

Original article

Assessing the efficacy of non-arthroscopic joint lavage in patients with osteoarthritis of the knee

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ABSTRACT

Objective: To evaluate the efficacy of joint lavage in patients with osteoarthritis of the knee.

Design: We conducted an open prospective study involving 111 patients of whom 77% were females. The patients' age range was 43–81 years and the average age 64 (8.7) years. All patients had gonarthrosis as diagnosed according to the (ACR) American College of Rheumatology criteria (Kellgren radiographic grades II and III). Patients were randomly distributed between 2 treatment groups: a) joint lavage without non-steroidal anti-inflammatory drugs (NAJL, n=57), and b) non-steroidal anti-inflammatory drugs alone (NSAIDs, n=54). Evaluations were done at baseline and 1, 3, and 6 months after enrollment. Clinical and demographic variables, and WOMAC index scores, were recorded and patient improvement was determined by following the OARSI guidelines. Statistical analyses included c2, analysis of covariance (baseline WOMAC) with one between-subject factor (treatment). Post-hoc comparisons were made with Sidak's adjustment.

Results: The respective improvement rates as measured by the OARSI index for the patients in the JL and NSAIDs groups were 50.9% and 31.5% at 1 month; 55.4% and 38.9% at 3 months; and 63.2% and 64.8% at 6 months. The patients in both groups were seen to improve from the first month (P=.038). At the end of the 6-month follow-up period, the WOMAC score had decreased significantly in both groups (P=.000), with no significant differences between them.

Conclusions: Six months after treatment, joint lavage proved as effective as NSAIDs in patients with gonarthrosis, so it constitutes an effective therapeutic choice in those cases where NSAIDs are contraindicated.

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Valoración de la eficacia del lavado articular no artroscópico en pacientes con artrosis de rodilla

RESUMEN

Objetivos: El objetivo de este trabajo fue evaluar la eficacia del lavado articular (LA) en pacientes con osteoartritis de rodilla.

Diseño: Se realizó un estudio abierto prospectivo en el que se incluyeron 111 pacientes, de los que el 77% eran mujeres. El rango de edad fue de 43 a 81 años y la media de edad de 64 ± 8,7 años. Todos los pacientes tenían diagnóstico de artrosis según los criterios del American College of Rheumatology (ACR), con grado radiológico II y III de la escala radiológica de Kellgren. Los pacientes se aleatorizaron en 2 grupos de tratamiento: a) LA sin antiinflamatorios no esteroideos (AINE) (LA, n = 57) y b) AINE solos (AINE, n = 54). Las evaluaciones se realizaron de forma basal, al mes, a los 3 meses y a los 6 meses de haberse realizado el tratamiento. Se recogieron variables clínicas y demográficas, así como el índice de WOMAC (Western Ontario and McMaster University). La mejoría de los pacientes se valoró según los criterios de la (Osteoarthritis Research Society International [OARSI] Investigación de la Osteoartritis). El análisis estadístico incluyó el test de c2, y el análisis de covarianza (WOMAC basal) con un factor entre sujetos (tratamiento). Las comparaciones post hoc se realizaron con ajuste de Sidak.

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Resultados: El grado de mejoría según los criterios de la OARSI para los pacientes del grupo LA y del grupo AINE fue, respectivamente: 50,9 y 31,5% al mes; 55,4 y 38,9% a los 3 meses, y 63,2 y 64,8% a los 6 meses. Los pacientes en ambos grupos mejoraron desde el primer mes ($p = 0,038$). Al final de los 6 meses del seguimiento, el WOMAC había descendido significativamente en ambos grupos ($p = 0,000$), sin que hubiera diferencias significativas entre ellos.

Conclusiones: A los 6 meses del tratamiento, el LA es tan eficaz como los AINE en pacientes con gonartrosis, por lo que es una alternativa terapéutica eficaz en los pacientes en los que los AINE están contraindicados.

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Introduction

Knee osteoarthritis is the most common clinical presentation of osteoarthritis (OA), and its increase in prevalence parallels the increasing populations' age.¹ This disease is associated with pain and joint capsule swelling,² a reduction in the range of movement³ and in the functional capacity in approximately 10% of the population over 55, of which 25% is has severe disability due to this disease.⁴ Knee OA treatment guides recommend drug treatment, initially with paracetamol and then with non-steroidal anti-inflammatory drugs (NSAID).⁵ The introduction of selective cyclo-oxygenase 2 (COX-2) inhibitors at first promised a reduction of some of the adverse events of NSAID,⁶ but their efficacy in this regard is currently controversial.⁷ According to the EULAR (European League Against Rheumatism) guidelines, both pharmacologic and non-pharmacologic therapy and invasive procedures are necessary for an optimal treatment of knee OA.⁸ The great variety of potential effects of invasive treatment, even joint lavage (JL), makes it important to assess their efficacy.

In knee osteoarthritis, JL can be effective because it produces the elimination of particles and debridement of the joint space and leads to dilution of enzymes and proinflammatory cytokines.⁹ The efficacy of arthroscopic JL in patients with OA has been subject to analysis in different randomized studies.¹⁰ On the other hand, non arthroscopic JL technique which includes tidal irrigation, or single needle technique, and the double needle lavage have not been evaluated thoroughly.^{12,13} Non arthroscopic JL is a minimally invasive, cheap technique and must be considered as an alternative in the treatment of OA.¹⁴ In addition, the increase of evidence on its efficacy makes this procedure something that is everyday more commonly employed in the clinical practice of rheumatologists.

The objective of this study was to evaluate the efficacy of non-arthroscopic JL with a double needle technique versus conventional treatment with NSAID in patients with knee OA.

Patients, material, and methods

Patients

The patients which were included in the study were selected from a local treatment unit at our hospital, all of them referred from their primary care center. All of the selected patients complied with the (ACR)¹⁵ American College of Rheumatology criteria for knee OA and had the following inclusion criteria: *a*) symptomatic knee OA of more than 3 months since onset in spite of conservative medical treatment; *b*) radiological stage II or III of the Kellgren classification¹⁶; *c*) patients were not under any evaluation for disability payments; and *d*) all patients signed informed consent. Patients with any of the following criteria were excluded from the study: *a*) total joint ankylosis; *b*) total knee arthroplasty (patients with a prior osteotomy were not excluded); *c*) patients with a potentially infected lesion in the region close to the puncture area; *d*) patients in treatment with coagulation-altering drugs (if the patient took antiplatelet therapy they were not excluded); *e*) patients with a suspected venous thrombosis or

marked venous insufficiency who presented an episode of superficial or deep venous thrombosis; and *f*) prior administration of hyaluronic acid during the year prior to evaluation, or those receiving steroids or JL in the 3 months prior to evaluation. A total of 111 patients were included in the study.

Study design

A prospective, open, controlled, randomized study was performed with a single evaluator who was not aware of the inclusion or exclusion criteria or the distribution of the patients. The random assignment of the patient into each one of the 2 study groups was performed using the SIGESMU V.2 (Suárez Ramón and Silva Luis C.) software.

For group 1 (JL, $n=57$) a continuous irrigation technique with 2 needles was employed, while in group 2 ($n=54$) only NSAID were employed. NSAID employed were COX-2 selective inhibitors (25 mg/day rofecoxib or 200 mg/day celecoxib). Patients in the JL group could only employ paracetamol as an analgesic in case of need, up to 4 mg/day. The ethics committee of the hospital approved the study protocol and all participants signed an informed consent.

Administration of treatment

The JL procedure started with the collocation of sterile drapes and cleansing of the skin around the knee with iodine solution, after which the injection of local anesthetic in the median patellar region took place with 5 cc of 2% mepivacaine without vasoconstrictor. Once the anesthetic took effect, an access port was generated using a n° 16 catheter. Prior to the application of the lavage fluid, drainage of all possible synovial effusion was carried out in order to leave the joint as empty as possible and in addition, a sample of synovial fluid was obtained for its analysis. Then the cold normal saline was infused through the Access port until 100 cc had been instilled. Once the knee was distended, the median patellar region was infiltrated with another 5 cc of local anesthetic and another catheter was placed as an internal drainage, with the same procedure as with the external drainage. The lavage itself was carried out with 3 liters of cold saline (8°C) with a constant flow connected to the entry port through a drip line, and the internal zone had another drip line installed that drained through gravity to a collection bottle. The time of perfusion varied and depended on the individual characteristics of each patient, but oscillated between 90 and 120 min. Once the perfusion was complete, the remaining fluid was evacuated and manually compressed out of the joint. The limb was then bandaged; this compressive bandage remained for 24 hours.

Efficacy of treatment was evaluated according to the Osteoarthritis Research Society International (OARSI) criteria.¹⁷ Pain and functional capacity were measured through the WOMAC questionnaire^{18,19,20} and the patient's global evaluation was performed through visual analog scale (0 to 100 mm). All of the variables were measured at baseline (day 0), at 1 month (day 30), at 3 months (day 90), and at 6 months (day 180).

Statistical analysis

The statistical analysis of data consisted in a descriptive analysis with the calculation of absolute and relative frequencies for qualitative variables and means (standard deviation [SD]) for quantitative variables.

The inferential analysis compared the baseline values using the Student *t* test for quantitative variables and the χ^2 test (dichotomic variables) for qualitative variables; to compare the percentage of patients who improved, the OARSI criteria were used for both groups. The WOMAC index analysis was done using repeated measures with 2 factors: the intrasubject factor was time (0, 1, 3, and 6 months) and the intersubject factor was time of effect (1=JL, 2=NSAID). Post hoc comparisons were performed using a Sidak adjustment for multiple comparisons.

Lastly, a covariance analysis was performed, contrasting the WOMAC score at different timepoints and taking the baseline WOMAC score as a covariable to prove the homogeneity in both treatment groups with respect to the baseline values (WOMAC) of the patients; we previously confirmed that there existed a linear correlation between baseline WOMAC values and those obtained at different points in time.

In all statistical tests we considered a value of $P < .05$ as statistically significant and the hypothesis contrast was bilateral.

Results

Of the 111 patients included in the study, 77% were women. Mean age was 64 years with a standard deviation (SD) of 8.7; age range was 43 to 81 years. All of the patients complied with ACR criteria for knee OA. Thirty-three patients (39%) had a radiologic stage II and 68 patients (61%) had a radiological stage III according to the Kellgren scale. Forty-nine percent of patients had an affected right knee and 51% had the left one affected. Fifty-seven patients were included in the JL group and 54 in the NSAID group. Table 1 reflects the clinical and demographic characteristics of patients included in each treatment group and baseline values are compared for each of the variables.

There were no significant baseline differences regarding age and gender. On the other hand, significant differences were found regarding the baseline WOMAC scores between the 2 groups ($P = .011$, Table 1).

Figure represents the WOMAC score index obtained for each month. No significant differences between the 2 treatment groups at different moments in time; however, independent of the type of effect, there was a reduction of the WOMAC score during follow-up.

In lieu of the results and taking into account that the group selection was done randomly at every moment, we decided to perform a covariance analysis²¹ to contrast the WOMAC score at different timepoints in the evaluation; the baseline WOMAC score was considered a covariable because, according to Molinero,²² when these baseline differences are found in spite of correctly performing

Table 1
Clinical and demographic characteristics and baseline values of patients in each treatment group

Variables	JL group	NSAID group	P
Gender (women) ^a	44 (77)	41 (76)	>.05
Age, mean (SD), y ^b	64.37 (8.72)	64.07 (8.56)	>.05
Radiological stage III ^a	45 (79)	23 (42)	.000
WOMAC (score) ^b	54.97 (17.92)	46.26 (17.55)	.011

JL indicates joint lavage; NSAID, non-steroidal anti-inflammatory drugs; WOMAC, Western Ontario and McMaster University.

^a n (%), significant differences using χ^2 test.

^b Mean (standard deviation), significant differences measured through Student *t* test.

the randomization of patients, the correct thing to do is to analyze and adjust the results in relation to the baseline values. Results are represented in Table 2.

A linear correlation between the baseline WOMAC values and those obtained at different points in time had been previously proven (Pearson correlation coefficient, $P = .000$).

By introducing the baseline WOMAC score into the analysis as a covariance, mean scores of the questionnaire during the study were lower in the group that underwent JL and increased in the NSAID group; in addition, differences between them were shortened. Even when the first analysis showed that differences were significant almost at the end of the study in favour of group 1 (JL, 36.20 [SD, 18.0] points vs NSAID, 29.36 [SD, 19.06] points; $P = .056$), the covariance analysis showed the differences to be significant at the one month evaluation, also in favour of group 1 (JL, 38.97 [SD, 2.20] points vs NSAID, 44.82 [SD, 2.25]; $P = .07$), which demonstrates that patients that undergo JL improve before patients who are administered NSAID, although by the end of follow-up these almost significant differences had almost disappeared.

Table 3 reflects the proportion of patients who presented improvement at different time-points during follow-up (1 month, 3, and 6 months) according to the OARSI criteria. In both groups, improvement in OA symptoms was observed during the first month. At 6 months there were no significant differences between the 2 groups.

Discussion

In this study we can observe how a JL in patients with knee OA with a histological stage II or III improve clinically as measured by the

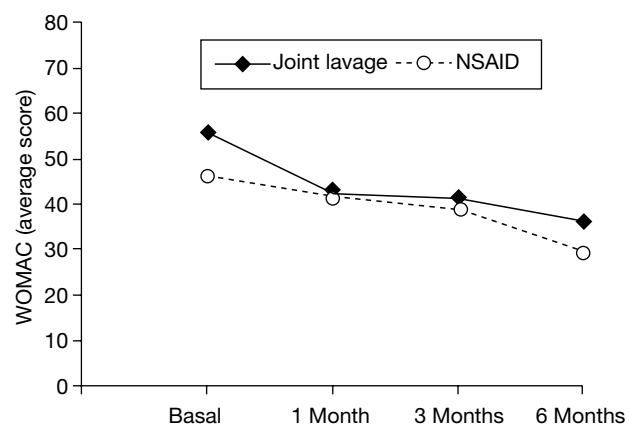


Figure. WOMAC scores (Western Ontario and McMaster University) at different times.

Table 2
Results of the covariance analysis (baseline WOMAC) and mean (standard deviation)

Time of assessment	JL group (n=56)	NSAID group (n=54)	P between groups
1 Month	38.97 (2.20) ^c	44.82 (2.25) ^c	.070
3 Months	38.24 (2.33) ^c	41.72 (2.37) ^c	.305
6 Months	33.66 (2.14) ^{ab}	32.00 (2.18) ^{ab}	.593
P intrasubjects			

Statistical significance determined through a covariance analysis (baseline WOMAC) with a factor between subjects (treatment). Post hoc comparisons performed using a Sidak adjustment.

JL indicates joint lavage; NSAID, non-steroidal anti-inflammatory drug; WOMAC, Western Ontario and McMaster University.

^a Statistical differences at 1 month.

^b Statistical differences at 3 months.

^c Statistical differences at 6 months.

Table 3

Proportion of patients that showed improvement according to the International Society for Osteoarthritis Research

	JL group (n=57)	NSAID group (n=54)	P ^a
F1 Month, n (%)	29 (50.9)	17 (31.5)	.038
3 Months, n (%)	31 (55.4)	21 (38.9)	.084
6 Months, n (%)	36 (63.2)	35 (64.8)	.856

JL indicates joint lavage; NSAID, non-steroidal anti-inflammatory drug.

^a Statistical significance determined by χ^2 test.

response percentage according to the OARSI criteria, as well as show a reduction in the WOMAC scores at different time-points during follow-up. As can be proven by the obtained results there were no significant differences with NSAID treatment at the end of the study period, which has important repercussions because this can help to better limit the indications for JL treatment.

JL is a widely accepted modality for the treatment of patients with knee OA and it has several known mechanisms through which it can be beneficial: a) evacuation of cartilage detritus; b) microcrystal evacuation; c) dilution of degrading enzymes and chondrolysis-implicated cytokines; e) capsule distension; and f) rupture of intra-articular adhesions. Several studies have been performed to evaluate the therapeutic efficacy of JL and there has been great differences regarding their conclusions, probably due to methodological differences and also to the ethical and technical difficulties that “sham” interventions and patient blinding imply, which in many cases is impossible. In addition, the analysis of the placebo effects in these studies is also difficult, something that is also important.

Dawes et al²³ were incapable of showing any significant benefit of JL over intra-articular injection (IA) of saline and concluded that JL was not indicated in the management of knee OA. In any case, the size of the sample (20 patients) precluded a valid statistical analysis. Ike et al²⁴ performed a randomized, single-blind study comparing medical treatment and JL and proved that the latter was significantly beneficial for the pain produced by OA compared to the benefits found in patients who only received medical treatment. The possibility that the benefits of JL are due to a placebo effect induced by puncturing the knee cannot be excluded. Philippe Ravaud et al¹² performed a randomized trial with a relatively wide sample of patients, evaluating JL and using IA of placebo as a control group. The objective was to evaluate the efficacy of JL alone and JL associated to the use of IA steroids. The study concluded that when compared to placebo, both procedures had significant improvements of pain but not joint function. We published in 2004 similar results¹³ in a longitudinal, prospective study in which 205 patients with Kellgren radiological stage II and III knee osteoarthritis (299 treated knees) were randomly assigned to one of 2 groups, one that only received JL and the other one a JL followed by IA steroids. A significant improvement was found in relation to baseline data in patients in both groups at one month since the intervention, but no differences between both treatments were seen, concluding that both treatments are effective and no significant differences exist between them after 3 months of follow-up.

In this sense it is important to point out the study published by Moseley et al,¹⁰ in which patients with knee OA were randomly assigned to one of 3 treatment groups: one in which only an arthroscopic lavage was performed; another in which debridement was performed after arthroscopic lavage; and the third one that simulated an arthroscopic lavage and served as placebo. The conclusion reached was that the response seen both the arthroscopic lavage as well as in debridement was not superior to placebo. This a priori data questions the real efficacy of the procedure; however, this study can have a selection bias because it was performed in male subjects who refused to participate in the study in 44% of cases,

because it was explained to them that they had a one in 3 chance of actually undergoing the procedure, which leads to think that only those patients who were more predisposed to present the placebo effect of the sham intervention finally agreed to participate in the study. In addition, this data is not applicable to the general population because most patients with OA are women.

As was pointed out at the beginning of this discussion, this study did not find significant differences between JL and NSAID treatment in the management of patients with knee OA and a radiological stage II or III. Therefore, this is a great advance when indicating JL, summarized as patients with stage II or III knee OA and with counter indications for NSAID treatment of gastropathy. In addition, JL is a much cheaper therapeutic option than NSAID treatment because a single intervention leads to patient improvement than continuous treatment with NSAID and much less side effects. In this sense, it is necessary to point out that JL is a minimally invasive technique that can be performed on an outpatient basis and is widely accepted by the patient.

However, it is convenient to perform further studies that confirm these results, all of them with the objective of purveying resources to patients with knee OA that may improve their quality of life.

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