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## Type and Location of Injection Drug Use–Related Soft Tissue Infections Predict Hospitalization

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**ABSTRACT** *The prevalence of soft tissue infections (abscesses, cellulitides, infected ulcers) among injection drug users (IDUs) is estimated to be between 21% and 32%. Little is known regarding the health care utilization associated with these infections. This study describes IDUs seeking emergency department (ED) care for soft tissue infections, their inpatient health care utilization, including operating room procedures, and the types and locations of infections associated with increased inpatient health care utilization. This study used a medical record case series of all IDUs seeking initial care for soft tissue infections at an urban, public emergency department from November 1999 through April 2000. Initial care for IDU-related soft tissue infections was sought by 242 patients. Most were male (63.6%), Caucasian (69.4%) and without health insurance (52.0%), and most had abscesses (72.3%). All patients with only cellulitis had arm or leg infections, while most abscesses were arm, deltoid, or buttock infections (81.1%). Forty percent of the patients were hospitalized, and 44.3% of the hospitalizations were for 3 or more days. Patients with only cellulitis were more likely to be hospitalized compared to those with abscesses. Among those with abscesses, deltoid abscesses were 5.2 times more likely to receive an operating room procedure compared to other abscess locations. IDUs with cellulitis and deltoid abscesses commonly required inpatient care and operating room procedures. The morbidity associated with such infections and the intensive use of hospital services needed to treat these infections provide strong rationale for the development of preventive interventions and improved care for this neglected clinical problem.*

**KEYWORDS** *Abscess, Cellulitis, Health care utilization, Injection drug use, Soft tissue infection.*

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### INTRODUCTION

Although precise estimates are difficult, the injection drug using population in the United States approaches 1 million people.<sup>1</sup> Members of this population are at risk for a variety of medical problems that, when coupled with relatively poor access to

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medical care, lead to substantial morbidity, mortality, and health care expenditure.<sup>2-8</sup>

Soft tissue infections (abscesses, infected ulcers, and cellulitides) are some of the most common medical complications of injection drug use. A study conducted in San Francisco, California, in 1997 found that 32% of injection drug users (IDUs) in the community had abscesses, cellulitides, or both based on exam,<sup>9</sup> whereas 16% of injection drug users in Baltimore, Maryland, reported having an abscess within a 6-month period.<sup>10</sup> The estimated prevalence rates in European studies have been 29%–31% among injection drug users evaluated in emergency departments (EDs)<sup>11,12</sup> and 21% of injection drug users interviewed at needle-exchange programs.<sup>13</sup>

Despite these data on the relatively high prevalence rates of soft tissue infections related to injection drug use, little is known regarding health care utilization for these infections. The reported average length of stay for patients treated for injection drug use–related abscesses in US city hospitals has varied from 3 to 13 days.<sup>14-16</sup> One European study describing patients with upper extremity infections reported that 89% of infections due to injection drug use required surgical debridement.<sup>17</sup> A recent medical record review at San Francisco General Hospital reported an increasing number of admissions for soft tissue infections between 1996 and 2000, with such infections becoming the most common reason for admission for medical or surgical treatment.<sup>16</sup> However, this study included all soft tissue infections, not just those related to injection drug use. No study has assessed rates of hospitalization or operating room procedures specifically for injection drug users seeking care for soft tissue infections in the United States. Moreover, no research has evaluated the relationship of the types of injection drug use–related soft tissue infections (e.g., abscess, cellulitis, and infected ulcer) or their anatomic locations (e.g., arm, leg, buttock) to health care utilization.

As an initial investigation of the health care utilization of soft tissue infections among injection drug users, we conducted a medical record review of all patients who sought care for injection drug use–related soft tissue infections during a 6-month period at a county hospital emergency department. This study describes patients with injection drug use–related soft tissue infections, their clinical characteristics, and inpatient health care utilization, including operating room use, and the types and locations of soft tissue infections associated with increased inpatient health care utilization.

## **METHODS**

### **Study Population**

All injection drug users who sought care at the Harborview Medical Center Emergency Department from November 1999 through April 2000 for initial treatment of a soft tissue infection related to their injection drug use were eligible. Harborview serves indigent residents of King County, Washington, and many of Seattle's injection drug users seek care there.

### **Data Collection**

We identified eligible patients through review of ED records. For quality assurance purposes, the Director of Emergency Services, who reads all ED records daily, identified all ED records with documentation of current illicit drug use either reported

by the patient or demonstrated by urine toxicology results. We reviewed these substance abuse-related records for a diagnosis of cellulitis, abscess, or infected skin ulcer related to injection drug use. Those patients having a diagnosis of an injection drug use-related cellulitis, abscess, or infected ulcer and a chief complaint pertaining to symptoms or signs of a soft tissue infection were included in this analysis. Patients whose records indicated a medical visit and treatment for the presenting soft tissue infection in the previous 30 days were excluded to simplify assessment of the association between the number of days of symptoms before seeking care and inpatient health care utilization. For patients with multiple Harborview ED visits for injection drug use-related soft tissue infections during the 6-month study period, clinical characteristics from only the first ED visit were used in analyses to eliminate any bias resulting from correlated data.

Patient demographic characteristics, ED triage vital signs, physical findings, and disposition after discharge from the ED (outpatient treatment, hospitalization, and/or operating room procedure) were obtained from the ED and/or Harborview's electronic medical record. When noted on the ED record, a history of subjective fever and days of symptoms before seeking care were also obtained. Additional information from the hospital's electronic medical record system included laboratory results and, for hospitalized patients, length of stay, procedures, and follow-up care. The institutional review board of the University of Washington approved the study.

### Measures

Based on the ED physician's diagnosis and the results of incision-and-drainage procedures, patients were categorized into three groups: (1) those who had abscesses, (2) those who had only cellulitis, and (3) those with infected ulcers. Patients were considered to have abscesses if there was a record of an incision-and-drainage procedure with purulent material. Since patients may have soft tissue infections in more than one location, we created five separate, dichotomous variables for each location of infection (arm, deltoid, leg, buttock, neck/torso). For arm infections, patients were dichotomized as having at least one arm infection or not having any arm infections. A similar dichotomization was done for each of the other locations of infection. We defined three categories of ED disposition: outpatient treatment, short hospital stay (less than 3 days), and prolonged hospital stay (3 or more days). Prolonged hospital stay was defined as 3 or more days to differentiate patients with a fever admitted primarily to rule out endocarditis from other patients. We used a dichotomous measure of operating room incision and drainage, as indicated by the ED or hospital medical record. Infections noted as "deltoid" infections were distinguished from other arm infections because they appeared to be distinct clinical entities that may be treated differently.

### Statistical Analysis

Initially, we calculated descriptive statistics, including frequencies, mean or median values, and ranges when appropriate, for characteristics of the patients and their current soft tissue infections.

We then used unadjusted logistic regression to estimate the odds ratio (OR) of hospitalization versus outpatient treatment for various patient and clinical factors, focusing on the type and location of the soft tissue infections. For these analyses, we used ED disposition as the dependent variable (hospitalization vs. outpatient treatment) with outpatient treatment as the baseline (referent category). We also

used unadjusted logistic regression to estimate the odds ratio for having an operating room procedure in relation to patient and clinical factors among patients with abscesses. Patient temperature, heart rate, white blood cell (WBC) count, and the type and location of infection were included in all multivariate logistic regression models based on our a priori hypotheses that they would be associated with hospitalization or having an operating room procedure. Other variables with a statistically significant association with each outcome measure (hospitalization or having an operating room procedure) in unadjusted analysis were also included in subsequent multivariate logistic regression models ( $P < .05$ ). The final model included those variables chosen a priori and any other variables that changed their association with the outcome measure by more than 10%.

Stata version 7.0 (Stata Corp., College Station, TX) was used for all statistical analyses.

## RESULTS

### Patient Characteristics

There were 242 patients who sought initial care for 280 different episodes of injection drug use–related soft tissue infections at the Harborview Emergency Department over the 6-month period. Women comprised 36% of the total population and were younger than men on average (38 years vs. 42 years,  $P = .002$ ). The majority of patients were Caucasian (69.4%), unemployed (78.0%), and had no insurance (52.0%) (Table 1). Most (54.1%) patients with soft tissue infections had an initial WBC count of 10,000/mL or higher, and 8.7% had an initial temperature of 38°C or higher. Among all patients, 28% had at least one blood culture drawn, and 20.9% of these patients had a positive culture.

The most common site of infection was the arm (50.0%), followed by the leg (22.7%), buttock (19.8%), and deltoid (14.1%). Less than 2% of infections were located on the neck or torso. Most patients had abscesses (72.3%). While the majority of abscesses were described in the ED record as arm, deltoid, or buttock (81.1%), all patients with only cellulitis had arm or leg infections (Figure).

Overall, 97 (40.1%) of the patients with injection drug use–related soft tissue infections were admitted to the hospital. Of the 55 (22.7%) patients who had only cellulitis, 28 (51.0%) were admitted to the hospital. In contrast, of the 175 (72.3%) patients with abscesses, 61 (34.9%) were admitted. Among the 97 hospitalized patients, the median hospital stay was 2 days, with 43 (44.3%) patients hospitalized 3 or more days, the longest hospitalization lasting 42 days. Patients with abscesses had a significantly shorter median length of hospitalization than patients with only cellulitis ( $P = .03$ ). In addition, over twice as many patients with only cellulitis or infected ulcers had a prolonged hospital stay compared to those with abscesses ( $P < .05$ ) (Table 1). Of patients with abscesses who underwent an operating room procedure, 65% were discharged within 48 hours.

There were 33 (13.6%) patients who had multiple visits to the ED for treatment of injection drug use–related soft tissue infections, including 27 patients with two visits and 6 patients with three visits. They did not differ significantly from patients with single visits in any measured demographic or clinical variables.

### Risk Factors Associated With Hospitalization

In unadjusted analyses, patients noted to have only cellulitis and those with infected ulcers were more likely to be hospitalized compared to patients with abscesses. In

**TABLE 1. Patient and clinical characteristics\***

	Overall (N = 242)	Abscess (N = 175)	Only Cellulitis (N = 55)	Infected Ulcer (N = 12)
Mean age, years ( $\pm$ SD)	40.3 ( $\pm$ 9.3)	40.6 ( $\pm$ 8.7)	39.4 ( $\pm$ 11.2)	39.8 ( $\pm$ 6.2)
Female, n (%)	88 (36.4)	69 (39.4)	15 (27.3)	4 (33.3)
Ethnicity, n (%)				
African American	54 (22.3)	39 (22.3)	10 (18.2)	5 (41.7)
Caucasian	168 (69.4)	121 (69.1)	40 (72.7)	7 (58.3)
Native American	8 (3.3)	4 (2.3)	4 (7.3)	0 (0.0)
Hispanic	12 (5.0)	11 (6.3)	1 (1.8)	0 (0.0)
Homeless, <sup>†</sup> n (%)	43 (17.8)	27 (15.4)	15 (27.3)	1 (8.3)
WBC $\geq$ 10,000/mL, n (%)	131 (54.1)	96 (54.9)	29 (52.7)	6 (50.0)
Pulse $\geq$ 100, n (%)	98 (40.5)	75 (42.9)	20 (36.4)	3 (25.0)
Temperature $\geq$ 38.0°C, n (%)	21 (8.7)	12 (6.9)	8 (14.5)	1 (8.3)
Subjective fever, n (%)	90 (37.2)	64 (36.6)	20 (36.4)	6 (50.0)
Median days of symptoms before seeking care, n (range)	4 (1–30)	5 (1–30)	3 (1–30)	7 (1–30)
ED disposition, <sup>‡</sup> § n (%)				
Outpatient	140 (57.8)	109 (62.3)	27 (49.1)	4 (33.3)
Short hospital stay	54 (22.3)	39 (22.3)	11 (20.0)	4 (33.3)
Prolonged hospital stay	43 (17.8)	22 (12.6)	17 (31.0)	4 (33.3)
Median days of hospitalization among hospitalized patients, <sup>  </sup> n (range)	2 (<1–42)	2 (<1–24)	3 (<1–12)	3 (1–42)

ED, emergency department; WBC, white blood cells.

\*For patients with multiple visits, clinical characteristics are based on the first emergency department visit only.

<sup>†</sup>A higher proportion of patients with only cellulitis was homeless compared to patients with abscesses ( $P = .046$ ).

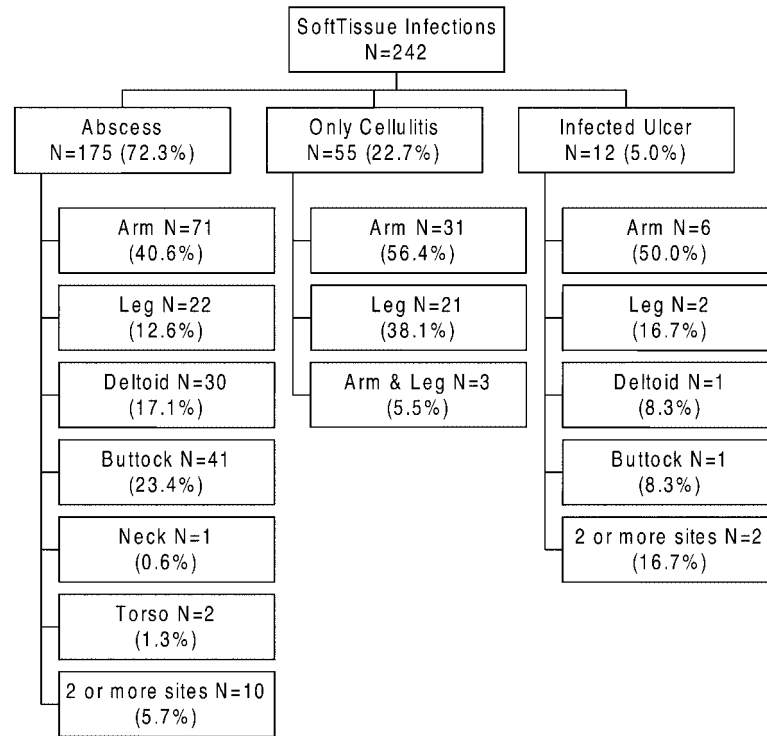
<sup>‡</sup>Five (2.1%) patients left against medical advice (AMA).

<sup>§</sup>A significantly higher proportion of patients with only cellulitis and with infected ulcers had a prolonged hospital stay compared to those who had abscesses ( $P < .05$ ).

<sup>||</sup>Patients with abscesses had shorter median hospital stays compared to patients with only cellulitis ( $P = .03$ ).

addition, patients with deltoid infections were more likely to be hospitalized compared to those without deltoid infections, whereas patients with arm infections were less likely to be hospitalized compared those without arm infections. Patients with a history of subjective fevers noted in ED records or with an elevated triage temperature, heart rate, or WBC count also had increased odds of hospitalization (Table 2). Ethnicity, gender, age, insurance status, and the number of days of symptoms before seeking care were not significantly associated with hospitalization (data not shown).

Based on multivariate analyses, several factors were independently associated with increased odds of hospitalization (Table 2). Patients with only cellulitis and patients with infected ulcers were more likely to be hospitalized compared to those with abscesses after adjusting for the location of infection, history of subjective



**Figure.** Types and locations of soft tissue infections related to injection drug use.

**TABLE 2. Odds of hospitalization (N = 236)**

	Odds ratio (OR)			
	Unadjusted	(95% CI)	Adjusted	(95% CI)
Type of soft tissue infection*				
Only cellulitis	1.9	(1.0– 3.4)	4.0	(1.7– 9.6)
Infected ulcer	3.6	(1.0–12.6)	13.7	(2.5–74.4)
Arm infection (vs. no arm infection)	0.5	(0.3– 0.8)	1.0	(0.3– 3.2)
Deltoid infection (vs. no deltoid infection)	3.1	(1.5– 6.7)	4.5	(1.1–19.0)
Leg infection (vs. no deltoid infection)	1.1	(0.6– 2.1)	1.1	(0.3– 3.6)
Buttock infection (vs. no buttock infection)	1.6	(0.8– 3.0)	1.8	(0.5– 6.4)
History of subjective fever	3.9	(2.2– 6.8)	3.3	(1.6– 6.6)
White blood cell $\geq$ 10,000/mL	5.4	(3.0– 9.7)	5.7	(2.8–11.5)
Heart rate $\geq$ 100 beats/minute	2.7	(1.6– 4.6)	2.6	(1.3– 5.3)
Temperature $\geq$ 38.0 °C	15.7	(3.5–69.5)	7.1	(1.4–35.6)

CI, confidence interval.

\*Referent category = abscess.

fevers, vital signs, and WBC count. An elevated heart rate, elevated WBC count, and a history of subjective fever were also associated with increased odds of hospitalization independent of temperature at triage and the type or location of infection (Table 2). Among the hospitalized patients, having a positive blood culture was not significantly associated with prolonged hospitalization (OR 2.3, 95% confidence interval [CI] 0.7–8.0).

### Risk Factors Associated With Operating Room Incision and Drainage

Among the 175 patients with abscesses, 45 (25.7%) received an operating room procedure. Of patients with an ED record diagnosing deltoid abscesses, 59% went to the operating room for an incision-and-drainage procedure, while only 17.0% of those with abscesses in other locations underwent this treatment. When assessing the independent association of potential risk factors for receiving an operating room procedure, having a deltoid abscess was most strongly associated with receiving an operating room procedure (OR 5.2, 95% CI 1.0–26.3) after adjusting for the patient's vital signs and a history of fever. Having an elevated heart rate or WBC count and a history of a subjective fever were also associated with having an operating room procedure (Table 3). Ethnicity, gender, age, insurance status, and the number of days of symptoms before seeking care noted in the ED record were not associated with receiving an operating room procedure (data not shown).

## DISCUSSION

This study provides unique data on the clinical features and health care utilization of injection drug users seeking medical care for soft tissue infections at a US hospital emergency department. We found that, overall, 40.1% of injection drug users seeking care for a soft tissue infection at an urban county hospital emergency department were admitted to the hospital for treatment of their infection. Among patients with abscesses, just 13% with an arm abscess were admitted, but 59% with deltoid abscesses and 45% with buttock abscesses were admitted. Of patients with abscesses, 26% received a surgical procedure in the operating room. Although only

**TABLE 3. Odds of receiving an operating room procedure among patients with abscesses (N = 175)\***

	Odds ratio (OR)			
	Unadjusted	(95% CI)	Adjusted	(95% CI)
Arm infection (vs. no arm infection)	0.2	(0.1– 0.4)	0.4	(0.1– 1.8)
Deltoid infection (vs. no deltoid infection)	6.4	(2.8–14.5)	5.2	(1.0–26.3)
Leg (vs. no leg infection)	0.5	(0.2– 1.5)	0.5	(0.1– 3.0)
Buttock (vs. no buttock infection)	2.2	(1.0– 4.7)	1.7	(0.4– 8.1)
History of subjective fever	4.1	(2.0– 8.4)	4.4	(1.7–11.2)
White blood cell $\geq$ 10,000/mL	7.3	(2.9–18.5)	4.0	(1.4–11.3)
Heart rate $\geq$ 100 beats/minute	3.2	(1.5– 6.6)	4.9	(1.9–12.9)
Temperature $\geq$ 38.0 °C	1.6	(0.5– 5.8)	0.4	(0.1– 1.7)

CI = confidence interval.

\*Referent category = emergency department bedside incision and drainage.

17% of all abscesses were diagnosed as deltoid abscesses by the ED physicians, over 44% of the operating room incision-and-drainage procedures were performed on these deltoid abscesses.

This study complements and extends recent investigations of the health care utilization of drug users. Drug users have been reported to consume fewer ambulatory care services and more inpatient and emergency department services than non-drug users.<sup>18–20</sup> Our finding that hospital stays for soft tissue infections are much shorter (median 2 days) than previously reported (mean 12–13 days)<sup>14,15</sup> is consistent with a recent study in San Francisco (average stay 3.2 days).<sup>7</sup> While that study described an increase in health care utilization for all soft tissue infections, including those unrelated to injection drug use, the present study assessed health care utilization for soft tissue infections specifically related to injection drug use. Moreover, the present study identified the types and locations of soft tissue infections that were associated with increased rates of hospitalization and operating room procedures.

In our analyses, cellulitis was a strong predictor of hospitalization regardless of the location of the infection or the patient's vital signs. This reflects common clinical practice and the principle that the definitive therapy for an abscess is usually incision and drainage only, whereas cellulitis generally requires antibiotics and more severe infections may warrant intravenous antibiotics and hospitalization.

Among patients with abscesses, the location of infection was important in determining whether a patient was hospitalized or received an operating room procedure even after controlling for the patient's vital signs and WBC count. In particular, having an abscess described as a deltoid infection was strongly associated with receiving an operating room procedure and, probably as a consequence, a short hospital stay. Deltoid infections are often the result of intramuscular injections, which can lead to deeper and potentially more severe infections, including necrotizing fasciitis. Physical exam findings alone may not identify these infections, especially after the development of chronic scarring due to multiple injections. Surgeons may thus opt for more extensive exploration in the operating room rather than performing an incision-and-drainage procedure in the ED.<sup>21,22</sup> However, 41% of patients diagnosed with deltoid abscesses did not have an operating room procedure. No clinical studies have compared the long-term outcomes and complications of patients with deltoid abscesses managed with or without an operating room procedure.

Several limitations of this study merit note. Since this was a retrospective medical record review, data collection depended on documentation by the ED providers. We were therefore unable to ascertain accurate prevalence rates for several important demographic and clinical characteristics, including modifiable patient behaviors such as injection practices and the use of alcohol and tobacco and chronic medical and psychiatric problems, due to missing data. Although we were unable to know how many of the patients studied were HIV positive, only 2% of injection drug users in this city are HIV positive, so we do not expect HIV status to significantly influence our findings.<sup>23</sup> Our classification of the type and location of soft tissue infections was based on a retrospective review of the written assessments by ED physicians. Consequently, we were unable to validate these assessments and determine their degree of misclassification. Finally, we may have missed important associations between less-common clinical characteristics and health care utilization due to the relatively small sample size and/or missing data.



Although injection drug use–related soft tissue infections are a commonly encountered clinical syndrome, especially in urban settings, they remain understudied. Since no specific *International Classification of Diseases (ICD)* codes exist for these infections, tracking their health care utilization is difficult, and they have not been included in estimations of the medical costs of drug abuse.<sup>4,24</sup> Further research is necessary to define regional and national patterns of injection drug use–related soft tissue infections and their costs, as well as to determine the most effective prevention and treatment strategies.

This study of the relationship between the type and location of injection drug use–related soft tissue infections and their hospital care provides important evidence that injection drug users seeking care in emergency departments will often have serious infections that result in hospitalization and an operating room procedure. The patterns of health care utilization noted here underscore the need for improvements in the provision of medical services for this population and preventive interventions to decrease rates of soft tissue infections. These results suggest the need for education regarding early identification of cellulitis and deltoid abscesses since these particular infections appear to be associated with increased hospitalization and operating room procedures. Future research will need to identify specific barriers to timely medical care and modifiable patient behaviors associated with increased morbidity and health care utilization in this population.

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