AB0594

IMPROVING OSTEOARTHRITIS CARE BY AUTOMATIC MEASUREMENT OF HIP EFFUSION USING AI

J. L. Jaremko¹, B. Felfeliyan², A. Rakkunedeth¹, B. Thejeel¹, V. Quinn-Laurin¹, M. Østergaard³, P. G. Conaghan⁴, R. Lambert⁵, J. Ronsky⁶, W. P. Maksymowych⁵.
¹University of Alberta, Radiology and Diagnostic Imaging, Edmonton, Canada; ²University of Calgary, Biomedical Engineering, Calgary, Canada; ³Copenhagen University, Department of Clinical Medicine, København, Denmark; ⁴University of Leeds, School of Medicine, Leeds, United Kingdom; ⁵University of Alberta, Department of Medicine, Edmonton, Canada; ⁶University of Calgary, Department of Mechanical and Manufacturing Engineering, Calgary, Canada

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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AB0595

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

V. Sethi¹, K. Siddiqui¹, M. Garg². ¹GSK Consumer Healthcare Pte Ltd, Pain Relief Medical Affairs, Singapore, Singapore; ²University of Newcastle Callaghan, Nutraceuticals Research Program, Newcastle, Australia

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

in the inflammatory biomarkers (IL-4, IL-6, hs-CRP, TNF- α , TGF- β and mean ESR between the curcuminoid treatment group and the placebo group ($p>0.05$)⁶.

Conclusion: Enriched boswellic acid and curcumin/piperine formulations demonstrate efficacy and safety for suitable treatment option: both ingredients, often cited as natural alternatives to address OA pain and stiffness could be evaluated to explore the potential benefit as a formulated combination.

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AB0596

THE POSSIBLE CONTRIBUTION OF DEHYDROEPIANDROSTERONE SULFATE FOR OSTEOARTHRITIS OF THE KNEE

I. Bashkova^{1,2}, I. Madyanov^{1,3}, K. Misko¹, E. Preobrazhenskaia⁴. ¹Chuvash State University named after I.N. Ulyanov, Department of Hospital Therapy, Cheboksary, Russian Federation; ²Federal Center of Traumatology, Orthopedics and Endoprosthesis, Consultative polyclinic, Cheboksary, Russian Federation; ³Republican Clinical Hospital, Department of Endocrinology, Cheboksary, Russian Federation; ⁴Federal Center of Traumatology, Orthopedics and endoprosthesis, Scientific and Educational Department, Cheboksary, Russian Federation

Background: Genetic, biochemical, metabolic, hormonal (primarily imbalance of sex hormones) factors are involved in the progression of osteoarthritis (OA). Dehydroepiandrosterone and its metabolite, dehydroepiandrosterone sulfate (DHEA-S), have a stress-limiting, anti-atherogenic, anti-diabetic, antihypertensive, anti-infective, immunomodulatory effects. Heroprotective effect is not excluded. Experimental studies have identified a relationship between an age-related decrease in DHEA-S levels and various adverse effects of aging.

Objectives: To identify the contribution of DHEA-S to the pathogenesis of OA, it's advisable to conduct a comparative analysis of connection of the adrenal hormones with clinical, laboratory, radiological signs of the course of OA.

Methods: Patients with primary OA with a lesion of the knee joints (n=90, including 22 men) were examined. The age of the patients - 29-69 years, the duration of the disease - 1.5-20 years. The control group (n=114, including 26 men) was formed by random sampling of the population from healthy people, it's representative by gender and age. We investigated the serum levels of cortisol, DHEA-S, estradiol (in women), testosterone (in men) and carried out radiography of the knee joints. OA was diagnosed using R.D. Althman, the x-ray stage-according to the classification of Kellgren and Lawrence. Statistically determined the mean value, standard deviation. Differences between the samples were considered statistically significant at $p<0.05$. To create a model of OA pathogenesis, the method of principal components of factor analysis was used.

Results: The DHEA-S level in the blood of patients with OA was lower than that of the control group (2.40 ± 1.20 vs 3.66 ± 1.45 $\mu\text{g/ml}$, $p=0.001$), in women was lower, than in men (2.25 ± 1.17 vs 2.89 ± 1.23 $\mu\text{g/ml}$, $p=0.045$). In the control group, gender differences were not statistically significant ($p>0.05$). All patients with OA showed an inverse correlation between age and DHEA-S ($r=-0.511$, $p=0.0001$, and $r=-0.549$, $p=0.0001$ respectively). For factor analysis the most important signs for the course of OA are ESR levels, C-reactive protein (CRP) in the blood (as markers of inflammatory component of OA, or factor 2) were selected, and the radiological stage of OA (degenerative component, or factor 1). In women, we regarded factor 1 as «degenerative», the maximum contribution to total dispersion was made by the «x-ray stage» (+0.72). This symptom was opposed by the «DHEA-S level» (-0.79) and «estradiol blood level» (-0.68), which suggests a link between degenerative and dystrophic processes in the knee joint in women with OA and a decrease in blood levels of DHEA-S and estradiol. Factor 2 we interpreted as «inflammatory». This was indicated by the values of «CRP» (+0.66) and «ESR» (+0.64). The «inflammatory» factor in women from hormonal indicators was opposed by the «blood cortisol content» (-0.31) and «DHEA-S level» (-0.26). Factor 1 in men accounted for 46% of the total variance. Since factor 1 in men included the most significant «CRP» (+0.85), «X-ray stage» (+0.77) and «ESR» (+0.72), we called it «antidegenerative anti-inflammatory factor». The maximum value (modulo) in factor 1 is for DHEA-S (-0.76) and the lower is for testosterone (-0.53). So, in men, a sufficient level of DHEA-S is closely related to the «antidegenerative-anti-inflammatory» factor of OA pathogenesis and DHEA-S counteracts 2 key pathogenetic processes simultaneously-degenerative and inflammatory.

Conclusion: In women, a decrease in DHEA-S is a risk factor for the predominantly degenerative component of OA, in men it's a universal risk factor,

predisposing both to the development of inflammation and degenerative changes in the joints

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AB0597

COMPLIANCE WITH CLINICAL PRACTICE GUIDELINES IN KNEE OSTEOARTHRITIS

M. Yasmine¹, L. Souebni¹, S. Miladi¹, A. Fazaa¹, S. Mariem¹, K. Ouenniche¹, S. Kassab¹, S. Chekili¹, K. Ben Abdelghani¹, A. Laatar¹. ¹Mongi Slim Hospital, Rheumatology, Tunis, Tunisia

Background: Knee osteoarthritis (OA) is a leading cause of disability among older adults. Recently, evidence-based guidelines for the comprehensive management of osteoarthritis (OA) were developed by the American College of Rheumatology (ACR).

Objectives: The aim of this study was to assess compliance of doctors with ACR 2019 clinical practice guidelines for the management of knee OA.

Methods: We conducted a prospective study including rheumatologists and general practitioners. The doctors were invited to answer a structured questionnaire via Google Form. The outcomes of interest concerned the medical management of knee OA as well as alternative medicine.

Results: The study included 100 doctors: 75 rheumatologists and 25 general practitioners. Almost half of them (49%) have been practicing medicine for more than 10 years. Forty four percent of doctors see between 10 to 20 patients with knee OA per month and 47% of them declared seeing more than 20 patients. Regarding the pharmacological treatment of knee OA flares, oral Non-steroidal Anti-inflammatory drug (NSAIDs) was the initial molecule of choice (91%) followed by grade I analgesics (86 %) and topical NSAIDs (68%). Tramadol and non-Tramadol opioids as well as intraarticular glucocorticoid injections were prescribed respectively in 41% and 46 % of cases. Glucosamine and chondroitin sulfate were prescribed in 49% and 54% of cases respectively and as a combination in 20% of cases. The reasons for non-prescribing these molecules were non-affordable prices (n=19), a lack of efficacy (n=6) and potential sides effects (n=1). Seventy three percent of doctors prescribe hyaluronic acid injections, with a frequency of three weekly injections in 38.7 % of cases and according to the response to the first injection in 61.3% of cases. The combination of both corticosteroids and hyaluronic acid injection was preferred in 38% of cases. The majority of doctors (84%) referred their patients to physical therapy as a first-line prescription (82.1%) or after medical treatment failure (17.9%). The use of alternative medicine was at follows: acupuncture (42.7%), prolotherapy (28.1%) and platelet-rich plasma injections (16.7%). Thirty eight doctors recommended against alternative medicine.

Conclusion: Our study showed a poor compliance to guidelines regarding the use of intra-articular injections and alternative medicine. Even though, these guidelines provide direction for clinicians, doctors and patients should engage in shared decision-making that accounts for patients' values, preferences, and susceptibilities.

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AB0598

EFFICACY OF ULTRASOUND GUIDED INJECTIONS OF A CROSS-LINKED SODIUM HYALURONATE COMBINED WITH TRIAMCINOLONE HEXACETONIDE FOR OSTEOARTHRITIS OF THE KNEE

F. Porta¹, G. Filippou², G. Sakellariou³. ¹Florence, Istituto di Neuroscienze, Florence, Italy; ²Luigi Sacco University Hospital, Rheumatology Department, Milano, Italy; ³University of Pavia, Istituti Clinici Scientifici Maugeri IRCCS, Pavia, Italy

Background: According to guidelines, the use of steroid and/or hyaluronate (HA) intra-articular injections for knee osteoarthritis (KOA) is controversial. Heterogeneity of studies and difference in HAs characteristics does not allow to draw safe conclusions. One of the major concerns is the accuracy of the procedure as up to 1/3 of injections could miss joint space when performed blindly (1), negatively affecting the efficacy of HA that needs to be placed correctly in the joint space.

Objectives: The aim of our study was to evaluate the longterm efficacy of a novel association of a Cross-Linked Sodium Hyaluronate Combined With Triamcinolone Hexacetonide (SHCTH) in patients with KOA in a real life setting.

Methods: We retrospectively evaluated the clinical and ultrasonographic (US) data of patients (pts) affected by symptomatic KOA with intra-articular injections of SHCTH (1 injection every 6 months). Pts with concomitant inflammatory arthropathies were excluded. US guidance was carried out with the "in plane" technique choosing either the lateral suprapatellar or midpatellar approach. All pts were evaluated for pain with a VAS 0-10 for pain at baseline and after 2 weeks, 1, 3, 6, 9 and 12 months, with the WOMAC questionnaire and with US, scoring joint effusion, synovial hypertrophy (SH) and power Doppler (PD) synovial signal. Due to the retrospective design, the WOMAC data were available as VAS or Likert scales; to allow comparability these values were standardized. Clinical and US variables at different time points were compared using the Wilcoxon rank sing test, the McNemar test or the paired samples t-test, depending on the variable.