

Total Knee Replacement –Histopathological Patterns

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Abstract

Background: To determine the frequency of different degenerative joint diseases and their morphological changes seen in total knee replacement specimens.

Methods: In this descriptive study total knee replacement specimen of 130 patients undergoing bilateral or unilateral knee arthroplasty were included. All specimens were received in 10% formaline fixative and routinely processed and stained with haematoxylin and eosin (H&E). These were examined microscopically and various histological patterns were evaluated.

Results: A total of 130 cases of total knee replacement specimen were evaluated. The age range was 43-81 years. The most frequent finding was osteoarthritis which was in 121 cases, 8 cases were of rheumatoid arthritis and one of gouty arthritis.

Conclusion: Osteoarthritis with female predominance is the most common pathological finding amongst various patterns.

Key-words: Total knee replacement, Osteoarthritis, Joint

Introduction

Total knee replacement is safe and effective procedure when nonsurgical treatments like medications and using walking supports are no longer helpful. The knee is the largest joint in the body and healthy knees are required to perform most everyday activities. The most common cause of chronic knee pain and disability is arthritis.¹ The knee joint is one of the complex joint in human body, comprising two long leg bones held together by muscles, ligaments and tendon. Tendons are tough cords of connective tissue that connect muscles to bones. Ligaments (anterior, posterior and lateral cruciate) are elastic bands of tissue that connect bone to bone. Some ligaments provide stability and protection of the joint, other ligaments limit forward and backward movement of the tibia.¹⁻³

Although there are many types of arthritis, most knee pain is caused by osteoarthritis, rheumatoid arthritis,

and post-traumatic arthritis. Osteoarthritis is a degenerative joint disease occurring in knee in middle age and elderly individuals caused by multiple factors including age gender, genetic predisposition and mechanical stress. In osteoarthritis when there is damage of one component leads to the failure of other component, and collectively leading to joint failure and the clinical manifestation of osteoarthritis. Rheumatoid arthritis is a chronic inflammatory degenerative disease with destruction of synovial membrane.^{1, 4-6} In osteoarthritis there is replacement of articular cartilage by fibrous membrane, and in rheumatoid arthritis there is synovial hyperplasia with lymphoplasmacytic infiltrate.^{7,8,9} Few cases of infective arthritis and gouty arthritis can be seen in these specimens.

Patients and Methods

A prospective study was carried out in the department of Histopathology, Quaid-i-Azam international hospital, Islamabad, during the period from January 2012 to June 2013. A total of 130 knee replacement specimens were received in one and half year period. The patients were diagnosed as osteoarthritis, rheumatoid arthritis and gouty arthritis depending on clinical symptoms, examination and radiological findings. The specimens were received in 10% formalin. Gross examination of all the specimens was carried out, representative bony and soft tissue (including ligaments) sections were taken. Bone was decalcified in 5% nitric acid and then processed. Appropriate sections were prepared and stained with hematoxylin and eosin for light microscopy.

Results

The age range in total knee replacement specimen (degenerative joint diseases) was 43-81 years (Table 1). Females constituted 76.15%, while males were 23.84%. The most frequent finding was osteoarthritis which was in 121 cases and 8 cases were of rheumatoid arthritis and one of gouty arthritis (Table 2). On gross examination of these bony and soft tissue fragments, the changes in osteoarthritis included some thinning of cartilage, articular surface was

granular, rheumatoid arthritis showed thick hyperplastic synovium with bulbous fronds and chalky white surface of joints in gouty arthritis (Table 3). Histological changes seen in osteoarthritis included articular cartilage replacement by fibrous tissue, increased aggregation of macrophages with degenerative changes and congestion. In rheumatoid arthritis proliferation of synovial cells (Table 4; Figure 1-4). Lymphoid follicle was often present, synovial giant cells were seen. In gouty arthritis urate deposits destroy cartilage, with appearance of tophi surrounded by histiocytes and foreign body type giant cells.

Table 1- Age range in different joint lesions

Histopathological finding	Number (43-50 years)	Number (51-60 years)	Number (61-70 years)	Number (71-81 years)
Osteoarthritis	20	31	42	28
Rheumatoid arthritis	3	4	1	0
Gouty arthritis	0	1	0	0

Table 2. Total Knee Replacement - Diagnosis

Diagnosis	No	Percentage
Osteoarthritis	121	93%
Rheumatoid arthritis	8	6.1%
Gouty arthritis	1	0.7%

Table 3: Morphological changes seen in osteoarthritis (n= 121)

Morphological changes	No	Percentage
Articular cartilage replaced by fibrous tissue	21	17.3%
Macrophages with degenerative changes and congestion	100	82.6%

Table 4: Morphological changes Seen in Rheumatoid Arthritis (n=8)

Morphological changes	No	Percentage
Proliferation of synovial cells	3	37.5%
Lymphoid follicle formation	5	62.5%

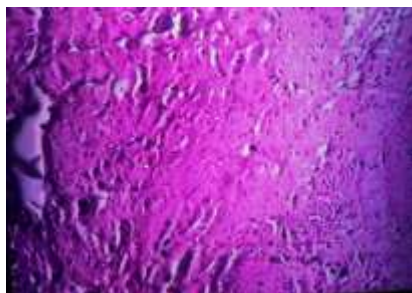


Figure 1: Fibrovascular tissue with lymphocytes and macrophages in osteoarthritis

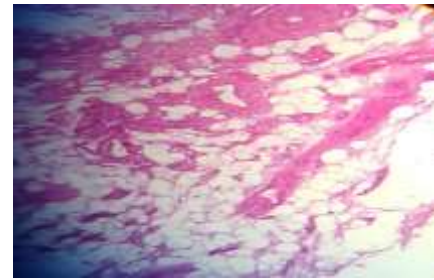


Figure 2: Fibrovascular tissue with degenerative changes in osteoarthritis

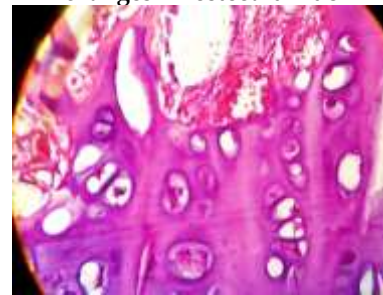


Figure 3: Degenerative changes in articular cartilage in Osteoarthritis

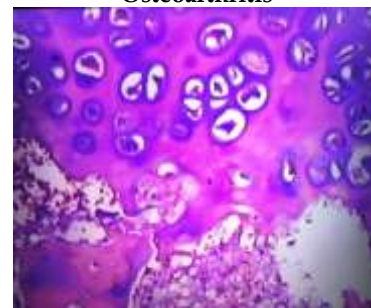


Figure 4: Degenerative changes in articular cartilage and partly replaced by fibrous tissue in osteoarthritis

Discussion

To analyze different diseases and their histological patterns we reviewed total knee replacement specimen received in laboratory. Although degeneration and loss of cartilage was the main finding in these specimens, but we conducted the comprehensive analysis. In osteoarthritis main finding was replacement of articular cartilage by fibrous membrane, other findings included degeneration and macrophage infiltration. One Iraqi study also discussed the findings but emphasis was on posterior cruciate ligament.^{1, 2} These changes were degeneration, synovitis and inflammatory cell infiltration. One study showed hyalinization and fibrosis were main features but in our study these changes were present but in focal areas. Most of the international studies compare the finding of posterior cruciate ligament with anterior cruciate ligament, but in present study ligaments were present but not mentioned separately. We also

processed bony tissue for their changes but this was not seen in other studies.¹¹⁻¹⁴

In rheumatoid arthritis cases in our study showed synovial proliferation and lymphoid follicle formation, whereas in Iraqi study fiber proliferation was the most frequent finding. Inflammation is an important feature seen in both osteoarthritis and rheumatoid arthritis but more intense in the latter. Histological evidence of inflammation was also seen in other studies but it was more pronounced in lining joints that cause damage to joints and cause destruction.

Osteoarthritis is considered to be of primary chondrocytes failure and secondary involvement of bones and rheumatoid arthritis primarily involves synovial lining and then nodule can form with palisading of histiocytes. These changes are usually seen in late presentation of rheumatoid arthritis which is not seen in our study.¹⁵⁻²⁰ A case of gouty arthritis was seen in one case. Gouty arthritis can be differentiated from rheumatoid arthritis by the presence of tophi because in later stages rheumatoid nodule is formed which has necro-biotic centre has surrounded by palisading histiocytes and giant cells.

Conclusion

1. Knee joint after showing damage by osteoarthritis, rheumatoid arthritis and other kind of infected arthritis show number of histological changes. These histological patterns are different in different stages of arthritis and aging, so it can lead to long term damage to the joints.

2. Osteoarthritis is the most common finding with the female predominance amongst various patterns.

3. Total knee replacement specimen is necessary for prevention of maximum disability, and by viewing these cases we can separate the type and extent of arthritis for any further management.

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