Relationship between The Young–Burgess Classification System of Pelvic Fractures and Mortality and Morbidity

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ABSTRACT

This study aimed to investigate the relationship between the Young–Burgess classification (YBC) system and mortality and morbidity.

A total of 50 cases of pelvic fracture in patients who were admitted to our emergency department between January 01, 2011, and February 26, 2012, were scanned. The fractures were classified according to the YBC system based on plain graphs and tomography results for a more objective classification.

The total mortality rate was 10%. No relationship was found between the YBC groups and mortality. The relationship between the YBC types and erythrocyte transfusion requirement was statistically significant. The fracture types were classified into two groups: stable [lateral compression type 1 (LC-1) and anterior–posterior compression (APC) type 1] and unstable [LC-2-, LC-3, APC-2, APC-3, vertical shear, and combined mechanism of injury]. The erythrocyte transfusion requirements were found to be significantly higher in the unstable group. Similarly, LC-2 showed higher erythrocyte transfusion requirements compared with LC-1. No relationship was observed between the groups and head–chest–abdomen–spine injuries. The mortality was higher in the unstable group than in the stable group, although the difference was not statistically significant.

The YBC system is useful to understand the pelvic fracture type, despite no relationship between the different types of fracture and mortality and morbidity. The present results indicated the need for a new system for the classification of pelvic fractures.

Key words: Bone; injuries; multiple trauma; fractures; pelvic bones; pelvis, traumatology

INTRODUCTION

A pelvic fracture is a life-threatening injury that occurs as a result of high-energy trauma such as traffic accidents and falls. It has been reported that 3% of all fractures are pelvic fractures, and rigid clinical observation is required (1, 2). Patients with pelvic fractures are prone to bleeding. Pelvic fractures are associated with serious head, chest, stomach, and spine injuries. Organ injuries can cause high mortality and morbidity rates (3, 4, 5, 6). Fast and intensive treatment management is necessary to reduce mortality and morbidity (7). When a pelvic fracture is diagnosed at the emergency department, the hemodynamic parameters should first be stabilized and then the patient should be assessed for multisystem injuries, primarily gastrointestinal and urogenital.

Few systems exist to classify pelvic fractures. The Young–Burgess classification (YBC) system is popular because it can theoretically predict mortality, transfusion requirement, and associated organ injuries (Table 1 and Figure 1) (8, 9). Furthermore, this system is considered to guide treatment (10, 11).

MATERIALS AND METHODS

This retrospective study enrolled 50 patients with a pelvic fracture who visited the Emergency Department of the Ankara Dışkapı Yıldırım Beyazıt Hospital from January 01, 2011 to February 26, 2012. For a more objective classification, findings

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Table 1: Young–Burgess classification system.

Category	Subclassifications and distinguishing characteristics
Lateral compression	Anterior transverse fracture of the pubic rami Type 1 -Sacral compression on the side of injury Type 2 -Iliac wing fracture on the side of injury Type 3 -Type 1 or 2 findings -Contralateral open book pelvic fracture
Anterior–posterior compression	Symphyseal diastasis or anterior vertical fracture Type 1 -Diastasis <2.5 cm of the pubic symphysis or anterior sacroiliac joint -Stretched but intact anterior ligaments -No posterior disruption Type 2 -Diastasis>2.5 cm of pubic symphysis -Disrupted anterior ligaments -No posterior disruption Type 3 -Complete disruption of the sacroiliac joints and the anterior and posterior ligaments
Vertical shear	Symphyseal diastasis or vertical displacement anteriorly and posteriorly of major fragments through the sacroiliac ligaments, iliac wing, or sacrum; completely unstable
Combined mechanical	A combination of injury patterns is observed, with lateral compression/vertical shear being the most common

from pelvic x-ray and tomography images were combined to assess patients. The assessment of tomography images, except the pelvic ring, was based on the reports of the Radiology Department of the hospital.

RESULTS

In this study, 32 (64%) of the patients were males. The mean age was 40.6 ± 20.9 years, and the median age was 37 (range: 3–84) years. Pedestrian accidents were the most frequently encountered of a pelvic injury, with a frequency of 42% (21 patients), followed by falls, which were encountered at a frequency of 30%. Furthermore, 62% of the pelvic injuries encountered in this study were caused by traffic accidents. The other causes of pelvic injuries are presented in Figure 2.

The most commonly encountered types of fracture according to the YBC were lateral compression (LC)-1 and LC-2 types (Figure 3). No relationship was found between the cause of accident and the fracture type ($P = 0.459$, $\chi 2 = 7.227$). However, the pedestrian accident was the most commonly seen cause among all the fracture types.

The mortality rate of the study sample was 10% (5 patients). Of these, one patient had an anterior–posterior compression (APC)-2-type fracture, but the remaining patients had LC-2-type fractures. The mortality rate associated with LC-2- and APC-type fractures was 18% (four patients) and 25% (one patient), respectively (Figure 4). Considering the main groups [LC, APC, vertical shear (VS), and combined mechanism of injury (CMI)] of the YBC, the mortality rate was 9.3% in the LC types and 20% in the APC types. No difference was found in the mortality between the LC, APC, and VS fracture types ($P = 0.922$; $\chi 2 = 0.801$). If the patients were divided on the basis of the fracture types into stable (LC-1 and APC-1) and unstable (LC-2, LC-3, APC-2, APC-3, VS, and CMI) groups, no mortality was observed in the stable group. However, this difference was not statistically significant ($P = 0.057$; $\chi 2 = 3.704$), probably due to the small sample size. All the deaths occurred in the unstable group.

The series showed no statistically significant difference between the different fracture types and head–chest–stomach–spine injuries (Table 3). However, the pathologies of abdominal computed tomography (CT) of LC-2 were relatively more than those of LC-1 (Table 2). Similarly, the unstable group was associated with relatively more abdominal pathologies compared with the stable group.

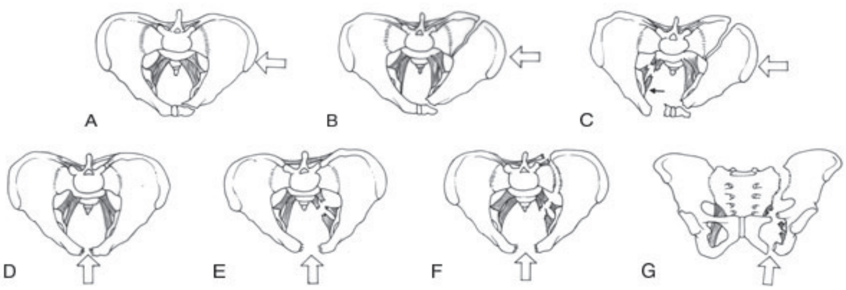

Figure 1: Fracture types according to the force on the pelvic ring. (A) LC-1; (B) LC-2; (C) LC-3; (D) APC-1; (E) APC-2; (F) APC-3; (G) VS. (*This figure is taken from http://bb-mf.blogspot.com/2009/09/pelvic-fractures.html)

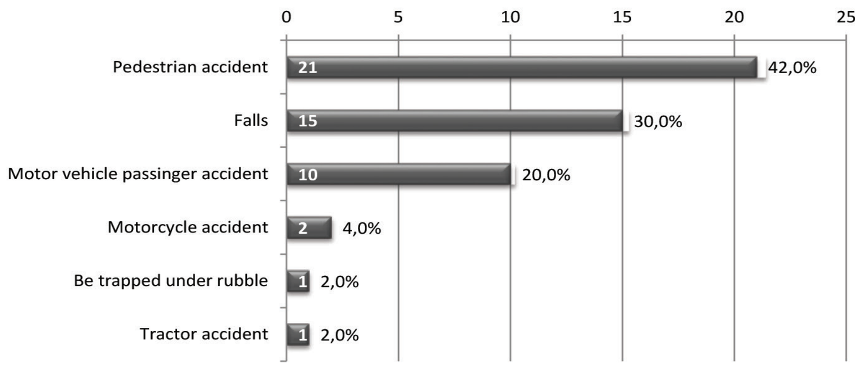

FIGURE 2: Frequencies of the causes of injury.

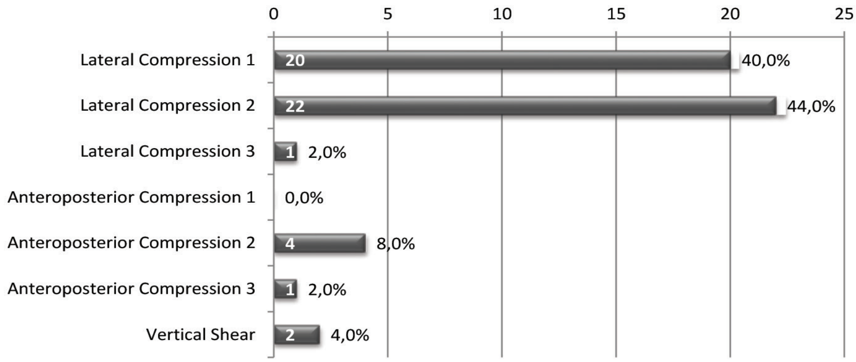

FIGURE 3: Frequencies of the fracture types according to Young–Burgess classification.

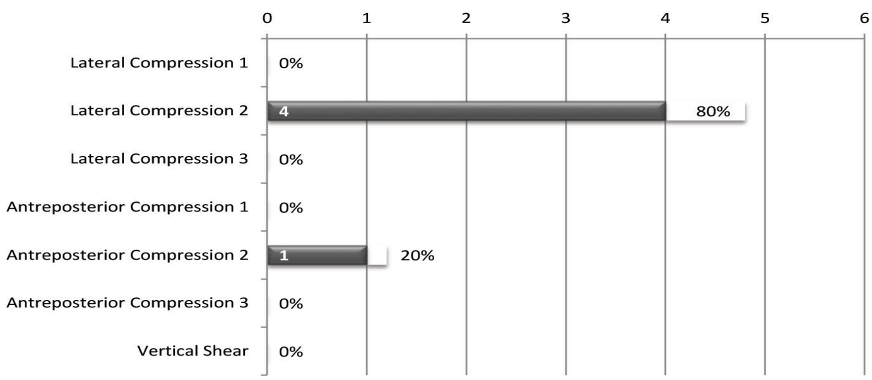

FIGURE 4: Percentage of mortality in each subgroup.

Cranial CT findings revealed skull fracture in seven patients (14%), pneumocephalus in three (6%), subarachnoid hemorrhage in two (4%), and cerebral contusion in two (4%).

Also, 1 cervical, 1 thoracic, and 11 (22%) lumbar vertebral fractures were detected. No statistically significant difference was observed between vertebral fracture and classification type. However, the findings suggested that the lumbar vertebrae should be carefully examined in patients with a pelvic fracture.

Thoracic CT findings revealed pulmonary contusions in eight patients (16%), costal fracture in eight (16%), pleural effusion/hemothorax in six (12%), and pneumothorax in three (6%).

During the hospitalization period, 16 (32%) patients received blood transfusions. Patients with LC-2 fractures received more frequent blood transfusions compared with those with LC-1 fractures ($P = 0.033$; $\chi 2 = 4.546$). As expected, the unstable group showed more erythrocyte transfusion requirements

TABLE 2: Abdominal CT findings for each group.

		Young–Burgess classification					
		LC 1	LC 2	LC 3	APC 2	APC 3	VS
Diaphragm rupture	–	14	17	1	2	0	2
	+	0	1	0	0	0	0
Liver injury	–	14	16	1	2	0	2
	+	0	2	0	0	0	0
Kidney injury	–	14	15	1	2	0	2
	+	0	3	0	0	0	0
Spleen injury	–	13	15	1	2	0	2
	+	1	3	0	0	0	0
Free fluid	–	11	15	1	1	0	1
	+	3	3	0	1	1	1

TABLE 3: Systemic pathologies of each group according to computerized tomography reports.

		Young–Burgess classification						Total
		LC1	LC2	LC3	APC2	APC3	VS	
Abdominal pathology	–	16	14	1	3	1	1	36
	+	4	8	0	1	0	1	14
Vertebral pathology	–	15	16	0	3	1	2	36
	+	5	6	1	1	0	0	13
Cranial pathology	–	19	17	1	3	0	2	42
	+	1	5	0	1	1	0	8
Thoracic pathology	–	17	16	1	2	1	2	39
	+	3	6	0	2	0	0	11

compared with the stable group (P = 0.028). The mean blood transfusion was 2.02 units; 10 (20%) of the patients received 4 or more units of blood. In the patients who died, the mean blood transfusion was 7.6 units. As expected, patients who died received greater amounts of blood compared with the surviving patients (P = 0.001).

DISCUSSION

The pelvic fractures of 50 patients were classified according to the YBC system in this study. The patients were examined for the presence of associated head, chest, stomach, and spine injuries. The system pathologies, erythrocyte transfusion requirements, and mortality rates were compared between the main groups (LC, APC, VS, and CMI), subgroups (LC-1–3, APC-1 to APC-3, VS, and CMI), stable groups (LC-1 and APC-1), and unstable groups (LC-2 and LC-3, APC-2 and APC-3, VS, and CMI).

O'Sullivan and colleagues (12) reported a 20% mortality (35 patients) rate for 174 patients with a pelvic fracture during a 15-year period; 57 of the cases received erythrocyte transfusion in the first 24 h of hospital admission. Also, 10 units were transfused in 1 case, and the use of more than 10 units for transfusion was associated with mortality. Greater quantities were used for transfusion, and erythrocyte suspension usage was for the complete hospital stay.

Manson and et al. (13) carried out a study with 1248 patients and reported that the fracture pattern tended to predict the mortality rate. However, they were unable to show a statistical relationship between fracture type and mortality rate. LC-3, APC-2, and APC-3 injuries tended to be associated with higher mortality rates. They found a mortality of 11.5% with unstable fractures and 7.9% with stable ones. The total mortality rate was 9.1%. Even LC-1 injuries had a mortality rate of 8.2%. They emphasized that the YBC system could predict erythrocyte transfusion requirements ($P < 0.05$). They noted that LC-2, LC-3, APC-2, and APC-3 injuries had higher erythrocyte transfusion requirements, and VS-type fractures were associated with very low transfusion requirements. Their findings were in contrast with those of older studies. The stable and unstable groups in their study required mean blood transfusion of 2.4 and 4.9 units, respectively. A statistically significant relationship was observed between erythrocyte transfusion requirements and these two groups. Head and chest traumas did not differ across different fracture types. Abdominal injuries were significantly higher in the LC-3 group than in the LC-1 group. The APC and LC groups had a similar frequency of head and abdominal injuries, but chest injuries were encountered more frequently in LC traumas. The stable and unstable groups showed similar rates of head and chest injuries but the unstable group showed higher rates of abdominal injury. Statistically, no relationship was found between the main groups, subgroups, and stable or unstable groups according to systemic pathologies. However, LC-2 traumas tended to have a higher rate of head, chest, stomach, and spine injuries compared with LC-1 traumas. Furthermore, unstable groups were prone to have higher rates of abdominal injury compared with stable groups.

The present study of 50 patients showed 0% mortality in the stable group (20 cases) and 16% mortality in the unstable group (30 cases). Thus, the unstable group tended to have higher mortality rates, although the result was not statistically significant (P = 0.057). LC-2 traumas had significantly greater transfusion requirements compared with LC-1 traumas (P = 0.03), and the unstable group had more transfusion requirements compared with the stable group (P = 0.28). The LC-2 and APC-2 subgroups showed the highest need for erythrocyte transfusion. Thus, as reported by Manson et al. (13), the YBC system was more useful for predicting erythrocyte transfusion requirements than for predicting nonorthopedic pathologies.

Poole et al. (14) studied 236 patients with a pelvic fracture for a 4-year period. The mean erythrocyte transfusion requirement was five units for one case, and 36% of the patients in that study did not receive transfusions. The transfusion amount was 7.8 units for one case among the patients who had a transfusion (64% of the total). The amount of erythrocyte suspension changed from 1 to 48 units used for 1 case. The mortality rate in their study was 7.6% (18 cases). The mean erythrocyte transfusion requirement was 2.02, and 68% of the patients did not receive transfusions in the present study. A maximum of 12 units were used for 1 case, and 7.6 units were used for a patient who subsequently died. It was believed that the transfusion rates in this study were low compared with those reported in other studies. This might be because the readiness rate for blood donation was low in Turkey or because the hospital might have initiated transfusion in patients after a delay. Furthermore, the Interventional Radiology Department of the hospital did not effectively perform angiography for these cases.

Many researchers (15-19) have reported the rates of head, chest, and abdominal injuries ranging from 37%–50%, 25%–66%, and 42%–51%, respectively. These rates were 16, 22, and 28%, respectively, in the present study. Furthermore, lower rates of head and abdominal injuries were encountered compared with those reported in previous studies.

No statistically significant relationship was found between the fracture type and systemic pathologies. However, LC-2 traumas were prone to have more injuries to the head, chest, abdomen, and spine compared with LC-1 fractures. This finding suggested that the YBC system could be used to predict systemic pathologies, although this method was not accurate. Further investigations are required in this regard.

Emergency medicine practitioners such as orthopedists and general surgeons should use the YBC system to classify pelvic fractures. In particular, unstable fractures that are prone to bleeding and hemorrhagic shock require more erythrocyte transfusions, and are associated with higher mortality rates and serious system pathologies. Therefore, these factors should be considered when devising treatment algorithms for these cases.

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