Budapest

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Ph.D. Thesis Booklet

Evidence-Based Strategies for Optimizing Shoulder Treatment Outcomes

From Injections to Antimicrobials:

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1. Introduction

This thesis addresses two contemporary challenges in shoulder care: the conservative management of partial-thickness rotator cuff tears (PTRCTs) and the reduction of Cutibacterium acnes-related infections in surgical practice.

PTRCTs are a frequent cause of shoulder dysfunction, particularly in older adults. Historically, corticosteroids have been the primary injection therapy due to their anti-inflammatory properties. Still, emerging concerns over tendon degeneration, systemic effects, and reduced long-term efficacy have motivated the investigation of regenerative options like platelet-rich plasma (PRP) and hyaluronic acid (HA).

Parallelly, C. acnes—a skin bacterium frequently implicated in deep infections after shoulder surgery—poses a persistent challenge to infection control protocols. This organism's ability to reside in sebaceous glands and resist standard antiseptics has led to increased interest in peroxide-based skin preparation protocols, including benzoyl peroxide (BPO) formulations.

2. Objectives

Study I: To evaluate and compare the clinical effectiveness of corticosteroids, PRP, HA, PRP+HA, and adipose-derived regenerative cells (ADRCs) in treating PTRCTs, focusing on patient-reported outcomes such as pain (VAS), function (CMS, ASES), and adverse effects.

Study II: To assess the comparative effectiveness of various antiseptic regimens—especially those based on benzoyl peroxide—in reducing preoperative C. acnes colonization on the shoulder, using data from skin, dermis, and joint cultures.

3. Methods

Both studies followed PRISMA 2020 guidelines and were registered in PROSPERO. Randomized controlled trials (RCTs) were identified using systematic searches in PubMed, Embase, and CENTRAL.

For Study I, eligible trials included adult patients with isolated PTRCTs treated with injectable agents. Extracted outcomes included changes in Visual Analogue Scale (VAS), Constant-Murley Score (CMS), and ASES at defined time points (4 weeks, 3 months, 6 months).

For Study II, trials that evaluated C. acnes colonization after skin disinfection protocols were included. Seven antiseptic strategies were compared using risk ratios for culture positivity.

Statistical analyses included frequentist network meta-analysis with random-effects modeling. Certainty of evidence was assessed using GRADE. Risk of bias was independently reviewed using the Cochrane RoB 2 tool.

4. Results

Study I (PTRCTs): Seven RCTs with 315 patients were included. PRP+HA resulted in the greatest improvements in VAS, CMS, and ASES at 4–12 weeks. Corticosteroids, while effective initially, had diminishing results over time and ranked lowest in all outcome categories. PRP and HA alone showed moderate benefits.

Study II (C. acnes reduction): Ten RCTs (948 participants) were analyzed. 5% BPO significantly outperformed chlorhexidine, alcohol, and placebo in reducing surface colonization. Combinations like BPO+Clindamycin also performed well but without statistical superiority over BPO alone.

Subgroup analyses suggested greater impact of BPO in high sebaceous density areas, aligning with the anatomical features of the shoulder. No treatment significantly eradicated deep dermal or intra-articular C. acnes, underscoring the need for multi-layered approaches.

5. Conclusions

HA+PRP injections offer superior short-term pain and function improvements in PTRCTs compared to corticosteroids, supporting a shift toward biologic-first approaches in appropriate patients.

Preoperative skin preparation using 5% benzoyl peroxide provides superior decolonization of C. acnes, justifying its routine inclusion in shoulder surgery protocols.

These findings support revised clinical guidelines aimed at safer, more effective, and personalized orthopedic care.

6. Bibliography

6.1 Publications related to the thesis:

1. Weninger V, et al. Hyaluronic Acid Plus Platelet-Rich Plasma Versus Steroids for PTRCTs: A Network Meta-Analysis. Arthroscopy: The Journal of Arthroscopic and Related Surgery 2025.

2. Weninger V, et al. 5% benzoyl peroxide is the most ef reducing the cutibacterium skin: a network meta-analysis. EFORT Open Reviews 2025.

6.2 Other publications:

1. Hergár L, Weninger V, et al. No Evidence for the Superiority of 3 Tesla Magnetic Resonance Imaging Over 1.5 Tesla Magnetic Resonance Imaging for Diagnosing Wrist Ligamentous Lesions: A Systematic Review and Meta-analysis. Arthroscopy: The Journal of Arthroscopic and Related Surgery 2024.
2. Kovács K, Weninger V, et al. Anisotropy, Anatomical Region, and Additional Variables Influence Young's Modulus of Bone: A Systematic Review and Meta-Analysis JBMR PLUS