



# HISTOPATHOLOGICAL CHANGES IN SYNOVITIS: A SYSTEMATIC REVIEW OF LITERATURE

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*Abstract:* Synovitis is a key pathological feature in multiple joint disorders, including rheumatoid arthritis, osteoarthritis, and traumatic joint injuries. This review aims to synthesize the histopathological alterations in synovial tissue reported in previously published literature. A comprehensive review of PubMed-indexed articles was conducted focusing on synovial lining changes, inflammatory infiltrates, vascular proliferation, and stromal responses. Findings indicate that synovitis demonstrates a spectrum of pathological changes depending on aetiology, with rheumatoid arthritis showing aggressive inflammatory features, while osteoarthritis exhibits milder, fibrotic alterations. Histopathological evaluation remains essential for diagnosis, disease grading, and therapeutic planning.

*Index Terms* - Synovitis, Histopathology, Rheumatoid arthritis, Osteoarthritis, Synovial membrane

## I. INTRODUCTION

### 1. INTRODUCTION

Synovitis refers to inflammation of the synovial membrane and is a hallmark of various articular disorders. It plays a central role in the pathogenesis and progression of diseases such as rheumatoid arthritis (RA), osteoarthritis (OA), and post-traumatic joint conditions. The synovial membrane, composed of intimal lining cells and subintimal stroma, undergoes significant structural and cellular alterations in response to inflammatory stimuli.

Histopathological examination provides direct visualization of these changes and remains a cornerstone in understanding disease mechanisms. Previous studies have demonstrated that different etiologies of synovitis produce distinct microscopic patterns, ranging from hyperplastic inflammatory lesions to degenerative fibrotic changes.

This review aims to comprehensively analyze and synthesize histopathological findings in synovitis based on previously published literature, with emphasis on identifying patterns relevant to diagnosis and disease progression.

In Ayurveda, Indulgence in specific etiological factors cause simultaneous vitiation of Vata as well as Raktadosha afflicting the region of knee joint causing severe pain and swelling which appear like the head of Jackal for which it was given with that name Krostukasheersha. Bhavaprakasha called it with the name Jambookamasthakam and described the treatment as to be done similar to Vatarakta.<sup>2,3</sup>The presenting

symptoms include severe pain which causes difficulty in walking, and the large swelling due to accumulation of fluid causes heaviness of the joint.

## 2. MATERIALS AND METHODS

### 2.1 Study Design

This study is a narrative systematic review of published literature focusing on histopathological changes in synovitis.

### 2.2 Data Sources

A comprehensive search was performed using PubMed and other open-access medical databases.

### 2.3 Search Strategy

Keywords used included:

- “Synovitis histopathology”
- “Rheumatoid arthritis synovium”
- “Osteoarthritis synovial changes”
- “Inflammatory joint disease histology”

### 2.4 Inclusion Criteria

- Studies published in peer-reviewed journals
- Articles focusing on histopathological features of synovitis
- Human studies with clear microscopic descriptions

### 2.5 Exclusion Criteria

- Non-English articles
- Case reports without histological detail
- Animal studies (unless highly relevant)

### 2.6 Data Extraction

Data were extracted regarding:

- Synovial lining thickness
- Type and density of inflammatory infiltrate
- Vascular changes
- Stromal fibrosis and edema
- Presence of pannus formation

## 3. RESULTS

### 3.1 General Histopathological Features

Across studies, synovitis consistently demonstrated:

- Synovial lining hyperplasia (increase from 1–3 layers to 5–10 layers)
- Subsynovial inflammatory infiltration
- Increased vascularity and angiogenesis
- Stromal edema and fibrosis

### 3.2 Rheumatoid Arthritis

Rheumatoid arthritis showed the most severe histopathological changes:

- Marked synovial hyperplasia
- Dense infiltration of lymphocytes, plasma cells, and macrophages
- Formation of pannus tissue invading cartilage and bone
- Fibrinoid necrosis in advanced cases

These findings reflect an aggressive autoimmune inflammatory process with destructive potential.

### 3.3 Osteoarthritis

In osteoarthritis, synovial changes were comparatively milder:

- Moderate lining layer thickening
- Low-grade inflammatory infiltrate
- Increased fibrosis in subintimal stroma
- Neovascularization

Fibrosis and chronic low-grade inflammation were the dominant features, correlating with degenerative pathology.

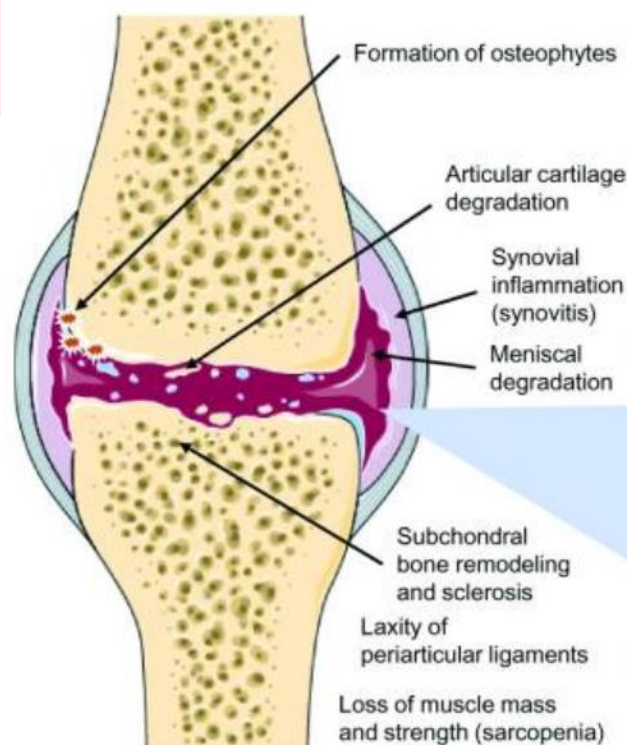
### 3.4 Traumatic Synovitis

Trauma-induced synovitis demonstrated:

- Capillary congestion and hemorrhage
- Fibrin deposition
- Acute inflammatory cell infiltration
- Subsequent fibrotic healing

These features varied depending on the duration and severity of injury.

#### Structural Alterations



### 3.5 Histopathological Scoring Systems

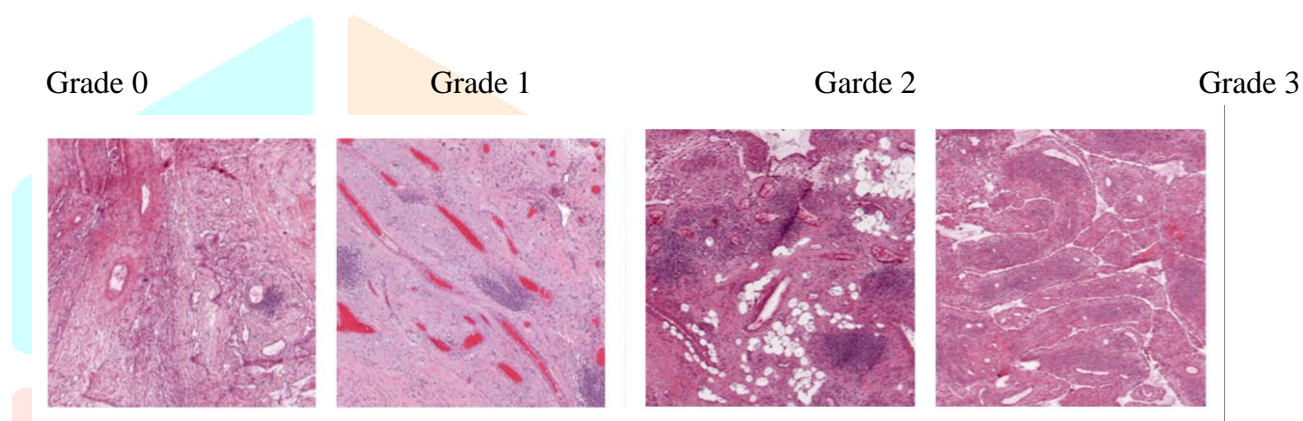
Several studies utilized semiquantitative scoring systems evaluating:

- Lining layer thickness
- Inflammatory infiltrate intensity
- Stromal activation

These scoring systems improved diagnostic accuracy and reproducibility in clinical and research settings.

#### Grading:

- Grade 0: (none, 23%): Less than 1 perivascular aggregate in at least 2 fields
- Grade 1: (mild, 29%): 1 perivascular aggregate in at least 2 fields
- Grade 2: (moderate, 28%):  $\geq 2$  perivascular aggregates or interstitial inflammation
- Grade 3: (marked, 21%): Widespread perivascular / interstitial aggregates or band-like bridging between blood vessels



### 4. DISCUSSION

The present review highlights that synovitis is not a uniform pathological entity but rather a spectrum of histological changes influenced by etiology and disease stage.

Rheumatoid arthritis demonstrates a highly inflammatory and proliferative synovitis, characterized by immune cell infiltration and pannus formation, leading to joint destruction. In contrast, osteoarthritis shows a degenerative pattern with fibrosis and mild inflammation, suggesting a different pathogenic mechanism. The presence of angiogenesis across all forms of synovitis indicates its critical role in sustaining inflammation and tissue remodeling. Similarly, synovial lining hyperplasia is a consistent early response to injury or inflammation.

Histopathological scoring systems have enhanced the objectivity of synovial assessment, although variability still exists between observers. Integration of histology with molecular markers such as cytokines and growth factors may further improve diagnostic precision.

### 5. CONCLUSION

Synovitis exhibits diverse histopathological patterns depending on its underlying cause. While inflammatory synovitis is marked by cellular proliferation and immune activity, degenerative synovitis is dominated by fibrosis and low-grade inflammation. Histopathological evaluation remains indispensable for understanding disease mechanisms, guiding treatment, and predicting outcomes.

Future studies should focus on correlating histopathological findings with molecular and clinical parameters to enable personalized therapeutic approaches.

Kroshtuka shirsha is described by Acharya Sushruta as a *vatavyadhi*<sup>3</sup> can be compared with Synovitis of Knee Joint with Effusion in modern terminology.

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