

To Study the Association between Weather Conditions and Changes in the Pain Perception of Subjects with Osteoarthritis Knee.

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Conflict of interest: Nil

Abstract

Background: This is an observational study regarding seasonal variation in perception of pain in primary osteoarthritis (OA) knee. This paper aims to gather information which might contribute in planning effective preventive strategies to maintain and to improve the quality of Life in patients with Primary Osteoarthritis knee.

Materials and methods: It is a longitudinal study conducted in various orthopaedics OPD and clinics. Diagnosed cases of Primary OA of knee were interviewed using standard questionnaire and scoring using Visual Analogue Score (VAS) in the 3 Indian seasons.

Result: According to VAS 73.3 % had most severe pain in winters followed by 26.2% in rainy and 0.4 % in summer. Gender-wise distribution suggested more pain in females as compared to males. As per age-wise distribution, the pain perception was more in patients in age group of 45-59 years of age as compared to those above and below this age group.

Discussion: OA is a chronic degenerative disorder whose exact etiology is unknown and is multi-factorial disease causing pain. There are many theories of pain genesis; one of them is effect of change in temperature. It is well documented by the fact that various symptoms increased at lower temperatures including pain and there is subjective relief from the pain after application of localized heat remedies. Such heat remedies cause vasodilatation and hence, there is increased blood flow which leads to washing away of the inflammatory infiltrates, leading to relief from the pain. Environmental factors such as decrease in temperature and moisture have been noticed to contribute to symptomatic worsening. Also some other factors such as levels of hormones, antibodies, inflammatory factors and immune responses could also be responsible for this trend.

Conclusion: There is seasonal variation in the perception of pain in previously diagnosed osteoarthritis knee patients, with an increased level of pain observed when there was decrease in atmospheric temperature during winter and rainy season.

Keywords: Primary Knee Osteoarthritis (OA), Visual Analogue Scale, Atmospheric Temperature.

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Introduction

Primary osteoarthritis, where no known cause exists, is often associated with aging. With a prevalence of 22-39% in India [1], it is one of the leading causes of disability, in the population over the age of 50 years, affecting females more than males. Indian Lifestyle puts excessive pressure on the knee joint eg. sitting over floor, squatting for defecation, sitting cross legged. Since the etiology is multifactorial, we wish to study the environmental factors affecting the pain perception. It is a clinical observation that patients complain of increased pain and disability in winter and rainy seasons as compared to summers. This paper aims to gather information which might contribute in planning effective preventive strategies to maintain and to improve the quality of Life in patients with Primary Osteoarthritis knee.

Materials and Methods

Type of study: Longitudinal Study

Study settings: It was conducted in various orthopedic Out Patient clinics in and around Nashik City.

Study Population: The patients of Primary Osteoarthritis knee visiting OPDs of various orthopedic hospitals and clinics.

Inclusion criteria: {A} Patients previously diagnosed with Primary osteoarthritis on the basis of the following parameters:

1. Symptoms: knee pain at rest, Early morning stiffness < 30 mins, painful knee movements, Restricted range of movements.
2. Radiological diagnosis

{B} Age > 45 years.

Exclusion criteria: secondary Osteoarthritis

The participants who were diagnosed to have osteoarthritis of knee using the above criteria were interviewed using a standard questionnaire format and Visual analogue scale (VAS).

The questionnaire were made in in English and vernacular language and the scoring was done by visual analogue scale.

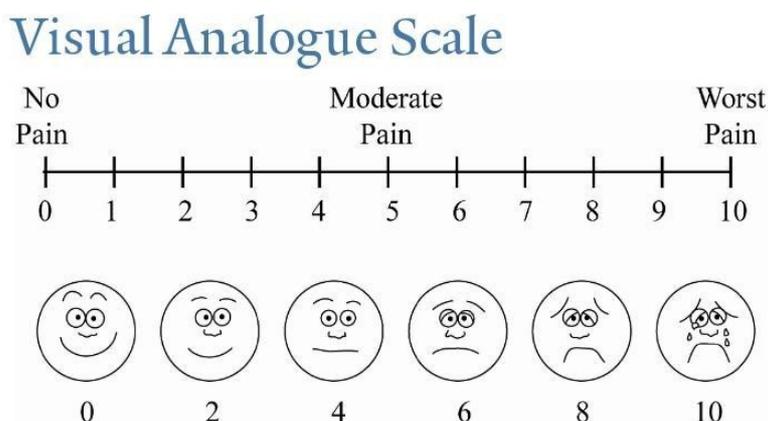


Figure 1:

0 no pain
10 worst pain

Results

1. Out of total respondents, 225 perceived a change in severity of pain with seasonal variation, while 50 participants did not notice any change

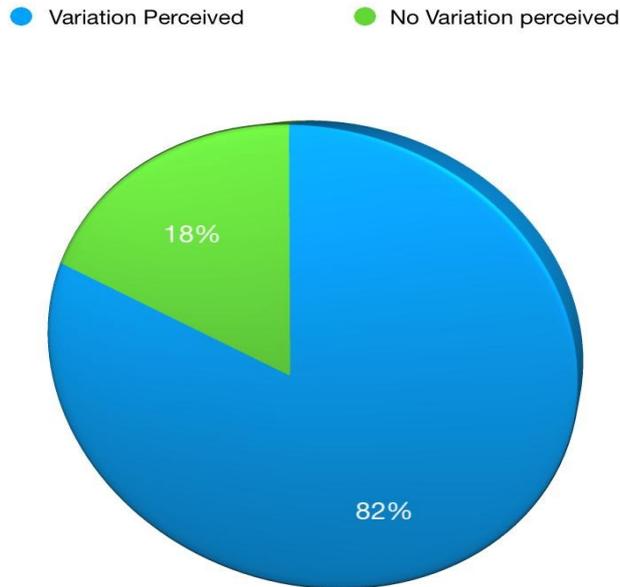


Figure 2:

2. Out of those 225 who perceived change in severity with seasonal variation, 165 had most severe pain in Winter, 59 in Rainy Season while 1 participant perceived it in Summer.

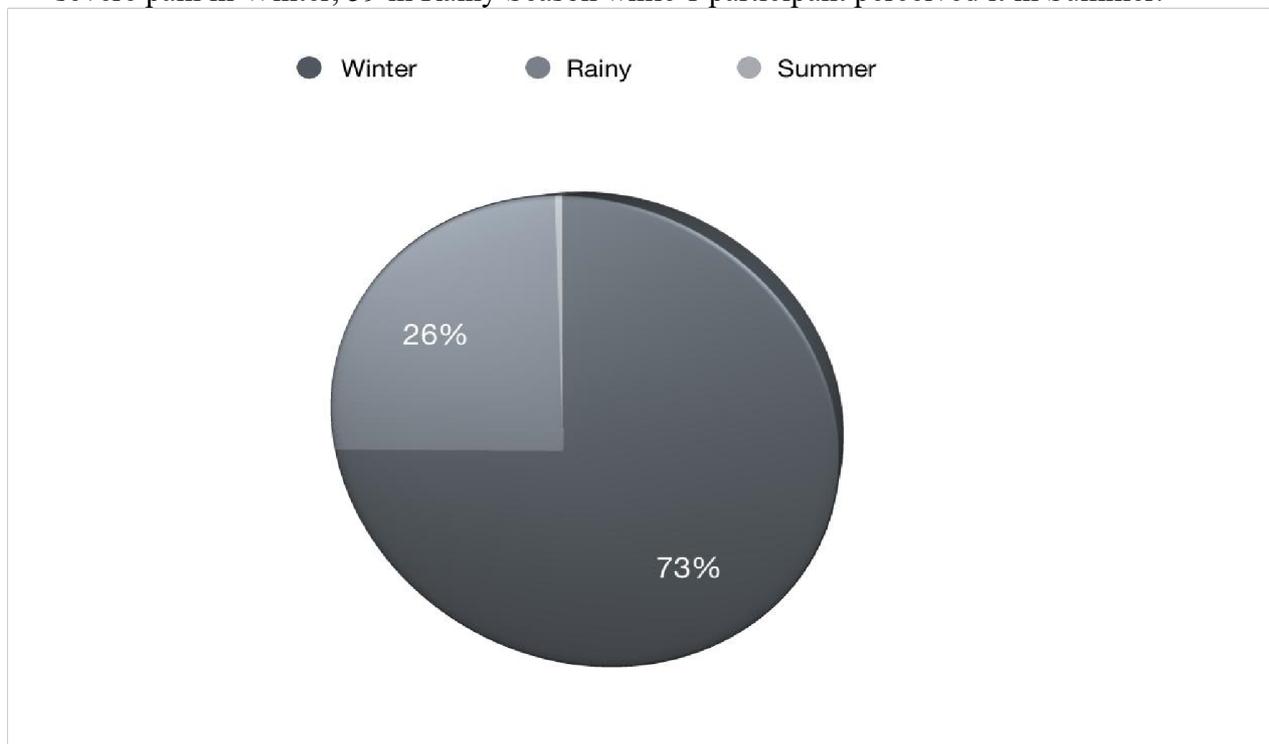


Figure 3:

Results according to the Visual Analogue Scale, 73.3% had the most severe pain in Winters, followed by 26.2% in rainy and bare, 0.4% in Summers.

Table 1: Chi square test of the sample data:

| Chi square Test (degree of freedom =2,significance level =.05) | | | |
|---|---------------------------|------------|--------------|
| Pain Severity | Seasonal Variation | | TOTAL |
| | No | Yes | |
| Mild | 25 | 44 | 69 |
| Moderate | 17 | 112 | 129 |
| Severe | 8 | 69 | 77 |
| TOTAL | 50 | 225 | 275 |

Hypothesis

H₀: There is no relation between the severity of pain perception and seasonal variation.

H₁: There is a relation between Pain severity and seasonal variation.

Table 2: Result of chi square:

| Pain Severity | Expected value table | | |
|---------------------------------------|-----------------------------|------------|------------------|
| | Seasonal Variation | | |
| | No | Yes | |
| Mild | 12.55 | | 56.45 |
| Moderate | 23.45 | | 105.55 |
| Sever | 14 | | 63 |
| Observed Values(O) | Expected Values(E) | O-E | (O-E)^2/E |
| 25 | 12.55 | | 12.45 |
| 17 | 23.45 | | -6.45 |
| 8 | 14 | | -6 |
| 44 | 56.45 | | -12.45 |
| 112 | 105.55 | | 6.45 |
| 69 | 63 | | 6 |
| χ^2 calculated | | | 20.43 |

By above calculation we conclude that $X^2(2, N = 275) = 20.43$, $p = .000037$.

Here the value of p is near about 0 and we consider the level of significance as 0.05, the value of p is less than the level of significance, which means our null hypothesis(H₀) gets rejected. Hence, there is a relation between seasonal change and variation in pain perception in patients of OA knee.

Similarly, other Tests like likelihood ratio test and linear by linear association test were performed whose result is given in the following table.

Table 3:

| Test | Values | Degrees of freedom | p value (2 significant digits) |
|-----------------------------------|---------------|---------------------------|---------------------------------------|
| likelihood ratio test | 18.314 | 2 | 0.00 |
| linear by linear association test | 15.406 | 1 | 0.00 |

Clearly, the value of p is near about 0 and we consider the level of significance as 0.05, the value of p is less than the level of significance, which means our null hypothesis(H₀) gets rejected. Hence, there is a relation between seasonal change and variation in pain perception in patients of OA knee.

3. Seasonal pain - Gender Cross-tabulation

Table 4:

| | | Gender | | Total |
|---------------|-----|--------|--------|-------|
| | | Male | Female | |
| Seasonal pain | NO | 28 | 22 | 50 |
| | Yes | 77 | 147 | 224 |
| Total | | 105 | 169 | 274 |

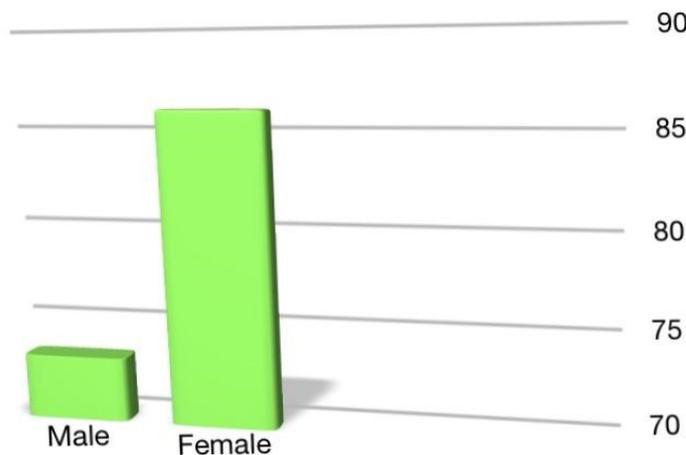


Figure 4:

Hypothesis

H0: There is no relationship between seasonal variation of pain perception and gender

H1: There is relationship between seasonal variation of pain perception and gender

Table 5: Chi-Square Tests

| | Value | df | Asymp. Sig. (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
|------------------------------------|--------------------|----|-----------------------|----------------------|----------------------|
| Pearson Chi-Square | 8.087 ^a | 1 | 0.004 | | |
| Continuity Correction ^b | 7.198 | 1 | 0.007 | | |
| Likelihood Ratio | 7.880 | 1 | 0.005 | | |
| Fisher's Exact Test | | | | 0.006 | 0.004 |
| Linear-by-Linear Association | 8.058 | 1 | 0.005 | | |
| N of Valid Cases | 274 | | | | |

Clearly, the value of p is .004 and we consider the level of significance as 0.05, the value of p is less than the level of significance, which means our null hypothesis(H0) gets rejected. Hence, there is a relation between seasonal variation of pain perception and gender

4. Gender-wise Severity of pain Cross Tabulation

Table 6:

| | | Severity Pain | | | Total |
|--------|--------|---------------|----------|--------|-------|
| | | Mild | Moderate | Severe | |
| Gender | Male | 59 | 40 | 6 | 105 |
| | Female | 10 | 89 | 70 | 169 |
| Total | | 69 | 129 | 76 | 274 |

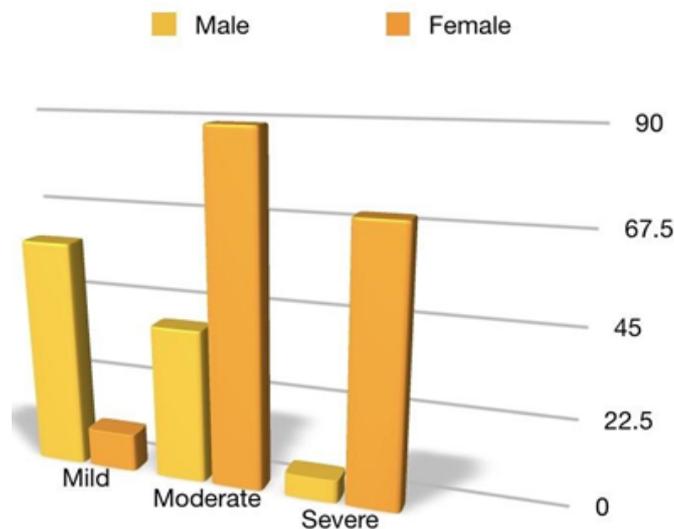


Figure 5:

Hypothesis

H0: There is no relationship between severity of pain perception and different gender group.

H1: There is relationship between severity of pain perception and different gender group.

Table 7: Chi-Square Tests

| | Value | df | Asymp. Sig. (2-sided) |
|------------------------------|---------------------|----|-----------------------|
| Pearson Chi-Square | 97.685 ^a | 2 | 0.000 |
| Likelihood Ratio | 105.926 | 2 | 0.000 |
| Linear-by-Linear Association | 90.249 | 1 | 0.000 |
| N of Valid Cases | 274 | | |

Clearly, the value of p is 0 and we consider the level of significance as 0.05, the value of p is less than the level of significance, which means our null hypothesis(H0) gets rejected. Hence, there is relationship between severity of pain perception and different gender group.

Table 8: Seasonal pain - Age-wise cross tabulation

| Age | No. of subjects had seasonal variations |
|----------|---|
| Below 45 | 4 |
| 45-59 | 157 |
| 60-74 | 76 |
| Above 75 | 37 |

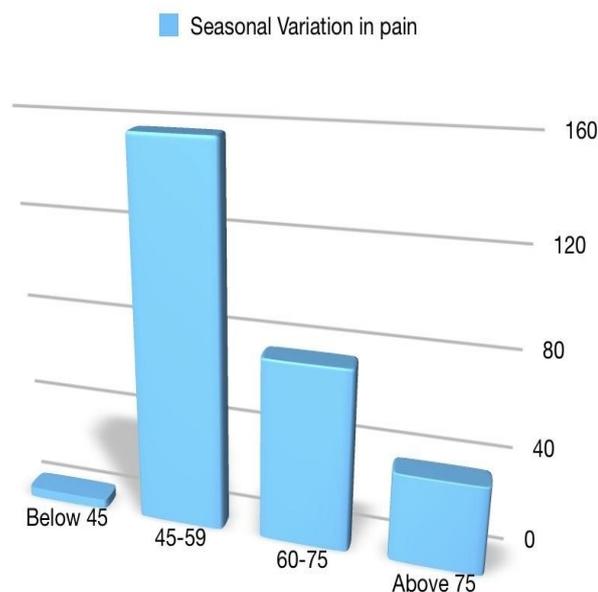


Figure 6:

Hypothesis

H0: There is no relationship between seasonal variation of pain perception and different age groups.

H1: There is relationship between seasonal variation of pain perception and different age groups.

Table 9: Chi-Square Tests

| | Value | df | Asymp. Sig. (2-sided) |
|------------------------------|--------------------|----|-----------------------|
| Pearson Chi-Square | 8.231 ^a | 3 | .041 |
| Likelihood Ratio | 11.611 | 3 | .009 |
| Linear-by-Linear Association | 2.597 | 1 | .107 |
| N of Valid Cases | 274 | | |

Clearly, the value of p is 0 and we consider the level of significance as 0.05, the value of p is less than the level of significance, which means our null hypothesis(H0) gets rejected. Hence, there is relationship between seasonal variation of pain perception and different age group.

Discussion:

Osteoarthritis is a chronic degenerative disorder of multifactorial etiology characterised by the loss of articular cartilage, hypertrophy of bone at the margins, subchondral sclerosis and range of biochemical and morphological alterations of the synovial membrane and joint capsule. [2] Primary OA is mainly degenerative

arthritis and it affects large weight bearing joints viz., KNEE and HIP joints .

Since the exact etiology of primary osteoarthritis is not known it is assumed to be multifactorial.

We found many theories about pain genesis and pain perception in osteoarthritis knee in literature.

Genesis of pain in Osteoarthritis- The disability and pain in OA are also not well understood and are believed to involve numerous interactive pathways. Articular cartilage is both aneurotic and avascular, hence incapable of generating pain, causing inflammation or generating any other clinical symptoms observed in

OA knee [3]. However, surrounding structures like periosteum, subchondral bone, peri articular ligaments, peri articular muscle spasm, synovium and joint capsule are very well innervated and hence are responsible for nociception in OA.

Synovial hyperplasia, fibrosis, thickening of synovial capsule, activated synoviocytes and in some cases lymphocytic infiltrate (B- and T-cells as well as plasma cells) comprise the synovial reaction in OA knee [4]. The site of infiltration of synovium is the white adipose tissue of the fat pad, which is richly innervated and is a good source of inflammatory adipokines [5]. Release of prostaglandins, leukotrienes, proteinases, neuropeptides and cytokines causes irritation of sensory nerve endings in the synovium from osteophytes and resulting in synovial inflammation. [6] Synovitis being frequently present in osteoarthritis, may correlate with pain and helps in predicting clinical outcomes.

The effect of change in temperature locally at the joint has been well shown by the fact that there is more stiffness in the joints at lower temperatures than at higher ones, which could very well be the reason for subjective relief from the pain after localised heat remedies [7] Localised heat remedies cause vasodilatation and so, there is increased blood flow which leads to washing away of the inflammatory infiltrates which is why local heat remedies provide relief from the pain. There could be various reasons for the stiffness. Patients sleep in crouched positions at night in cold temperatures, which may lead to increased muscle spasm. Another reason for early morning stiffness could be the accumulation of various inflammatory infiltrates over the night when there is not much movement.

Environmental factors such as decrease in temperature and moisture have been noticed to contribute to symptomatic worsening. But some other factors such as levels of hormones, antibodies

, inflammatory factors and immune responses could also be responsible for this trend [8].

Also, Knee joint consists of tendons, muscles, ligaments, bone and scars and all these are of varying densities, they contract and expand at different proportions at the same temperature, which results in the pain at the sites of microtrauma. [9]

It has also been suggested that weather affects mood a great deal, so pain perception is indeed altered.

Rainy and winter seasons may negatively affect mood and hence may lead to altered pain perception. [10-13]

Limitations:

There are certain limitations to this study.

1. The results derived from this study are solely based on the questionnaire and VAS which was given to the patients.
2. The pain perception in seasons other than the one in which the test was given was solely based on the memory of the patient
3. The pain bearing capacity is also subjective in nature, which varies from person to person, so there can be subject variation.
4. Larger sample size is required to make a factual statement.
5. Factors like humidity and atmospheric pressure, altitude and sun cover are not taken into consideration, season as a whole is considered.

Conclusion

In the absence of specific medical management other than NSAIDs to control osteoarthritis, to maintain quality of Life and to prevent its deterioration, it is essential to recognize the other contributing factors and take measures to control the same. Hence, we conclude that there is seasonal variation in the perception of pain in previously diagnosed osteoarthritis knee patients, with an

increased level of pain observed when there was decrease in atmospheric temperature during winter and rainy season.

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