



Review Article

HYPOTHESIZING THE MECHANISM OF ACTION OF *VIRECHANA* IN NEUROLOGICAL DISEASES WITH RESPECT TO THE GUT-BRAIN MICROBIOTA AXIS

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ABSTRACT

Panchakarma is an efficient and popular Ayurvedic treatment modality that helps eliminate various *Doshic* imbalances in the body to prevent and treat diseases. Its efficacy is being proven through multiple studies conducted across the globe; still, the mode of action of these therapies is to be understood far and wide. *Virechana* is one of the *Panchakarmas* that have an impact on the whole body to remove the *Doshas* that spread across the entire system. Due to this reason, it is considered best in the management of many disorders affecting different systems of the body, including the nervous system. The present review aimed at understanding the mechanism of action of *Virechana* with respect to the microbiota-gut-brain axis in neurological diseases. *Virechana* using *Mridu* and *Snigdha* medicines is mentioned for the management of *Vatarogas*. As *Virechana* is considered the primary treatment of pitta, its effect may be related to hormones and enzymes having neuroregulatory properties also. The microbiota-gut-brain axis plays an active role in the pathogenesis, management, and prevention of neurological diseases. Gastrointestinal complications like constipation are common in diseases affecting the nervous system, and they have shown a negative correlation with neurological recovery. Here comes the importance of *Snigdha virechana* or *Mridu virechana* mentioned in *Vatavyadhi*. *Virechana* can remove unfavorable bacterial colonization and is effective in correcting gut flora dysbiosis. Thus, the mechanism of action of *Virechana* in modifying the gut-brain axis and thereby facilitating neurologic recovery is understood. The present review sheds light on the Mechanism of action of *Virechana* with respect to the microbiota gut-brain axis in neurological disorders, which may be helpful for further research.

INTRODUCTION

Panchakarma is an effective and popular Ayurvedic treatment method used to eliminate various *Doshic* imbalances in the body, helping to address and prevent ailments. Its effectiveness has been supported by numerous studies conducted worldwide, but the mechanisms behind these therapies still need further understanding. *Virechana* is one of the panchakarmas that impacts the entire body to remove doshas that are dispersed throughout the system.

Because of this, it is considered ideal for managing many different conditions affecting various body systems.

In Ayurveda, *Yukti* (logical reasoning) is regarded as one of the methods for acquiring knowledge. To hypothesize the potential mechanism of *Virechana* regarding the microbiota gut-brain axis, various connections between factors related to *Virechana* or the microbiota gut-brain axis are analyzed. This includes Ayurvedic references showing the effectiveness of *Virechana* in neurological disorders, the link between the development of neurological disorders and gut dysbiosis, the role of *Virechana* in restoring normal gut microbial composition and managing gastrointestinal complications-which can further delay neurological

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recovery-and Ayurvedic references supporting proper gut microbial functioning after *Virechana*.

Vatarogas are always associated with gastrointestinal issues since *Pakvasaya* is considered the root of all *Vatarogas*. *Virechana*, performed with mildly potent and oily medicines, is recommended for managing *Vatarogas*. The significance of *Mridu virechana*/ mild therapeutic purgation in *Vatarogas* should be explained and scientifically validated to understand its mechanism better and to promote related research in the future. *Virechana* is regarded as one of the *Shodhana* (whole-body purification) procedures, capable of influencing even the subtle levels of an organ system. Since *Virechana* is viewed as the primary treatment for *Pitta*, its effects may involve hormones and enzymes with neuroregulatory functions.

The enteric nervous system (ENS) in the gastrointestinal (GI) tract and the central nervous system (CNS) communicates through a bidirectional system that involves neuronal, immunological, and endocrine pathways. This is known as the microbiota-gut-brain axis or gut-brain axis. Constipation is a common gastrointestinal problem in disorders affecting the nervous system, and research has shown that this condition negatively correlates with neurological recovery. This underscores the importance of *Snigdha virechana* or *Mridu virechana*, as mentioned in *Vatavyadhi*. In Ayurveda, treatment aims not only to reduce symptoms and pre-existing weakness but also to reverse the disease process by addressing the root causes. The improper functioning of gut microbiota is associated with numerous neurological disorders. *Virechana* has been demonstrated to influence microbiota composition. Therefore, *Virechana* likely plays a role in modifying the gut-brain axis to support neurological recovery.

Data Sources

Brihatrayis (Ayurveda classics) were referred to for reviewing the application of *Virechana* in *Vatarogas*, as well as the benefits of *Virechana* in various aspects. To review the role of the microbiota gut-brain axis in neurological diseases, the role of *Virechana* in the gut-brain axis, and the gastrointestinal complications associated with neurological diseases, the PubMed database was primarily referred to, along with some previous thesis works.

Review methods

A detailed review of *Virechana* in *Vatarogas* was done from the classical textbooks. Details and updates of research in the microbiota-gut-brain axis, neurological diseases, and *Virechana* were reviewed from the PubMed database. The data collected were compiled, and the mechanism of action of *Virechana* is

hypothesized with respect to the microbiota gut-brain axis.

Methods

Role of *Virechana* in *Vatarogas* (neurological disorders)- Ayurvedic perspective

Virechana is used to reduce pitta dosha when it is aggravated or dominant, especially when associated with *Kapha dosha* or when *Kapha* accumulates in place of *Pitta*.^[1] It is recommended for conditions such as *Udavarta*, *Urdhvaga Raktapitta*, *Chardi*, and *Timira* caused by the *Pratilomagati* of *Vata dosha*, along with the primary *Doshic* pathology. There is a *pratiloma gati* of *Vata* in the development of *Pakshaghata*, which occurs due to various *Sroto vaigunyas*, such as *Sanga* (as in arteriosclerosis and atherosclerosis), *Grandhi* (aneurysm), and *Vimargagamana* (thrombotic stroke), among others. Therefore, *Virechana* therapy targets both the *Anulomana* of *Vata dosha* and the removal of aggravated doshas responsible for the *Pratilomata* of *Vayu*. *Sneha Virechana* is the type of *Virechana* mentioned for treating *Vatarogas*.^[2] *Mridu virechana*, also known as *Snigdha virechana*, is recommended for *Vatarogas* due to the predominance of *Vata dosha* and the presence of associated doshas at the onset of the disease. This can support *Vatanulomana*, *Vatadosha samana*, and the elimination of associated doshas. The *Avarana* of *Vyanavayu* over other *Vayus* like *prana* and *apana* causes *Suptagatrata* (loss of sensation) and *Udavarta*, respectively. The treatment for *Avarana* caused by *Vyanavayu* includes either *Snigdha virechana* or *Snigdha anulomana*.^[3] *Sneha virechana* is also recommended in *Vegantara chikitsa* for *Apatanaka* and *Bahirayama*.^[4] *Virechana* is indicated when *Vata* is aggravated in *Rakta*, *Mamsa*, *Meda*, and *Sukramarga vibadhatha*.^[5] It is the preferred treatment when *Kapha* is present in *Pakvashaya* in *Vatarogas*.^[6] *Snigdha virechana* is again the treatment for *Pakvashayagata vata*.^[7] Since *pakvashaya* is the root of all *Vatarogas*, pacifying *Vata dosha* at its source can cure all types of *Vatarogas*. When *Vata* is blocked by *Sakruth Snigdhanulomana* with *Erandataila* is recommended.^[8] Administering *Virechana* followed by *Shamana* therapy in patients with *Pakshaghata* (post-CVA) resulted in significant improvement in motor function, muscle power, and reduction of exaggerated reflexes and muscle tone. This highlights the role of *Virechana* in neurological recovery.^[9] *Virechana*, followed by *Samana* medicine, was used in *Pakshaghata* and led to improvements in finger movement, arm lifting, wrist drooping, muscle strength, handgrip, and walking downstairs. Most patients showed marked improvements in all symptoms.^[10] *Virechana karma* resulted in a better overall quality of life and reduced speech slurring over *Kala basti*.^[11] *Snehayuktha Virechana* provided greater

relief from pain, improved ability to sit up from a supine position, stand from sitting, speech, muscle tone, and muscle power, among other benefits.^[12]

The gut-brain axis, gut dysbiosis, and neurological diseases

Gut dysbiosis is the change in the functional composition, metabolic activities, and local distribution of microbiota by the underrepresentation of usually dominating species by outcompeted or contained species, often related to the gastrointestinal tract. Gut dysbiosis is said to be one of the leading causes of neurological diseases. The gut-brain axis links the various centers of the brain with peripheral intestinal functions through bidirectional communication between the CNS and ENS under the influence of gut microbiota. The gut microbiome is thought to affect emotion regulation, anxiety, cognitive function, and various diseases, such as autism spectrum disorders, attention deficit-hyperactivity disorder, Parkinson's disease, Alzheimer's disease, stroke, epilepsy, multiple sclerosis, and depression, as a result of bidirectional interactions between the intestine and the brain.^[13] These bidirectional connections involve several neurotransmitters and neuromodulators, including vasoactive intestinal polypeptide (VIP), brain-derived neurotrophic factor (BDNF), etc. The altered Composition of the gut microbiota affects the level of BDNF. Similarly, in the case of VIP, the deficiency of which leads to altered gut microbiota composition in mice.^[14] The alterations in the gut microbial composition may affect the neurological functions and vice versa.^[15] Gut microbiota has the role of interacting and activating the pattern of recognition receptors (PRRs), thereby influencing the development, functions, and disorders of the CNS and ENS.^[16] On this evidence, a probiotic cocktail (Lactobacillus rhamnosus GG) was used to achieve a reduction of anxiety- and depression-related behaviors in mice.^[17] The same product was also administered to healthy human beings to get a similar effect.^[18]

Microbiota and stroke

Patients who had strokes or ischemic attacks had a marked reduction in blood TMAO (trimethylamine N-oxide) levels as well as a considerable dysbiosis of the gut flora. Therefore, treatments for microbiota dysbiosis may be utilized to manage stroke and stop subsequent episodes of the same.^[19] The treatment of stroke patients could also benefit from restoring the balance and health of their gut microbiota. The dysbiosis of the gut microbiota results from acute brain injury, and the level of dysbiosis significantly influences post-stroke immunological changes and stroke outcomes.^[20]

Microbiota and Parkinson's disease

In the case of Parkinson's disease (PD), there is a significant contribution of microbiota to motor deficits and neuroinflammation. Alterations in the human gut microbiome are one of the risk factors for PD.^[21] The altered communication between gut microbiota and the mucosal immune system leads to the development and exacerbation of PD^[22]. There is a proven association between characteristic shifts in the gut microbiota and the progression of PD^[23]. PD is caused by systemic and neural inflammation, which is produced because of impairment of the integrity of both the intestinal barrier and blood-brain barrier caused by an increase in putative pathobionts and alterations of bacteria with the capacity to produce short-chain fatty acids.^[24]

Microbiota in Autism Spectrum disorder and Intellectual disability

Patients with intellectual disability and autism spectrum disorder have mutations in members of the KDM5 gene family. KDM5 and microbial interactions affect animal social behaviour. In *Drosophila*, the absence of KDM5 caused abnormal immune activation, social behaviour issues, and gut dysbiosis. Using a probiotic (Lactobacillus plantarum L168) may help improve these signs, indicating that directly modifying the gut microbiome could be a therapeutic option for individuals with ID and ASD.^[25]

Microbiota and Alzheimer's disease

Aging changes the composition of gut microbes, which can lead to gastrointestinal problems and nervous system disorders, including dementia. One such disorder is Alzheimer's disease (AD), primarily affecting older adults. Gut microbial dysbiosis results in the secretion of amyloid and lipopolysaccharides (LPS), disrupting the blood-brain barrier and gastrointestinal permeability. These changes then affect the inflammatory signalling system, causing neuroinflammation, neuronal damage, and neuronal death in AD. Taking strong probiotics may help manage AD.^[26]

Gastrointestinal complications and neurological diseases

Virechana is a detoxification procedure effective in removing doshas that have accumulated in the *Koshta* and *Shakha*. Most gastrointestinal complications are resolved after *Virechana*. Since GI complications act as barriers to faster recovery in stroke patients and other neurological diseases, understanding their connection is more essential and effective. Constipation is the second most common gastrointestinal complication in stroke patients after dysphagia. It affects 45% of patients during their acute stage and 48% during their rehabilitation stage.^[27] In Alzheimer's disease, there is a higher incidence of serious upper and lower gastrointestinal events

compared to individuals without AD.^[28] The GI symptoms common in Parkinson's disease include dysphagia, constipation, and defecatory dysfunction. Constipation increases in both severity and frequency.^[29] Gastrointestinal dysautonomia is linked to reductions in dopamine transporter (DAT) availability. There is a very close link between constipation and caudate-DAT reduction. Reduced bowel movements may be associated with progression of nigral degeneration or changes in nigrostriatal dopamine function.^[30]

Role of microbiota in gastrointestinal diseases

Many gastrointestinal diseases are linked to imbalances in microbial composition. Manipulating gut microbiota is also viewed as an effective treatment option for managing these conditions.

Effect of *Virechana* and microbiota-gut-brain axis

Virechana helps reduce the colonization of aerobic bacteria and corrects gut flora dysbiosis.^[31] Consumption of the laxative notably increased the levels of Proteobacteria, Fusobacteria, and bacteria related to Dorea formicigenerans.^[32] The Proteobacteria are thought to play a key role in preparing the gut for colonization by strict anaerobes, which is necessary for healthy gut function, by consuming oxygen and lowering the redox potential in the gut environment. Fusobacteria activate host inflammatory responses designed to protect against pathogens that promote tumor growth. The role of microbiota in digestion and metabolism is evident from previous research. According to Ayurveda, *Agni* is essential for proper digestion and metabolism. Adequate functioning of *Agni* implies excellent gastrointestinal health and, thereby, an appropriate microbiota of gut composition and function. From an Ayurvedic perspective, a strong and stable digestive mechanism, known as *Urjo agni*, is a key benefit of *Virechana*.^[33] The *Samsarjana krama* (dietary modification after *Virechana*) is also intended to make *Agni* strong and stable systematically, which is necessary to digest the various forms of diet we intake.^[34] This is possible only under a healthy microbial composition in the gut. *Snigdha virechana* is the ultimate solution for chronic constipation, which is always associated with gut dysbiosis. Intestinal neuropeptides have a role in the bidirectional communication pathways in the microbiota gut-brain axis. The metabolites produced by the gut microbiome's influence have some receptor mechanisms in common with these neuropeptides.

Discussion

Mridu samshodhana, also known as *Mridu virechana*, is included in the treatment protocol for diseases of *Vata* origin. *Sneha virechana* is also a specific treatment method for many of the *Vatarogas*

like *Apatanaka*, *Pakshaghata*, *Avarana vata*, *Pakvashayagata vata*, *Timira*, and *Udavarta*, where there is an associated dosha aggravation causing the abnormality in the normal flow of *Vatadosha*. The microbiota-gut-brain axis is the bidirectional communication between CNS and ENS, and its involvement is proven in many neurological diseases like Autism spectrum disorders, Intellectual disability, Parkinson's disease, various psychological disturbances, and stroke. Gut dysbiosis leads to the development of these disorders, and treatments that correct or improve this can result in better neurological outcomes. Studies have also shown that *Virechana* plays a role in remedying gut flora imbalance; therefore, the mechanism of *Virechana*'s action probably relates to restoring the microbiota gut-brain axis in *Vatarogas*. However, further detailed studies are needed to confirm this.

CONCLUSION

Sneha virechana is the treatment of many *vatarogas* which are having neurological impairment. *Virechana* in *Vatarogas* is helpful in *Vatashamana*, *Vatanulomana*, and *Anubandha dosha samana*. The microbiota gut-brain axis is involved in most of the neurological disorders, in their pathogenesis and therapeutic outcome. *Virechana* has been proven to correct gut dysbiosis and help promote practical gut reorientation. Thus, the mechanism of action of *Virechana* can be related to the microbiota-gut-brain axis, especially in neurological disorders.

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