

# Whiplash Injuries: An Interventional Approach

**Type:** Review Article

**Received:** February 25, 2023

**Published:** February 28, 2023

**Citation:**

Bilal F Shanti., et al. "Whiplash Injuries: An Interventional Approach". PriMera Scientific Surgical Research and Practice 1.3 (2023): 32-36.

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## Abstract

Whiplash-associated disorders (WAD) occur when shifting of energy during a crash or collision, from acceleration-deceleration mechanism, is transferred to the neck region. WAD is characterized by excessive extension-flexion movements, and/or excessive side bending of the head and neck, beyond the normal and regular range of motion.

Motor vehicle collisions remain the majority of trauma responsible for WAD. Nevertheless, other causes include contact sports injuries, falls, physical and domestic abuse, and other types of traumas.

Clinical features and presentations are variable. In general, these includes neck pain, decreased range of motion at cervical spine, spasms and tightness, headaches, arm(s) numbness or pain, and other symptoms and signs depending on the extent of the insult. These range from fractures, joint dislocations, ligament tears, and even traumatic brain injuries/post-concussion syndrome, with its subsequent clinical sequelae.

The trauma associated with WAD outcome can result in acute and chronic pain syndromes, functionality limitations and restrictions, psychological and psychosocial ramifications, financial crisis, unemployment, and certain cases, prolonged disability. This causes a significant economic burden on any country.

This review manuscript will enumerate the latest in WAD approaches for interventional procedures. We base our review on relevant databases such as PubMed, Ovid-Medline, Embase, Web of Science, NIH website, Google Scholar, and the Cochrane Library. No Institutional Review Board permission was obtained since this manuscript does not directly involve animals or humans.

**Keywords:** Whiplash; whiplash-associated disorder; neck pain; chronic neck pain; motor vehicle collision; chronic pain syndrome; chronic pain; neck trauma

## Introduction

According to a study published in 2015, based on statistics for the year of 2010, the U.S. Department of Transportation, National Highway Traffic Safety Administration reports there were “32,999 people killed, 3.9 million were injured, and 24 million vehicles were damaged in motor vehicle crashes in the United States”. Studying the economic burden amounted to “\$242 billion...this represents the equivalent of nearly \$784 for each of the 308.7 million people living in the United States, and 1.6 percent of the \$14.96 trillion real U.S. Gross Domestic Product for 2010. These figures include both police-reported and unreported crashes” [1].

As an example, in the State of Arizona where the lead author resides, with a population of about 7.44 million and considered to be the 14<sup>th</sup> most populous in the United States [2], according to a study published in 2021 [3], there were a total of 121,345 motor vehicle crashes, of which 1063 were fatal, and associated with 35,203 injuries [3]. This represents 22.45% increase compared to the year of 2020 [3].

It is interesting to notate that in the early medical reports, whiplash injuries were referred to as ‘railway spine’ [4]. This term was used in the 19<sup>th</sup> century to describe the pain and other symptoms related to railway passengers and personnel reported following minor railway crashes [4].

In 1928, Harold Crowe was the first to use the term whiplash to describe 8 types of injuries to the neck associated with car collisions [5].

In 1955, it was reported that even motor vehicle collisions at the speed of 20km/hour can result in injuries to the head and neck and can cause symptoms [6].

### ***Interventional Pain Procedures for WAD***

This manuscript will only address the latest options we have in hand in interventional choices. We recommend individualizing treatment options depending on WAD cases. We recommend interventional pain procedures when “lower levels of care” have failed, or in conjunction with non-interventional options. These options include oral or injected medications, such as Tylenol (Acetaminophen, Paracetamol), a course of steroids, Anticonvulsants such as Gabapentin, physiotherapy, chiropractic care, myofascial release, massage, and muscle relaxants. The authors no longer promote the use of NSAIDs for acute phase linked to WAD given their serious side effects, and also since these were found to prolong the pain and even render it chronic in a monumental study published in 2022 [7]. We feel interventional procedures can be extremely beneficial when done in the right time and after appropriate patient and procedure selections. We believe these can be performed especially for patients with high risk of developing chronic pain syndrome following WAD.

### ***Myofascial Trigger Point Injections for Whiplash Injuries***

The authors recommend performing a series of 3-5 trigger point injections (TPI) in whiplash injury patients, regardless of time elapsed from initial insult. We found these are very useful in decreasing spasms and restoring range of motion, especially in the cervical spine posterior neck muscles. We suggest using plain sterile, bacteriostatic normal saline solution with or without local anesthetics, preferably small aliquots of 0.5% or 1% Lidocaine. In our modest experience, local anesthetics especially Bupivacaine (followed by Lidocaine) may cause some degree of dizziness, and other side effects, and may trigger vasovagal reactions. When successful, the relief is felt within seconds to minutes. It is best if TPI is followed by manual myofascial release of the spasms.

Diagnosis of trigger points depends on the accurate palpation with 2-4 kg/cm<sup>2</sup> of pressure for 10 to 20 seconds over the suspected trigger point to allow the referred pain pattern to develop [8].

In our experience, the idea behind the early use of TPI is to prevent, curb, and reverse the genesis of central sensitization. The latter is a chronic painful curse associated with significant chronic neuroplasticity along with complex psychological ramifications and disability.

A study [9] of patients with whiplash injuries suggest that myofascial trigger points served to “perpetuate lowered pain thresholds in uninjured tissues” [9]. It also added that the “lowered pain thresholds associated with central sensitization can be immediately reversed, even when associated with long standing chronic neck pain” [9]. It described an immediate increase in cervical spine ROM with average increase of 49% in flexion, 44% in extension, 47% and 28% in right and left lateral flexion respectively, and a 27% and 45% in right and left rotation, respectively [9].

A double-blind, cross-over study [10] studied the role of TPI in central sensitization related to whiplash injuries. Central sensitization with low peripheral pain thresholds is a fairly common finding in patients with chronic pain resulting from whiplash [10]. It has been suggested that TPI may act as modulators of central sensitization [10]. The study recruited 31 patients with chronic pain (trapezius myalgia) and central sensitization after whiplash and did sham comparison. It found that peripheral pain threshold was likely modulated by myofascial tender points in selected patients with central sensitization [10].

Another study [11] looked at the usefulness of sterile water or normal saline in trigger point injections in 40 patients after whiplash injuries. A maximum of three treatments were given during the first two months of the study and the patients were followed up for 8 months [11]. Neck pain and cervical spine mobility were monitored. After 3 months, the mean total mobility of the cervical spine increased by 39 degrees in the sterile water group versus 6 degrees in the saline group [11]. Three months later, 19 of 20 patients in the sterile water group assessed their condition has improved but only 6 in the saline group felt they improved [11].

### ***Interventional Pain Procedures for treatment of whiplash-related Neck Pain***

In general, this manuscript authors opine that interventional pain procedures should be reserved to cases where all “lower level of care” has been tried and exhausted and/or if the pain is becoming a debilitating daily burden even early on after the injury. We also promote using interventional procedures in select patient with high risk of development of chronic pain syndrome, such as chronic pain patients with pre-existing pain syndromes, chronic smokers or vapers, and those with a history of psychological/mental illness. These procedures must be performed by an experienced interventional pain clinician with skills not only to perform the procedure under fluoroscopy but also address any untoward potential complications or side effects.

For self-limited, non-radicular neck pain, which is fairly common after WAD, the authors recommend performing facet joint injections under fluoroscopy, with 3 levels on each side at a time, 2-3 weeks apart, rather than radiofrequency ablation (RFA). RFA is indicated after whiplash injuries once you establish relief from 2 diagnostic medial branch blocks [12]. It is also indicated for neck pain unrelated to whiplash injury [12]. It typically will last about 6-9 months before the pain starts to recur [12]. Another RFA will need to be done at that time without subsequent diagnostic blocks. The second and subsequent RFA will be performed under insurance rather than personal injury, in case of a collision, and it will be then the burden of health insurance to decline or approve the procedure.

We also recommend the use of Dexamethasone in these procedures since it is non-particulate, powderless, rapid onset, and is long-acting. It also lacks the sodium retentive properties of other steroids.

In a recent Korean study published in 2022 [13], this prospective study included 30 patients with chronic and persistent cervical facetogenic pain after whiplash trauma. Facet joint injections were carried out under fluoroscopy, and patients were followed up for pain relief at 1 and 2 months after the intervention. It was found that pain scores, in both follow-ups “were significantly decreased compared to pretreatment scores”. Furthermore, 26.7% patients reported pain relief of  $\geq 50\%$  2 months after the treatment [13]. It encouraged the use cervical facet joint injections as it as “a management option” for whiplash-related cervical facetogenic pain [13].

Kim et al [14] conducted a study on 20 patients after cervical facet joint injections for the treatment of cervical facetogenic pain related to WAD amongst other etiologies [14]. The study found there was “clear evidence why the intraarticular injections are superior to medial nerve blocks in case of presence of inflammation. Pain from nociceptive signals may result from a combination of inflammatory and mechanical joint stress, possibly in the presence of additional central sensitization” [14].

In a case series observational study [15], that recruited 118 patients, the researchers postulated the effectiveness of therapeutic intraarticular cervical zygapophyseal joint injections in atraumatic patients. They indicated facet joint injections should be considered as an alternative treatment before RFA [15].

When there is neck pain with true radicular pain after whiplash collision, cervical epidural injection under fluoroscopy is indicated. The outcome will depend on the mechanism of injury and the degree of pathology [16]. There is a recurrence of symptoms in up to one-third of patients with compressive cervical radiculopathy following initial treatment [17]. There is good evidence for cervical epidural injections for pain secondary to cervical disc herniation, central spinal stenosis, and neck pain after surgery [16, 18].

In a 2-year randomized follow-up, double-blind study, involving active control trial [19] of 120 patients with chronic function-limiting axial or discogenic pain, patients were managed with cervical epidural injections under fluoroscopy, with local anesthetic with or without steroids [19]. Results showed effectiveness in 71% of patients, with improvement in pain and functional status [19]. It also found that patients required an average of 6 procedures over 2 years period with a resultant average-relief for 72 weeks over a period of 2 years [19].

### ***Surgical Options for Whiplash Injuries***

In a minority of patients who fail to improve from chronic whiplash-related complaints, after trial of all options available on the table, there is finally an indication for surgery. Early surgical intervention may be indicated in case of motor weakness or severe disk pathology such as compressive extrusion with myelopathy. Surgeries on the neck can include anterior cervical discectomy, anterior cervical discectomy with fusion, anterior cervical corpectomy and fusion, and anterior cervical foraminotomy [20].

In one study [21], the most common indications for surgery were disabling headache and neck pain, in addition to radiographically verified disc protrusions [21]. In that study, at follow-up, 11 patients had reduced headache and neck pain, while paresthesia and radicular pain were diminished in 9 patients undergoing discectomy and anterior cervical fusion [21].

In an effort to study the clinical outcomes of early and delayed surgery in cervical spinal cord injury following whiplash in elderly Chinese patients [22], 46 patients aged 65-82 years, with spinal cord injury following whiplash injury were enrolled. Twenty-four patients underwent early surgery and twenty-two patients received delayed surgical intervention after conservative treatment failure. The study concluded that delayed surgery after unsuccessful conservative treatment provided “excellent clinical results for elderly patients”; but, prompt surgical intervention was necessary in case of neurological deterioration [22].

### **Conclusion**

Throughout the industrialized world, whiplash-associated disorder (WAD) represents a major public health problem, resulting in significant social, psychosocial, and economic costs an burden. We advocate the use of a multimodal interdisciplinary approach to take the issue of WAD. We also advocate the use of interventional pain procedures early on in cases of WAD, when a patient is identified as high risk for development of chronic pain related to WADS.

Further research is required to determine the role of best of interventional pain procedures for the treatment of WAD.

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