The utility of routine cultures, cell count, and crystal evaluation of aspirate from aseptic olecranon bursitis

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**Level of Evidence:** Level IV; Case Series; Diagnostic Test

**Background:** Aspiration of the olecranon bursa is a treatment option for acute olecranon bursitis (OB). Typically, the aspirate is sent for microbiologic analysis, cell count, and crystal analysis. This study investigates the utility of fluid aspirate analysis from patients with clinically diagnosed aseptic OB.

**Methods:** In this prospective study (IRB #i20-00986), patients presenting with acute aseptic OB were treated with aspiration as standard of care. Patients consented to participate in this study via phone. The aspirate was sent out for routine microbiologic analysis (aerobic and anaerobic cultures and Gram staining) and fluid analyses, including cell count with differential and crystal analysis. Nucleated and differential cell count was reported as absolute numbers per cubic millimeter and percentage, respectively. Compression wrap was applied after OB aspiration, and patients were asked to ice and take anti-inflammatory medications. Clinical follow-up was done after 6 weeks and at 3 months for resolution vs. recurrence of symptoms, and the mean time to resolution was reported.

**Results:** A total of 26 patients (28 cases) with aseptic OB were enrolled in this study. Two patients had bilateral OB. The mean time to aspiration after the onset of symptoms was 26.4 days. One patient had recurrence of swelling after the first aspiration and underwent repeat bursa aspiration. All patients had resolution of swelling and symptoms without the development of postaspiration infection.

**Conclusions:** This study demonstrates limited clinical utility of routine microbiologic analysis (cell count, microbiologic, and crystal evaluation) of fluid aspirate from patients with clinically diagnosed aseptic OB. Although 7% of fluid aspirates were positive for calcium pyrophosphate dihydrate crystals, it did not change the overall treatment.

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Olecranon bursitis (OB) can be either septic or aseptic, with considerable overlap between their history and clinical presentation. It has been reported that OB is typically noninfectious in origin, with septic cases comprising only 20%-33% of diagnosis. Both types usually present as an elbow swelling with pain being less common in aseptic OB unless associated with considerable trauma. Septic OB typically has overlying erythema extending beyond the olecranon bursal region, warmth to touch, elbow pain and in some cases can have a draining sinus or purulent drainage. Differentiating between these 2 categories is important because their treatments are different.

Regardless of the type, the initial diagnosis of OB is based on the clinical presentation, patient history, and physical examination. Clinical follow-up was done after 6 weeks and at 3 months for resolution vs. recurrence of symptoms, and the mean time to resolution was reported.

Aspiration can be both therapeutic and diagnostic. The therapeutic benefits include reduction of swelling size and discomfort. Typically, it is recommended to send aspirate for microscopic analysis (cell count, microbiologic, and crystal analysis). However, the utility of routine fluid analysis of an OB aspirate in clinically determined aseptic OB is not known. The aim of this prospective study was to determine the utility of routine...
microscopic fluid analysis of OB aspirate in patients with clinically
determined aseptic OB. Our hypothesis was that there would be no
change in the treatment plan with microscopic analysis (cell count,
microbiologic, and crystal analysis) of the aspirated OB fluid, and
therefore, microscopic analysis of bursal fluid is not necessary in
clinically diagnosed aseptic OB.

Materials and methods

Study design

From August 2020 to July 2021, 26 patients with OB were treated
with aspiration of their olecranon bursa at our center. One patient
was treated during the same visit for bilateral OB, and another had
both elbows treated but each elbow on separate visits. This totals 28
different olecranon bursae aspirated during this time. Eight pa-
tients elected to have their OB treated without aspiration during
the same time. All patients underwent plain radiographs of the
affected elbow.

None of the patients reported fever, cough, dysuria, significant
pain, or other symptoms suggestive of septic OB. Exclusion criteria
were drainage from bursa and chronic OB. We defined chronic OB
as swelling persisting for more than 3 months.

Treatment

The senior author performed all aspirations using sterile tech-
nique without ultrasound guidance. The aspirated fluid was char-
acterized as being serous (straw color), purely hemorrhagic, or
mixed based on its external appearance. The aspirate was sent for
routine microbiologic analysis (aerobic and anaerobic cultures and
Gram staining) and fluid analyses including cell count with differ-
cential and crystal analysis. Nucleated and differential cell count
was reported as absolute numbers per cubic millimeter and percentage,
respectively. Crystal analysis included the presence or absence of
calcium pyrophosphate dihydrate (CPPD) or monosodium urate
crystals (MSU).

After aspiration, a compression wrap was applied over the
elbow and held in place for 24-48 hours. All patients were
instructed to apply ice topically for 15 minutes every 2-3 hours
when awake and take oral anti-inflammatory medications for 7
days (ibuprofen 600 mg TID). Patients were instructed to report any
erythema, drainage, or recurrence of swelling during the follow-up
period. Clinical follow-up was done after 6 weeks and at 3 months
for resolution vs. recurrence of symptoms, and the mean time to
resolution was noted.

Results

Clinical characteristics

Of the 26 patients, 18 were male and 8 were female. The average
age was 59 years (range, 33-90 years). Twelve of the aspirated
bursae were on the patient's dominant arm, and 16 were on the
nondominant arm. Twenty-one cases were on patients who re-
ported no inciting trauma to the elbow before symptoms appeared.
One patient reported that he had been skiing before both of his
elbows started swelling up. Five patients reported direct trauma to
the elbow: 3 from hitting the elbow against a hard surface and 2
from a fall onto the elbow. Twenty-six of the cases had never
been aspirated before; one was aspirated after failed initial conserva-
tive treatment at an outside hospital. One OB case had already been
aspirated at least one time before receiving treatment at our center.

The average time from symptom appearance to aspiration was 26.4
days (range, 3-90 days). None of the patients had a history of hy-
peruricemia, but 3 patients were positive for at least 3 of the
diagnostic criteria for metabolic syndrome, indicating a positive
diagnosis for metabolic syndrome (Table I). Eight aspirates were
characterized as serous in nature, 3 were characterized as hemor-
rhagic, and 17 were characterized as a mix of blood and serous fluid.

Microbiologic analysis

No organism was isolated or reported on Gram staining on any
of the samples from the aspirates, and no bacterial growth was
found on any of the cultures (Table II). The specimens were held for
14 days.

Cell count and crystal analysis

The average white cell count was 1289.5 cells/mm³ (range, 44-
15,070 cells/mm³). Two aspirates reported positive for CPPD crys-
tals. No patient had MSU crystals (Table II).

Discussion

In this study, we found no utility of microbiologic analysis and
crystal analysis of clinically determined aseptic OB. Two aspirates
were positive for CPPD crystals, but this result did not change the
treatment plan. None of the patients had positive cultures or Gram
staining. All patients had resolution of their swelling.

The treatment of acute aseptic OB varies according to the patient
and physician preferences, but typically one of the common
decision-making includes whether to aspirate the bursa sac or not.
Although differentiating between septic and nonseptic bursitis can
be done clinically, it is not always easy to distinguish between the
two.1,2,10 One of the approaches in making a definite diagnosis is
to aspirate the OB and submit the fluid for microbiologic analysis and
crystal analysis.1,2,7 This, however, is not a universal practice. Pro-
ponents of fluid aspirate analysis use this strategy to confirm the
aseptic nature of the bursitis and to detect crystal-induced bursitis
(gout or pseudogout). However, there is no evidence for or against
routine microbiologic analysis and crystal analysis of clinically
determined aseptic OB. Furthermore, the reliability of the cutoff
laboratory values obtained on fluid analysis to distinguishing septic
from aseptic OB has come into question.17 Truong et al have sug-
gested high variability in the sensitivity of Gram staining, finding
sensitivity values between 15% and 100%, and results being nega-
tive in half of all cases of septic bursitis,12 whereas Reilly et al
suggested that positive Gram stains are found in 50%-100% of septic
OB cases proven by positive cultures.9 These authors also found
aspirate white blood cell counts to be unreliable in making this
distinction–reporting counts between 690 cells/mm³ and 418,000
cells/mm³ in septic OB and between 50 cells/mm³ and 10,000 cells/
mm³ in aseptic cases.1,2 In this study, we clinically characterized OB
as aseptic if there was no erythema and/or drainage. To provide a
meaningful value to this study, we excluded patients of OB with
erythema or drainage or history of chronic OB.

In this study, we found that routine microbiologic analysis and
crystal analysis did not change the treatment plan in clinically
determined aseptic OB. This finding has important conclusions
with respect to the treatment of OB. First, physicians who want to
treat clinically determined aseptic OB without aspiration could do
so with minimal risk of missing any finding that would change the
treatment plan. Second, if fluid aspiration of an aseptic OB is per-
formed, microbiologic or crystal analysis has a low diagnostic and
injected after Third, in clinically determined aseptic OB, steroids can be safely minimized health care resource utilization and health care spending. Evidence-based practice will translate into cost savings and minimize the impact extending beyond the confines of the swelling. This evidence-based practice will translate into cost savings and minimize the impact extending beyond the confines of the swelling. This evidence-based practice will translate into cost savings and minimize the impact extending beyond the confines of the swelling.

| Table I Patient demographics and comorbidities. |
|-------------------------------------------------|
| **Total patients**                              | 26 |
| **Total cases**                                 | 28 |
| **Sex, n (%)**                                  |    |
| Male                                            | 18 (69.23) |
| Female                                          | 8 (30.77)  |
| **Age, mean (range)**                          | 59 (33–90) |
| **Dominant hand, n (%)**                       |    |
| Right                                           | 25 (96.2) |
| Left                                            | 1 (3.8) |
| **Laterality, n (%)**                          |    |
| Right                                           | 11 (39.29) |
| Left                                            | 17 (60.71) |
| **Mechanism of injury, n (%)**                 |    |
| Atraumatic                                      | 21 (75) |
| Traumatic                                       | 7 (25) |
| **Time between onset of symptoms and aspiration, mean, days, (range)** | 26.4 (3–90) |
| **Comorbidities (n)**                          |    |
| Anemia                                          | 1 |
| Anterior uveitis and iritis                     | 1 |
| Arrhythmia                                      | 3 |
| Asthma                                          | 4 |
| Benign prostatic hyperplasia                    | 3 |
| Breast cancer                                   | 1 |
| Choroiditis                                     | 1 |
| Chronic kidney disease                         | 2 |
| Clotting disorder                               | 2 |
| Coronary artery disease                        | 4 |
| COPD                                            | 1 |
| Depression                                     | 2 |
| Diabetes                                        | 2 |
| Deep vein thrombosis                            | 2 |
| Epilepsy                                       | 1 |
| GERD                                            | 5 |
| Glaucome                                        | 2 |
| Hepatitis C                                    | 1 |
| Hypercholesterolemia                            | 1 |
| Hyperlipidemia                                  | 16 |
| Hypertension                                   | 10 |
| Hyperuricemia                                   | 0 |
| Hyperthyroidism                                 | 3 |
| Inflammatory bowel disease                      | 1 |
| Lateral epicondylitis                           | 1 |
| Lyme disease                                    | 1 |
| Melanoma                                        | 1 |
| Metabolic syndrome                              | 3 |
| Migraines                                       | 2 |
| Nephrolithiasis                                 | 1 |
| Osteoarthritis                                  | 2 |
| Osteoporosis                                    | 4 |
| Paget-Schroetter syndrome                       | 1 |
| Parkinson disease                               | 1 |
| Peripheral vascular disease                     | 1 |
| Prostate cancer                                 | 1 |
| Rheumatoid arthritis                            | 1 |
| Seizures                                        | 1 |
| Squamous cell carcinoma                         | 1 |
| TIA                                            | 1 |
| Varicose veins                                   | 1 |

Crystals, n (%) Comorbidities (n)

| Microbiological culture, n (%)                  |    |
| Positive                                        | 0 (0) |
| Negative                                       | 28 (100) |
| Monosodium urate                               | 0 (0) |
| Calcium pyrophosphate dihydrate                 | 2 (7.14) |

COPD, chronic obstructive pulmonary disease; GERD, gastroesophageal reflux disease; TIA, transient ischemic attack.

or therapeutic utility unless there are clinical signs of infection, including drainage, presence of purulence in an aspirate, or erythema extending beyond the confines of the swelling. This evidence-based practice will translate into cost savings and minimize health care resource utilization and health care spending. Third, in clinically determined aseptic OB, steroids can be safely injected after fluid aspiration if this is the preference of the treating physician without the fear of missing an infection.

Two patients had CPPD crystals on fluid aspirate analysis. As all patients were prescribed a short course of non-steroidal anti-inflammatory drugs along with ice application, this result did not change our treatment plan. The 2 patients with positive CPPD crystals had an uneventful course without a recurrence compared with the CPPD-negative cohort. None of the aspirates were positive for MSU crystals.

Although the findings from this study demonstrate the limited value of microbiologic and crystal analysis of fluid aspirate from OB, these results should not be extrapolated to all types of OB. We do believe that laboratory analysis of the OB aspirate has a role in certain clinical scenarios. Patients with past medical history of gout, acute OB with drainage, erythema, or moderate-severe elbow pain will benefit from fluid analysis to assist in diagnosis other than aseptic OB. Furthermore, if there is any suspicion of infection based on unusual clinical examination findings, aspiration and fluid analysis of OB are warranted.

Our study is not without limitations. We had a total of 28 bursal aspirations included in this analysis. Although this cohort is small, we performed a post hoc power analysis based on an alpha of 0.05 and an incidence of 20% for septic OB as previously reported Aaron et al.1 This analysis demonstrated that our study was sufficiently powered (1 – β > 0.8) for our conclusions. We used the standard accepted laboratory cutoff values for synovial fluid analysis to diagnose septic OB, although there is no consensus on the cutoff parameters for white cell count and differential cell count for aseptic vs. septic OB. To make sure that a diagnosis of septic OB is not missed, we followed all patients clinically for 3 months to demonstrate that they did not have signs of missed infection.

**Conclusion**

Our study demonstrates limited clinical utility of routine microscopic analysis (cell count, microbiologic, and crystal analysis) of fluid aspirate from clinically diagnosed aseptic OB.

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