

Time delay between diagnosis and arthroscopic lavage in septic arthritis. Does it matter?

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Abstract

Purpose Septic arthritis is a life-threatening emergency with high mortality of up to 11 %. We investigated if delay of arthroscopic lavage of infected major joints would have a bearing on the mortality and morbidity such as admission to an intensive care unit (ICU).

Methods We retrospectively reviewed patients presenting with septic arthritis to two regional hospitals over a period of seven years from 1 January 2005 to 31 December 2011. We divided our sample of 82 patients into four groups based on the time delay between clinical diagnosis and arthroscopic lavage ranging from less than six hours to more than 24 hours. **Results** We determined that 35.4 % of patients had prosthetic joints. Knee joints were predominantly involved (74.4 %). *Staphylococcus aureus* was the most commonly isolated pathogen (41.5 %). There were ten (12.2 %) deaths and the same number of admissions to an ICU. Our study revealed there was no statistical significance between the time delay and mortality ($P=0.25$) or ICU admission ($P=0.74$) or the number of washouts ($P=0.08$) in all four groups.

Conclusions Up to 48 hours delayed arthroscopic lavage for septic arthritis does not increase the risk of mortality. Further prospective large sample studies are recommended to investigate this and the risk of long-term morbidity.

Introduction

Septic arthritis or infectious arthritis is a condition caused by the inoculation of pathogens into the joint or to secondary haematogenous spread. The incidence of this condition is reported to be up to 7.8 per 100,000 per year [1–3]. The progression can be very rapid with potentially life-threatening complications. Even in an era with antibiotics and surgical interventions, the mortality of patients presenting with this condition is high (10–16 %) [4, 5]. Delay in treatment can lead to rapid and irreversible damage to the articular surface [6]. There is a high volume of evidence on the management of septic arthritis, duration of antibiotic therapy and comparison of medical to surgical options of treatment [7–10]. The role of clinical suspicion in diagnosis of septic arthritis cannot be overemphasised. A systematic review performed by Mathews et al. found that no investigation is more reliable than clinical diagnosis of an experienced doctor [11]. Arthroscopic lavage has been shown to be effective in the surgical management of infectious arthritis [12, 13]. However, there is hardly any evidence suggesting a time frame for the surgical management of acute septic arthritis.

Aims

Our aims included the study of timing in the surgical management (arthroscopic lavage) of septic arthritis, assessing its

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effect on mortality, admission to intensive care units (ICU) and the number of subsequent washouts the patients required.

Materials and methods

We performed a retrospective cohort study of all patients presenting to two hospitals in our region (one general hospital and one teaching hospital) from 1 January 2005 to 31 December 2011. We included all patients who were clinically diagnosed to have septic arthritis with positive microbiology results from a synovial fluid sample. We excluded patients who had infection of small joints (hand, foot and wrist), together with children and patients whose synovial fluid did not reveal any pathogens. Patients were selected by identifying those in whom synovial fluid growth was positive for a pathogen and who had had arthroscopic lavage. Thus these patients had clinically proven septic arthritis. The hospitals' microbiology databases were reviewed to identify the nature of pathogens isolated. Operative records in patients' case notes were reviewed for specific intraoperative details.

Our primary outcome measure was the effect of time delay on mortality and the secondary outcome measures were admission into an ICU, the total number of washouts the patients required within a three month period following admission and the nature of pathogens isolated. We divided our patients into four groups based on the delay between time of clinical diagnosis and surgical intervention: T1 (less than six hours), T2 (six to 12 hours), T3 (12–24 hours) and T4 (more than 24 hours).

If the patients met the clinical criteria [11, 14], a diagnosis of septic arthritis was made. The standard treatment regimen at both hospitals was as follows. All patients with a suspected septic joint had a joint aspiration in the emergency department unless they had a prosthetic joint; when they had a joint aspiration in a clean air laminar flow theatre. Once a sample had been taken the patient would be started on a broad-spectrum intravenous antibiotic which would be subsequently changed according to the sensitivity of the organism grown. During the procedure, synovial fluid and tissue were taken for culture and sensitivity and at least six litres of normal saline was used for joint debridement. In prosthetic joints, early or haematogenous infection with stable implant was treated by arthroscopic lavage. If septic arthritis recurred in these prosthetic joints, they would then undergo a formal open washout with exchange of liner or undergo a single or double stage revision. None of the patients had drains postoperatively.

Statistical analysis

A power calculation revealed a sample size of 88 patients was necessary for a confidence level of 95 % and confidence interval of 80–90 %. Statistical analysis was carried out

using chi-square tests and multivariate analysis using analysis of variance (ANOVA) tests. Statistical significance was taken at a *P* value less than 0.05. All the data were analysed with SPSS 17.0 version software.

Results

Our study yielded a sample of 82 patients (47 men and 35 women). The mean age of the group was 64.5 ± 18.3 (standard deviation) years. There were 29 patients in the T1 group, 17 patients in the T2 group, 17 patients in the T3 group and 19 patients in the T4 group. A summary of the four groups' baseline characteristics is shown in Table 1. The mean time to operating theatre was 11.24 hours (range one to 49). The distribution of comorbidities in the four groups is presented in Table 2.

There were ten (12.2 %) deaths reported in total. The majority of these (6.4 %) were in the T4 group. There was no statistical significance between time delay and the deaths reported in patients (*P* value 0.25). Ten patients (12.2 %) needed admission to the ICU. The majority of these (4.8 %) were in T1. There was no statistical significance between the time delay and ICU admission (*P* value 0.74). Four patients (4.8 %) eventually had a two stage revision, and one (1.2 %) had a single stage revision. One patient in the T1 group had a failed revision secondary to severe sepsis and needed an above knee amputation.

A total of 141 washouts were performed in the sample size. The mean number of washouts was 1.7 (range one to five) per patient. Arthroscopic lavage had to be repeated if the clinical features of septic arthritis persisted or recurred in our patients. Thirty-six (43.9 %) patients had more than one washout performed within the time frame of two weeks. A comparison of the mean number of washouts between the groups did not reveal a statistically significant difference (*P* value 0.08).

Fifty-three (64.6 %) patients had native joints of which six (7.3 %) had an arthroscopic procedure within the previous six weeks [three anterior cruciate ligament (ACL) reconstructions and three shoulders]. None of the ACL grafts needed removal. Six (7.3 %) patients had an intra-articular steroid injection in the previous four weeks. Twenty-nine (35.4 %) patients had prosthetic joints (27 knees, one shoulder and one elbow). Knee joints were predominantly involved (74.4 %). Subgroup analysis showed no statistically significant association between the delay and various subgroups including the native and prosthetic joints. Time delay versus mortality in native joints (*P* value 0.13) and time delay versus mortality in prosthetic joints (*P* value 0.48) did not reveal a statistically significant difference. Again time delay versus ICU admission in native joints (*P*=0.61) and prosthetic joints (*P*=0.48) did not reveal a statistically significant difference.

Table 1 Summary of the patient groups with characteristics

Characteristic	T1 (<6 h)	T2 (6–12 h)	T3 (12–24 h)	T4 (>24 h)
Mean age±SD (years)	57.2±18.7	61.2±21.3	69.7±16.7	69.5±12.1
Mean delay±SD (h)	3.7±1.3	8.7±1.4	18.3±4.3	32±8.1
Sample size	29 (35.4 %)	17 (20.7 %)	17 (20.7 %)	19 (23.2 %)
Deaths	3 (3.6 %)	0 (0 %)	2 (2.4 %)	5 (6.1 %)
ICU admissions	7.1 %	1.7 %	1.7 %	1.7 %
Mean number of washouts	1.4	1.4	1.27	1.42

The duration of presenting symptoms prior to admission was often not recorded in the notes (27 %) and for those who had a record of symptoms (73 %) it was often unclear as to whether these symptoms were that of true septic arthritis. Twenty-one patients (25 %) had had preceding symptoms of pain for greater than one week and in two extreme cases, months. This is unlikely to have been the case for true septic arthritis; therefore the true onset of septic arthritis in the community could not be established. Analysis of these data did not show any significant difference between those who presented early and those who presented late with regards to mortality ($P=0.71$), admission to ICU ($P=0.71$) or the number of washouts needed ($P=0.8$). The mean number of washouts in patients presenting early compared to those presenting late is shown in Table 3.

The mean follow-up period was 12.38 months; 22.64 % of patients had restricted mobility of the joint involved and 53.84 % had no impaired function of the joint. The rest of the group (23.52 %) had poor mobility secondary to unrelated causes such as cerebrovascular accident, respiratory and cardiac problems. Only three patients (5.3 %) in the native group needed subsequent arthroplasty of the involved joint. Six patients (five in the T4 group and one in the T3 group) underwent further revisions within one year of initial presentation.

Staphylococcus aureus was the most commonly isolated pathogen (41.5 %) and group B *Streptococci* were second most common (9.8 %).

Discussion

We performed an analysis of the importance of timing on arthroscopic lavage of acute infectious arthritis among patients who presented to two major hospitals in our region

Table 2 Spread of medical comorbidities in the four groups

Comorbidity	T1 (<6 h)	T2 (6–12 h)	T3 (12–24 h)	T4 (>24 h)
Diabetes	3 (5.3 %)	2 (3.5 %)	1 (1.7 %)	1 (1.7 %)
Heart failure	4 (7.1 %)	1 (1.7 %)	1 (1.7 %)	4 (7.1 %)
Renal failure	1 (1.7 %)	1 (1.7 %)	0	0
Arthritis	1 (1.7 %)	3 (5.3 %)	1 (1.7 %)	0

covering a population of 2.85 million [22, 23]. Septic arthritis is a common clinical problem [1–3] and previous studies have identified the importance of early diagnosis and treatment to reduce the risk of chondral damage and poor long-term function due to complications of early arthrosis. Vispo Seara et al. [18] found that early surgical intervention (mean 12 days) in large joint septic arthritis led to improved functional outcomes and fewer repeat surgical interventions. Balabaud et al. [15] found that surgical delay from the onset of symptoms was the major factor influencing the success of eradicating the infection and suggested early aggressive intervention with arthroscopic debridement as the routine initial procedure to treat the infection.

To our knowledge, no previous study has looked at the effect of time delay of lavage of a septic joint to mortality or short-term morbidity. This is a potential problem given that a large proportion of patients presenting with septic arthritis have prosthetic joints [20]. With prosthetic articular surfaces, these patients do not have a priority with respect to lavage for salvage of articular cartilage and thus may receive delayed treatment. Although no significant difference was found between delay to theatre and the various subgroups, eight of the 17 patients that were delayed beyond 12 hours had a prosthetic joint (total knee replacement) making up almost 50 % of these patients. However, our study did not reveal any statistical significance between timing of arthroscopic lavage and the mortality or admissions to ICU. Five of ten deaths (two in the T1 group and three in the T4 group) were directly related to systemic infection (pneumonia, urosepsis). Five deaths were due to unrelated causes such as cerebrovascular accident and aspirational pneumonia. All of

Table 3 Time to presentation in comparison to the number of washouts

Time in community	Number of patients	Total number of washouts	Mean number of washouts
Up to 7 days	23	29	1.26
8–14 days	17	25	1.47
15–28 days	4	6	1.5
>28 days	8	14	1.75

the patients that were admitted to ICU eventually recovered and were discharged home.

Arthroscopy has been shown to be an effective surgical treatment measure for joint infections with successful outcomes from 91 to 98 % of treated patients [13, 18]. We consider our procedure successful in 98 % of this patient group; 43.9 % of our sample needed more than one arthroscopic lavage. Balabaud et al. had reoperation rates of 37.5 % in their study [15]. Vispo Seara et al. had similar reoperation rates (38 %) in their group [18]. Our criteria to repeat arthroscopic lavage was based predominantly on the clinical features of effusion, pain and erythema supported by a trend in inflammatory markers such as C-reactive protein (CRP), erythrocyte sedimentation rate (ESR) and white cell count.

We have excluded a large sample of patients ($N=23$) with no growth in their aspirates. The British Society for Rheumatology (BSR) guidelines state absence of synovial fluid culture growth does not rule out septic arthritis [14]. A separate subgroup analysis performed on these patients revealed no statistically significant difference in time delay to mortality and ICU admissions (P value >0.05). Therefore this analysis including the patients with negative culture results had little bearing on the final primary and secondary outcomes of our study. A prospective observational study would be marginally stronger than our retrospective cohort study; however, it would be deemed unethical to randomise patients into such a setting. This would explain why almost all the studies in this field have been observational [13, 16, 17, 19]. Our hospitals did not follow the Gächter classification in assessing the grade of infection [13]. Thus we could not analyse the extent of chondrocyte damage of the native joints. Reasons for time delay in the surgical procedure were mostly due to lack of surgical theatre space out of hours. We did not assess the functional outcome measures of our patients; however, there is evidence (Vispo Seara et al. [18] and Yanmış et al. [21]) that showed direct correlation between the time delay from presentation and poor functional results in their patients. Therefore we recommend that surgeons take these patients to theatre where possible at the earliest opportunity, particularly in patients where their native joint is involved. We also recommend further prospective larger sample size studies which include accurate data on the true duration of the presenting complaint in the community. This combined with prospectively collected data on the functional outcomes of these patients may give a greater understanding of the true effect of delay to lavage.

Conclusion

Our study is the first to our knowledge to compare directly the time delay in surgical procedure and mortality outcomes

in septic arthritis. There was no statistical significance between the time delay of arthroscopic lavage and mortality associated with septic arthritis. Our results show that the delay in lavage does not appear to increase the risk of mortality or admission to ICU; however, more research is required to explore this issue. We recommend systematic clinical approach and judgement in the acute management of septic joints and further prospective studies to demonstrate the true effect of timing on the functional outcomes of septic arthritis.

Conflict of interest The authors declare that they have no conflict of interest.

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