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SCHOOL OF MEDICINE
FORT WAYNE

Student Research Fellowship Program

Abstract Booklet

July 25, 2022

Assessing the Impact of Physician Pain on Motivation to Provide Longitudinal Osteopathic Manipulative Therapy to Patients and its Correlation to Opioid Prescribing: A Cohort Study

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Background/Objective: In recent years physician wellness has become a priority. Current well-being initiatives focus on the emotional and spiritual components of health. However, physical pain and its relationship to wellbeing and patient care has not been examined. We hypothesized that reductions in resident's physical pain would impact their enthusiasm for providing OMT services to patients in need of pain management while also reducing opioid prescribing. **Methods:** Both allopathic and osteopathic residents were offered biweekly osteopathic treatments by board certified osteopathic physicians. Participant pain scores were obtained prior to each treatment. The osteopathic resident cohort was surveyed regarding their motivation to perform OMT (SIM Scale). Patient OMT encounters provided by the participants were evaluated by tracking the number of segments, attempts, OMT modality and BMI were correlated with the participants pain scores. Finally, the opioids prescribed by all participants was compared to their pain scores. Pearson's correlation and independent t-tests were used for this project with an alpha of 0.05 for significance. **Results:** A correlation was demonstrated between patient BMI and participants delivering osteopathic treatments ($p = .006$). This study did not identify any statistically significant correlations between the regularity of received OMT services and physician physical wellness. Additionally, there was not a statistically significant correlation between the other data points included in this study. **Conclusion:** Patients BMI as a surrogate value for their body habitus did correlate with DO physician pain scores. Longitudinal OMT did not improve provider pain over time thus supporting OMT use in alleviating acute somatic dysfunction. Provider pain did not correlate with opioid prescribing habits or frequency of OMT as a pain management option. There remains a need for physical wellness interventions to improve provider wellness and especially for providers using OMT on large body habitus patients due to its impact on the providers health.

Predicting Cognitive Decline in Long-COVID Patients: A Demographic and Comorbid Analysis Using BrainCheck Cognitive Assessment

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Introduction: Coronavirus disease (COVID-19) was declared a global pandemic by the World Health Organization (WHO) on March 11, 2020. From the onset in early January 2020 until now, we have made monumental steps toward combatting the deadly virus. Now a subset of individuals is experiencing post-acute sequelae of COVID-19, more colloquially known as Long-COVID. Research surrounding the long-term consequences of COVID-19 is now at the height of importance as approximately 25-56% of individuals who were initially diagnosed with COVID-19 will go on to display new neuropsychiatric symptoms [5]. Mind long consequences of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection include brain fog, difficulties with memory, and focusing [3]. The burden of disease is substantial. Approximately 5.8% of individuals will be diagnosed with new psychiatric illnesses [8]. While many of the symptoms associated with Long-COVID have been summarized, the cognitive decline that takes place because of COVID-19 infection were quantified in this study using BrainCheck cognitive assessment. **Methods:** A retrospective chart review was conducted on subjects' data that was included in the Parkview Post-COVID Clinic (PPCC). BrainCheck cognitive assessment measures were the main cognitive metric utilized to assess cognitive decline in patients. BrainCheck cognitive assessment compares patient's current cognitive levels to the national average by using normalizations and standard deviations. Subcategories of the BrainCheck cognitive assessment include attention, mental flexibility, executive functioning, and memory. Age, gender, weight, BMI, and hospitalization status were the demographic and predisposing factors that were analyzed, looking for correlations with levels of cognitive decline experience by patients. Pearson Correlation Coefficient calculations were conducted on the continuous variables, and Point-Biserial Correlation Coefficient calculations were conducted on the dichotomous variables. Furthermore, ANOVA and chi-squared analysis was done to assess for differences among stratified groups.

Results: There is a correlation between age and mental flexibility (p -value = $<.001$, correlation = 0.3131), indicating that with increased age there is a less decline in the mental flexibility aspect of cognitive function. There is a correlation between age and executive functioning digit symbol substitution (p -value = 0.03431, correlation =

0.1601), indicating that younger individuals will have worse cognitive decline in complex attention and processing speed. There is also a correlation between age and executive functioning Stroop color interference (p-value = 0.01904, correlation = 0.1661), indicating that younger individuals will experience a worse decline in their judgement and decision making. There is a correlation between hospitalization status and immediate memory recognition (p-value = 0.01107, correlation = 0.1742), indicating that being hospitalized at the onset of COVID-19 infection leads to worse short-term memory. Lastly, when stratifying the sample by BMI, the chi-squared analysis yielded significance (chi-squared = 14.00, p-value = <.001) when comparing to BrainCheck mental flexibility scores. This would suggest that BMI has implications for differing levels of cognitive decline in Long-COVID patients. **Conclusion:** The aim of this study was to utilize the PPCC database to analyze levels of cognitive decline in Long-COVID patients, looking for correlations between predisposing factors, as well as demographics. It was determined that age, BMI, and hospitalization status have indications for differing levels of decline in certain aspects of cognition for patients experiencing Long-COVID symptoms. The goal is to inform clinicians on what levels of cognitive decline to expect from Long-COVID patients and shed light on COVID-19's effect on the central nervous system.

The Use of Anticoagulants in COVID-19 Positive Patients on Extracorporeal Membrane Oxygenation

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Background: Anticoagulation during extracorporeal membrane oxygenation (ECMO) for COVID-19 patients is complicated by thromboembolic and bleeding events. The primary objective of the study aims to assess the incidence of bleeding and thromboembolic events in COVID-19 positive patients treated with ECMO in the presence or absence of various anticoagulant therapies. **Methods:** The study included 26 patients in a retrospective case review of electronic medical records who began ECMO therapy from September 2020 to January 2022. Patients were positive for COVID-19 infection, 18 years or older, and on ECMO for greater than 24 hours. The data was assessed with a standard paired t-test, survival proportions, and Chi-squared analysis. **Results:** Patients who received more frequent administration of intravenous anticoagulants had an increased total bleeding event (p=.004). The data demonstrated an increased risk of mortality associated with increased bleeding events $X^2 (25, N=26) = 8.1723, p=.017$, but not increased risk of mortality associated with increased deep venous thromboses $X^2 (25, N=26) = 1.663, p=.435$. **Conclusions:** Based on this study, treatment guideline should recommend less frequent anticoagulation therapy to decrease the risk of bleeding events and mortality for COVID-19 patients on ECMO.

A Mineralized Allograft in Lumbar Interbody Fusion – A Retrospective Chart Review Study

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Background: Lumbar interbody fusion is a routine surgical intervention for treatment of degenerative disc disease to treat lumbar stenosis. Minimally invasive surgical approaches do not afford the opportunity to harvest large amounts of local bone autograft, therefore iliac crest autograft and or additional allograft material is strongly relied upon to achieve an arthrodesis. This study uses a blend of a blend of Ventris Medical's osteoinductive allograft; Allocell® and SurGenTec's nanoputty OsteoFlo® as an effective autograft extension material. **Methods:** A retrospective chart review was performed on patients that underwent lumbar interbody fusion between October 2021 and January 2022. Demographic information was recorded, three- and six-month follow-up radiographs were assessed, and arthrodesis was graded using the Bridwell Anterior Grading System. **Results:** A total of 18 patients were included in the study, representing 27 lumbar level fusions. A Bridwell grade of I (successful fusion) was achieved at three months in 11.1% of cases and at six months in 85.2% of cases. Four fusions remained a Bridwell grade of II at six months and were subsequently evaluated for complete arthrodesis. No patients received a Bridwell grade of IV (lucency with collapse of graft) at three- or six-month follow-up. **Conclusions:** The combination of OsteoFlo® and Allocell® contributed to successful arthrodesis status post lumbar fusion.

Creating a Patient Registry for the Parkview Vein Clinic

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Background/Objective: The Parkview Vein Clinic provides individualized care to patients suffering from venous disease by providing assessment, education, treatment, ultrasound imaging, and surgical interventions all under one roof. The Vein Clinic has experienced a consistent increase in patient volume since opening in 2019, creating a need for tracking patient outcomes. Patient registries are useful tools for tracking high volumes of patients, assessing outcomes, and improving treatment guidelines. The main objective of this quality improvement project is to define the workflow for creating a patient registry for the Vein Clinic and determine which data points are feasible to collect. **Methods:** This is a retrospective chart review of patients with the diagnosis of “venous stasis ulcer” seen at the Vein Clinic from September 2019 to July 2022. A total of 84 data fields were collected on each patient, including information on demographics, medical history, ulcer descriptions, imaging, procedure information, and post-procedure follow-up. The Society for Venous Surgery Vascular Quality Initiative was used as a template for registry design, with the goal of merging the registry with the national database in the future. **Results:** Venous ulcer information, including number of healed ulcers, duration of ulcer, and largest diameter active ulcer, was not readily accessible within the chart and required expanded review find and quantify. All other categories were readily accessible in the chart. **Conclusions:** The data collected by the registry will be useful for future quality improvement purposes of the Vein Clinic. Creation of a structured reporting template in Epic would help facilitate the ease and accuracy of data extraction and help maintain the internal validity of the registry. More detailed follow-up assessments should be implemented to track patient outcomes, which could include use of the Venous Clinical Severity Score or a patient-reported outcomes assessment.

Traumatic Brain Injury in a Level II Trauma Center Network Serving Rural Northeastern Indiana: A Cross-Sectional Study

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Background: CDC Report to Congress states that there is a need for research to fill gaps in current Traumatic Brain Injury (TBI) epidemiology for at risk populations including age groups 0-4, 15-19, and 75+, males, and residents of rural geographic areas to help understand injury mechanisms, burden, and elucidate preventive resources. This study aimed to characterize the epidemiological picture of TBI in a level II trauma center network serving a rural area by measuring TBI incidence, causal factors, and outcomes. Secondly, patients aged 65 and above (Seniors) have worse outcomes post-TBI; therefore, we sought to determine predictors associated with post-TBI mortality in the senior population. **Methods:** A retrospective cross-sectional study of TBI in northeastern Indiana was conducted with cases selected from 2019 TBI patients from five counties admitted or transferred to Parkview affiliated hospitals (n=404). Incidence rates (IR) and age-adjusted IR per 1,000 study county residents was examined by age group and gender. We used descriptive analysis of TBI type, mechanism of injury (MOI), intent of injury, and hospital transfer by age group and patient type (ED, hospitalization, deaths), and analytical analysis of mortality post-TBI for seniors (n=120) using multivariable logistic regression. **Results:** Males (2.5) and 75+ age group (6.7) had the highest IRs per 1,000 residents. Concussions were the most common TBI in all age groups (87.7% for 15-19) except for seniors which 71.7% were more severe including intracranial bleeds and/or skull or orbit fractures. Concussion accounted for 57.6% of ED visits, 17% hospitalizations and 0% deaths. Falls were the most common MOI for all age groups accounting for 88.3% of senior injuries. Motor vehicle accidents (MVA) and struck by or against object became significant for ages 5-19 (42.6%, p<0.001) and 20-64 (57.2%, p<0.001) compared to other age groups. Unintentional injuries were the most common intent for all age groups. Under 5 and seniors had the highest hospital transfer rates. Binary regression results were significant for anticoagulant therapy, skull, or orbit fracture, severe TBI, CCI, male sex, and age as predictors for senior mortality post-TBI. **Conclusions:** Incidence, severity, and mortality matched national high-risk groups including males and seniors, but mortality data was not remarkable for age groups 0-4 and 15-19. Unintentional falls was the most common MOI indicating the study population would benefit from a fall prevention program focused on seniors. Pre-existing anticoagulant therapy and skull or orbit fracture on admission were suggested to be predictors for senior mortality post-TBI, which adds to the current understanding that these factors are associated with higher risk of TBI progression acutely and higher mortality for in-hospital patients with severe TBI respectively.

Peripheral Neuropathy in Long-COVID Patients: Demographic Distribution and Medical Risk Factors

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Objective: A retrospective study was conducted to examine the relationship between long-COVID peripheral neuropathy and patient demographics and comorbid medical conditions. **Materials and Methods:** Electronic health records of 543 patients from the Parkview Post-COVID Clinic were reviewed for their demographic information, past medical histories, and post-COVID clinic visit summaries. Based on whether patients had peripheral neuropathy as a post-COVID clinical visit diagnosis and whether they had had a history of neuropathy prior to COVID infection, the patients were assigned into the new-onset neuropathy group, progressing and non-progressing neuropathy groups, and non-neuropathy group. Age and BMI were compared among the four groups using two-sampled t test. Sex, prior COVID hospitalization status, and chronic comorbidities including hypertension, diabetes, anemia, congestive heart failure, and hypothyroidism were compared using chi-squared test. **Results:** 19 of 543 (3.5%) patients had new-onset neuropathy and 18 (3.3%) were found to have progressing neuropathy. Compared with patients with no neuropathy, patients with new-onset neuropathy were of older age ($p = 0.042$), more male ($p = 0.022$), and more frequently hospitalized for COVID ($p = 0.003$). Compared to patients with no neuropathy, patients with progressing neuropathy were of older age ($p < 0.001$), had more COVID hospitalization ($p = 0.033$), diabetes (0.014), hypertension ($p < 0.001$), and anemia ($p = 0.02$). No statistically significant relationship was found between neuropathy and factors not listed above. **Conclusion:** The study's incidence of new-onset peripheral neuropathy in long-COVID patients is higher than indicated in the current literature. Age and COVID hospitalization were found to be risk factors for both new-onset and progressing neuropathy. Being male was a risk factor for new-onset neuropathy only, in contrast to current literature suggesting female predominance in peripheral neuropathy and long-COVID. Diabetes, anemia, and hypertension were risk factors for both progressing and non-progressing neuropathy but not for new-onset neuropathy.

Complications in Burn Patients Following Fluid Over-Resuscitation

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Background/Objective: Over-resuscitation of burn patients leads to dangerous edema-related sequelae. The Parkland formula is commonly used to predict fluid requirements in the 24 hours following burn injury, yet studies report widely varying resuscitation rates. This study aims to assess fluid resuscitation practices at Lutheran Hospital and evaluate correlations between resuscitation rates and fluid-overload complications. **Methods:** A retrospective chart review assessed fluid resuscitation of 36 adult patients with burns affecting at least 15% total surface body area (TBSA) between May 2020-May 2022 at Lutheran Hospital. Intravenous fluid rates and urine output (UO) were recorded for the first 24 hours of each patient's hospital stay. Complications and mortality were recorded for the entirety of a patient's hospital stay. Patients who received volumes exceeding those recommended by the Parkland formula were placed in the high-volume group whereas patients who received a lesser volume were placed in the low-volume group. Statistical analyses were performed using Microsoft Excel ($\alpha = 0.05$). **Results:** The study included 36 patients with an average fluid resuscitation of 4.13 ± 2.14 mL/kg/%TBSA in the first 24 hours following hospital admission. Average UO in the high-volume group ($n=14$) was 1.33 ± 0.76 mL/kg/hr compared to 0.75 ± 0.47 mL/kg/hr in the low-volume group ($n=22$). Fluid complications were more common in the high-volume group (41.7%) compared to the low-volume group (19.0%), but this difference was not statistically significant ($p=0.230$). No difference in mortality was observed ($p=1.000$).

Conclusion: The high-volume group had an average UO exceeding the recommended range (0.5-1.0 mL/kg/hr) and experienced greater rates of fluid-overload complications (pulmonary edema, compartment syndromes, etc.). Due to the small sample size and limited power of this study, the difference in fluid-related complications was not statistically significant. **Clinical Impact and Implications:** Physicians should limit fluid volumes exceeding the Parkland formula when resuscitating burn patients to avoid fluid overload sequelae.

Lutheran Children's Hospital Neonatal Follow-Up Clinic: Risk of Developmental Delay of Preterm Neonates as a Function of Gestational Birth Age

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Background/Objectives: About 1 in 10 babies are born prematurely, a number that increased from previous years because more resources are available and fertility treatments are effective. Children born prematurely have a higher risk of developmental delays that are associated physically, socially, linguistically, and neurodevelopmentally. With these delays being commonly associated with preterm infants, there is the need to continuously study the longitudinal effects caused by being born prematurely. Our objectives include creating a more comprehensive care plan, comparing gestational age with developmental delay levels, and noting correlations between delays and their respective cohort. We hypothesize the more premature the child was born, the higher the likelihood of developmental delay(s). **Methods:** Two main tests were used to look for a correlation between the delay or lack of a delay with the child's adjusted age. TIMP, Test of Infant Motor Performance, was used at two different age intervals to measure infant motor capacity. The ASQ, Ages and Stages Questionnaire, was used to screen several different developmental areas of concern, including social and behavioral abilities. **Results:** The data shows the developmental delay decreasing over time in all preterm cohorts with an exception being the late preterm cohort, likely due to its small sample size. The Chi-square test is not significant for the TIMP1 and TIMP2 comparisons of preterm cohorts. The ASQ data sets did not have a clear consensus of data. **Conclusions:** There is an increase of developmental delay in neonatal infants in comparison to the standard developmental milestones. A positive finding is that there is an overall decrease in developmental delay as the child progresses in age. **Potential Impact:** This research may promote other hospitals to implement a NFC for patient care and research considerations.

The Effects of the COVID-19 Pandemic on IVC Filter Placement

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Background: IVC filters are self-expanding stents that have been used to prevent pulmonary embolisms when anticoagulants are contraindicated. However, the current literature shows no decrease in mortality when using a filter. These filters can be retrievable or permanent. Retrieval of filters is imperative to their success as prolonged dwell time can cause further complications. The IVC filter clinic was created in July 2017 to track patient outcomes and to provide improved care. **Objectives:** The purpose of this study is to determine differences in indication, removal rate, follow-up rate, dwell time, mortality, and general trends before and during the COVID-19 pandemic. **Methods:** The current study is a retrospective chart review of patients who received an IVC filter between July 2017 and June 2022. In determining differences related to the COVID-19 pandemic, March 2020 was used as the start date of the pandemic, and it is ongoing through June 2022. **Results:** There was a decrease in 1 year survival (86% vs 63%, $p = .000412$) when patients did not receive a follow-up office visit. There was a decrease in follow-up rate (86% vs 77%, $p = .049762$) after the onset of the COVID-19 pandemic. Patients who had their retrievable filter removed were significantly more likely to be alive at 1 year than those who did not get their filter removed (95% vs 72%, $p < .00001$). There was no significant change in indication, removal rate, dwell time, or 1-year mortality after the start of the pandemic. **Conclusions and Potential Impact:** A patient's chance of survival can be increased if they attend a follow-up visit, and if they have their filter removed. This indicates the need for a more selective process in placing retrievable filters. Additionally, this data could also help clinics around the country place a stronger emphasis on follow-up rate to improve patient survival.

The Impact of Improving Nutrition Status, Pre-habilitation, Optimization of Cardiac Hemodynamics Including use of Temporary Mechanical Support When Indicated on the Reduction of Frailty in Patients Evaluated for Advanced Heart Failure Therapies

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Background: Advanced frailty and age are associated with increased mortality, adverse surgical and transplant outcomes. Aside from bridge-to-transplant ventricular assist device (VAD) implant, minimal literature exists regarding reversing frailty. The aim of this study was to assess interventions used by Lutheran Heart Transplant (HTx) and VAD Program on reducing frailty and the impact on short-term operative outcomes. **Methods:** A retrospective chart review of 29 patients evaluated in the Lutheran HTx and VAD program was performed. Data collected included biomarker and demographic data for June 2020 to present. The study population was analyzed and then stratified by their modified Fried Frailty Phenotype (mFFP) score. Independent analysis was performed for HTx and VAD cohorts. Fisher's exact and t-tests were used to analyze categorical and continuous variables, respectively ($\alpha = 0.05$). **Results:** 18 out of 29 patients (62%) were classified as frail at initial assessment. Significant improvements were observed in bilirubin ($p=0.017$), creatinine ($p=0.001$), eGFR ($p=0.001$), lactic acid ($p=0.002$), and prealbumin ($p=0.002$) for the total study population. Frail patients experienced longer intubation (3 vs 4 days) and hospitalization (20 vs 23 days) times post-HTx. Due to limited sample size, we were unable to analyze the VAD cohort by mFFP score. **Conclusions:** Significant improvements were seen in kidney function and nutrition status as indicated by creatinine, eGFR, and prealbumin data. However, the available data was insufficient to examine the interventions impact on frailty as described by the Fried Frailty Phenotype. Similar to other studies, frailty was associated with increased intubation and hospitalization duration post-HTx.

Associations Between Psychiatric Symptoms and Cognitive Impairment in Post-Acute Sequelae of COVID

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Introduction: Post-acute sequelae of COVID (PASC) is an emerging postviral syndrome affecting patients who have recovered from acute COVID infection. Symptoms can affect many different organ systems, including the CNS. Neuropsychiatric complications are common in PASC, affecting roughly 1 in 3 patients who recover from COVID. The present study aims to investigate relationships between depressive, anxious, somatic, and general psychiatric symptom burden and cognitive impairment in PASC. **Methods:** Patients were recruited from the Parkview Post-COVID Clinic (PPCC) from April 2021 to March 2022. Patients were deemed eligible if data were available for both Brief Symptomatic Inventory (BSI) and BrainCheck scores. Eligible patients were divided into low or normal cognitive function based on BrainCheck guidelines, and differences in psychiatric symptom severity were assessed via Mann-Whitney U testing. Strength and direction of associations were determined using Pearson's correlation coefficient. A smaller subset of patients was analyzed for differences in PASC symptom severity based on Omicron or Delta infection. **Results:** Generalized cognitive and mental flexibility complaints were associated with more severe psychiatric symptom burden in all domains measured by BSI ($p = 0.003$ and $p = 0.01$, respectively). Impaired attention was not related to any psychiatric symptom domain ($p > 0.05$). Impaired memory was related to more severe symptom burden in all psychiatric domains except depression (immediate recall $p = 0.015$; delayed recall $p = 0.015$). **Conclusion:** General cognitive and mental flexibility complaints can be used to prompt clinical suspicion of concurrent psychiatric symptoms. Complaints regarding attention are not linked to any psychiatric symptom domain. Complaints regarding memory can also provide impetus for investigating concurrent psychiatric symptoms, excluding depression. These associations can be used to facilitate earlier diagnosis and treatment of cognitive impairment and psychiatric illness in the context of PASC.

Therapeutic Effects of Benzoylacetone on Microglia Activation in Multiple Sclerosis Zixuan (Angela) Zhao¹, Ping-Chang Kuo², Barbara A. Scofield² and Jui-Hung Jimmy Yen²

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Background: Multiple Sclerosis (MS) is an autoimmune disease of the central nervous system (CNS). Pathogenic T cells, such as Th1 and Th17, infiltrate the CNS, resulting in neuroinflammation, demyelination and

axonal damage. Th1 activates microglia (MG) in the CNS and Th17 acts as a chemokine to recruit immune cells into the CNS. MG is a resident immune cell in the CNS and its activation is associated with destruction of myelin and secretion of inflammatory cytokines such as IL-12, IL-23 and IL-1 β . IL-12 and IL-23 are important for Th1 and Th17 differentiation and reactivation, respectively. IL-1 β is a key mediator of the inflammatory response. Benzoylacetonitrile (BTN) has been shown to reduce disease severity in mouse model of MS and reduce Th1 and Th17 differentiation in vitro. However, the effects of BTN on MG are unknown, and this study was aimed to investigate the effects of BTN on MG activation in vitro. We hypothesize that BTN can suppress MG activation and decrease the production of inflammatory cytokines. **Methods:** Primary MG were pretreated with BTN at concentration of 200 μ M or 300 μ M for 2 hours or with DMSO (vehicle), followed by lipopolysaccharide (LPS) 100ng/ml stimulation for 1.5 or 3 hours. RNA was isolated from MG and mRNA expression levels of IL-12, IL-23, IL-1 β were measured using Q-PCR. **Results:** Our results showed that BTN suppressed MG activation and reduced inflammatory cytokine production. The mRNA expression levels of IL-12, IL-23, and IL-1 β in LPS and BTN-treated MG were significantly lower than LPS-treated MG. **Conclusion:** This study demonstrated that BTN was able to suppress MG expression of inflammatory cytokines in vitro, suggesting that BTN exhibits immunomodulatory effects on MG activation in vitro. BTN has a potential to attenuate neuroinflammation in MS through the reduction of inflammatory cytokines.