



ANALYSIS OF RISK FACTORS AFFECTING LUMBAL FACET JOINT OSTEOARTHRITIS IN MRI SCAN

Aulia Anastasia^{1*}, Hermina Sukmaningtyas², Agus Priambodo³, Erna Setiawati⁴

¹Undergraduate Program, Faculty of Medicine, Universitas Diponegoro, Semarang, Indonesia

²Department of Radiology, Faculty of Medicine, Universitas Diponegoro, Semarang, Indonesia

³Department of Surgery, Faculty of Medicine, Universitas Diponegoro, Semarang, Indonesia

⁴Department of Physical Medicine and Rehabilitation, Faculty of Medicine, Universitas Diponegoro, Semarang, Indonesia

*Corresponding Author : Email : auliaanastasia@students.undip.ac.id

ABSTRACT

Background: Osteoarthritis is a long-term, chronic disease that is usually marked by cartilage degeneration in the joints, which in turn induces bone friction. One of the subtype of this disease is facet joint osteoarthritis or in short, FJOA. In Indonesia, FJOA has not been commonly documented. The most common method for FJOA inspection is X-Ray modality. The usage of other radiology imaging, such as CT-Scan or MRI, are also used to evaluate erosion, osteophyte creation, subchondral sclerosis, and joint constriction. Nevertheless, the most ideal FJOA inspection method is still an ongoing debate due to strengths and weaknesses of each methods. CT scans are more widely used than MRIs and are typically less expensive. MRIs, however, are thought to be superior in regards to the detail of the image. **Objective:** To understand the effect of age, sex, and spinal level towards FJOA on MRI scanning. **Method:** This research used cross-sectional approach. Sample taken in this research were all radiology results from patients that fulfills inclusion criteria and had gone through MRI inspection in Jatinegara Premier Hospital. Age, sex, disk degeneration degree, and spinal level are the main focus for this study since those are the most common risk factor for FJOA. **Results:** 46.8% of FJOA were found in male patients while the other 53.2% were found in females. L4-5 and Grade 1 FJOA had the highest incidence found, with the amount of 29% and 48.4% respectively. There was no correlation between sex and FJOA degree based on Asymp. Sig of 0.255. There was also no correlation between age and FJOA degree based on Asymp. Sig of 0.702. However, there was a correlation between spinal level and disk degeneration degree with FJOA degree due to Asymp. Sig <0.05. **Conclusion:** There was no significant relationship between age and sex to lumbar facet joint osteoarthritis and there was a significant relationship between spinal level and disk degeneration degree with lumbar facet joint osteoarthritis.

Keywords: risk factors, degree, lumbar facet joint osteoarthritis, MRI

INTRODUCTION

Low back pain is one of the most common symptoms in adults and seniors that is caused by osteoarthritis. Osteoarthritis itself is a long-term, chronic disease that is usually marked by cartilage degeneration in the joints, which in turn induces bone friction and creates pain, stiffness, and impaired movement.¹ A certain type of osteoarthritis may occur in the vertebrae, which usually is preceded by intervertebral discs degeneration. This degeneration creates segmental instability that can increase the pressure on facet joints and induces joint cartilage damage.² This process is a medical condition that cannot be avoided and may progress in age.

Osteoarthritis are affected by risk factors, such as age, genetics, sex, history of trauma, sport activities, and history of illness. Movements such as excessive rotation, extension, or vertebral flexion may also cause degenerative changes in articular cartilage and other structures, including intervertebral discs.³

Previous community-based cross-sectional study reported that in population with the age of <50 years, the prevalence of lumbar facet joint osteoarthritis (FJOA) is <45%, and for the age of >50 years, the prevalence is ~75%.⁴ However, the reports on FJOA in Indonesia are still uncommon.

The method that is frequently used for FJOA inspection is X-Ray modality. In conventional X-Ray, oblique projection is the most useful imaging to visualize lumbar joint cavity.⁵ However, MRI scanning has several advantages when compare to other methods. Based on new studies, pathologic lesions such as articular cartilage degeneration are often used as a basis for intervention and degree measurement of FJOA, which can be evaluated through CT-Scan or MRI, where those two are usually used to evaluate erosion, osteophytes creation, subchondral sclerosis, and joint constriction. Not only that, MRI has the ability to evaluate neural structures, such as intervertebral foramen, radix nerves, and compression in dural sac



more clearly.⁶ MRI also does not emit ionizing radiation to the patients.⁷ Based on the evaluation, FJOA is then scored using Weishaupt scoring to classify them into 4 degrees.⁸

This research is aimed to analyze the effects of risk factors towards the degree of FJOA. Risk factors that are analyzed in this research are age, sex, and spinal level.

METHODS

This cross-sectional research has a sample of all radiology results from patients that fulfills the inclusion criteria and had undergone MRI scanning in Jatinegara Premier Hospital. Consecutive sampling is used to determine the subjects. In this research, a minimum of 20 sample are needed.

Independent variables in this research are risk factors, such as age, sex, and spinal level. Dependent variable in this research is lumbar facet joint osteoarthritis degree from MRI results.

Gathered data are secondary data from medical records of patients that had undergone MRI scan. Data analysis are done with SPSS by bivariate analysis using chi square test and Kruskal-wallis test in order to test the hypothesis. Pearson and Spearman correlation test will be used for parametric and nonparametric respectively.

RESULTS

Each variables of the data are presented in a table with the labels sex, age, spinal level, disc degeneration degree, and FJOA degree. The results are as presented below.

Table 1. Results

Characteristics	Total
Sample Total	20
Sex	
Male	9
Female	11
Age Group	
45 – 54 years	2
55 – 65 years	9
66 – 74 years	8
75 – 90 years	1
> 90 years	0
Spinal Level	
L1 – 2	9
L2 – 3	10
L3 – 4	10
L4 – 5	17

L5 – S1	12
Degree of Disc Degeneration	
Grade 1	9
Grade 2	12
Grade 3	11
Grade 4	18
Grade 5	12
Degree of FJOA	
Grade 1	30
Grade 2	22
Grade 3	10

Chi square test is used to analyze the relationship between sex and age with the degree of FJOA. Whereas Kruskal Walls is used to analyze the relationship between degree of disk degeneration and spinal level with the degree of FJOA. In this research, by understanding the Asymp. Sig, if the relationship has $p < 0.05$, the hypothesis is accepted. The hypothesis is rejected if $p > 0.05$.

Table 2. Chi Square Test of Sex towards Degree of FJOA

Sex	Degree of FJOA						P
	Grade 1		Grade 2		Grade 3		
	n	%	n	%	n	%	
Male	12	40	10	45,5	7	70	0,255
Female	18	60	12	54,5	3	30	

In the relationship of sex with the degree of FJOA, it is found that p equals to 0.255, which is above 0.05. For this, there is no significant relationship between sex and degree of FJOA.

Table 3. Chi Square Test of Age towards Degree of FJOA

Age	Degree of FJOA						P
	Grade 1		Grade 2		Grade 3		
	n	%	n	%	n	%	
45 – 54	2	6,7	2	9,1	1	10	0,702
55 – 64	10	33,3	10	45,5	6	60	
65 – 74	16	53,3	9	40,9	2	20	
75 – 90	2	6,7	1	4,5	1	10	

In the relationship of age with the degree of FJOA, it is found that p equals to 0.702, which is above 0.05. This proves that there is no significant relationship between age and degree of FJOA.



Table 4. Kruskal-Wallis Test of Spinal Level towards Degree of FJOA

Spinal Level	Degree of FJOA						P
	Grade 1		Grade 2		Grade 3		
	n	%	n	%	n	%	
L1 - 2	9	30	0	0	0	0	<0,05
L2 - 3	7	23,3	5	22,7	0	0	
L3 - 4	9	30	1	4,5	1	10	
L4 - 5	4	13,3	11	50	3	30	
L5 - S1	1	3,3	5	22,7	6	60	

In the relationship of spinal level with the degree of FJOA, it is found that p is less than 0.05. Due to this result, there is a significant relationship between spinal level and degree of FJOA.

Table 5. Kruskal-Wallis Test of Disk Degeneration Degree towards Degree of FJOA

Disk Degeneration Degree	Degree of FJOA						P
	Grade 1		Grade 2		Grade 3		
	n	%	n	%	n	%	
Grade 1	9	14,5	0	0	0	0	<0,05
Grade 2	3	15,8	8	26,7	1	7,7	
Grade 3	3	15,8	5	16,7	3	23,1	
Grade 4	4	21,1	11	36,7	3	4,8	
Grade 5	0	0	6	20	6	46,2	

In the relationship of disk degeneration degree with the degree of FJOA, it is found that P is less than 0,05. Because of this result, there is a significant relationship between disk degeneration degree with degree of FJOA.

DISCUSSION

In this research, patients of FJOA are dominated by females, with a number of 33 patients (53.2%). Male are comprised of 29 patients (46.8%). Based on their spinal level, 14.5% are L1-2, 19.4% are L2-3, 17.7% are L3-4, 29% are L4-5, and 19.4% are L5-S1. It can be seen that L4-5 are the most common spinal level to be found, with L1-2 to be the least common.

For the characteristics of the patients based on their FJOA degree, 48.4% has grade 1, 35.5% has grade 2, and 16.1% has grade 3. Grade 1 is the most common degree to be found while grade 3 is the least common. This finding is in line with the study conducted by Fujiwara, where grade 1 is found to be 61% more common than other grades.⁹

This research found that there is no significant relationship between sex and the degree of FJOA. This may be explained through several radiology imaging researches in regards to FJOA that reported females to be one of the risk factors in osteoarthritis. However, in a study conducted by Pratiwi (2015), osteoarthritis incidence in females is 3 times higher than males.¹⁰ This is repeated in a study by Rahmadiyahanti N (2016) which stated that the ratio of females and males that were diagnosed with osteoarthritis is 5:1. This phenomenon is affected by estrogen levels in females and spinal movement that is higher in females.¹¹

The result of the relationship above is in line with several prior studies. Fujiwara stated that there is no significance in the relationship between sex and the degree of FJOA. Rahmadiyahanti N (2016) also reported the same, with p equals to 0.130.¹¹

This research also found that there is a significant relationship between age and the degree of FJOA. This is consistent with a previous study conducted by Ali (2017), where the highest incidence rate is found in 65-74 years old, with an increase of osteoarthritis as the age increases and a steep increase above 55 years old.^{11, 12} This may be caused by progressive changes in cartilages, subchondral sclerosis, and osteophyte formation in ages above 45 years old.^{13, 14}

However, this research found that there is also a relationship between spinal level and degree of FJOA. In previous research, degenerative spondylolisthesis is usually connected with FJOA that happens in L4-5 and L5-S1.¹⁵ In the study conducted by Kalichman, it was also explained that degenerative spondylolisthesis is usually connected with FJOA in L5-S1.¹³ In this research, it is shown that P is less than 0.05, which indicated that there is a significant relationship between spinal level and degree of FJOA.

It is also found through this research that there is a relationship between intervertebral disc degeneration with the degree of FJOA. This finding is in line with the research done by Fujiwara (2017) that stated intervertebral disc degeneration is also related to FJOA.¹²

This research is not without its limitation. Cross-sectional study limits the research into a certain time frame. Not only that, other factors have not been explored, such as BMI, physical activities



pattern, duration of FJOA, and others that may play a role in FJOA degree. Besides that, if more data were able to be obtained, it may help give a more thorough and complete explanation to the relation between available risk factors with the degree of FJOA.

CONCLUSION

This research found that there were no significant relationship between age and sex with the degree of lumbar facet joint osteoarthritis.

However, this research also points out that there is a significant relationship between spinal level and intervertebral disc degeneration with the degree of lumbar facet joint osteoarthritis.

ETHICAL APPROVAL

This study is approved ethically by Health Research Ethics Committee of Faculty of Medicine of Diponegoro University with the certificate number of No. 145/EC/KEPK/FK-UNDIP/V/2021. This study is also authorized by Jatinegara Premier Hospital.

CONFLICT OF INTEREST

There is no conflict of interest related to the materials, methods, and findings in this study.

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REFERENCES

1. Jarraya M, Guermazi A, Lorbergs AL, Brochin E, Kiel DP, Bouxsein ML, et al. A longitudinal study of disc height narrowing and facet joint osteoarthritis at the thoracic and lumbar spine, evaluated by computed tomography: the Framingham Study. *Spine J.* 2018;
2. Greene MA, Loeser RF. Aging-related inflammation in osteoarthritis. *Osteoarthr Cartil.* 2015;23(11):1966–71.
3. Little JW, Grieve T, Cantu J, Bogar WB, Heiser R, Miley H, et al. Reliability of Human Lumbar Facet Joint Degeneration Severity assessed by magnetic resonance imaging. 2020;43(1).
4. Moskowitz RW. Osteoarthritis: diagnosis and medical/surgical management. Lippincott Williams & Wilkins; 2007.
5. Mann SJ, Viswanath O, Singh P. Lumbar Facet Arthropathy. 2020;(StatPearls Publishing). Available from: <https://www.ncbi.nlm.nih.gov/books/NBK538228/>
6. Vitriana. Aspek anatomi dan biomekanik tulang lumbosakral dalam hubungannya dengan nyeri pinggang. Disertasi. 2010;
7. Perolat R, Kastler A, Nicot B, Pellat J-M, Tahon F, Attye A, et al. Facet joint syndrome: from diagnosis to interventional management. *Insights Imaging* [Internet]. 2018/08/08. 2018 Oct;9(5):773–89. Available from: <https://pubmed.ncbi.nlm.nih.gov/30090998>
8. Gellhorn AC, Katz JN, Suri P. Osteoarthritis of the spine: the facet joints. *Nat Rev Rheumatol* [Internet]. 2013;9(4):216–24. Available from: <https://doi.org/10.1038/nrrheum.2012.199>
9. Arimbawa G. Osteoarthritis - ilmu orthopedi dan traumatologi [Internet]. 2015 [cited 2021 Jul 11]. Available from: <https://adoc.tips/download/osteoarthritis>
10. Pratiwi AI. Diagnosis and treatment osteoarthritis. Vol. 4, Diagnosis and Treatment Osteoarthritis J MAJORITY |. 2015.
11. Rahmadiyahanti N. Hubungan Antara Usia dan Jenis Kelamin dengan Derajat Keparahan Osteoarthritis Lutut di RS Al-Islam Bandung Periode 1 Januari 2013-31 Desember 2015. Unisba [Internet]. 2015 Dec [cited 2021 Jul 11]; Available from: <http://repository.unisba.ac.id/handle/123456789/26342>
12. Fujiwara A. The relationship between facet joint osteoarthritis and disc degeneration of the lumbar spine: an MRI study. *Ear Spine J.* 1999;8:396–401.
13. Kalichman L, Hunter DJ. Lumbar Facet Joint Osteoarthritis: A Review. *Semin Arthritis Rheum.* 2007;37(2):69–80.
14. Gellhorn AC, Katz JN, Suri P. Osteoarthritis of the spine: The facet joints. *Nature Reviews Rheumatology.* 2013.



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Agus Priambodo, Erna Setiawati

15. Jamalullail S. Hubungan antara derajat radiologi menurut kellgren dan lawrence dengan tingkat nyeri pada pasien OA di RS. Universitas Hassanudin [Internet]. 2017 [cited 2021 Jul 11]. Available from: <http://digilib.unhas.ac.id>