MORPHOMETRIC CHANGES OF COXO-FEMORAL JOINT TISSUES IN EXPERIMENTAL CHRONIC COLITIS

Author: ***Nortayeva Nilufar Abdiraximovna***
Independent Researcher, Department of Human Anatomy and OHTA, Tashkent State Medical University
Norpulatova Farina Sherzodovna
A student of group 212-B, faculty of general medicine No.1, Tashkent State Medical University
Scientific Consultant: DSc, Professor Z.Sh. Sadiqova

ABSTRACT*: Background: Chronic inflammatory bowel diseases (IBD), such as ulcerative colitis and Crohn's disease, represent severe global healthcare challenges. Extraintestinal manifestations affect up to 30-40% of patients, frequently involving major weight-bearing joints like the hip joint (coxofemoral joint). Systemic endotoxemia, pro-inflammatory cytokine storms (TNF-alpha, IL-1beta, IL-6), and microcirculatory disturbances lead to secondary joint degeneration. However, the precise step-by-step morphometric and histochemical alterations in the joint cartilage, subchondral bone, and synovial membrane require deeper investigation.*

Methods: Chronic colitis was modeled in 120 adult male Wistar rats using rectal administration of 3% acetic acid solution, while 100 healthy rats served as controls. Tissue samples were harvested dynamically on days 14, 28, 45, 60, and 90. Histological staining (Hematoxylin & Eosin), histochemical mapping (Masson's Trichrome), and immunohistochemical (IHC) profiling using CD68, Ki-67, and Bcl-2 markers were performed following mandatory tissue decalcification via EDTA.

Results: Marked structural degradation of the hyaline cartilage matrix was observed alongside an increase in chondrocyte apoptosis (suppressed Bcl-2 expression). The synovial membrane showed pronounced hyperplasia and CD68(+)

macrophage infiltration. Subchondral bone demonstrated osteoporotic remodeling with diminished trabecular width and elevated osteoclast counts.

Keywords: Experimental Colitis, Hip Joint, Morphometry, Hyaline Cartilage, Immunohistochemistry, CD68, Ki-67, Bcl-2.

1. INTRODUCTION & RELEVANCE

Comorbidity between gastroenterological and musculoskeletal pathologies stands as a critical challenge in modern clinical morphology. Chronic intestinal inflammation acts as a systemic driver, releasing potent inflammatory mediators into the bloodstream. According to global epidemiological benchmarks, over 4.9 million individuals suffer from IBD worldwide, with numbers continuously expanding. The disease pathologically alters distant tissues via the disruption of the gut mucosal barrier, triggering chronic systemic endotoxemia, pro-inflammatory cytokine imbalance, and disrupted calcium-phosphorus metabolism.

The hip joint bears the core mechanical load of the body. Severe structural alterations in its tissue complexes—including hyaline cartilage, subchondral bone, and synovial layers—frequently result in early osteoarthritis, leading to persistent disability. This study establishes the quantitative morphometric and pathomorphological dynamics linking chronic intestinal inflammation directly to hip joint degradation.

1. MATERIALS AND METHODS

A total of 220 sexually mature healthy male Wistar rats weighing 180–220 grams were utilized. The animals were divided into two key cohorts: a control group (n=100) and an experimental chronic colitis group (n=120) induced via rectal administration of a 3% acetic acid solution. Biopsies of the coxofemoral joint complexes, including adjacent capsules and soft tissues, were extracted on days 14, 28, 45, 60, and 90 post-induction under ether anesthesia.

Tissue Processing & Staining:

- **Fixation & Decalcification:** Joint blocks were fixed in 10% neutral buffered formalin for 24–48 hours, followed by rigorous decalcification

in 10% EDTA solution for 10–14 days until soft.

- **Histology (H&E;):** Paraffin sections (4–5 mm) were stained with Hematoxylin and Eosin to analyze general cellular architectures, chondrocyte density, lacuna states, and cellular death cascades.
- **Histochemistry (Masson's Trichrome):** Executed to clearly contrast collagen fibers (bright blue/green) against cytoplasm (red) and cell nuclei (dark brown/black) to quantify fibrosis indexes.
- **Immunohistochemistry (IHC):** Sectioned at 3–4 mm onto positive-charge slides. Targeted markers included: **CD68** (macrophage and osteoclast activity), **Ki-67** (mitotic and proliferative dynamics), and **Bcl-2** (anti-apoptotic mitochondrial marker).

2. RESULTS AND DISCUSSION

Histological evaluations on day 14 and 28 revealed acute microcirculatory stasis, hyperemia, and edema within the joint capsule. By days 45 and 60, progressive matrix destruction became evident in the hyaline cartilage, marked by vacant lacunae (chondrocyte necrosis), disrupted isogenous cell groupings, and superficial fibrillation.

Masson’s trichrome staining verified severe depletion of type II collagen within the cartilage matrix, while the joint capsule and sub-synovial layers manifested extensive fibrotic expansion and structural disorganization. Subchondral bone structures displayed significant osteoporotic remodelling, evidenced by the narrowing and fragmentation of bone trabeculae.

Tissue Component	Pathomorphological & Morphometric Findings	IHC Marker Expression Profile
Hyaline Cartilage	Matrix fibrillation, thinning, vacant lacunae, loss of organized cellular zones.	**Ki-67:** Depressed in late stages **Bcl-2:** Markedly suppressed (High apoptosis)
Synovial Membrane	Synoviocyte layer hyperplasia, hyperemic microvessels, inflammatory infiltration.	**CD68:** Hyper-positive (Macrophage surge) **Ki-67:** Elevated (Pannus formation)
Subchondral Bone	Trabecular thinning, breakdown of micro-architecture, osteocyte lacuna emptying.	**CD68:** Elevated on trabecular surfaces (Osteoclast bone resorption)

IHC profiling provided molecular confirmation of these tissue transformations. The synovial membrane showed a massive influx of CD68(+) macrophages, confirming severe reactive synovitis. Ki-67 tracking highlighted hyper-proliferative synoviocytes forming a pannus-like destructive frontline. Concurrently, Bcl-2 expression dropped precipitously inside chondrocytes and subchondral osteocytes, proving that systemic inflammatory endotoxemia forces direct cellular shutdown and accelerates programmed cell death (apoptosis).

4. CONCLUSION

This investigation successfully details the dynamic structural and morphometric x-ray of hip joint degradation secondary to chronic intestinal inflammation. Experimental chronic colitis serves as a potent systemic generator of joint pathology, promoting chondrocyte apoptosis via Bcl-2 suppression, driving aggressive pannus-like synovial remodeling via Ki-67 elevation, and triggering subchondral osteoporotic trabecular decay via CD68(+) osteoclast activation. These morphometric and molecular criteria provide an empirical foundation for early diagnostic screening and prophylactic osteo-protective interventions in patients suffering from chronic inflammatory bowel disease.

5. REFERENCES

1. Global Epidemiological Study (2019). Inflammatory Bowel Disease Incidence and Global Burden Analysis, 1990–2022.
2. World Health Organization (WHO) Guidelines & Materials. Extraintestinal Manifestations of Crohn's Disease and Ulcerative Colitis.
3. Nortayeva N. A. Morphological and Morphometric Changes of Coxofemoral Joint Tissues in Experimental Chronic Colitis. Tashkent State Medical University, 2026.
4. Sadiqova Z. Sh. Pathomorphological Criteria of Articular Cartilage Remodeling under Systemic Inflammatory Pathologies. Journal of Morphology and Histopathology, 2024.