



Do patients with acute isolated pubic ramus fractures have to be hospitalized?

Ali TURGUT, Önder KALENDERER, Ihsan AKAN, Gökhan ILYAS, Mert KUMBARACI, Levent KARAPINAR

From the Tepecik Training and Research Hospital, Department of Orthopaedics and Traumatology, Izmir/Turkey

A total of 129 patients were included in the study. Haemoglobin levels on admission and at 24 hours were evaluated. Radiographs and computed tomography of the pelvis were also evaluated. The patients were divided into subgroups, according to the accompanying occult posterior pelvic injuries, whether they received anticoagulant-antiaggregant treatment, the number of pubic ramus fractures (single or multiple), the level of energy (low or high) and the zone(s) of the fracture(s).

The mean haemoglobin decrease was 1.21 g/dL. Forty-six of the patients were under anticoagulant or antiaggregant treatment. Fifty-one of the fractures occurred due to low energy trauma. Posterior ring injuries were observed in 75 of the patients. Haemoglobin level decreases were statistically significant in injuries with high energy trauma aetiology, in patients using antiaggregant or anticoagulant and in fractures of the lateral half of the superior pubic ramus.

It is important to follow all pubic ramus fractures closely because, even in low energy trauma, haemoglobin levels could decrease significantly. We recommend hospitalization to monitor this group of patients.

Keywords : isolated pubic ramus fracture ; hospitalization ; haemoglobin level.

INTRODUCTION

Isolated pubic ramus fractures are classified as stable injuries, and the current treatment modalities are pain management and mobilization (8). However, possible posterior ring injuries, which usually

cannot be detected by conventional radiographs, can accompany these injuries, (16). According to the Young and Burgess classification, pubic ramus fractures have been reported to be lateral and antero-posterior compression injuries to the pelvis (19-21). Although pubic ramus fractures are usually seen in the elderly as a result of low energy injuries, they can also occur after high energy injuries (10). In the acute phase, bleeding is an important complication of pubic ramus fractures that can cause life-threatening complications, and such bleeding is commonly associated with injury to the inferior epigastric artery, particularly in patients on oral anticoagulant and antiaggregant therapies (9,17). The retropubic vascular anastomosis is located immediately posterior to the lateral half of the pubic ramus, which is mostly composed of veins (12). Accordingly, venous bleeding can also be expected with these injuries.

Many centres, including our clinic, prefer to hospitalize these patients, mainly to follow up

-
- Ali TURGUT, M.D.
 - Önder KALENDERER, Assoc. Prof.
 - Ihsan AKAN, M.D.
 - Gökhan ILYAS, M.D.
 - Mert KUMBARACI, M.D.
 - Levent KARAPINAR, Assoc. Prof.

Tepecik Training and Research Hospital, Department of Orthopaedics and Traumatology, Izmir/Turkey.

Correspondence : Ali Turgut, M.D., Tepecik Training and Research Hospital, Department of Orthopaedics and Traumatology.

E-mail : draliturgutort@yahoo.com.tr, + 90 5370274425

© 2017, Acta Orthopaedica Belgica.

No benefits or funds were received in support of this study. The authors report no conflict of interests.

their haemoglobin levels. There have been no clear data in the literature about the indication(s) for hospitalizing patients with these fractures. Again, there is no information available about the changes in haemoglobin levels among patients with isolated acute pubic ramus fractures. In this study, we aimed to evaluate the changes in haemoglobin levels in patients with isolated acute pubic ramus fracture and attempted to determine whether the presence of occult posterior pelvic ring injury, which can be diagnosed by computed tomography (CT), the amount of trauma energy, anticoagulant-antiaggregant usage and the location of the fracture could affect the amount of bleeding. We aimed to draw objective conclusions for making decisions about the hospitalization of these patients as a result of this study.

PATIENTS AND METHODS

In our clinic, patients who are admitted to hospital with acute isolated pubic ramus fracture are hospitalized for haemodynamic monitoring. These patients are usually submitted to conventional radiographs and CT of the pelvis in emergency medicine clinic. We monitor the complete blood count (CBC) and haemodynamic status of these patients as a standard protocol after hospitalization. This study was approved by the local ethical committee. All of the blood sample studies were analysed in the same laboratory. Our inclusion criteria were patients with acute isolated pubic ramus fractures on conventional radiographs, patients with initial pelvic CT and patients who were followed up at least 24 hours. Patients who received intravenous fluid and blood product replacement in the first 24 hours and patients with associated major injuries that could cause additional bleeding, such as long bone fractures, abdominal trauma or thoracic trauma, were excluded from the study.

Patients who were admitted to our emergency room with pelvic fractures between January 2005 and January 2015 were evaluated retrospectively. There were a total of 361 patients. The number of patients who received fluid intravenously was 119, and erythrocyte suspension was required for 12 additional patients. Thirty-two of these injuries

were unstable pelvic ring injuries; 22 were old injuries (older than 24 hours), and 14 had isolated pubic ramus fractures whom also had associated injuries which could cause additional bleeding. Thirty three of the patients had isolated pubic ramus fracture, but CT images were lacking. Overall 129 patients (74 female, 55 male) who met inclusion criteria were included in this study. The patients' haemoglobin levels at admission and after 24 hours and additional medical data of the patients, such as their usage of anticoagulant-antiaggregant treatment, were obtained from hospital records. The patients' conventional radiographs and CT of the pelvis were also evaluated by the first author.

Grouping the patients

Group 1: The amount of energy that caused the fracture (low or high). Low energy aetiology included simple falls at home, and high energy included as traffic accidents and fall from higher than 3 m.

Group 2: Accompanying occult posterior pelvic fracture diagnosed with CT (present or absent)

Group 3: Number of fractured rami (single or more than one)

Group 4: Usage of antiaggregant or anticoagulant (present or absent)

Group 5: Zone of the fracture (lateral or other). The superior pubic ramus was divided into two equal parts. The fracture was considered to be in the lateral zone if it was in the lateral part of the superior pubic ramus, while the remaining fractures were considered to be in the 'other zone'. The lateral zone has been considered more dangerous because of the possible vascular anastomosis that should be directly behind it (12).

Entire groups were compared according to haemoglobin level decreases and length of hospitalization. Groups 1, 3 and 5 were compared according to having occult posterior pelvic injuries.

SPSS software, version 17 for Windows (Chicago, IL, USA) was used for statistical analysis. Student's t test was used for analysis of continuous data and the Chi-squared test was used for the analysis of categorical data. p values <0.05 were accepted as indicating statistical significance.

RESULTS

The mean age of the patients was 53.6 ± 23.7 (range: 18-92) years old. The mean hospitalization time was 2.1 ± 1.2 (range: 1-7) days. Fifty-one of the fractures (39.3%) were due to low energy trauma. On CT images, posterior ring injuries (all of them were sacral ala compressions) were observed in 75 of the patients (58.1%). Forty-six of the patients (35.6%) were on anticoagulant or antiaggregant treatment. The mean haemoglobin level decrease was 1.21 ± 0.84 (range: 0.1-5.1) grams/decilitres (g/dL).

No statistically significant differences were observed according to haemoglobin level decreases in groups 2 and 3, but the difference was statistically significant in groups 1, 4 and 5 (p: 0.02, p: 0.03

and $p < 0.01$, respectively) (table I). When we compared the groups according to hospitalization time, statistically significant differences were observed in groups 1 and 5 ($p < 0.01$ and $p: 0.01$, respectively) (table II). Occult posterior pelvic injury was observed statistically significantly more commonly in the patients who had fractures of the lateral half of the superior pubic ramus ($p < 0.01$) (table III).

DISCUSSION

Pelvic fractures that cause haemodynamic instability are usually high energy injuries, and they are mostly seen in the younger population. In elderly patients, osteoporosis combined with a tendency towards falling can result in stable

Table I. — Mean haemoglobin level decreases of patients according to subgroups and statistical analysis (Student's t test)

	Haemoglobin Level (grams/decilitre) p value Mean \pm Standard deviation (minimum-maximum)
<u>Trauma Energy</u>	1.33 \pm 0.91 (0.1-5.1)
High (n:78)	0.02
Low (n:51)	0.99 \pm 0.67 (0.1-3.2)
<u>Occult Posterior Pelvic Ring Injury</u>	1.27 \pm 0.80 (0.2-5.1)
Present (n:75)	0.25
Absent (n:54)	1.10 \pm 0.89 (0.1-3.6)
<u>Pubic Ramus Fracture</u>	1.12 \pm 0.81 (0.2-5.1)
Single (n:44)	0.46
More than one (n:85)	1.24 \pm 0.86 (0.1-3.6)
<u>Antiaggregant or Anticoagulant Usage</u>	1.41 \pm 0.79 (0.3-3.6)
Present (n:46)	0.03
Absent (n:83)	1.08 \pm 0.85 (0.1-5.1)
<u>Pubic Ramus Fracture Zone</u>	1.40 \pm 0.87 (0.1-3.6)
Lateral (n:67)	<0.01
Others (n:62)	0.97 \pm 0.75 (0.1-5.1)

Table II. Mean hospitalization time (days) according to subgroups and statistical analysis (Student's t test)

	Hospitalization Time (days)	P Value
Mean ± Standard deviation (minimum-maximum)		
<u>Trauma Energy</u>		
High (n:78)	2.39±1.41 (1-7)	<0.01
Low (n:51)	1.76±0.86 (1-4)	
<u>Occult Posterior Pelvic Ring Injury</u>		
Present (n:75)	2.29±1.23 (1-7)	0.12
Absent (n:54)	1.94±1.27 (1-7)	
<u>Pubic Ramus Fracture</u>		
Single (n:44)	1.86±1.11 (1-6)	0.053
More than one (n:85)	2.29±1.31 (1-7)	
<u>Antiaggregant or Anticoagulant Usage</u>		
Present (n:46)		0.32
Absent (n:83)	2.22±1.36 (1-7)	
	2.00±1.05 (1-5)	
<u>Pubic Ramus Fracture Zone</u>		
Lateral (n:67)	2.40±1.40 (1-7)	0.01
Others (n:62)	1.87±1.03 (1-5)	

pubic ramus fractures (5,17). Usually, isolated pubic ramus fractures are considered stable injuries and are treated conservatively with analgesia and immobilization. These injuries are not routinely monitored closely. However, there have been few case reports demonstrating massive haemorrhage with stable pubic ramus fractures (5,17,18). Because of the close localization of the corona mortis anastomosis to the posterior of the iliopubic rami, fractures of these levels, especially if displaced, can cause massive bleeding (2,4,11). Therefore, monitoring of these injuries is crucial. For all of these reasons, we prefer hospitalizing patients with these types of injuries, although they are caused by low energy trauma. The present study showed that haemoglobin levels decreased by a mean of 1.2 g/

dL in patients who were diagnosed with isolated pubic ramus fractures.

Pennal et al. reported for the first time the association of anterior lesions of the pelvic ring with posterior lesions (13,16). Gertzbein et al. reported that isolated injuries were associated with disruptions elsewhere within the ring, usually of the acetabulum or sacroiliac joints (3). Scheyerer et al. demonstrated that 96.8% of their patients with pubic ramus fractures also had injuries of the posterior pelvic ring (transforaminal sacral fractures, avulsion fractures of the ligaments, compression fractures of the lateral mass of the sacrum) (16). Furthermore Isler et al. suggested that, if an appropriate examination could be undertaken, a lesion of the posterior pelvis should be always

Table III. — Evaluation of the factors important for occurrence of occult posterior pelvic injury (chi-square test)

	Occult Posterior Injury		
	Present	Absent	p value
	n:75	n:54	
High Energy Trauma/Low Energy Trauma	48/27	30/24	0.33
Single Pubic Ramus Fracture/Multiple Ramus Fracture	23/52	21/33	0.35
Fracture of the Lateral Pubic Ramus / Fracture of the Medial or Inferior Pubic Ramus	47/28	20/34	<0.01

detected in these types of injuries (6). Small posterior fractures can be repositioned spontaneously, and they can also be missed, especially by conventional radiographs (13). CT is superior to radiography for detecting posterior pelvic injuries (7). Rommens et al. detected posterior pelvic injuries using CT that were initially missed with conventional radiographs (14). CT imaging has radiation hazards for patients, and it is not clear whether occult posterior pelvic injury has important therapeutic consequences, and the routine use of CT imaging in these patients is also unclear (3,6). In our patients, we detected that there were posterior pelvic injuries in 75 (58.1%) of them that were missed by conventional radiography. In our study group, it was observed that the incidence of occult posterior pelvic injuries was statistically significantly higher in patients with lateral zone pubic ramus fractures ($p < 0.01$). Although haemoglobin level decreases were greater in patients with posterior pelvic injuries, the difference was not statistically significant ($p: 0.25$). Having occult posterior pelvic injury can cause a delay in weight bearing in this group of patients, so it is important to reveal such injuries. We cannot advise performing pelvic CT for all patients with isolated pubic ramus fractures because of the high concentration of radiation exposure, but one should be careful if the pubic ramus is fractured in the lateral half.

Isolated pubic ramus fractures mostly occur in elderly patients with chronic illnesses and who are usually under anticoagulant and/or antiaggregant treatments (8). Theodorides et al. stated that patients who received anticoagulant treatment were more frail (17). In a recent study, Sandri et al. (15) stated that careful haemodynamic monitoring of

patients, especially those receiving anticoagulants, with isolated osteoporotic pubic ramus fractures was important to providing adequate management and preventing severe complications. They also recommended hospitalizing these patients. There were statistically significant haemoglobin level decreases in patients who were receiving anticoagulant or antiaggregant treatment in our study population ($p: 0.03$). We also agree that physicians should be more careful in treating this group of patients.

We also found that haemoglobin level decreases were statistically not significant in patients with more than one pubic ramus fracture ($p: 0.46$). Hospitalization time was nearly statistically significantly longer for patients with multiple pubic ramus fractures ($p: 0.053$). This result was probably due to the need for analgesia.

Pubic ramus fractures are usually seen in the elderly population. In this patient group, people can have chronic illnesses, such as cardiac diseases. Pont-Thibodeau et al. stated that haemoglobin levels greater than 7-8 g/dL were safe for patients with stable acyanotic cardiac disease (1). However, in their report, they also stated that the safe limit for the haemoglobin level was not clearly defined in adult patients with unstable cyanotic cardiac disease. Because we found that the mean haemoglobin level decrease was 1.21 g/dL in patients with isolated pubic ramus fractures, we can state that one must be more careful in elderly patients who have reference haemoglobin levels less than 10 g/dL.

This study had some limitations. First, it was a retrospective study. All of the radiographs and CT scans were evaluated by the first author, so inter-observer variability was not evaluated. This study

investigated haemoglobin levels only for the first 24 hours. The number of the studied patients was limited. The international normalization ratio values of the patients who were receiving anticoagulant medication could not be documented. One strength of this study was that all of the data were collected from a computer database, which is more reliable and clearer than handwritten data, and the quality of the radiographs and CT scans was greater, allowing for enlargement of the images. To our knowledge, this study was the first that evaluated haemoglobin level decreases in patients with isolated pubic ramus fractures.

In conclusion, in routine practice, occult posterior pelvic ring injuries could accompany isolated pubic ramus fractures but might not be detected by conventional radiographs. CT imaging is useful for detecting posterior injuries; however, this procedure includes the hazard of radiation. If the lateral half of the pubic ramus is fractured, the likelihood of an accompanying occult posterior pelvic ring injury (commonly sacral ala compression) is high. It is important to follow all pubic ramus fractures closely because, even in low energy trauma, haemoglobin levels can decrease significantly. The follow-up of haemoglobin levels over first 24 hours might be crucial, especially for patients who receive anticoagulant or antiaggregant treatment. It might be more important for older patients with reference haemoglobin levels less than 10 g/dL. Both single and multiple pubic ramus fractures can have similar bleeding risks, and accompanying occult posterior pelvic ring involvement does not seem to increase this bleeding risk. We recommend hospitalizing and monitoring patients with acute isolated pubic ramus fractures for at least 24 hours if the energy causing the trauma is high, if the patient is receiving anticoagulant or antiaggregant treatment and if the pubic ramus is fractured in the lateral half. Further studies (probably multicentric) of these fractures should be performed with larger numbers of patients to verify our statements.

REFERENCES

1. **Du Pont-Thibodeau G., Harrington K., Lacroix J.** Anemia and red blood cell transfusion in critically ill cardiac patients. *Annals of Intensive Care*, 2014 ; 4, 16.
2. **Garrido-Gómez J, Pena-Rodríguez C, Martín-Noguerol T, Hernández-Cortes P.** Corona mortis artery avulsion due to a stable pubic ramus fracture. *Orthopedics*. 2012, 16 ; 35 : 80-2.
3. **Gertzbein SD, Chenoweth DR.** Occult injuries of the pelvic ring. *Clin Orthop Relat Res*. 1977 ; 128 : 202-7.
4. **Henning P, Brenner B, Brunner K, Zimmermann H.** Hemodynamic instability following an avulsion of corona mortis secondary to a benign pubic ramus fracture. *J Trauma*. 2007 ; 62:E14-E17.
5. **Herrera Perez MU, Alcover HA.** Hypovolaemic shock due to a fracture of the superior pubic ramus in a young man. *Injury*. 2004 ; 35 : 80-2.
6. **Isler B, Ganz R.** Classification of pelvic ring injuries. *Injury*. 1996 ; 27 : 3-12.
7. **Kessel B, Sevi R, Jeroukhimov I, Kalganov A, Khashan T, Ashkenazi I.** Is routine portable pelvic X-ray in stable multiple trauma patients always justified in a high technology era? *Injury*. 2007 ; 38 : 559-63.
8. **Krappinger D, Struve P, Schmid R, Kroesslhuber J, Blauth M.** Fractures of the pubic rami: a retrospective review of 534 cases. *Arch Orthop Trauma Surg*. 2009 ; 129 : 1685-90.
9. **Loffroy R, Yeguiayan J-M, Guiu B, Cercueil J-P, Krause D.** Stable fracture of the pubic rami: a rare cause of life-threatening bleeding from the inferior epigastric artery managed with transcatheter ablation. *CJEM* 2008 ; 10 : 392-5.
10. **Macdonald DJM, Tollan CJ, Robertson I, Rana BS.** Massive hemorrhage after low energy pubic ramus fracture in a 71 year old woman. *Postgrad Med J*. 2006 ; 82 : e25.
11. **Meyers TJ, Smith WR, Ferrari JD, Morgan SJ, Franciose RJ, Echeverri JA.** Avulsions of the pubic branch of the inferior epigastric artery: a cause of hemodynamic instability in minimally displaced fractures of the pubic rami. *J Trauma*. 2000 ; 49 : 750-3.
12. **Okcu G., Erkan S., Yercan H., Ozic U.** The incidence and location of corona mortis A study on 75 cadavers. *Acta Orthopaedica* 2004 ; 75, 53-55.
13. **Pennal GF, Tile M, Waddell JP, Garside H.** Pelvic disruption: assessment and classification. *Clin Orthop Relat Res*. 1980 ; 151 : 12-21.
14. **Rommens PM, Vanderschot PM, Broos PL.** Conventional radiography and CT examination of pelvic ring fractures. A comparative study of 90 patients. *Unfallchirurg*. 1992 ; 95 : 387-92.
15. **Sandri A, Regis D., Bizzotto N.** Delayed Bleeding and Pelvic Haematoma after Low-Energy Osteoporotic Pubic Rami Fracture in a Warfarin Patient: An Unusual Cause

- of Abdominal Pain. Case reports in emergency medicine, 2014, article ID 783268.
16. **Scheyerer MJ, Osterhoff G, Wehrle S, Wanner GA, Simmen HP, Werner CM;** Detection of posterior pelvic injuries in fractures of the pubic rami. *Injury*. 2012 ; 43 : 1326-9.
 17. **TheodoridesAA, MorganBW, SimmonsD.** Haemodynamic instability resulting from a low energy pubic ramus fracture in a 78 year old woman. A case report and review of the literature. *Injury. Int J Care Injured*. 2011 ; 42 : 722-4.
 18. **Wong TC, Chan WL, Wu WC.** Life threatening stable pubic rami fracture. *Injury Extra*. 2005 ; 36 : 300-2.
 19. **Young JWR, Burgess AR, Brumback RJ, Poka A.** Lateral compression fractures of the pelvis: the importance of plain radiographs in the diagnosis and surgical management. *Skeletal Radiol*. 1986 ; 15 : 103-9.
 20. **Young JWR, Burgess AR, Brumback RJ, Poka A.** Pelvic fractures: value of plain radiography in early assessment and management. *Radiology*. 1986 ; 160 : 445-51.
 21. **Young JWR, Burgess AR.** Radiologic management of pelvic ring fractures: systematic radiographic diagnosis. *Baltimore: Urban & Schwarzenberg* ; 1987.