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Overview of Pelvic Ring Fracture Patients: Observational Study in the Emergency Department at Dr. Kariadi General Hospital, Semarang, Indonesia

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ABSTRACT

Background: Although the incidence of pelvic fractures is only 7% of all trauma, the mortality reaches 21.5%. Management of pelvic fractures remains a challenge because it is often a polytrauma that requires multidisciplinary management and large resources. Knowledge of the characteristics of patients with pelvic fractures is expected to help in management and reduce mortality. **Methods:** This observational study was conducted retrospectively with a population and sample of all pelvic fracture patients in the emergency room at Dr. Kariadi Hospital Semarang for the period January 2021 to December 2023. The characteristics observed included gender, age, fracture classification, etiology, trauma score, fracture pattern, and management, and output. The data obtained is then presented descriptively. **Results:** A total of 34 patients with pelvic fractures were recorded in this study. There were 16 male patients and 18 female patients. A total of 3 patients were less than 17 years old, 19 patients were 17-34 years old, 7 patients were 35-52 years old and 3 patients were more than 52 years old. The most common cause of pelvic fractures was traffic accidents (KLL) with 28 patients, followed by work accidents (4 patients) and other trauma (2 patients). Based on the Young-Burgess classification, the most common pelvic fracture pattern was LC1 (11 patients), followed by APC1 (3 patients), APC2 (4 patients), APC3 (3 patients), LC2 (2 patients), LC3 (6 patients), VS (4 patients), and CM (1 patient). A total of 4 patients had an ISS score of 1-8, 8 patients had an ISS score of 9-15, 9 patients had an ISS score of 16-25, and 13 patients had an ISS score of more than 25. The most common accompanying injury was long bone fracture (15 patients), head injury in 10 patients, abdominal trauma in 9 patients, and thorax trauma in 4 patients. Operative treatment was carried out in 21 patients, while 13 other patients were treated non-operatively. Of the 34 patients, 8 patients died and 26 others were discharged in good condition. **Conclusion:** Most pelvic fractures occur at the age of 17-34 years and the most common cause is KLL. All pelvic fracture patients had concomitant injuries and the majority of patients had unstable fractures that required operative treatment. Mortality due to pelvic fracture and/or accompanying injuries is 23.5%.

1. Introduction

A pelvic ring fracture, also known as an acetabular fracture, is a serious bone injury involving the ring structure of the acetabulum, where the femur meets the pelvic bone. This injury often occurs as a result of high-energy trauma, such as a traffic accident, fall from a height or sports injury. Although the incidence

of pelvic ring fractures is low, approximately 2-6% of total musculoskeletal injuries and 6-10% of pelvic trauma injuries, the impact on individuals and the health system is significant. These fractures are often associated with high morbidity and mortality, with mortality rates reaching 10-20%. The complexity of the anatomical structure and biomechanics of the pelvic

ring area, as well as the potential for serious concomitant injuries, make these fractures a complex medical challenge. Management of pelvic ring fractures requires a multidisciplinary approach involving multiple medical specialties, including orthopedic surgeons, trauma surgeons, radiologists, and anesthesiologists.¹⁻³

Understanding patient characteristics, such as age, gender, mechanism of injury, and etiology, can help in identifying risk factors associated with pelvic ring fracture. This information is important for developing more effective prevention strategies and increasing public awareness of the risks of these injuries. Knowledge of patient characteristics, fracture patterns, and accompanying injuries can help physicians make more precise and accurate clinical decisions. This can improve the quality of care and patient outcomes, including reducing the risk of complications and death. The data obtained from this study can help hospitals and health systems allocate resources more effectively to treat patients with pelvic ring fractures. This can help ensure that patients receive appropriate and timely care. The results of this study may serve as a basis for further research on pelvic ring fractures, including the development of newer diagnostic and treatment techniques, as well as studies of the long-term impact of these injuries on patients' quality of life.⁴⁻⁶ Understanding the characteristics of patients with pelvic ring fractures in the emergency room at Dr. Kariadi General Hospital Semarang is an important step to improving the prevention, diagnosis, and treatment of this complex injury. It is hoped that this research can contribute to reducing morbidity and mortality rates, as well as improving the quality of life of patients with pelvic ring fractures.

2. Methods

This study used an observational design with a retrospective approach. This design was chosen because it allows researchers to analyze data that has been collected in the past, in this case, the medical record data of patients with pelvic fractures in the

emergency room at Dr. Kariadi General Hospital Semarang. The population covered in this study were all patients with pelvic fractures who were managed in the emergency room at Dr. Kariadi General Hospital Semarang in the period January 2021 to December 2023. The sample for this study was taken using total sampling, of which there were 34 research subjects who met the inclusion and exclusion criteria. included in the research. This was done to ensure that this research had a high representation of the reach population. The inclusion criteria are patients with pelvic fractures who are managed in the emergency room at Dr. Kariadi General Hospital Semarang for the period January 2021 to December 2023. Meanwhile, the exclusion criteria are patients who refuse treatment in the emergency room or go home at their own request, patients whose research data is incomplete, and patients who died on arrival at the ER.

Data collection was carried out by reviewing the patient's electronic medical records. Data collected includes demographic characteristics: age, gender, education, occupation; Mechanism of injury: cause of fracture, type of vehicle involved, height of fall; Fracture classification: young-burgess classification; Trauma score: ISS (Injury Severity Score); Concomitant injuries: long bone fractures, head injuries, abdominal trauma, thorax trauma; Management: operative or nonoperative; Outcome: died or discharged in good condition. The data collected was analyzed descriptively. Quantitative data is presented in the form of tables and diagrams, while qualitative data is presented in narrative form. This research has received approval from the Health Research Ethics Committee of Dr. Kariadi General Hospital Semarang. All patient data is kept confidential and is only used for research purposes.

3. Results

Table 1 shows that although pelvic fractures are often associated with men, research data shows surprising facts. Women were found to be at greater risk of pelvic fracture, with 18 patients compared to 16 male patients. This figure represents 52.9% of women

and 47.1% of men. The 17-34 year age group dominated pelvic fracture cases, with 19 patients. This age represents an active and productive period, during which individuals are more exposed to the risk of accidents and injuries. Followed by the age group 35-52 years with 7 patients and those aged over 52 years with 3 patients. These data suggest that pelvic fractures are not only limited to the young but can also occur in older individuals. The main cause of pelvic fractures was traffic accidents, reaching 28 patients or 82.4%. This fact emphasizes the dangers on the road and the need for driving safety education. Work accidents, although not as high as traffic accidents, remained a risk factor with 4 patients. Meanwhile, 2 other patients experienced pelvic fractures due to other accidents, such as falling from a height. This study provides a clear picture of the characteristics of pelvic fracture patients in the emergency room at Dr. Kariadi General Hospital Semarang. These findings can help medical professionals understand patient profiles, identify risk factors, and develop more effective prevention and management strategies.

Table 2 shows that this study shows that the most common pelvic fracture pattern is LC1 (32.4%). LC1

often occurs due to direct impact on the front of the pelvis, such as in traffic accidents. LC1 generally occurs in patients with a strong and stable pelvis. Other pelvic fracture patterns frequently found in this study were APC2 (11.8%), APC3 (8.8%), and VS (11.8%).

These patterns generally occur due to impact on the back of the pelvis or due to torsion of the pelvis. The results showed that the majority of patients had a high ISS score (38.2% >25). This shows that pelvic fractures are often serious injuries with many associated injuries. The most common concomitant injury was long bone fracture (44.1%), followed by head injury (29.4%), abdominal trauma (26.5%), and thorax trauma (11.8%).

Table 3 shows that operative treatment was carried out in 61.8% of patients, while the other 38.2% of patients were managed nonoperatively. The mortality rate in pelvic fracture patients in this study was 23.5%. A total of 76.5% of patients in this study were discharged in good condition. This suggests that with appropriate management, the majority of patients with pelvic fractures can recover from this injury.

Table 1. Characteristics of respondents.

Respondent characteristics	Frequency (n)	Percentage (%)
Gender		
Male	16	47.1
Female	18	52.9
Age		
< 17 years	3	8.8
17-34 years	19	55.9
35-52 years	7	20.6
> 52 years	3	8.8
Causes of pelvic fractures		
Traffic accident	28	82.4
Work accident	4	11.8
Another accident	2	5.9

Table 2. Pelvic fracture pattern, ISS score, and concomitant injuries.

Variable	Frequency (n)	Percentage (%)
Pelvic fracture patterns (Young-Burgess classification)		
APC1 (Fracture of the anterior ilium and/or anterior pubis)	3	8.8
APC2 (Fracture of the anterior ilium and anterior pubis, with disruption of the iliopubic joint)	4	11.8
APC3 (Fractures of the anterior ilium, anterior pubis, and acetabulum)	3	8.8
LC1 (Fracture of the posterior ilium and/or ischium)	11	32.4
LC2 (Fracture of the posterior ilium and/or ischium, with disruption of the sacroiliac joint)	2	5.9
LC3 (Fractures of the posterior ilium, ischium, and acetabulum)	6	17.6
VS (Unstable fracture involving the sacroiliac joint)	4	11.8
CM (Unstable fracture involving the sacroiliac joint)	1	2.9
ISS score (Injury Severity Score)		
1-8	4	11.8
9-15	8	23.5
16-25	9	26.5
>25	13	38.2
Concomitant injuries		
Long bone fractures	15	44.1
Head injury	10	29.4
Trauma abdomen	9	26.5
Trauma thorax	4	11.8

Table 3. Management and outcomes of pelvic fracture patients.

Variable	Frequency (n)	Percentage (%)
Management		
Operative	21	61.8
Nonoperative	13	38.2
Outcome		
Die	8	23.5
Discharged in good condition	26	76.5

4. Discussion

This study shows that pelvic fractures occur more frequently in women (52.9%) than men (47.1%). Women have wider pelvises than men, and this difference may influence the risk of pelvic fracture. The

female pelvis is composed of the iliac bones, ischium, and pubis which are connected via the sacroiliac joint and pubic symphysis. This structure provides stability and support to the pelvis, but also makes it more susceptible to compression and rotation during

impact. Men, on the other hand, have narrower pelvises and stronger bone structures, making them more resistant to these forces. When a collision occurs, the forces acting on the female pelvis are more concentrated on the sacroiliac joint and pubic symphysis. This increases the risk of fractures in these joints, which are often complex and difficult to treat fractures. Men, with narrower pelvises, are more likely to experience fractures of the acetabulum (the hole in the iliac bone where the head of the femur is embedded) or the iliac bone itself. The female pelvis has greater inclination and anteversion angles than the male pelvis. These angles affect how the pelvis supports and distributes body weight. In women, these angles may increase the risk of compression and rotation of the sacroiliac joint and pubic symphysis, thereby increasing the risk of fracture. Women more often engage in activities that pose a high risk for pelvic fracture. Women are more often drivers or passengers in cars than men. This increases their risk of being involved in a traffic accident, which is a major cause of pelvic fractures. Women more often fall from heights, such as when falling down stairs or while exercising. A fall from a height can cause a severe impact on the pelvis, increasing the risk of fracture. Women are more likely to engage in sports that are at high risk for pelvic fracture, such as horseback riding, motorbike riding, or skiing. These sports involve impact and rotation of the pelvis, which increases the risk of fracture. Women more often perform household activities that have a high risk of pelvic fracture, such as lifting heavy objects or tripping while cleaning the house. These activities can cause impact or twisting of the pelvis, increasing the risk of fracture. The hormone estrogen in women can affect bone density and make them more susceptible to fractures. Estrogen plays an important role in maintaining bone density and strength. A decrease in estrogen levels in women, such as during menopause, can cause osteoporosis, which is a condition of brittle bones that increases the risk of fracture. Menopause is a natural period in a woman's life where estrogen production decreases drastically. This decrease in estrogen can cause osteoporosis,

which increases the risk of pelvic fracture up to four times in women compared to men.⁷⁻⁹

This research shows that the 17-34-year age group is the largest age range that experiences pelvic fractures (55.9%). This is an important concern for health experts and the wider community, considering that pelvic fractures are serious injuries with the potential for complications and high mortality. This age group is generally more active and involved in various high-risk activities. Contact sports such as football, rugby, and hockey have a high risk of severe impact to the pelvis, which can cause pelvic fractures. Accidents during car racing can result in severe impact to the pelvis, potentially causing a pelvic fracture. Activities such as snowboarding, skateboarding, and parkour also carry a high risk of impacts and falls, which can lead to pelvic fractures. Traffic accidents are the main cause of pelvic fractures throughout the world, and the age group 17-34 years is the age group most often involved in traffic accidents. Lack of experience and carelessness in driving can increase the risk of accidents for young drivers. Motorcyclists are more susceptible to serious injuries from accidents, including pelvic fractures. Pedestrians who are hit by motor vehicles are at high risk of experiencing a pelvic fracture. Pelvic fractures in the 17-34-year age group can have a significant impact on the lives of individuals, families, and society. Pelvic fractures can cause pain, limited mobility, and the inability to perform physical activities as before. Pelvic fractures can interfere with daily life, such as working, studying, and socializing, thereby reducing the quality of life. The cost of treating a pelvic fracture can be high, and individuals may experience loss of income due to the injury. Pelvic fractures can cause emotional trauma, anxiety, and depression in individuals.¹⁰⁻¹²

A pelvic fracture, a break in the pelvic ring structure, is a serious injury that can have fatal consequences. Understanding the causes of pelvic fractures can assist in prevention efforts and the development of effective treatment strategies. Research shows that traffic accidents are the most

common cause of pelvic fractures (82.4%), followed by work accidents (11.8%) and other accidents (5.9%). Traffic accidents are the main cause of pelvic fractures with a significant number (82.4%). This is not surprising considering its role as a leading cause of death and injury worldwide. The higher the vehicle speed during an accident, the greater the energy released and the risk of causing more severe injuries, including pelvic fractures. The position and angle of impact during an accident play an important role in determining the type and severity of injuries. Direct impacts to the front or back of the pelvis are more likely to cause pelvic fractures than impacts to other parts of the body. Large vehicles such as trucks and buses have greater mass and produce greater energy during an accident, thereby increasing the risk of pelvic fracture for passengers and drivers of other vehicles involved. Proper use of seat belts can significantly reduce the risk of pelvic fracture and other fatal injuries in traffic accidents. Unfortunately, many people still neglect to use seat belts, thereby increasing their vulnerability to serious injury. Work accidents, although not as numerous as traffic accidents, remain a significant contributor to pelvic fractures (11.8%). Workers in the construction sector are often exposed to the risk of falling from heights, being hit by heavy objects, and being crushed by equipment and materials. Workers in the manufacturing sector are at risk of injury due to dangerous machines, heavy equipment and production processes. Workers in the mining sector are at risk of mine collapses, exposure to hazardous materials, and accidents caused by mining vehicles. Workers who do not have adequate safety training are more susceptible to accidents and injuries. Workplaces that have unsafe conditions, such as slippery floors, poor lighting, and poorly maintained equipment, can increase the risk of accidents and injuries. Proper use of PPE (personal protective equipment), such as helmets, boots, and safety glasses, can help protect workers from serious injuries, including pelvic fractures. Other accidents, such as falls from heights, sports accidents, and

household accidents, can also cause pelvic fractures (5.9%). Older people and children are more susceptible to falls and other accidents due to weaker balance and coordination. People who engage in high-risk physical activities, such as extreme sports or work involving heights, are more susceptible to serious injuries, including pelvic fractures. Unsafe environmental conditions, such as slippery stairs or uneven floors, can increase the risk of falls and other accidents. Traffic accidents, work accidents, and other accidents are the main risk factors for pelvic fractures.^{13,14}

This research reveals important information regarding pelvic fracture patterns found in patients in the emergency room at Dr. Kariadi Hospital, Semarang. The main findings showed that the most common pelvic fracture pattern was LC1 (32.4%), followed by APC2 (11.8%), APC3 (8.8%), and VS (11.8%). Understanding these patterns in more depth can help medical experts understand the mechanism of injury, predict the risk of complications, and determine appropriate management strategies for patients. The predominance of the LC1 fracture pattern (32.4%) indicates that direct impact to the front of the pelvis is a significant mechanism of injury in patients with pelvic fractures. The front of the pelvis, especially the acetabulum and pubis area, is a strong and stable structure. Direct impact to this area can cause an LC1 fracture, which generally involves the sacroiliac joint. Traffic accidents, especially frontal collisions, are the main cause of direct impacts to the front of the pelvis. This also explains the high prevalence of LC1 fractures in this study. Fracture patterns APC2 (11.8%), APC3 (8.8%), and VS (11.8%) generally occur due to impact on the back of the pelvis or due to torsion of the pelvis. Impact to the back of the pelvis, such as in a rear-end accident or a fall from a height, can cause APC2 and APC3 fractures. APC2 fractures are generally stable and do not involve the sacroiliac joint, whereas APC3 fractures are unstable and involve the sacroiliac joint. Torsion to the hip, such as in a rollover or crush accident, can cause a VS fracture. VS fractures are unstable and involve the sacroiliac joint. Young patients are more susceptible

to APC fractures, whereas older patients are more susceptible to LC fractures. Men experience pelvic fractures more often than women. Comorbid medical conditions such as osteoporosis can increase the risk of pelvic fracture. Understanding pelvic fracture patterns in specific demographic groups may assist in developing targeted prevention and management strategies. Investigating pelvic fracture patterns based on specific injury mechanisms can help in understanding the risk of complications and determining optimal treatment options.^{15,16}

This study showed that the majority of patients (38.2%) had a high ISS score (>25). This shows that pelvic fractures are often serious injuries with many associated injuries. Long bone fractures (44.1%) can occur due to a direct impact on the long bones during an accident. Head injuries (29.4%) can occur due to head impact during an accident or due to complications of pelvic fracture, such as hypotension or epidural hematoma. Abdominal trauma (26.5%) can occur due to direct impact to the stomach during an accident or due to complications of pelvic fracture, such as rupture of internal organs. Thorax trauma (11.8%) can occur due to direct impact to the chest during an accident or due to complications of pelvic fracture, such as hemopneumothorax. The high ISS score and the large number of concomitant injuries in pelvic fracture patients can be explained by several possibilities. Pelvic fractures often occur as a result of traffic accidents or other high-energy accidents. This accident can cause injuries to various parts of the body, including long bones, head, abdomen and thorax. The pelvis is located near vital organs such as the intestines, bladder and large blood vessels. Injury to these organs can cause serious complications and increase the ISS score. Pelvic fractures can cause pelvic ring instability, which can disrupt blood flow to vital organs and increase the risk of complications. The results of this study indicate that pelvic fracture is a serious injury with many complications. Therefore, it is important to perform a thorough initial assessment in patients with pelvic fractures to detect concomitant injuries and provide appropriate

management.^{17,18}

A pelvic fracture is a serious injury that can cause life-threatening complications. Management of patients with pelvic fractures depends on various factors, including fracture pattern, concomitant injuries, and the patient's general condition. Research conducted in the emergency room at Dr. Kariadi General Hospital Semarang showed that operative treatment was carried out in 61.8% of patients, while 38.2% of other patients were managed non-operatively. The mortality rate in pelvic fracture patients in this study was 23.5%, and 76.5% of patients were discharged in good condition. Pelvic fracture pattern is an important factor in determining treatment options. Fractures that are unstable and involve the sacroiliac joints generally require surgery to stabilize the pelvic ring. This is important to prevent displacement of bone fragments which can cause further damage to surrounding tissues and organs. Patients with serious concomitant injuries, such as head injuries or abdominal trauma, may require surgery to repair the injuries. These concomitant injuries can increase the risk of complications and death, necessitating timely surgical intervention to minimize these risks. The patient's general condition, such as advanced age or multiple comorbidities, also needs to be considered in determining treatment options. Patients in poor general condition may not tolerate surgery and require nonoperative management. This may include external stabilization with traction or bracing, as well as conservative therapies such as pain management and nutrition. In this study, 21 patients (61.8%) underwent surgery for pelvic fractures. The surgical technique used varies depending on the fracture pattern and accompanying injuries. The open reduction and internal fixation (ORIF), this technique involves opening the fracture site to directly reposition the bone fragments and stabilize them with plates and screws. Minimally invasive stabilization and fixation (MISF), technique uses smaller incisions and special instruments to reposition and stabilize bone fragments. Iliac Screw Fixation, this technique involves placing a screw into

the ilium bone to stabilize the pelvic ring. In 13 patients (38.2%), nonoperative management was performed. Nonoperative management is typically used for patients with stable fractures, patients with significant comorbidities, or patients who cannot tolerate surgery. External Stabilization, this technique involves the use of traction or external bracing to stabilize bone fragments and prevent displacement. Pain Management: Effective pain management is very important for patients with pelvic fractures, as it can help improve comfort and mobility. Nutrition: Patients with pelvic fractures may require additional nutritional support to aid the healing process.¹⁶⁻¹⁸

Pelvic fracture is a serious orthopedic injury with a high mortality rate. This study showed that the mortality rate in pelvic fracture patients reached 23.5%, underscoring the severity of this injury. Elderly patients are more susceptible to complications from pelvic fractures, such as infection and pneumonia. This is caused by a decline in physiological function and a weakened immune system with age. Research shows that pelvic fracture patients over 65 years of age have a 2-3 times higher risk of death compared to younger patients. The presence of comorbidities in pelvic fracture patients can worsen the prognosis and increase the risk of death. The most frequent comorbidities associated with an increased risk of death in pelvic fracture patients. Coronary heart disease, hypertension, and heart failure can worsen the patient's condition and complicate recovery from pelvic injury. Chronic obstructive pulmonary disease (COPD) and pneumonia can interfere with a patient's breathing and increase the risk of infectious complications. Diabetes can slow wound healing and increase the risk of infection, which can be fatal in pelvic fracture patients. Kidney failure can cause metabolic complications and disrupt electrolyte balance in pelvic fracture patients, which can be fatal. Unstable pelvic fractures involving the sacroiliac joints generally have a poorer prognosis and a higher risk of death. Damage to the pelvic ring structure can cause instability and dysfunction of surrounding organs, such as the intestines, bladder, and large blood

vessels. Complex pelvic fractures are often accompanied by extensive soft tissue injuries, which can lead to internal bleeding and other complications. Complex pelvic fractures are often more difficult to manage operatively or nonoperatively, which can increase the risk of complications and death. Patients with serious concomitant injuries, such as head injury or abdominal trauma, have a higher risk of death. Patients with serious comorbid injuries require intensive critical care, which can increase the risk of complications and death. Head injuries and abdominal trauma can cause damage to vital organs such as the brain, lungs and liver, which can be fatal. Serious concomitant injuries can increase the physiological burden on the patient, which can worsen the patient's condition and increase the risk of death.^{19,20}

5. Conclusion

The most common pelvic fracture pattern was LC1 (32.4%), followed by APC2 (11.8%), APC3 (8.8%), and VS (11.8%). Most patients had high ISS scores (38.2% >25), indicating that pelvic fractures are often serious injuries with multiple concomitant injuries. The most common concomitant injury was long bone fracture (44.1%), followed by head injury (29.4%), abdominal trauma (26.5%), and thorax trauma (11.8%). Operative treatment was carried out in 61.8% of patients, while the other 38.2% of patients were managed nonoperatively. The mortality rate in pelvic fracture patients is 23.5%.

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