	
• Comprehension	6
• Expression	4
<b>Social cognition</b>	
• Social interaction	3
• Problem-solving	4
• Memory	4
<b>COGNITIVE SUB-TOTAL SCORE</b>	<b>21</b>
<b>TOTAL FMI SCORE</b>	<b>46</b>

**DIAGNOSIS: Shiro-marma Abhigata Janya Vata Vyadhi**

**THERAPEUTIC INTERVENTION:** Considering the *Vata* and *Pitta* predominance associated with the *Ama* condition, the patient was given the following treatment [Table 2a and 2b]. All the medicines dispensed to the patient were obtained from GMP-certified companies. Strict diet restrictions were advised. She was asked to refrain from the use of *Vata Pitta Vardhaka Ahara* (*Vata-Pitta* aggravating diet) such as pickles, salted items, pappads, horse gram, and fermented food. She was also advised to avoid day sleeping, staying awake at night, and other strenuous activities.

**Table 2a: Details of the Panchakarma procedures performed during admission:**

Sl. No	Procedure		Medicine	Duration	Actions	Results	Adverse Effects
1	<i>Sarvanga Dhara</i>		<i>Dhanyamla</i>	18/4/23 – 27/4/23 (10 days)	<i>Rookshana</i>	Reduction in the heaviness and pain all over the body	Nil
2	<i>Sarvanga Abhyanga</i>		<i>Maha Narayana + Karpasastyadi taila</i>	17/4/23 – 12/5/23 (26 days)	<i>Bhaya Snehana</i>	Improved strength, walking, and mobility.	Nil
3	<i>Sarvanga Sweda</i>		<i>Patra Pinda &amp; taila</i>	17/4/23 – 12/5/23 (26 days)	<i>Rookshana, Snehana and Bruhmana</i>	Improved movements of the body	Nil
4	<i>Mrudhni taila</i>	<i>Shiro Dhara</i>	<i>Maha Narayana taila + Brahmi taila</i>	8/5/23 – 12/5/23 (5 days)	<i>Vata shamana &amp; Bhaya Snehana</i>	Reduction in temperament and improved consciousness	Nil
		<i>Shiro Pichu</i>		17/4/23 – 30/4/23 & 1/5/23 – 7/5/23 (21 days)			
		<i>Shiro Basti</i>		18/4/23 – 27/4/23 (10 days)			
5	<i>Madhu tailika Basti</i>	<i>Anuv-asana Basti</i>	<i>Mahanarayana taila 50ml + Guggulu Tiktaka Grutha 50ml (100ml)</i>	28/4/23 (1 day)	<i>Shodhana</i>	General improvement was noted all over the body, especially in the	Nil

		<i>Niruh -a Basti</i>	<i>Madhu 80ml + Saindhava 15gms + Sneha – (Mahakalyanaka Grutha 40ml + Mahanarayana taila 40ml) + Kalka – Shatapushpa + Brahmi choorna 15gms, Kashaya – Dashamoola kwatha choorna 15gms + Erandamoola niruha basti kwatha choorna 15gms; Insertion – 700ml</i>	29/4/23 – 12/5/23 (14 days)	<i>Shodhana, Brhumana, Vatashamana and Balavardhana</i>	mobility of both extremities.  Mean Retention Time of <i>Anuvasana Basti</i> – 2hrs 30mins and Mean Retention Time of <i>Kashaya Basti</i> – 10mins.
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**Table 2b: Details of the internal medications administered during treatment.**

Sl No	Medicine	Dosage	Duration	Action	Results	Adverse effects
1	<i>Dashamoolarishtam</i>	1tsp +	18/4/23 – 13/5/23 (26 days)	<i>Kapaha Vata hara,</i>	Generalized body pain is reduced	Nil
2	<i>Balarishtam</i>	1tsp +		<i>Balya, Rasayana</i>	Improved strength and stability	Nil
3	<i>Jeerakarishtam</i>	1tsp +		<i>Deepana</i>	Improved digestive health	Nil
4	<i>Saraswatharishtam</i>	1.5tsp (4tsp – 0 – 4tsp)		<i>Medya Rasayana</i>	Improved cognition	Nil
5	Tab Neuron Plus	2-0-2	18/4/23 – 13/5/23 (26 days)	Neuro tonic	Imparts strength and improved mobility of extremities	Nil

### FOLLOW UP AND OUTCOMES:

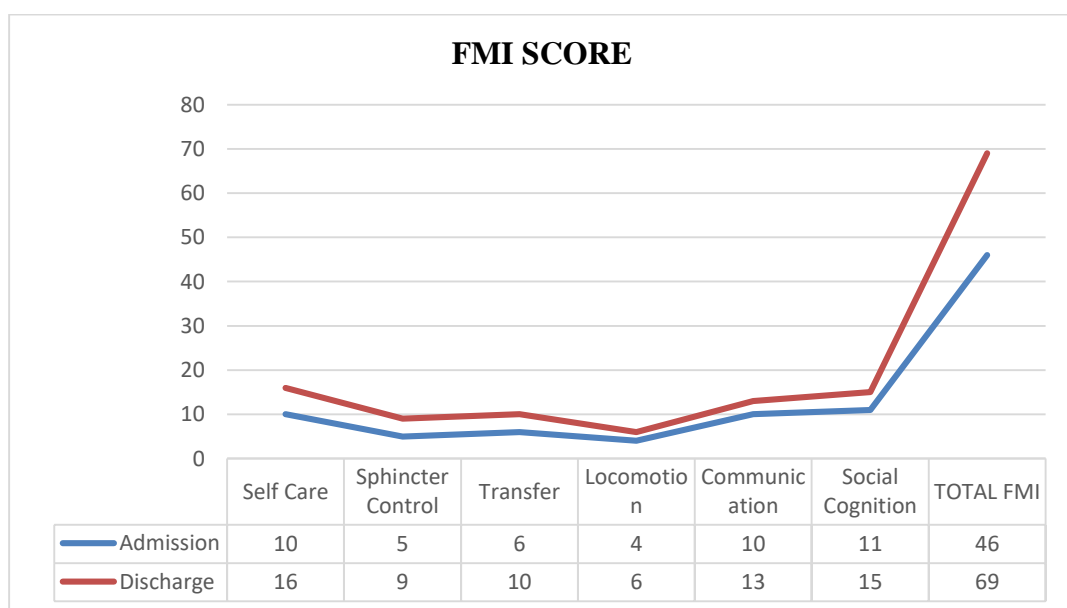
Considerable relief in the symptoms was noted after the treatment. She was able to walk better and weakness of the upper limb improved by 40%. The functional Independence Measurement(FIM) score at the time of admission was 46 (Motor subtotal score – 25 & Cognitive subtotal score – 21); after the treatment, it had improved to 69 (Motor subtotal score of 41 and Cognitive subtotal score – 28) [Table 3]. There were improvements in the patient's cognitive function, motor skills, and emotional well-being throughout the treatment thus improving the patient's QOL., On discharge, she was advised to continue the above-mentioned internal medications as they are *Vatapitta Shamaka* and *Brihmana* for 1 month. Externally, she was advised for *Abhyanga* and *Shiro Pichu* with *Maha Narayana taila* for 15 days. Follow-up with the patient after one month showed no worsening of the symptoms.

A graphical representation of the FMI score taken at the time of Admission (17/4/2023) and at the time of discharge (13/05/2023) is shown in [Graph 1]



**Table 3: Functional Independence Measure after the completion of the treatment:**

	Discharge (13/05/2023)
<b>Self-Care</b>	
• Eating	3
• Grooming	3
• Bathing	3
• Dressing – upper body	2
• Dressing – lower body	2
• Toileting	3
<b>Sphincter control</b>	
• Bladder Management	5
• Bowel Management	4
<b>Transfer</b>	
• Bed, chair, wheelchair	4
• Toilet	3
• Tub, shower	3
<b>Locomotion</b>	
• Walk/ wheelchair	4
• Stairs	2
<b>MOTOR SUBTOTAL SCORE</b>	<b>41</b>
<b>Communication</b>	
• Comprehension	7
• Expression	6
<b>Social cognition</b>	
• Social interaction	4
• Problem-solving	6
• Memory	5
<b>COGNITIVE SUB-TOTAL SCORE</b>	<b>28</b>
<b>TOTAL FMI SCORE</b>	<b>69</b>

**Graph 1: Graphical representation of the FMI score taken before treatment (17/4/2023) and after treatment (13/05/2023)****DISCUSSION:**

Diffuse axonal injury is a severe form of traumatic brain injury characterized by widespread damage to axons, (the nerve fibers that facilitate communication between brain cells). As a result of rapid deceleration or rotational forces, it often leads to extensive brain dysfunction. Its impact on human health includes cognitive and motor impairments, coma, and, in severe cases, persistent vegetative state. It also results in neurological

deficits and impaired consciousness. Though the acute stage is appropriately managed by contemporary science, the disabilities due to DAI are the main factor affecting the Quality of Life of the patient. Despite advancements in medical interventions, the prognosis for DAI remains challenging. Hence, an integrated approach in management that generally focuses on supportive care, addressing the associated complications, and rehabilitation to mitigate long-term disabilities becomes necessary.

In the present case, the patient exhibited neurological deficits such as diminished strength in upper and lower limbs, loss of memory and extreme temperament, slurred speech, difficulty standing/walking without support, difficulty holding an object in the right hand, and generalized body pain. These symptoms may be correlated to *Shiras* (brain) being afflicted by *Vata Dosha*. In this context, *Ayurveda* considers DAI to be analogous to *Shiromarma abhighata* (brain injury), impacting the brain parenchyma and leading to *Dhatu kshaya* (depletion of dhatus), in turn, resulting in *Vata prakopa* [8]. Consequently, treatment principles focus on *Vata Shamana*, aiming to alleviate the aggravated *Vata* and address the associated tissue damage.

'*Sneho Anilam Hanti*' as described by *Acharya Charaka* states that *Sneha* (unctuous) is the best *Chikitsa* to pacify the vitiated *Vata Dosha* [9]. But, before *Snehana*, it is essential to adequately prepare the body to ensure medicine's effective assimilation and distribution for which *Rookshana* (dryness) is considered as a preliminary procedure. [10] *Sarvanga Dhanyamla Dhara*, a form of *Drava Sweda* (Wet sudation), known to be *Apatarpana* (depleting) was employed for this purpose owing to its *Ushna Guna* (Hot nature), and *Ushna Veerya* (Hot potency) thereby resulting *Vata Kapha shamana* (reduction of *Vata* and *Kapha Dosha*). The *Amla Rasa* (sourness) of *Dhanyamla* renders *Deepana* (Improved digestive fire), thus reducing *Ama* (undigested food/toxins), and effectively reducing generalized body pain, swelling, and heaviness. Furthermore, this intervention also prepares the body for *Brihmana* (nourishing) and *Vata Shamana Chikitsa*. The effectiveness of *Dhanyamla* can also be supported by examining the phytochemicals present in its ingredients, including flavonoids and tannins. Flavonoids possess potent antioxidant qualities, while tannins aid in the healing process. These attributes have been associated with antiviral, anti-inflammatory, and anti-carcinogenic properties. Additionally, their antioxidant and detoxifying actions could potentially mitigate degenerative disorders, as observed in this case. [11]

*Sarvanga Abhyanga* (Complete body oleation) followed by *Mrudu Bashpa Sweda* (mild sudation) was done with *Maha Narayana Taila* and *Karpasastyadi Taila* as the former is considered to be *Pavana* (*Vata disorders*) *Ardita* (*facial palsy*) *Ekanaghaani* (loss of sensation of any particular anga) *Veppanna hara* and features antioxidant, immune-modulatory and adaptogenic characteristics. These attributes could potentially alleviate stress and have a calming effect on the mind [12]. The latter is considered to be *Sarva anilaapaham* and is indicated in *Sarva Vata Rogas* [13]. It was followed by *Patra Pinda Swedana* (pottali sudation) with the same oils to help attain *Rookshana*, *Bruhmana*, and *Snehana*.

*Murdhni taila* holds significance in addressing *Shiro Marma Abhigata* and *Vata Roga Chikitsa* [14] and hence *Shiro dhara*, *Shiro pichu*, and *Shiro basti* were administered with *Maha Narayana* and *Brahmi taila*. This helped to attain *Snehana* and *Vata Shamana*. *Brahmi* is considered to possess neuroprotective properties, pacifies *Vata* and helps to balance in *Tarpaka Kapha*. This balance promotes the proper functioning and harmonious connection of sensory organs and perception, which were disrupted by an excess of aggravated *Vata dosha* previously. [15]

*Basti Chikitsa* is considered to be the prime line of treatment for *Vata Dosha* and helps to relieve *Sthabdata* (stiffness), *Sankocha of Angas* (contraction), *Pangu* (paralysis), *Shakaastu Charanti Vata* (Extremities afflicted by *Vata Dosha*), *Shoola* (pain), *Kukshiaamaya* (toxins in abdominal cavity) and *Marma Urdhwa Sarvavaya Anga Rogas* (diseases afflicting Trividha marmas and all over the body) [16]. '*Erandoomoola kwathenabhirooho madhu tailikaha...Rasayanam*' [17] hence, *Madhu tailika basti* was employed. This helped to attain *shodhana*, *brihmana*, *vata shaman*, and *balavardhana* thus improving the strength all over the body. Internally, the patient was administered *Dashamoola Arishta*, *Balamoola Arishta*, *Jeeraka Arishta*, and *Saraswatha Arishta* as they are *Kapha Vata Shopha Haram* (anti-inflammatory), *Rookshana* (imparts dryness), *Balyam* (imparts strength), *Rasayanam* (rejuvenator), *Deepanam* (improves digestive fire) and *Medhya Rasayanam* (improves memory and intelligence) respectively. The main ingredient of the Reventos' Tab Neuron Plus is *Mashathmagupthadi Kashaya*, a neuro tonic, and *Brihatvata Chintamani Rasa* which is generally used to manage any Neuro psychiatric illness, hence was administered during admission. *Vata Hara Ahara* having *Snighdha*, *Ushna Laghu guna*, and *Yoga* also proved beneficial in this case.

**CONCLUSION:** This case study highlights the successful application of *Ayurvedic* medications and *Panchakarma* procedures in addressing residual neurological deficits following diffuse axonal injury. The positive outcomes observed in the patient's recovery and improved quality of life underscore the potential of *Ayurvedic* approaches in managing the residual symptoms due to DAI such as tremors, loss of memory, imbalance, and weakness. This study also encourages further exploration and consideration of *Ayurveda* as a complementary and effective approach in the holistic care of individuals with residual neurological deficits arising due to traumatic brain injuries.

#### **ACKNOWLEDGMENT:**

The authors acknowledge the patient for her cooperation.

#### **PATIENT'S PERSPECTIVE:**

The patient felt better with the treatment given. There were significant and visible changes noted in her physical aspects. She also strictly adhered to the advised *Pathya Ahara Vihara*. The patient also acknowledged the improvement in her general well-being after taking the advised internal medications.

**INFORMED CONSENT:** The authors certify that they have obtained the appropriate patient consent form. In the form, the patient has given her clinical information to be reported in the journal. The patient understands that her name and initials will not be published and due efforts will be made to conceal her identity, but anonymity cannot be guaranteed.

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Nil

#### **CONFLICT OF INTEREST:**

The authors have no conflicts of interest to declare.

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