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Original Article

Septic arthritis of the shoulder and elbow: one decade of epidemiological analysis at a tertiary referral hospital☆

*Jorge Henrique Assunção**, *Guilherme Guelfi Noffs*, *Eduardo Angeli Malavolta*, *Mauro Emilio Conforto Gracitelli*, *Ana Lucia Munhoz Lima*, *Arnaldo Amado Ferreira Neto*

Instituto de Ortopedia e Traumatologia, Faculdade de Medicina, Universidade de São Paulo, São Paulo, SP, Brazil

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ABSTRACT

Objective: To describe the clinical and epidemiological characteristics of patients with septic arthritis of the shoulder or elbow and to evaluate prognostic factors for complications during treatment.

Methods: A retrospective case series was studied with patients treated between 2004 and 2014. The patients' clinical and epidemiological characteristics were collected. The clinical and orthopedic complications were identified and possible prognostic factors were evaluated.

Results: Twenty-seven patients were analyzed, 17 with septic arthritis of the shoulder and ten of the elbow. Median age was 46 years (IQR, 24.5; 61). Previous joint disease was observed in nine patients (33%). At least one clinical comorbidity was observed in 23 patients (85%). *Staphylococcus aureus* was identified in 14 cases (52%). Fourteen patients (52%) had at least one clinical complication and five patients died (19%). Nine patients (33%) had some type of orthopedic complication. The time between onset of symptoms and surgical treatment was longer in patients with orthopedic complications ($p = 0.020$). Regarding the development of clinical complications, leukocytosis on hospital admission time ($p = 0.021$) and the presence of clinical morbidities ($p = 0.041$) were predictive factors.

Conclusions: Septic arthritis of the shoulder and elbow primarily affects individuals who are immunocompromised and/or have clinical comorbidities. *S. aureus* is the most common pathogen in Brazil. Leukocytosis at hospital admission and the presence of clinical comorbidities are factors associated with the presence of clinical complications. Longer time between onset of symptoms and surgical treatment was correlated with orthopedic complications.

☆ Study conducted at Grupo de Ombro e Cotovelo, Instituto de Ortopedia e Traumatologia, Hospital das Clínicas, Faculdade de Medicina, Universidade de São Paulo, São Paulo, SP, Brazil.

* *Corresponding author*.
E-mail: drjorgeassuncao@gmail.com (J.H. Assunção).

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Artrite séptica do ombro e do cotovelo: análise epidemiológica de uma década em um hospital terciário

Palavras-chave:
Ombro
Cotovelo
Infecção
Artrite infecciosa
Epidemiologia

RESUMO

Objetivo: Descrever as características clínicas e epidemiológicas de pacientes com artrite séptica do ombro ou cotovelo e buscar fatores prognósticos para complicações durante o tratamento.

Métodos: Foi feita uma série de casos retrospectiva com pacientes atendidos entre 2004 e 2014. As características clínicas e epidemiológicas dos pacientes foram coletadas. As complicações clínicas e ortopédicas foram identificadas e possíveis fatores prognósticos foram avaliados.

Resultados: O estudo avaliou 27 pacientes, 17 com pioartrite no ombro e dez no cotovelo. A mediana da idade foi de 46 anos (IIQ 24,5; 61). Doença articular prévia foi observada em nove pacientes (33%). Uma ou mais comorbidades clínicas foram identificadas em 23 pacientes (85%). *Staphylococcus aureus* foi isolado em 14 casos (52%). Quatorze pacientes (52%) tiveram pelo menos uma complicação clínica e cinco pacientes foram a óbito (19%). Nove pacientes (33%) tiveram alguma complicação ortopédica. O tempo entre o início dos sintomas e o tratamento cirúrgico foi maior nos pacientes com complicações ortopédicas (p = 0,020). Em relação ao desenvolvimento de complicações clínicas, leucocitose na admissão hospitalar (p = 0,021) e presença de comorbidades clínicas (p = 0,041) foram fatores preditivos.

Conclusões: A pioartrite do ombro e cotovelo acomete preferencialmente indivíduos com comorbidades clínicas e/ou imunocomprometidos. O *Staphylococcus aureus* é o patógeno mais frequente no Brasil. Leucocitose na admissão hospitalar e a presença de comorbidades clínicas são fatores associados à presença de complicações clínicas. Maior tempo entre o início dos sintomas e o tratamento cirúrgico foi correlacionado a complicações ortopédicas.

Introduction

Septic arthritis is an orthopedic disease with an incidence of 12 cases per 100,000 inhabitants per year.[1] Among patients with septic arthritis, 8% to 21% present shoulder involvement,[1–3] while in 6 to 9% the elbow is involved.[1–3] Severe complications can occur, such as osteomyelitis[2] and joint stiffness;[4] the mortality rate may reach 11.5%.[2]

Few articles exclusively analyzed septic arthritis of the shoulder[5–10] or the elbow.[4,11] References to these joints can also be found in some series that assessed septic arthritis of all joints[1,2] or of the upper limb.[12] In addition, few studies have evaluated the prognostic factors for unsatisfactory results or complications.[2,3,13]

This study is aimed at describing the clinical and epidemiological characteristics of a series of patients treated at a tertiary hospital with the diagnosis of shoulder or elbow septic arthritis over a ten-year period. As a secondary objective, the study addresses clinical and epidemiological characteristics correlated with the onset of clinical or orthopedic complications during the treatment of these patients.

Methods

This was a series of retrospective cases, consisting of patients with shoulder or elbow septic arthritis who underwent surgical treatment. The patients were treated between February 2004 and January 2014. This study was approved by the Research Ethics Committee under No. 13.646.

Patients with a diagnosis of shoulder and/or elbow septic arthritis treated at this institution were included. All patients who had undergone shoulder or elbow surgery were excluded, thus excluding those who presented postoperative infections.

Septic arthritis was defined by the criteria established by Newman.[14] The cases met at least one of the following criteria:

- positive synovial fluid culture;
- positive blood culture with negative synovial fluid culture;
- negative cultures from previous use of antibiotics, but purulent synovial fluid in the joint drainage of the shoulder or elbow.

The following variables were collected: gender; age; cause of infection (hematogenic, contiguity, or inoculation); origin of the patient, to characterize the infection as community or hospital-acquired[15]; leukocyte count (leukocytosis was defined as serum leukocyte count greater than 11,000); serum C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR) on hospital admission; Gram-staining; synovial fluid culture; antibiogram; number of surgical drainages; comorbidities; presence of immunosuppression; time elapsed between symptom onset and surgical drainage; previous joint disease; empirical antibiotic therapy; systemic and orthopedic complications; and length of hospital stay.

Statistical analysis

Continuous variables were assessed for normality through the Kolmogorov-Smirnov test and for homogeneity through the Levene test. Continuous variables were presented as means and standard deviation. Median and interquartile range (IQR) were also calculated if the distribution was non-parametric. Categorical variables were presented as absolute values and percentages.

The possible factors correlated with clinical and orthopedic complications were assessed. For the categorical variables, regarding the different variables, the correlation was made using the chi-squared or Fisher's exact tests. For continuous variables, the non-paired Student's *t*-test was used if the data distribution was parametric, or the Mann–Whitney test, if this distribution was not parametric.

The SPSS program (SPSS Science Inc., Chicago, Illinois) version 20.0 was used for statistical analysis, and the significance level was set at 5%.

Results

Twenty-seven patients were analyzed, 17 with shoulder septic arthritis and 10 with elbow septic arthritis. Fifteen patients were female (56%). The median age was 46 years (IQR 24.5; 61). Fig. 1 presents the distribution of patients in the different age groups.

Among the assessed patients, 21 (77%) had a hematogenic infection, one (4%) after a shoulder infiltration procedure (direct inoculation), and five (19%) had infections caused by soft tissue infection around the shoulder and elbow joint (contiguity).

Fever (body temperature above 37.8 °C) was observed in 19 patients (70%) at the time of hospital admission. Regarding laboratory tests, 15 cases (56%) had leukocytosis, defined as a leukocyte count greater than 11,000, and all patients had elevated CRP and ESR. The Gram-staining of the synovial fluid was positive for bacteria in only 12 cases (44%); however, 24 patients (89%) presented positive intraoperative cultures for some type of microorganism (Table 1).

Previous joint disease was observed in nine patients (33%). At least one clinical comorbidity was found in 23 cases (85%). Eighteen patients (67%) were immunocompromised; chronic

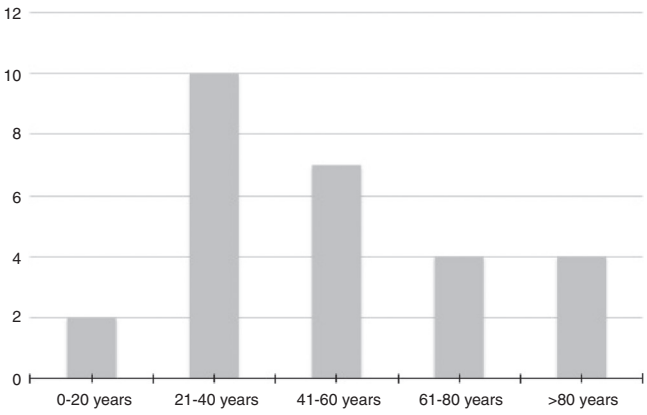

Fig. 1 – Sample distribution per age group.

Table 1 – Clinical and epidemiological characteristics of the sample.

Joint	
Shoulder	17 (63%)
Elbow	10 (37%)
Gender	
Female	15 (56%)
Male	12 (44%)
Age (years)	45.63 ± 22.60[a] 46 (IQR, 24.5–61)[b]
Etiology	
Hematogenic	21 (77%)
Contiguity	5 (19%)
Direct inoculation	1 (4%)
Origin of the patient	
Community	18 (67%)
Hospital	9 (33%)
Diagnosis	
Fever	19 (70%)
Pain	27 (100%)
Leukocytosis	15 (56%)
Elevated C-reactive protein and ESR	27 (100%)
Gram staining	12 (44%)
Positive synovial fluid culture	24 (89%)
Interval for surgical treatment (days)	11.56 ± 12.36[a] 6 (IQR, 4–17)[b]
Previous joint disease	9 (33%)
Systemic lupus erythematosus	4 (14%)
Rheumatoid arthritis	2 (7%)
Osteoarthrosis	2 (7%)
Psoriatic arthritis	1 (4%)
Immunosuppression	18 (67%)
Use of corticoids or immunosuppressants	5 (18%)
Chronic kidney failure	6 (22%)
Neoplasms	2 (7%)
Acquired Immunodeficiency Syndrome	2 (7%)
Hepatic cirrhosis	2 (7%)
Sickle cell anemia	1 (4%)
Comorbidities	23 (85%)
Systemic hypertension	9 (33%)
Diabetes	4 (15%)
Clinical complications	14 (52%)
Septic shock	7 (26%)
Acute kidney failure	4 (15%)
Hepatic failure	2 (7%)
Acute myocardial infarction	1 (4%)
Acute pancreatitis	1 (4%)
Pulmonary complications	3 (11%)
Death	5 (19%)
Orthopedic complications	9 (33%)
Chronic osteomyelitis	4 (15%)
Osteochondral lesion	2 (7%)
Rigidity	4 (15%)
Surgical wound complications	1 (4%)
Osteoarthrosis	2 (7%)
Bacteria isolated	24 (89%)
S. aureus	14 (52%) MRSA: 4 MSSA: 10
S. epidermidis	2 (7%)

– Table 1 (*Continued*)

Streptococcus spp.	3 (11%)
Neisseria gonorrhoeae	2 (7%)
Salmonella spp.	1 (4%)
E. coli	1 (4%)
Pseudomonas aeruginosa	1 (4%)
Length of hospital stay	33 ± 22.28[a]
	21 (IQR, 13.5–39)[b]
Number of surgeries ≥2	8 (30%)
Change in empirical antibiotic therapy	9 (33%)

IQR, interquartile range; MRSA, methicillin-resistant *S. aureus*; MSSA, methicillin-sensitive *S. aureus*; ESR, erythrocyte sedimentation rate.

[a] Mean.

[b] Median.

renal failure in use of dialysis and chronic use of corticosteroids were the most common cause.

Staphylococcus aureus was isolated in 14 cases (52%). *Streptococcus* spp. (11%) and *Staphylococcus epidermidis* (7%) were the second and third most prevalent etiological agents. Among *S. aureus* infections, four (29%) were caused by oxacillin-resistant bacteria in the antibiogram analysis (MRSA).

All patients underwent open surgical septic arthritis drainage. The deltopectoral approach was used for all shoulder septic arthritis. In infections involving the elbow, a lateral incision was made, opening a gap between the anconeus and the extensor carpi ulnaris muscles (modified Kocher's access).[16] Eight patients (30%) required two or more surgeries. The median time between symptom onset and joint drainage was six days (IQR 4; 17).

All patients received empirical antibiotic therapy until the results of the intraoperative cultures were retrieved, followed by specific antibiotics for the bacteria identified in those cultures. Nine patients (33%) received oxacillin and gentamicin; 11 (41%) received oxacillin and ceftriaxone, and six (22%) patients who were hospitalized for over 72 h for other diseases received vancomycin and cefepime.

Fourteen patients (52%) presented at least one clinical complication, and five died (19%). Nine patients (33%) presented orthopedic complications during the follow-up period. The mean follow-up time among the surviving patients was 5.31 ± 2.14 years.

Univariate statistical analysis showed that the time between symptom onset and surgical treatment was significantly higher in patients with orthopedic complications ($p = 0.020$). This group of patients also presented a greater number of surgeries for definitive treatment of infection, 56% with two or more procedures. Only 17% of the patients without orthopedic complications underwent two or more surgeries ($p = 0.072$; Table 2).

Leukocytosis at the time of the first hospital evaluation ($p = 0.021$) and the presence of at least one comorbidity ($p = 0.041$) was correlated with the development of clinical complications (Table 3). The time of hospitalization was significantly higher in patients with clinical complications $p = 0.003$), with a median of 38 days (IQR 22.75; 50; 75).

Discussion

Septic arthritis is less common in the shoulder and elbow than in the knee or hip.[2,17] This study presents the clinical and epidemiological evaluation of 27 cases. The median age was 46 years, lower than that observed in the majority of the studies,[5,8–11] which reported a mean age of over 60 years. However, populations similar to that of the present study have already been described by other authors.[4,12] In the present sample, 67% of patients were immunosuppressed, 33% had previous joint disease, and 85% had some comorbidity. Several authors have demonstrated the association of septic arthritis with a compromised immune system,[5,11] comorbidities,[8,10,12] and previous joint disease (osteoarthrosis and rheumatoid arthritis, among others).[2,18] Leukocytosis was present in 56% of the cases, a value similar to that described by other authors, ranging from 50% to 68%.[2,10,12] In turn, fever was observed in 70% of the patients. Reports indicate a prevalence of 42% to 83%.[2,9,10,17] ESR and CRP presented alterations in all cases in the present series. These data are compatible with those described by other authors.[10,12] Duncan and Sperling,[9] despite having observed ESR alterations in most patients (78%), demonstrated that in some cases the examination may be normal.

Among the 27 patients in the present study, the synovial fluid culture was able to identify the etiologic agent in 24 (89%). Similarly, other authors have described the identification of the responsible bacteria in 82% to 95% of the cases.[1,2,5,8,9] Gram-staining positively identified the etiologic agent in 44% of cases in the study by Weston et al.[2] The main pathogen in the present series was *S. aureus*, observed in 52% of the patients. This microbial profile is consistent with the other articles, in which this pathogen is responsible for 42% to 77% of infections.[1,4–6,8,10–13,17–20] Only Duncan and Sperling[9] demonstrated a different profile, where *S. aureus* and *Streptococcus spp.* had the same prevalence, 26%. Methicillin-resistant *S. aureus* (MRSA) was identified in 15% of the present cases. This value is within the spectrum reported by other authors: 8% to 20% of the cases of shoulder or elbow septic arthritis.[5,8,12,21]

In the present study, 33% of the patients had orthopedic complications during follow-up, primarily chronic osteomyelitis (15%) and joint stiffness (15%). In the study by Moon et al.,[4] 27% of patients presented elbow stiffness after treatment of elbow septic arthritis. Gelberman et al.[19] observed that 46% of their patients with shoulder septic arthritis developed orthopedic complications. It has been observed that patients who undergo the surgical procedure later are prone to orthopedic complications. The occurrence of complications is known to be related to the delay in diagnosis and initiation of treatment,[2,19] and early treatment leads to better clinical results[6,8] and shorter hospitalization time.[6]

In 30% of the cases, two or more surgical procedures were necessary for treatment. The reoperation rate was similar to that of other studies, which reported values between 19% and 32%.[5,8,9,13,20] Jung et al.[22] recently reported a surgical reintervention rate of only 2%. These authors used negative pressure dressings after open debridement for septic arthritis of the shoulder, a seemingly promising technique for the treatment of these infections.

Table 2 – Prognostic factors for orthopedic complications.

	Orthopedic complications		*p*
	Yes	No	
Joint			
Shoulder	5 (56%)	12 (67%)	0.683
Elbow	4 (44%)	6 (33%)	
Gender			
Female	3 (33%)	9 (50%)	0.684
Male	6 (67%)	9 (50%)	
Age (years)	39 (IQR, 25–60)	46.5 (IQR, 24.25–64.75)	0.896
Etiology			
Hematogenic	5 (56%)	16 (89%)	0.132
Non-hematogenic	4 (44%)	2 (11%)	
Origin of the patient			
Community	5 (56%)	13 (72%)	0.667
Hospital	4 (44%)	5 (28%)	
Diagnosis			
Fever	7 (78%)	12 (67%)	0.657
Pain	9 (100%)	18 (100%)	>0.999
Leukocytosis	3 (33%)	12 (67%)	0.217
Elevated C-reactive protein and ESR	9 (100%)	18 (100%)	>0.999
Gram staining	3 (33%)	9 (50%)	0.683
Positive synovial fluid culture	8 (89%)	16 (89%)	>0.999
Interval for surgical treatment (days)	17 (IQR, 10–20)	5 (IQR, 3.25–7.5)	0.0193
Previous joint disease	4 (44%)	5 (28%)	0.667
Immunosuppression	7 (78%)	11 (61%)	0.667
Comorbidities	7 (78%)	16 (89%)	0.582
Systemic hypertension	3 (33%)	6 (33%)	>0.999
Diabetes	2 (22%)	2 (11%)	0.582
Clinical complications	5 (56%)	9 (50%)	>0.999
Bacteria isolated			
Other (includes methicillin-sensitive *S. aureus*)	6 (75%)	12 (75%)	>0.999
Oxacillin-resistant	2 (25%)	4 (25%)	
Length of hospital stay	32 (IQR, 10–40)	19.5 (IQR, 14.25–37.25)	0.936
Number of surgeries ≥2	5 (56%)	3 (17%)	0.072
Change in empirical antibiotic therapy	2 (22%)	7 (39%)	0.667

IQR, interquartile range; ESR, erythrocyte sedimentation rate.

Orthopedic complications have been well-described and evaluated in the literature regarding shoulder or elbow septic arthritis.[4,6,8,19] Nonetheless, the articles do not report the clinical complications, which are the main cause of mortality or the increase the hospitalization time of these patients. In the present study, 52% of the patients developed some clinical complication during hospitalization; sepsis (26%) was the main occurrence. Patients with clinical complications presented a hospitalization time of approximately 200% higher than that of patients without complications.

In the present study, a mortality rate of 19% during hospitalization was observed. This value is higher than that described in the series that included septic arthritis of several joints, with 6% to 11.5% of deaths.[1,2] The present results are also higher than those reported in the specific studies on shoulder septic arthritis, which ranged from 5% to 17%.[1,5,9,10] However, in one of the few studies on septic arthritis of the elbow, van den Ende and Steinmann described a mortality rate of 50%.[11] Despite the inherent variation of the studied populations, these data demonstrate the high risk of fatal evolution of septic arthritis.

Few studies have assessed the prognostic factors of unsatisfactory results or complications in septic arthritis.[2,3,13] The results of the present study demonstrated that leukocytosis at the time of hospital admission and the presence of clinical comorbidities are factors associated with the presence of clinical complications. Moreover, a longer time between symptom onset and surgical treatment was correlated with orthopedic complications. Weston et al.[2] observed that age greater than 65 years and involvement of multiple joints or elbows are independent factors associated with increased mortality, while open drainage was associated with a reduction of this complication. Maneiro et al.[3] reported that *S. aureus* infection, endocarditis, and involvement of the hips and small joints of the hand and feet are predictive factors of treatment failure. Furthermore, age, leukocytosis, bacteremia, and comorbidities are predictors of mortality. Hunter et al.[13] observed that patients with inflammatory arthropathy, the involvement of

Table 3 – Prognostic factors for clinical complications.

	Clinical complications		*p*
	Yes	No	
Joint			
Shoulder	10 (71%)	7 (54%)	0.440
Elbow	4 (29%)	6 (46%)	
Gender			
Female	7 (50%)	5 (38%)	0.704
Male	7 (50%)	8 (62%)	
Age (years)	43 (IQR, 24–59.5)	46 (IQR, 25–61)	0.719
Etiology			
Hematogenic	11 (79%)	10 (77%)	>0.999
Non-hematogenic	3 (21%)	3 (23%)	
Origin of the patient			
Community	8 (79%)	10 (85%)	0.420
Hospital	6 (21%)	3 (15%)	
Diagnosis			
Fever	11 (79%)	8 (62%)	0.420
Pain	14 (100%)	13 (100%)	>0.999
Leukocytosis	11 (79%)	4 (31%)	0.021
Elevated CRP and ESR	14 (100%)	13 (100%)	>0.999
Gram staining	5 (36%)	7 (54%)	0.449
Positive synovial fluid culture	11 (79%)	13 (100%)	0.222
Interval for surgical treatment (days)	5.5 (IQR, 4–16.5)	7 (IQR, 4–20)	0.881
Previous joint disease	5 (36%)	4 (30%)	>0.999
Immunosuppression	10 (71%)	8 (62%)	0.695
Comorbidities	14 (100%)	9 (69%)	0.041
Systemic hypertension	6 (43%)	3 (23%)	0.420
Diabetes	4 (29%)	0 (0%)	0.098
Orthopedic complications	3 (21%)	5 (38%)	0.417
Bacteria isolated			
Other (includes methicillin-sensitive *S. aureus*)	10 (71%)	11 (85%)	0.648
Oxacillin-resistant	4 (29%)	2 (15%)	
Length of hospital stay	38 (IQR, 22.75–50.75)	13 (IQR, 10–18)	0.003
Number of surgeries ≥2	4 (29%)	4 (31%)	>0.999
Change in empirical antibiotic therapy	8 (57%)	1 (8%)	0.013

IQR, interquartile range; ESR, erythrocyte sedimentation rate.

large joints, leukocytosis, *S. aureus* infection, and diabetes are at increased risk of treatment failure. The authors believe that the analysis of predictive factors is important to alert the orthopedist who provides the initial care and thereby reduce the number of complications.

The retrospective design of the present study is one of its limitations. The sample, albeit small, is equivalent to that of previously published studies on septic arthritis of the shoulder[9,10,19,20] and of the elbow.[4,11] Because it is a rare disease,[1] series of cases are important to add knowledge about the topic and contribute to future meta-analyses. In the present study, only patients who underwent surgical drainage of septic arthritis were included; those treated with antibiotic therapy alone were not included, which may represent a selection bias. Only more severe cases of patients and consequently with a greater number of complications may have been selected. Another criticism is the lack of evaluation by functional scales. Moreover, only a univariate analysis was used in the search of the prognostic factors for complications in septic arthritis. A multivariate analysis would allow the control and evaluation of different prognostic criteria and would reduce the bias caused by confounding factors. However, the present sample was insufficient for this analysis. Nonetheless, the present study was the first to evaluate and identify possible predictive factors for orthopedic and clinical complications in patients with shoulder and elbow septic arthritis.

Conclusion

Septic arthritis of the shoulder and elbow primarily affects individuals with clinical comorbidities and/or those who are immunocompromised. *S. aureus* is the most commonly identified pathogen in Brazil. Clinical and orthopedic complications are frequent in the treatment of these conditions, and 19% of the patients died of said complications. Leukocytosis at the time of hospital admission and the presence of clinical comorbidities are factors associated with the presence of clinical complications. A longer time between symptom onset and

surgical treatment was correlated with orthopedic complications.

Conflicts of interest

The authors declare no conflicts of interest.

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