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Osteopathic Manipulative Therapy on Cervicogenic Headache in Veterans with Mild Traumatic Brain Injury - A Case Series

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Abstract

Background: Headache is a significant problem often seen following traumatic brain injury (TBI) in U. S. military veterans. Cervicogenic headache, which originates from the soft tissues and bones of the neck, is a subtype of headache often associated with TBI.

Methods: In this case series of military veterans with a history of TBI at a Veterans Affairs Medical Center outpatient clinic, we examined the efficacy of Osteopathic Manipulative Therapy (OMT) in reducing the severity of pain associated with cervicogenic headache as measured on a 0-10 numeric pain rating scale. Secondary outcome measures include the percentage of patients who reported feelings of sadness and anxiousness, measures of neck range of motion pre-treatment and post-treatment, total score on the Pittsburgh Sleep Quality Index and incidence of adverse events.

Subjects: Patients included were at least eighteen years of age, had been previously diagnosed with mild traumatic brain injury and cervicogenic headache, had clinical symptoms and radiographic imaging study findings of cervical spine degeneration, had at least two OMT treatments for cervicogenic headaches and completed a follow up evaluation.

Results: In eight patients included in the case series, there were consistent reductions in headache pain as determined by a pain scale score after the treatments. There were statistically significant improvements in some measures of neck range of motion and a statistically significant reduction in anxiety after only one treatment. There was not a statistically significant improvement in sad mood or sleep, and one self-limited adverse event was reported.

Conclusion: Osteopathic Manipulative Therapy is an effective and safe technique in the treatment of cervicogenic headache in patients with mild traumatic brain injury.

Keywords: Osteopathic manipulative therapy; Traumatic brain injury; Military veterans; Headache; Physical medicine and rehabilitation; Pain management

Abbreviations: TBI: Traumatic Brain Injury; OMT: Osteopathic Manipulative Therapy; VAMC: Veterans Affairs Medical Center; PSQI: Pittsburgh Sleep Quality Index; PM&R: Physical Medicine and Rehabilitation; ROM: Range of Motion; AROM: Active range of Motion; PROM: Passive Range of Motion

Introduction

Headache is a significant problem in U. S. military veterans; in one observational study of 308 veterans returning from Iraq and Afghanistan, 40% had self-reported current headache [1]. In combat veterans, headaches are often seen following traumatic brain injury (TBI). In some reports up to 38% of veterans with moderate to severe TBI have been reported to develop acute post-traumatic headache [2].

Cervicogenic headache is pain that originates from the soft tissues and bones of the neck [3,4], and is often associated with the trauma encountered in TBI [5]. The prevalence of cervicogenic headache has been estimated at 0.4%-2.5% in the general population and up to 15-20% of patients with headache are thought to suffer from the cervicogenic subtype [6]. Cervicogenic headache is often triggered by neck movements or sustained postures and is frequently intermittent although can be continuous, and has features similar to migraine and tension-type headache, including nausea and sensitivity to light and sound [4,7] and as such, is often underdiagnosed and undertreated in combat veterans. Diagnosis is based on clinical, laboratory, or imaging evidence of a lesion within the cervical spine that is implicated as the source of the pain [4]. Most patients have restricted movement of the head and neck [8,9], and while the definitive pathophysiologic basis of the disorder has yet to be determined, hypomobility at the occipito-atlantal (OA), atlanto-axial (AA), and upper cervical zygopophyseal joints have been correlated with cervicogenic headache [7,10]. Pathologic changes originating in these areas can cause compression of the upper cervical spinal nerves as well as muscular and vascular structures and cause referred headache pain [6,10,11].

The effects of current treatments of cervicogenic headache are variable. Oral medications include analgesics such as non-steroidal anti-inflammatory agents, acetaminophen, and opioids, all of which could lead to rebound headaches from analgesic overuse. Abortive medications that are typically effective in migraine, such as triptans and ergot derivatives, are not helpful in the treatment of cervicogenic headache [8]. Tricyclic antidepressants and anti-epileptic drugs have been used in treatment of cervicogenic headache and migraine with variable results [8,12]. Cervical epidural steroid injections and occipital nerve blockade have been shown to provide relief in some patients [13,14], although results are typically short-lived [14] and efficacy is controversial. While surgeries have been performed on various cervical

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structures, no controlled studies support the use of any surgical management of this disorder [6].

Spinal manipulation therapies use techniques various techniques to relieve potential pain generators in the soft tissues and joints. Some commonly used techniques are myofascial release and soft tissue treatment which both involve increasing the extensibility of soft tissue structures by the application of manual pressure, and muscle energy, which involves the movement of muscles beyond a point of pathologic restriction with the use of coordinated isometric muscle contractions. Many studies exist with widely varied methodologies that show mixed results of various types of spinal manipulation on headache, and multiple review articles [6,11,15,16] group all physical manipulation used in studies as "Spinal Manipulation Therapy" or SMT. While the collective evidence suggests that these therapies are safe and helpful [6,16] there have been few studies to examine the safety and effectiveness of specific techniques used in Osteopathic Manipulative Therapy (OMT) in headache treatment despite its wide clinical use and acceptance by Osteopathic physicians and their patients.

OMT is commonly used for treatment of multiple types of headache in practice and anecdotally has good success. It involves the diagnosis and treatment of structural disorders and muscular dysfunction in the body to address various pain states and other illnesses. One early study using OMT in the treatment of headache showed a significant reduction in headache pain without significant adverse events [17]. Another found that patients receiving OMT for tension-type headaches had significantly fewer days per week with headache than those undergoing relaxation therapy, again without untoward side effects [18]. The use of OMT as an adjunctive therapy has also been associated with reduced medication usage after certain surgical procedures [19]. Little has been published, however, relating to the use and efficacy of Osteopathic manipulative therapy in treating veterans with cervicogenic headaches after mild TBI.

As a pilot for future research, we conducted a chart review examining the efficacy of OMT to reduce pain in veterans with cervicogenic headache after mild traumatic brain injury in one outpatient Physical Medicine and Rehabilitation (PM&R) clinic at the Atlanta Veterans Affairs Medical Center (VAMC).

Materials and Methods

Patients diagnosed with TBI at the Atlanta Veterans Affairs Medical Center are often referred from the TBI clinic to the Physical Medicine and Rehabilitation clinic for the evaluation and treatment of pain issues, including neck pain and cervicogenic headache, which is a common occurrence in the TBI population. Multiple treatment options are available for these patients, including OMT.

Chart review of TBI patients with cervicogenic headache who received OMT treatments from July 1, 2011 to December 30, 2011 was conducted to discern whether future investigations in this area are warranted.

Patient charts were reviewed if they were at least eighteen years of age and had been previously diagnosed with mild traumatic brain injury by a trained practitioner in the Atlanta VAMC TBI clinic. Patients are referred to TBI clinic by primary care providers for evaluation, which involves a thorough screening by history, physical examination, and in some cases, advanced brain imaging. Clinical diagnosis of TBI is based primarily on historical information. All carried a diagnosis of cervicogenic headache with clinical symptoms and radiographic imaging study findings of cervical spine degeneration. The patients had at least two OMT treatments for cervicogenic headaches over the course of two weeks and completed a follow up evaluation within on to two weeks following the initial treatment. The OMT treatments included identification of muscular dysfunction in the cervical region followed by myofascial release, soft tissue treatment, and muscle energy techniques directed at areas of dysfunction in all patients. Patients under the age of 18, those without headache or a diagnosis of traumatic brain injury and those with cephalgia other than cervicogenic headache were excluded.

Primary outcome measures

Includes headache pain score on a numeric pain scale from 0 to 10 pre-treatment, post-treatment and at follow-up, where 0 indicates the absence of pain, 5 indicates moderate pain severity, and 10 is the most severe pain imaginable.

Secondary outcome measures

Include the percentage of patients who reported feeling sad and anxious prior to treatment 1 and prior to treatment 2, active range of motion (AROM) and passive range of motion (PROM) measurements in bilateral rotation, flexion, extension and bilateral bending in the cervical field pre-treatment 1 and post-treatment 1, as well as pre-treatment 2 and post-treatment 2, and incidence of adverse events. Also included is the overall score on the Pittsburgh Sleep Quality Index (PSQI) survey as a sleep assessment.

One patient developed a headache several minutes after treatment and this was considered an adverse event secondary to the close temporal proximity to treatment in which the headache developed. The patient's pain resolved spontaneously several minutes after its onset and required no medical attention.

Statistical analysis

Due to small sample size, non-parametric two- sample analyses were performed. The Wilcoxon signed-rank test was used to assess statistically significant changes in pain rating scores, range of motion, and PSQI scores pre-treatment and post-treatment. A Likelihood Ratio Chi-Square Test was used to assess sadness pre-treatment and post-treatment.

Results

Thirty patient charts were examined, and all were patients who had been seen in both TBI clinic and the PM&R clinic for the treatment of headache. Twenty-two patients with TBI did not have two OMT treatment sessions, had insufficient documented diagnostic criteria for cervicogenic headache, or did not complete a follow-up evaluation and so were excluded from analysis. Eight patients met the inclusion criteria and were included in the analysis. Of the charts that were reviewed, OMT was performed by one Osteopathic physician (MS). The patients had no contraindications to therapy, including neck fractures, bony or ligamentous instability, known malignancy or disorders causing a predisposition for fractures or instability. In addition to a standard physical examination including a full musculoskeletal examination, somatic dysfunction and cervical range of motion in degrees were documented.

Age ranged from 25 to 62 years of age, with a median age of 40.5 and a standard deviation of 11.2. The study population was 38% female and 62% male, 75% Caucasian and 25% of the patients were identified as African American or other race.

The average pre-treatment pain score on a scale of 0 to 10 showed a borderline significant reduction after the first treatment. There was no

significant difference when comparing pain scores pre-and post- the second treatment (Table 1).

Because the PSQI evaluates sleep condition over a period of 4 weeks, PSQI scores were assessed at baseline prior to the first treatment and after the second treatment. There was no statistically significant difference between them (Table 1). When comparing the percentage of patients who reported sadness and anxiety prior to the first treatment with the percentage of patients who reported those feelings prior to the second treatment, there was a statistically significant reduction in anxiety and a reduction in sadness that was not statistically significant (Table 1).

Overall there were consistent improvements in range of motion, some of which were statistically significant (Table 2).

Discussion

There were consistent immediate decreases in reported pain scores that are clinically significant. The average pre-treatment pain score was 6.4 ± 3.0 and the immediate post-treatment score was 3.4 ± 2.8, p=0.047, and in practice a reduction of 3 points on a 0 to 10 pain scale is generally considered to be successful clinical improvement [20]. The pain scores prior to the second treatment (4.6 ± 2.9) were lower than those prior to the first treatment and again improved after the second treatment (2.9 ± 1.9). The lack of statistical significance among these measures could be related to the small sample size.

In addition, patients consistently had improvements in active and passive range of motion in multiple planes immediately following treatments. It is known that patients with cervicogenic headache often have impaired range of motion in the neck [7,9], up to 16 degrees less rotational motion to the side affected by pain than in controls [9]. While many of the improvements in our study led to a patient going from an initial abnormal range to a normal range, the pooled data for each plane did not show statistically significant results, which again could be limited by the small sample size.

In one study anxiety was reported in over 19% of patients with headache [21] and other studies have shown that depressed mood is strongly correlated with the presence of headache [22] and headache frequency [23]. In our present study there was a significant reduction in anxiety, as fewer patients reported feeling anxious between treatments. This could be related to the overall effect of the therapy on headache pain, and a significant indicator of clinical improvement. Such an effect was not observed for depressed mood in our study.

There were a very small number of patients with mild TBI in this particular clinic who were treated with OMT for their cervicogenic headache and even fewer completed a follow-up evaluation, and so the sample size was limited. This limitation was associated with clinic resources, and not with patient interest or ability to participate in the treatments. Additionally, chronic musculoskeletal problems often require several treatments within a short timeframe to achieve better, lasting improvements in pain and range of motion, and our patients

	Pre-Tr 1	Post-tr 1	p-value*	Pre-tr 2	Post-tr 2	p-value
Average pain score	6.40 (± 3.0)	3.40 (± 2.8)	*0.05*	4.60 (± 2.9)	2.90 (± 1.9)	0.06
Average PSQI score	14.80 (± 3.4)	-	-	-	15.80 (±1.6)	1.00
Sadness (%)	71.40	-	-	57.10	-	0.81
Anxiety (%)	100	-	-	52.7	-	*0.01*

*Significance level set at p=0.05. Pre-tr 1: Score prior to treatment 1 ,SD: Standard Deviation, Post-tr 1: Score after treatment 1, Pre-tr 2: Score prior to treatment 2, Post-tr 2: Score after treatment 2. PSQI: Pittsburgh Sleep Quality Index

Table 1: Comparison of pre-treatment and post-treatment pain scores.

	Pre-Tr 1	Post-tr 1	p-value*	Pre-tr 2	Post-tr 2	p-value
Average pain score	6.40 (± 3.0)	3.40 (± 2.8)	*0.05*	4.60 (± 2.9)	2.90 (± 1.9)	0.06
Average PSQI score	14.80 (± 3.4)	-	-	-	15.80 (± 1.6)	1.00
Sadness (%)	71.40	-	-	57.10	-	0.81
Anxiety (%)	100	-	-	52.7	-	*0.01*

*Significance level set at p=0.05. Pre-tr 1: Score prior to treatment 1 ,SD: Standard Deviation, Post-tr 1: Score after treatment 1, Pre-tr 2: Score prior to treatment 2, Post-tr 2: Score after treatment 2. PSQI: Pittsburgh Sleep Quality Index.

Table 2: Comparison of pre-treatment and post-treatment pain scores.

	Average AROM			Average PROM			Average AROM			Average PROM		
	Pre-tr 1 (SD)	Post-tr 1 (SD)	p*	Pre-tr 1 (SD)	Post-tr 1 (SD)	p	Pre-tr 2 (SD)	Post-tr 2 (SD)	p	Pre-tr 2 (SD)	Post-tr 2 (SD)	p
Flexion	46.3 (18.2)	51.3 (17.9)	0.063	48.1 (19.9)	53.1 (17.9)	0.13	47.9 (18.2)	54.3 (20.5)	*0.03*	49.3 (19.2)	53.6 (20.4)	0.13
Extension	44.4 (14.9)	48.8 (14.3)	0.063	46.3 (16.4)	50.6 (14.3)	0.13	47.1 (19.8)	54.3 (23.3)	*0.03*	48.6 (20.9)	54.3 (24.1)	*0.03*
Left lateral bending	24.4 (9.4)	30.0 (8.5)	0.063	26.9 (10.3)	31.9 (8.4)	0.13	28.6 (13.8)	58.6 (15.3)	0.13	29.3 (13.7)	36.4 (16.8)	0.06
Right lateral bending	24.4 (9.4)	30.6 (9.0)	*0.03*	26.9 (10.3)	32.5 (8.9)	0.06	34.3 (13.7)	37.9 (14.1)	0.13	34.3 (13.7)	39.3 (15.4)	0.13
Left rotation	60.6 (19.4)	66.9 (14.8)	0.063	63.8 (20.1)	67.5 (16.9)	0.25	52.9 (26.4)	35.0 (28.3)	0.25	52.9 (26.4)	57.1 (27.5)	0.13
Right rotation	61.3 (18.1)	68.1 (13.3)	*0.03*	64.4 (19.1)	68.8 (16.6)	0.13	51.4 (27.5)	57.1 (28.2)	0.13	51.4 (27.5)	55.7 (27.2)	0.06

(SD): standard deviation, P: p-value, *Significance level set at p=0.05. AROM: Active Range of Motion, PROM: Passive Range of Motion, Pre-tr 1: Measurement prior to treatment 1, Post-tr 1: Measurement after treatment 1, Pre-tr 2: Measurement prior to treatment 2, Post-tr 2: Measurement after treatment 2.

Table 3: Range of Motion before and after treatments.

might have benefitted from additional treatments. A prospective, randomized, placebo-controlled trial with a larger sample size will further test our hypotheses.

Conclusion

In our pilot study, Osteopathic Manipulative Therapy was shown to provide statistically significant improvements in cervicogenic headache among patients with mild traumatic brain injury and showed statistically significant improvements in some measures of active and passive cervical range of motion as well as a significant reduction in anxiety. This study suggests that its use could provide a safe and cost-effective adjunct or alternative to other widely-used treatments. Additional studies, including larger, randomized trials are warranted to further confirm the efficacy of the treatment and explore additional symptoms that could be improved with the treatment.

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