Can We Trust Anesthetics?
Supporting the Legitimacy of Neuraxial Injections on Multiple Sclerosis (MS) Patients

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Abstract

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Multiple Sclerosis (MS) is a prominent immune disease that eats away the protective covering of nerves present in the central nervous system. Because of the effects of the disease, many treatments have been made to help deal with this disease overall. One such treatment is the usage of neuraxial spinal injections. There has been a debate on spinal injections for various reasons, including but not limited to anesthesia and pain, which may trigger or exacerbate MS symptoms. While anesthesiological literature may suggest that performing spinal injections on MS patients is risky, as they could increase the severity of MS, clinical data begs to differ. Thus, this research project' s purpose is to showcase whether there is a decrease or not in performing spinal injections on MS patients, in spite of traditional literature. A sample size of 100 patients was used for this project. The difference in pain level was recorded, and a decrease in the severity of the symptoms thus, one would see a decrease in the severity of their symptoms in relation to receiving the treatment. Furthermore, the average pain decrease for the control was - 0.72, while for the treatment group, it was -1.51. The reported p-value was also .001672. This is shown through the change in the value of their pain and through a statistical T-test (which is further reflected as a table instead), which shows a significant association between the two variables. Thus, one can see that these anesthetic treatments can greatly aid MS patients in dealing with their various symptoms and pain.

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Introduction

Many people suffer from the dangerous and paralyzing effects of multiple sclerosis, with everyday common people being the target of this deadly disease. It is estimated that over 1.8 million people have MS worldwide. People of all ages can be affected, but it is more common in young adults and in females.

Thus, with the invention of modern medicine, many breakthroughs have been placed to help combat this disease. One such technique is the use of neuraxial injection in (MS) patients present in the spinal epidural area of the body. The treatment is administered as an injection of medication into the epidural or intrathecal space to produce anesthesia, thus giving pain relief to the specific patient in order to better themselves and their human bodily systems and to allow the patient to carry out daily functions such as breathing, eating, walking, etc. Furthermore, the anesthetic treatment works by bathing the nerve roots of the spinal cord, inhibiting sodium channel transmission to block pain signals to the central nervous system. The most commonly used local anesthetics for neuraxial anesthesia are lidocaine, bupivacaine, and ropivacaine (https://www.ncbi.nlm.nih.gov/books/NBK537299/). Opioids such as fentanyl, morphine, and hydromorphone can be coadministered with local anesthetics to produce a synergistic effect that inhibits pain transmission. However, in the case of neuraxial spinal injections administered to patients who have multiple sclerosis, the drugs sevoflurane, desflurane, nitrous oxide, propofol, midazolam, and dexmedetomidine are usually administered. Regardless, after taking anesthetic medication, it'll take twenty to thirty minutes for the pain relief and/or loss of feeling to take full effect, with the medication lasting several days or even longer.

Despite the use of neuraxial spinal injections in the medical field, some anesthetic literature argues for the stopping of this practice as it could pose a threat to these various patients. Historically, the use of regional anesthetic techniques in patients with pre-existing (CNS) disorders has been considered relatively contraindicated. It is commonly reported that mechanical trauma and/or local anesthetic toxicity, with the additional fear of worsening neurologic outcomes, are the main reasons for disliking the anesthetic Hebl, et al., (2006). Furthermore, such literature has advised that going against the adherence to recommended practices when performing epidural injections should lead to a reduction in the incidence of

neurologic injuries, (Rathmell - Renezon, et al,. (2015)). One prominent threat of elevated brain swelling is that it could lead to infection and allow the introduction of meningitis into the subject area, Koff, M. D. (Feb. 2008).

Despite traditional medical literature stating against the support of using such medical treatment, recent positive results have been reported when performing such treatment in clinical spaces. This research will help illustrate the decrease in the severity of multiple sclerosis symptoms when applying such treatment. Furthermore, with the usage of neuraxial spinal injections in the general populace it will help aid patients who suffer from the illnesses as more hospitals begin to use this treatment overall.

Purpose

The purpose of this study is to survey patients who have received neuraxial injections in order to determine if this procedure is effective in decreasing the severity of their symptoms.

Methods and Materials

Database Search

Most, to all aspects, of this research project, in regard to using patient information from the EMR (emergency medical record) system present in any sort of hospital setting, used the basis of anonymity when dealing with the confidential information of patients. Furthermore, the data from said patients will be used under patient numbers that only the mentee, mentor, and science research instructor would know about as well in order to abide by HIPPA guidelines. A sample size of 100 patients was used. These patients were chosen at random when scanned from the thousands of patients situated in the EMR system. Furthermore, the racial demographic was based on more Hispanic and African-American patients being present, with Asian and White patients being of smaller numbers. In the study, out of the hundred patients, 42% were African-American, 33% were Hispanic, 17% were Asian, and 8% were White. The reason for such a demographic, despite there being more White individual patients present in hospital settings and in the world globally, was the fact that the hospital setting that was used was more inclined to have more minority patients since they were surrounded by minority communities nearby. In addition, the age range that was used for patients in this research project was

broadened to as young as eighteen to as young as seventy-six, though most patients were situated in the age range of older adults (late 20s to early 30s) to middle-aged adults (late 30s to mid-late 40s). Once one has the present demographic from the patients, one would then use the EMR (Electronic Medical Records) system present in most hospital settings and go through the sample size to see whether they had (MS) exacerbation after x amount of hours of neuraxial injections. (quantitative measure). This would allow one to see whether the patients received the injections overall and to see if the severity of their MS symptoms decreased over time after receiving such treatment.

Data Collection

When collecting data on the pain severity of MS from the sample group, most of the data of this metric came from the description section of the EMR that doctors record after each consultation with each patient. Each present doctor had different ways of recording such symptoms, and thus, there wasn't a uniform way of organizing the metric pain value scale. Thus, a scale was created by the researcher based on symptoms based on the gathered data and scaled via such symptoms:

1.0-1.9:	Patient has no prevalent disability but is displaying minimal symptoms to one of their functional human bodily systems
2.0-2.9:	Patient has some sort of minimal disability that has impacted one of their functional systems
3.0-3.9:	Patient has some medium-level disability in one of their functional systems, and only a minimal disability in the other present systems
4.0-4.9:	Patient having some significant disability but they are still self-sufficient and are able to function for at least twelve hours a day.
5.0:	Patient who either has any level of disability that gets in the way of daily activities, any disability that doesn't allow them to work throughout the day with any sort of accommodations, or can walk without any sort of help or rest.

The difference between 1.0 and 1.9 is that one to one-point-nine means that the patient has no prevalent disability but is displaying minimal symptoms to one of their functional human bodily systems, two to two-point-nine means that the patient has some sort of minimal disability that has impacted one of their functional systems, and three to three-point-nine means that the patient has some medium-level disability in one of their functional systems, and only a minimal disability in the other present systems. Four to four-point-nine represents a patient having some significant disability but they are still self-sufficient and are able to function for at least twelve hours a day. Finally, five represents any patient who either has any level of disability that gets in the way of daily activities, has a disability that doesn't allow them to work throughout the day with any sort of accommodations, or can walk without any sort of help or rest. Also, in trying to

clarify the distinction of disability present in the previous sentence, it is in regard to a lack of walking or performing basic human functions, such as speaking, eating, seeing, etc. This is conjugation with common multiple scoliosis symptoms that were stated previously above. the more the number increases by each decimal point(s), the more it reflects, the greater illustration of any functional system being affected by the disease. It also reflected whether the illness was affecting more of one bodily system compared to multiple bodily systems at the time.

Evaluation

After coding the patient responses before and after injection, the difference was recorded as before receiving neuraxial injection and after receiving neuraxial injection.

Results

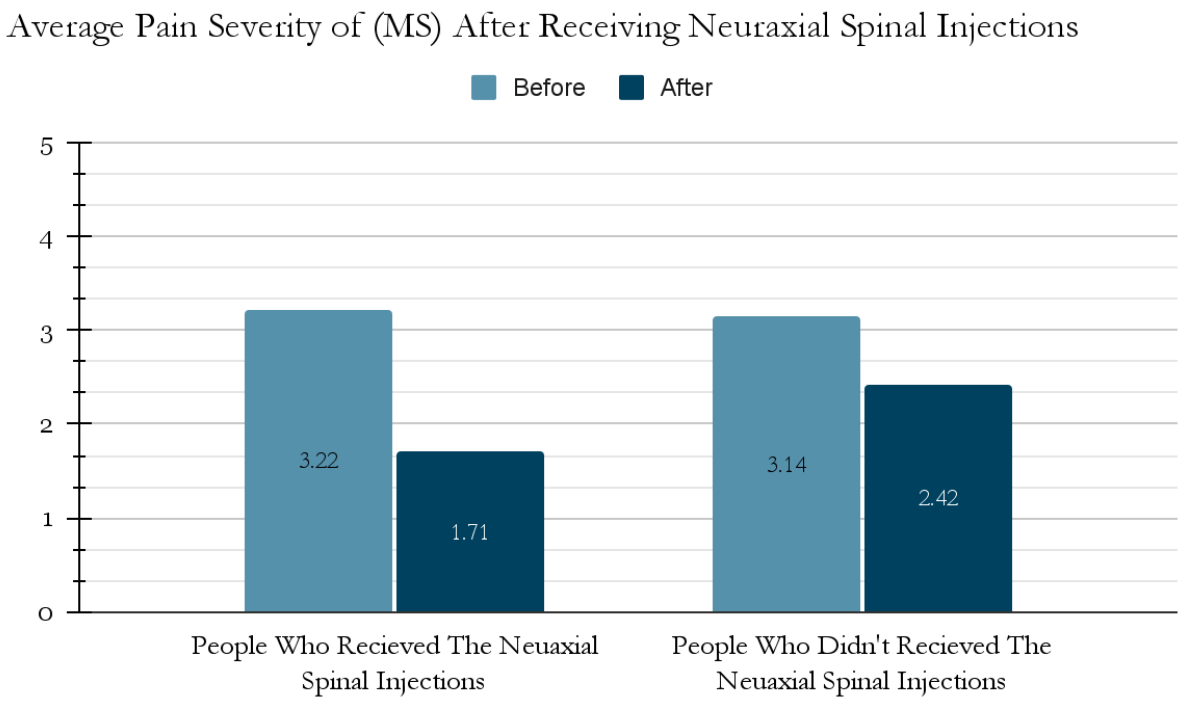

Figure 1. Analysis of Apparent (MS) Symptoms in Individuals Who Had the Injections and Who Didn't Before and After They Taken Such Medication.

In total, out of the 100 anonymous patients who were consistent with the experiment and data, 10 of the patient's descriptions did not explicitly state that they were prescribed or have been given

the neuraxial spinal injections. Furthermore, 13 of the individual patients stated that after being given the anesthetic treatment, it did not decrease the severity of the MS symptoms. When given the anesthetic treatment, the severity of the various symptoms decreases, thus giving us a lower number value of 1.71 for the after-bar when compared to the individuals who didn't receive the medication after-bar, as their value was 2.42. When comparing the two groups, one can see how the treatment had more of an effect on individuals who suffer from (MS) symptoms, as the metric value went down by 1.51, compared to the people who didn't receive the treatment only going down from 0.72 units.

	Treatment One (Control)		Treatment Two (Treatment)
N_1	10	N_2	90
df_1	N-1= 10-1=9	df_2	N-1= 90-1=89
M_1	-0.72	M_2	-1.51
SS_1	5.88	SS_2	54.46
s^2_1	$SS_1 I(N\text{-}1)$= 5.88/(10-1)= 0.65	s^2_2	$SS_1 I(N\text{-}1)$= 54.46/(90-1)= 0.61

T-value Calculation

$s^2p = ((df_1 I(df_1+df_2) x s^2_1) + ((df_2 I(df_2+df_2) x s^2_2) = ((9/98)x0.65)+((89/98)x0.61) = 0.62$

$s^2_{Mt} = s^2 \; I \; N_1 = 0.62/10 = 0.06$
$s^2_{M2} = s^2 \; I \; N_2 = 0.62/90 = 0.01$

$t = (M_1 - M_2) f \sqrt{(s^2_{M1}+s^2_{M2})} = 0.79/\sqrt{0.07} = 3.01$

Figure 1. T-value calculations confirming the significance of association with decrease of pain value for MS

After plugging in the numbers for the recommended T-test, those numbers being the numbers of

metric value for pain severity from (MS) after being given the injections being subtracted from the metric value for pain severity from (MS) before being given the injections., it gives us a t-vale of 3.00782, with a p-value of .001672. Thus, the t-tests state that the results are significant and that the difference is also significant. This supports that the use of such anesthetic treatment does have a beneficial effect on individuals who suffer from the illness of (MS)

Discussion

When performing such statistics and combing through the racial biases for the composed sampling, one would have to take into account that the sampling was based on a more minority majority, with African-Americans and Hispanic individuals comprising more of the sampling compared to White and Asian individuals. This is restated through the percentage of how many individuals are of each respected race in the provided sampling: with 42% being African-Americans, 32% being Hispanics, 17% composed of Asian individuals, and 9% composed of White individuals.

This might be representative more so of the individual county population instead of the whole national population, as the county in question, Bergen County in NJ, presented such medical records in due fashion for this research project. This is shown by how Bergen County consists of 31.7% White population, 10.4% Asian, 22.5% Black population, and 33.9% Hispanic population, whereas most individuals that are composed of having multiple sclerosis are the greater majority of being of the white race. This is indicative of common knowledge of how multiple sclerosis is shown to be present in about 4 in 1,000 white people, about 3 in 1,000 Black people, about 2 in 1,000 people of "other races," including Asians, Native Americans, Alaska natives, and multi-race individuals, and about 1.5 in 1,000 people of Hispanic/Latinx origin. In regard to this demographics, I would have expected to see

Conclusion

Based on the results, there is a significant difference in the symptoms between those who received the neuraxial injections and those who didn't. Thus, this supports the use of neuraxial spinal injections in patients who have the disease. This then encourages the additional implementation of this treatment in clinical practice as a way to aid people who have the illness. If more time is available, it would be interesting to see if this specific treatment would have any sort of effects, whether it would be beneficial or not, on similar illnesses of multiple sclerosis, such as fibromyalgia, vitamin B12 deficiency, muscular dystrophy (MD), etc. Further research on studies analyzing the effectiveness of neuraxial spinal injections on these additional diseases would better enhance the option of new treatments for individuals who suffer from such diseases. Regardless, people who suffer from such a terrible illness can be relieved to know that they can better transverse throughout life with this additional medical benefit.

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