

Osteoarthritis of the knee - correlations between clinical and functional variables

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Abstract

This study is an observational one in which we tried to highlight possible correlations between different clinical and functional parameters on a group of patients (n=21) diagnosed with knee osteoarthritis. We monitored different clinical and functional variables (pain, the patient's general condition and the doctor's assessment regarding the disability, the limitation of joint mobility, the HAQ questionnaire, the Lequesne index) and noted statistically significant correlations between the clinical and functional parameters studied for different subgroups of patients in order to prevent the disabilities and to improve the quality of these patients life. The results of the present study supports the idea that using different subgroups of patient some parameters can become very important for the evolution of the osteoarthritis, prevention of disabilities and for the improving the patients quality of life.

Key words: *knee osteoarthritis, pain, quality of life.*

Introduction

The arthritis disease (osteoarthritis) is a chronic condition that mainly affects the elderly population, with the most common location being the knee joint. The prevalence of the disease shows a significant increase in persons over 55 years of age (in 80% of the population) clinical and functional signs and/or imaging changes suggestive of the diagnosis are detected) (1). Factors like age, gender, body mass index, weight status, certain anatomical changes, trauma to joint are common risk factors of knee osteoarthritis (KOA) (2). The KOA has pathophysiology not fully understood. The changes are related to a proinflammatory status (3, 4) and several factors including cytokines, leptin are some of the pathogenic factors of knee OA. In this context it may be essential to detect modifiable risk factors, with individualized prevention strategies and also to detect the factors that may have a protective role (5).

Regardless of the form (primitive or secondary), from a clinical and functional viewpoint, KOA is manifested by pain and later by limited mobility with the onset of joint instability and quadriceps hypotrophy (6). Disability, a result of the disease evolution on the one hand and secondary to pain and joint immobilization, has important repercussions on the quality of life of these patients (7).

There have been different population based studies on the risk factors of knee osteoarthritis but those studies in common had limited validity. The objective of our observational study was to determine the possible risk factors for osteoarthritis of the knee and establishes different correlations between clinical and functional variables and to prevent the disabilities and to improve the quality of these patients life.

Material and method

The observational study was conducted in the Physical Medicine and Rehabilitation Clinic of Craiova, Clinical Emergency County Hospital. The population sample included patients diagnosed with knee osteoarthritis (KOA). The subjects were diagnosed with osteoarthritis of the knee according to the ACR criteria (concomitant presence of pain symptoms and at least one of the following: crepitus, morning stiffness, age over 38 years and changes emphasized by radiology) (8).

Inclusion into this study was based on having the following criteria: women and men over the age of 18; a confirmed diagnosis of KOA; regardless of the pharmacological treatment or rehabilitation program the patient is undergoing; perfectly speaking and understanding the language.

The exclusion criteria that disabled the patients from taking part in this study were the following: uncooperative patients; illiteracy, alcoholism, severe psychiatric disorders, associated conditions that might otherwise explain the evolution of the symptoms.

This study was performed in accordance with the principles of Helsinki Declaration and Good Clinical Practice and was approved by Ethics Committee of Craiova Emergency County Hospital. All patients provided written informed consent.

The clinical and functional variables monitored were: pain, the patient's general condition and the doctor's assessment regarding the disability - objectified by using visually analogous 10 cm scales for each of the parameters listed; the presence of joint swelling, patellar shock, crepitus, pain on passive mobilization, the presence of varus/valgus as well as quadriceps atrophy were noted with values of 0/1 (depending on the presence or absence of the listed changes); the limitation of active joint mobility (flexion and/or extension deficit) was quantified by summation, granting one point for each 10° deficit.

The HAQ questionnaire for assessing the performance of ADLs and pain generated by the disease during the last week, scoring from 0 to 3 for each activity included in the questionnaire (0: carrying out the activity without pain; 3: impossibility to carry out that activity); Lequesne index (severity index for gonarthrosis) calculated on 3 sections (pain/discomfort, maximum distance walked and ADL performance); the scoring ranged from 0 to 6 depending on the section and the final value represented the sum of the 3 results of the sections (0: no disability; 1-4: minor disability; 5-7: medium disability; 8-10: severe disability; 11-13: very severe disability; ≥14: extreme disability) (9,10).

The results were analysed using the SPSS medical statistics software, the determination of the correlation coefficient (R) for different clinical and functional variables in the studied group and the predictive coefficient (R²). Continuous data were characterized by mean values and standard deviations, and categorical data were expressed as percentages.

Results

The studied group included 21 patients with a mean age of 62.62 years (minimum 49 years, maximum 83 years), 71.4% from rural areas and 28.6% from urban areas, 71.4% females and 28.6% males; of them, in 52.4%, the diagnosis was primary gonarthrosis and in 47.6% it was secondary gonarthrosis.

By calculating the body mass index (BMI) we obtained values between 22 and 44 kg/m². The age of the disease was ranged from 3 to 27 years (mean 10.09 years).

The socio-demographic data is presented in Table I.

Table I. Socio-demographic data (n=number of patients, SD=standard deviation)

Socio-demographic data	KOA(n=21)
Age mean (SD)	62.62 (7.2)
Rural/Urban areas	71.4%/28.6%
Females/Males	71.4%/28.6%
Primary/Secondary KOA	52.4%/47.6%
Age of the disease	10.09(4.8)

Regarding the clinical data observed, more than 50% of the patients reported pain on passive mobilization, almost 100% of studied patients had limitation of active mobility of the knee. Also, swelling or varus/valgus knee deviation was found in 28.6%, respectively 100% of the population included in this study.

The results obtained (frequency) in determining the clinical and functional variables (crepitus, swelling, patellar shock, pain on passive mobilization, limitation of active mobility, the presence of varus/valgus knee) are summarized in Figure 1.

The average value obtained for the HAQ questionnaire was 13.66 (SD 2.97) and for the Lequesne index 14.57 (SD 5.70).

For the whole study group, the results obtained from the correlation of the different clinical and functional variables were modest and disparate, but dividing the patients into subgroups according to the type of KOA, the BMI values, the environment of origin or the gender, we obtained significant results.

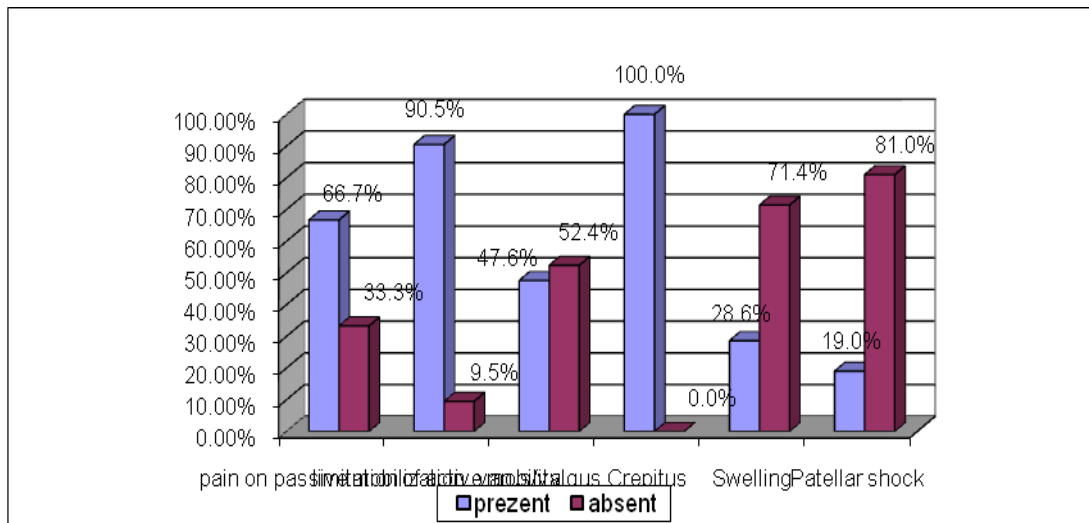


Figure 1. Clinical diagnosis data

Using the linear regression equation, the correlation between the variable pain on passive mobilization, the presence of varus/valgus deviation with the limitation of active mobility (present/absent) proved to be satisfactory for obese patients ($R = 0.546$ and $R^2 = 0.299$), one third of whom are subjected to the regression equation, as we can see in the Table II.

A statistically significant correlation and prediction were obtained for patients from urban areas ($R=0.750$, $R^2=0.563$) but also in the subgroup of male patients ($R=0.756$) whereas in the subgroups with primary or secondary gonarthrosis the results had approximately the same statistical significance ($R=0.653$ and $R=0.500$, respectively). Correlating the presence of pain in passive mobilization with the Lequesne index and HAQ we noticed that important results were obtained for the subgroup of obese patients as well as for the normo/supraponderal group. All the results had a statistically significant correlation (Table III).

We also obtained values close to the ones showed above for the subgroup of patients from urban areas ($R=0.788$, $R^2=0.621$)(Table IV) and lower values for patients with secondary gonarthrosis or the female subgroup ($R=0.653$ and $R=0.510$, respectively).

Table II. Correlation between pain on passive mobilization, the presence of varus/valgus and limitation of active mobility (present/absent) in obese patients

IMC	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
≥ 30	1	.546a	.299	.158	.345

a. Predictors: (Constant), varus/valgus, limitation of active mobility

Table III. Correlation between pain on passive mobilization, the Lequesne index and HAQ depending of IMC

IMC	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
≤ 29.9	1	.726a	.527	.338	.863
≥ 30	1	.608a	.370	.244	1.144

a. Predictors: (Constant), MHAQ, Lequesne index

Table IV. Correlation between pain on passive mobilization, the Lequesne index and HAQ depending of the residential area

IMC	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
rural		.410a	.168	.030	.481
urban		.788a	.621	.369	.410

a. Predictors: (Constant), MHAQ, Lequesne index

Both for the normal weight/overweight group and for the obese group, the correlation and the predictability between functionality of the knee and quality of life proved to be important ($R=0.904$, with a prediction of 0.817 and $R=0.738$ and $R^2 = 0.545$, respectively), thus being able to state that depending on the degree of flexion and/extension deficit we predict the values for HAQ and Lequesne index for 80 % and 55 % of patients, respectively (normal weight/overweight or obese).

Table V. Correlation between Lequesne index and HAQ depending of the IMC

IMC	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
≤29.9	1	.904a	.817	.743	.649
≥30	1	.738a	.545	.454	2.254

a. Predictors: (Constant), MHAQ, Lequesne index

We also obtained values close to the maximum possible value for the subgroup of patients in rural areas ($R=0.956$, $R^2=0.914$), whereas for male patients the correlation proved to be statistically significant ($R=0.780$, $R^2=0.608$); for the primary or secondary KOA groups the results were similar, with one third of patients undergoing a linear regression equation ($R^2=0.323$).

For the normal weight and overweight subgroup, we obtained an R value of 0.723 (statistically significant), with the highest value resulting from the correlation of the disease age with the performance section of the ADLs from the Lequesne index ($R=0.748$, $R^2=0.560$); however, the correlation and prediction for the obese group are not statistically significant.

The same correlation for the primary/secondary type of KOA and male/female subgroups did not show significantly different values, with the results obtained showing a satisfactory correlation but without an actual prediction ($R=0.465$ and 0.449 for the type of gonarthrosis, and $R=0.302$ and 0.364 for female/male subgroups, respectively). We find it interesting to present the results obtained for the subgroups of the environment of origin, with the correlation of the two variables expressing statistically significant values for the subgroup "urban areas" ($R=0.515$) especially based on the correlation with the section "ADL performance" ($R=0.601$); we mention that a significant percentage of them had previously undergone drug treatment (chondroprotectors, NSAIDs or intra-articular NSAIDs) or other stages of recovery treatment (Table VI).

Table VI. Correlation between disease age and ADL performance depending of the residential area

Residential area	R	R Square	Adjusted R Square	Std. Error of the Estimate
rural	.094a	.009	-.067	6.982
urban	.601a	.362	.202	5.604

a. Predictors: (Constant), ADL performance (Lequesne index)

Discussion and Conclusion

The osteoarthritis of the knee is characterized by loss of joint articular cartilage associating osteophytes and subchondral bone remodeling. Classical risk factors for KOA include age, gender, local micro-trauma, weight, joint injury and family history of osteoarthritis. On the other hand, the environmental and genetic factors are associated with its progression. The most common clinical symptoms include pain, limitation of the joint movement and stiffness, all of these leading in major joint dysfunctionality.

Knee osteoarthritis is known as a common disease of aged population and most probably one of the leading causes of disability for these patients. It is well known the incidence of knee OA is rising by increasing average age of the population of the globe. Changes in articular cartilage exacerbated by aging support the increased frequency of osteoarthritis of the knee in older people (11,12).

Our results support this conclusion, the studied patients have a mean age of 62.62 ± 7.2 years. It has also reported that females have an increased frequency (13) and our results found a higher frequency in women (71.4%). The ratio of women to men affected by knee OA is 4:1 and the effect of gender is more pronounced over the age of 50 years (14).

There should be a relationship between the age of the disease parameter and the level of functional disability, starting from the idea that the evolution of the disease cannot be stopped; however, the results obtained do not fully support this statement. Other factors may be more important in disability of the knee joint.

In 2005 Yi-Chung Pai concluded that declined knee position sense may contribute to functional impairment in OA of the knee (15).

In a 4-year study, Dunlop *et al.* (16) identified different predictors of knee disability. The presence of an impaired range of motion (ROM) was one of the factors who are involved in joint impairment, but this is not the only one. Other factors, such as swelling and pain during motion, were used in the assessment of joint. The authors did not identify a separate association between joint ROM and disability. In our study, limitation of joint mobility cannot be risk factor for disability but association of pain on passive mobilization, the presence of varus/valgus knee with the limitation of active ROM proved to be satisfactory for obese patients. Obviously, the results obtained for the quality of life evaluated with HAQ questionnaire and the Lequesne index are influenced by the joint functional integrity; however, we wanted to highlight this statistically, correlating the limitation of active joint mobility with HAQ and the index of severity for osteoarthritis.

As a result of our study we can say that for 6 out of 10 patients the joint functional status is predicted depending on the presence of pain in the passive mobilization of the affected knee. In 2008 Bedson found that knee pain should be an imprecise marker of knee functionality and is partly dependent to extent of radiographic involvement. Moreover, radiographic knee osteoarthritis is an imprecise guide to the knee pain or disability of the joint (17).

Regarding the environment of origin, we found a better correlation between clinical and functional variables in urban patients, with a good prediction for the Lequesne index and HAQ depending on the degree of limitation of joint mobility or pain in passive joint mobilization, with them lending more significance to the pain parameter or to the secondary alteration of the gait pattern. Muraki *et al.* (18) found the prevalence of pain in KOA as age-dependent in women living in urban area, but not in men. Also, symptomatic OA of the knee was common among the general adult Japanese population but more in women of older age groups. On the contrary, in a study developed in Greece, symptomatic knee affected by OA was significantly more common in rural area compared to urban populations and the logistic regression analysis highlights a significant association of female patients aged over 50 years with all sites of OA, including the knee joint (19).

The subgroup of male patients showed a statistically significant correlation with 60% prediction for determining the degree of joint disability and the HAQ questionnaire (prediction for 6 out of 10 patients) compared to the results obtained in the subgroup of female patients. Few studies have examined the interplay of gender and disability in patients with KOA. Women tend to report more pain during knee examination (20) and had significantly increased risk and greater severity of knee disability (21). On the contrary, the results of our study are surprising, with evidence of substantially higher joint disability in men. In 2009, Ershele L *et al.* concluded that age have a stronger relationship with gait disability in men with osteoarthritis of the knee (22).

The results of correlations between clinical and functional variables in the present study proved superior in patients diagnosed with secondary gonarthrosis compared to the primary gonarthrosis subgroup (one-third of patients with secondary gonarthrosis undergo the regression equation to correlate Lequesne score and HAQ score variables depending on the degree of limitation mobility), but there were no significant differences between the two groups. It is well known that primary knee osteoarthritis is articular degeneration without apparent underlying reason while secondary type of osteoarthritis is the consequence of an abnormal concentration of force across the joint. The aggressiveness with which joint injuries set in could explain why the symptoms and clinical manifestations are more intensely expressed in secondary degenerative knee joint disease.

For a heterogeneous group of patients with KOA (diagnosis of primary and secondary knee OA, different environment of origin, normal weight/overweight and obese patients who have or have not performed demanding professional activity requiring lower body and with different degrees of culture) the results may be mediocre. Using subgroups of patient some parameters can become very important for the evolution of the osteoarthritis, prevention of disabilities and for the improving the quality of the patients life.

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