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Prognosis of acute pelvic fractures in elderly patients: retrospective study

對老年患者急性骨盤破裂的預後：回顧性研究

Objective. To analyse the pattern of acute pelvic fractures, prognostic indicators, and intermediate-term functional outcome among elderly patients.
Design. Retrospective study.
Setting. Community-based hospital, Hong Kong.
Patients. Sixty patients older than 60 years who were admitted to hospital with acute pelvic fracture between 1 November 1993 and 31 December 1996.
Main outcome measures. Review of medical records and X-ray assessment to determine the patients' demographic data, medical comorbidities, aetiology and mechanism of injury, associated injuries, and clinical outcome indicators such as complications, duration of hospital stay, ambulatory status, and 1- and 2-year mortality rates.
Results. The mean follow-up period was 29 months (range, 12 to 65 months). Eighty-seven percent of patients were women and the predominant fracture pattern was Tile A2. The leading cause of injury was low-energy fall injury (75%). The 1-year mortality rate was nearly 12%. Thirty-six percent of patients experienced a decline in ambulatory status. Twenty-five percent of superior rami fractures involved the low anterior column of the acetabulum. There was a high incidence of associated cardiovascular disorders.
Conclusions. Pre-existing medical conditions and acetabular involvement are important adverse factors affecting postinjury ambulatory status. A significant decline in ambulatory status and a significant mortality rate at 1 year were found following pelvic fracture in elderly patients.

目的：分析老年患者的急性骨盤破裂的模式，預後指標，和中期功能結果。
設計：回顧性研究。
安排：香港社區醫院。
患者：在 1993 年 11 月 1 日至 1996 年 12 月 31 日期間被診斷為急性骨盤破裂而入院的 60 名年齡超過 60 歲的患者。
主要結果測量：利用醫學紀錄回顧和X射線評估，來確定患者人口統計學的數據，醫學併合發病率，傷害和與傷害有關的病因和機制，與及臨床結果指標，諸如併發症、住院期、走動的狀況，和 1 年及 2 年的死亡率。
結果：平均跟進期是 29 個月(範圍， 12 至 65 個月)。 87% 的患者是婦女且主要骨折模式是 Tile A2 。受傷的最主要原因是輕度跌傷(75%)。 1 年死亡率接近 12% 。 36% 的患者步行能力衰退。 25% 上骨盤分支骨折病例有髖臼下前柱損傷。大多數病例伴隨有心血管疾病。
結論：健康狀況不佳和有髖臼的損傷是影響傷後步行能力的重要不利因素。發現老年患者在骨盤骨折後步行能力有顯著衰退，且 1 年死亡率甚高。

Key words:
Aged;
Fractures/complications;
Multiple trauma/etiology;
Pelvic bones/injuries

關鍵詞：
年老的；
骨折 / 併發症；
多重外傷 / 病因學；
盤骨 / 傷害

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Introduction

Pelvic fracture is a major issue in orthopaedics and traumatology. Knowledge in this field is well established,[1] however, and aggressive treatment of pelvic fracture for adult patients can prevent complications and allow an early return to a productive life.[1-5] In these studies, patients have generally been young, sustained high-energy trauma, and received aggressive treatment, including surgery, for stabilisation of their fractures, whereas there have been few studies of geriatric patients with pelvic injury. The aim of this study was to identify the prognostic factors affecting the clinical outcome for geriatric patients following acute pelvic fractures.

Methods

A retrospective study was undertaken of patients older than 60 years with acute pelvic fracture, admitted via the Accident and Emergency Department to the Department of Orthopaedics and Traumatology at the Pamela Youde Nethersole Eastern Hospital from 1 November 1993 to 31 December 1996. The Pamela Youde Nethersole Eastern Hospital is a community-based hospital that serves a population of 600 000. Treatment of pelvic fractures followed the classification and recommendations of Tile and Pennal,[1] and Kregor and Routt.[2] In the current series, the majority of patients did not require operative intervention and the fractures were managed with pain control, physical therapy, treatment of associated injuries, and other medical conditions. Walking exercises with appropriate aids and assistance was started once the pain was controlled. Patients were discharged when they could walk with minimal assistance or when they reached prefracture status. No anticoagulants were used as prophylaxis against deep vein thrombosis. Exclusion criteria included pathological fractures, old fractures, and incomplete data or X-ray film retrieval. Patients readmitted to hospital were excluded to avoid double entry in the study. Data were retrieved by review of medical records, the hospital computer system, and telephone contact. Two experienced orthopaedic surgeons assessed all X-ray films and documented the fracture sites.

A structured assessment form was designed to record the patients' demographic data, medical comorbidities, aetiology and mechanism of injury, associated injuries, and clinical outcome indicators, including complications, duration of hospital stay, ambulatory status, and 1- and 2-year mortality rates (Box). The premorbid ambulatory status was modified from Hoffer et al.[6] Analysis of variance was used to test the significance of these factors on the outcome indicators ($P<0.05$).

Results

Sixty patients were included in the study. Their ages ranged from 60 to 101 years, with an average age of 78 years (standard deviation, 8.5 years). There were 52 (87.7%) women and 8 (13.3%) men. The women (average age, 78.8 years) were older than the men (average age, 73.5 years). The duration of follow-up ranged from 12 to 65 months (average follow-up, 29 months).

Fifty-two (86.7%) patients were community ambulators before the injury, whether aided or unaided (Fig 1). Forty-three (71.7%) patients were independent in activities of daily living. Forty-two (70%) patients lived with their family and the remaining patients lived alone, with friends/relatives, or in an institution (Fig 2).

Fifty-one (85%) patients' injuries were caused by low-energy trauma and nine (15%) were due to high-energy trauma. Twenty-two (36.7%) patients had their accidents at home. Fall injury at the same level was the most frequent cause of injury (Fig 3). The mechanism of the injury had a strong correlation with the type of injury sustained.

Six major coexisting diseases or disorders were recorded, with 1.3 conditions per patient present. The most prevalent system affected was the cardiovascular system (Fig 4).

Using Tile classification, 45 patients had a Tile A fracture, two had a Tile B fracture, and one Tile C fracture (Fig 5). Isolated pubic ramus or rami fractures were the most common pattern of injury (35/60; 58.3%), followed by superior pubic ramus fracture with extension to the low anterior column of the acetabulum (11/60; 18.3%). All diagnoses were confirmed with Judet's oblique views and six patients had a computed tomography scan because of unclear initial X-rays. Among the 44 patients with superior pubic ramus involvement, 11 (25%) had extension of fractures to the low anterior column of the acetabulum. A significant proportion of patients thus had acetabular involvement of the rami fractures. All fractures were, however, minimally displaced and the congruency of the weight-bearing dome was not involved.

Other injuries were frequently associated with these geriatric pelvic fractures. Eight patients had concomitant fractures of ipsilateral extremities, five had upper limb involvement, and three had lower limb involvement.

Box. Structured assessment form for recording patients' data

Assessment Form Name	Age Sex
Premorbid ambulatory status (1 year) 1. Unaided community ambulator 2. Aided community ambulator 3. Household ambulator 4. Non-functional ambulator	Activities of daily living D=dependent; I =independent (all aspects) 1. Feeding 2. Dressing 3. Bathing
Living with 1. Family 2. Friends/relatives/others 3. Alone 4. Institution	
Coexisting morbidity 1. Cardiovascular	Hypertension, ischaemic heart disease, congestive heart failure, peripheral vascular disease, arrhythmia, valvular heart disease, taking warfarin
2. Respiratory	Obstructive airway disease, restrictive lung disease, pneumoconiosis, pulmonary tuberculosis
3. Neuromuscular	Parkinsonism, hemiparesis (ipsilateral/contralateral), epilepsy, degenerative disease of the central nervous system, peripheral nerves and muscle, previous stroke, ataxia
4. Renal	Chronic renal failure, urinary tract calculus
5. Endocrine	Diabetes mellitus, thyrotoxicosis, hypothyroidism, Cushing's syndrome
6. Neoplasm	
Mechanism of injury 1. High energy 2. Low energy	Site of injury 1. Indoor 2. Outdoor
Aetiology 1. Slipped and fell 2. Fell from height 3. Road traffic accident 4. Hit by falling object 5. Others	
Pelvic fracture pattern Tile classification—A/B/C	
Letournel (acetabulum) associated injuries	
Fractures Ipsilateral limb Contralateral limb Spine	 Lower/upper Lower/upper With/without neurology
Head injury Chest injury Abdominal injury	
Hospital stay Acute Convalescent	 days days
Mortality rate Pubic and/or groin pain Number of days survived within: 1 year 2 years	

Ten percent of patients had minor head injuries, although there was no severe intracranial pathology. Spinal fractures were noted in three patients, with the levels involved being C5, T12, and L2. None of the patients had any neurological deficit after sustaining the fracture. Associated chest or abdominal trauma was rare in this group. One patient had a fracture of the first rib and serious chest injury, and died shortly after admission because of the severe trauma sustained after a fall from a height. Abdominal trauma did not occur in any patients in this study.

Ten complications developed for five patients during their stay in hospital (Table). Two patients died of

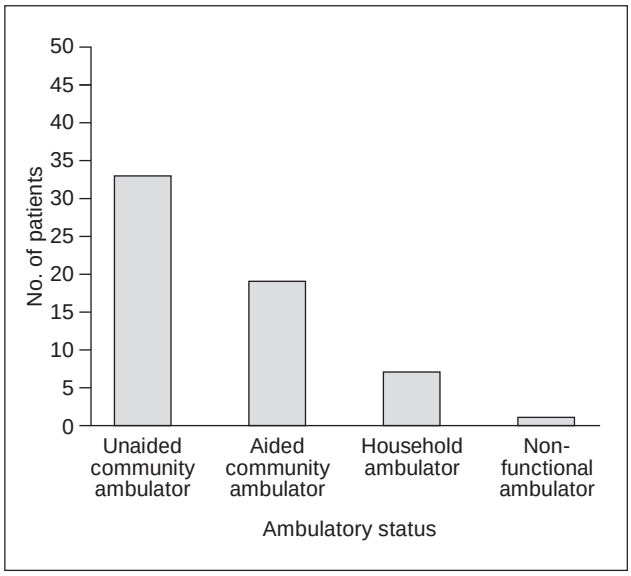

Fig 1. Premorbid ambulatory status of elderly patients with acute pelvic fracture

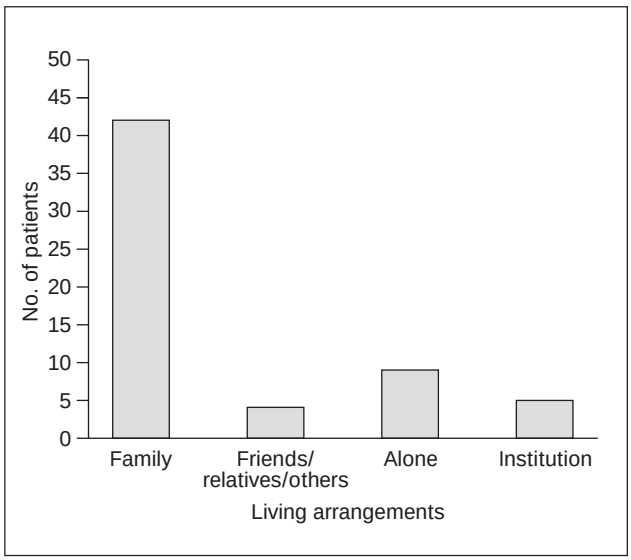

Fig 2. Patient's living arrangements before injury

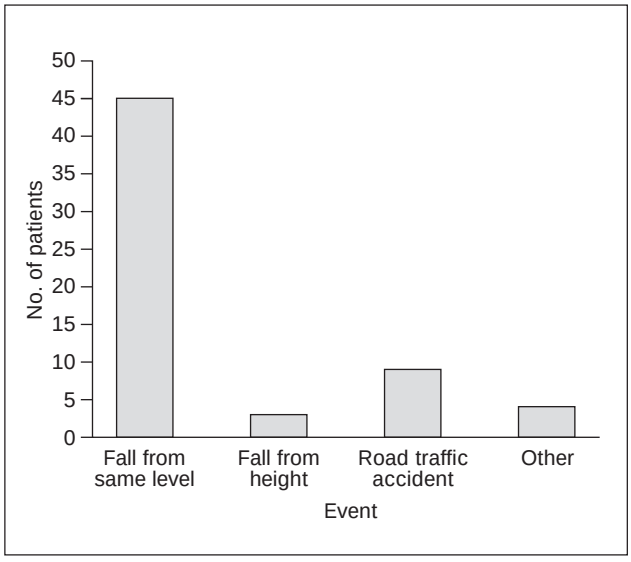

Fig 3. Events causing pelvic fracture

causes directly related to the pelvic fracture—one died of uncontrolled bleeding from a comminuted pelvic fracture, and the other died of pulmonary embolism. This patient had sustained right superior and inferior pubic rami fractures after a same level fall injury. She had no underlying medical disease and was able to walk well with a walking frame after 5 days in hospital. Thirteen days after the injury, however, she presented to the medical department for acute dyspnoea and died shortly after admission. Postmortem examination revealed deep vein thrombosis and massive pulmonary embolism without any other identifiable cause.

The 1- and 2-year cumulative mortality rates were 11.7% (7/60) and 19.6% (11/56), respectively. Four patients were lost to follow-up after 1 year. The causes of death included chest infection, stroke, congestive heart failure, chronic obstructive airways disease, cirrhosis, and neoplastic conditions. We did not find any positive prognostic indicators of survival within the first 2 years after fracture such as sex, age, associated medical comorbidities, energy of trauma, or associated injuries.

There were 53 patients available for ambulatory status assessment after more than 1 year of follow-up. Forty-three (81.1%) patients experienced no or mild pubic and/or groin pain; these patients did not require regular analgesia. Thirty-four (64.2%) patients had no deterioration in ambulatory status, while 19 (35.8%) patients declined assessment. Change in ambulatory status was not associated with sex, age (younger or older than 70 years or 80 years), absence or presence of complications, or number of associated injuries. Regarding the associated medical comorbidities, change in ambulatory status was not associated with pulmonary disease, neuromuscular disease, or endocrine disease. There was, however, a weak correlation with associated cardiovascular disease but this was not statistically significant ($P=0.051$). The change in ambulatory status was significantly different in the presence of two or more medical comorbidities ($P<0.05$), but was not found to be different when comparing patients

Table. Complications of pelvic fractures

Complications	No.
Chest infection	2
Urinary tract infection	1
Pin tract infection	1
Implant infection	1
Lower limb cellulitis	1
Syndrome of inappropriate antidiuretic hormone secretion	2
Decubitus ulcer	1
Thromboembolism	1

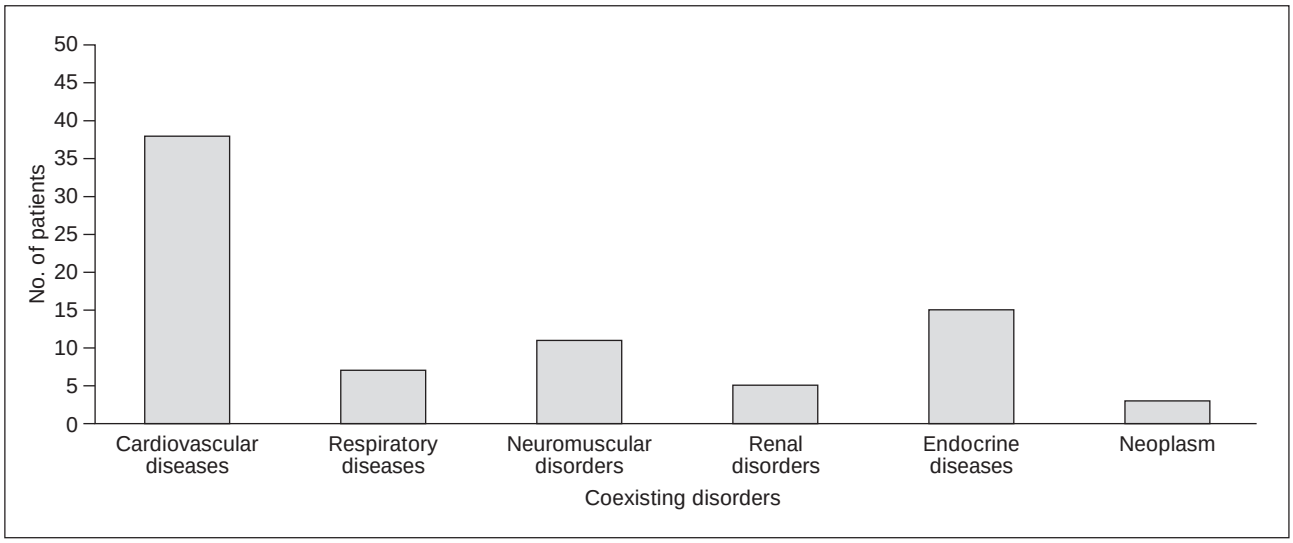

Fig 4. Number of coexisting diseases or disorders

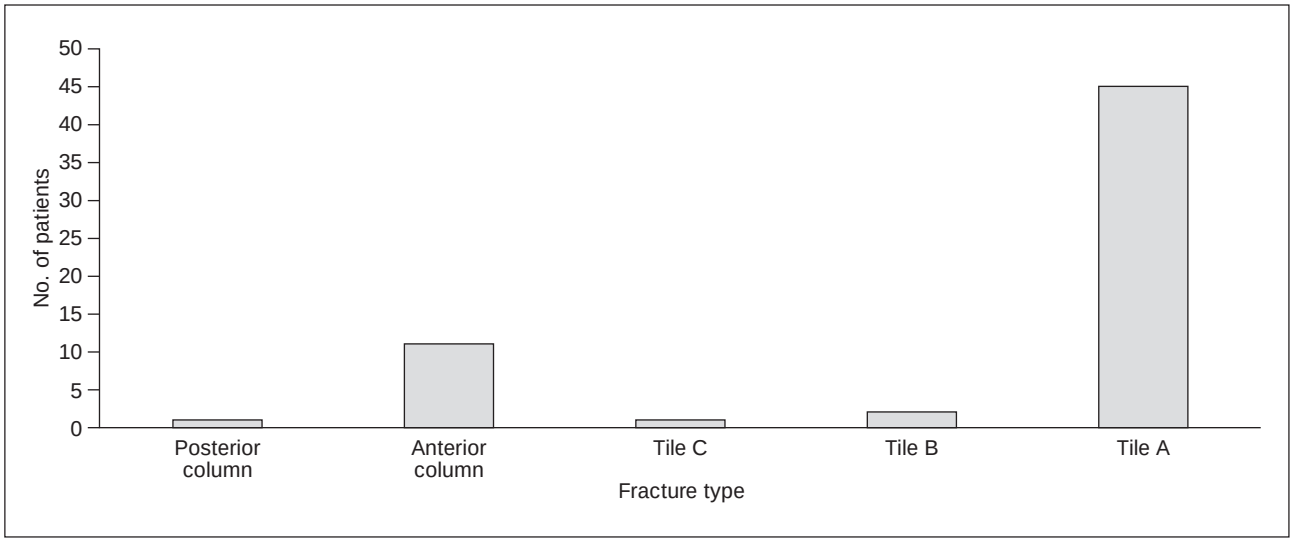

Fig 5. Pattern of pelvic fractures

with or without comorbidities. Patients with associated head injury also experienced deterioration of ambulation ($P<0.05$).

The pattern of fracture had an implication for recovery. Patients with acetabular column involvement had a poorer ambulatory recovery than those with rami or parasymphyseal fractures and required a longer duration of bed rest before mobilisation exercises could begin ($P=0.012$). For patients with isolated rami or parasymphyseal injury, the number of fractures and involvement of one or both sides were not statistically significant as a prognostic factor for ambulatory status. The fracture pattern had no implications for survival except for Tile C fracture; only one patient had this fracture and the patient died of uncontrolled haemorrhage. There were only two patients with Tile B fracture, precluding meaningful statistical analysis.

Geriatric pelvic fractures have a significant impact on medical resources. Patients may require a prolonged hospital stay, often including convalescent stay. In this study, the minimum stay was 3 days, with a maximum stay of 100 days (excluding those patients who died). The average stay was 20.8 days (standard deviation, 19.7 days). After excluding the patients who died, we found that several factors affected the duration of hospital stay. Patients with underlying medical comorbidities had a longer stay in hospital than those without underlying disease ($P=0.031$). Cardiac diseases were associated with a longer duration of stay ($P=0.013$), although pulmonary, neuromuscular, or endocrine diseases did not affect the duration of stay. The presence of complications and associated injuries, including head injury, had a strong correlation with duration of hospital stay ($P<0.001$). In general, patients with head injury required a longer duration of stay. Although the head injuries were all considered minor

and required no surgical intervention, they were associated with a higher incidence of complications. Premorbid ambulatory status, living place, sex, and age did not affect the duration of hospital stay and there was no correlation between duration of hospital stay and the 1- or 2-year mortality rate.

Discussion

Geriatric pelvic fracture is a relatively under-researched topic. Few publications could be found in the English language literature. Koval et al[7] performed a comprehensive retrospective study of geriatric patients with pubic rami fractures. These researchers reported a 1-year mortality rate of 9.5%, which was comparable to our finding. Similar to our results, the number of comorbidities was associated with a longer duration of hospital stay.[7] Rossvoll and Finsen[8] conducted a 4-year retrospective study involving 62 patients, one of whom died of pulmonary embolism. This is similar to our results in terms of the number of patients diagnosed with pulmonary embolism, total number of patients, and duration of follow-up. Because of the apparent low mortality due to pulmonary embolism in this series and in Rossvoll and Finsen's study,[8] it appears that routine anticoagulant prophylaxis against deep vein thrombosis is not necessary. The chance of pulmonary embolism has been related to severity of injury by Buerger et al,[9] although it may be difficult to confirm this statement in a trial of geriatric patients since most elderly patients are unlikely to survive a severe trauma.

Alost and Waldrop[10] recently published a detailed analysis of geriatric patients with pelvic fractures. They found that a significant proportion of geriatric mortality was caused by exacerbation of pre-existing cardiovascular disease. Browner et al[11] found that mortality after hip or pelvic fracture was related to an underlying medical condition rather than the fracture itself. Although both groups of researchers showed that prefracture comorbidities were the major cause of death rather than the pelvic fracture, they did not show that medical comorbidities increased the mortality rate. In this study, the 1- and 2-year mortality rates were 11.7% and 19.6%, respectively. We found that pre-existing medical conditions made an important contribution to deterioration in ambulatory status but did not increase the mortality rate during the first 2 years after fracture. We did find, however, that most deaths were due to prefracture medical conditions.

There was a statistically significant difference in ambulatory status when comparing patients with two or more medical comorbidities to those with fewer medical conditions. Patients sustaining a head injury tended to have poorer ambulatory status. This could be due to disorders affecting proprioceptive sense and hence balance, and problems with muscle coordination causing more ambulatory deterioration. Patients with acetabular involvement had poorer ambulatory status than those with rami or parasymphysis fractures, which could be due to involvement of the hip joint. Coexisting diseases such as cardiovascular diseases may also affect ambulation (P=0.051), although other individual categories of disease did not appear to affect ambulatory status.

We identified five factors correlated with the duration of hospital stay—medical comorbidities, presence of complications, associated injuries, cardiovascular disease, and head injury. Possible explanations for patients with cardiovascular disease or head injury requiring a longer duration of hospital stay include longer observation period for haemodynamic status for patients with poor reserve, adjustment of cardiac drug dosage, and neurological observation.

Conclusion

In this retrospective study, the major determining factor of duration of hospital stay and ambulatory status was the presence of underlying medical conditions, especially cardiovascular diseases. Head injury is also an important indicator of the duration of hospital stay and development of complications. Fracture of the pelvis is less important as a prognostic indicator except when there is acetabular involvement. We need a classification or scoring system that includes these factors so that the outcome for these patients will be more predictable. This study supplies further information on the prognostic factors for geriatric patients following pelvic fracture, although there is the drawback that this is a retrospective study, with a relatively small number of patients, and only medium-term follow-up. Further study is required to provide the necessary information for developing an effective clinical management protocol for this increasing group of patients.

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