Pelvic Fractures : Experience in Management of 170 Cases at a University Hospital in Thailand

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Abstract

Background, Objective and Method : Management of patients with pelvic fractures requires a multidisciplinary team approach. Currently, survival has been dramatically improved but some controversies still remain. The purpose of this study was to examine management and results of treatment of patients with pelvic fractures who were admitted to the Trauma Unit, King Chulalongkorn Memorial Hospital, Bangkok, Thailand from January 1991 to December 2000.

Results : There were 170 patients in the study. The age ranged from 15 to 91 years (mean 33.89 ± 16.14). The most common cause of injuries was motorcycle accidents (50.0%). There were 27 (15.9%), 47 (27.6%), 80 (47.1%) and 16 (9.4%) patients with Type I, II, III and IV pelvic fractures, respectively. Forty per cent of patients were in shock when they first arrived at the emergency room. Seventy two patients (42.4%) had 274 associated injuries. Sixteen patients (9.4%) had open pelvic fractures. The Injury Severity Score (ISS) ranged from 4 to 75 (mean 17.55 ± 12.86). Eighty two patients (48.2%) received blood transfusion from 1 to 40 units (mean 10.04 ± 8.47). Sixteen patients (9.4%) underwent pelvic angiography, 10 bleeding points were demonstrated and successfully treated by transcatheter embolization. One hundred and thirty two patients (77.6%) received no specific treatment for the pelvic fractures. The remainder (22.4%) were treated with pelvic sling in 6 patients (3.5%), skeletal traction in 21 patients (12.4%), external fixation in 6 patients (3.5%), internal fixation in 4 patients (2.4%), and right hemipelvectomy in 1 patient (0.6%). Fifteen patients (8.8%) died. Causes of death were exsanguination in 6 patients (40% of death), severe head injuries in 6 patients (40% of death) and sepsis with multisystem organ failure in 3 patients (20% of death). Nonsurvivors had a significantly higher ISS and units of blood transfusion than survivors ($P < 0.001$). The hospital stay ranged from 1 to 300 days (mean 24.7 ± 34.19).

Conclusion : Approximately 75 per cent of patients in our study had major pelvic fractures (Type II and Type III pelvic fractures). The majority of bleeding from pelvic fractures could be treated conservatively. Angiography with transcatheter embolization was extremely helpful when conservative treatment failed to stop pelvic bleeding. External fixation for early control of bleeding pelvic fractures was infrequently employed.

Key word : Pelvic Fracture, Angiography, Transcatheter Embolization

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Pelvic fractures usually result from significant forces acting on the pelvic bones. While minor pelvic fractures themselves may cause little consequence to the patients, major pelvic fractures may have catastrophic sequelae and certain mortality if improperly treated. Apart from massive bleeding and severe associated injuries to structures in the pelvis, injuries to other parts of the body may also be responsible for the complexity of patient management. Although recent advances in trauma care have dramatically improved the outcome of management of patients with major pelvic fractures, some controversies still remain. For example, in early control of bleeding pelvic fractures, some institutions preferred to use external fixation of the fractured pelvic bones[1-3] while others advocated pelvic angiography with embolization[4-6].

The purpose of this study was to review patients with pelvic fractures. Data collection included causes and types of injuries, associated injuries, management, and results of treatment.

PATIENTS AND METHOD

This was a retrospective study of patients who had pelvic fractures and were admitted to the Trauma Unit, King Chulalongkorn Memorial Hospital from January 1991 to December 2000. Pelvic fractures were classified into 4 types according to Kane WJ as shown in Table 1[7]. Type I and IV were graded as minor and Type II and III were graded as major pelvic fractures. The reason for grading Type II and III as major pelvic fractures was based on the hemodynamic point of view. A previous study has shown that Type II and III pelvic fractures were associated with major hemorrhage[7]. During the study period, management of patients with pelvic fractures depended largely on hemodynamic status and associated intra and extra abdominal injuries. Exploratory laparotomies were performed in exsanguinating patients, patients with positive diagnostic peritoneal lavage determined by the criterion of initial aspiration of gross blood from the lavage catheter > 10 ml, and patients with positive computed tomography who were not candidates for nonoperative management. Pelvic angiography with possible embolization was performed when conservative management of pelvic hemorrhage was unsuccessful which was indicated by requirement of blood transfusion > 6 units during the first 24 hours. External fixation of the fractured pelvic bones was performed by orthopedic surgeons in selected cases of unstable pelvic fractures (Type III). Suprapubic cystostomy was performed in cases of urethral or bladder injuries. Transverse or sigmoid loop colostomy was performed in cases of open pelvic fractures or pelvic sepsis. Data are presented as percentage or mean ± S.D. as appropriate.

Shock in this study was defined as a systolic blood pressure of ≤ 90 mm Hg when patients first arrived at the emergency room.

RESULTS

During the 10 year-period, 170 patients were enrolled into the study. One hundred and fifteen patients (67.6%) were males and 55 (32.4%) were females. The age ranged from 15 to 91 years (mean 33.89 ± 16.14). Causes and types of injuries including number of patients with shock and number of patients who died are shown in Table 2. Seventy two patients (42.4%) had 274 associated injuries. Details of associated injuries are shown in Table 3. Sixteen patients (9.4%) had open pelvic fractures. The Injury Severity Score (ISS) ranged from 4 to 75 (mean 17.55 ± 12.86). Eighty two patients (48.2%) received blood transfusion. Units of blood transfusion administered to the patients ranged from 1 to 40 (mean 10.04 ± 8.47).

Sixteen patients (9.4%) underwent pelvic angiography, 10 of them (62.5% of patients who had

Table 1. Kane modification of Key and Conwell classification of pelvic fractures[7].

Type I	Breaks of individual bones not involving the pelvic ring. Includes avulsion fractures, fractures of a single ramus, and isolated fracture of the iliac wing, sacrum, or coccyx.
Type II	Single break in the pelvic ring, occurring through both Ipsilateral rami, one sacroiliac joint, or subluxation of the symphysis pubis. By definition, there can be no displacement ; otherwise, a second break in the ring must also be present.
Type III	Double breaks in the pelvic ring. Three subtypes : 1. Malgaigne variants, also called double vertical or Dimetric fractures 2. Bilateral double ramus fractures, referred to as either straddle fractures or "butterfly pattern" 3. Severe multiple or crushing fractures.
Type IV	Acetabular fractures. Three types : 1. Rim fractures 2. Central acetabular fractures 3. Ischio-acetabular fractures.

Table 2. General characteristics of patients with pelvic fractures.

	Number of patients	%
Total	170	
Male	115	67.6
Female	55	32.4
Patients with shock	68	40.0
Causes of injuries		
Motorcycle accidents	85	50.0
Automobile-pedestrian accidents	29	17.0
Fall from height	20	11.8
Motorvehicle accidents	19	11.2
Run-over by trucks or cars	9	5.3
Hit or fall-over by objects	8	4.7
Type of injuries		
Type I	27	15.9
Type II	47	27.6
Type III	80	47.1
Type IV	16	9.4
Number of deaths	15	8.8

Table 3. Associated injuries in 72 patients (42.4% of all patients)*.

Injuries	Number of patients (% of all associated injuries)	
Long bone fractures	89	32.5
Severe soft tissue injuries	26	9.5
Head injuries	24	8.8
Urinary bladder injuries	17	6.2
Pneumohemothorax	15	5.5
Spinal fractures	12	4.4
Splenic injuries	11	4.0
Kidney injuries	11	4.0
Urethral ruptures	11	4.0
Multiple rib fractures	8	2.9
Liver injuries	8	2.9
Common femoral artery injuries	6	2.2
Testis and scrotal sac injuries	6	2.2
Small bowel injuries	4	
Rectal injuries	4	
Common femoral vein injuries	3	
Maxillofacial injuries	3	
Diaphragmatic injuries	3	
Anal injuries	3	
Traumatic above knee amputation	2	10.9
Scapular fractures	2	
Colon injuries	2	
Traumatic hemipelvectomy	1	
Severe lung laceration	1	
Vaginal laceration	1	
External iliac artery injury	1	
Total	274	

* Some patients had more than 1 associated injury.

Table 4. Pelvic fracture patients who underwent angiography.

	Number of patients
Angiography with embolization [successful in all]	10
(Superior gluteal artery 5)	
(Branches of internal iliac artery 4)	
(Internal pudendal artery 1)	
Normal angiography	3
Abnormality of branches of internal iliac artery but no active bleeding	1
Bleeding from external iliac artery	1
Occlusion of common femoral artery	1
Total	16

angiography or 5.9% of all patients) were found to have hemorrhage from branches of the internal iliac artery. All 10 patients had successful transcatheter embolization with gel foam (Table 4).

One hundred and thirty two patients (77.6%) received no specific treatment for the pelvic fractures. The remaining (22.4%) were treated with pelvic sling, skeletal traction, external fixation, internal fixation, and right hemipelvectomy (Table 5).

Fifteen patients (8.8%) died. All of them had Type III pelvic fractures. Causes of death were exsanguination in 6 patients (40% of death), severe head injuries in 6 patients (40% of death), and sepsis with multisystem organ failure in 3 patients (20% of death). Statistical analysis using Student-*t* test found that patients who died had a significantly higher ISS and number of blood transfusions compared to patients who survived ($P < 0.001$).

Excluding patients who died, the hospital stay ranged from 1 to 300 days (mean 24.7 ± 34.19).

DISCUSSION

Management of patients with major pelvic fractures has long been a surgical challenge. Improvement of survival requires a painstaking effort of medical and surgical teams since severely injured patients with major pelvic fractures usually have associated injuries which are equal or more dangerous than the pelvic fractures themselves[8-13]. The mortality rate of patients with pelvic fractures was 8.8 per cent which was comparable to the mortality rate of 6-8 per cent reported elsewhere [8-10,12-14]. The causes of death of patients in the current study were similar to previous studies

Table 5. Orthopedic management of pelvic fractures.

Treatment	Classification of pelvic fractures					
	Type I	Type II	Type III	Type IV	Total	%
Bed rest (No specific treatment)	26	38	57	11	132	77.6
Pelvic sling	-	1	5	-	6	3.5
Skeletal traction	-	8	8	5	21	12.4
External fixation	-	-	6	-	6	3.5
Internal fixation	1	-	3	-	4	2.4
Right hemipelvectomy	-	-	1	-	1	0.6
Total	27	47	80	16	170	

(bleeding 40%, head injury 40%, sepsis and multiorgan failure 20%)[15]. This study also demonstrated a significantly higher Injury Severity Score (ISS) and number of blood transfusion in patients who died which indicates more severe injuries in nonsurvivors.

Although 40 per cent of patients in the current study were in shock on arrival at the emergency room, only 6 patients (3.5%) died from exsanguination. Most pelvic fracture bleeding in the presented patients were successfully treated conservatively. Patients with major pelvic fractures who required operative treatment for hemodynamic instability after a short period of initial resuscitation usually had serious associated injuries and higher mortality. This observation is in agreement with previous reports[8,16]. When hemodynamic stability can be achieved after the initial resuscitation but there is evidence of continued bleeding such as a fall in hematocrit levels and requirement of large amount of fluid and blood transfusion to stabilize the patient, further interventions should be considered. The authors prefer to perform pelvic angiography with possible embolization as a treatment of choice when more than 6 units of blood transfusion are needed during the first 24 hours to keep the hematocrit levels to $\geq$ 30 per cent.

Pelvic angiography with possible embolization is now an armamentarium in patients with major pelvic fractures who have continued bleeding from branches of the internal iliac artery. These branches are not easily accessible by exploratory laparotomy with opening of the pelvic hematoma. Opening of the stable pelvic hematoma in patients with major pelvic fractures is no longer recommended by most trauma surgeons[15]. The success rate of transcatheter embolization when the bleeding vessels can be identified by angiography is 80-90 per cent[4-6,17]. The authors had a 100 per cent success rate of transcatheter embolization in 10 patients in the present study. None of them had evidence of continued bleeding after transcatheter embolization. However, two subsequently died from associated severe head injuries. Apart from its therapeutic value, angiography also diagnosed major vasular injuries in 2 of the presented cases (one with bleeding external iliac artery and one with occlusion of the common femoral artery). In the authors' opinion, pelvic angiography with possible embolization is extremely important in selected cases of bleeding major pelvic fractures. Indications for pelvic angiography in patients with major pelvic fractures are 1. blood transfusion requirement for pelvic bleeding > 6 units during the first 24 hours, and 2. absence of one common femoral pulse. However, patients should be hemodynamically stable enough for the whole process in the angiography suite.

The majority of patients in the present study (77.6%) received no specific treatment for the fractured pelvic bones other than bed rest. Only 6 patients who had Type III pelvic fractures (3.5% of all patients or 7.5% of Type III pelvic fracture patients) underwent pelvic stabilization with external fixators for bleeding control. The number of patients in this study with external fixation for early control of bleeding is quite low compared to those reported from other institutions where external fixation is used early to control pelvic fracture hemorrhage[1,2,10,18-20]. This discrepancy indicates different philosophies among institutions in dealing with bleeding pelvic fractures. Most of the time it depends largely on availability of interventional radiologists for angiography and the opinion of

orthopedic surgeons. However, in some situations, simultaneous use of both methods may be necessary for effective bleeding control[15]. One patient in the present study underwent hemipelvectomy as a life saving procedure. Such a formidable operation has been reserved for devastating injuries which could not be treated by other less aggressive means. Examples of the injuries that may necessitate hemipelvectomy are, open pelvic fractures with severe soft tissue, nerves, and iliac vessel injuries[21-24].

Patients with major pelvic fractures usually require a multidisciplinary team approach. Prolonged hospital stay is the rule rather than the exception. Long term follow-up is also necessary since many patients require further urologic or orthopedic rehabilitation or reconstruction.

SUMMARY

One hundred and seventy patients who had pelvic fractures were reviewed. Fifty per cent of the patients were caused by motorcycle accidents. Approximately 75 per cent of the patients had major pelvic fractures (Type II and Type III pelvic fractures). The majority of bleeding from pelvic fractures could be treated conservatively. However, 9.4 per cent of the patients required pelvic angiography. When bleeding points from the internal iliac artery branches were demonstrated from angiography, the success rate of transcatheter embolization was 100 per cent. External fixation for early control of bleeding pelvic fractures was infrequently employed. Prolonged hospital stay and long term rehabilitation were also observed. The mortality rate was 8.8 per cent. The causes of death were bleeding (40%), severe head injuries (40%), and sepsis with multisystem organ failure (20%).

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กระดูกเชิงกรานหัก : ประสบการณ์ในการรักษาผู้ป่วย 170 ราย ที่โรงพยาบาลมหาวิทยาลัยแห่งหนึ่งในประเทศไทย

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ความเป็นมาและวัตถุประสงค์ การรักษาผู้ป่วยกระดูกเชิงกรานหักต้องอาศัยความร่วมมือเป็นอย่างดีของคณะแพทย์ พยาบาล และบุคลากร อื่นๆ ที่เกี่ยวข้อง ปัจจุบันถึงแม้ว่าอัตราตายของผู้ป่วยจะลดลงเป็นอย่างมากแต่ก็ยังมีอยู่หลายปัญหาที่แพทย์ผู้รักษามีความคิดเห็นไม่ตรงกัน ผู้รายงานมีวัตถุประสงค์ที่จะศึกษาผู้ป่วยกระดูกเชิงกรานหักที่โรงพยาบาลจุฬาลงกรณ์เพื่อวิเคราะห์การรักษาด้วยวิธีต่างๆ และผลการรักษาผู้ป่วยดังกล่าว

วิธีการ เป็นการศึกษาย้อนหลังโดยเก็บรวบรวมข้อมูลจากบัตรผู้ป่วยนอกและทะเบียนประวัติ ของผู้ป่วยที่มีกระดูกเชิงกรานหักที่มารับการรักษาที่ตึกอุบัติเหตุ โรงพยาบาลจุฬาลงกรณ์ ตั้งแต่เดือนมกราคม พ.ศ. 2534 ถึงเดือนธันวาคม พ.ศ. 2544

ผลการศึกษา ในช่วงเวลา 10 ปีที่ทำการศึกษา มีผู้ป่วย จำนวน 170 ราย ผู้ป่วยมีอายุระหว่าง 15 ถึง 91 ปี (เฉลี่ย 33.89 ± 16.14) สาเหตุของการบาดเจ็บส่วนใหญ่เป็นอุบัติเหตุรถจักรยานยนต์ (ร้อยละ 50) ผู้ป่วยร้อยละ 15.9 มีกระดูกเชิงกรานหักชนิด Type I, ร้อยละ 27.6 มีกระดูกเชิงกรานหักชนิด Type II, ร้อยละ 47.1 มีกระดูกเชิงกรานหักชนิด Type III และร้อยละ 9.4 มีกระดูกเชิงกรานหักชนิด Type IV ผู้ป่วยร้อยละ 40 อยู่ในภาวะช็อกเมื่อแรกรับที่ห้องฉุกเฉิน ผู้ป่วย 72 ราย (ร้อยละ 42.4) มีการบาดเจ็บร่วมต่ออวัยวะอื่น 274 แห่ง ผู้ป่วย 16 ราย (ร้อยละ 9.4) มีกระดูกเชิงกรานหักที่มีแผลเปิด (open pelvic fractures) ผู้ป่วยในรายงานมีคะแนนความรุนแรงของการบาดเจ็บ (Injury Severity Score หรือ ISS) ระหว่าง 4 ถึง 75 (เฉลี่ย 17.55 ± 12.86) ผู้ป่วย 82 ราย (ร้อยละ 48.2) ได้รับเลือดตั้งแต่ 1 ถึง 40 ยูนิต (เฉลี่ย 10.04 ± 8.47) ผู้ป่วย 16 รายได้รับการตรวจหลอดเลือดแดงที่เลี้ยงอุ้งเชิงกรานโดยการฉีดสารทึบรังสี (pelvic angiography) ในจำนวนนี้ 10 ราย พบจุดเลือดออกและได้รับการรักษาโดยการฉีดสารเข้าหลอดเลือดเพื่ออุดจุดเลือดออก (transcatheter embolization) ซึ่งทุกรายสามารถหยุดจุดเลือดออกเป็นผลสำเร็จ ผู้ป่วย 132 ราย (ร้อยละ 77.6) ไม่ได้รับการรักษาเฉพาะใดๆ ต่อกระดูกเชิงกรานที่หัก ผู้ป่วย 6 ราย (ร้อยละ 3.5) ได้รับการรักษาด้วย pelvic sling ผู้ป่วย 21 ราย (ร้อยละ 12.4) ได้รับการรักษาโดย skeletal traction ผู้ป่วย 6 ราย (ร้อยละ 3.5) ได้รับการรักษาโดย external fixation ผู้ป่วย 4 ราย (ร้อยละ 2.4) ได้รับการรักษาโดย internal fixation และผู้ป่วย 1 ราย ได้รับการรักษาโดยการทำ right hemipelvectomy มีผู้ป่วยเสียชีวิตในรายงานนี้ 15 ราย (ร้อยละ 8.8) สาเหตุตาย ได้แก่ เสียเลือดมาก 6 ราย (ร้อยละ 40 ของ ผู้ป่วยที่เสียชีวิต) บาดเจ็บรุนแรงต่อสมอง 6 ราย (ร้อยละ 40 ของผู้ป่วยที่เสียชีวิต) และติดเชื้อรุนแรง 3 ราย (ร้อยละ 20 ของผู้ป่วยที่เสียชีวิต) ผู้ป่วยที่เสียชีวิตในรายงานนี้มีคะแนนความรุนแรงของการบาดเจ็บ (ISS) และได้รับเลือด มากกว่าผู้ป่วยที่รอดชีวิตอย่างมีนัยสำคัญ ($P < 0.001$) ผู้ป่วยที่รอดชีวิตพักรักษาตัวอยู่ในโรงพยาบาล ตั้งแต่ 1 ถึง 300 วัน (เฉลี่ย 24.7 ± 34.19)

สรุป ผู้ป่วยในรายงานนี้ประมาณร้อยละ 75 มีกระดูกเชิงกรานหักรุนแรง (Type II และ Type III pelvic fractures) ผู้ป่วยที่มีเลือดออกจากกระดูกเชิงกรานที่หักส่วนใหญ่เลือดหยุดเองด้วยการรักษาแบบประคับประคอง ผู้ป่วยที่ยังคงมีเลือดออกอย่างต่อเนื่องควรได้รับการฉีดสารทึบรังสีเข้าหลอดเลือดแดงที่เลี้ยงอุ้งเชิงกรานเพื่อตรวจดูจุดเลือดออกและถ้าพบควรรักษาโดยการฉีดสารเข้าไปอุดจุดเลือดออกซึ่งมักจะหยุดเลือดออกได้สำเร็จ สำหรับการทำ external fixation ของกระดูกเชิงกรานที่หักเพื่อหยุดเลือดออกทำค่อนข้างน้อย

คำสำคัญ : กระดูกเชิงกรานหัก, การตรวจหลอดเลือดแดงโดยการฉีดสารทึบรังสี, การฉีดสารเข้าหลอดเลือดเพื่ออุดจุดเลือดออก

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