P-87

Clinical characteristics of traumatic ankle fractures accompanied by nerve injuries in Korean soldiers

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Background

- **Ankle fractures** are common as 9% of fractures presented in trauma center, and the **2nd most frequent fractures** in Korean military population.
- Most patients with an ankle fracture undergo surgery for open or closed reduction and internal fixation (ORIF or CRIF), followed by several months of rehabilitation.
- Some of these patients have suffered **traumatic nerve injuries**, which may lead to longer rehabilitation periods and permanent disability.

Objective

- The aim of this study is to **determine the proportion of ankle fractures accompanied by nerve injuries** and **describe their clinical characteristics** in Korean soldiers.

Methods

- **Study design:** Retrospective chart review (2018 to 2021)
- **Inclusion criteria:** Korean soldiers with an ankle fracture after entering military service who had received surgery and had been admitted to the Armed Forces Capital Hospital
- **Ankle fractures** were defined as fractures involving talocrural joint, except pilon fracture, and **classified** based on 3 systems: **the number of involved malleoli**, the **Danis-Weber classification**, and the **Lauge-Hansen classification**.
- Any accompanying nerve injuries were identified with **electrophysiological tests**.
- **Statistical analysis:** The Mann-Whitney U test, Pearson's chi-square test, and Fisher's exact test were used to compare the characteristics between two groups (presence vs. absence of nerve injuries).

Results

Table 1. Clinical characteristics and classification of patients with ankle fractures (n = 393)

	Mean ± SD or *n* (%)
Age (Year)	22.27 ± 5.47
Height (m)	1.75 ± 0.06
Body weight (kg)	75.48 ± 11.33
BMI (kg/m^2)	24.59 ± 3.05
Right-/ left-sided injury	198 (50.4)/ 195 (49.6)
Causative events	
Soccer	230 (58.5)
Free-fall training	32 (8.1)
Slip down	94 (23.9)
Fall down	27 (6.9)
Contusion	10 (2.5)
Presence of nerve injuries	21 (5.3)
Presence of dislocation	55 (14.0)
Ankle fracture classification	
Number of involved malleoli	
—Mono-/ Bi-/ Tri-malleolar	147 (37.4)/ 95 (24.2)/ 151 (38.4)
Danis-Weber	
—A(infra-syndesmotic)	12 (3.1)
—B(trans-syndesmotic)	276 (70.2)
—C(supra-syndesmotic)	90 (22.9)
—No fibula fracture	15 (3.8)
Lauge-Hansen[a]	
—SAD/ SER/ PAB/ PER/ UC	11(2.8)/ 276(70.2)/ 15(3.8)/ 91(23.2)/ 7(1.8)
Underwent syndesmosis fixation	104 (26.5)

SD standard deviation, *BMI* body mass index, *SAD* supination-adduction, *SER* supination-external rotation, *PAB* pronation-abduction, *PER* pronation-external rotation, *UC* unclassifiable. [a]Seven patients are included in both PAB and PER groups.

- Among 393 patients, **soccer was the leading cause** of ankle fractures (58.5%), followed by slip down (23.9%) and free-fall training (8.1%).
- **Nerve injuries** following ankle fractures were identified in **21 (5.3%) patients**.
- Ankle fracture-**dislocation** was present in **55 (14.0%) patients**.
- Trimalleolar (38.4%), Danis-Weber B (70.2%), and Lauge-Hansen SER (70.2%) fracture was the most frequent type of each classification system.

Table 2. Comparison of characteristics and fracture classification according to the presence of nerve injuries

	No nerve injury (n = 372)	Nerve injury (n = 21)	P value (OR)
Age (Year)	22.28 ± 5.50	22.19 ± 5.12	0.971
Height (m)	1.75 ± 0.06	1.75 ± 0.06	0.757
Body weight (kg)	75.70 ± 11.40	71.62 ± 9.31	0.179
BMI (kg/m^2)	24.66 ± 3.08	23.39 ± 2.40	0.137
Left-sided injury	183 (49.2)	12 (57.1)	0.478 (1.377)
Causative events			
Soccer	215 (57.8)	15 (71.4)	0.217 (1.826)
Free-fall training	30 (8.1)	2 (9.5)	0.685 (1.200)
Slip down	91 (24.5)	3 (14.3)	0.288 (0.515)
Fall down	26 (7.0)	1 (4.8)	>0.999 (0.665)
Contusion	10 (2.7)	0 (0.0)	>0.999
Presence of dislocation	47 (12.6)	8 (38.1)	**0.004 (4.255)**
Ankle fracture classification			
Number of involved malleoli			
—Monomalleolar	144 (38.7)	3 (14.3)	0.024 (0.264)
—Bimalleolar	89 (23.9)	6 (28.6)	0.628 (1.272)
—Trimalleolar	139 (37.4)	12 (57.1)	**0.070 (2.235)**
Danis-Weber			
—A(infra-syndesmotic)	11 (3.0)	1 (4.8)	0.488 (1.641)
—B(trans-syndesmotic)	267 (71.8)	9 (42.9)	0.005 (0.295)
—C(supra-syndesmotic)	80 (21.5)	10 (47.6)	**0.013 (3.318)**
Lauge-Hansen[a]			
—SAD	10 (2.7)	1 (4.8)	0.458 (1.810)
—SER	267 (71.8)	9 (42.9)	0.005 (0.295)
—PAB	14 (3.8)	1 (4.8)	0.568 (1.279)
—PER	82 (22.0)	9 (42.9)	**0.035 (2.652)**
—UC	6 (1.6)	1 (4.8)	0.321 (3.050)
Underwent syndesmosis fixation	98 (26.3)	6 (28.6)	0.822 (1.118)

The Mann-Whitney U test, Pearson's χ^2 test, and Fisher's exact test were used to compare variables between the patient groups. *OR* odds ratio, *BMI* body mass index, *SAD* supination-adduction, *SER* supination-external rotation, *PAB* pronation-abduction, *PER* pronation-external rotation, *UC* unclassifiable. [a]Seven patients are included in both PAB and PER groups.

- The patients with **relatively lower BMIs** were prone to suffer nerve injuries following ankle fractures.
- The **ankle fracture-dislocation** was associated with a **4-fold increase** in risk of nerve injuries.
- The proportion of patients with nerve injuries was significantly higher in **trimalleolar, Danis-Weber C** and **Lauge-Hansen PER** fracture groups.

Conclusion

- Of traumatic **ankle fractures**, **5.3%** are accompanied by **nerve injuries**.
- The patients with ankle fractures accompanied by nerve injuries presented a relatively lower BMI and higher proportion of **ankle dislocation**.
- The **trimalleolar, Danis-Weber C** type and **Lauge-Hansen PER** type of ankle fractures should be carefully examined for possible nerve injuries.
- This study may allow for **better understanding** and **early prediction** of ankle fracture patients with a **poor prognosis**.