Clinical Research

The correlation between lower extremity morphometric and the presence of knee osteoarthritis symptoms in indonesian mongoloid population with knee osteoarthritis

Stefanus Hengkie Marseno[1]

[1]Department of Orthopedic and Traumatology, Faculty of Medicine, Gadjah Mada University

ABSTRACT

Introduction: Knee osteoarthritis is the most common joint disease. The risk factors for knee osteoarthritis are lifestyle, obesity, history of knee injury, sex, and also race. Different race may also have different body habitus, including lower extremity shape, therefore it is important to study the morphometric parameters of the lower extremity. In this study, the morphometric parameters of lower extremity and body mass index in Indonesian Mongoloid population were measured to see their correlation with the presence of symptom of knee osteoarthritis.

Methods: This study was a cross sectional study. The subjects of this study weremale and female with knee osteoarthritis KL grade 2 or more who agreed toparticipate in this study. From the physical examination, the subjects were then classified into symptomatic and asymptomatic knee osteoarthritis. The lower extremity morphometric parameters that weremeasured in this study: (1) *Femoral Valgus Cut Angle* (FVCA), (2) *Neck Shaft Angle* (NSA), (3) *Femoral Head Offset* (FHO), (4) *Trans-Epicondylar Axis* (TEA), (5) *Tibial Bone Varus Angle* (TBVA), and (6) *Patellar Morphometry*, which were measured by scanogramct scan. Body mass index was measured and classified into normal, overweight, and obese.

Results: Fifty-eight subjects were included in this study, 38 male and 20 female. From the 58 subjects, 37 had symptomatic knee osteoarthritis and 21 had asymptomatic knee osteoarthritis. An increase in the Neck Shaft Angle (right OR=6.51, p<0.05 and left OR=0.516, p<0.05) had a statistically significant correlation with the presence of symptom ofknee osteoarthritis. While FVCA, FHO, TEA, TBVA, and patellar morphometry did not have significant correlation (p>0,05). The data showed that Femoral Valgus Cut Angle (p<0.05) and Patellar Morphometry (p<0.05) were statistically different in Indonesian Mongoloid male and female with knee osteoarthritis, whereas NSA, FHO, TEA, and TBVA were not statistically different (p>0,05) among male and female of Indonesian Mongoloid Population. Another finding was that BMI had a statistically significant correlation with the presence of symptom ofknee osteoarthritis with a positive and very strong correlation (r=0.776, p<0.05).

Conclusion: From six lower extremity morphometries in Indonesian Mongoloid population, only Neck shaft angle that had a statistically significant correlation with the presence of knee osteoarthritis symptoms. FVCA and Patellar Morphometry, however, were found to be statistically different between the male and female patients with knee osteoarthritis. BMI also had statistically significant correlation with the presence of symptom in knee osteoarthritis patients of Indonesian Mongoloid population.

ABSTRAK

Pendahuluan: *Osteoarthritis lutut merupakan salah satu penyakit sendi yang paling sering terjadi, factor risiko yang dapat menyebabkan osteoarthritis lutut antara lain gaya hidup, obesitas, riwayat cedera lutut, jenis kelamin, dan juga ras. Perbedaan ras meyebabkan perbedaan bentuk tubuh, termasuk bentuk ekstremitas bagian bawah, sehingga penting mengetahui nilai morfometri ekstremitas bawah. Pada penelitian ini, kami mengukur parameter ekstremitas bawah dan BMI pada populasi Mongoloid di Indonesia serta menilai hubungannya dengan kemunculan gejala osteoarthritis lutut.*

Metode: *Penelitian ini dilakukan dengan menggunakan studi cross sectional. Subjek penelitian adalah laki-laki maupun perempuan dengan OA lutut KL grade 2 atau lebih yang telah menyetujui untuk mengikuti penelitian ini. Subjek kemudian dibagi menjadi osteoarthritis lutut simptomatik dan asimptomatik berdasarkan pemeriksaan fisik. Pengukuran parameter morfometri ekstrimitas bawah kemudian dilakukan, yang meliputi: (1)* Femoral Valgus Cut Angle, *(2)* Neck Shaft Angle, *(3)* Femoral Head Offset, *(4)* Transepicondylar Axis, *(5)* Tibial Bone Varus Angle, *(6)* Patellar Morphometry *dari hasil CT Scan subjek penelitian. Kami juga menilai BMI dan mengklasifikasikannya menjadi normal, overweight, dan obese.*

Hasil: *Penelitian ini diikuti oleh 58 subjek, dengan 38 subjek laki-laki dan 20 subjek perempuan. Diantara subjek tersebut, 37 subjek menderita osteoarthritis lutut simptomatik dan 21 subjek menderita osteoarthritis lutut asimptomatik. Peningkatan nilai* Neck Shaft Angle *dextra berhubungan dengan munculnya gejala pada pasien osteoarthritis lutut dengan nilai OR=6.51, p<0.05 dan juga* Neck Shaft Angle *Sinistra dengan nilai OR=5.16, p<0.05. Sedangkan FVCA, FHP, TEA, TBVA dan* Patellar Morphometry *tidak berhubungan signifikan terhadap munculnya gejala pada pasien osteoarthritis lutut. Pada penelitian ini ditemukan bahwa* Femoral Valgus Cut Angle *(p<0,05) dan* Patellar Morphometry *(p<0.05) berbeda secara bermakna diantara laki-laki dan perempuan Mongoloid Indonesia penderita osteoarthritis lutut. Sementara NSA, FHO, TEA, dan TBVA didapatkan tidak berbeda secara bermakna. BMI juga didapatkan berhubungan dengan munculnya gejala klinis pada pasien dengan osteoarthritis di Indonesia (p<0.05) dengan korelasi positif dan korelasi yang sangat kuat (r=0.776 dan p<0.05).*

Kesimpulan: *Dari enam macam parameter morphometry ekstremitas bawah yang diperiksa pada populasi Mongoloid Indonesia, hanya NSA yang didapatkan berhubungan dengan munculnya gejala pada pasien osteoarthritis lutut. FVCA dan patellar morphometry juga didapatkan berbeda secara bermakna antara laki-laki dan perempuan penderita osteoarthritis lutut. Selain itu, IMT juga didapatkan berhubungan dengan munculnya gejala pada penderita osteoarthritis lutut di Indonesia.*

Corresponding author : Stefanus Hengkie Marseno, MD. virus_dlx@yahoo.com

The correlation between lower extremity morphometric and the presence of knee osteoarthritis symptoms in indonesian mongoloid population with knee osteoarthritis

28

INTRODUCTION

Osteoatritisis the most common joint disease among degenerative population. Knee is the most common site for osteoarthritis.[1]

There are modified and unmodified risk factors for knee osteoarthritis. The modified risk factors are lifestyle, obesity, history of knee injury, physical activity, and occupation, whilethe unmodified risk factors are age, gender, and race.[2]

Human race can be classified into Mongoloid, Caucasoid, Negroid, and Australoid. Indonesian population consist of Malayan Mongoloid and Australoid. Malayan mongoloid usually lives in Sumatra, Java, Sulawesi, Maluku, Nusa Tenggara, and Bali. While Indonesian Australoid usually live in Papua.

African-American have higher osteoarthritis prevalence than Caucasian and Chinese.[1,3] This may bean indication that different Race and sex may affect different body shape and then create different lower extremity morphometries.

The morphometric parameters calculated in this study were (1) *Femoral Valgus Cut Angle,* (2) *Neck Shaft Angle,* (3) *Femoral Head Offset,* (4) *Transepicondylar Axis,* (5) *Tibial Bone Varus Angle,* and (6) *Patella Morphometry*.[4,5] We analyzed the correlation between these lower extremity parameters and the presence of symptoms in Indonesia mongoloid population with knee osteoarthritis Kellgren-Lawrence (KL) grade 2 or more.

METHODS

This study was a cross sectional study. The subjects of this study were male and female with knee osteoarthritis Kellgren-Lawrence (KL) grade 2 or more who had agreed to participate in this study.

Physical examination was performed to classified the subjects as symptomatic or asymptomatic knee osteoarthritis. The lower extremity morphometric parameters that were measured in this study: (1) *Femoral Valgus Cut Angle* (FVCA), (2) *Neck Shaft Angle* (NSA), (3) *Femoral Head Offset* (FHO), (4) *Trans Epicondylar Axis* (TEA), (5) *Tibial Bone Varus Angle* (TBVA), and (6) *Patellar Morphometry*, which were measured by scanogramct scan (CT-Scan Philips Ingenuity core 128, 128 slices 120 kvp, 2.0 mm). Body mass index was measured and classified into normal, overweight, and obese.

Data distribution was analyzed by using *Kolmogorov-smirnov* test. Independent t-test and *Mann Whitney* test was also used to analyze the difference in each variable. Logistic regression was used to measure the correlation among variables and *pearson correlation* test to measure the correlation between two variables and the presence of symptomsofosteoarthritis.

RESULTS AND DISCUSSION

There were total 58 subjects included in this study, 38 (65.5%) male and 20 (34.5%) female. The mean age of the subjects was 57.62 ($\pm$ 5.49) years, body weight was 69,28 ($\pm$6.98) kg, and body height was 165,29 ($\pm$5.53) cm. The mean BMI was 25.36 ($\pm$2.27), where 17 subjects (29.3%) normal, 29 subjects (50%) overweight, and 12 subjects (20.7%) obese.

Table 1. Difference between male and female lower extremity morphometries

		P Value
Femoral morphometry	FHO Right	0.8
	FHO left	0.762
	FVCA Right	0,049
	FVCA Left	0,024
	TEA Right	0,537
	TEA Left	0,966
	NSA Right	0,39
	NSA Left	0,19
Tibial Morphometry	TBVA Right	0,44
	TBVA Left	0,518
Patellar Morphometry	Width Right	0,001
	Width Left	0.001
	Height Right	0.001
	Height Left	0.001
	Thickness Right	0.043

As seen in Table 1, the Femoral Valgus Cut Angle Right and Left were found to be statistically different between the male and female of Indonesian Mongoloid population, p = 0.049 & p = 0.024, respectively. The Patellar width, height, and thickness were also found to be statistically different between the male and female of Indonesian Mongoloid population (P<0.05). While the Femoral Head Offset, Trans-epicondylar Axis, Neck Shaft Angle, and Tibial Bone Varus Angle were not statistically different between the male and female of

The correlation between lower extremity morphometric and the presence of knee osteoarthritis symptoms in indonesian mongoloid population with knee osteoarthritis

29

Indonesian mongoloid population.

Table 2. Chi square test analysis of BMI and OA

		BMI						
		Normal		Overweight		Obese		P value
		n	%	n	%	n	%	
OA	Symptomatic	0	0	25	67.6	12	32.4	0,000
	Asymptomatic	17	81	4	19	0	0	
		17	29.3	29	50	12	20.7	

A logistic regression was performed to confirm the correlation between lower extremity parameters and the likelihood the subjects to have symptomatic knee osteoarthritis. An increase in the right neck shaft angle of 6.15 times is more likely to have symptomatic knee osteoarthritis and left neck shaft angle of 5.61 times is more likely to have symptomatic knee osteoarthritis.

It can be seen from the Table 2 that there is a statistically significant association between BMI and the presence of symptoms of knee OA ($p<0.001$). The result of Pearson correlation is $r = 0,776$ ($<0,001$), which indicates that there is a positive correlation between BMI and the presence of symptom of knee OA.

Previous study showed that an increase in NSA and FHO correlated with the presence of symptom of knee osteoarthritis.[6,7] From this study, we found that only the increase in NSA correlated with the presence of symptom of knee osteoarthritis. Female lower extremity morphometry values were normally bigger than male,

which suggested higher risk for osteoarthritis in female.[8] In this study, only femoral valgus cut angle and patellar morphometry were found to be significantly different in the Indonesian mongoloid male and female.

Body Mass Index is known as the risk factor for osteoarthritis. People with BMI >25 is three times more likely to develop knee osteoarthritis.[9] In this study, it was also found that BMI was strongly associated with OA and an increase in BMI had a positive correlation with the presence of symptom of knee osteoarthritis.

CONCLUSION

This study showed that an increase in the neck shaft angle value correlated with the presence of symptoms of knee OA in Indonesian Mongoloid knee osteoarthritis patients.

Femoral valgus cut angle and patellar morphometry (height, width, thickness) were different in the Indonesian Mongoloid male and female. Body Mass Index was strongly associated with osteoarthritis and had a positive correlation with the presence of symptom of knee osteoarthritis.

REFERENCES

1. Wluka AE. Ethnicity May be a Risk Modifier for Knee Osteoarthritis. Int. J. Clin. Rheumatol. 2009;4(1):29-32
2. Silverwood V et al. Current Evidence on Risk Factors for Knee Osteoathritis in Older Adults: A Systematic Review and Meta-Analysis. Osteoathritis and Cartilage.2015;23:507-515
3. Chaganti RK, Lane NE. Risk Factors for Incident Osteoarthritis of the Hip and Knee. Curr Rev Musculoskelet Med. 2011;4:99-104
4. Lyras, D.N., Louxks, C., Greenhow, R., Analysis of the Geometry of the Distal Femur and Proximal Tibia in The Osteoarhtritic knee: A 3D reconstruction CT Scan Based Study of 449 Cases. Arch Bone Joint Surgery. 2016; 4(2): 116-121
5. Peng, S. et al., Morphometric measurement of the patella on 3D model reconstructed from CT scan images for the southern Chinese population. Chinese Med Journal. 2014;127 (1): 96-101
6. Bombaci H et al. Tibial Torsion: Cause or Consequence of Osteoarthritis?. Acta OrthopTraumatol Turc.2012;46(3):181-185
7. Malhotra R et al. Femoral head-neck Offset in the Indian Population: a CT based Study. Indian J Orthop.2010;46(2):212-215)
8. Prieto-Alhambra, D. et. al. Ann Rheum Dis. 2014 September ; 73(9): 1659–1664
9. Gandhi R et al. BMI Independently Predicts Younger Age at Hip and Knee Replacement. Obesity.2010;18(12):2362-2366