

Comparison of Radiographic Changes in Knee Joints between Males and Females in a Tertiary Care Center, Kolkata, West Bengal

Running Title: Comparison, radiographic changes of knee, males, females

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Abstract: ***Aims and objectives:** Knee is the most common weight bearing joint in human being during walking. It commonly resists compressive forces produced as a result of transmission of body weight while walking. Osteoarthritis of the knee joint is a degenerative joint disease producing damage of the articular cartilage; as a result, there is reduction of joint space width, formation of marginal osteophytes, subchondral sclerosis, subchondral cyst and lastly loose bodies. Our aim in this study is to compare the imaging results of knee joints between males and females having age of 35 years and above. **Methods:** We took total 544 patients with joint symptoms in our study. Imaging of the affected knee joint was performed in all patients. We divided the male female patients into 8 age groups at an interval of 5 years starting from 35 years of age. Then we compared the radiographic findings, like, reduced joint space, marginal osteophytes, subchondral sclerosis, subchondral cyst and loose bodies between both sexes statistically at 95% confidence interval. **Results:** Females at early and middle age, suffered significantly. Significant number of Females of 35 to 45 years, 51 to 55 years, 61 to 65 years and 66 to 70 years showed reduced joint space, marginal osteophytes, subchondral cyst as well as loose bodies respectively, whereas, in case of more than 75 years of age, significant number of males showed evidence of marginal osteophytes and subchondral sclerosis. **Conclusion:** There is increase of incidence of osteoarthritis in non-linear fashion. Generally, there was increase incidence of osteoarthritis in females than males. In more than 75 years of age, significant number of males showed early evidence of marginal osteophytes and subchondral sclerosis. Female showed increase incidence of loose bodies in the joints. Significant number of younger females demonstrated the evidence of decreased joint-space width.*

Keywords: Males and females, osteoarthritis, Comparisons, different ages.

1. Introduction

Articular surface of the synovial joint is increased by articular cartilage. It's convex surface is thickest centrally and concave surface thinned peripherally, thickness being increased from maturity to old age¹. This articular cartilage provides extremely smooth resistant surface, which is bathed in synovial fluid and thus prevents friction during movement of that joint. The elasticity of the cartilage spreads the effect of concussion throughout the joint surface, so that whole articular surface will be flexible. The knee joint normally resists the compressive forces produced as a result of transmission of the body weight during walking. Thickness of the articular cartilage is 1 to 7 millimeter. Osteoarthritis is a type of slowly progressive degenerative disease of the joint – it characterised by degeneration of the articular cartilage producing narrowing of the joint space, simultaneous proliferation of the cartilaginous cells, bone cells as well as connective tissue, inflammation of the synovial membrane. It is a major cause of disability in elderly. Worldwide the incidence of osteoarthritis in patients of more than 65 years is 30%, whereas in USA the incidence has been increased up to 80% to 90%. Severity of symptoms of osteoarthritis and radiographic advanced features increases with age, but there may be some discrepancy between symptoms and radiographic stages². Three principal symptoms of osteoarthritis are persistent pain, morning stiffness and restricted functions. Similarly three cardinal signs are crepitus around the joints, restricted joint movement and bony enlargement³. Incidence osteoarthritis in males is high

in less than 50 years of age. But as the age advances to more than 50 years, incidence in female will be increased. This sex difference is due to difference in cartilage volume⁴. Radiographic features of knee joint in different stages of osteoarthritis are asymmetric joint space narrowing, presence or absence of osteophytes, subchondral sclerosis and subchondral cyst formation⁵. Joint space narrowing is mainly due to age related loss of function of chondrocyte leading to degeneration of articular cartilage^{6, 7}. Recently, magnetic resonance imaging is very sensitive method of diagnosing lesion of cartilage due to its very high sensitivity, specificity, high contrast and multiplaner capability⁸.

2. Methods

We performed our own studies only after getting permission from our ethical committee. Total 544 patients having ages between 35 years and above were taken in our study in K P C Medical College and Hospital, Kolkata, West Bengal.. These patients had symptoms, like pain in and around the knee joints, joint stiffness and signs, like, restricted joint movement and bony enlargement. Imaging studies of the affected knee joints were performed in all the patients. We took the following parameters:

1. Joint space whether normal and reduced.
2. Marginal osteophytes whether present or absent.
3. Subchondral sclerosis, whether present or absent.
4. Subchondral cyst, whether present or not.
5. Loose bodies, whether present or not.

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We divided the male and female patients into 8 age groups: 35-40 years, 41-45 years, 46-50 years, 51-55 years, 56-60 years, 61-65 years, 66-70 years and ≥ 71 years. In each age group, comparison was done between male and females according to above parameters.

Statistics:

- 95% confidence interval for different percentage:
 $(p_1 - p_2) \pm 1.6SE (p_1 - p_2)$, where $SE (p_1 - p_2) = \sqrt{\{p_1(1 - p_1)/n_1\} + \{p_2(1 - p_2)/n_2\}}$
- 'p' values showed maximum probability for a given level of significance.

3. Results

Between 35 to 65 years of age, females were significantly affected than males ($p=0.00$). In case of 1st parameter (joint space width), females significantly showed joint space narrowing than males (11 of 29 males vs. 29 of 47 females, $p=0.00$). In case of second parameters (marginal osteophytes), significant number of females having age between 51 to 55 years, demonstrated marginal osteophytes than males (61 out of 65 females vs. 27 of 38 males, $p=0.00$), whereas, number of males having ≥ 71 years of age, is significantly edged over females (23 of 23 males vs. 16 of 19 females, $p=0.04$). In case of third parameter (subchondral sclerosis), significant number of males showed subchondral sclerosis (18 of 23 males vs. 9 of 19 females, $p=0.03$) in the age group of more than 75 years. In other age groups, there was no evidence of significant difference between males and females. In the fourth parameter (subchondral cyst), significant number of females showed the presence of subchondral cysts in the age group of 66 to 70 years (7 of 20 females vs. none of 19 males, $p=0.00$). In case of last parameter (loose bodies), only in the age group of 61 to 65 years significant number of females demonstrated the presence of loose bodies (3 of 25 males vs. 17 of 43 females, $p=0.01$).

4. Discussion

Usually the incidence of osteoarthritis is low in patients below 50 years of age, and become gradually higher as the ages increases. Our study showed similar incidence below and above 50 years of age (205 patients of ≤ 50 years vs. 339 patients having ≥ 50 years). According to one study done by Ding C et al., due to variation in cartilage volume in females and males, the males are very prone to develop osteoarthritis under the age of 50 years, whereas, females were affected after the age of 50 years⁴. But in our study, after the age of 65 years, sex-wise difference in respect to different features of osteoarthritis was not seen except males of ≥ 71 years of age, who showed the evidence of marginal osteophytes and subchondral sclerosis. Though, incidence of osteoarthritis is usually increased as the age increases, but, it is not a part and parcel of normal aging process. In case of aging, there is evidence of localized fibrillation of the articular cartilage, decrease of water content of the matrix, no evidence of bony remodeling; as a result, there is loss of shock absorbing property of articular cartilage. On the contrary, in case of osteoarthritis, there is evidence of generalized fibrillation, fragmentation of the articular cartilage, and resulting loss of thickening of the cartilage, along with evidence of bony remodeling in the form of marginal osteophytes,

subchondral sclerosis and subchondral cyst formation⁸. The precipitating factors, like, abdominal stress, muscle weakness, neurological dysfunctions and abnormal shape of bones as well as joints may be responsible for osteoarthritic changes of the knee joints⁹.

Most important radiological features in osteoarthritis is the formation of marginal osteophytes, less sensitive features are reduced joint space, subchondral sclerosis and subchondral cyst. Last three features may not be present in absence of osteophytes formation¹⁰. This was not evident in the study done by Himani Pulivarthi et al.¹¹ (16 out of 60 males vs. 4 out of 40 females), whereas, in our study, marginal osteophytes were present in large number of patients (169 of 205 males vs. 284 of 339 females).

In our study, significant number of females was affected between 35 to 65 years of age, after that, the sex-wise difference was found to be negligible. But, study done by Himani Pulivarthi et al. males were mostly affected below 50 years of age⁴.

5. Conclusion

Females of 35 to 65 years of age suffered significantly from osteoarthritis. Significant number of females having age of 35 to 40 years, 51 to 55 years, 61 to 65 years and 65 to 70 years demonstrated evidence of reduced joint space width, marginal osteophytes, subchondral cyst and loose bodies respectively, whereas, significant number of males of ≥ 71 years of age demonstrated subchondral sclerosis and evidence of marginal osteophytes.

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Table 1: Radiographic joint space demonstration in males and females

Age (Years)	Sex		Total Pts	P value	Joint space width				
	M	F			Normal		Reduced		P value
					M	F	M	F	
35-40	29	47	76	0.00	18	18	11	29	0.04
41-45	19	48	67	0.00	12	20	7	28	0.09
46-50	20	42	62	0.00	7	17	13	25	0.67
51-55	38	65	103	0.00	18	21	20	44	0.12
56-60	32	55	87	0.00	17	13	15	42	0.10
61-65	25	43	68	0.00	9	8	16	35	0.11
66-70	19	20	39	0.82	3	2	16	18	0.10
>75	23	19	42	0.38	7	6	16	13	0.93
Total	205	339	544	0.00	91	105	114	234	0.00

Table 2: Radiographic marginal osteophytes demonstration in males and females

Age (Years)	Sex		Total Pts	P value	Marginal osteophytes				
	M	F			Present		P value	Absent	
					M	F		M	F
35-40	29	47	76	0	18	31	0.73	11	16
41-45	19	48	67	0	14	40	0.36	5	8
46-50	20	42	62	0	16	32	0.73	4	10
51-55	38	65	103	0	27	61	0	11	4
56-60	32	55	87	0	31	48	0.13	1	7
61-65	25	43	68	0	22	36	0.63	3	7
66-70	19	20	39	0.82	18	20	0.29	1	0
>75	23	19	42	0.38	23	16	0.04	0	3
Total	205	339	544	0	169	284	0.96	36	55

Table 3: Radiographic demonstration of subchondral sclerosis in males and females

Age (Years)	Sex		Total Pts	P value	Subchondral sclerosis				
	M	F			Present		P Value	Absent	
					M	F		M	F
35-44	29	47	76	0	18	20	0.09	11	27
41-45	19	48	67	0	10	21	0.51	9	27
456-50	20	42	62	0	12	25	0.97	8	17
51-55	38	65	103	0	23	46	0.28	15	19
56-60	32	55	87	0	21	30	0.31	11	25
61-65	25	43	68	0	16	25	0.63	9	18
66-70	19	20	39	0.82	8	12	0.26	11	8
>75	23	19	42	0.38	18	9	0.03	5	10
Total	205	339	544	0	126	188	0.16	79	151

Table 4: Radiographic demonstration of subchondral cyst and loose bodies in males and females

Age (years)	Sex		Total Pts	P Value	Subchondral cyst					Loose bodies		
	M	F			Present		P Value	Absent		M	F	P value
					M	F		M	F			
35-40	29	47	76	0.00	1	1	0.72	28	46	2	9	0.14
41-45	19	48	67	0.00	1	1	0.49	18	47	2	3	0.54
46-50	20	42	62	0.00	1	0	0.14	19	42	1	9	0.10
51-55	38	65	103	0.00	2	5	0.63	36	60	5	17	0.12
56-60	32	55	87	0.00	2	3	0.87	30	52	5	14	0.28
61-65	25	43	68	0.00	4	6	0.81	21	37	3	17	0.01
66-70	19	20	39	0.82	0	7	0.00	19	13	8	8	0.89
≥71	23	19	42	0.38	3	3	0.80	20	16	7	4	0.49
Total	205	339	544	0.00	14	26	0.71	191	313	33	81	0.03