# PREVALENCE RATE OF NEUROPATHY DUE TO PELVIC AND ACETABULUM FRACTURES AND RELATION BETWEEN DIFFERENT TYPES OF NEUROPATHY AND TYPES OF FRACTURES

**Ali Moazamipour[1], Mohammad Nabi Bahrami[2], Mortaza Rezaie[2]**

[1] Assistant professor of orthopedic surgery, Qom university of medical science, Qom, Iran

[2] Assistance professor of orthopedic, Hormozgan university of medical science, Bandar Abbas, Iran

**Correspond**

Ali Moazamipour, MD, Orthopedic surgery

Assistant professor of orthopedic surgery, Qom university of medical science, Qom, Iran

Orcid ID: 0000-0002-0642-4651

## Abstract

Background: Pelvic ring and acetabular fractures are one of the most serious events in multiple trauma patients, and nerve injury is one of the most annoying complications of these fractures. This study aimed to investigate neuropathies caused by initial trauma rather than iatrogenic cases.

Methods: Between 2013 and 2016, 50 patients suffering from multiple traumas with different types of pelvic ring or acetabular fractures were investigated for neuropathy and also different types of this disorder and the association between types of fracture and neuropathy.

Result: Neuropathy due to pelvic and acetabulum fractures was seen in 30 patients (60%). The involved side was right, left, and both in 43.3%, 43.3%, and 13.3%, respectively. The injured nerve was sciatic, lumbosacral plexus, and peroneal in 66.7%, 26.7%, and 6.7%, respectively. The injury was chronic, motor, and other types in 32%, 44%, and 24%, respectively. The fractures occurred in the posterior wall, APC, transverse and posterior walls, LC1, both columns, and other sites at 30%, 16%, 14%, 14%, 10%, and 16%. There was a relationship between the side of injury and the injured nerve (P=0.001), with left-sided injuries primarily associated with sciatica, whereas bilateral injuries involved the lumbosacral plexus. There was a correlation between the fracture location and the type of injury, with posterior wall injuries and fractures of both columns only affecting the sciatic nerve (P=0.006). Also, there was a significant association between fracture location and injury type (P=0.046).

Conclusion: According to the results, nearly two-thirds of pelvic and acetabular fracture cases may develop neuropathy related to the type of fractures and contributing mechanism of injury. This matter would be essential in reducing neuropathy in pelvic and acetabular fracture patients.

**Keywords:** Neuropathy, Fractures, Pelvic, and Acetabulum

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## Introduction

Multiple trauma patients, including those injured during vehicle accidents, fall-downs, or other high-energy mechanisms, have more complicated fractures like the pelvic ring, acetabular fractures, and spine, joint or nerve injuries (1,2). The nerve injuries may be isolated or the result of an initial fracture or surgical intervention (3). Hematoma, traction, compression, and penetration are the most mechanisms of neuropathy, dependent on the anatomic location of the injury, severity and chronicity of injury, patient comorbidity, and age (4). Lumbar, lumbosacral and sacral plexuses are more injured (5). Common nerve injuries associated with acetabular fractures involve the obturator, femoral, and lateral femoral cutaneous nerves on the anterior and the sciatic nerve on the posterior aspect of the hip (6–8).

Neuropathies have both short- and long-term complications (9). regular imaging methods like plain X-rays or CT images are not diagnostic; MRIs can only detect muscle atrophy due to neuropathy, and only EMG-NCV can detect nerve injury associated with pelvic or acetabular fractures (10,11). Symptoms range from sensory loss to motor dysfunction, like foot drop due to peroneal nerve injury and erectile or other pelvic floor dysfunctions (12–15). Previous retrospective studies found that patients with the posterior wall, posterior column and posterior wall, and transverse + posterior wall fractures are more likely to have nerve injuries at the hospital (16,17). Since high-quality data about the risk of traumatic and iatrogenic nerve lesions and epidemiology of these disorders for different types of fracture and the utilized surgical approaches are scarce, this study was carried out to determine the prevalence rate of neuropathy due to pelvic and acetabulum fractures and the relation between different types of neuropathy and types of fractures (18, 19).

## Method

In this cross-sectional study, between 2015 and 2017, multiple trauma patients with pelvic ring or acetabulum fractures were transferred to our University Hospital and admitted to the orthopedic reconstruction service and prepared for surgery. They included 38 men and 12 women with a mean age of 58 years (range, 10–90) at injuries. The type of injury was assessed according to the AO-Orthopedic Trauma Association (AO-OTA) classification system. Some patients had associated injuries like limb fractures, head trauma, or others. In this study, we included patients eligible for surgery who had no contraindications for surgery. We diagnosed associated nerve injuries with EMG-NCV of the pelvic and both lower limbs, all in one electromyography center.

Data analysis was performed among 50 subjects by SPSS (version 13.0) software [Statistical Procedures for Social Sciences; Chicago, Illinois, USA]. Chi-Square, Independent-Sample-T, and ANOVA tests were used and were considered statistically significant at P values less than 0.05.

## Result

The mean age was 36.4 ± 11.1 years. Neuropathy due to pelvic and acetabulum fractures was seen in 30 patients (60%). The involved side was right, left, and both in 43.3%, 43.3%, and 13.3%, respectively. The injured nerve was sciatic, lumbosacral plexus, and peroneal in 66.7%, 26.7%, and 6.7%, respectively. The injury was chronic, motor, and other types in 32%, 44%, and 24%, respectively. The fracture location was poster wall, APC, transverse + posterior wall, LC1, both columns, and other sites in 30%, 16%, 14%, 14%, 10%, and 16%, respectively. Gender was not related to the injured nerve (P=0.732), but it was related to injury type (P=0.006), and in female patients, only chronic subtypes were present.

Also, as shown in Table 2, there was a relationship between the side of injury and the injured nerve (P=0.001), with left-sided injuries primarily associated with sciatica, whereas bilateral injuries involved the lumbosacral plexus. However, the side of the injury did not influence the type of injury (P=0.093). As demonstrated in Table 3, the fracture location was related to the type of injury and posterior wall injuries, and those with both columns fracture were only affecting the sciatic nerve (P=0.006). Also, as shown in Table 4, there was a significant association between fracture location and injury type (P=0.046). Age was not related to the type of injury (P=0.927) and fracture location (P=0.759). However, it was related to the involved nerve, and injuries to the lumbosacral plexus were associated with older participants (P=0.001).

## Discussion

The current economic development in developing countries such as Iran has brought about an associated increase in acetabular and pelvic fractures associated with car use and industrialization (20, 21). The decline in trauma cases in developed countries has decreased such problems, but these are yet important issues in developing countries (22). In this study, it was found that nearly two-thirds of patients with acetabular fractures had neuropathy due to pelvic and acetabulum fractures, and there was a significant relationship between different types of neuropathy and types of fractures (23). As shown by Krom et al., chronic pain and disability after pelvic and acetabular fractures are common and would result in some decrease in quality of life and health-related life dimensions (24). As reported by Simske et al., sciatic nerve injuries are mainly associated with acetabular fractures and may be due to initial trauma in patients or because of injury at the time of surgical reconstruction (25). Patients may be attending with a broad range of symptoms, from radiculopathy to foot drop, as seen in our study.

Similar to the study by Ahn et al., it was seen in our study that lumbosacral neuropathy is a rare clinical complication that results in a potentially severe neurological deficit (26). The clinical presentation of lumbosacral plexopathy includes sensory and motor deficits, as seen in our study. Fractures of the acetabulum and the pelvis would result in one in five patients losing employment, as reported by Nusser et al., consistent with our findings showing one out of three patients with nerve injury (27). Similarly, Mauffrey et al. in China and the United States reported that posterior wall fractures are our population's most common fracture type (28).

Mesbahi et al. reported that iatrogenic nerve injuries, including sciatic nerve, are possible complications during acetabular surgery and showed that the overall incidence of sciatic nerve palsy was 5.1%, with no other nerve injuries (29). However, in our study, there were lumbosacral plexus and peroneal nerve injuries in one-third of cases with neuropathy. In unstable pelvic and acetabular fractures, the rate of nerve injury would be higher, and further caution is required (30,31). The studies by Lehmann et al. demonstrated that four percent of patients had nerve injuries at hospital admission, and seven percent had nerve injuries upon discharge. The patients with the posterior wall, posterior column and posterior wall, and transverse + posterior wall fractures were more likely to have nerve injuries at hospital discharge (32). We also observed this in our study and found that the fracture location was related to the type of injury, and posterior wall injuries and those with both columns fracture only affected the sciatic nerve. However, Wuellner et al. reported that pelvic and acetabular fractures might result in sciatic nerve injury with a poor prognosis. Open reduction and internal fixation combined with nerve exploration and neurolysis should be carried out as early as possible for severe sciatic pain (33). This matter is also important in our patients due to the higher rate of sciatic nerve injury. However, further precautions would not affect the prognosis, and the use of intraoperative monitoring would not decrease the rate of sciatic palsy as shown by Haidukewych et al, (34); it may be deceased in fracture-related cases by attention to the points found in our study such as type of fracture and related mechanism of injury.

According to the results, nearly two-thirds of pelvic and acetabular fracture cases may develop neuropathy related to the type of fractures and contributing mechanism of injury. This matter would be essential in reducing neuropathy in pelvic and acetabular fracture patients. However, further studies with larger sample sizes and multi-center sampling would be required to attain more definite results with higher generalization potency.

## Ethics approval and consent to participate

Compliance with ethical guidelines

## Consent for publication

Not applicable.

## Availability of data and material

The datasets generated and/or analyzed during the current study are not publicly available due to the fact that it belongs to a hospital database, and its public availability could compromise the confidentiality of participants and other patients registered in the database. However, this data can be made available from the corresponding author on reasonably serious request.

## Competing interests

The authors declare that they have no competing interests.

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**Authors' contributions**

All three authors were involved in the design and formulation of the argument.

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None

**Conflicts of Interest**

The authors declare no potential conflicts of interest.

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## Tables

**Table 1- Type of injury according to gender**

**Crosstab**

| | | | Injured Mechanism | | | Total |
|---|---|---|---|---|---|---|
| | | | Chronic | Motor | Others | |
| Gender | Male | Count | 4 | 11 | 6 | 21 |
| | | % within Gender | 19.0% | 52.4% | 28.6% | 100.0% |
| | Female | Count | 4 | 0 | 0 | 4 |
| | | % within Gender | 100.0% | .0% | .0% | 100.0% |
| Total | | Count | 8 | 11 | 6 | 25 |
| | | % within Gender | 32.0% | 44.0% | 24.0% | 100.0% |

**Table 2- Injured nerve according to side of injury**

**Crosstab**

| | | | Injured Nerve | | | Total |
|---|---|---|---|---|---|---|
| | | | Sciatic | Lumbosucral Plexus | Peroneal | |
| Involved Side | Right | Count | 7 | 4 | 2 | 13 |
| | | % within Involved Side | 53.8% | 30.8% | 15.4% | 100.0% |
| | Left | Count | 13 | 0 | 0 | 13 |
| | | % within Involved Side | 100.0% | .0% | .0% | 100.0% |
| | Both | Count | 0 | 4 | 0 | 4 |
| | | % within Involved Side | .0% | 100.0% | .0% | 100.0% |
| Total | | Count | 20 | 8 | 2 | 30 |
| | | % within Involved Side | 66.7% | 26.7% | 6.7% | 100.0% |

**Table 3- Injured nerve according to fracture location**

**Crosstab**

| | | | Injured Nerve | | | Total |
|---|---|---|---|---|---|---|
| | | | Sciatic | Lumbosucral Plexus | Peroneal | |
| Fracture Location | Post. Wall | Count | 4 | 0 | 0 | 4 |
| | | % within Fracture Location | 100.0% | .0% | .0% | 100.0% |
| | APC | Count | 4 | 2 | 0 | 6 |
| | | % within Fracture Location | 66.7% | 33.3% | .0% | 100.0% |
| | Transverse+Post. Wall | Count | 3 | 2 | 0 | 5 |
| | | % within Fracture Location | 60.0% | 40.0% | .0% | 100.0% |
| | LC1 | Count | 0 | 4 | 0 | 4 |
| | | % within Fracture Location | .0% | 100.0% | .0% | 100.0% |
| | Both Columns | Count | 5 | 0 | 0 | 5 |
| | | % within Fracture Location | 100.0% | .0% | .0% | 100.0% |
| | Others | Count | 4 | 0 | 2 | 6 |
| | | % within Fracture Location | 66.7% | .0% | 33.3% | 100.0% |
| Total | | Count | 20 | 8 | 2 | 30 |
| | | % within Fracture Location | 66.7% | 26.7% | 6.7% | 100.0% |

## Table 4- Injury type according to fracture location

**Crosstab**

| | | | Injured Mechanism | | | Total |
|---|---|---|---|---|---|---|
| | | | Chronic | Motor | Others | |
| Fracture Location | Post. Wall | Count | 4 | 2 | 0 | 6 |
| | | % within Fracture Location | 66.7% | 33.3% | .0% | 100.0% |
| | APC | Count | 0 | 0 | 2 | 2 |
| | | % within Fracture Location | .0% | .0% | 100.0% | 100.0% |
| | Transverse+Post. Wall | Count | 2 | 1 | 2 | 5 |
| | | % within Fracture Location | 40.0% | 20.0% | 40.0% | 100.0% |
| | LC1 | Count | 0 | 2 | 0 | 2 |
| | | % within Fracture Location | .0% | 100.0% | .0% | 100.0% |
| | Both Columns | Count | 0 | 2 | 2 | 4 |
| | | % within Fracture Location | .0% | 50.0% | 50.0% | 100.0% |
| | Others | Count | 2 | 4 | 0 | 6 |
| | | % within Fracture Location | 33.3% | 66.7% | .0% | 100.0% |
| Total | | Count | 8 | 11 | 6 | 25 |
| | | % within Fracture Location | 32.0% | 44.0% | 24.0% | 100.0% |

## Table 5- Injured nerve according to age

**Report**

Age

| Injured Nerve | Mean | Std. Deviation |
|---|---|---|
| Sciatic | 33.15 | 9.422 |
| Lumbosucral Plexus | 47.75 | 3.694 |
| Peroneal | 31.50 | .707 |
| Total | 36.93 | 10.279 |