Clinical Research
Vertebral fracture characteristics at dr. Kariadi hospital, Semarang

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ABSTRACT

Introduction: The incidence of vertebral trauma in the world is recorded at 0.019% to 0.088% per year. Previous research found that men have 1.9-3.3 times higher risk of vertebral injuries than women. However, the number of incidence is different in each country depending on several factors such as geographical background, climate, socio-economic, and cultural community.

Methods: To determine the epidemiology of vertebral fractures at Dr. Kariadi General Hospital, Semarang. This was an observational descriptive study. Data were obtained from the medical records of vertebral fractures patients at Dr. Kariadi General Hospital, Semarang, from 2015 to 2019. There were 358 samples in this study. Patient demographic, diagnosis, and duration of treatment data were collected. The number of cases, comparison of cases in gender, age distribution, number of cases per year, type of fracture, and length of treatment in vertebral fractures of patients were analyzed using SPSS.

Results: The incidence of vertebral fractures in male (64.8%) was higher than in female (35.2%). Age distribution showed age >50 years had the most frequent vertebral fracture (41.6%). The most common type of vertebral fracture was lumbar vertebra fracture (60.9%). The longest treatment duration of vertebral fracture was 5-10 days (30.7%).

Conclusion: Male have higher risk of experiencing trauma to the vertebrae than female. In the population group of age >50 years, the higher risk is due to the presence of postmenopausal primary osteoporosis. The high incidence of lumbar vertebral trauma in male is generally related to the trauma caused by traffic accidents or falling from height.

ABSTRAK

Pendahuluan: *Angka kejadian trauma vertebra di dunia tercatat sebesar 0,019% hingga 0,088% per tahun. Berdasarkan penelitian sebelumnya, laki-laki ditemukan memiliki risiko 1,9 – 3,3 kali lebih besar daripada perempuan untuk mengalami cedera vertebra. Angka kejadian tersebut berbeda untuk masing-masing negara bergantung pada beberapa faktor, seperti latar belakang geografis, iklim, sosio-ekonomi, serta budaya masyarakat.*

Metode: *Penelitian ini bertujuan untuk mengetahui gambaran epidemiologi fraktur vertebra di RSUP Dr. Kariadi, Semarang. Penelitian dilakukan dengan desain deskriptif observasional. Data diperoleh dari rekam medik pasien dengan fraktur vertebra di RSUP Dr. Kariadi dalam periode tahun 2015 - tahun 2019, dan diperoleh 358 sampel. Data yang dikumpulkan berupa data diri pasien, diagnosis, dan lama perawatan. Data diolah menggunakan SPSS untuk mengetahui jumlah kasus, perbandingan kasus pada laki laki – perempuan, distribusi usia, jumlah kasus per tahun, jenis fraktur, dan lama perawatan.*

Hasil: *Angka kejadian fraktur vertebra pada laki-laki (64,8%) lebih tinggi dibandingkan pada perempuan (35,2%). Distribusi usia yang paling banyak mengalami fraktur vertebra adalah kelompok usia >50 tahun, yaitu sebesar 41,6%. Jenis fraktur vertebra paling banyak adalah fraktur vertebra lumbal, yaitu sebesar 60,9%. Lama perawatan terpanjang pasien fraktur vertebra adalah 5-10 hari, yaitu sebesar 30,7%.*

Kesimpulan: *Laki-laki lebih berisiko untuk mengalami trauma vertebra. Kelompok usia >50 tahun mempunyai risiko lebih tinggi dikarenakan adanya osteoporosis primer pasca-menopause. Tingginya angka kejadian vertebra lumbal pada laki-laki umumnya berkaitan dengan trauma yang disebabkan kecelakaan lalu lintas atau jatuh dari ketinggian.*

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INTRODUCTION

Vertebral fractures occur as a result of improper axial loading with or without a rotating component and/or distraction/dislocation due to trauma, osteoporosis, infection, metastasis, or other bone diseases. Osteoporosis is the most common precipitating factor in causing vertebral fractures. The etiology of decreased bone density can be attributed to smoking, alcohol abuse, lower estrogen levels, anorexia, kidney disease, drugs (proton pump inhibitors, and other drugs). Risk factors for osteoporosis can include gender, in which female has higher risk, or vertebral injury, osteoporosis, osteopenia, age over 50 years, history of vertebral fractures, smoking, vitamin D deficiency, and prolonged use of corticosteroids.[1]

It is estimated that more than 200 million people suffer from osteoporosis.[2] Osteoporosis can occur in 30% of female. Vertebral compression fractures affect more than 1.5 million Americans each year, 10.7 per 1,000 female, and 5.7 per 1,000 male.[3,4] These fractures result in chronic and acute pain, decreased quality of life, loss of self-esteem, social isolation, increased risk of falls and fractures, and mortality rates are about twice from the same control.[5] Compression fractures due to osteoporosis most often occur as high as thoracolumbar vertebrae T11-L2.[6]

Several things such as trauma, cancer, chemotherapy, infections, long-term steroid use, hyperthyroidism, and radiation therapy are also known to weaken bones and can cause compression fractures.[1,7] Although 80% of vertebral injuries are not accompanied by serious complications such as spinal cord injury, all vertebral injuries must initially be considered serious. Therefore, first aid and transportation of patients with vertebral injuries are very important.[5]

In general, major injuries to the vertebral column need to be assessed on the stability of the injury. A stable injury, such as a vertebral corpus compression fracture, is when the vertebral component does not shift due to normal movement because the posterior spinal ligament is still intact. In stable injuries, the risk of damage to the nerves of the vertebra is very low. In unstable injuries, such as in dislocation and fracture-dislocation, the vertebral component has experienced a significant shift because the posterior spinal ligament has been torn. All vertebral fractures involving the middle vertebral column and at least one of the other (anterior/posterior) columns must be considered as unstable injury. Only 10% of vertebral injuries are unstable and less than 5% are related to spinal cord injuries. The cervical vertebra is the most mobile and most susceptible to unstable injury. In addition, the spinal cord in the cervical vertebrae is more prone to compression or transection.[8]

The incidence of vertebral trauma in the world is recorded at 0.019% to 0.088% per year. However, the number of incidence is different in each country depending on several factors such as geographical background, climate, socio-economic, and cultural community.[7,9]

Based on a research conducted at a military hospital in Chongqing in 2001-2010, male had 1.9 times greater risk than female for vertebral injuries. The most common injury mechanism was due to fall, especially falling from a height of over 2 meters, and traffic accidents, where 9.9% of patients who experienced traffic accidents were car passengers. Based on the location of the fracture, 47.81% of patients had lumbar vertebral fracture (especially lumbar 1 vertebra), 30.49% had thoracic vertebra fracture, 20.45% had cervical fracture, and 1.24% had sacral vertebral fracture. When assessing neurological status with ASIA classification, 15.25% of patients had complete sensory and motor deficits (ASIA A), 3.21% of patients had complete motor deficits with partial intact sensory function (ASIA B), 5.98% of patients had inefficient motor function (ASIA C), and 19.86% of patients had normal motor function (ASIA D). Most neurological deficits occur due to lumbar vertebral fractures (41.31%) cases.[10]

Meanwhile, according to a research conducted at Dr. Soetomo Hospital, Surabaya, in 2013-2017, male had 3.3 times greater risk than female for vertebral injuries.[11] The most common causes of vertebral fractures were due to fall from height, followed by traffic accidents, and direct impact/load hit. Based on the fracture level, the majority of patients (34.6%) had fractures as high as the lumbar vertebra, followed by thoracic vertebra fractures (33%), fractures as high as C3-C7 (25.3%), fractures as high as C1-C2 (4.9%), and fractures of the sacrococcygeus (1.1%). Based on the fracture subtype, fracture type A (compression or burst) was the type of fracture that most commonly occurred in all vertebral segments.[11]

There were no data and characteristics of vertebral fracture at Dr. Kariadi General Hospital, Semarang. Therefore, we conducted this study to determine the epidemi-

ology and the characteristics of vertebral fractures at Dr. Kariadi General Hospital, Semarang, for evaluation and improvement.

METHODS

This study was an observational descriptive study. This study was conducted on patients with vertebral fractures at Dr. Kariadi General Hospital, Semarang, during the period of 2015-2019. This study was conducted by collecting data through the medical records of vertebral fracture patients who were seeking treatment at Dr. Kariadi General Hospital, Semarang, in 2015-2019. The study and report were carried out in March 2020.

This study involved 358 samples from the medical records installation recorded at Dr. Kariadi General Hospital, Semarang. The patient's demographic data, diagnosis, and duration of treatment were collected from the patients' medical records.

Analysis of the study data were processed using SPSS software to determine the number of cases, case comparison in male-female patients, age distribution, number of cases per year, type of fracture, and length of treatment in patients with vertebral fractures.

RESULTS

Subject Analysis

From this study, we obtained 358 medical records of vertebral fracture patients at Dr. Kariadi General Hospital, Semarang, in the period of 2015-2019.

Subject Demographics

Medical records of 358 vertebral fracture patients were included in this study. Sample characteristics are listed in Table 1.

The data shown in Table 1 demonstrated that male experienced more vertebral fractures (64.8%). Age group of >50 years had the most vertebral fractures (41.6%). The highest number of cases per-year occurred in 2018 as high as 25.7%, the most common fracture location was at lumbal around 60.9%, and 30.7% patients were hospitalized for 5-10 days.

Table 1. Patients' demographic data

	Amount	Percentage (%)
Gender		
Male	232	64.8
Female	126	35.2
Total	358	100
Age (years)		
<20	26	7.3
20-30	72	20.1
31-40	43	12.0
41-50	68	19
>50	149	41.6
Total	358	100
Number of cases per year		
2015	53	14.8
2016	64	17.9
2017	91	25.4
2018	92	25.7
2019	58	16.2
Total	358	100
Fracture type		
Cervical vertebral fracture	61	17
Thoracal vertebral fracture	79	22.1
Lumbar vertebral fracture	218	60.9
Total	358	100
Duration of treatment		
<5 days	34	9.5
5-10 days	110	30.7
11-15 days	102	28.5
16-20 days	53	14.8
>20 days	59	16.5
Total	358	100

Table 2. Cervical vertebral fracture characteristics

	Amount	Percentage (%)
Gender		
Male	51	83.6
Female	10	16.4
Total	61	100
Age (years)		
<20	6	9.8
20-30	16	26.2
31-40	2	3.3
41-50	17	27.9
>50	20	32.8
Total	7	100

Number of cases per year		
2015	6	9.8
2016	13	21.3
2017	13	21.3
2018	25	41
2019	4	6.6
Total	7	100
Durations of treatment		
<5 days	12	19.7
5-10 days	23	37.7
11-15 days	12	19.7
16-20 days	4	6.6
>20 days	10	16.4
Total	7	100

Table 3. Thoracal vertebral fracture characteristic

	Amount	Percentage (%)
Gender		
Male	49	63.6
Female	28	36.4
Total	77	100
Age (years)		
<20	5	6.5
20-30	11	14.3
31-40	10	13
41-50	15	19.5
>50	36	46.8
Total	77	100
Number of cases per year		
2015	16	20.8
2016	12	15.6
2017	16	20.8
2018	12	15.6
2019	21	27.3
Total	77	100
Duration of treatment		
<5 days	6	7.8
5-10 days	21	27.3
11-15 days	31	40.3
16-20 days	8	10.4
>20 days	11	14.3
Total	77	100

From Table 2, the data showed that cervical vertebral fracture cases consisted of 83.6% male patients and 16.4% female patients. The age distribution of the patients was as follows: <20 years: 9.8%, 20-30 years: 26.2%, 31-40 years: 3.3%, 41-50 years: 27.9% and >50 years: 32.8%. The highest incidence of cervical vertebra

fractures was in 2018 (41%), followed by year of 2016 and 2017 (both 21.3%), 2015 (9.8%), 2019 (6.6%). The duration of treatment for cervical vertebral fractures was at most 5-10 days (37.7%), followed by <5 days and 11-15 days (both 19.7%), > 20 days (16.4%), and 16- 20 days (6.6%).

From Table 3, the data showed that thoracal vertebral fracture cases consisted of 63.6% male patients and 36.4% female patients. The highest cases occurred in the age group of >50 years, which was 46.8%, then followed by the age group of 41-50 years 19.5%, the age group of 20-30 years 14.3%, the age group of 31-40 years 13%, and the age group of <20 years 6.5%. The most cases of thoracal vertebral fracture occurred in 2019 (27.3%), followed by 2015 & 2017 (each 20.8%), in 2016 & 2018 (each 15.6%). The duration of treatment of the thoracal vertebral fracture patients was at most 11-15 days (40.3%), then followed by 5-10 days (27.3%), >20 days (14.3%), 16-20 days (10.4%), and <5 days (7.8%).

Table 4. Lumbar vertebral fractures characteristics

	Amount	Percentage (%)
Gender		
Male	138	61.1
Female	88	38.9
Total	226	100
Age (years)		
<20	17	7.5
20-30	49	21.7
31-40	31	13.7
41-50	36	15.9
>50	93	41.2
Total	226	100
Number of cases per year		
2015	37	16.4
2016	39	17.3
2017	62	27.4
2018	55	24.3
2019	33	14.6
Total	226	100
Duration of treatment		
<5 days	16	7.1
5-10 days	67	29.6
11-15 days	60	26.5
16-20 days	41	18.1
>20 days	42	18.6
Total	226	100

From Table 4, the data showed that the cases of lumbar vertebral fractures consisted of 61.1% male patients and

38.9% female patients. Lumbar vertebral fractures most commonly occurred in the age group of >50 years, which was 41.2%. The age group of 20-30 years experiencing lumbar vertebral fractures was 21.7%, 41-50 years 15.9%, 31-40 years 13.7 % and <20 years 7.5%. Year 2017 had the most cases of lumbar vertebral fractures (27.4%), followed by 2018 (24.3%), 2016 (17.3%), 2015 (16.4%), and 2019 (14.6%). The duration of treatment for lumbar vertebral patients was mostly for 5-10 days (29.6%), 11-15 (26.5%), >20 days (18.6%), 16-20 days (18.1%), and <5 days (7.1%).

DISCUSSION

From the results of this study, it can be seen that male has higher risk to have vertebral fractures than female, which is 64.8% vs 35.2%. The reason for this is because male has greater risk of experiencing trauma to the vertebrae due to work-related trauma. Male is three times more likely to experience vertebral fractures than female. According to Lomaz, *et al*. (2017), the main causes for vertebral fractures are traffic accidents (51.2%) and falling from height (33.2%).[12,13] In male population, there is a history of chronic back pain and anatomical deformities that cause male to have higher risk than female.[12,13] Whereas in the female population, the age group of >50 years has higher risk due to the presence of postmenopausal primary osteoporosis.[12] From this study, the data showed that the highest incidence of vertebral fractures was experienced by the age group of >50 years, which was 41.6%. This is related to the presence of primary osteoporosis in this age group, especially in the female population due to postmenopausal osteoporosis.[14] Vertebral fractures (56.1%) was most commonly occurred in the lumbar region, which consisted of 76.7% male patients and 23.3% female patients. This is consistent with the hypothesis that male has higher risk of trauma, especially in the lumbar vertebra caused by traffic accident or falling from height.[12–14] As for the specific causes of the vertebral fractures in the cases of this study were not investigated because of the limited data.

CONCLUSION

Male have higher risk of experiencing trauma to the vertebrae than female. In the population group age of >50 years, the higher risk is due to the presence of postmenopausal primary osteoporosis. The high incidence of lumbar vertebrae trauma in male is related to trauma caused by traffic accidents or falling from height.

REFERENCES

1. Ralston S, Fraser J. Diagnosis and management of osteoporosis. *Practitioner*. 2015;259(1788):15-2.
2. Sozen T, Ozisik L, Calik Basaran N. An overview and management of osteoporosis. *Eur J Rheumatol*. 2017;4(1):46-56. doi:10.5152/eurjrheum.2016.048
3. Issa K, Diebo BG, Faloon M. The Epidemiology of Vertebral Osteomyelitis in the United States From 1998 to 2013. *Clin spine Surg*. 2018;31(2):E102-E108. doi:10.1097/BSD.0000000000000597
4. Alexandru D, So W. Evaluation and Management of Vertebral Compression Fractures. *Perm J*. 2012;16(4):46-51. doi:10.1007/s13670-018-0268-7
5. Salter RB. *Textbook of Disorders and Injuries of the Musculoskeletal System 3rd Edition*. Maryland : Lippincott William & Wilkins; 1999.
6. Gertzbein SD. Multicenter Spine Fracture Study. *Spine (Phila Pa 1976)*. 1992;17(5):528-540. doi:10.1097/00007632-199205000-00010
7. Scheer JK, Bakhsheshian J, Fakurnejad S, Oh T, Dahdaleh NS, Smith ZA. Evidence-based medicine of traumatic thoracolumbar burst fractures: A systematic review of operative management across 20 years. *Glob Spine J*. 2014;5(1):73-82. doi:10.1055/s-0034-1396047
8. Solomon L. *Apley's System of Orthopaedics and Fractures 9th Edition*. London: Butterworths Medical Publications; 2010.
9. Ballane G, Cauley JA, Luckey MM, El-Hajj Fuleihan G. Worldwide prevalence and incidence of osteoporotic vertebral fractures. *Osteoporos Int*. 2017;28(5):1531-1542. doi:10.1007/s00198-017-3909-3
10. Wang H, Liu X, Zhao Y. Incidence and pattern of traumatic spinal fractures and associated spinal cord injury resulting from motor vehicle collisions in China over 11 years An observational study. *Med (United States)*. 2016;95(43). doi:10.1097/MD.0000000000005220
11. Widhianto L, Martiana IK, Airlangga PA, Permana D. Studi Epidemiologi Fraktur Vertebra di RSUD Dr . Soetomo Surabaya pada tahun 2013-2017. *Qanun Med*. 2019;3(1):15-22.
12. Lomaz MB, Netto LAFS, Filho MSG, Alves AP, De Tavares Canto FR. Epidemiological profile of patients with traumatic spinal fracture. *Coluna/ Columna*. 2017;16(3):224-227. doi:10.1590/S1808-185120171603176399
13. Briot K, Fechtenbaum J, Christian Roux1. Clinical Relevance of Vertebral Fractures in Men. *J Bone Miner Res*. 2016;31(8):1500-1503. doi:10.1002/jbmr.2831
14. Felsenberg D, Silman A, Lunt M. Incidence of Vertebral Fracture in Europe: Results From the European Prospec-

tive Osteoporosis Study (EPOS). *J Bone Miner Res*. 2002;17(4):716-724.