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OPTIMIZING REHABILITATION STRATEGIES FOR CEREBELLAR ATAXIA IN INDIAN POPULATION : A SYSTEMATIC REVIEW OF PHYSICAL THERAPY INTERVENTIONS

Physiotherapy

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ABSTRACT

Background: Cerebellar ataxia has a major impact on the functional independence of patients with degenerative cerebellum. As there is paucity of published literature in Indian population, this study attempts to explore the various non-pharmacological interventions available to increase motor control, independence in activity of daily life, quality of life, balance and mobility in patients with cerebellar ataxia in Indian rural population affected with cerebellar ataxia. **Methodology:** Relevant literature published from January 2001 to 30th June 2022 searched. Recruitment of patients with- Hereditary ataxia/genetic cerebellar ataxia, Non hereditary ataxia. No limitations were applied to study designs. Primary intervention was of physiotherapy. Letters, other conference abstracts and studies on children population were excluded. **Results:** A total of 1301 studies were found through search and out of them 36 were selected. Upto 706 studies were searched in Pubmed / Medline databases whereas a total of 595 studies were searched in Cochrane databases. 27 studies were included. The search results depicted heterogeneity in wide domains related to patients with cerebellar ataxia. **Conclusion:** As the nature of the disorder under observation, it is difficult to develop a holistic approach focussing on all affected domains in these patients. The therapy should be tailor made and should comprise physical therapy, tDCS, balance and coordination exercises but not only limited to these.

KEYWORDS

Cerebellar Ataxia, Balance, Indian Population, Physical Therapy

INTRODUCTION:

Cerebellar ataxia has a major impact on the functional independence of patients with degenerative cerebellum. Damage to the cerebellum can be caused by traumatic, vascular, congenital or metabolic events and in certain cases, damage occurs spontaneously (Ashizawa & Xia, 2016). Cerebellar ataxia may occur isolated or exists with the involvement of other neurological systems i.e multiple sclerosis and can be of acquired or genetic type. While the cerebellum is the unifying site of pathology in the hereditary cerebellar ataxias, the clinical phenotype differs between and within the ataxias. Extracerebellar pathology often coexists alongside cerebellar degeneration. This may include extrapyramidal, pyramidal, brainstem, spinocerebellar tract, dorsal column, basal ganglia, vestibular and peripheral nerve pathology.

Currently, global epidemiological studies on ataxia have estimated an overall ataxia occurrence rate of 26/100,000 in children, and for dominant hereditary cerebellar ataxia an occurrence rate of 2.7/100,000 and the frequency of recessive hereditary cerebellar ataxia as 3.3/100,000 (Sridharan, R. et al., 1985; Brignolio, F et al., 1986, Erichsen, A., et al., 2009; Musselman, K. E., et al., 2014). SCA3 being the commonest variety worldwide, accounting for 20-50% of all cases, though SCA2 is generally considered the commonest one in India(Tsuchiya, K. et al.,1998).

As far as epidemiology of cerebellar ataxia in India is concerned, Rengaraj, R. et al. (2005) conducted a study of prevalence of cerebellar ataxia was done in two villages in Indian state of Tamil Nadu. The prevalence of SCA1 was high(7.2%) in ethnic Tamil community.

Patients with cerebellar ataxia suffer from wide variety of symptoms which primarily include frequent falls due to incoordination, deviation from normal gait pattern leading to taxing and unsafe mobility and balance difficulties for maintaining upright posture, dysmeteria, dysdiadokinesia, tremors, hypotonia and affect the motor learning. Secondary difficulties include eye movement disorders, depression because of increased dependency on others(relatives or care givers) and further decreased the mental status of these patients.

In India, other additional problems arise along with above mentioned difficulties, which significantly affect quality of life of in these patients. There is lack of awareness among Indian rural population, resulting in non-diagnosis or delayed diagnosis of cerebellar ataxia contributing to development of co-morbidities with the disruption of cerebellar circuits. The fact that the patients belonging to rural areas are unable to participate in regular rehabilitation program for long period of time; it is a big challenge as far as management of patients with cerebellar ataxia is concerned. Moreover, co-existence of poverty, illiteracy and lack of awareness in majority of Indian rural population, further hinders the maximal recovery which could be possible in these patients.

There is no specific management regarding the cure of cerebellar ataxia and the pharmacological management available for most forms is only supportive and aimed for symptomatic relief. As far as, rehabilitation programs are concerned, Jorge L Jorge-Rodríguez , et al. (2013), Amy Bastian, et al. (2014) and Scott Barbuto et al., (2020) explored the role of various rehabilitation strategies in patients with cerebellar ataxia in improving motor control, balance, mobility and reducing severity of ataxia in these patients. They advocated positive effects of their respective rehabilitation protocols as well as aerobic exercises programs in their findings. The available literature for developed nation in this context clearly suggests that physiotherapeutic management is effective in making the patient independent in activity of daily life and improving quality of life.

In spite of work done regarding physiotherapy approaches and their effectiveness in patients with cerebellar ataxia, there is paucity of published literature on Indian population, especially belonging to rural area. Currently, there is no proven effective protocol justifying the role of various physiotherapeutic and other non-pharmacological interventions on Indian rural population affected with cerebellar ataxia. Insufficient resources, lack of awareness, dependency only on medication, non availability of skilled rehabilitation specialists and tertiary care facilities in rural areas are further constraints that limit the recovery of cerebellar ataxic patients and affect their prognosis. Therefore this study attempts to explore the various non-pharmacological interventions available to increase motor control, independence in activity of daily life, quality of life, balance and mobility in patients with cerebellar ataxia in Indian rural population affected with cerebellar ataxia.

METHODOLOGY

Databases: A systematic review of studies that documented the physiotherapy approaches and non-pharmacological interventions for cerebellar ataxia was undertaken. Three databases were searched (Pubmed/MEDLINE, Cochrane).

Search Strategy: The following search strategy was applied to collect

articles from different databases. "physical therapy modalities"[MeSH Terms] AND "Cerebellar ataxia", "Cerebellar ataxia" AND "Physical Therapy", "Ataxia"[Mesh] AND "therapy"[All Fields], "cerebellar ataxia"[Mesh] AND "Therapy" ,Spinocerebellar ataxia AND Physiotherapy , "Spinocerebellar ataxia[Mesh] AND "training", "Spinocerebellar degeneration" AND "Exercise" , cerebellar disease AND exercise, "cerebellar diseases" AND "physical therapy", Spinocerebellar degeneration AND physical training.

Filters: The filters used in the searching of databases for relevant articles were,

a. English language
b. Free full text availability
c. Adult 19^{+} years

Selection Criteria: Articles were included in the study if they met following inclusion criteria:

Studies: All types of quantitative studies were included for this review on cerebellar ataxia from January 2001 to 30th June 2022, with patients affected with Hereditary ataxia/ genetic cerebellar ataxia and Non hereditary ataxia. A total of twenty seven eligible studies were selected for this review Randomized control trials, Quasi Randomized control trials, Case control trials, Observational trials, Case series and Quasi experimental designs with or without a comparison group were the included study designs in the review. The reason of inclusion of all these study designs was because of paucity of comparative studies. Letters to the editors, other conference abstracts and studies on children population/Friedreich's ataxia were excluded.

Participants:

Eligible studies were those of adults patients (19 years or above) with isolated cerebellar dysfunction. Patients with Multiple system involvement, other movement disorders (e.g. Parkinson's disease) and any other Central Nervous System involvement (cerebral hemisphere or spinal cord involvement), any post surgical case and psychological cases were excluded due to discrepancy of effects of therapeutic regimens for rehabilitation of individuals with isolated cerebellar dysfunction.

Type of interventions:

In this review those studies were included whose primary intervention was physiotherapy . Examples of eligible physiotherapy interventions include: Proprioreceptive neuromuscular training approach, Balance training, Gait training, Coordination exercises, Stability training, Range of motion exercises, Activity-based approach, Electrotherapy modalities, Endurance training and Other new/modified physiotherapeutic approaches. The studies comprising of treatment with drugs for medical or surgical purposes or any other treatment taken for other co-morbidities were excluded.

Outcome measures:

Since cerebellar ataxia vary in severity, the previous studies evaluated a wide variety of domains using number of outcome measures but not limited to BBS (Berg Balance Scale),International Cooperative Ataxia Rating Scale (ICARS), Timed Up and Go Test (TUG), Functional Reach Test (FR), Activities Specific Balance Confidence Scale (ABC), 6 minute walk test, 9 hole peg test, SARA (Scale for Assessment and Rating of Ataxia),EMG (Electromyography), Dynamic Gait Index(DGI) etc

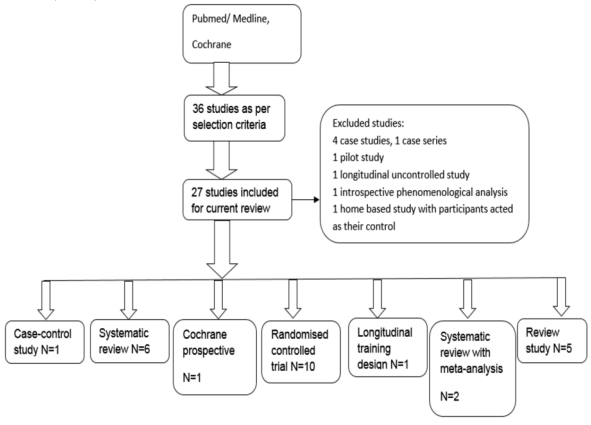

Figure 1: The flowchart depicting overview of searched literature

Table 1: Comprising the analysis of the included studies.

Sr no	Author ,Year, Country	Design	Number of subjects /articles	Age (years)	Assessment points	Outcome measures	Interventions	Conclusion
1	Winser,S.J.,et al, (2022), Hong kong	Randomised control trial	N= 24	18–65	week 0 week 12 week 24	BBS, SARA(bal), Euroqol, VAS, Sensory Organization Test and Limits of Stability test	The 8-form Tai Chi exercise	Study demonstrateD some evidence to support the benefits of Tai Chi training on the dynamic balance among ambulant patients with CA.
2	Jabri, S., et al., (2022) USA	2 × 2 crossover experimental design	N=10	27-63	Initial, intermediate and final assessments	SARA mctsib DGI TUG TUG-motor Sit-to-Stand Test	Home-based training with vibrotactile sensory augmentation Home-based training without vibrotactile SA	Study provided preliminary evidence of the effectiveness of vibrotactile Sensory augmentation during home-based training.. This training decreased SARA and posture & gait scores, indicating an improvement in performance.
3	Winser, S., et al., (2022) Hong Kong	Systematic review with meta analysis	N=26			BBS SARA FIM ICARS Number of falls	Balance exercises, coordination training, aerobic exercises such as cycling, gait training, range of motion and strengthening exercises for extremities, robotic assisted exoskeleton orthosis, lumbar stabilization exercises or a combination of these exercises.	Review found low to moderate evidence supporting the therapeutic exercise to reduce exercise to reduce the disease severity among adults with non hereditary degenerative hereditary ataxia.
4	Chen, T. X., et al., (2021) USA	Systematic review with meta-analysis	N=5			9 hole peg test 8 meter walk test SARA	tDCS	The study revealed that that tDCS could improve symptoms of cerebellar ataxia with lasting results that can be sustained for months. The treatment showed preferential effects on gait ataxia and is relatively safe.

5	Wang, S. M., et al., (2021) Hong kong	Systematic review	N=5			Nine-hole peg test Eight-meter walking time Timed up and go test Pediatric balance scale pediatric evaluation of disability inventory	tDCS	The review suggested that anodal cerebellar tDCS decreases disease severity and improves finger dexterity and quality of life in patients with cerebellar ataxias.
6	Kwei, K. T., et al., (2020) USA	Review study	N=15			SARA ICARS	TMS, tDCS exercises and physical therapy	The study concluded that there are currently a multitude of treatments for ataxia that can be offered, both symptomatic therapies that may help regardless of the cause of ataxia as well as potential disease-modifying therapies targeting specific types of ataxia. It is not only the time to dispel the myth that there is no treatment for ataxia, but in fact there is a reason to be hopeful about the current state and future of ataxia treatments.
7	Perlman, S. L., (2020) USA	Review study	N=6				Stretching, core strengthening, balance, and cardio, tDCS, occupational therapy, TMS, speech and swallowing therapy, weighted vests , orthotics.	The study revealed that both transcranial magnetic stimulation and transcranial direct current stimulation effectively influence cerebellar motor functions, as well as visual tracking tasks, motor adaptation and learning, and cognitive and affective operations mediated by cerebro-cerebellar pathway.
8	Song, P., et al., (2020) China	Randomized , controlled trial	N=45	18-75	At baseline At 10 days	SARA EEG	rtms, itbstherapy	Findings provided novel evidence that itbs over the cerebellum is potentially an effective strategy to improve motor symptoms in patients with MSA
9	Barbuto, S., et al., (2020) USA	Randomized control trial	N=20	20 to 70	Pre training Immediate post training At 3 months post training	SARA TUG DGI Vo2 Max Gait speed	stationary bicycle training, home balance training consisting easy, moderate, and/or hard exercises.	A larger, phase II trial comparing aerobic and balance training is technically feasible. Although improvements in gait and balance may be similar, improvements in ataxia severity and fitness may be greater with aerobic training than balance training.
10	Velázquez Pérez, L., et al., (2019) Cuba	Randomised control design	N=30	18-60	Basleine At 12 week	5-m tandem gait Times upholding the tandem stance over a mattress Inventory of Non-Ataxia Symptoms (INAS) SARA	Range-of-motion exercise for trunk and limbs, dynamic and static balance exercises, walking indoors and outdoors, climbing up and down stairs, and coordinative tasks of the upper and lower limbs.	Authors demonstrated the efficacy of 12-week rehabilitative therapy on motor cerebellar manifestations in preclinical SCA2 mutation carriers.
11	Tercero-Pérez,K., et al., (2019) Mexico	Case-control pilot randomized and observationa l study	N=18	17-64	At baseline At 12 weeks At 24 weeks	SARA INAS Lawton and Barthel scales.	interventional strategies focussed on the maintenance of motor control, coordination exercises, gait re-education, dynamic and static balance, physical conditioning, and muscular strengthening	The study supported the notion that physical training could positively influence their general health condition
12	Da Silva,J.D., et al., (2019) Portugal	Review study	N=5				Physical therapy and mobility aids.	Physical therapy has been shown to decrease spasticity to daily activities. Exercising is complementary to this approach and should be encouraged. Moreover, a novel exergaming strategy was shown to improve ataxic symptoms
13	Carr, J. J., et al., (2019) Australia	Scoping review	N=30			53 different outcome measures	Walking training, task specific training and balance training	The interventions had a positive impact on walking and moving around.

14	Velázquez Pérez, L., et al., (2018) Cuba	Randomised control design	N=38	18-60	At baseline At 24 weeks	SARA INAS 3 electronystagmographical measure	Range-of-motion exercises for the trunk and limbs, dynamic and static balance exercises, indoor and outdoor walking, stair climbing up and down, coordinative tasks of the upper and lower limbs, and muscle strengthening exercises, among others Occupational therapy, Psycotherapy	The program significantly improves the motor cerebellar symptoms of spinocerebellar ataxia type 2 patients likely as result of the partial preservation of motor learning and neural plasticity mechanisms these findings provide evidence in support of this therapeutic approach as palliative treatment in spinocerebellar ataxia type 2
15	Milne, S. C., et al., (2017) Australia	Systematic review	N=17			SARA, BBS FIM, FAC GAIT, PARAMETERS DGI, TUG Number Of Falls ICARS	Coordination and balance training, multifaceted inpatient rehabilitation, cycling regime, balance training, treadmill training, occupational therapy, and Inspiratory muscle training.	This review highlighted emerging evidence that rehabilitation may improve function, mobility, ataxia and balance in genetic degenerative ataxia. Although these conclusions are based primarily on moderate to low-quality studies, the consistency of positive effects verifies that rehabilitation is beneficial.
16	Ferrucci ,R., et al., (2017) Italy	Review study	N=10				Rtms, tDCS	Overall, low-frequency rtms and theta-burst stimulation and tDCS seem to be effective for the treatment of cerebellar ataxias.
17	Im, S. J., et al., (2017) South Korea	Single-group, longitudinal training design	N=19	Mean - 53.2	0 week 12 week 3 months	ICARS OPTITRAK	Locomotor training program, emphasizing the relearning of proper gait movement strategies, weight transfer practice in stance.	The study had provided preliminary evidence that restorative rehabilitation strategies targeting disease specific locomotion symptoms may be helpful for reducing ataxic gait and improving motor control during walking in patients with cerebellar dysfunction.
18	Chang, Y. J., et al., (2015) Taiwan	Randomized controlled trial	N=40	20-65	Before intervention After 4 week	ICARS, RPE-rate of perceived exertion 10-meter walking test, gait speed, standing capacity, spread of feet, and body sway with eye open or close, knee-to-tibia test	Leg cycling and cycling regimen, verbal health education, upper-extremity exercises	The 4-week leg cycling regimen suggested for clinical use to restore the short- and long-term adaptive plasticity and coordination function in the individuals with ataxia.
19	Huang, Y. Z., et al., (2015) Taiwan	Randomised control study	N=20	Mean - 49	0 week 4 week	EMG	Temporal ES-assisted training at home , General health education	Temporal ES-assisted training alleviated hypermetria by restoring antagonist premovement and temporal triphasic EMG patterns in SCA patients.
20	Durairaj, S. K., et al., (2014) India	Systematic review	N=11			TUG DGI SARA ICARS ABC FR 9 HOLE PEG TEST BBS FIM NUMBER OF FALLS GAIT SPEED	Re-training Balance and Gait, Strengthening and Resisted Training, General Conditioning and Co-ordination exercises, Ideomotor Retraining, Range of Motion Exercises, Proprioceptive Neuromuscular Facilitation , and Use of Prosthetic Shoes.	This review brought fact that further studies have proved vastly the benefits of Physiotherapy interventions in persons with cerebellar dysfunction although no particular intervention could be highlighted as superior because of the fact that randomized controlled trials were not completely reviewed.
21	Marquer, A., et al., (2014) France	Systematic review	N=19			SARA BBS Timed standing tests Posturography 6 minute walk test Timed up and go test	Balance, coordination exercises, walking over uneven ground, Biofeedback, Bilateral deep brain stimulation (DBS)	Intensive rehabilitation programs with balance and coordination exercises are necessary. Although techniques such as virtual reality, biofeedback, treadmill exercises with supported bodyweight and torso weighting appear to be of value, their specific efficacy has to be further investigated.

22	Chen, C. C., et al., (2015) Taiwan	Single-blind case-control study	N=27	SCA group=mean 43.7 Age matched control=mean 41.3 Young control=; mean 24.3 3	Before electrical stimulation 10 min after 20 min after 30 min after 10 min after ES ended 20 min after ES ended	EMG	NMES of the median nerve.	The low motor cortex excitability of individuals with SCAIII and sporadic SCA can be enhanced after a 30-min repetitive peripheral NMES to the same extent as in healthy controls. This indicates that people with SCA can benefit from NMES to the same extent as health controls.
23	Martins, C. P., et al., (2013) Brazil	Systematic review	N=5			SARA, ICARS GAS, BBS FIM GAIT/CADENCE DGI	Balance, coordination exercises, falls prevention, TMS, Conditioning exercises, muscle strengthening, stairs, gait training with weight on lower limbs,	In this review, studies demonstrating the positive effects of interventions to treat the sequels of SCA were identified: balance, gait and coordination training, muscle strengthening and stretching, use of shin pads in lower limbs and the application of TMS pulses on the cerebellum.
24	Fonteyn, E. M., et al., (2013) Netherlands	Systematic review	N=13			Various outcome measures were used such as: SARA, EDSS	conventional physical therapy exercises, treadmill training, relaxation and biofeedback therapy, Computer-assisted training, Supervised sports, Occupational therapy, Speech and language therapy	Physical therapy and occupational therapy are recommended in cerebellar disease, based on two level 2 conclusions for physical therapy, and the many level 3 conclusions for physical therapy and occupational therapy
25	Miyai, I., et al., (2012) Japan	Randomized controlled trial	N=42	40-82	At 0 week At 4 week At12 week At24 week	SARA FAC FIM	General conditioning; range-of-motion exercise for trunk and limbs; muscle strengthening; static and dynamic balance exercise with standing, kneeling, sitting, and quadruped standing; mobilizing the spine; walking indoors and outdoors; and climbing up and down stairs., Occupational therapy, Home base program	Short-term benefit of intensive rehabilitation was evident in patients with degenerative cerebellar diseases. Although functional status tended to decline to the baseline level within 24 weeks, gains were maintained in more than half of the participants.
26	Čakrt, O., et al., (2012) Czech Republic	Clinical trial with no control group	N=7	39–71 years	At the beginning At the day of discharge After 4week	SARA Static Posturogaphy Customized software-MATLAB for postural sway	Position based tongue biofeedback exercises	Balance rehabilitation program with postural exercise performed with a head position-based tongue-placed biofeedback system could significantly improve bipedal postural control in patients suffering from ataxia due to cerebellar degeneration.
27	Ilg, W., et al., (2009) Germany	Prospective cohort study	N=16	Group C mean =64.6 Group A mean = 56.2	8 week before intervention-e1 Immediately before first coordinative training- e2 Immediately after last training –e3 After 8 week	ICARS SARA BBS GAS VICON 612 GAIT	Static balance, dynamic balance, whole-body movements to train trunk-limb coordination; steps to prevent falling and falling strategies; movements to treat or prevent contracture.	This study provides Class III evidence that coordinative training improves motor performance and reduces ataxia symptoms in patients with progressive cerebellar ataxia.

RESULTS:

A total of 1301 studies were found through search criteria. 706 studies were searched in Pubmed / Medline databases whereas a total of 595 studies were searched in Cochrane databases. Finally, 27 studies were selected as per the criteria and their findings have been described in Table 1.

The analysis suggested a number of interventions that have been applied by various authors in these selected studies and these interventions again varied heterogeneously in dosage, duration and techniques.

Physical Therapy Exercises:

Since ages, physical therapy exercises have been widely incorporated and compared in majority of rehabilitation programs in patients with cerebellar ataxia. These exercises benefitted these patients in terms of improved strength, balance, coordination and gait. In the present review 13 studies incorporated Physical Therapy as a standard interventional regimen in patients with cerebellar ataxia. Most of the studies reported positive outcomes of physical therapy not only on motor cerebellar manifestation but other components affected by cerebellar ataxia(Velázquez Pérez et al., 2018; Durairaj et al., 2014).

Balance and Coordination:

In patients with cerebellar ataxia impaired mobility is the main reason of short term as well as long term disability. Many previous studies have highlighted that major determinant factor of impaired mobility is impaired balance and coordination in these patients (Sartor-

Glittenberg, C., et al.,2014).

Thirteen studies out of total number of 27 implied balance and coordination exercises as an intervention to improve gait component in these patients. A study by Ilg, W., et al., (2009) provided class III evidence that coordinative training improved motor performance and reduced ataxia symptoms in progressive cerebellar ataxia. Further, Marquer, A., et al., (2014) highlighted the role of balance and coordination as a method of Intensive Rehabilitation in these patients.

Gait Training:
In the present review, 8 studies utilized gait training as a method of rehabilitation program and all of these studies reported positive outcomes in reducing ataxic gait and improving motor control during walking.

Aerobic Exercise:
Patients with cerebellar ataxia have more sedentary lifestyle in comparison to normal age matched controls. Barbuto, S., et al., (2020) in their study utilized stationary bicycle training as a form of aerobic exercise showed that aerobic training in individuals with cerebellar degeneration is feasible. Fonteyn, E. M., et al., (2013) and Marquer, A., et al., (2014) in their review studied the applicability of treadmill training in patients with cerebellar ataxia and highlighted the positive effects of this training on gait and balance parameters but they specified that efficacy of treadmill training has to be further investigated.

Neuromuscular Electrical Stimulator(NMES):
Neuromuscular Electrical Stimulator(NMES) traditionally has been used right from 1960's in neurological patients for foot drop (Kapadia et al., 2020). The present review could find only one study which had applied NMES in patients with SCA and reported benefit from it to the same extent as health controls (Chen, C. et al., 2015)

tDCS (transcranial Direct Current Stimulation) and TMS(Transcranial Magnetic Stimulation):
Other forms of stimulation especially at cortical level have gained tremendous recognition in the rehabilitation of patients with cerebellar ataxia. Three studies revealed that both tDCS and TMS effectively influence and improve the symptoms of patients with cerebellar ataxia(Kwei, K. T., et al., 2020; Perlman, S. L., (2020)and Ferrucci, R., et al.,2017). Further, Chen, T. X., et al., (2021) found lasting results with tDCS in improving symptoms of cerebellar ataxia that can be sustained for months whereas Wang, S. M., et al., (2021) documented improvement in quality of life in these patients using tDCS. Three studies namely Song, P., et al.,(2020); Huang, Y. Z., et al., (2015) and Martins, C. P., et al., (2013) provided novel evidence that TMS is potentially an effective strategy to improve motor symptoms in patients with cerebellar ataxia.

Orthosis, Mobility Aids, weighted vests:
Winser, S., et al., (2022) reported effectiveness of orthosis on balance in patients with cerebellar ataxia but te quality of evidence for its effectiveness was low whereas Da Silva,J.D., et al., (2019) advocated usage of mobility aids such as canes, crutches, walkers, rollators, wheelchairs, and motorized scooters are essential to allow for independent activity and prevent social isolation.

Biofeedback:
Marquer, A., et al., (2014) analysed the role of biofeedback through their systematic review and stated that although biofeedback appeared to be of value, yet its specific efficacy has to be further investigated.

Tai Chi:
Winser, S.J., et al, (2022) in their randomised control trial demonstrated some evidence to support the benefits of Tai Chi training on the dynamic balance among ambulant patients with cerebellar ataxia

Task specific Training;
Carr, J. J., et al., (2019) in their scoping review found that Task specific Training has a positive impact on walking and moving around in people with Machado-Joseph Disease.

Deep brain stimulation:
Deep brain stimulation has been part of one review done by Marquer, A., et al., (2014) who in their review noted marked improvement in sitting and standing postures in patients with SCA type 2 but they further stated that its specific efficacy has to be further investigated.

DISCUSSION:

The basic aim of the study was to explore the current non-pharmacological interventions available for the effective management of patients with cerebellar ataxia. Hence an attempt was made to conduct a thorough search of the available literature as per the predefined criteria. The patients with cerebellar ataxia are often burdened with a number of impairments both direct as well as indirect. The management of these patients is bound to put lots of pressure on the healthcare system especially in developing countries. This issue is a major area of concern even in developed nations as it causes a great amount of financial burden on the economy.

The search results depicted heterogeneity in wide domains related to patients with cerebellar ataxia. The search literature was limited to studies with non-pharmacological interventions. Further, the literature review showed that there was diversity in terms of age, severity of affection, motor deficits, outcome measures as well as interventional strategies in patients with cerebellar ataxia. This variability was widely reflected not only in wide range of study designs but was also seen in the final course of disease process among these patients. Majority of the studies lacked randomisation and thus were not included. Meta-analysis was limited to handful of available studies. The studies with systematic reviews outnumbered those with meta-analysis but again, these systematic reviews had huge variations in terms of interventional strategies. Hence, most of the published literature had cross-sectional design lacking long term follow up. The use of interventional tools and modalities were limited to few domains mainly TMS, tDCS & NMES. Apart from cerebellar ataxia, patients suffering from stroke , brain tumors, head injuries also exhibited similar impairments. Even the interventional approaches used in cerebellar ataxia overlap in patients with above disorders. Thus, the literature comprising disorders other than cerebellar ataxia was excluded.

The current review proposes a plethora of clinically available interventions exist for managing patients with cerebellar ataxia, thereby providing a broad range of options for clinicians. Certainly, physical therapy is often recommended in these patients. As far as interventions are concerned, the literature is extensive but as a whole structured therapy interventions and general physical therapy guidelines are still not available. The reason could be lack of control groups in majority of studies and heterogenic nature of symptoms associated with cerebellar ataxia. Thus, a structured program that is tailor made as per individual needs of patients seems to be the ideal therapy recommendation. Undoubtedly, this current investigation has emphasized the systematic review and RCT findings to comprehend the most robust evidence currently available for managing cerebellar ataxia. However, the ideal model should involve the generalization of fundamental treatment guidelines, as they are available for stroke(Pogrebnoy, D., & Dennett, A., 2020) and Parkinson's disease (Munneke, M., et al., 2010).

CONCLUSION:

Table 1 consists of various available interventional physiotherapeutic approaches currently searched which are clinically applicable in patients with cerebellar ataxia. Considering the nature of the disorder under observation, it is difficult to develop a holistic approach focussing on all affected domains in patients with cerebellar ataxia. The rehabilitation strategy should be tailor made and should comprise physical therapy, tDCS, TMS, balance and coordination exercises, strengthening exercises, gait training but not only limited to these. Future studies should endeavour the integration of physical therapy on a particular domain of patient's needs and expectations to augment the credibility of their generalised findings.

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