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Disclaimer:

A Mechanistic Insight into Sources of Error of Visual Working Memory in Multiple Sclerosis (PP-01)

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Working memory (WM) is one of the most affected cognitive domains in multiple sclerosis (MS), which is mainly studied by the previously established binary model for information storage (slot model). However, recent observations based on the continuous reproduction paradigms have shown that assuming dynamic allocation of WM resources (resource model) instead of the binary hypothesis will give more accurate predictions in WM assessment. Moreover, continuous reproduction paradigms allow for assessing the distribution of error in recalling information, providing new insights into the organization of the WM system. Hence, by utilizing two continuous reproduction paradigms, memory-guided localization (MGL) and analog recall task with sequential presentation, we investigated WM dysfunction in MS. Our results demonstrated an overall increase in recall error and decreased recall precision in MS. While sequential paradigms were better in distinguishing healthy control from relapsing-remitting MS, MGL were more accurate in discriminating MS subtypes (relapsing-remitting from secondary progressive), providing evidence about the underlying mechanisms of WM deficit in progressive states of the disease. Furthermore, computational modeling of the results from the sequential paradigm determined that imprecision in decoding information and swap error (mistakenly reporting the feature of other presented items) were responsible for WM dysfunction in MS. Overall, this study offered a sensitive measure for assessing WM deficit and provided new insight into the organization of the WM system in MS population.

Keywords: Binding; Multiple sclerosis; Resource model; Swap error; Working memory

Acute Brainstem syndrome with NMOSD and related to systemic lupus erythematosus, A Rare Case Report (PP-02)

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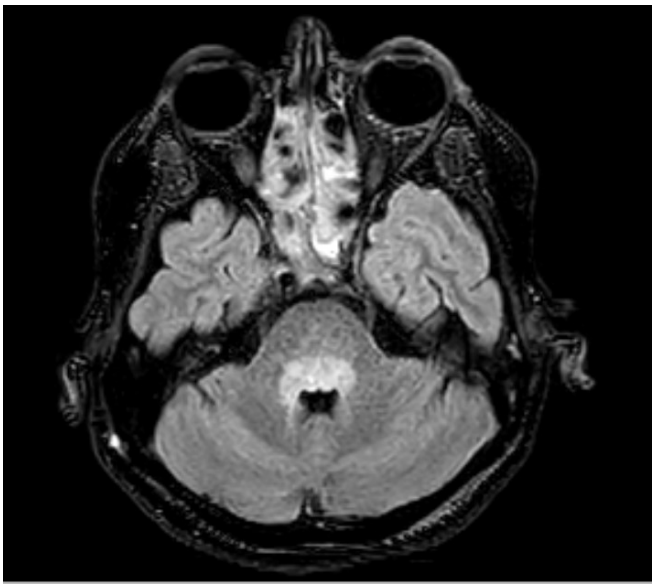
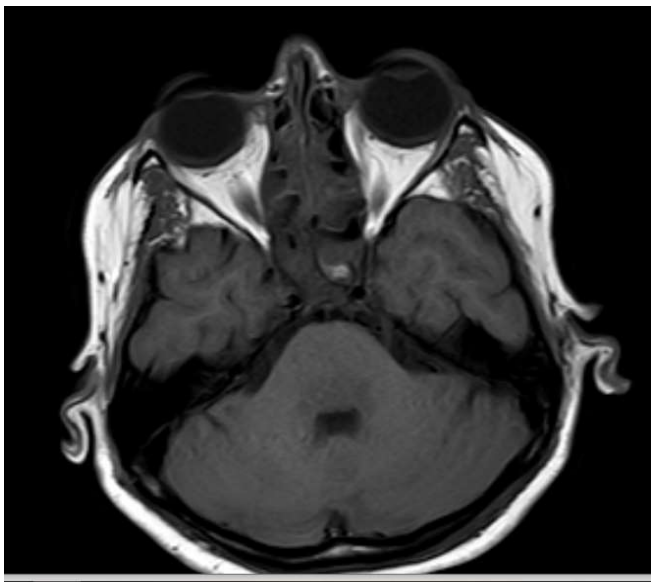
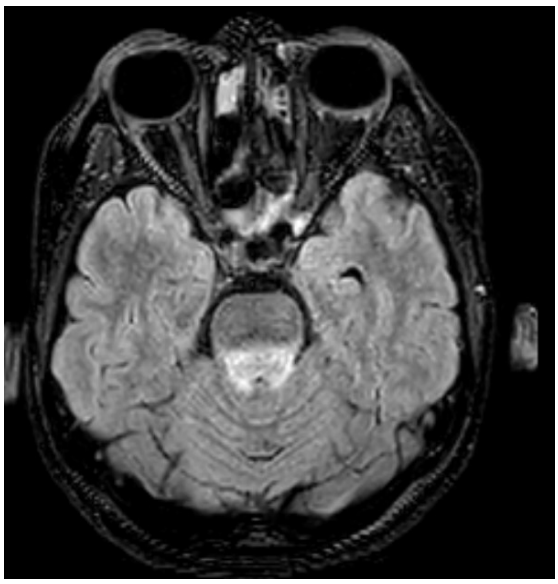
Introduction: Neuromyelitis optica spectrum disorders (NMOSD) are a family of syndromes, dominated by optic neuritis (ON) and myelitis, but also including brainstem syndrome. Systemic lupus erythematosus (SLE) is an autoimmune disease that may affect the CNS. We report a case in which SLE and NMOSD subsequently occurred and presented with acute brainstem syndrome.

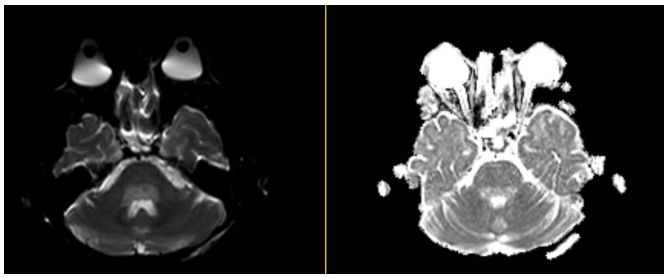
Case History: A 36-year-old woman with history of poorly managed SLE was brought to the emergency department with

sudden onset respiratory distress and a witnessed tonic-clonic seizure. The symptoms started a few days ago with headache, blurred vision, vertigo, ataxia, nausea, and hiccups. The patient had bilateral visual loss one year ago, which recovered after a few days without treatment. On examination, clinical features include drowsiness, facial asymmetry, dysphagia and tachypnea, lower limb movement weakness, and urinary incontinence, Babinski sign. She was diagnosed lupus a long time but non-cooperative for treatment. Initial assessment revealed afebrile, tachypnea, tachycardia without meningeal irritation. She intubated and managing the frequent seizures with midazolam. Lab data showed mild leukocytosis, and ABG analysis revealed respiratory acidosis. ANA and anti-dsDNA tests were positive. AQP4-IgG and MOG-IgG checked once but was negative. CSF analysis was normal. Chest CT Scan displayed bilateral patchy infiltrates. Brain MRI (Figs. 1-3) showed hyper intensity in posterior of pons and midbrain in FLAIR, T2, DWI sequences. Cervical MRI was unremarkable. Based on the clinical presentation and investigation, treatment with pulse of methyl prednisolone 1gr/day for five days and then cyclophosphamide has been started. The patient showed gradual improvement in respiratory distress and regained consciousness.









Discussion: Diagnostic criteria of NMOSD was fulfilled. This rare case illustrates the importance of accurate diagnosis and targeted treatment of NMOSD when coexisting with SLE.

Keywords: Acute Brainstem syndrome, NMOSD, Lupus, Treatment

Acute disseminated encephalomyelitis (ADEM), Report A Rare Case of Refractory form to treatment (PP-03)

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Introduction: Acute disseminated encephalomyelitis (ADEM) is a rare disease of central nervous system with myriads of presentation. We report a case with atypical feature and partial response to treatment.

Case History: A 39-year-old woman, with no previous relevant medical history, was admitted to the Emergency Department for acute confusional state and gait disorders and urinary retention over the last 48 hours. Two weeks earlier, the patient presented fever, headaches and nausea. On examination, she was drowsy, aphonic, dysphagia, urinary incontinence and flaccid quadriplegia but right-sided dominantly. Deep tendon reflexes were decreased with positive Babinsky sign. Eye movements and fundoscopy was normal. There is no fever, seizures or meningeal irritation. Lumbar puncture was done. Normal CSF analysis and OCBs was negative. All laboratory tests, including Aquaporin 4 and MOG Antibodies tests were unremarkable. Brain MRI revealed multiple hyper intense lesions seen in T2-\9+weighted, FLAIR, and PD imaging scans. The lesions may be large and confluent, occupying almost all of the white matter. (Figs.). Cervical MRI seems to be normal. The diagnosis of ADEM is suggested and treated with high-dose intravenous of methylprednisolone 1 g/d for 5 days. The response was poor. Pulse IV methylprednisolone was repeated again after one week. Despite two courses pulse, there was no change in the patient's symptoms and brain MRI. So we started plasmapheresis (250 CC/Kg (Every other day for two weeks. After two months, control MRI before hospital discharge demonstrated partial regression of the brain hyper intensity. The patient recovered partially within six months.

Conclusion: The outcome of ADEM in most cases is good. We report a rare case with refractory to treatment.

Keywords: Acute disseminated encephalomyelitis, case report

Acute disseminated encephalomyelitis following vaccination against SARS-cov-2: a case report (PP-04)

Ebrahim Pourakbar

Introduction: ADEM an inflammatory demyelinating discase of the central nervous system that is usually considered a monopnasic disease. Post-vaccination ADEM has been associated with severa vaccines. however there is scarce information related to SARS-CoV-2 vac-cines. We report the case of a 26-year-old female who suffered from ADEM four weeks after Gam-COVID-Vac administration.

Result: A 26-vear-old female was admitted affer 10 davs of temporal spatial disorientation, inappropriate behavior and headache. She reported no upper respiratory infection or diarrhea and she has no significant medical history. Four weeks prior admission she received a first dose of Gam-COVID-vac vaccine (humai adcnovirus viral vector). Neurological examination showed failure cognitive function in attention, deferred memory, orientation visuospatial and language. Montreal Cognitive Assessmen (MoCA) 12/30. Also right upper limb weakness and gait ataxia was noted. Her brain MRI showed wide spread abnormal signals on FLAIR images with ring enhancement pattern. Analysis of cerebrospinal fluid was normal and oligo clonal bands were positive. ADEM was suspected and she was treated wit intravenous Methylprednisolone with partial recovery. MoCA at 30 days was 24/30.

Conclusion: our patient met the ADEM diagnostic criteria diagnosis were excluded .although a plausible relationship was not demonstrated. The possibility of association with vaccine is suspected

Keywords: : Acute disseminated encephalomyelitis, case report, SARS-cov-2

Acute Relapses of Neuromyelitis Optica Spectrum Disorder After COVID-19 Vaccination Shot, Among Iranian Patients (PP-05)

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Background: The COVID-19 vaccination was one of the most important medical events of the century which resulted in the end of a horrible pandemic. Since NMOSD patients were high-risk for COVID-19 infection, they had priority in vaccination like patients with other autoimmune disorders. But the point is that immunological effects of vaccines may lead to disease activation and acute relapses.

Objectives: In this study we aimed to report any acute relapses or neurological deficits, that occurred within three months after each episode of COVID-19 vaccination in Iranian NMOSD patients. The type and severity of symptoms were noticed.

Methods: We asked 170 NMOSD patients who had been registered in our NMOSD clinic electronic database about experiencing acute relapses or neurological deficits during three months after each dose of COVID-19 vaccine. There was positive response in 7 patients out of 170. The duration

between vaccine shot and neurological sign had been considered.

Results: Acute relapses occurred in seven NMO patients (four seropositive) after vaccination shot. All of them were female with mean age of 39.28±7.02 years and disease duration about 7.14±2.41 years. The earliest relapse happened 2 weeks after vaccine shot and the latest one happened two months later but most of the relapses occurred about one month after vaccination. The type of neurological conflict included optic neuritis in two patients, myelitis in two patients, cranial nerves palsy, area postreoma syndrome and paresthesia. They received corticostroid pulse therapy. Optic neuritis in one patient was so severe that she received plasma exchange therapy. All of them were treated by rituximab as maintenance therapy.

Conclusion: In our study 4.11% of patients experienced acute relapses after vaccination but we don't know if it is a coincidence, or it is directly due to the immunological effect of vaccine. The other probability is the duration between receiving rituximab and vaccination, which is usually more than 4 months and in this time the drug effect is reduced and the immune system is more prone to be activated by vaccination.

Keywords: Neuromyelitis Optica Spectrum Disorder, COVID-19

Alopecia universalis in a patient under treatment of Ocrelizumab after switching from Rituximab (PP-06)

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Background: Ocrelizumab is a humanized monoclonal antibody, which acts as anti-CD20 antibody. It is used as a treatment of both relapsing-remitting MS and Progressive type.

Objective: The aim of this study is to report the first patient with Alopecia universalis after switching DMTs from rituximab to ocrelizumab.

Case: A 37 year old female with the history of SPMS beginning from 8 years ago, who used to be treated with rituximab and her drug was switched to ocrelizumab from 6 months ago, presented with patchy scalp hair loss a day after receiving second dose of ocrelizumab. Hair loss rapidly progressed in 3-4 days to completely loss whole body hairs. This patient responded incompletely and slowly to receiving topical corticosteroid and minoxidil.

Result: Ocrelizumab may be responsible for autoimmune reactions such as alopecia areata in immunocompromised patients .

Keywords: Ocrelizumab, alopecia areata, multiple sclerosis, hair loss

Artificial intelligence in multiple sclerosis imaging: advancements, benefits and challenges (PP-07)

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The integration of artificial intelligence (AI) techniques into the field of Multiple Sclerosis (MS) imaging has shown remarkable advancements, promising benefits, and unique challenges. Advancements in AI algorithms have revolutionized MS imaging, enabling accurate and efficient analysis of imaging data. AI-based methods have facilitated lesion segmentation, tissue classification, and quantification of disease burden. Moreover, AI algorithms have demonstrated the potential to improve the detection of subtle abnormalities and the prediction of disease progression, enhancing early diagnosis and prognosis. Additionally, AI techniques have enabled the extraction of intricate imaging features, serving as potential biomarkers for assessing treatment response and developing personalized therapeutic strategies. The benefits of AI in MS imaging are multifaceted. First, it reduces the burden on radiologists and clinicians by automating repetitive and time-consuming tasks, allowing them to focus more on patient care. Second, AI algorithms can enhance the reproducibility and standardization of image interpretation, reducing inter-observer variability. Third, AI techniques have the potential to uncover novel imaging patterns and insights, providing a deeper understanding of MS pathophysiology. However, several challenges need to be addressed for the successful integration of AI in MS imaging. These include the need for large, annotated datasets for training robust AI models, issues related to data privacy and ethical considerations, and the lack of standardized protocols for AI implementation across different imaging modalities and clinical settings. Furthermore, AI algorithms may suffer from biases and may not always generalize well to diverse patient populations, necessitating ongoing validation and refinement.

AI advancements have brought transformative changes to MS imaging, offering various benefits while presenting unique challenges. The integration of AI in MS imaging holds great promise for advancing diagnosis, prognosis, and personalized treatment strategies. However, further research, collaboration, and standardization efforts are essential to unleash the full potential of AI in the field of MS imaging. This narrative review aims to provide a comprehensive overview of the current state of AI in MS imaging, highlighting its advancements, benefits, and challenges.

Keywords: artificial intelligence, multiple sclerosis, imaging, limitations, deep learning

A Systematic Review and Meta-analysis on Safety and Effectiveness of Extended-interval Dosing of Natalizumab in Patients with Relapsing-remitting Multiple Sclerosis: Is There Any Value in The Cost of Treatment? (PP-08)

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Background: Standard-interval dosing (SID) of natalizumab (i.e., 300 mg every 28 days) is approved for patients with relapsing-remitting multiple sclerosis (RRMS). Since patients taking natalizumab are at increased risk of developing progressive multifocal leukoencephalopathy (PML), some neurologists may consider extended-interval dosing (EID) regimen instead. However, there has been by far no consensus on the safety and effectiveness of the EID regimen.

Methods: We searched MEDLINE, EMBASE, Scopus, Web of Science, Cochrane Database of Systematic Reviews, and Clinical trials.gov until March 30, 2023. To evaluate the safety and effectiveness of EID (> 5 weeks) and SID (≤ 5 weeks) regimens of natalizumab, studies on RRMS patients aged> 18 years old were included. The primary effectiveness outcome was pooled Mean Difference (MD) of annualized relapse rate (ARR), and the primary safety outcome was pooled Risk Ratio (RR) of PML development. Additional outcomes were the pooled MD of the expanded disability status scale (EDSS) and pooled RR of new MRI activity.

Results: Of the 712 publications identified, 11 studies involving 9397 patients were included. The median duration of follow-up was 23 months. Pooled MD of ARR was -0.001 (95% CI, -0.05 to 0.05; P-value = 0.95) indicating that there is no statistically significant difference between SID and EID regimens of natalizumab in terms of effectiveness. This is while, pooled RR of PML was 0.49 (95% CI, 0.28 to 0.87; P-value = 0.01) suggesting statistically significant superiority of natalizumab EID over the SID regimen in RRMS.

Conclusion: Compared to the SID regimen, extending the dosing interval of natalizumab was associated with a statistically meaningful reduced risk of PML, and probably lower cost of the treatment, while preserving the treatment effectiveness. However, due to the limited number of included populations, any interpretation of the present study's results in clinical practice should be done with caution.

Keywords: Natalizumab, Multiple sclerosis

Benign Paroxysmal Positioning Vertigo in Multiple Sclerosis (PP-09)

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Introduction: In patients with multiple sclerosis (MS), demyelination occurs frequently in the brainstem and cerebellum. It is therefore not surprising that abnormal vestibular sensations are a frequent feature of the clinical course. True vertigo (the perception of self and/or environmental movement, typically rotational) is estimated to occur in about 20% of MS patients at some time during the illness. True vertigo is estimated to occur in about 20% of MS patients and can be the presenting manifestation of MS in up to 5%. Lesions within the vestibular nuclei and in the root entry zone of cranial nerve VIII represent the most common locations where demyelinating activity can provoke vertigo in patients with MS. However, other causes of vertigo should be explored in MS patients in order to avoid unnecessary treatment with corticosteroids and vestibular suppressants. The aim of this study is report on the most common causes of vertigo in patients with multiple sclerosis (MS) and

emphasizes appropriate diagnostic techniques and treatment interventions.

Method and materials: We performed a literature review with the following keywords: multiple sclerosis, benign paroxysmal positional vertigo, repositioning maneuvers. Four different databases (PubMed, Scopus, and Web of science and Google Scholar) were independently screened. Publications in English were considered and reviewed from 2021 to 2022.

Results: We a total of 20 articles. Results showed that benign paroxysmal positioning vertigo (BPPV) to be the most common cause. In this vertigo, episodes of vertigo lasting only seconds, and provoked by movement of the head. All patients diagnosed with BPPV were treated successfully with particle repositioning maneuvers without any need to suppressors of the vestibular system.

Conclusion: Empiric treatments with corticosteroids and/or vestibular suppressants should not be employed until all MS patients undergo a careful bedside examination which includes diagnostic positional and, if indicated, particle repositioning maneuvers.

Keywords: Multiple Sclerosis, Benign Paroxysmal Positional Vertigo, Repositioning Maneuvers, Dix-Hallpike Maneuver

Cardiovascular autonomic dysfunction in MS (PP-10)

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The autonomic nervous system maintains homeostasis of heart rate, blood pressure, respiration and bowel and bladder control as well as sexual and sudomotor function. Autonomic Dysfunction is common in multiple scelerosis patients and probably present years before diagnosis , even as early as ten years , making it the most prominent symptom in the prodromal phase of MS. Among these disorders are Cardiovascular autonomic dysfunction(CAD) that has been reported in up to 20 % of patients with multiple sclerosis and may occur years before typical symptoms and signs of MS. CAD may contribute to dizziness, falling or other orthostatic symptoms in patients and affect quality of life and reduce the life expectancy. Both inflammation and neurodegeneration are thought to contribute to the development of CAD. Some disease modifying drugs (DMDs) especially S1P receptor modulators and the most popular of them, fingolimod can cause disturbances in cardiovascular autonomic system. The most important indices of cardiovascular autonomic funtions are impedance cardiography parameters , heart rate and blood pressure variablitiy during head up tilt test . The most common abnormality related to CAD in MS is reduced heart rate variability. This is postulated that CAD is correlated with MS type(progressive more than relapsing types), disease duration (long-standing disease more than early MS) ,disease progression and disability level(both physical and cognitive), MS characteristic and fatigue severity. Neuromodulation with acupuncture could be an interesting tool to change heart rate variability in these population.

Keywords: Cardiovascular autonomic dysfunction, Multiple sclerosis,

Case presentation, Atypical imaging of MS (PP-11)

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A 36 year-old-lady, presented with numbness of left side of the face,followed by left side weakness, upper limb more than lower, leading to gait difficulty, associated with persistent pain in left knee joint,referred to neurologist, so work up was done including. Vasculitis and collagen vascular disease lab tests,which all were negative. Brain mri was done T2/Flair hyper signal spots were seen in different parts of both cerebral hemispheres,suggestive for nonspecific ischemic insult ,no diffusion restriction, can be suggestive for acute infarvtion. Neurologic exam.. Patient was alert,orient and cooperative,suffering from LT side weakness and LT side upward plantar reflex,no objective sensory loss in left side.Positive Hx of left eye blurred vision since 8 months ago,fundoscopy was normal.Work up for exclusion of stroke,including lab tests,CDS,and TTE ,were done,which were unremarkable.Again cervical&brain mri with &without GD was requested.Brain mri revealed an indistinct &inhomogenous region of signal changes in RT hemisphere,cervical mri showed one hypersignal (plaque) at c4-c5 level. Brain MRS was performed which was infavor of atypical form of MS &less possibility a neoplasm, LP was recommended, at first she refused,CSF analysis for OCB and IGg index was done, OCB with 3 bands was positive,patient,s weakness responded to 5 gr/iv methyl prednisolone in 5 consecutive days. OCT was borderline in both eyes.

Keywords: MS, Atypical imaging, dirthy white matter

Comparing the Impact of Bariatric Surgery and Diet Therapy on MS Disease-Related Symptoms: A Systematic Review Study (PP-12)

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Multiple sclerosis is a chronic demyelinating disease of the central nervous system that can be exacerbated by obesity-induced systemic inflammation. Previous studies have shown that weight loss can improve symptoms of MS. Bariatric surgery and non-surgical methods, like diet therapy, are two common approaches to weight loss. In this systematic review, we have reviewed the effectiveness and safety of surgical and non-surgical methods for weight loss in MS patients. This systematic review was conducted based on PRISMA guidelines. PubMed, Embase, Cochrane, Scopus, Web of Science, Science Direct databases were used. Four articles on bariatric surgery and nine articles on diet therapy were included. Both bariatric surgery and diet therapy are safe and effective methods for weight loss in MS patients as in normal population, and both of them can improve quality of life without exacerbating disease progression. No major complications were reported. However, no studies directly compared these two methods and also there is uncertainty regarding long-term effects. Therefore more studies are needed to compare bariatric surgery with other weight loss methods and also to investigate the effect of these methods on more MS-related outcomes to determine the safest and most effective weight loss method in these patients.

Keywords: Bariatric Surgery, Multiple sclerosis

Demyelinating Disease following Anti-TNFa Treatment (Adalimumab)In patients with psoriasis: A case report (PP-13)

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Tumor necrosis factor antagonists (anti-TNFa) are an established therapeutic option for several autoimmune and inflammatory bowel diseases. Despite their clinical effectiveness, neurological adverse events have been reported and literature data suggest a potential role of anti-TNFa in the induction of demyelination of the CNS.

Adalimumab is used to reduce pain and swelling due to certain types of arthritis (such as rheumatoid, psoriatic, juvenile idiopathic, ankylosing spondylitis). Adalimumab is also used to treat certain skin disorders (such as plaque-type psoriasis, hidradenitis suppurativa). It works by blocking a protein (tumor necrosis factor or TNF) found in the body's immune system that causes joint swelling and damage in arthritis as well as red scaly patches in psoriasis.

The patient is a 39-year-old man with psoriasis and gout who is being treated with Adalimumab. He has been suffering from headache, dizziness, weakness, nausea, vomiting, and significant weight loss for about 6 months.About 90 days before the patient's visit, the above-mentioned symptoms worsened, and he also had other symptoms, including blurred vision, diplopia, dizziness, worsening weakness and imbalance. After hospitalization, necessary diagnostic and therapeutic measures were taken for the patient. In the Brain and Cervical MRI, demyelinating lesions were seen. In the cerebrospinal fluid, the levels of oligoclonal bands and The IgG index was reported to be negative. Adalimumab was stopped and he was treated with steroid pulse and plasma exchange, and then oral steroids, and after the mentioned treatment measures, the patient's symptoms improved to a great extent. According to the consultation with the dermatologist, MTX was started to treat psoriasis.

This case is one of the rare and significant side effect of tumor necrosis factor antagonists.

Keywords: Demyelinating Disease, Psoriasis, Anti-TNF-α

Demyelinating etiology as a possible cause of Parry–Romberg Syndrome (PP-14)

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Parry–Romberg syndrome (PRS) is a rare disease that causes hemiatrophy of the face. The pathophysiological mechanisms involved in its etiology are unknown, but several previous reports suggest the involvement of autoimmune factors. In the case-reoprt that we introduce, we raise the question that can multiple sclerosis (MS) be a possible cause of PRS? Can Radiologically isolated syndrome(RIS) cause PRS?

Keywords: Parry–Romberg Syndrome, hemifacial atrophy, Multiple sclerosis, Radiologically isolated syndrome

Diagnosis of multiple sclerosis and Fahr's Disease in a young woman: A case report (PP-15)

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Fahr's disease is a progressive and idiopathic basal ganglia calcification with normal metabolism of calcium and phosphore with motor and psychiatric sings and symptoms. Dementia, chorea athetosis, psychosis and depression due to Fahr's disease are frequently reported.

Multiple sclerosis is a chronic disease that mostly affects young adults and is pathologically characterized by inflammation and loss of myelin and sclerosis in many areas of the white matter of the central nervous system.

The patient is a 20-year-old woman with a history of hearing loss since childhood, who has experienced significant weight loss, weakness, increased libido and overspending, occasional hallucinations and delusions, psychomotor slowness, delayed eye and verbal contact, slow affect, and depressed mood and sleep disorder since about a year ago. She suffered from dizziness, imbalance, blurred vision, diplopia, and right hemiparesis since 21 days before the visit, and she was hospitalized for diagnostic and therapeutic procedures. Diagnostic procedures for the patient include brain CT scan, brain and cervical MRI, the necessary tests and LP were performed. Evidence of bilateral calcification of the basal ganglia was observed in the brain CT scan and multiple demyelinating plaques were observed in the brain and cervical MRI. IgG Index and Oligoclonal Band were confirmed in the cerebrospinal fluid. Finally, according to History and records, examination of mental status and paraclinical evaluations in this patient, the diagnosis of Fahr's Disease was made and based on McDonald's criteria, the diagnosis of multiple sclerosis was given. The patient was treated with plasma exchange and pulse corticosteroids and natalizumab was started as maintenance therapy. This is the first case of simultaneous diagnosis of Fahr's disease and multiple sclerosis.

Conclusion: we reported a co-occurrence of idiopathic basal ganglia calcification with multiple sclerosis. The association between this disease and MS is unclear and also maybe probably coincidental. Research is recommended about concurrence of MS with brain calcification.

Keywords: Fahr's Disease, multiple sclerosis, Basal ganglia calcification, Demyelinated plaques

Early Clinical Response and Complications of Therapeutic Plasma Exchange in Central Nervous System Demyelinating Diseases (PP-16)

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Background: Appropriate treatment reduces the severity and duration of relapses in demyelinating diseases of Central Nervous System (CNS). If high-dose corticosteroids treatment fails, therapeutic plasma exchange (TPE) is considered as a rescue treatment. This study aimed to investigate early clinical response and complications of TPE and prognostic factors in CNS demyelinating relapses.

Methods: This prospective observational study was designed in a tertiary center during one year. All adult patients diagnosed corticosteroid-resistant Multiple Sclerosis (MS), NeuroMyelitis Optica Spectrum Disorder (NMOSD), idiotypic Transverse Myelitis or Clinical Isolated Syndrome relapses, were eligible. Clinical response is defined based on

Expanded Disability Status Scale (EDSS) at discharge. Clinical and laboratory complications recorded.

Results: seventy-two patients were analyzed which 58.3% patients were female. MS was diagnosed for 61.1% of cases. Thirty-five patients (48.6%) responded and the mean differences of EDSS significantly decreased 0.60 score (CI95%:0.44-0.77). Electrolyte imbalances and thrombocytopenia occurred in 80.6% and 55.6% of cases respectively and 40.3% of patients had systemic reactions. However, 26.4% patients experienced moderate to severe complications. In patients with moderate to severe disability, responders were younger (MD:8.42years, CI95%:1.67-15.17) and had lower EDSS score at admission (median:6, IQR:5.5-6 against 7.5 IQR:6.5-8). Relapsing-Remitting MS (RRMS) patients had more odds of response compared to active progressive MS patients (OR:6.06, CI95%:1.37-26.76). Patients with thrombocytopenia were hospitalized more than others (MD:1.5 days, CI95%:0-3). Females were more prone to hypokalemia and systemic reactions (OR:3.11, CI95%:1.17-8.24 and OR:6.67, CI95%:2.14-20.81 respectively).

Conclusion: The most common indication of TPE was corticosteroid-resistant severe MS relapses. About half of the patients presented an early clinical response. Lower disability, younger age and RRMS diagnosis are prognostic factors of better response. One out of four patients experienced moderate to severe complications, mainly electrolyte imbalances and systemic reactions. Appropriate interventions against these complications should be considered during TPE, especially in females.

Keywords: Plasma Exchange, Multiple sclerosis

The Effect of Multiple Sclerosis on Peripheral Audio-Vestibular System (PP-17)

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Introduction: Multiple sclerosis (MS) is a chronic, immune mediated, inflammatory disease that causes a neurodegenerative process in the central nervous system (CNS). The autoimmune process of MS results in CNS plaques (focal areas of demyelination) in addition to axonal injury or loss. These plaques most commonly occur in the white matter of the brain, cerebral cortex including subpial regions, spinal cord and optic nerve, resulting in optic neuritis, double vision, tremor, ataxic gait, weakness and numbness in one or more limbs. It has been suggested that demyelination plaques can also occur in the central auditory and vestibular pathways resulting in hearing loss and balance disorders. Also, the vestibular nuclei and the root entry zone of the eighth cranial nerve have been shown to be one of the most common neuroanatomic locations for inflammatory demyelination, but it is unknown the effects of MS on the peripheral audio-vestibular pathways. So the aim of this article is a review on the effects of MS on peripheral audio-vestibular system.

Method and materials: We performed a literature review with the following keywords: multiple sclerosis, auditory function, vestibular function, hearing loss, dizziness and vertigo. Four different databases (PubMed, Scopus, and Web of science and Google Scholar) were independently screened. Publications in English were reviewed from 2000 to 2022.

Results: We reviewed a total of 20 articles. Results showed that peripheral neural connections in the internal auditory canal and within the inner ear structures may be affected by demyelination resulting in peripheral auditory and vestibular involvement in persons with MS.

Conclusion: both the peripheral and central vestibular systems may be involved in the degenerative process of MS, but the brainstem and central auditory and vestibular systems were more likely to be affected by MS than the peripheral auditory and vestibular system.

Keywords: Multiple Sclerosis, Auditory Function, Vestibular Function, Hearing Loss, Dizziness, Vertigo

Long-term and Short-term Episodic Memory Dysfunction in Female MS Patients (PP-18)

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Multiple Sclerosis (MS), a myelin- targeting autoimmune disease of CNS, targets cognitive abilities in patients. The degree of this dysfunction would be different from one patient to another regarding their disease duration, age, EDSS, and lesion location in brain networks. The cognitive impairment will impact patients' life adversely. Therefore, the present cross-sectional study aimed to evaluate the verbal episodic memory performance in Iranian Relapsing- Remitting Multiple Sclerosis (RRMS) patients and their healthy counterparts. Due to the susceptibility of women to MS, 35 female patients and 35 age, gender, and education-matched healthy controls were selected based on convenient sampling. The MS patients with Expanded Disability Status Scale (EDSS) scores ≤ 6 were recruited. The Montreal Cognitive Assessment (MoCA) and the California Verbal Learning Test (CVLT-II)

were used for screening participants' cognitive and verbal episodic memory function respectively. MoCA test (Persian version) was used to screen the participants for their cognitive function due to the higher sensitivity of the MoCA to the Mini-Mental State Exam (MMSE) for measuring cognitive function in individuals with MS. CVLT-II assess attention, learning strategies, recall accuracy and consistency, proactive and retroactive interference, recall errors, and recognition. The results revealed that MS patients were significantly impaired in the short and long-term recall as well as recognition list compared to their healthy counterparts. The findings showed that Multiple sclerosis has an adverse impact on verbal episodic memory performance.

Keywords: episodic memory, short delay, long delay, Multiple Sclerosis, female

Headache first manifestation of Multiple Sclerosis (PP-19)

Fatemeh Abrishamchi

The importance of headaches in multiple sclerosis is largely neglected as focal neurological symptoms such as optic neuritis, paresthesia or weakness of organs has become the main focus of conce rn. Studies indicate a prevalence of 43% for migraine in patients with MS, which is higher than general population. Therefore, this study emphasizes on the importance of headache in MS patients and its precise workup, as well as timely management of headaches in MS.

In the current study, we examined a 49-year-old patient with sudden throbbing headache that worsened with movement, photophobia and phonophobia, concomitant with non-pulsating tinnitus and true vertigo. In the physical examinations, we found a preceding decrease in the force of the right upper limb and the left lower limb since a long time before. CT scan and MRI of the brain was performed. CT scan showed evidence of periventricular and centrum semiovale lucency, and MRI findings along with clinical observations were consistent with RRMS. Periventricular and pericerebellar plaques with Gad Enhancement were evident. During the admission for headache, the patient was hypertensive and received amlodipine, metoral and valsartan. His headache was treated with acetaminophen and vitamin B. The headache was successfully controlled, and the blood pressure decreased. Furthermore, due to a recent evidence of tinnitus and true vertigo, pulse corticosteroid therapy and dimethyl fumarate were administered for MS attack.

Keywords: multiple sclerosis, MS, RRMS, Relapsing remitting multiple sclerosis, migrain headache, True vertigo, Tinitus, HTN

Investigating the relationship between stress, anxiety and depression with the quality (PP-20)

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Introduction: Multiple sclerosis (MS) is an autoimmune disease which can affect all aspects of a person's life. Therefore, the present study aims to investigate the relationship between stress, anxiety and depression with the quality of life of patients with MS.

Methods: This cross-sectional descriptive study was conducted in 2018-2019 on 245 patients with MS in Shahrekord city. Non-random sampling method was used and data collection tool was Depression, Anxiety and Stress Questionnaire (DASS-21) and Quality of Life Questionnaire in MS Patients (MISIS-29). The data were analyzed through SPSS 20 software.

Results: In the present study, only 26/6% of the patients experienced high quality of life, and 30/5% of patients had severe to moderate anxiety, 13/8% moderate stress, and 34/2% experienced moderate and severe depression. There was a significant relationship between the stress and anxiety of the patients and their jobs ($p<0/05$) and also there was a significant difference between the quality of life and the patients' education ($p<0/05$). A significant relationship was observed between the level of stress, depression, and anxiety of the patients with the quality of life and with the physical and mental subscales ($p<0/001$).

Conclusion: The results indicated the prevalence of mental disorders in patients with MS, which has affected the quality of life of patients. Therefore, providing suitable interventions to deal with or adapt to these symptoms and ultimately improve the quality of life in MS patients seems necessary. This article is the result of the general practice thesis of Razia Hashemi from Shahrekord University of Medical Sciences.

Keywords: Multiple Sclerosis, Anxiety, Stress, Depression, Quality of Life

Is There a Need to Differentiate Atypical Multiple Sclerosis from Neuromyelitis

Optica Spectrum Disorders (NMOSD)? The Pros and Cons: A Systematic Review (PP-21)

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Introduction: Most atypical inflammatory demyelinating diseases (IDD) exhibit pathological characteristics comparable to multiple sclerosis (MS). We conducted this systematic review to investigate the atypical cases that appear to be intermediate between MS and Neuromyelitis Optica Spectrum Disorders (NMOSD) with a final diagnosis of MS.

Methods: We systematically searched Scopus (n=143), PubMed (n=111) Embase (n=286), and Web of Science (n=140) on February 21, 2022, without time limitations. We included all cohorts, cross-sectional studies, case reports, and case series to review the characteristics and management of patients with atypical MS overlapping NMOSD features. Studies focusing on MS variants such as Marburg, Baló concentric sclerosis, Schilder type MS, or tumefactive demyelinating lesions associated with disease-modifying treatments (DMTs) in a known case of MS, studies on other diagnoses except for MS, studies related to overlapping syndromes in the era before Aquaporin-4 (AQP4) antibody discovery, the reviews, recommendations, guidelines, consensus, and presentations, and studies with insufficient data or unavailable full text were excluded.

Results: Out of 680 records, ten studies met the inclusion criteria. Among the 258 patients with a final diagnosis of atypical MS, most patients (67.17%) were female, with a mean age of 38.44 years. The most clinical manifestations were optic neuritis and transverse myelitis, which were more severe than conventional MS, with a mean Expanded Disability Status Scale (EDSS) score of 4.16. Most patients had a relapsing-remitting evolution. However, 23.7% had a primary progressive course, mainly seen in patients with cavitary or leukodystrophy-like involvement in magnetic resonance imaging (MRI). Brain MRI was in favor of typical MS lesions, at least in association with atypical lesions in most studies. However, spinal MRI revealed longitudinally extensive transverse myelitis in 57.5% of patients. Serum anti-AQP4 antibody was negative in all patients. While treatment data were lacking in most studies, a partial clinical recovery was obtained after pulse methylprednisolone with or without plasma exchange. A broad spectrum of disease-modifying treatments (DMT) for attack prevention was used, from first-line immunomodulatory agents to immunosuppressive DMTs.

Conclusion: The analysis suggests that the cases of atypical MS have features comparable to either NMOSD or conventional MS. Further studies are needed to determine the best practice for managing atypical MS.

Keywords: Multiple sclerosis, Neuromyelitis Optica spectrum disorders, Overlap syndrome

Lingual dystonia as the first manifestation of multiple sclerosis (PP-22)

Farid Shamlou

Multiple sclerosis, as a chronic nerodegenrative disease, reveals various complications for patients. The presentation of the disease with a neurological dysfunction called clinically isolated syndrome(CIS) is commonly Vision problems and weakness in the body or extremities. Dystonia as a movement disorder is a rare presentation in MS. Here we report a case presenting lingual dystonia as the first manifestation of multiple sclerosis.

Keywords: Lingual dystonia, Multiple sclerosis

MS and exercise (PP-23)

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Multiple sclerosis (MS) can result in significant mental and physical symptoms, specially muscle weakness, abnormal walking mechanics, balance problems, spasticity, fatigue, cognitive impairment and depression. Patients with MS frequently decrease physical activity due to the fear from worsening the symptoms and this can result in reconditioning. Physicians now believe that regular exercise training is a potential solution for limiting the reconditioning process and achieving an optimal level of patient activities, functions and many physical and mental symptoms without any concern

about triggering the onset or exacerbation of disease symptoms or relapse. Appropriate exercise can cause noteworthy and important improvements in different areas of cardio respiratory fitness (Aerobic fitness), muscle strength, flexibility, balance, fatigue, cognition, quality of life and respiratory function in MS patients. Aerobic exercise training with low to moderate intensity can result in the improvement of aerobic fitness and reduction of fatigue in MS patients affected by mild or moderate disability. MS patients can positively adapt to resistance training which may result in improved fatigue and ambulation. Flexibility exercises such as stretching the muscles may diminish spasticity and prevent future painful contractions. Balance exercises have beneficial effects on fall rates and better balance. Some general guidelines exist for exercise recommendation in the MS population. The individualized exercise program should be designed to address a patient's chief complaint, improve strength, endurance, balance, coordination, fatigue and so on. An exercise staircase model has been proposed for exercise prescription and progression for a broad spectrum of MS patients. Exercise should be considered as a safe and effective means of rehabilitation in MS patients. Existing evidence shows that a supervised and individualized exercise program may improve fitness, functional capacity and quality of life as well as modifiable impairments in MS patients.

Keywords: exercise, Multiple sclerosis

Multidisciplinary rehabilitative management (PP-24)

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As a chronic disabling disease Multiple Sclerosis is a dilemma, hence multidisciplinary approach is of a paramount significance. How the perspective of patients with MS would be when they receive multidisciplinary pharmacological, psychological and rehabilitative management? And what kind of rehabilitative consideration is mandatory for each individual? Every practitioner should be aware of various available forms of rehabilitation therapy for patients, addressing balance, gait, urinary problems, and also memory deficits besides occupational and social ones. The therapeutic methods have a spectrum from exercise therapy, physical, cognitive, pharmacological therapies to instrumental ones such as excitation therapy, robot-assisted and tele-rehabilitation methods.

Keywords: rehabilitation therapy, Multiple sclerosis

Multiple sclerosis relapse after COVID-19 vaccination: A case report-based systematic review (PP-25)

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Background: Concerns about vaccination increased among patients with multiple sclerosis (MS) regarding side effects, efficacy, and disease exacerbation. Recently there were reports of MS relapses after the COVID-19 vaccination, which emerged the safety concerns. Therefore, we aimed to perform a systematic review of case reports and case series studies to investigate the MS relapses after COVID-19 vaccination with most details.

Methods: We systematically searched three databases, including PubMed, Scopus, and Web of Science, in February 2022. Case reports and case series which reported relapse after COVID-19 vaccination in MS patients were eligible to include in our study.

Results: Seven studies were included in our systematic review after the abstract and full-text screening with a total of 29 cases. The mean duration between COVID-19 vaccination and relapse appearance was 9.48 ± 7.29 days. Among patients, 22 cases experienced relapse after their first dosage of the COVID-19 vaccine, one after the second dose, and five after the booster dose. The type of vaccine was unknown for one patient. The most common symptoms of relapses were sensory deficits (paresthesia, numbness, dysesthesia, and hypoesthesia) and weakness.

Conclusion: Overall, the COVID-19 vaccination may trigger relapses in some MS patients, but as the infection itself can stimulate relapse, the benefit of vaccination outweighs its risk in this population, and mass vaccination against COVID-19,

especially in MS patients, should be continued and encouraged.

Keywords: Multiple sclerosis, COVID-19 vaccination, Relapse, Exacerbation

Neurosarcoidosis in an adult man with a family history of MS: A Case report (PP-26)

Elham Sadat Azimi

A non-caseating granuloma is the histological hallmark of sarcoidosis, a multisystem disease. Neurosarcoidosis is a complex and rare form of sarcoidosis that affects the CNS . It involves the spinal cord with intradural lesions. Herein, we present a case of neurosarcoidosis with a family history of MS . He first underwent surgery for swelling of the right wrist joint and then was diagnosed with multiple sclerosis due to the onset of paraparesis and Magnetic resonance imaging (MRI) results. After an open biopsy, the diagnosis of neurosarcoidosis was established and was followed up by appropriate medical management. In conclusion, to distinguish MS from neurosarcoidosis, CSF analysis may not be particularly useful since it may reveal similar abnormalities. All manifestations are not identical between MS and neurosarcoidosis; nonetheless, persistent meninges enhancements or parenchymal enhancements in tissue are not expected in MS and likely indicate a granulomatous process. The administration of appropriate treatment at an early stage of the disease can assist in decelerating its progression.

Keywords: Neurosarcoidosis, Multiple sclerosis

Patterns of Attention Deficit in Relapsing and Progressive Phenotypes of Multiple Sclerosis (PP-27)

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Behavioral aspects and underlying pathology of attention deficit in multiple sclerosis (MS) remain unknown. This study aimed to clarify impairment of attention and its relationship with MS-related fatigue.

Thirty-four relapse-remitting MS (RRMS), 35 secondary-progressive MS (SPMS) and 45 healthy controls (HC) were included. Results of psychophysics tasks (attention network test (ANT) and Posner spatial cueing test) and fatigue assessments (visual analogue scale and modified fatigue impact scale (MFIS)) were compared between groups.

In ANT, attentional network effects were not different between MS phenotypes and HC. In Posner task, RRMS or SPMS patients did not benefit from valid cues unlike HC. RRMS and SPMS patients had less gain in exogenous trials with 62.5ms cue-target interval time (CTIT) and endogenous trials with 250ms CTIT, respectively. Total MFIS was the predictor of gain in 250ms endogenous blocks and cognitive MFIS predicted orienting attentional effect. Executive attentional effect in RRMS patients with shorter disease duration and orienting attentional effect in longer diagnosed SPMS were correlated with MFIS scores.

The pattern of attention deficit in MS differs between phenotypes. Exogenous attention is impaired in RRMS patients while SPMS patients have deficit in endogenous attention. Fatigue trait predicts impairment of endogenous and orienting attention in MS.

Keywords: Multiple Sclerosis, Attention, Fatigue, Phenotype, Psychophysics, Cognition

Personality traits of patients with multiple sclerosis and their correlation with anxiety and depression levels: A cross-sectional case–control study (PP-28)

Amir Ali Gharemani

Introduction: Multiple sclerosis is a chronic demyelinating disease of the central nervous system that can cause severe disability and impair the quality of life (QoL).

Methods: In the current cross-sectional, case–control study, we investigated personality traits, anxiety and depression levels, in 101 patients in the case group and 202 individuals as a control group. The personality traits of the participants were collected via the Neuroticism-Extraversion-Openness Five-Factor Inventory (NEO-FFI) questionnaire. We evaluated the level of anxiety and depression based on the Hospital Anxiety and Depression Scale questionnaire.

Results: Our study showed in patients with disease duration above 1 year, the rates of agreement (29.78), anxiety (8.83), and depression level (6.39) were significantly higher than the control group (27.19, 6.47, and 4.97, respectively). Although patients with disease duration below 1 year showed a higher level of agreement and conscientiousness (29.65 and 34.35, respectively) than controls (26.6 and 30.86, respectively). The level of anxiety and depression in patients with a disability index above 4.5 was significantly higher than patients with a disability index below 1. Patients with a disability index below 1 showed a higher rate of extraversion and agreement and conscientiousness (31.47, 31.53, and 35.07, respectively) than controls (25.5, 26.23, and 3033, respectively). In addition, patients with a disability index above 4.5 showed a higher level of agreement (35.64), conscientiousness (35.5), anxiety (9.64), and depression (7.5) than controls (25.96, 30.71, 6.96, and 4.71, respectively).

Conclusions: In conclusion, anxiety and depression levels were much higher among MS patients compared with controls and the severity of these conditions correlate with the score of the disability index. Therefore, a complete comprehension of these conditions by the neurologist could be vital in improving patients' QoL and increasing compliance and adherence to pharmacological therapy.

Keywords: anxiety, Multiple sclerosis, depression

Comparison of COVID-19 infection, Acute Relapse, and Adverse Effects Following COVID-19 Vaccination Between Patients with Multiple Sclerosis and Other Neurological Disorders (PP-29)

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Background: Patients with neurological disorders have been vaccinated in response to the global COVID-19 pandemic. This study aimed to determine the factors contributing to COVID-19 infection and acute relapse and compare adverse effects following COVID-19 vaccination among patients with multiple sclerosis (pwMS) and other neurological disorders (OND).

Method: This prospective observational study was conducted between September 2021 and September 2022 in Isfahan, Iran, to collect demographic and clinical data on pwMS and OND patients, COVID-19 infection, vaccination, and adverse effects. Headache, migraine, low back pain, epilepsy, myasthenia gravis, Parkinson's disease, stroke, Alzheimer's disease, motor neuropathy, myopathy, major depressive disorder, obsessive-compulsive disorder, and brain tumor were considered OND. Logistic and Poisson regression were used to investigate the relationship between clinical indicators and COVID-19 infection and acute disease relapse after COVID-19 vaccination.

Results: This study included 1306 participants, 818 of whom had MS and 488 had OND. Among pwMS, age (OR=1.030, 95%CI: 1.007–1.054, p=0.012), exacerbated neurological symptoms after COVID-19 infection (OR=1.920, 95%CI: 1.028–3.586, p=0.029) were associated with the higher risk of COVID-19 infection after vaccination, and the presence of adverse effects following the second dose of the vaccine compared to no adverse effects after second dose (OR=0.576, 95%CI: 0.374–0.887, p=0.012) was correlated with the lower risk. While OND patients with inactivated vaccine compared to vector-based vaccine (RR=0.424, 95%CI: 0.188–0.958, p=0.009) were at a lower risk of COVID-19 infection after vaccination. The risk of acute disease relapse following COVID-19 vaccination in pwMS and OND patients was not significantly influenced by demographic and clinical characteristics.

Conclusion: The risk of COVID-19 infection after COVID-19 vaccination in pwMS was associated with some demographic characteristics and COVID-19-related data, while OND patients did not exhibit these relationships. Consequently, these factors should be considered after COVID-19 vaccination in pwMS.

Keywords: Multiple sclerosis, COVID-19, SARS-CoV-2, Vaccine, Other neurological disease, Adverse effect

Pharmacogenomics of Multiple Sclerosis: Sieving treatment biomarkers from blood gene-expression profiles (PP-30)

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Introduction: Over the past two decades, various novel disease-modifying drugs for multiple sclerosis (MS) have been approved. However, there is high variability in the patient response to the available medications, which is hypothesized to be partly attributed to genetics. our aim was To conduct a systematic review of the current literature on the pharmacogenomics of MS therapy to find candidate genes to respond to treatment.

Methods: A systematic literature search was conducted using the GEO database and PubMed searching for articles investigating the role of genetic variation in response to disease-modifying MS treatments include: interferon beta, and glatiramer acetate .

Results: In recent years, hypothesis-free approaches identified novel candidate genes that remain to be validated. We identified many candidate genes that were effective in responding to treatment for MS patients such as : CCR5, STAT1, IFIT3, OASL, HLA-DRB1, IL10, & etc.

Discussion: At the moment, there is no available clinically actionable pharmacogenomic biomarker that would enable more personalized treatment of MS. So, finding the biomarkers that can predict the probability of responsiveness in patients at the early stages of disease diagnosis is very important and it can minimize the chance of injury from the disease. Of course more large-scale studies with a uniform design are needed to identify novel and validate existing pharmacogenomics findings.

Keywords: Pharmacogenomics, Multiple sclerosis

Physical Regular Exercise for Human Health and Multiple Sclerosis (PP-31)

Abdolali Banki

Multiple sclerosis (MS) is an immune- mediated disease of the central nervous system (CNS) with an estimated prevalence approaching 85000 adults in Iran. The disease pathogenesis and resulting damage express as dysfunction (e.g., walking and cognitive impairment) and symptoms (e.g., fatigue and depression) that comprise quality of life (QOL) and full participation. There has been a steady increasing body of research on the outcomes of exercise among persons with MS, and this has accelerated sharply over the past decade. The review provides a full assess of exercise and its outcomes, safety, and prescription in MS. This review initially shows the evidence for benefits of exercise based on principally on meta-analyses and literature reviews and then reviews evidence on the safety of exercise in MS. Collectively this review serves as an overview and reference for researchers and

Keywords: Diet, Multiple sclerosis, Clinical trial, Intervention

A narrative review on the dietary interventions in multiple sclerosis (PP-32)

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Currently, multiple sclerosis (MS) lacks a definitive treatment, emphasizing the need for research that prioritizes the investigation of modifiable environmental risk factors such as diet associated with MS development or the manifestation of its symptoms. Therefore, we designed a narrative review to investigate the role of dietary interventions on multiple sclerosis symptoms.

Swank is one of the oldest dietary interventions in MS. In 1948, swank started utilizing low fat diet, supplemented by cod liver oil. After 34 years follow-up, the survival rate was higher in swank diet group and patients were still ambulatory and otherwise healthy.

Modified Paleo diet (Wahl's protocol), recommends green leafy and sulfur-rich vegetables, as well as intensely colored fruits and vegetables, encourage to eat omega-3 sources, animal and plant protein, nutritional yeast, plant based milk, and kelp and spirulina, and excludes gluten, dairy and eggs. A 12-month multimodal intervention of it resulted in improvement in anxiety, depression, cognitive function and executive function (self-reported).

Sand et al in 2019 investigated the effects of modified Mediterranean dietary program in MS patients in a 6 months intervention. They reported the significantly improvement in fatigue score.

Ketogenic diet is a high fat and low carbohydrate diet. Benton et al, in 2019 investigated the effects of 6-month intervention of modified Atkins diet as a type of ketogenic diet (KDMAD) in MS patients. No subject experienced worsening disease on diet. Body mass index and total fat mass decreased. Fatigue and depression improved and leptin declined after 3 month.

Data on the effects of dietary interventions in MS is limited and the available studies are not methodologically strong. Based on the beneficial effects of some investigated diet and modifiable characteristics of diet, it seems to there is a need for more investigation with better methodology to prove the effects of each dietary patterns.

Keywords: Exercise, Multiple sclerosis

Radiological insights in predicting Secondary Progressive Multiple Sclerosis (PP-33)

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Over 50% of people with relapsing-remitting multiple sclerosis (MS) develop secondary progressive multiple sclerosis (SPMS), which is characterized by irreversible neurological impairments. The timing of this shift is a bit unclear, and SPMS was only universally defined recently. SPMS is defined as neurological deterioration that is confirmed within three months without relapses on the Expanded Disability Status Scale (EDSS). Despite new criteria, assessing disease activity in SPMS patients remains difficult. The EDSS is primarily used to assess neurological decline, with a focus on lower extremity function and potentially missing upper extremity, urinary, or cognitive deterioration. MRI, on the other hand, provides an objective assessment of disease activity. Radiological disease activity is present in approximately one-third of SPMS patients, indicating active SPMS. Because different medications are approved for different types of diseases, finding out which patients have active SPMS is critical for treatment decisions. Immunomodulatory therapies are available, and identifying active SPMS is crucial. New MRI biomarkers include atrophied lesion volume (atrophied LV), slowly expanding lesions (SELs), leptomeningeal contrast enhancement (LMCE), and spinal cord damage. Atrophied LV, representing T2 lesion volume in cerebrospinal fluid, predicts disability progression. SELs, indicative of chronic inflammation, are associated with clinical disability and aggressive disease. LMCE, reflecting leptomeningeal inflammation, is linked to gray matter injury and may be useful in monitoring SPMS. Spinal cord atrophy, although challenging to adopt in clinical trials, could serve as a promising outcome measure. This is especially true with improvements in automated segmentation algorithms and longitudinal assessment techniques. Overall, these biomarkers may offer insights into MS pathology and aid in predicting disease progression. Notably, anti-inflammatory therapies may be more effective during the transition from relapsing-remitting MS to SPMS than in the later stages of SPMS. This transition is delayed, resulting in disability accumulation. To address this, studies propose replacing the current classification with "active progressive" MS, emphasizing the role of MRI in monitoring SPMS patients, and recommending annual imaging assessments to guide therapy choices.

Keywords: Multiple sclerosis; Secondary progressive multiple sclerosis; MRI; Immunomodulatory treatments

Relationship between circadian rhythm and timing of interferon injections, incidence and severity of flu-like syndrome in Multiple Sclerosis (MS) (PP-34)

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Introduction: Noted the necessity of on time treatment and diagnosis of Multiple Sclerosis (MS) and it's role in preventing the disabilities, compliance to the process of treatment is a vital point. Some of the aspects that create major disorders in patients' compliance are complications like flu-like syndrome. On the other hand, according to circadian rhythm's role in physiologic processes and it's effect on MS patients treatment, it's not possible to waiver from circadian rhythm's changes importance. We investigated on circadian rhythm's relation to the interferon injection time and prevalence and severity of flu-like syndrome in MS patients using MEQ survey.

Methods: During this study MS patients who visited in neurology clinic of Zanjan Vali-e-Asr hospital were surveyed using two public questionnaires (age, gender, duration of infection, MS subtype, education, marital status, address, usage of pain killers, usage of fruit or juice) and morning-evening (MEQ) questionnaire. All data were statistically analyzed, using SPSS ver.26.

Results: Among 118 patients, 114(96.6%) had experienced post interferon injection flu-like syndrome. The most frequent interferon was Cinnovex with 80(67.8%) cases. The RRMS was the most common subtype with 90(73.8%) cases. Injection of interferon was in the evening in 100(84.7%) patients and in the morning for the rest. Only 5 patients (4.2%) were using fruits or juice beforehand the injection. 51(43.3%) patients consumed pain-killers or refrigerants. Regarding the circadian rhythm, according to the MEQ questionnaire, the morning form had the more frequency with 40(33.9%) patients comparing to the other forms.

Conclusion: Despite 96.6% prevalence of flu-like syndrome after interferon injection, there was no meaningful relation between the rate and severity of this syndrome and circadian rhythm. It is recommended that changes in circadian rhythm in MS should be investigated by more complementary laboratory measurements.

Keywords: circadian rhythm, Multiple sclerosis, interferon

Relationship between severity of symptoms of sleep disorders and information processing speed in people with multiple sclerosis (PP-35)

Aryan Kavosh

Objectives: It is estimated that up to 65% of pwMS (people with multiple sclerosis) experience varying degrees of cognitive impairment, the most commonly affected domain being information processing speed (IPS). As sleep disturbance is a predictor of detriments in IPS, we aimed to study the association between severity of restless leg syndrome (RLS) and obstructive sleep apnea (OSA) symptoms with IPS in pwMS using a language and education independent tool.

Methods: In a cross-sectional study, we enrolled pwMS referred to multiple sclerosis comprehensive center of Kashani hospital in Isfahan, Iran. We used Berlin and STOP-Bang questionnaires for assessing OSA symptom severity. The International Restless Legs Syndrome Study Group scale was utilized for determining presence and severity of symptoms of restless leg syndrome. We used Integrated Cognitive Assessment (ICA) test assess visual processing speed.

Results: We included 199 pwMS, with a mean age of 36.88±8.76 (82.9% female). There were no significant association between ICA index and OSA symptom severity using STOP-Bang scale (ICA index of 0.61±0.14 and 0.60±0.08 in low and high-risk pwMS respectively; p=0.897) and Berlin scale (ICA index of 0.61±0.14 and 0.59±0.15 in low and high-risk pwMS, respectively; p=0.384). Similarly, no association between RLS symptoms severity and ICA index was observed (ICA index of 0.64±0.14 and 0.60±0.14 in normal and impaired groups, respectively; p=0.085).

Conclusion: We did not find any significant associations between severity of symptoms of sleep disorders studied and IPS. There is need for multi-center longitudinal studies to make this controversial area clearer.

Keywords: sleep disorders, Multiple sclerosis

Salivary Cortisol Levels in Multiple Sclerosis and Its contribution to Depression, Anxiety, and Quality of Life: A Case-control Study (PP-36)

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Background: Dysfunctions of the hypothalamus-pituitary-adrenal (HPA) axis can serve as a trigger for the manifestation of symptoms associated with multiple sclerosis (MS). The HPA dysregulation would result in mood disorders comorbid with MS in most patients with MS (pwMS). The purpose of this study was to investigate the levels of salivary cortisol and their relationship with psychological measures among pwMS.

Methods: This case-control study included 43 men PwMS and 16 healthy control (HC) men. PwMS and HC completed Beck Depression Inventory (BDI), 36-Item Short Form Survey (SF-36), Fatigue Severity Scale (FSS), Depression Anxiety and Stress Scale, and Hospital Anxiety and Depression Scale questionnaires. Salivary cortisol levels were also measured in PwMS and HC. The association between expanded disability status scale (EDSS), psychological indices, and cortisol levels were analyzed using a linear regression model.

Results: PwMS had significantly higher salivary cortisol levels, anxiety, depression, fatigue, and stress than HC ($p < 0.05$). There was no correlation between cortisol levels and anxiety, depression, and fatigue measurements ($p > 0.05$). Significant correlations between cortisol levels and role emotional ($r = 0.3$, $p < 0.05$) and role physical ($r = 0.34$, $p < 0.05$) in SF-36 were also found among pwMS.

Conclusions: According to our findings, salivary cortisol does not play a role in determining the severity of depression, anxiety, and fatigue in pwMS. Further research in this area is warranted.

Keywords: Quality of Life, Multiple sclerosis, Salivary Cortisol

Respiratory tract infection (tuberculosis) associated with Ocrelizumab treatment of multiple sclerosis: case report (PP-37)

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Ocrelizumab is a disease modifying therapy (DMT) for active relapsing MS or early primary progressive MS. It is a humanized anti-CD20 monoclonal antibody.It targets CD20 marker on B lymphocytes and is an immunosuppressive drug.

Common side effects include increased risk of infections, including herpes, influenza (flu) and other viral infections, infections of the skin, sinuses, respiratory tract, stomach and bowel. This treatment may also increase the chance of developing the following conditions:Breast cancer, brain infection (progressive multifocal leukoencephalopathy-PML). Overall no serious side effects have been reported. we report a rare case of multiple sclerosis with Respiratory tract infection (tuberculosis) caused by Ocrelizumab.

The patient is a 37-year-old young man with a history of multiple sclerosis, who is being treated with Ocrelizumab , who referred due to general body weakness and lower limb paraparesis. The patient was treated with Ocrelizumab 6 months ago, and after some time of receiving Ocrelizumab, he developed cough, blood sputum and The fevers have been intermittent. The patient did not go to the treatment center until he had symptoms of general weakness and paraparesis, and he went there for this reason. During the hospitalization, the patient developed cough, sputum, and shortness of breath. For the patient, complete tests for infection and Lung CT scan and skin and lung tests for tuberculosis as well as PCR for Covid-19 were performed, and according to the consultation with an infectious disease specialist, the diagnosis of pulmonary tuberculosis and Covid-19 was confirmed, and the patient was transferred to the ICU and received anti-tuberculosis and anti-covid 19 treatment. After a period of treatment, the patient's symptoms improved and he was discharged with the prescribed medication.

This is the first case of Tuberculosis caused by Ocrelizumab.

Keywords: Ocrelizumab,Tuberculosis,Covid19, multiple sclerosis

The effects of lavender herbal tea on spasticity and ataxia in patients with multiple sclerosis (PP-38)

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Background and Aim: Multiple Sclerosis (MS) is a neurological disease with an unknown cause that affects the central nervous system, the brain and spinal cord, and causes loss of control, vision, balance, and senses. However, it is observed and causes a significant decrease in performance and quality of life. Pharmacological treatments, physiotherapy and rehabilitation methods are usually used to deal with ataxia and spasm. Given the World Health Organization's emphasis on the use of herbal medicines with fewer side effects, as well as the anti-inflammatory and neuroprotective effects of lavender extract, the study aims to investigate the effect of hydroalcoholic extract of lavender extract on ataxia and multiple sclerosis.

Materials and Methods: The present study is a double-blind clinical trial controlled by placebo. 80 patients with Emas who referred to Imam Ali Clinic and Hajar Hospital in Shahrekord entered the study and were randomly divided into two groups of intervention and control. Patients in the lavender intervention group and the placebo group received placebo for 60 days. Before and after the intervention, spasticity was assessed based on the Ashort scale and the spasm repetition scale. Ataxia scaling and leaf balance test were used to evaluate ataxia. Data were analyzed by SPSS16 statistical software.

Results: The results showed the mean Ashworth and spasm index before and after intervention did not differ significantly between the two groups of drugs and placebo ($P>0.05$) but lavender tea could increase BBS and decrease ICARS index significantly in groupe reciving lavender tea ($P<0.05$).

Conclusion: Lavender due to the presence of phenolic and flavonoid compounds as well as high antioxidant properties can decrease spasticity and ataxia and improve their function along with other chemicals used in the treatment of MS.

Keywords: Spasm, Ataxia, Lavender, Multiple sclerosis

The role of antioxidant agent for Multiple Sclerosis treatment (PP-39)

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Multiple sclerosis is an autoimmune neurodegenerative disease that is caused by the immune system attacking the central nervous system leading to myelin loss and axonal damage. The pathophysiology of MS is complex with involvement of genetic and environmental factors that define the susceptibility to generate the autoimmune attack. Precise details of inflammatory cascades involved in MS pathogenesis remain unclear, but one of the key factors in the pathogenesis of MS is oxidative stress, enhancing inflammation and neurodegeneration. In MS, both reactive oxygen and nitrogen species are formed in the CNS mainly by activated macrophages and microglia structures, which can lead to

demyelination and axon disruption. In this review, we describe the different mechanisms of axonal injury and discuss some of the principal antioxidant compounds that could provide neuroprotection in MS.

Keywords: antioxidant, Multiple sclerosis

Third nerve palsy in multiple sclerosis: case report (PP-40)

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Multiple sclerosis is a chronic, autoimmune, demyelinating disease of the central nervous system. Although brainstem involvement is common at MS onset and during the course of the disease, isolated cranial nerve involvement is rare in MS patients and especially 3rd nerve palsy. In this study we present a rare case of third cranial nerve palsy triggered by an acute relapse of multiple sclerosis and correlate our findings with a brief review of literature.A 30-year old woman followed up for relapsing-remitting multiple sclerosis. She was treated with Interferon-beta. She was admitted to our department 10 days after the onset of binocular horizontal diplopia and right upper eyelid ptosis. On examination, her visual acuity was 10/10 in both eyes. She demonstrated 1mm of anisocoria, with the right pupil larger than the left. There was Imm of right upper eyelid ptosis. There were adduction deficits on the right.

Brain MRI revealed bilateral periventricular white matter hyperintensities and spinal MRI showed two hyperintense lesions at the D11-D12 vertebral levels. The patient was treated with five days of IV methylprednisolone with a good outcome.

Conclusion: Despite the rarity of CN IlI palsy as a clinical manifestation of MS relapse, demyelinating disease should remain on one's differential diagnosis, particularly in young patients without typical microvascular risk factors.

Keywords: Diet, Multiple sclerosis, Clinical trial, Intervention

Unlocking Insights: Radiomics for Multiple Sclerosis Diagnosis and Personalized Treatment (PP-41)

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Multiple sclerosis (MS) is an inflammatory disease that affects the central nervous system and is a significant cause of disability in young adults. Selecting appropriate treatment options becomes critical to preventing disability, but patient responses to treatments vary greatly. Traditionally, disease assessment in MS is based on visual interpretations by experienced clinicians, which results in time-consuming and non-reproducible decisions. As a result, accurate and timely recognition of individual treatment responses is critical for effective personalized MS therapy.

However, comprehensive predictive models for individual treatment responses are currently lacking. A rigorous evaluation of the efficacy of demographic, clinical, and paraclinical factors in predicting responses to disease-modifying therapies using patient information The paper extends the success of AI in medical imaging, particularly in magnetic resonance imaging, where automated lesion and tissue segmentation, disease classification, and data synthesis have flourished, to the realm of "omics." This approach is critical in personalized medicine, where comprehensive data analysis for a single patient is required. Radiomics is crucial to improving disease diagnosis and personalized treatment.

A personalized prediction model for disease stages can be developed by combining machine learning and big data methodologies, assisting clinical decision-making for individual MS patients. Furthermore, these techniques aided in data reduction and the identification of key patient characteristics, allowing the predictive model to be refined.

After conducting an extensive review, various key uses of radiomics within the context of MS were revealed: 1) categorizing different types of MS; 2) predicting disease progression and treatment responses; and 3) exploring additional potential applications. Preliminary findings indicate that machine learning algorithms hold promise in providing substantial support to medical professionals working on MS and personalized MS treatment.

Keywords: Personalized Treatment, Multiple sclerosis

Unmasking the Impact of a Pandemic: Investigating the Prevalence and Incidence Shifts of Multiple Sclerosis in Tehran Pre and Post COVID-19 Era (PP-42)

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Introduction: Recent evidence has shown an increasing prevalence of multiple sclerosis (MS) in Asia, including Iran. Tehran, the capital of Iran with an estimated population of 14,134,000 by the end of 2021, has also experienced this rise in both crude and familial MS rates 2–4. In 2018, the prevalence of MS in Tehran was reported as 151.3 per 100,000, with familial MS observed in 19% of the cases. Here we aimed to estimate the incidence, prevalence, and risk of MS and familial MS (FMS) in Tehran in 2021 and their trend regarding COVID-19 era.

Materials and Methods: This retrospective cross-sectional study from 1999–2021 utilized the Iranian MS Society (IMSS) and the National MS Registry System of Iran (NMSRI) data banks. These population-based registries collect data from various sources including universities, hospitals, clinics, and neurologists' offices. Neurologists confirmed diagnoses using the latest McDonald 2017 criteria. Variables such as gender, age at MS onset, and FMS history were analyzed using likelihood ratio Chi-squared test and logistic regression to identify factors associated with familial recurrence of MS.

Results: In total, 27,508 people with MS (PwMS) were registered in the IMSS and NMSRI, with a female/male ratio of 3.1:1. The point prevalence of MS in 2021 was 194.62 per 100,000, with higher rates in females (295.46 per 100,000) compared to males (94.54 per 100,000). The prevalence was previously reported as 151.1 and 151.3 in 2017 and 2018, respectively. There were 1113 newly diagnosed cases, resulting in an incidence rate of 7.87 per 100,000 in 2021, which showed an increase compared to pre-COVID incidence of 7.56 per 100,000 in 2017. Approximately 14.47% of respondents reported a positive history of familial MS, with a female/male ratio of 2.85:1. The mean age at MS onset was 29.27 years old, with a difference between genders. Familial recurrence of MS was associated with male gender and age at MS onset.

Conclusion: In summary, the incidence and prevalence of MS are increasing in Tehran, both overall and among those with a family history, reaching it roughly to the rates in the United States, Canada, and Northern Europe. This trend was also observed in Pre/Post COVID period which calls for attention and action to address. It was found that a higher proportion of males have a familial history of MS. Despite economic difficulties, IMSS and NMSRI are working towards expanding their coverage in Tehran to provide better care services for people with MS.

Keywords: Multiple Sclerosis, Epidemiology, Prevalence, Incidence, COVID-19, Tehran, Iran

Unusual presentation of neurobrucellosis mimicking demyelinating disorders: a case report and review of the literature (PP-43)

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Introduction: Central nervous system (CNS) involvement is a serious complication of brucellosis with a quite heterogeneous clinical manifestations. Clinical-radiologic correlation in neurobrucellosis varies from a normal imaging study to a variety of imaging abnormalities that reflect either an inflammatory process mimicking demyelinating disorders. Herein we aimed to report a case of neurobrucellosis which was radiologically in distinguishable from demyelinating diseases.

Case presentation: A 43-year-old man from a village referred to our center with a four months history of headache and weight loss. Initial work up revealed multiple non-enhancing supratentorial lesions affecting the corpus callosum with significant mass effect. With a suspicion of lymphoma or demyelinating lesion, the patient was candidate for brain biopsy. Before surgery, a neurologic consult was requested. Neurological examination revealed generalized hyperreflexia and up plantar reflexes. Other examinations were unremarkable. Routine conventional tests were normal. The Wright agglutination test for brucellosis in the serum was positive at a titer of 1:320. Cerebrospinal fluid (CSF) analysis revealed glucose levels 33 mg/ dl, protein 128 mg/dl, and white blood cells 220/mm^3 (lymphocytes 80%, neutrophils 20%) and six oligoclonal bands. With a diagnosis of neurobrucellosis, the patient was started on an oral combination of rifampin, doxycycline, and ciprofloxacin. The patient clinically improved dramatically and repeated MRI after a month revealed significant resolution of the lesions.

Conclusion: Corpus callosum is rarely affected in neurobrucellosis. The present case highlights the various radiological involvement of neurobrucellosis.

Keywords: demyelination, neurobrucellosis, corpus callosum

Validity and reliability of the Persian version of the Reece Stigma Scale (RSS) questionnaire in multiple sclerosis patients (PP-44)

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Background: Patients with multiple sclerosis (PwMS) often experience a fear of social stigma, which negatively impacts their quality of life (QoL). Currently, no validated questionnaire is available in Persian to assess this issue in PwMS. Therefore, this study seeks to validate the first Stigma questionnaire in Persian for use in PwMS.

Method: This is a cross-sectional study on the PwMS diagnosed with the 2017 version of McDonald's criteria. The demographic and clinical information and the Reece Stigma Scale (RSS) and Multiple Sclerosis Impact Scale-29 (MSIS-29) questionnaires were recorded. The validity was evaluated using the content validity index (CVI) and the Content Validity ratio (CVR), and an exploratory factor analysis (EFA) was established to determine the factor structure that endorses the MS-related stigma.

Results: A total of 194 patients were recruited in the present study. A factor analysis revealed that only two factors retained eigenvalues ≥ 1.0 and have excellent internal consistency. The Cronbach's α coefficient for internal consistency of the RSS questioner was 0.822. More evidence for the construct suggests that having higher levels of stigma is significantly correlated with psychological (P-value<0.001) and physical dimensions (P value<0.001). No significant correlation was evident between stigma and EDSS score (P-value: 0.308), and disease duration (P-value: 0.535).

Conclusion: The present study demonstrates that an adapted Persian version of the RSS score effectively measures stigma among PwMS. The study found that the scale has strong psychometric properties. These findings emphasize the importance of addressing stigma in the multiple sclerosis population, which can improve medication adherence and psychological and quality of life outcomes.

Keywords: Stigmatization, Quality-of-life, Multiple Sclerosis, reliability, validity

Working memory dysfunction differs between secondary progressive and relapsing multiple sclerosis: effects of clinical phenotype, age, disease duration, and disability (PP-45)

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Background: Cognitive dysfunction is relatively common in patients with multiple sclerosis (MS). Although it occurs in all stages and all phenotypes of MS, it is more prevalent in secondary progressive MS (SPMS) compared to relapsing MS (RMS). It is unclear whether the higher frequency of cognitive impairment in SPMS is linked to the progressive phenotype or other clinical factors. In this study, we compared working memory in patients with RMS, SPMS, and healthy subjects. We also investigated the effects of age, disease duration, and disability on working memory performance.

Methods: This case-control study enrolled 134 MS patients, 69 patients were diagnosed with RMS and 65 patients with SPMS, and 77 healthy control subjects. We designed two working memory tasks with different sets of stimuli (face vs. checkerboard) and different instructions (same or different vs. which one is the same).

Results: Accuracy was significantly more impaired in SPMS patients than in RMS patients and both groups were worse than healthy subjects. This finding was similar between both tasks. Age and overall cognitive functions (measured with MoCA) also affected accuracy, but disease duration and disability only affected accuracy in working memory task with checkerboard stimuli.

Conclusion: MS patients are impaired in keeping the information in the visual working memory for a few seconds. Progressive phenotype significantly affected working memory accuracy, and this effect did not explain out with other demographic or clinical factors. Future studies are needed to reveal underlying mechanisms of working memory dysfunction in SPMS and working memory dysfunction as a biomarker of disease progression.

Keywords: Multiple sclerosis; Working memory; Cognitive dysfunction; Progressive multiple sclerosis

Consent for publication

This manuscript has been approved for publication by all authors.