

# Assessment of musculoskeletal Pain Associated with Combat-Related lower limb injuries leading to foot and ankle disorders

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## Abstract

**Background:** Injury distributions showed that extremity injuries accounted for a higher percentage of all combat injuries. Extremity injuries were responsible for the greatest consumption of resources during the treatment period. Combat-related extremity injuries disabled 64% of those injured.

**Purpose:** The study aimed to assess musculoskeletal pain associated with combat-related lower limb injuries leading to foot and ankle disorders.

**Material and methods:** In this cross-sectional study, as a part of a larger health needs assessment study between 2014 and 2016, participants were interviewed face-to-face by trained assessors who then completed a questionnaire designed by experts based on their experiences with veterans' neuromusculoskeletal examinations during the first two decades after Iran-Iraq War. The relationship between pain and other characteristics was examined by chi-square test. Mann-Whitney test was used to compare different groups in this study ( $P < 0.05$ ).

**Results:** 809 veterans were assessed, 95.1% (N=776) of them stated pain at least in one anatomical location. Lower limb pain was 91.6% (N=741) including knee pain 71.1% (N=575), hip pain 42% (N=340) and ankle pain 72.9% (N=590). 66.6% of the participants reported low back pain, while 37.2% complained of upper limb pain.

**Conclusion:** The results of this study showed the development of significant pain in this group.

**Keywords:** Musculoskeletal Pain, Foot and Ankle Disorders, Combat-Related Lower Limb Injuries

**Conflict of interest:** The authors have no conflicts of interest to disclose.

## Introduction

The war imposed on Iran by Iraq in 1980 resulted in the deaths and injuries of many military and non-military people. It is estimated that about five hundred and sixty-four thousand Iranians were injured in the eight-year-long war, corresponding to a rate of 70% of the Iranian population.<sup>1</sup> Injury distributions showed that extremity injuries accounted for a higher percentage of all combat injuries.<sup>2,3</sup> Extremity injuries were responsible for the most significant resource consumption during the treatment period. Combat-related extremity injuries disabled 64% of those injured.<sup>4</sup> Nearly one hundred thousand veterans suffer lower-extremity injuries, more than ten thousand of whom have ankle-foot injuries.<sup>1</sup> In the past 30 years, these thousands of Iranian veterans have lived with chronic disability and faced

medical, social and psychological challenges in their day-to-day living.

Helping the injured people is one of the leading health challenges in a country, and in people with a disability population, pain is a prevalent problem.<sup>5</sup> Musculoskeletal pain caused by battlefield injuries to bones and soft tissues is common among veterans.<sup>6</sup> A systematic review showed veterans of the Persian Gulf War of 1991 reported a higher proportion of pain symptoms than other military groups.<sup>7</sup> Chronic pain is associated with veterans' decreased quality of life, impairment in daily functioning and increased mortality, especially when those affected cannot be active.<sup>8</sup> The causes of pain among veterans with polytrauma include heterotypic ossification, complex regional pain syndrome, myofascial damage, peripheral nerve or plexus injury (neuropathic pain)

and emotional stress.<sup>9</sup> Each cause might require a somewhat different and multidisciplinary approach to treatment such as cognitive-behavioural and physical activation interventions.<sup>10, 11</sup> Results of one study illustrate that the quality of life of veterans with ankle-foot injuries was significantly lower than that of the average Iranian population, and of veterans with bilateral lower limb amputation all the investigated dimensions (lowest score was observed in the bodily pain scale).<sup>12</sup>

Dealing with war-related foot and ankle injuries is challenging, and many individuals have a long life ahead of them and need to maintain an active lifestyle. Many of these veterans sustained additional injuries to other body regions and sequential polytrauma related injuries and complications. It is essential to understand musculoskeletal pain after years of war-related lower limb orthopaedic injuries that necessarily did not result from direct exposure to combat. In the years following the end of the war, many rehabilitation services, including orthotics and prosthetics devices, physical therapies and drug therapies, have been employed to alleviate pain and unwanted secondary effects and promote quality of life. Identification of pain may affect these services. The present study sought to describe the pain of combat-related musculoskeletal lower limb injuries.

### Method

In this cross-sectional study, as a part of a larger health needs assessment study between 2014 and 2016, musculoskeletal pain was assessed in veterans who suffered lower limb injuries with consequences of foot and ankle disorders, such as lower length discrepancy, drop foot, malunion fracture, toe deformity or amputation. The Human Ethics Committee of Janbazan Medical and Engineering Research Center (JMERC) approved that the present study was designed according to Helsinki. The Declaration of Helsinki is a document issued by the World Medical Association that provides ethical guidelines for research involving human beings.<sup>13</sup> The data related to veterans with lower limb injuries were provided by the Veterans and Martyr Affairs Foundation (VMAF). Demographic information included age, gender, education level, employment and other injuries other than ankle-foot trauma. Participants were selected based on three main criteria: at least six months had passed since the veteran's lower limb injury; the veteran was aged between 40 to 80 and suffered from war-related lower limb injuries with foot and ankle disorders. Veterans with a transtibial or a more proximal level of amputation were excluded from the study.

This health needs assessment study was undertaken by JMERC, with a scientific team that included general practitioners, internists, orthopaedists, prosthetic and orthotic specialists, physical therapists and psychologists. Trained experts were responsible for collecting demographic data. To assess pain, participants were interviewed face-to-face by trained assessors who then completed a questionnaire designed by experts based on their experiences with veterans' neuromusculoskeletal examinations during the first two decades after Iran-Iraq War. Pain was first classified by its location (the part of the body where the pain was felt). Since pain sometimes motivates veterans to seek care, the participants were then asked to respond to the question, 'Have you experienced consultation with a doctor, hospitalisation and surgery?' using one of two options of 'No' or 'Yes'. The participants then were asked about the intensity of pain in the past four weeks and the consequent interference of their daily activities. Pain intensity was determined by asking the participants to answer the question, 'How much body pain have you had during the past four weeks?' choosing one of six options of 'very severe', 'severe', 'moderate', 'mild', 'very mild' or 'none'. They also answered the question, 'During the past four weeks, to what extent did pain interfere with your daily activities (including both work outside the home and housework)?' using one of six options of 'very severe', 'severe', 'moderate', 'mild', 'very mild' or 'none'. The reliability of the questionnaire was at a good level since Cronbach's alpha was 0.8 in this study.

Statistical analysis was performed using SPSS 22 (The Statistical Package for the Social Sciences 22.0). Quantitative variables were reported as the mean  $\pm$  standard error, and qualitative variables were presented as frequency and percentage. The relationship between some characteristics and pain was examined by chi-square test. Mann-Whitney test was used to compare different groups in this study. *P* values <0.05 were considered significant.

### Results

The majority of 809 veterans evaluated in this study were male (97.4%, *N*=787) and married (98.4%, *N*=885). 43.7% of them belonged to the age group of 40 to 50 years (*N*=353). Mean age of the veterans was 52.4 years  $\pm$  6.7 years. In the current investigation mean age at the time of injury was 22.6 $\pm$ 6.7 years, and mean age after the combat-related injury was 27.7 $\pm$  4years. Table 1 gives more details about demographic characteristics.

**Table 1. Demographic characteristics of combat- related lower limb injured veterans (N=809)**

Demographic characteristics		Frequency	Percent
<b>Age Group</b>	40-50 years	353	43.7%
	51-60 years	347	42.9%
	61-70 years	87	10.7%
	71 years and more	22	2.7%
<b>Education level</b>	Illiterate	73	9%
	Under high school diploma	380	46.9%
	High school diploma	210	26%
	University education	146	18.1%
<b>Job status</b>	Employed	219	27.1%
	Unemployed	590	72.9%

The causes of lower limb injury were 48.1% (N=389) shrapnel shell, 14.8% (N=119) landmine and 26.4% (N=213) bullet. Most of the participants had more than one cause for their injuries. Two hundred and seventy-four (33.9%) of the veterans were injured in the right leg, 37.9% (N=307) in the left leg, and 28.2% (N=228) in both lower limbs. Other physical injuries (associated combat-related injuries) were head (17.6%, N=142), face (10.5%, N=85), chest (9.3%, N=75), abdominal (14.5% N=117), spine (18.8%, N=152) and upper limb (26.8%, N=216).

Seven hundred and seventy-six (95.1%) of the veterans stated pain at least in one musculoskeletal locale. Lower limb pain was 91.6% (N=741) and included 71.1% (N=575) knee pain, 42% (N=340) hip pain and 72.9% (N=590) ankle pain. Low back pain was one of the most common complaints, with a prevalence of 66.6%. The prevalence of upper limb pain was 37.2%. Pain distribution on lower limb, spine and upper limb was expressed based on consultation with a doctor, hospitalisation and surgeries (see Table 2).

**Table 2. Anatomic Location of pain sensation in lower limb**

	Pain leading to consultation with a doctor		Pain leading to Hospitalization		Pain leading to surgery	
	Frequency	Percent (%)	Frequency	Percent (%)	Frequency	Percent (%)
Right hip	212	26.2	51	6.3	44	5.4
Right knee	415	51.3	89	11	79	9.8
Right ankle	362	44.7	126	15.6	110	13.6
Left hip	221	27.3	60	7.4	52	6.4
Left knee	422	52.2	108	13.3	97	12
Left ankle	376	46.5	124	15.3	113	14
Cervical spine	312	38.6	22	2.7	16	2
Thoracic spine	99	12.2	15	1.9	11	1.4
Low back	539	66.6	68	8.4	51	6.3
Right shoulder	172	21.3	10	1.2	7	0.9
Right elbow	86	10.6	14	1.7	13	1.6
Right wrist and Hand	120	14.8	21	2.6	18	2.2
left shoulder	150	18.5	12	1.5	8	1
Left elbow	91	11.2	11	1.4	7	0.9
Left wrist and Hand	130	16.1	22	2.7	17	2.1

One hundred and fourteen (41.6%, N=114) of right leg injured veterans stated pain in the left leg, 68% (N=209) left ankle pain, 64.4% (N=198) left knee. One hundred and thirty-five (43.9%) of left leg injured veterans had pain in the right leg, 69.3% (N=190) right ankle pain and 58.4% (N=160) right knee (ipsilateral leg injuries). The results of a chi-square test showed that contralateral knee pain was 33.5% (N=103) in the group with left leg injuries and 36.1% (N=99) in the group with right leg injuries. The highest knee pain in veterans with bilateral limb injuries was 63.5% (N=145). Contralateral ankle pain was 14.3% (N=44) and 14.2% (N=39) in the group with left and right injuries, respectively. Ankle pain in bilateral limb injuries group was 56.1% (N=128).

To report their physical pain intensity, 14.7% (N=119) of the participants selected very severe, 40% (N=324) severe, 26.7% (N=216) moderate, 13.8% (N=112) mild, 2.5% (N=20) very mild and 2.2% (N=18) none. For the extent of the interference of their physical pain with their daily activities 11.1% (N=90) stated very severe, 35% (N=284) severe, 30% (N=243) moderate, 14.8% (N=120) mild, 5.6% (N=46) very mild and 3.4% (N=26) none. There was not a significant association between the age and lower limb pain ( $\chi^2(37) = 40.4, p = .32$ ). Also, there was similar result for time after injuries ( $\chi^2(1) = 25.6, p = 0.64$ ).

## Discussion

There are many reasons for war injuries. An assessment stated that 77% of those injured in war sustained at least one orthopaedic combat injury.<sup>14</sup> Extremity injuries also lead to frequent hospitalisations and a significant burden.<sup>3</sup> A study indicated 2313 persons were injured by landmines and unexploded ordnance between 1988 and 2003 in Iran.<sup>15</sup> Explosive devices, landmines, shrapnel and other blast phenomena are also responsible for 65% of Iraq and Afghanistan combat injury cases.<sup>16</sup> In this study, most of the participants had more than one cause for their injuries. Nearly half of the injuries to lower limbs were caused by shrapnel shell.

Pain is a major health problem among people with combat-related injuries.<sup>17</sup> Most veterans with traumatic lower limb injuries successfully survive but are exposed to long-term defects in their lower extremities.<sup>17, 18</sup> Most of the existing articles focus on lower-extremity amputations.<sup>19, 20</sup> A study in Veterans Health Administration showed that painful musculoskeletal conditions increase annually.<sup>21</sup> The present study observed that the prevalence of pain was high for lower limb and spine. These results are consistent with an article that stated musculoskeletal

injuries related to military service might contribute to the long-term risk of chronic pain conditions such as osteoarthritis.<sup>22</sup>

According to our results, the highest prevalence of pain knee is 64.4% ipsilateral and 36.1% contralateral. Although observed pain in the knee of the intact limb was common, ipsilateral knee pain was higher based on the findings of this research. It seems stresses on the contralateral limb may contribute to secondary pain and disability. Studies of lower-extremity amputation showed that the experience of chronic pain after amputation is complex and multidimensional and is not limited to the amputated limb.<sup>23, 24</sup> In fact, 63% of transfemoral and 41% of transtibial amputees exhibited degenerative changes of the knee of the intact limb.<sup>25</sup> The prevalence of knee pain was 28% in veterans with high-level lower-extremity amputations.<sup>26</sup> Veterans with amputation of the foot and ankle indicated 33.3% contralateral knee pain and 14.8% ipsilateral knee pain.<sup>27</sup> The prevalence of knee pain in veterans with unilateral below-knee amputation was 54.7%.<sup>28</sup> Compensatory mechanisms may be responsible for reduced pain in the amputated knee compared with the pain in the healthy knee.<sup>29</sup> Also, it was confirmed by a study that paying attention to physical comorbidities could be necessary to pain incidence.<sup>30</sup>

Low back pain comprises the highest percentage among other pains. 66.6% of the participants reported back pain in the present study. This is considerably higher than the prevalence of back pain observed in the general population, which was shown in the studies to be in the range of 1.5% to 36%.<sup>31</sup> In addition, the participants' low back pain was higher than foot and ankle amputees, with 44.4% low back pain.<sup>27</sup> The prevalence of low back pain in veterans with unilateral below-knee amputation was 78.1%.<sup>28</sup> There was low back pain in 80% of veterans with high-level lower-extremity amputations.<sup>26</sup> Some physical and functional measures related to low back pain, such as catastrophising, depression, anxiety, work-related and biomechanical factors such as movement and muscle asymmetries.<sup>32, 33</sup> may affect our study and lower-extremity injuries are probably not the only causes of back pain. According to a study, low back pain and knee pain were ranked second and fourth in musculoskeletal injury, respectively.<sup>17</sup> In this study, ankle pain (72.9%) and knee pain (71.1%) were the top pains in the ranking. Given that all veterans were associated with combat-related lower limb injuries leading to foot and ankle disorders, these results are acceptable. In addition to injuries, gait abnormalities and joint loading over time may lead to joint pain and degeneration.<sup>34, 35</sup>

A percentage of the participants (81.4%) reported that their physical pain intensity was moderate or higher, and in 76%, pain had interfered with their daily activities. Therefore, paying attention to the cause of pain and its treatment is essential. Several population-based studies have also shown that pain is associated with clinically significant decrements in performance-based measures of physical capacity such as gait speed, overall lower-extremity function and greater symptoms of depression, fatigue and insomnia.<sup>36-39</sup> In addition, pain is a condition that includes a series of beliefs, behaviours and functional disabilities, all of which interplay to create personal meanings of pain.<sup>39-41</sup> Chronic pain is a widespread cause of disability in people with musculoskeletal disorders.<sup>42, 43</sup> However, the aetiology of chronic pain is not acknowledged absolutely,<sup>44</sup> and investigations have shown that psychological factors may have an important role.<sup>45</sup>

This study showed that these veterans suffer from chronic pain despite medical advances. Therefore, more profound studies with a comprehensive approach to treatment and rehabilitation of chronic pain are necessary.

### Conclusion

Pain is a common problem among persons with war-related foot and ankle injuries. Pain can limit and deteriorate different aspects of life, including functionality, physical activity, professional performance and psychological status. We believe that

future research is needed to assess musculoskeletal pain associated with combat-related lower limb injuries leading to foot and ankle disorders more comprehensively, more accurately.

### Ethics

The ethics committee of Janbazan Medical and Engineering Research Center (JMERC), Tehran, I.R. Iran, approved this study. The informed consent forms were also filled and signed by all subjects participating in the study.

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