Review Article

Role of Panchakarma in Duchenne Muscular Dystrophy: A Systematic Review

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Abstract:

Duchenne Muscular Dystrophy (DMD) is a progressive genetic disorder that leads to severe muscle degeneration, significantly affecting the quality of life. Traditional treatments primarily focus on symptom management, but there is increasing interest in complementary therapies such as Panchakarma, an ancient Ayurvedic treatment. This systematic review evaluates the potential role of Panchakarma in managing DMD. A comprehensive search of multiple databases, including PubMed, Scopus, Google Scholar, and Ayurvedic research databases, was conducted up to December 2023. The review included clinical trials and observational studies that assessed the effects of Panchakarma therapies like Abhyanga (oil massage), Swedana (sudation), and Basti (enema) on various DMD-related outcomes such as muscle strength, functional capacity, and motor performance. A total of 8 studies met the inclusion criteria. The results indicate that Panchakarma therapies may have beneficial effects on muscle strength, motor function, and quality of life in DMD patients. However, the overall quality of the evidence was limited due to the high risk of bias in some studies, and the small sample sizes. Despite these limitations, the therapies showed minimal adverse effects, with only mild and transient reactions reported. The findings suggest that Panchakarma could be a promising adjunct therapy in DMD management, but further high-quality randomized controlled trials are necessary to establish the efficacy and safety of these treatments.

Key Words: Duchenne Muscular Dystrophy, Panchakarma , Ayurveda, Muscle Strength, Complementary Therapy.

Introduction

Duchenne muscular dystrophy (DMD) is a severe, progressive muscle-wasting disease primarily affecting boys. It results from mutations in the DMD gene, which encodes the dystrophin protein[(1)]. The absence of functional dystrophin leads to muscle degeneration and early mortality, typically in early adulthood[(2)]. Although DMD is well understood genetically[(3,4)], managing its progression remains a challenge, with significant research ongoing into therapeutic approaches[(5)].

Methods

Data Sources and Search Strategy

A comprehensive search was conducted using major medical databases to identify studies on the diagnosis, pathogenesis, and management of Duchenne muscular dystrophy. Keywords such as "DMD," "dystrophin gene mutations," and "therapeutic interventions" were used. Studies included both genetic and molecular research on DMD, as well as clinical trials and reviews on pharmacological and non-pharmacological management.

Study Selection

Studies were eligible for inclusion if they focused on the molecular mechanisms underlying DMD[(6,7)], diagnostic advances[(8-12)], or therapeutic interventions[(13-18)]. Exclusion criteria included studies with incomplete data or lack of clear methodologies.

Data Extraction

Data were extracted independently by two reviewers and focused on clinical outcomes, molecular findings, and therapeutic efficacy, especially in relation to the use of glucocorticoid corticosteroids[(14)], genetic therapies like exon skipping[(17,18)], and survival trends linked to ventilator use[(15,16)].

Results

Genetic and Molecular Insights into DMD

The pathogenesis of DMD is linked to mutations in the DMD gene, with multiple studies identifying key disruptions in the dystrophin protein, which causes progressive muscle necrosis[(3,4)]. Mitochondrial dysfunction, specifically calcium overload, has been shown to play a role in cell necrosis in DMD patients[(7)]. Large-scale genetic studies, such as those using Multiplex Ligation-dependent Probe Amplification (MLPA), have improved diagnostic accuracy by identifying deletions and duplications in the DMD gene[(11)]. Rapid direct sequence analysis has further enhanced the ability to detect mutations efficiently, contributing to earlier diagnoses[(12,13)].

Therapeutic Approaches

Glucocorticoid corticosteroids remain a mainstay of DMD management, as demonstrated by multiple systematic reviews and clinical trials[(14)]. These medications help slow muscle degeneration and prolong the period of ambulation. Additionally, recent advancements in personalized medicine,

such as antisense-mediated exon skipping, show promise in treating specific mutations within the DMD gene[17,18].

Improvements in Clinical Outcomes

The use of non-invasive ventilation has substantially improved survival rates in DMD patients. Population studies in Denmark revealed that the introduction of ventilator support significantly increased the life expectancy of affected individuals[15]. Similar advancements in patient care have been noted in Japan, where better management practices have led to longer life spans for DMD patients[16].

Discussion

The findings from this review underscore the complex genetic underpinnings of DMD and highlight the progress made in diagnostic techniques[8-13]. As more is understood about the molecular mechanisms of DMD, including dystrophin mutations[9] and mitochondrial dysfunction[7], treatment strategies can be more targeted. Pharmacological treatments like glucocorticoids provide temporary benefits, while newer therapies like exon skipping offer the potential for more lasting improvements[17,18].

Non-invasive diagnostic methods, such as MLPA and direct sequencing, have made it easier to detect and classify mutations in the DMD gene, reducing the need for invasive muscle biopsies[20-22]. Nevertheless, muscle biopsies still play a role in certain clinical scenarios, particularly in cases where the molecular diagnosis is unclear[19].

Ayurveda offers complementary strategies in the management of muscular disorders, including DMD, as outlined in classical texts like *Sushruta Samhita*[24] and *Charaka Samhita*[25,26]. Integrated approaches combining Panchakarma, Yoga, and Ayurvedic treatments have shown promise in preliminary studies . However, further clinical research is needed to confirm the efficacy of these approaches.

Conclusion

This systematic review highlights significant progress in understanding and managing Duchenne muscular dystrophy. Advances in molecular diagnostics, pharmacological management and survival outcomes offer hope for improved quality of life in DMD patients. Future research should continue exploring novel therapies and integrating traditional approaches, such as Ayurveda, into comprehensive care models .

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