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Comparative Analysis of Diagnostic Methods of Femoroacetabular Impingement Syndrome: Systematic Review

Mamadou Aliou Barry[1], Eduardo Pérez-Campos[2], Luis Manuel Sánchez Navarro[3], Laura Pérez Campos Mayoral[4], Souadou Diallo[5], Julia Hernández Jerónimo[6], Socorro Pina Canseco[7]

[1] (PhD) in Medical Sciences, Scientific Researcher, Cubamex Clinic Research and Postgraduate Degree from the faculty of medicine and surgery Autonomous University Benito Juarez of Oaxaca México.
[2] (PhD) in Biomedical Sciences, Scientific Researcher, Postgraduate from Tecnológico Nacional de México / IT de Oaxaca and the faculty of medicine and surgery Autonomous University Benito Juarez of Oaxaca, 68020, Mexico.
[3] Doctor Specialist in Dermatology Sciences, Autonomous University Benito Juarez of Oaxaca., the postgraduate degree from the faculty of medicine and surgery, Ex Hacienda of Aguilera S / N, Calzada San Felipe in Agua, 68020.
[4] PhD in Biomedical Sciences, Autonomous University Benito Juarez of Oaxaca., the postgraduate degree from the faculty of medicine and surgery Ex Hacienda of Aguilera S / N, Calzada San Felipe in Agua,68020.
[5] Doctor in General Medicine and Surgery, Institution**:** Anahuac University of Oaxaca, School of medicine and surgery.
[6] PhD in Medical Sciences, Autonomous University Benito Juarez of Oaxaca., the postgraduate degree from the faculty of medicine and surgery, Ex Hacienda of Aguilera S / N, Calzada San Felipe in Agua,68020.
[7] PhD in Biomedical Sciences, Institution**:** Autonomous University Benito Juarez of Oaxaca., from the postgraduate degree, the faculty of medicine and surgery Ex Hacienda of Aguilera , San Felipe in Agua, 68020.

ABSTRACT

Background*: femoroacetabular impingement syndrome is a degenerative pathology that is diagnosed using different methods which allow us to reduce pain and regain functional capacity.*

Objective*: to compare the diagnostic methods in the femoroacetabular impingement syndrome.*

Methods*: to carry out this research they were consulted the following databases available on the internet: PubMed, Science Direct, SciELO, and Springer Link. With the extraction of studies obtained via the Internet using the different descriptors in health science and medical subject heading. For this selection, articles published between the 2010-2020 period in English, Spanish and French were taken into account. Only 3 randomized and 2 controlled studies were included.*

Results: *a total of 5 studies were selected with a total of 223 patients who met the selection criteria for this systematic review.*

Limitation: *studies dealing with impingement of other joints in the human body except hip and animal species.*

Conclusion: *arthroscopy has greater sensitivity, which is why it is considered a very effective method for the diagnosis of femoroacetabular impingement.*

Key words*: Femoroacetabular Impingement, Diagnosis, Pain and Disability*

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I. INTRODUCTION

Hip osteoarthritis is a very common pathology that generally affects people over 40 years of age with a prevalence of 2-4% of this population, regardless of sex, which can cause groin pain and lead to gait disability. (Conrozier, 2010) (1). One of the most common factors for the development of hip osteoarthritis also called coxarthrosis is femoroacetabular impingement. The latter mainly affects young people between 20 and 40 years of age and its prevalence is estimated at 10 to 15%. (Mardones et al, 2010; García F et al. 2015) (2). That means that at least 1 out of every 100 young people suffers from femoroacetabular impingement syndrome. However, there is still no concrete data on its incidence worldwide. Knowledge about this syndrome was very scarce, until in 1990 Ganz described it as a consequence of the poorly consolidated fracture of the neck of the femur in retrotorsion. However, recent studies, conducted by Ghaffari et al. (2018) (3), show that femoroacetabular impingement is due to a bone pathomorphology in the hip that alters normal biomechanics, causing accelerated joint degeneration and characteristic patterns of chondral and labral lesions. Egger et al. (2016) (4) mention that femoroacetabular impingement is produced by abnormal morphology, which subsequently causes repetitive contact between the proximal part of the femur and the acetabulum, leading to a femoroacetabular mismatch, thus causing labral and chondral lesions. A similar study shows that femoroacetabular impingement causes a decrease in mechanical function and progression to early osteoarthritis. (Menge and Truex, 2018) (5). In this way, this syndrome directly affects mechanical function. There are various diagnostic methods for this disease, among which we have radiology, ultrasound, and resonance. The latter is considered the most accurate and reliable so its usefulness is enormous.

II. MATERIALS AND METHODS

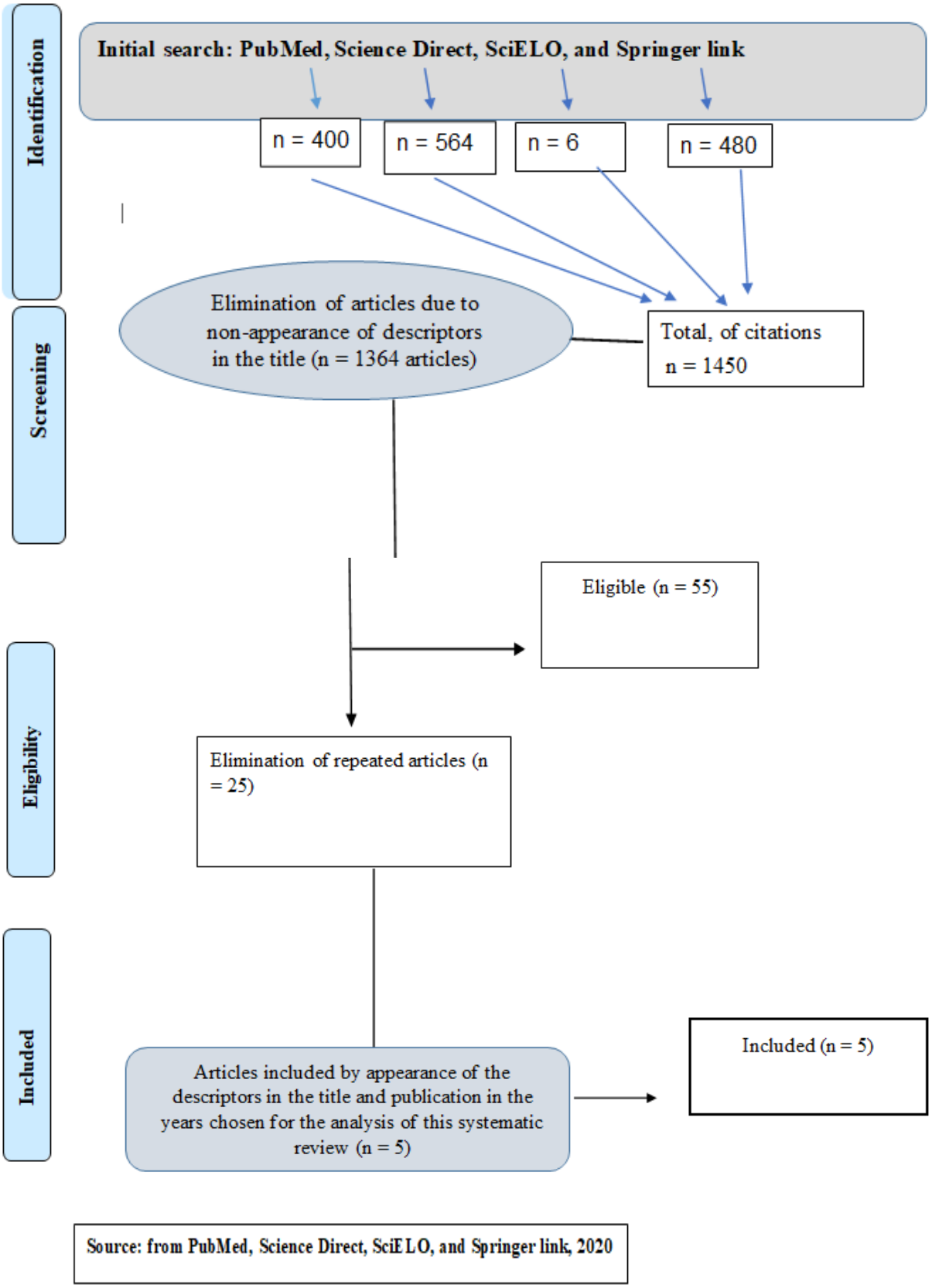
The objective of this systematic review is to compare the diagnostic methods of femoroacetabular impingement syndrome. For this, an investigation was carried out in the following databases: PubMed, ScienceDirect, SciELO and SpringerLink, with the extraction of studies obtained via the Internet using the different descriptors in health science (6) and medical subject heading (7). For the selection of the information, articles published between the 2010-2020 period in English, Spanish and French were taken into account.

INCLUSION CRITERIA :3 randomized and 2 controlled articles were selected. Only articles dealing with femoroacetabular impingement and hip osteoarthritis were considered.

EXCLUSION CRITERIA: non-randomized and uncontrolled articles were not selected. Articles written in languages other than English, French and Spanish were not selected. Articles dealing with impingement of other joints in the human body except the hip. In addition, the articles that deals with the animal species.

FINAL SELECTION: a total of 1450 articles were found in the initial search, 1350 were eliminated by exclusion criteria; however, 55 articles were considered eligible, only 5 articles were selected with a total of 223 subjects studied for the present systematic review. No article was rejected for methodological reasons. See the diagram below:

DIAGRAM OF CONSULTED ARTICLES OF INTREST



Source: from PubMed, Science Direct, SciELO, and Springer link, 2020

TABLE OF RESULTS:

5 Studies	Characteristics of the intervention	Data demographic of pacients			Result		
Hortúa, I., Nossa, JM, Forero Melo, JF, & Pérez Hidalgo, JM (2010)	descriptive retrospective study magnetic resonance arthrography Physical examination Randomized	Number and Sex 32	18 Men 14 women	Age 53 9	Period of study ±18 months	Outcome measures Inguinal Pain Disability	Evaluation -Crush test -WOMAC	Final scores sign of the IC at 90%. The subtype PINCER 46.6% the MIXED 39.3%
Camacho-Alvarez, D., & Mardones-Peterman, R. (2013)	Randomized and controlled -Prospective study of 16 patients (17 hips) -Arthroscopy	17	Men and Woman	16 56	to 6 months	Inguinal Pain Disability	WOMAC	In 16 hips (94%) after resecting the acetabular overlay,
Vidal-Ruiz, CA, Barajas-Olivos, AG, & Castañeda-Leeder, P. (2013) .	Retrospective review Radiographic method Randomized	61	55 Men and 6Women	0 15	to	Hip pain . Disability	-	7 hips in group A (10.3%), 37 in group B (54.4%) and 24 in group C (35.3%) P.35 61 patients, 54 with 7 bilateral, giving a total of 68 hips
Kivlan BR, Martin RL, Sekiya JK. (2011)	Arthroscopy Randomized		54 Woman and 18 Men 29.9 ± 10.4	16 55	to			($F_{3, 67}$ = 1.96, P = .128, partial η^2 = .081) ($F_{2, 68}$ = 0.008, P = .992, partial η^2 = .000) ($F_{3, 67}$ = 3.03, P <.05, partial η^2 = .128).
Rodríguez, AC, de Lucas Villarrubia, JC, Ledesma, MP, Santos, IM, & Padrón, M. (2015)	MR arthrography Controlled	51	25 Men 19 Women	43 9	6 ±months	Pain Disability		labral rupture were 94.5% and 100%, 100% and 87.5% chondrolabral junction injury, articular cartilage injury 92.5 and 54.5%.

Source: from PubMed, Science Direct, SciELO, and Springer link,2020

III. RESULTS AND DISCUSSION

In this study, three fundamental characteristics were considered: study, intervention and results. The characteristics deal with the subjects, age, duration, type of study, objective, method, methodology, then outcome measures, instruments, and scores.

In the study carried out by Hortúa I et al. (2010) (8) entitled "Femoroacetabular impingement syndrome: clinical manifestations and findings by arthroresonance", the femoroacetabular impingement syndrome was diagnosed by arthroresonance, in which 32 patients of early age were subjected for a period of 18 months (January 2008- June 2009). The study was retrospective and descriptive. The findings were that the α angle and the femoral version of the hip were the most relevant signs with sensitivity data of 90% for groin pain, in which the clamp test was positive. With the use of this diagnostic method, the sensitivity never exceeded the value of 50% for functional disability. Nevertheless,

In comparison with the study by Camacho Álvarez D et al. (2013) (9) entitled "Femoroacetabular impingement: Association between the over coverage and acetabular cartilage delamination areas". Arthroscopy was used as a diagnostic method to diagnose femoroacetabular impingement in which the sensitivity was 94%, therefore this value indicates very good precision. While the specificity was 6% which represents one patient of the 17 studies. In Hortúa's work, unlike Camacho, MRI was used as a diagnostic method for femoroacetabular impingement. Both studies showed groin pain and functional disability as results. The sensitivity was only 94%, therefore, greater sensitivity in the diagnosis compared to the study carried out by Vidal et al, which used radiology with a sensitivity of 10.3% in the group of subjects A, of 54.4 % in group B and 35.3% in group C. The sensitivity of these diagnostic results is considered low. In both studies, the WOMAC was used as an evaluation method (measuring instrument for pain, stiffness, physical function and activities associated with the hip and knee, in patients with OA) for the evolution of pain and disability, however Hortúa In addition to the WOMAC, I take the clamping test for evaluation. The results obtained were effective in an average of 55% of the patients in the study carried out by Hortúa regarding the treatment of groin pain and less than 50% in functional disability, while in the study by Camacho, a 94% improvement was obtained where a resection of the acetabular overcoating is performed, eliminating the delaminated area leaving the cartilage stable and only 6% required minifractures to treat the exposed subchondral bone after resecting the acetabular overcovering and delaminated cartilage. Both the results obtained by Hortúa and Camacho suggest one of these techniques as a diagnostic method for femoroacetabular impingement syndrome.

Vidal Ruiz C. (2013) (10) carried out a retrospective study, in which 68 patients aged 0-15 years participated. In order to determine if there is a correlation between the initial classification of the lateral abutment and the fomoroactibular impingement. The results obtained were classified into three groups: Group A with 7 patients, group B with 37 and group C with 24. 3 from group A had radiological results of cam-type femoroacetabular impingement (Cam), 3 with a pinzer type and one of a mixed type. In group B, the radiological data found were 17 patients with cam-type clamping, 12 with clamping-type clamping, and 10 with mixed type. In group C, 23 patients were diagnosed with cam-type clamping, 15 with clamping-type and 15 mixed.

Kivlan BR et al. (2011) (11), presented a clinical case, in which 72 subjects were submitted, of which 54 women and 18 men with an average age of 29.9 ± 10.4 years, and an age range between 16-55 years. The study aimed at a comparison of the percentage of disability relief by injection of these subjects

The diagnostic method used for this clinical case was arthroscopy, which made it possible to diagnose femoroacetabular impingement where two types were found: labral and chondral. Three separate analyzes were performed using the covariance technique to compare the percentage of relief after injection between the groups. The findings were classified into three types: surgical, labral pathology, and chondral pathology.

In Vidal Ruiz's study, compared to Kivlan's, the radiographic method was implemented while in Kivlan's, arthroscopy was used. This last method was previously used by Camacho Álvarez. The results were significant in both studies.

Referring to the diagnosis of femoroacetabular impingement syndrome, various methods are applied for its diagnosis. For this, magnetic resonance imaging, radiology, ultrasound and arthroscopy are mentioned.

Rodríguez et al. (2015) (12) compared to the previous authors demonstrated the effectiveness and efficacy of the use of MRI as a reliable and cost-effective method to diagnose the signs and symptoms for femoroacetabular impingement syndrome. The sensitivity in this study carried out by Rodríguez with an MRI method was 94.5% in labral rupture, 100% in chondrolabral and 92.5% in articular cartilage. These data indicate a very high sensitivity with a good resolution of the images obtained from the diagnosis of the femoral acetabular impingement syndrome. However, this effectiveness shows that the use of magnetic resonance for the diagnosis of this pathology is more effective and reliable compared to other methods such as Radiology, Arthroscopy and Arthroresonance. With these data obtained in the aforementioned studies, it is demonstrated that the sensitivity of arthroresonance exceeds that of arthroscopy; therefore, the diagnosis by magnetic resonance has greater precision than radiology in the diagnosis of said pathology. And on the other hand, magnetic resonance imaging shows greater effectiveness than arthroresonance and arthroscopy, therefore, the use of this method is recommended in the diagnosis of this disease.

According to the methodological quality of the different studies carried out for this work, most of the sectioned articles present some methodological defects. Some are more complete when compared against each other. In the study carried out by Kivlan et al) in the clinical case, the name of the type of injection used to carry out the study in these patients was not identified.

According to the implications for conducting clinical practice, is recommended for an evaluation of the different findings as complete as possible, and that some variables are considered pain and functional disability. The findings of this work facilitate the planning of some scientific research for the future in the health field. In fact, it is extremely important to consider the methodological quality of the articles that we can review considering the selection of the sample because it has to be representative. In addition, variables should be considered as a control and intervention group to be able to compare the efficacy of the diagnosis or treatment.

Kivlan et al. and Camacho et al. implemented arthroscopy as a diagnostic method for this pathology, while Rodiguez et al. and Hortúa et al. chose arthroresonance. In both studies the results were statistically significant.

Vidal et al. compared with the others; they used radiography where the results obtained varied in a low confidence interval, which is why this method is considered an inappropriate method due to its level of certainty for the diagnosis of femoraoactabular impingement syndrome.

IV. FINAL COMMENTS

Femoroacetabular impingement syndrome is one of the degenerative diseases that affects the hip. This pathology causes pain and loss of joint functional capacity. Recent publications have shown an increased risk for patients with this pathology. One of its most effective and reliable method of diagnosis is MRI-guided arthroscopy

V. CONCLUSIONS

In this systematic review, MRI-guided arthroscopy has greater sensitivity, which is why it is considered a very effective method for the diagnosis of femoroacetabular impingement.

Comparisons of the methods used in the selected articles indicate that radiography has the lowest sensitivity with 54%, followed by arthroresonance with 90%, and finally arthroscopy guided by magnetic resonance imaging with 94% and arthroscopic magnetic resonance with 94.5% However, this last method has a higher probability of confidence and certainty to diagnose fomoroactibular syndrome.

VI. PERSPECTIVES

Further investigation is required about different diagnostic methods for femoroacetabular impingement syndrome.

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