Original article

Preoperative serum albumin as a predictor of complications following total hip replacement in patients with rheumatoid arthritis

Haro-Gómez HL,* Merida-Herrera E,* Torres-Fernández BJ,* Pérez-Hernández E,* Torres-González R,* Pérez-Atanasio JM*

UMAE «Dr. Victorio de la Fuente Narváez», IMSS

ABSTRACT. *Background:* **Rheumatoid arthritis is a chronic inflammatory disease characterized by polyarthritis with progressive articular wear, immunologic abnormalities and increasing physical limitation. Surgical correction with hip replacement comes as a successful solution for patients with advanced articular destruction. Following intervention, surgical site infection (SSI), venous thromboembolism, sepsis, renal and major cardiovascular complications are among the most cited in the literature. No consensus exists as to the detection of preoperative hypoalbuminemia in patients with rheumatoid arthritis.** *Methods:* **This study retrospectively evaluated the preoperative serum albumin of 75 patients with rheumatoid arthritis and analyzed its relevance in terms of appearance of postoperative complications with a six-month follow-up. Complications in the group of patients with low serum albumin and the group of patients with normal serum albumin were reviewed to identify the effect of each variable. Odds ratio for each variable was calculated (hospital readmission, surgical site infection, renal and cardiac complications, non-infectious wound complications and the presence of residual hip pain), as well as p-value and confidence intervals.** *Results:* **Surgical site infection showed a statistically significant relation with low serum albumin (OR: 6.125, p =**

RESUMEN. *Introducción:* **La artritis reumatoide es una enfermedad inflamatoria crónica con desgaste articular progresivo, anomalías inmunológicas y aumento de la limitación física. La corrección quirúrgica con el reemplazo de la cadera es una solución a la destrucción articular avanzada. Después de la intervención, la infección del sitio quirúrgico (SSI), el tromboembolismo venoso, la sepsis y las complicaciones cardiovasculares o renales se encuentran entre las más citadas en la literatura. No existe consenso en cuanto a la detección de hipoalbuminemia preoperatoria en pacientes con artritis reumatoide.** *Métodos:* **Estudio retrospectivo evaluando la albúmina de suero preoperatoria de 75 pacientes con artritis reumatoide, se analizó su importancia en términos de complicaciones postoperatorias en los primeros seis meses de seguimiento. Las complicaciones en el grupo de pacientes con albúmina de suero baja y el grupo de pacientes con albúmina de suero normal fueron repasadas para identificar el efecto de cada variable. Se calculó el odds ratio para cada variable (reingreso hospitalario, infección del sitio quirúrgico, complicaciones renales y cardíacas, complicaciones no infecciosas de la herida y presencia de dolor de cadera residual), así como el valor p y los intervalos de confianza.** *Resultados:* **La infección del sitio quirúrgico demostró una relación estadís-**

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* Trauma and Orthopaedic Surgery Hospitals. UMAE «Dr. Victorio de la Fuente Narváez», Mexico City.

Corresponding author:
Pérez-Atanasio, JM
Av. Colector 15 s/n Esq.
Av. Instituto Politécnico Nacional,
Col. Magdalena de las Salinas,
Deleg. Gustavo A Madero. P.C. 07760, CDMX.
Phone: +01 (52) 55 57-47-35-00 ext. 25583,
E-mail: jose.perezata@imss.gob.mx

Abbreviations:
RA = Rheumatoid arthritis.
DMARDs = Disease-modifying antirheumatic drugs.
BMI = Body mass index.
PEM = Protein energy malnutrition.
SSI = Surgical site infection.
VTE = Venous thromboembolism

0.018) as did non-infectious wound complications (OR: 3.714, p = 0.026) and residual hip pain (OR: 3.149, p = 0.022). *Conclusion:* Preoperative low serum albumin has a direct relation with the rate of postoperative complications including SSI, non-infectious wound complications (seroma formation, wound dehiscence) and residual hip pain. Preoperative serum albumin is a reliable marker of nutrition, which may establish preventive strategies to reduce postoperative complications in patients with rheumatoid arthritis.

Key words: Arthroplasty, rheumatoid arthritis, serum albumin, surgical site infection.

tica significativa con la albúmina de suero baja (o: 6.125, p = 0.018) al igual que complicaciones no infecciosas de la herida (o: 3.714, p = 0.026) y dolor residual de la cadera (o: 3.149, p = 0.022). *Conclusión:* La albúmina sérica baja preoperatoria tiene una relación directa con la tasa de complicaciones postoperatorias: infección, formación de seromas, dehiscencia de la herida y dolor residual.

Palabras clave: Artroplastía, artritis reumatoide, albúmina sérica, sitio de infección quirúrgica.

Introduction

Rheumatoid arthritis (RA) is a chronic inflammatory disease characterized by polyarthritis with progressive articular wear, immunologic abnormalities and increasing physical limitation.[1] It is considered an incurable disease of unknown origin, treatment is available but there is currently no existing cure.[2] RA affects females with a 3:1 ratio[3] and is a highly prevalent disease afflicting 1.6% of the Mexican population.[4,5] This high prevalence leads to an elevated economical burden for the public health system, and truly impacts the quality of life of patients. A study shows that the average cost of rheumatoid arthritis in Mexico is $2,330 U.S. dollars, with approximately 15% of a household income solely spent on disease related expenses.[6]

Hip replacement is considered a surgical option for patients with end-stage articular destruction, secondary to arthrosis and RA.[7] Today, surgical correction with joint replacement comes as a successful solution for patients with advanced articular destruction.[8] The goal in such patients is achieving a mobile joint, with a pain-free range of motion and mechanical stability.[9]

Current advances in the treatment of RA with disease-modifying antirheumatic drugs (DMARDs) have delayed and even reduced the need for surgical procedures like hip replacement in patients with RA worldwide.[10] Countries like Mexico do not share this favorable panorama since diagnosis and treatment take place late in the general population.[4,11]

Risk factors and their relation with post-op surgical complications in hip replacement have been recently studied in the general population.[12] An increased body mass index (BMI), the preoperative use of corticosteroids and low serum albumin, independently heighten the risk of hospital readmission following hip replacement surgery in the general population.[12] Patients with RA have not been studied in this respect. RA combined with other comorbidities

(i.e. hypertension, diabetes mellitus) lead to the use of DMARD, which in turn produce complications.[3,4,13] Costs of postoperative complications are high, SSI being among the most expensive.[14] In a study, the average cost of hospital readmission after hip replacement was $17,103 USD.[15]

Preoperative tests have the purpose of identifying and assessing the control of diseases in the population subject to a surgical procedure. The screening nature of these tests aid the clinician in the management of subclinical diseases such as protein energy malnutrition (PEM).[16,17] Low serum albumin levels, as defined by level below 3.5 g/dl, are considered a marker of protein depletion and thus PEM.[18,19] Hypoalbuminemia is present in the general population in those above sixty years old, in undernourished patients, in patients using corticosteroids and in patients with chronic diseases.[20]

This study aims to asses whether preoperative serum albumin is correlated with the appearance of complications following total hip replacement in patients with rheumatoid arthritis.

Methods

We conducted a case-control study with local ethics committee approval number R-2015-3401-7 at our institution. Electronic and print patient files that underwent hip replacement from June 2012 to July 2014 were reviewed.

A total of 1,490 hip replacement surgeries were reviewed in the above time frame, identifying 125 surgeries pertaining patients with RA. Out of the 125 patients, 75 had preoperative serum albumin level and a mean follow-up of at least six months. Two groups where created, the first consisted of patients with hypoalbuminemia (n = 31) and the second consisted of patients without hypoalbuminemia (n = 44), as defined previously.

All surgical candidates at our institution require a series of preoperative tests following institutional

guidelines. Patients with RA require additional liver function tests, including serum albumin levels and acute phase reactants (i.e. C-reactive protein, erythrocyte sedimentation rate) when admitted to our hospital. Preoperative tests are handled in our local lab using standardized reference values (COBAS INTEGRA 400 PLUS, Roche Diagnostics Ltd, Switzerland) and stored electronically.

Hip replacement surgeries were performed by high-volume arthroplasty surgeons in the Joint Replacement Department at our institution. The preferred surgical approach was the direct lateral, as described by Hardinge.[21] Surgeries included were cemented and cementless, in respect to femoral and acetabular components. Institutional and federal guidelines were followed in terms of choice and administration of prophylactic antibiotics, mechanical and pharmacological antithrombotic therapies. Regional anesthesia took place unless contraindicated, as performed by the anesthesiology department at our institution.

Statistical analysis of complications in group A and group B were performed to identify the effect of each variable. Using SPSS software (Version 20.0; Chicago, IL, EUA) the odds ratio for each variable was calculated, as well as p-values and confidence intervals. Variables analyzed were hospital readmission, surgical site infection, renal and cardiac complications, non-infectious wound complications and the presence of residual hip pain.

Results

We retrospectively evaluated the preoperative serum albumin of 75 patients with rheumatoid arthritis. Low serum abumin as defined by level below 3.5 g/dl was present in 31 patients and normal in 44 of them. The preponderance of female patients (80.6% and 84.1%) in our study reflects the expected epidemiological distribution of rheumatoid arthritis. Patients with rheumatoid arthritis requiring hip replacement in our study were generally under fifty years old. In terms of body mass index, patients with rheumatoid arthritis showed a mean BMI distribution in the 20-29.9 bracket with a p-value of 0.01.

Demographic characteristics of our patients are summarized in *Table 1*.

SSI as defined by the Center for Disease Control SSI Criteria, showed a statistically significant relation with low serum albumin in the patient with RA (OR: 6.125, p = 0.018). Non-infectious wound complications such as seroma formation and wound dehiscence (OR: 3.714, p = 0.026) were more prevalent in the low serum albumin population. Mortality was no present in any of the groups studied.

Residual hip pain as defined by the subjective presence or absence of pain in the passive arch of movement of the extremity on follow-up evaluation was also prevalent on the low serum albumin population (OR: 3.149, p = 0.022). Other variables (i.e., hospital readmission defined as medical attention requiring hospitalization, DVT/PE, renal and cardiac complications) did not show statistical significant relation among studied groups *(Table 2)*.

Discussion

Major surgical procedures like hip replacement are not complication-free. Recent studies show an increase in the complication rate in the RA population.[22] Our study showed a definite increased risk in surgical site infections as expressed by an odds ratio of 6.125, implying patients

Table 1: Demographic analysis.			
	Low serum albumin < 3.5g/dl (n = 31)	Normal serum albumin ≥ 3.5 g/dl (n = 44)	p-value
Sex (male/female)	6 (19.4%)/ 25 (80.6%)	7 (15.9%)/ 37 (84.1%)	0.232*
Age > 50	13/31 (41.9%)	28/44 (63.6%)	0.01†
Body mass index (BMI)			
BMI < 20	3/31 (9.7%)	1/44 (2.3%)	-
BMI 20-29.9	22/31 (71%)	35/44 (79.5%)	-
BMI 30-39.9	6/31 (19.4%)	8/44 (18.2%)	-
BMI > 40	0/31 (0%)	0/44 (0%)	-

* Pearson χ^2. † sample t-test.

Table 2: Univariate analysis.			
	Low serum albumin n = 31 (%)	Normal serum albumin (n= 44) (%)	Odds Ratio (95% CI)	p-value
Hospital Readmission	7/31 (22.6)	5/44 (11.4)	2.275 (0.648-7.982)	0.192
SSI*	7/31 (22.6)	2/44 (4.5)	6.125 (1.177-31.879)	0.018
DVT/PE†	4/31 (12.9)	1/44 (2.3)	6.370 (0.676-60.051)	0.069
Renal complications	2/31 (6.5)	1/44 (2.3)	2.966 (0.257-34.236)	0.363
Cardiovascular	5/31 (16.1)	1/44 (2.3)	8.269 (0.915-74.746)	0.029
Non-infectious Wound complications	10/31 (32.3)	5/44 (11.4)	3.714 (1.122-12.30)	0.026
Residual hip pain	23/31 (74.2)	21/44 (47.7)	3.149 (1.160-8.547)	0.022

* Surgical site infections. † Deep vein thrombosis/pulmonary embolism.

with rheumatoid arthritis and hypoalbuminemia are not well suited for surgery. A 7-8% hospital readmission for primary joint replacement in the general population, is included as one of the cited complications.[23] A recent study shows that patients with RA have a 1.74 higher adjusted risk for hospital readmission.[24] In our study hospital readmission occurred twice as often in the low serum albumin subgroup.

Surgical site infection (SSI), venous thromboembolism (VTE), sepsis, renal and major cardiovascular complications are among the most cited complications in literature.[14,25] The link between chronic inflammatory disease such as RA and VTE has been recently studied.[26] The state of hypercoagulability is induced by chronic inflammation and cytokine production, the same that in turn produces articular destruction.[26] In our study VTE occurred in both groups and did not prove statistically significant yet trending towards significance in the low serum albumin population.

The nutritional status of adult patients with hip fractures undergoing surgery has been studied in depth.[27,28,29] There is an increase in postoperative mortality in patients with hip fracture and low serum albumin.[18,30] Patients are at risk of postoperative PEM secondary to protein depletion and the metabolic stress of the surgical fixation of fractures.[31] In our study we did not find an increased mortality in any of the groups studied. The use of preoperative serum albumin levels suggests that it is less likely for a patient with preoperative PEM to recover.[30,32] There is 2.5 greater risk of death during hospital stay in patients with hypoalbuminemia and hip fracture.[18]

The nutritional state of adult patients undergoing joint replacement surgery is a major field of investigation today.[33] A patient with an elevated BMI can in fact be undernourished, and these patients particularly present the highest risk of complications following surgery.[33,34] In our study an increased BMI did not prove a greater statistical risk of complication yet our demographic showed a mean BMI between 20-29.9. In a recent study, the incidence of PEM was 8.5% and carried a higher risk of postoperative complication (12%) compared to patients with normal serum albumin (2.9%). PEM is linked to SSI, hematoma formation, renal and cardiac complications.[33] In the RA demographic our study showed an increased risk of SSI, non-infectious wound complications and residual hip pain.

Our study's main limitation was sample size. The population selected was retrospectively reviewed with a high loss to follow-up ratio by design. Our institution does not usually follow patients beyond a three-month window. Broad confidence intervals reflect our limited sample size.

Conclusions

Preoperative low serum albumin has a direct relation with the rate of postoperative complications including SSI, non-infectious wound complications (seroma formation, wound dehiscence) and residual hip pain. Thus, preoperative serum albumin is a reliable marker of nutrition, it is cost-effective and its routine use in the population with RA may establish preventive strategies to reduce postoperative complications in said demographic.

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