Scholars Journal of Applied Medical Sciences (SJAMS) **ISSN 2320-6691 (Online)**
Sch. J. App. Med. Sci., 2017; 5(10F):4252-4256 **ISSN 2347-954X (Print)**

(An International Publisher for Academic and Scientific Resources)
www.saspublishers.com DOI:10.36347/sjams.2017.v05i10.087

Accuracy of the Prehospital Diagnosis of Pelvic Fractures Diagnosed by Traumatic PAN Scans

Hiroki Nagasawa MD, Kazuhiko Omori MD. PhD, Ikuto Takeuchi MD, Ryosuke Takahashi MD, Kei Jitsuiki MD, Akihiko Kondo MD, Kouhei Ishikawa MD.PhD, Hiromichi Ohsaka MD, PhD, Hiroshi Ito MD.PhD.* Youichi Yanagawa MD. PhD
Department of Acute Critical Care Medicine, Shizuoka Hospital, Juntendo University, Numazu City Hospital
*Department of Emergency and Critical Care Medicine, Juntendo University, Nerima Hospital

Original Research Article

***Corresponding author**
Youichi Yanagawa

Article History
Received: 25.10.2017
Accepted: 28.10.2017
Published: 30.10.2017

Abstract: We retrospectively investigated the accuracy of the diagnosis of pelvic fracture (PF) by emergency medical technicians (EMTs). From April 2012 to March 2017, we performed a retrospective medical chart review of the prehospital and hospital medical charts of all trauma patients who were transported to Numazu City Hospital by ambulance and who were diagnosed with PF by a computed tomography. The subjects were divided into two groups: the PF + group, which included patients who were diagnosed with PF by the EMTs at scene; and the PF – group. There were 29 patients in the PF (+) group and 61 in the PF (-) group. The accuracy of the prehospital diagnosis of PF was 32.2 % (29/90). The average age and the ratio of female patients in the PF (+) group were significantly lower in comparison to the PF (-) group. In contrast, the classifications of the PFs in the PF (+) group were significantly more severe than those in the PF (-) group. The injury severity score values in the PF (+) group were greater than those in the PF (-) group; however the difference was not statistically significant (p = 0.05). The risk factors for the misdiagnosis of PF in the prehospital setting included advanced age, female sex, and minor pelvic fracture. However, the misdiagnosis of PF by EMTs did not affect the final outcome.
Keywords: pelvic fracture, computed tomography, prehospital, diagosis

INTRODUCTION

Pelvic fracture (PF) represents a potentially life-threatening injury that should be identified during the primary survey of patients who have sustained major trauma[1]. The early suspicion, identification and management of a PF at the prehospital stage is essential for reducing the risk of death due to hypovolemia for allowing the appropriate triage of the patient [1]. To diagnose PF in the prehospital setting, the first medical responder checks for complaints of pain, tenderness and/or instability at the pelvis. In Japan, emergency medical technicians (EMTs) provide standard prehospital trauma evaluation and care. First, they check for complaints of pain; then, for cases without pain, they perform a springing maneuver and compression at the pubis and sacro-iliac joints to identify tenderness [2]. However, the springing maneuver was found to have a specificity of 71% and a sensitivity of 59% in the diagnosis of PF, suggesting that the routine use of this examination should be abandoned [1,3]. In addition, some PF patients do not complain of pain, even when the compression of the pelvis is performed; this is especially true in the case of unconscious patients [1,4]. Actually, 3-22% of patients with PF who were diagnosed based on roentgenography were misdiagnosed in the prehospital setting [1]. Recently, whole body computed tomography (CT) for severe trauma patients (traumatic PAN scan) has been routinely performed to detect life-threatening injuries. CT shows higher sensitivity than roentgenography in the diagnosis of PF [5]. However, no reports have investigated the accuracy of the diagnosis of PF in prehospital setting. Thus, we retrospectively investigated the accuracy of the diagnosis of PF by EMTs at the scene and the risk factors for making a misdiagnosis.

METHODS

The protocol of this retrospective study was approved by the review board of Numazu City Hospital and Juntendo Shizuoka Hospital. All of the examinations were conducted in accordance with the standards of good clinical practice and the Declaration of Helsinki.

Numazu City Hospital is a hospital in eastern Shizuoka Prefecture that is located near Tokyo. The hospital has 426 beds and a medical emergency center and serves a population of approximately 190,000. This hospital mainly treats patients with severe trauma, acute coronary syndrome, stroke, cardiopulmonary arrest, drowning, intoxication and unstable vital signs. Due to a shortage of medical resources, including physicians, Numazu City Hospital is supported by staff from the Department of Acute Critical Care Medicine at Shizuoka Hospital, Juntendo University.

From April 2012 to March 2017, we performed a retrospective medical chart review of the prehospital and hospital medical charts of all trauma patients who were transported to Numazu City Hospital by ambulance and who were diagnosed with PF by a traumatic PAN scan. The exclusion criterion was a lack of PF. A diagnosis of PF in the prehospital setting was defined based on the information in the prehospital medical chart; the diagnostic factors included a description of the diagnosis of PF, or injury or pain in the area of the pelvis (including the gluteus).

The subjects were divided into two groups: the PF + group, which included patients who were diagnosed with PF by the EMTs at scene; and the PF - group, which included patients who were not diagnosed with PF by the EMTs. The following data were analyzed: sex, age, mechanism of injury (traffic accident, fall, others), Glasgow Coma Scale (GCS) at the scene, systolic blood pressure at scene, heart rate at the scene, isolated PF (or not), the classification of the PF[6], the injury severity score (ISS) and the outcome (death or survival).

The non-paired Student's t-test and χ^2 test were used as appropriate for the statistical analyses. P values of <0.05 were considered to indicate a statistically significant difference. All of the data are presented as the mean ± standard deviation.

RESULTS

During the investigation period, a total of 13,332 patients, including 2,944 patients, were transported to Numazu City Hospital by ambulance. Among the trauma patients, 2,854 were not diagnosed with PF by a physical examination, roentgenography and/or CT. After excluding these patients, a total of 90 patients were enrolled as subjects. There were 29 patients in the PF (+) group and 61 in the PF (-) group. The accuracy of the prehospital diagnosis of PF was 32.2 % (29/90).

The results of the inter-group analyses are shown in Table 1. There were no significant differences between the two groups with regard to the mechanism of injury, GCS, systolic blood pressure, heart rate at the scene or the final outcome. However, the average age and the ratio of female patients in the PF (+) group were significantly lower in comparison to the PF (-) group. In contrast, the classifications of the PFs in the PF (+) group were significantly more severe than those in the PF (-) group. The ISS values in the PF (+) group were greater than those in the PF (-) group; however the difference was not statistically significant ($p = 0.05$).

Table-1: **The accuracy of the prehospital diagnosis of pelvic fracture**

	PF (+) n = 29	PF (-) n = 61	p value
Age	50.6 ± 17.8	68.2 ± 21.6	n.s.
Sex (M/F)	16/13	20/41	<0.05
Mechanism			n.s.
Traffic accident	18	32	
Fall	11	29	
Glasgow Coma Scale	13.8 ± 3.0	13.3 ± 3.6	n.s.
Systolic blood pressure (mmHg)	113.8 ± 41.3	124.0 ± 42.2	n.s.
Heart rate (beats per minute)	75.3 ± 28.5	78.9 ± 21.6	n.s.
Isolated PF (yes/no)	5/24	29/32	<0.01
Classification of PF			<0.05
A	15	39	
B	11	22	
C	3	0	
Injury severity Score	14.3 ± 2.5	12.4 ± 14.2	0.05
Outcome (death/survival)	3/26	6/55	n.s.

PF, pelvic fracture; n.s., not significant.

DISCUSSION

This study demonstrated that the accuracy of the prehospital diagnosis of PF was 32.2% (29/90) in trauma patients who underwent traumatic PAN scans. The risk factors for a misdiagnosis of PF in the prehospital setting included advanced age, female sex, and a minor PF. However, the misdiagnosis of PFs by the EMTs did not affect the final outcome.

Generally, advanced age and female sex tend to be associated with a lower threshold for pain induced by pressure, mechanical, or thermal stimulation [7,8]. In contrast, with regard to acute myocardial infarction, advanced age and female sex are independent predictors of atypical acute myocardial infraction such as myocardial infraction in the absence of pain [9,10]. The discrepancy between these facts may be based on the difference in the pain source. Two different types of fiber conduct pain signals in the human body: Aδ fiber and C fiber. Aδ fibers carry cold, pressure and some pain signals. Because the Aδ fibers are thinly myelinated, they send impulses faster than unmyelinated C fibers. The Aδ fibers are associated with acute (sharp) pain, while the unmyelinated C fibers carry slow, burning pain [11,12]. The existence of two different fibers to carry pain signals might explain the

sex- and age-based discrepancies in the pain threshold that were observed in our study. It is noteworthy that female sex and advanced age have been identified as risk factors for osteoporosis [13]. Minor impact can cause the fracture of osteoporotic bone. CT has superior spatial resolution in comparison to roentgenography, and can detect minor fractures. The fragility of female patients and/or patients of advanced age, and the high sensitivity of CT in the detection of minor fractures, may explain our results.

The previous study suggested that among patients with severe multiple injuries and or shock, painful distracting injuries at other sites may have led to the misdiagnosis of PF [1]. In the present study, severe PF was easily diagnosed and the patients tended to have other injuries. Severe PF was associated with instability, which is easy to detect by hand manipulation. Furthermore, patients with severe PF suffered high-energy insults. These high-energy insults can cause the other injuries in addition to PF [14].

A previous study demonstrated that among patients with reduced consciousness levels due to intracranial injury, the absence of pain can lead to the misdiagnosis of PF [1]. However, this study failed to prove this hypothesis. In the present study, 8 patients had a total GCS value of ≤8, while 74 patients had a total GCS value of ≥14. The small number of patients with low GCS values (indicating a more severe degree of unconsciousness) may explain the discrepancy between the present study and the previous report.

This study demonstrated that the misdiagnosis of PF by the EMTs did not affect the final outcome. In the present study, the patients, who had suffered a high energy impact, underwent a traumatic PAN scan. Accordingly, after reading the mechanisms of injury, the patients were transported to an acute critical care center, and eventually received a correct diagnosis and appropriate treatment correctly diagnosed and correct diagnosis and appropriate treatment, even when the PF was misdiagnosed by the EMTs at the scene. The present study is associated with a limitation in that it did not examine any patients were transported to other local hospitals under the misdiagnosis of PF. This limitation should be evaluated in the future.

CONCLUSION

The present study demonstrated that accuracy of the prehospital diagnosis of PF was 32.2% (29/90) in the era of in which patients undergo traumatic PAN scans. The risk factors for the misdiagnosis of PF in the prehospital setting included advanced age, female sex, and minor pelvic fracture. However, the misdiagnosis of PF by EMTs did not affect the final outcome.

ACKNOWLEDGEMENT

This work received funding from the Ministry of Education, Culture, Sports, Science and Technology (MEXT)-Supported Program for the Strategic Research Foundation at Private Universities, 2015-2019. The title is [The constitution of total researching system for comprehensive disaster, medical management, corresponding to wide-scale disaster].

Conflict of Interest

The authors declare no conflicts of interest in association with the present study.

REFERENCE

1. Lee C, Porter K. The prehospital management of pelvic fractures. Emerg Med J. 2007;24(2):130-3.
2. Mashiko K. Trauma systems in Japan: history, present status and future perspectives. J Nippon Med Sch. 2005;72(4):194-202.
3. Grant PT. The diagnosis of pelvic fractures by 'springing'. Arch Emerg Med 1990 7(3): 178-182.
4. Tien IY, Dufel SE. Does ethanol affect the reliability of pelvic bone examination in blunt trauma? Ann Emerg Med 2000;36:451–5.
5. Soto JR, Zhou C, Hu D2, Arazoza AC, Dunn E, Sladek P. Skip and save: utility of pelvic x-rays in the initial evaluation of blunt trauma patients. Am J Surg. 2015;210(6):1076-9; discussion 1079-81.
6. Burgess AR, Eastridge BJ, Young JW, Ellison TS, Ellison PS Jr, Poka A, Bathon GH, Brumback RJ. Pelvic ring disruptions: effective classification system and treatment protocols. J Trauma. 1990;30(7):848-56.
7. Woodrow KM, Friedman GD, Siegelaub AB, Collen MF. Pain tolerance: differences according to age, sex and race. Psychosom Med. 1972;34(6):548-56.
8. Ostrom C, Bair E, Maixner W, Dubner R, Fillingim RB, Ohrbach R, Slade GD, Greenspan JD. Demographic Predictors of Pain Sensitivity: Results From the OPPERA Study. J Pain. 2017;18(3):295-307.
9. Culić V, Eterović D, Mirić D, Silić N. Symptom presentation of acute myocardial infarction: influence of sex, age, and risk factors. Am Heart J. 2002;144(6):1012-7.
10. Coronado BE, Pope JH, Griffith JL, Beshansky JR, Selker HP. Clinical features, triage, and outcome of patients presenting to the ED with suspected acute coronary syndromes but without pain: a multicenter study. Am J Emerg Med. 2004;22(7):568-74.
11. Granovsky Y, Anand P, Nakae A, Nascimento O, Smith B, Sprecher E, Valls-Solé J. Normative data for Aδ contact heat evoked potentials in adult population: a multicenter study. Pain. 2016;157(5):1156-63.

12. Weiss T, Giersch DA, Sauer H, Miltner WH, Bär KJ. Perception to laser heat stimuli in depressed patients is reduced to Aδ- and selective C-fiber stimulation. Neurosci Lett. 2011;498(1):89-92.
13. Compston J, Cooper A, Cooper C, Gittoes N, Gregson C, Harvey N, Hope S, Kanis JA, McCloskey EV, Poole KES, Reid DM, Selby P, Thompson F, Thurston A, Vine N; National Osteoporosis Guideline Group (NOGG). UK clinical guideline for the prevention and treatment of osteoporosis. Arch Osteoporos. 2017;12(1):43.
14. Burkhardt M, Nienaber U, Pizanis A, Maegele M, Culemann U, Bouillon B, Flohé S, Pohlemann T, Paffrath T; TraumaRegister DGU.; German Pelvic Injury Register of the Deutsche Gesellschaft für Unfallchirurgie. Acute management and outcome of multiple trauma patients with pelvic disruptions. Crit Care. 2012 Aug 22;16(4):R163.