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IMPROVING OSTEOARTHRITIS CARE BY AUTOMATIC MEASUREMENT OF HIP EFFUSION USING AI

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Background: Osteoarthritis (OA) is the commonest disease affecting hip joints and has high prevalence across various age groups [1,2]. Effusion is a hallmark of OA and could represent a potential target for therapy [3–5]. Positive correlations of effusion to clinical outcomes are not well established, partly due to variability in manual assessment. Voxel-based volume quantification could reduce this variability [6].

Objectives: We examine the inter-observer agreement of manual assessment of voxel-based effusion volume from coronal STIR MRI sequences at two time points and examine the feasibility of using Artificial Intelligence (AI) for standalone volume assessment.

Methods: Our algorithm is based on Mask R-CNN [7] and was trained on labeled effusion regions in MRI slices from 68 patients with hip osteoarthritis. For validation, 2 human readers measured effusion from MRI STIR sequences of 25 patients at baseline and at 8 weeks follow-up. AI was used to measure effusion volume as an independent reader. Agreement between human readers and AI was assessed using absolute difference in volume (DV), Coefficients of Variation (CoV) and intraclass correlation coefficient (ICC).

Results: Effusion regions detected by AI closely correlated with manual segmentation (Figure 1) for all samples. Differences in volumes measured by each pair of readers are summarized in Table 1. Agreement was excellent between human readers (ICC=0.99) and for each reader vs AI (ICC = 0.85-0.87).

Figure 1. Mask overlays of regions of joint fluid detected by human readers (green, column 2) and AI (red, column 3) from 3 different patients. Raw MRI images are shown in column 1.

Table 1. Comparison of volumes measured in cubic millimeters and agreement between each pair of readers (with AI as the 3rd reader)

Volumes measured by readers Agreement between reader pairs					
Reader	Overall Volume Mean ± Standard Deviation	Reader Pair	Difference in Volume Mean ± Standard Deviation	CoV	ICC
Reader 1	6943 ± 5845	Reader 1-2	1127 ± 900	0.21	0.99 [0.98, 1.0]
Reader 2	7638 ± 5619	Reader 1-AI	3311 ± 1643	0.35	0.87 [0.7, 0.94]
AI	11014 ± 4454	Reader 2-AI	4151 ± 4986	0.27	0.85 [0.66, 0.94]

Conclusion: Initial results of automatic effusion measurement using AI show high agreement with human experts. This has potential to reduce variability and save expert time in OA MRI assessment, and to lead to improved OA care.

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CURCUMA LONGA AND BOSWELLIA SERRATA FOR OSTEOARTHRITIS PAIN MANAGEMENT: A LITERATURE REVIEW OF SPECIFIC FORMULATED EXTRACTS FOR COMBINATION

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Background: The need for safe, effective pain management for osteoarthritis (OA) is important as the number of Australian people with OA is expected to grow by 30% from year 2015 to year 2030. Extracts from *Boswellia serrata* and *Curcuma longa* are described to have anti-inflammatory and analgesic properties. Clinical studies have also reported efficacy for improving joint pain and stiffness and tolerability. A combination of *Boswellia serrata* and *Curcuma longa* formulated extracts might provide benefits in OA pain management.

Objectives: To review the literature describing the efficacy, safety and bioavailability of a formulated *Boswellia serrata* extract enriched with boswellic acids and a *Curcuma longa* extract formulated with piperine for OA pain management.

Methods: PubMed searches for studies reporting efficacy, safety, and/or bioavailability data for Boswellia and Curcumin formulations were conducted on 4 December 2020 with no publication date limitations.

Results: For the enriched Boswellia formulation, two clinical studies in OA assessing efficacy and one preclinical bioavailability study were identified^{1,2,3}. For the curcumin formulation, 2 clinical studies were identified^{4,5}. Two double-blind, randomized, parallel, placebo-controlled studies (each N=60) demonstrated significant improvement in Western Ontario and McMaster Universities OA index (WOMAC) pain and stiffness subscale scores in patients with knee OA receiving the enriched Boswellia formulation (100mg/d). In the first study¹, a 30-day treatment with enriched Boswellia, compared with placebo, significantly reduced WOMAC pain (–23.6; placebo, –5.6; P<0.0001) and stiffness (–18.8; placebo, –3.4; P=0.0014) scores. Improvement in pain visual analog scale (VAS) score was significant versus placebo at day 5 (P<0.05). In the second study², a 90-day treatment with enriched Boswellia also significantly improved WOMAC pain (–31.1; placebo, –8.4; P<0.0001) and stiffness (–27.7; placebo, –9.9; P<0.0001) scores versus placebo; Of note, a significant reduction in pain score and functional ability was observed as early as day 7. For the curcumin/piperine formulation, piperine was added to increase the bioavailability of curcumin in humans as established in a comparative bioavailability and pharmacokinetic study⁴. The results obtained in his study demonstrates that piperine enhances the oral bioavailability of curcumin without side effects. Curcumin/piperine monotherapy (350-400mg curcumin TID) was also shown to significantly reduce WOMAC, VAS and Lequesne's pain functional index (LPI) compared to placebo in a randomized double-blind placebo-controlled parallel-group study (N=40)⁵. In a sub-study that measured inflammatory biomarkers (N=40), there is no significant difference in the magnitude of changes