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COMPARISON OF RADIOGRAPHIC AND ULTRASONOGRAPHIC FEATURES OF PAINFUL SHOULDER IN RHEUMATOID ARTHRITIS IN RELATION TO PAINFUL SHOULDER OF NON-INFLAMMATORY CAUSE

USPOREDBA RADIOGRAFSKIH I ULTRASONOGRAFSKIH OBILJEŽJA BOLNOG RAMENA U REUMATOIDNOM ARTRITISU U ODNOSU PREMA BOLNOM RAMENU NEUPALNOG UZROKA

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Abstract

Painful shoulder is an important public health problem present in various population groups, both the young as well as the elderly. Patients with rheumatoid arthritis (RA) and patients with non-inflammatory painful shoulder are two representative groups. The aim of this study was to estimate the differences in morphological parameters between the two patient groups and a possible predomination of one over the other. In 40 patients with RA both shoulders, and in 80 patients with non-inflammatory painful shoulders one shoulder, were radiographically and sonographically examined and the morphological parameters were compared. The patients with RA had a greater diameter of the biceps tendon sheath and the capsule-bone distance. More patients with RA had effusion of the biceps tendon sheath, subacromial-subdeltoid bursal effusion, and diffuse osteopenia. There were no differences between the groups in parameters usually associated with painful shoulder of non-inflammatory cause such as rotator cuff calcifications, supraspinatus tendon inhomogeneity, rotator cuff partial and total thickness tears, glenohumeral and acromioclavicular osteoarthrosis, large tuberculum sclerosis, and subacromial osteophytes. Patients with RA were then divided in two groups, the first involving patients with biceps tendon sheath effusion and subacromial-subdeltoid bursal effusion, and the second comprising patients without those symptoms. There was no significant difference among the parameters of painful shoulder in the second group and the parameters of non-inflammatory painful shoulder. Despite a significant difference in some parameters between the groups, the RA patients showed many parameters associated with non-inflammatory painful shoulder. They are obviously not "protected" against other intrinsic and extrinsic factors affect-

ing the shoulder; thus the cause of painful shoulder in the group of patients with RA may be multifactorial. Therefore, morphological analysis of the shoulder is required to evaluate the therapy after clinical estimates. A different combination of morphological shoulder parameters implies an individualized approach to the therapy.

Keywords: Arthritis, rheumatoid – complications, diagnostic imaging; Shoulder pain – diagnostic imaging, etiology; Shoulder joint – diagnostic imaging, pathology; Tendinopathy – etiology; Bursa, synovial – pathology; Inflammation – etiology; Ultrasonography; Radiography

Sažetak

Bolno rame važan je javnozdravstveni problem, koji se javlja u populacijskim skupinama različite dobi. Bolesnici s reumatoidnim artritisom (RA) skupina su s upalnom etiologijom bolnog ramena u odnosu prema bolesnicima s bolnim ramenom neupalne etiologije. Ciljevi istraživanja bili su utvrditi razliku u morfološkim parametrima između tih dviju skupina bolesnika i utvrditi eventualnu predominaciju nekih od praćenih parametara. Radiografski i ultrazvučno pregledana su oba ramena u 40-ero bolesnika s RA (bilateralna bol ramena) i po jedno rame u 80-ero bolesnika s bolnim ramenom neupalnog uzroka (unilateralna bol ramena). Bolesnici s RA imali su veći promjer ovojnice tetive duge glave bicepsa i veću distanciju kapsula – kost. Utvrđeno je da je više bolesnika s RA imalo izljev u ovojnici tetive duge glave bicepsa, izljev u subakromijskoj-subdeltoidnoj burzi i difuznu osteopeniju u odnosu prema drugoj skupini. Nije bilo razlike između skupina s obzirom na parametre koji su najčešće vezani za klinički entitet bolnog ramena neupalne etiologije kao što su kalcifikacije rotatorne manšete, inhomogenost tetive supraspinatusa, parcijalne i totalne rupture rotatorne manšete, osteoartritis akromioklavikularnog i humeroskapularnog zgloba, sklerozacije velikog tuberkula glave nadlakatne kosti te subakromijski osteofiti. Nakon utvrđivanja razlika između skupina bolesnici s RA podijeljeni su u dvije podskupine: onu s izljevom i onu bez izljeva u ovojnici tetive duge glave bicepsa i u subakromijskoj-subdeltoidnoj burzi, a kako bi se i oni usporedili s bolesnicima čija je bol u ramenu bila neupalne etiologije. Nije bilo znatne razlike među parametrima bolnog ramena između druge skupine i parametara bolnog ramena neupalne etiologije. Unatoč znatnoj razlici u nekim parametrima između dviju skupina bolesnici s RA imaju mnogo parametara povezanih s bolnim ramenom neupalnog uzroka. Oni, očigledno, nisu bili „zaštićeni" od ostalih promjena ramenoga zgloba, tako da uzrok bolnog ramena kod njih može biti multifaktorski. Za procjenu učinka i odabir terapije, a poslije i kliničku prosudbu, potrebna je morfološka analiza ramena. Različita kombinacija morfoloških parametara ramena implicira individualan pristup terapiji.

Ključne riječi: Reumatoidni artritis – dijagnostički slikovni prikaz, komplikacije; Bolno rame – dijagnostički slikovni prikaz, etiologija; Rameni zglob – dijagnostički slikovni prikaz, patologija; Tendinopatija – etiologija; Sinovijalna burza – patologija; Upala – etiologija; Ultrazvučno snimanje; Radiografija

INTRODUCTION

Approximately 90% of all rheumatoid arthritis (RA) patients have painful shoulder symptoms (1). The painful shoulder was found to be affected by inflammatory changes in the first two years of the disease in about 50% of patients, and in 83% of patients in 14 years of the disease (2).

Chronic inflammation in RA affects the articular synovial membrane and spreads to other articulated structures, such as bursae, tendons, and tendon sheaths. When examining such patients, conventional ultrasound with high-resolution probes is a reliable method for assessing all pathological changes of the above-mentioned joint structures, including the shoulder joint (3).

Proliferative synovitis therefore affects not only the humeroscapular joint, but also the other joints and bursae of the shoulder complex, especially the subacromial-subdeltoid bursa, as well as the long head of the biceps tendon (4).

Significant bone changes in the joints are expected in RA patients. However, unlike the small joints of the

UVOD

Simptome bolnog ramena ima oko 90% bolesnika koji boluju od reumatoidnog artritisa (RA) (1). Pritom je utvrđeno da je tijekom prve dvije godine bolesti rame zahvaćeno upalnim promjenama u oko 50% takvih bolesnika, a nakon 14 godina bolesti u njih 83% (2).

Kronična upala u RA zahvaća zglobnu sinovijalnu membranu i širi se u druge zglobne strukture kao što su burze, tetive i tetivne ovojnice. Pri pregledu takvih bolesnika konvencionalni ultrazvuk s visokorezolucijskim sondama pouzdana je metoda za procjenu svih patoloških promjena navedenih zglobnih struktura, pa tako i u ramenom zglobu (3).

Proliferativni sinovitis pritom zahvaća ne samo humeroskapularni zglob nego i ostale zglobove i burze ramenog kompleksa, poglavito subakromijsko-subdeltoidnu burzu, kao i ovojnicu tetive duge glave bicepsa (4).

U bolesnika s RA očekuju se znatne koštane promjene na zglobovima, ali za razliku od malih zglobova šaka i stopala, periartikularne promjene ramena utječu

hands and feet, periarticular shoulder changes affect the joint function much earlier than the bone structure (5, 6, 7). As a result, classical radiography reveals only late changes in advanced cases of the disease (8).

In contrast, diagnostic ultrasound can detect early changes in the soft tissues of the shoulder, subacromial-subdeltoid bursal effusion (9, 10), as well as effusion of the long head of the biceps tendon sheath (11), changes in the humeroscapular joint (12), and erosion of the humeral head (13, 14).

Painful shoulder which occurs due to a non-inflammatory etiology is often referred to as periarthritis humeroscapularis (PHS) in everyday practice. This diagnosis should be avoided, because it covers a large number of different clinical entities, which are all treated differently (15).

Therefore, we use the term painful shoulder of non-inflammatory cause, which means that it occurs without an underlying systemic inflammatory condition reported by patients that can be clinically determined. The cause of 60% cases of painful shoulder is subacromial impingement syndrome with consequential subacromial bursitis or supraspinatus muscle tendinitis. According to the research, 12% of these cases show adhesive capsulitis, 10% present with partial or complete rupture of the rotator cuff, 7% manifest with acromioclavicular joint osteoarthritis, 5% of cases are tendinitis of the long head of the biceps muscle, and 7% of cases are the result of some other causes (15).

Some of these causes occur on their own, and some occur in various combinations (16). Consequently, many morphological parameters occur together in both RA patients as well as in patients with non-inflammatory painful shoulder.

The purpose of this research was to investigate and possibly confirm the existence of a significant difference between the morphological parameters of painful shoulder in RA patients as compared to patients with painful shoulder of non-inflammatory etiology by using numerous radiographic and ultrasonographic diagnostic parameters.

MATERIALS AND METHODS

Description of the research

A cross-sectional study was conducted on patients diagnosed with RA presenting with a painful shoulder and patients with a painful shoulder of non-inflammatory etiology.

A conventional radiogram and ultrasound of both shoulders were performed in the RA patients, whereas in the patients with a non-inflammatory etiology the diagnostic procedures were done unilaterally, only on the painful shoulder. Additionally, the obtained parameters were analyzed and the findings of patients

na zglobnu funkciju prije nego koštane promjene (5 – 7). Klasična radiografija zbog toga otkriva tek kasne promjene u uznapredovalim slučajevima bolesti (8).

Za razliku od toga, dijagnostički ultrazvuk može otkriti vrlo rane promjene mekih tkiva ramena – i izljeve u subakromijskoj-subdeltoidnoj burzi (9, 10) i u ovojnici tetive duge glave bicepsa (11), promjene humeroskapularnog zgloba (12) te koštane erozije glave humerusa (13, 14).

Bolno rame koje nastaje zbog neupalne etiologije često se u svakodnevnoj praksi naziva humeroskapularni periartritis (PHS), što je dijagnoza koju valja izbjegavati jer se pod tim imenom skriva velik broj različitih kliničkih entiteta, koji se različito tretiraju (15).

Stoga u svojem radu rabimo izraz bolno rame neupalnog uzroka, što znači da je ono bilo dokazano bez sustavne upalne podloge tegoba koje bolesnici javljaju, a mi klinički utvrđujemo. U 60% slučajeva takvoga bolnog ramena uzrok je subakromijski sindrom sraza s posljedičnim subakromijskim burzitisom ili tendinitisom supraspinatusa. Prema provedenim istraživanjima, u 12% bolesnika radi se o adhezivnom kapsulitisu, u 10% o parcijalnoj ili potpunoj rupturi rotatorne manšete, u njih 7% o osteoartritisu akromioklavikularnog zgloba, u 5% o tendinitisu duge glave bicepsa, a u 7% bolesnika o „nekim drugim uzrocima“ (15).

Neki se od tih uzroka javljaju samostalno, a neki u različitim kombinacijama (16). Mnogi se morfološki parametri pritom javljaju zajedno – i kod bolnog ramena bolesnika s RA i u bolesnika s bolnim ramenom neupalnog uzroka.

Ciljevi ovog istraživanja bili su istraživanje i potvrđivanje postojanja znatne razlike između morfoloških parametara bolnog ramena bolesnika s RA i u onih s bolnim ramenom neupalnog uzroka, primjenjući pritom brojne radiografske i ultrasonografske dijagnostičke parametre.

ISPITANICI I METODE

Opis istraživanja

Provedena je presječna studija u bolesnika koji boluju od RA i imaju bolno rame te u onih što imaju bolno rame neupalne etiologije. U bolesnika s RA analiziran je konvencionalni radiogram i obavljen ultrazvučni pregled obaju ramena, a kod bolesnika s neupalnom etiologijom dijagnostika je obavljena jednostrano, samo na bolnom ramenu.

Nakon toga analizirali smo dobivene parametre te usporedili parametre bolesnika s bolnim ramenom u RA i parametre bolesnika s bolnim ramenom neupalne etiologije.

Ispitanici

Ultrazvučni pregled 160 ramena proveo je iskusan radiolog i ultrasoničar, koji u dijagnostici muskuloske-

with painful shoulder in rheumatoid arthritis were compared with the parameters of patients with painful shoulder of non-inflammatory etiology.

Respondents

An ultrasound examination of 160 shoulders was performed by an experienced ultrasound radiologist who had been working in the musculoskeletal system diagnostics field for more than 20 years. The diagnostic devices used were a Shimadzu SDU 1200 (Kyoto, Japan) with a 10-MHz linear probe, a Toshiba Nemio (Tokyo, Japan) with a linear probe of 11 and 14 Mhz, and Logic 8 (General Electrics) with an 8-Mhz linear probe.

Clinical examinations were carried out in 40 RA patients, examining both shoulders (bilateral painful shoulder in 28 women and 12 men, mean age 59.4 ± 11.9 years, average disease duration 4.3 years). In the same way, 80 patients with painful shoulder of non-inflammatory etiology were examined (unilateral shoulder pain in 54 women and 26 men, mean age 53.2 ± 7.2 years).

Before the examination, all patients stated that the pain had been present for more than 6 weeks, with no record of trauma.

The patients in the first group had been diagnosed with RA, supported by data on elevated CRP values and with no prior record of painful shoulder, while those in the second group had no record of possible RA.

Methods

For all 160 shoulders, the thickness of the supraspinatus tendon was measured in the transverse and longitudinal sections, in the neutral shoulder position as well as in adduction and internal rotation of the shoulder. The mean values in both cross-sections and both positions were measured.

Transverse cross-section: the upper part of the humeral head, above the intertubercular sulcus, was measured in the thickest medial part.

Longitudinal cross-section: measured in the place where the tendon emerges under the shadow of the acromion. The tendon diameter of the long head biceps muscle was measured on the upper edge of the intertubercular sulcus, in both the transverse and longitudinal cross-sections.

The humeroscapular joint effusion (capsule-bone distance), measured transaxillary, approached the part of the humerus not covered by the rotator cuff.

The presence of the subacromial bursal effusion has also been detected in the long head biceps tendon.

Data on the rotator cuff echo structure was analyzed during the examination, particularly the inhomogeneity of the supraspinatus tendon, as well as small deposits of calcium salts and the partial or complete rupture

letnog sustava radi dulje od 20 godina, rabeći pritom dijagnostičke uređaje Shimadzu SDU-1200 (Kyoto, Japan) s linearnom sondom od 10 MHz, Toshiba Nemio (Tokio, Japan) s linearnom sondom od 11 MHz i 14 MHz te Logiq 8 (General Electric, SAD) s linearnom sondom od 8 MHz.

U 40-ero bolesnika s RA pregledana su oba ramena (obostrano bolno rame u 28 žena i 12 muškaraca, srednje dobi 59,4 ± 11,9 godina, prosječnog trajanja bolesti 4,3 godine). Na isti je način pregled obavljen i kod 80-ero bolesnika s bolnim ramenom neupalne etiologije (jednostrana bol ramena, kod 54 žene i 26 muškaraca, srednje dobi 53,2 ± 7,2 godine).

Svi su bolesnici prije pregleda naveli da im boli traju dulje od 6 tjedana, bez evidencije o traumi. Bolesnici iz prve skupine imali su dokazan RA, praćen podatkom o povišenim vrijednostima CRP-a, bez prethodne evidencije o bolnom ramenu, dok su oni iz druge skupine bili bez evidencije o mogućem RA.

Metode

Kod svih 160 ramena istovjetno je mjerena debljina tetive supraspinatusa u transverzalnom i longitudinalnom presjeku, u neutralnoj poziciji ramena te pri adukciji i unutarnjoj rotaciji. Mjerene su srednje vrijednosti u oba presjeka i obje pozicije.

Transverzalni presjek: gornji dio glave humerusa, iznad intertuberkularnog žlijeba, mjerio se na najdebljem medijalnom dijelu.

Longitudinalni presjek: mjerio se na mjestu gdje tetiva izlazi ispod sjene akromiona. Promjer tetive duge glave bicepsa mjerio se na gornjem rubu intertuberkularnog žlijeba, u transverzalnom i longitudinalnom presjeku.

Izljev u humeroskapularnom zglobu (udaljenost zglobna ovojnica – kost) mjerio se transaksilarno, prilazeći dijelu humerusa koji nije pokriven rotatornom manšetom.

Registrirala se prisutnost izljeva u subakromijskoj burzi i u ovojnici tetive duge glave bicepsa.

Tijekom pregleda analizirali su se podatci o ehostrukturi rotatorne manšete, poglavito o inhomogenosti tetive supraspinatusa, malenim depozitima kalcijevih soli te o djelomičnoj ili potpunoj rupturi rotatorne manšete. Tetiva supraspinatusa definira se kao homogena ako je očuvana regularna fibrilarna struktura i ako je granica prema subdeltoidnoj burzi jasno očuvana. Tetiva se definira kao inhomogena ako je njezina fibrilarna struktura narušena bez jasne granice prema subdeltoidnoj burzi.

Analizirao se konvencionalni radiogram ramena, osobito s obzirom na prisutnost kalcifikacija tetiva i burza, cističnih formacija i uzura kosti te generalizirane osteopenije. Bilježili su se osteoartritis akromioklavikularnog i humeroskapularnog zgloba, sklerozacija

of the rotator cuff. The supraspinatus tendon is defined as homogeneous if the regular fibrillar structure is preserved along with the border towards the subdeltoid bursa. A tendon is defined as inhomogeneous if the fibrillar structure of the tendon is disturbed without a clear border to the subdeltoid bursa.

Conventional radiography of the shoulder was mainly analyzed on the presence of calcifications in the tendons and bursae, cystic formations, bone sulci, and generalized osteopenia. Osteoarthritis of the acromioclavicular and humeroscapular joints, greater tubercle sclerosis, and subacromial osteophytes were noted.

Statistical data analysis

A T-test for independent samples was used to determine statistically significant differences between numerical parameters. The correlation between category variables was determined by the χ^2 test.

The calculation of the sample size was carried out using an online program available on http://www.stat.ubc.ca/~rollin/stats/ssize/n2.html to calculate the number of respondents. The distance from the articulated sheath to the bone was taken as the main measure of the outcome. Preliminary measurements gave us a value of 3.1 mm in the painful shoulder of inflammatory cause group, and a value of 2.5 mm in the non-inflammatory painful shoulder group. The standard deviation was about 0.5 mm. With a significance level of 0.05 and a statistical power of 0.8, the sample size was calculated to be 11 participants for each group of independent data sets. The Statistica 6 software package (StatSoft Inc, Tulsa, USA) was used.

RESULTS

Paraarticular sulci were found on 24 shoulders in 12 RA patients, whilst in the group of patients with non-inflammatory painful shoulders only one sulcus was found in one patient's shoulder.

Our study showed that there was no significant difference in the supraspinatus tendon thickness and long head biceps tendon in RA patients compared to the patients with a painful shoulder of non-inflammatory etiology.

The joint capsule-bone distance (an indicator of the intra-articular synovial fluid amount) was significantly higher in RA patients than in the group of patients with a painful shoulder of non-inflammatory etiology (Table 1).

Considerably more RA patients had a long head biceps tendon effusion ($\chi^2 = 16.78$; $P < 0.01$) as well as subdeltoid bursal effusion (($\chi^2 = 33.63$; $P < 0.01$) (Table 2).

There was no significant difference between the two groups of patients considering diffuse osteopenia ($\chi^2 = 2.66$; $P = 0.10$), rotator cuff calcification ($\chi^2 = 1.51$; $P =$

Table 1. Comparison of metric parameters of painful shoulder in patients with RA and patients with non-inflammatory painful shoulder. Results obtained by ultrasound

Tablica 1. Usporedba metričkih parametara bolnog ramena u bolesnika s RA i u onih s bolnim ramenom neupalne etiologije, dobivenih ultrazvučnim pregledom

Analyzed parameter / Analizirani parametar	Patients with painful shoulder; findings (x ± SD) / Nalazi (x ± SD) u pacijenata s bolnim ramenom		*P**
	RA (n = 80)	Non-inflammatory etiology / Neupalna etiologija (n = 80)	
Supraspinatus muscle tendon thickness (left) (mm) / Debljina tetive supraspinatusa (lijevo) (mm)	6,56 ± 1,11	6,3 ± 1,08	0,409
Supraspinatus muscle tendon thickness (right) (mm) / Debljina tetive supraspinatusa (desno) (mm)	6,51 ± 1,3	6,5 ± 0,96	0,98
Long head of the biceps muscle tendon (left) (mm) / Debljina tetive duge glave bicepsa (lijevo) (mm)	4,96 ± 0,74	4,64 ± 0,7	0,127
Long head of the biceps muscle tendon (right) (mm) / Debljina tetive duge glave bicepsa (desno) (mm)	4,93 ± 0,09	4,85 ± 0,97	0,16
Joint capsule-bone distance (left) (mm) / Udaljenost zglobna ovojnica – kost (lijevo) (mm)	3,12 ± 0,53	2,48 ± 0,55	< 0,001
Joint capsule-bone distance (right) (mm) / Udaljenost zglobna ovojnica – kost (desno) (mm)	3,3 ± 0,6	2,68 ± 0,56	< 0,001

**t-test*

velikog tuberkula nadlakatne kosti te subakromijski osteofiti.

Statistička raščlamba podataka

Za utvrđivanje statistički značajne razlike među numeričkim parametrima upotrijebljen je t-test za nezavisne uzorke. Korelacija između kategorijskih varijabla utvrđena je χ^2-testom.

Izračun veličine uzorka proveli smo s pomoću mrežnog programa za izračun broja ispitanika koji je dostu-

Table 2. Comparison of categorical parameters of painful shoulder in patients with RA and patients with non-inflammatory painful shoulder. Results obtained by ultrasound and radiography

Tablica 2. Usporedba kategorijskih parametara bolnog ramena u bolesnika s RA i u onih s neupalnim uzrokom prema rezultatima dobivenim ultrazvukom i radiografijom

Analyzed parameter / Analizirani parametar	Diagnostic method / Dijagnostička metoda	Number (%) of shoulders with positive findings / Broj (%) ramena s pozitivnim nalazom		χ^2	*P*
		RA (n = 80)	Non-inflammatory etiology / Neupalna etiologija (n = 80)		
Long head of biceps muscle sheath effusion / Izljev u ovojnici duge glave bicepsa	Ultrasound / Ultrazvuk	42/80 (52,5)	17/80 (21,2)	16,78	< 0,01
Subdeltoid bursal effusion / Izljev u subdeltoidnoj burzi	Ultrasound / Ultrazvuk	42/80 (52,5)	8/80 (10,0)	33,63	< 0,01
Diffuse osteopenia / Difuzna osteopenija	Radiography / Radiografija	25/80 (31,5)	16/80 (20,0)	2,66	0,10
Rotator cuff calcifications / Kalcifikacije rotatorne manšete	Radiography / Radiografija	6/80 (7,5)	11/80 (13,7)	1,51	0,22
Supraspinatus muscle tendon inhomogeneity / Inhomogenost tetive supraspinatusa	Ultrasound / Ultrazvuk	23/80 (28,5)	28/80 (35,0)	0,72	0,39
Partial rupture of the rotator cuff / Djelomična ruptura rotatorne manšete	Ultrasound / Ultrazvuk	21/80 (26,2)	24/80 (30,0)	0,28	0,59
Complete rupture of the rotator cuff / Potpuna ruptura rotatorne manšete	Ultrasound / Ultrazvuk	9/80 (11,2)	12/80 (15,0)	0,49	0,48
Greater tuberous sclerosis / Sklerozacija velikog tuberkula	Radiography / Radiografija	50/80 (62,5)	52/80 (65,0)	0,11	0,74
Subacromial osteophytes / Subakromijski osteofiti	Radiography / Radiografija	44/80 (55,0)	59/80 (73,7)	6,13	0,05
Acromioclavicular joint ostheoarthritis / Osteoartritis akromioklavikularnog zgloba	Radiography / Radiografija	26/80 (32,5)	30/80 (37,5)	0,44	0,51
Humeroscapular joint ostheoarthritis / Osteoartitis humeroskapularnog zgloba	Radiography / Radiografija	15/80 (18,5)	16/80 (20,0)	0,04	0,84

0.22), supraspinatus muscle tendon inhomogeneity ($\chi^2 = 0.72$; $P = 0.39$), partial rupture of the rotator cuff ($\chi^2 = 0.28$; $P = 0.59$), complete rupture of the rotator cuff ($\chi^2 = 0.49$; $P = 0.48$), sclerotic lesion of the greater tubercle of the humerus ($\chi^2 = 0.11$; $P = 0.75$), acromioclavicular joint osteoarthritis ($\chi^2 = 0.44$; $P = 0.51$), and humeroscapular joint osteoarthritis ($\chi^2 = 0.04$; $P = 0.84$) (Table 2).

In a significantly higher number of patients with non-inflammatory shoulder pain subacromial osteophytes were found compared to the RA patients (Table 2).

The RA shoulders were later divided into two groups:
- the first group with subdeltoid bursa and long head biceps tendon sheath effusion, which always appeared in conjunction, and
- the second group without an effusion.

There were notably fewer shoulders with subacromial osteophytes ($\chi^2 = 23.11$; $P < 0.01$) and acromioclavicular joint osteoarthritis ($\chi^2 = 4.37$; $P < 0.05$) in the first group compared to the painful shoulder of the non-inflammatory cause group (Table 3).

pan na: http://www.stat.ubc.ca/~rollin/stats/ssize/n2.html. Kao glavnu mjeru ishoda uzeli smo udaljenost od zglobne ovojnice do kosti; preliminarna mjerenja dala su nam vrijednosti od 3,1 mm u skupini s bolnim ramenom upalnog uzroka i od 2,5 mm u skupini s bolnim ramenom neupalnog uzroka, dok je standardna devijacija bila oko 0,5 mm. S razinom značajnosti od 0,05 i snagom studije od 0,8 program je za ustroj studije od dvije skupine nezavisnih podataka dao veličinu svake skupine od 11 ispitanika. Upotrijebljen je softverski paket Statistica 6 (StatSoft Inc, Tulsa, SAD).

REZULTATI

Paraartikularne uzure nađene su u 24 ramena kod 12-ero bolesnika s RA, dok su u skupini bolesnika s bolnim ramenom neupalnog uzroka nađene samo u jednom ramenu, kod jednog bolesnika. Naše je istraživanje pokazalo da nema znatne razlike u debljini tetive supraspinatusa i tetive duge glave bicepsa u bolesnika s RA u odnosu prema bolesnicima s bolnim ramenom neupalne etiologije. Udaljenost zglobna kapsula – kost (in-

Table 3. Comparison of categorical parameters of painful shoulder in patients with RA with subdeltoid bursal effusion and biceps tendon sheath effusion versus parameters of patients with non-inflammatory painful shoulder. Results obtained by ultrasound and radiography

Tablica 3. Usporedba kategorijskih parametara bolnog ramena u bolesnika s RA s izljevom u subdeltoidnoj burzi i u ovojnici tetive duge glave bicepsa i parametara bolesnika s bolnim ramenom neupalne etiologije prema rezultatima dobivenim ultrazvukom i radiografijom

Analyzed parameter / Analizirani parametar	Diagnostic method / Dijagnostička metoda	Number (%) of shoulders with positive findings / Broj (%) ramena s pozitivnim nalazom		χ^2	P
		RA with effusion / RA s izljevom (n = 42)	Non-inflammatory etiology / S neupalnom etiologijom (n = 80)		
Diffuse osteopenia / Difuzna osteopenija	Radiography / Radiografija	14/42 (33,3)	16/80 (20,0)	1,55	0,21
Rotator cuff calcifications / Kalcifikacije rotatorne manšete	Radiography / Radiografija	4/42 (9,5)	11/80 (13,7)	0,36	0,55
Supraspinatus muscle tendon inhomogeneity / Inhomogenost tetive supraspinatusa	Ultrasound / Ultrazvuk	6/42 (14,3)	28/80 (35,0)	3,51	0,06
Partial rupture of the rotator cuff / Djelomična ruptura rotatorne manšete	Ultrasound / Ultrazvuk	8/42 (19,1)	24/80 (30,0)	1,71	0,19
Complete rupture of the rotator cuff / Potpuna ruptura rotatorne manšete	Ultrasound / Ultrazvuk	4/42 (9,5)	12/80 (15,0)	0,73	0,39
Greater tuberous sclerosis / Sklerozacija velikog tuberkula	Radiography / Radiografija	20/42 (47,6)	52/80 (65,0)	3,44	0,06
Subacromial osteophytes / Subakromijski osteofiti	Radiography / Radiografija	12/42 (28,6)	59/80 (73,7)	23,11	< 0,01
Acromioclavicular joint ostheoarthritis / Osteoartritis akromioklavikularnog zgloba	Radiography / Radiografija	8/42 (19,1)	30/80 (37,5)	4,37	< 0,05
Humeroscapular joint ostheoarthritis / Osteoartitis humeroskapularnog zgloba	Radiography / Radiografija	8/42 (19,1)	16/80 (20,0)	0,02	0,89

There was no significant difference between morphological parameters in the RA patients from the second group compared to the patients with non-inflammatory painful shoulder (Table 4).

DISCUSSION

The results of our study, in which we compared ultrasound and radiographic parameters of patients with painful shoulder in rheumatoid arthritis and patients with painful shoulder of non-inflammatory etiology, showed that there was a significant morphological difference between these two groups.

Moreover, our study has shown that the capsule-bone distance (an indicator of the intra-articular synovial fluid amount) was significantly higher in RA patients in comparison to the group of patients with non-inflammatory etiology of the painful shoulder.

In particular, more RA patients had an effusion of the long head biceps tendon sheath and a subdeltoid bursal effusion.

In a significantly higher number of patients with painful shoulder of non-inflammatory etiology subacromial osteophytes were found, in contrast to RA patients.

dikator količine intraartikularne sinovijalne tekućine) bila je bitno veća u bolesnika s RA nego u skupini bolesnika s bolnim ramenom neupalne etiologije (tablica 1.). Znatno više bolesnika s RA imalo je izljeve u ovojnici tetive duge glave bicepsa ($\chi^2 = 16,78$; $P < 0,01$) i u subdeltoidnoj burzi ($\chi^2 = 33,63$; $P < 0,01$) (tablica 2.).

Nije bilo bitne razlike između skupina bolesnika s obzirom na difuznu osteopeniju ($\chi^2 = 2,66$; $P = 0,10$), kalcifikacije rotatorne manšete ($\chi^2 = 1,51$; $P = 0,22$), inhomogenost tetive supraspinatusa ($\chi^2 = 0,72$; $P = 0,39$), djelomičnu rupturu rotatorne manšete ($\chi^2 = 0,28$; $P = 0,59$), potpunu rupturu rotatorne manšete ($\chi^2 = 0,49$; $P = 0,48$), kao ni s obzirom na sklerozaciju velikog tuberkula humerusa ($\chi^2 = 0,11$; $P = 0,75$), osteoartritis akromioklavikularnog zgloba ($\chi^2 = 0,44$; $P = 0,51$) i humeroskapularnog zgloba ($\chi^2 = 0,04$; $P = 0,84$) (tablica 2.).

U bolesnika s bolnim ramenom neupalnog uzroka nađen je znatno veći broj subakromijskih osteofita nego u bolesnika s RA (tablica 2.).

Ramena bolesnika s RA podijeljena su poslije u dvije skupine:

- prva skupina s izljevima u subdeltoidnoj burzi i u ovojnici tetive duge glave bicepsa, koji se uvijek javljaju u kombinaciji
- druga skupina bez izljeva.

Table 4. Comparison of categorical parameters of painful shoulder in patients with RA without subdeltoid bursal effusion and biceps tendon sheath effusion versus parameters of patients with non-inflammatory painful shoulder. Results obtained by ultrasound and radiography

Tablica 4. Usporedba kategorijskih parametara bolnog ramena u bolesnika s RA bez izljeva u subdeltoidnoj burzi i u ovojnici tetive duge glave bicepsa i parametara bolesnika s bolnim ramenom neupalne etiologije prema rezultatima dobivenim ultrazvukom i radiografijom

Analyzed parameter / Analizirani parametar	Diagnostic method / Dijagnostička metoda	Number (%) of shoulders with positive findings / Broj (%) ramena s pozitivnim nalazom		χ^2	*P*
		RA without effusion / RA bez izljeva (n = 38)	Non-inflammatory etiology / Neupalna etiologija (n = 80)		
Diffuse osteopenia / Difuzna osteopenija	Radiography / Radiografija	11/38 (28,9)	16/80 (20,0)	1,17	0,28
Rotator cuff calcifications / Kalcifikacije rotatorne manšete	Radiography / Radiografija	2/38 (5,3)	11/80 (13,8)	1,89	0,17
Supraspinatus muscle tendon inhomogeneity / Inhomogenost tetive supraspinatusa	Ultrasound / Ultrazvuk	17/38 (44,7)	28/80 (35,0)	1,04	0,31
Partial rupture of the rotator cuff / Djelomična ruptura rotatorne manšete	Ultrasound / Ultrazvuk	13/38 (34,2)	24/80 (30,0)	0,21	0,64
Complete rupture of the rotator cuff / Potpuna ruptura rotatorne manšete	Ultrasound / Ultrazvuk	5/38 (13,2)	12/80 (15,0)	0,07	0,79
Greater tuberous sclerosis / Sklerozacija velikog tuberkula	Radiography / Radiografija	30/38 (78,9)	52/80 (65,0)	2,36	0,12
Subacromial osteophytes / Subakromijski osteofiti	Radiography / Radiografija	32/38 (84,2)	59/80 (73,8)	1,59	0,21
Acromioclavicular joint osteoarthritis / Osteoartritis akromioklavikularnog zgloba	Radiography / Radiografija	18/38 (47,4)	30/80 (37,5)	1,04	0,31
Humeroscapular joint ostheoarthritis / Osteoartitis humeroskapularnog zgloba	Radiography / Radiografija	7/38 (18,4)	16/80 (20,0)	0,04	0,84

In a survey conducted in 2010, researchers Milutinović and Zlatković-Švenda showed by using ultrasound that RA patients are more likely to be associated with subdeltoid bursal and long biceps tendon sheath effusions, a bigger capsule-bone distance, cartilage reduction, and humerus head erosion in comparison to patients with a non-inflammatory etiology of painful shoulder (17). These results are similar to the results of our study, as expected.

It is known that chronic and progressive inflammatory diseases of the joint such as RA affect the synovial membrane and extend to extra-articular components (bursae, tendons, and tendon sheaths), causing damage to the joint cartilage (3, 18).

The non-inflammatory painful shoulder symptoms most often originate from a subacromial bursa irritation in subacromial impingement syndrome, as well as from calcium salt deposits in calcifying tendinitis.

According to the available data, in RA patients it can be expected to find a greater diameter of the supraspinatus muscle tendon, as well as the long head biceps tendon, and a bigger capsule-bone distance (which represents a higher amount of intra-articular synovial fluid). However, our study only found a greater cap-

U prvoj je skupini bilo znatno manje ramena sa subakromijskim osteofitima ($\chi^2 = 23,11$; $P < 0,01$) i osteoartritisom akromioklavikularnog zgloba ($\chi^2 = 4,37$; $P < 0,05$) nego u skupini bolnih ramena neupalnog uzroka (tablica 3.).

Nije bilo bitne razlike između morfoloških parametara u bolesnika s RA iz druge skupine i onih s bolnim ramenom neupalne etiologije (tablica 4.).

RASPRAVA

Rezultati našeg istraživanja, u kojem smo uspoređivali ultrazvučne i radiografske parametre bolnih ramena u bolesnika s RA i onih s bolnim ramenima neupalne etiologije, pokazali su da postoje znatne morfološke razlike između bolnih ramena upalne i neupalne etiologije. Naše je istraživanje pokazalo da je udaljenost zglobna kapsula – kost (indikator količine intraartikularne sinovijalne tekućine) znatno veća u bolesnika s RA nego u skupini bolesnika s bolnim ramenom neupalne etiologije. Bitno više bolesnika s RA imalo je izljev u ovojnici tetive duge glave bicepsa i izljev u subdeltoidnoj burzi. Subakromijske osteofite imao je znatno veći broj bolesnika s bolnim ramenom neupalnog uzroka u odnosu prema bolesnicima s RA.

sule-bone distance in RA patients, whilst the supraspinatus muscle tendon thickness and the long head biceps tendon thickness showed no statistically significant differences between the patient groups. The explanation of that result may be the shorter duration of the inflammatory rheumatic disease and the fact that the supraspinatus muscle and long head biceps tendon thickening is already recorded in the first stage of subacromial impingement syndrome, especially in younger patients (19–22). This fact diminishes the value of metric parameters in distinguishing changes in RA patients from those with painful shoulder of non-inflammatory etiology.

The long head biceps tendon and subdeltoid bursal effusions, as a common finding in RA patients, predominated in that group as expected. According to the experience and available literature, effusion can be also found in patients with a non-inflammatory etiology of the painful shoulder, especially in subacromial impingement syndrome, with consequential long biceps tendon bursitis and tendinitis, which may be found in asymptomatic patients as well. In cases of massive rupture of the rotator cuff, a passive effusion from the articulated area into the bursa can be detected (15, 21, 23, 24).

Diffuse osteopenia of the shoulder bones was found in both the RA patients and patients with non-inflammatory shoulder pain, with no statistically significant difference. An inflammatory component and access to earlier local corticosteroid administration, as well as the lack of movement in the painful shoulders, can be an explanation.

Other parameters associated with painful shoulder of non-inflammatory etiology, such as calcifications, partial and complete ruptures of the rotator cuff, inhomogeneity of the supraspinatus tendon, humeroscapular and acromioclavicular joint osteoarthritis, sclerosis of the greater tuberosity of the humerus, and the presence of subacromial osteophytes, surprisingly showed no statistically significant difference between the two groups. Even the number of RA shoulders with soft tissue calcifications was higher in comparison with the other group (25, 26).

Inhomogeneity of the supraspinatus tendon with an abnormal fibrillar structure and without a clear border towards the subdeltoid bursa can be also found in subacromial impingement syndrome (16, 27).

Although partial and complete rupture of the rotator cuff are strongly associated with subacromial impingement syndrome in elderly patients (28, 29), they can be found in advanced RA as well. Painful shoulder of non-inflammatory etiology is strongly associated with acromioclavicular osteoarthritis, large tuberous sclerosis, and the presence of subacromial osteophytes (30).

U istraživanju koje su 2010. g. provele Milutinović i Zlatković-Švenda pokazano je da ultrazvučnom dijagnostikom u bolesnika s bolnim ramenom u RA znatno češće nalazimo izljev u subdeltoidnoj burzi i ovojnici tetive duge glave bicepsa, veću udaljenost zglobna kapsula – kost, smanjenje hrskavice i erozije glave humerusa nego u bolesnika s neupalnom etiologijom bolnog ramena (17). Ovi su rezultati očekivano slični rezultatima našeg istraživanja.

Poznato je da kronična i progresivna upalna zglobna bolest kao što je RA zahvaća sinovijalnu membranu i širi se na izvanzglobne komponente (burze, tetive i tetivne ovojnice) te u zglobu oštećuje zglobnu hrskavicu (3, 18). Tegobe u bolnom ramenu neupalne etiologije potječu najčešće od iritacije subakromijske burze pri subakromijskom sindromu sraza te od prisutnih depozita kalcijevih soli u kalcificirajućem tendinitisu. Prema dostupnim podatcima očekivalo bi se da se kod bolesnika s RA zabilježe veći promjer tetive supraspinatusa i tetive duge glave bicepsa te veća udaljenost zglobna ovojnica – kost (koja znači veću količinu intraartikularne sinovijalne tekućine). Međutim, tijekom našeg istraživanja u bolesnika s RA našli smo samo veću udaljenost zglobna ovojnica – kost, dok debljine tetive supraspinatusa i tetive duge glave bicepsa nisu pokazale statistički značajne razlike među skupinama naših bolesnika. To možemo objasniti kraćim trajanjem upalne reumatske bolesti, kao i činjenicom da se zadebljanje tetive supraspinatusa i tetive duge glave bicepsa bilježi već u prvoj fazi subakromijskog sindroma sraza, poglavito među mlađim bolesnicima (19 – 22). Ta činjenica smanjuje vrijednost navedenih metričkih parametara pri razlikovanju promjena u bolesnika s RA i kod onih s bolnim ramenom neupalnog uzroka.

Izljev u ovojnici tetive duge glave bicepsa i subdeltoidnoj burzi, kao čest nalaz u bolesnika s RA, očekivano je dominirao u toj skupini bolesnika. Prema iskustvu i dostupnoj literaturi, on se može naći i u bolesnika s bolnim ramenom neupalne etiologije, osobito u onih sa subakromijskim sindromom sraza i posljedičnim burzitisom i tendinitisom tetive duge glave bicepsa, ali i u asimptomatskih bolesnika. U slučajevima masivne rupture rotatorne manšete nalazi se pasivni izljev u burzu iz zglobnog prostora (15, 21, 23, 24). Difuzna osteopenija kostiju ramena nađena je i u bolesnika s RA i u onih s bolnim ramenom neupalnog uzroka, bez statistički značajne razlike. Objašnjenje su upalna komponenta i moguća prijašnja lokalna administracija kortikosteroida, kao i manjak kretanja bolnih ramena. Ostali parametri povezani s bolnim ramenom neupalne etiologije (kalcifikacije rotatorne manšete i inhomogenost tetive supraspinatusa, djelomične i potpune rupture rotatorne manšete, osteoartritis humeroskapularnog i akromioklavikularnog zgloba, sklerozacija velikog tuberkula te subakromijski osteofiti) iznena-

The RA patient shoulders were divided into two groups in the second phase of the survey. The first group was associated with subdeltoid bursa and long biceps tendon sheath effusions in conjunction, whilst the second group had no such affiliation.

Comparing the shoulders of both the RA and non-inflammatory groups, a statistically significantly higher number of shoulders with acromioclavicular joint osteoarthritis and subacromial osteophytes were observed in the non-inflammatory painful shoulder group.

A comparison of the shoulders of the second group with RA and the non-inflammatory painful shoulders showed no statistically significant difference between the parameters. The multifactorial characteristic of the painful shoulder in RA is additionally emphasized by this fact.

CONCLUSION

RA patients are not protected from the usual harmful effects, especially in the older population, and therefore the etiology of painful shoulder in the stated group can be multifactorial. Due to that fact, painful shoulder treatment should be modified and adapted to each patient individually, based on radiological (X-ray and ultrasound) diagnostics. The significance of the results obtained by this study emphasizes the importance of a constant analysis of the morphological shoulder parameters after a clinical assessment in determining the prognosis and therapy of patients with a painful shoulder.

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đujuće i neočekivano nisu pokazali statistički značajnu razliku među skupinama naših bolesnika. Čak je broj ramena s kalcifikacijama mekih česti bio veći u skupini bolesnika s RA (25, 26). Inhomogenost tetive supraspinatusa s poremećajem normalne fibrilarne strukture, bez jasne granice prema subdeltoidnoj burzi, može se naći i pri subakromijskom sindromu sraza (16, 27). Djelomične i potpune rupture rotatorne manšete veoma su povezane sa subakromijskim sindromom sraza u starijih bolesnika (28, 29), ali se mogu naći i u uznapredovalom RA. Bolno rame neupalne etiologije često je povezano s prisutnošću osteoartritisa akromioklavikularnog zgloba, sklerozacijom velikog tuberkula i sa subakromijskim osteofitima (30).

Ramena bolesnika s RA podijeljena su u drugoj fazi istraživanja u dvije skupine: u prvoj su skupini bila ramena s izljevima u subdeltoidnoj burzi i ovojnici tetive duge glave bicepsa, koji se javljaju uvijek u kombinaciji, dok je druga skupina ramena bila bez izljeva.

Usporedimo li ramena iz prve skupine bolesnika s RA s onima iz skupine bolesnika s bolnim ramenom neupalnog uzroka, vidimo da je statistički značajno veći broj ramena s osteoartritisom akromioklavikularnog zgloba i subakromijskim osteofitima nađen u skupini bolesnika s bolnim ramenom neupalnog uzroka. Ako, pak, usporedimo ramena iz druge skupine bolesnika s RA s onima iz skupine bolesnika s bolnim ramenom neupalne etiologije, vidimo da nema statistički značajne razlike među parametrima. To dodatno ističe multifaktornost bolnog ramena kod RA.

ZAKLJUČAK

Bolesnici s RA nisu „zaštićeni" ni od drugih, uobičajenih noksa koje pogađaju posebno starije ljude, tako da uzrok bolnog ramena kod njih može biti multifaktorski. Terapija bolnog ramena trebala bi, stoga, biti modificirana prema svakomu pojedinom bolesniku i individualno prilagođena, uz prethodno napravljenu radiološku (RDG i UZ) dijagnostiku. Rezultati dobiveni ovom studijom ističu važnost analize morfoloških parametara ramena poslije kliničke prosudbe, a radi određivanja prognoze i terapije u bolesnika s bolnim ramenom.

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