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Research Article

Staphylococcal and Streptococcal Septic Arthritis in the Elderly

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ABSTRACT

In our study, septic arthritis due to *Staphylococcus aureus* and Streptococcal species was more common in the elderly. This contrasts with Lyme arthritis which has a higher incidence in younger patients. The majority of joint infections were in the elderly, with a median age of 65 (range 14-95) for *Staphylococcus aureus* and 70 for Streptococcal species. The age range of Methicillin-resistant *Staphylococcus aureus* (MRSA) septic arthritis was 27-95 (median 72) with 39/53 (73.6%) above age 60. The age range of Streptococcal arthritis patients was 36-86 (median 70). There were more males with septic arthritis for both *Staphylococcus aureus* (86/134) 64% and streptococci (12/22) 55%. The most frequently involved joint was the knee, 49.3% for *S. aureus* followed by hip (23.9%), elbow (14.3%), shoulder (14%), wrist (1.5%), ankle (0.75%) and sternoclavicular (0.75%). The knee was affected in 81% of Streptococcal infections, with the rest equally divided between the hip, elbow, acromioclavicular and ankle joints. The history of prior joint replacement in patients with septic arthritis was 21/28 (80%) for MRSA, 36/102 (35.3%) for methicillin-susceptible *Staphylococcus aureus* (MSSA) and 9/21 (43%) for streptococcal arthritis suggestive of healthcare-associated infections. Our results suggest a need for improvements to prevent the entry of pathogens into the surgical site during and after surgery.

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Introduction

We have previously reported a higher incidence of infections associated with *Pasteurella multocida* and *Stenotrophomonas maltophilia* in older patients [1, 2]. In elderly patients, many infections such as influenza, respiratory syncytial virus, SARS-CoV-2, herpes zoster and pneumococcal pneumonia are associated with a more serious outcome [3-6]. Here we present our findings from a large series of *S. aureus* and streptococcal infections where joint infections were more common in the elderly. Septic arthritis is a pyogenic infection of synovial joints. If left untreated promptly, joint destruction, irreversible impairment of joint function, skeletal deformity and systemic complications may result. In a recent study from India, *S. aureus* was the most common cause of septic arthritis. In this report, the number of elderly and those with prior joint surgery were strikingly smaller than our study, with no species identification of streptococci isolated [7]. In a 12-year study from Thailand, group B *Streptococcus* was the most common cause of septic

arthritis with a significant association with upper extremity joints, oligo-polyarthritis, tenosynovitis and rainy season. Our findings were remarkably different, with the majority of streptococcal septic arthritis affecting a single knee and significantly associated with prior joint surgery [8].

Methods

We reviewed the reports of approximately 7000 *Staphylococcus aureus* culture-positive patients in 10 hospitals of our network consisting of 9 hospitals in Eastern Pennsylvania and 1 in adjacent Warren County, New Jersey, USA for a period of 3 years ending in October 2019 and found 134 cases of *S. aureus* septic arthritis (86 males and 48 females), ages ranging from 14-95 with a median age 65. During the same period, 1321 Streptococcal isolates were reported by the laboratory. Twenty-one isolates were from the joint fluid. There were 12 males and 9 females. The ages ranged from 36-86 (median age 70). Only synovial fluid

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culture-positive patients were included in the study. The clinical findings and laboratory data were recorded and analysed.

Results

I *Staphylococcus aureus* Septic Arthritis

There were 134 cases (86 male and 48 female) ages 14-95 with a median age of 65 for all *S. aureus* infections. Methicillin-resistant *Staphylococcus aureus* (MRSA) septic arthritis patients were slightly older (ages 27-95, median 72) with 39/53 (73.6%) above age 60. The knee was the most common joint affected (66) 49.3% followed by hip (31) 23.9%, elbow (19) 14.2%, shoulder (14) 10.4%, wrist (2) 1.5%, ankle (1) 0.75% and the sternoclavicular joint (1) 0.75% (Table 1). History of prior surgery was highest for the hip 21/31 (68%) followed by the shoulder 7/14 (50%), knee 29/66 (44%) and the elbow 2/19 (11%). In 102 patients with MSSA septic arthritis, only 36 (35.3%) had prior surgery compared to 21/28 (75%) for MRSA septic joints (shoulder 5/6 83%), knee 9/11 82% and hip 7/9 78% (Tables 2-4). The most common co-morbidity was trauma 8/134 followed by gout 5/134, endocarditis 5/134, injection drug use and steroid injections to the joint 3/134 each, paraplegia 2/134 and 1/134 each of wart removed from elbow, psoas abscess, muscle abscess, spinal epidural abscess, lymphoma, motor vehicle accident, implanted cardiac device and pneumonia (Table 5). The synovial fluid cell count range was 335 - 470,000 cells/microliter with a mean of 72,073 (NL <200cells/ μ l), white blood cell count range 5,200 - 28,410 (mean 14,400) (NL 4,000-11,000/ μ l), Erythrocyte sedimentation rate range 3 - >130 (mean 63.7) (NL <20 mm/hr.) and the C-reactive protein range 4.1 - >90, with a mean 73.24 and the median > 90 (NL < 3.0mg/L) (Table 6).

Table 1: Distribution of *Staphylococcus aureus* septic joints.

Joint	Total	Percentage
Knee	66	49.3%
Hip	31	23.9%
Elbow	19	14.2%
Shoulder	14	10.4%
Wrist	2	1.5%
Ankle	1	0.75%
Sterno-clavicular	1	0.75%

Table 6: Laboratory results in *S. aureus* septic arthritis.

Lab value	Range	Normal value	Mean
Synovial fluid cell count	335-470,000	<200 cell/ μ l	72,073
White blood cell count	5,200-28,410	4,000-11,000/ μ l	14,400
sedimentation rate	3 - >130	<20/hr	63.7
C-Reactive protein	4.1 - >90	<3.0 mg/L	73.24 (median >90)

II Streptococcal Septic Arthritis

There were 21 cases (13 male and 9 female) ages 36-86 with a median age of 70 (Table 8). The distribution of streptococcal species was: Group B 9 (8 knee and 1 elbow), 7 group G (6 knee and 1 elbow), 3 group C with 1 each involving knee, ankle and hip and 2 due to group A (Table 7). Fifteen out of 21 were above age 60. Nine had a history of prior joint

Table 2: Prior joint surgery in patients with *S. aureus* septic arthritis.

Joint	Number	Percentage
Knee	29/66	44%
Hip	21/31	68%
Elbow	2/19	11%
Shoulder	7/14	50%

Table 3: MSSA/MRSA rates in joint replacement patients.

MSSA/MRSA	Number with history of Joint Surgery	Percentage
MSSA	36/102	35.3%
MRSA	21/28	75%

Table 4: Breakdown of MRSA rates in patients with a history of prior surgery.

Knee	9/11	82%
Hip	7/9	78%
Shoulder	5/6	83%
Elbow	0/2	0%
Wrist	0/2	0%
Ankle	0/1	0%
Sterno-clavicular joint	0/1	0%

Table 5: Co-morbidities in the *S. aureus* septic arthritis study population.

Condition	Number
Trauma	8
Endocarditis	5
Gout	5
Injection drug use	3
Steroid injection	3
Paraplegia	2
Wart removed from elbow	1
Psoas abscess	1
Muscle abscess	1
Spinal epidural abscess	1
Lymphoma	1
Motor vehicle accident	1
Implanted cardiac device	1
Pneumonia	1

replacement surgery (Table 9). Co-morbidities included 4 with diabetes mellitus, 2 with chronic kidney disease and 1 each of injection drug use, abdominal aortic aneurysm, breast cancer with metastasis, acute kidney injury, hepatitis C, coronary artery disease, deep vein thrombosis, aortic stenosis and congestive heart failure (Table 10). The synovial fluid cell count range was 15,242-641,425 cells/microliter with a mean of 162,480 (NL <200cells/ μ l), white blood cell count range 11,140 - 25,080 (mean

16,850) (NL 4,000-11,000/ μ l), Erythrocyte sedimentation rate range 9 - >130 (mean 58.9) (NL <20 mm/hr.) and the C-reactive protein range 44.3 - >90, with a mean 82.3 and the median > 90 (NL < 3.0mg/L) (Table

11). All isolates were susceptible to penicillin, ceftriaxone and vancomycin (Table 12).

Table 7: Distribution of streptococcal septic arthritis.

Group	Joint	Number	Total
Group B	Knee	8	9
	Elbow	1	
Group G	Knee	6	7
	Acromio-clavicular	1	
Group C	Knee	1	3
	Ankle	1	
	Hip	1	
Group A	Knee	2	2

Table 8: Age distribution of streptococcal septic arthritis.

Age group	Total
30-40	2
41-50	3
51-60	1
61-70	4
71-80	6
81-90	5

Table 9: History of prior joint surgery in cases of streptococcal septic arthritis.

Group	Prior joint Surgery
B	Knee 5/9
G	Knee 3/7
C	Hip 1/3
A	0/2

Table 10: Co-morbidities in patients with streptococcal septic arthritis.

Condition	Number of cases
Diabetes mellitus	4
Chronic kidney disease	2
Injection drug use	1
Abdominal aortic aneurysm	1
Acute kidney injury	1
Breast cancer with metastasis	1
Hepatitis C	1
Coronary artery disease	1
Deep vein thrombosis	1
Aortic stenosis	1
Congestive cardiac failure	1

Table 11: Laboratory studies in cases of streptococcal septic arthritis.

Laboratory test	Range	Normal value	Mean	Median
Synovial fluid cell count	15,242-641,425	< 200 cells/ μ l	162,480	80,665
White blood cell count	11,140-25,080	4,000-11,000/ μ l	16,850	16,330
Sedimentation rate	9-130	<20 mm/hr	58.9	41
C-reactive protein	44.3-90	<3.0 mg/L	82.3	>90
Lactic acid	0.7-6.4	0.5-1 mmol/L	2.36	1.7

Table 12: Streptococcal antibiotic susceptibilities in patients with septic arthritis.

Antibiotic	Minimal Inhibitory Concentration range (MIC)
Penicillin	0.016-0.16 S
Ceftriaxone	0.032-0.13 S
Vancomycin	0.19-0.5 S

S: Susceptible.

Discussion

Septic arthritis involves infection and inflammation of the joint space, synovial fluid, synovium and articular cartilage. Once the synovium is seeded, the resulting inflammatory reaction may result in rapid destruction of the articular cartilage. Since the cartilage is avascular and unable to regenerate, permanent damage results. The process is generally

acute and constitutes a medical emergency. Treatment delay for even 24-48 hours could result in permanent joint damage. Classically three modes of seeding of the joint space are described: hematogenous, direct inoculation and contiguous spread [9]. In our study, there was a clear association of many cases with prior surgery suggestive of direct inoculation of the surgical site during or after surgery. The hematogenous spread was the second most likely source of seeding in those with endocarditis and injection drug users.

S. aureus is usually the most frequent organism reported except in a recent study from Thailand where group B *Streptococcus* was reported in the majority [8]. The knee was the most common joint involved followed by the hip, consistent with prior studies except the Thai study. Older age groups were affected more in our study and other reports, with the exception of a 2019 study from India with a mean age of 48.8 with 116/210 below age 18 and only 18 patients above age 60. Only 12/210

had prior surgery in the Indian study differing from our report [7]. Thus, there are geographical variations in the presentation. In contrast, a parallel study done by authors on Lyme arthritis, showed joint involvement mainly in younger patients with the highest incidence in the 10-18 age group [10]. Of the laboratory findings, C-reactive protein was consistently elevated in all cases of septic arthritis. There was a clear association with prior joint surgery which was most pronounced for MRSA. These were most likely healthcare-associated infections, with organisms gaining entry during surgery or infecting the surgical wound. Group B was the predominant streptococcal isolate, followed by group G (Table 7). All streptococcal isolates in our study population were susceptible to penicillin, ceftriaxone and vancomycin (Table 12).

Conclusion

In our study, *Staphylococcus aureus* and streptococcal septic arthritis were more common in the elderly. Males were affected more than females which was more pronounced with staphylococcal septic arthritis. The most common joint affected was the knee for both *Staphylococcus aureus* and streptococcal Septic arthritis. Group B and G were the most common streptococci associated with septic arthritis. However, there were far fewer streptococcal joint infections compared to *S. aureus*. There was a higher incidence of septic arthritis associated with prior joint surgery, with the highest percentage associated with MRSA infections, suggestive of healthcare-associated infections. Our results suggest a need for improvements to prevent the entry of pathogens into the surgical site during and after surgery.

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Competing Interests

None.

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