Soft tissue infections from drug abuse

A clinical and microbiological review of 145 cases

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We evaluated clinical and microbiological aspects in 145 hospitalizations of 89 intravenous drug abusers with acute soft tissue infections at the injection site. There were 58 superficial abscesses, 27 deep abscesses, 57 cellulitis with or without concomitant ulcer, 1 purulent arthritis, 1 tenosynovitis and 1 incompletely categorized abscess. The commonest location was the groin. Serious complications occurred in 17 cases, including 4 lower-extremity amputations due to arterial lesions. There was a predominance of polybacterial infections (53 percent polybacterial, 38 percent monobacterial, 9 percent sterile). The commonest bacteria isolates were *Streptococcus* species with a preponderance of oropharyngeal bacteria, *Staphylococcus aureus*, and anaerobes, especially *Bacteroides* species. Typical intestinal bacteria were rare. In addition to surgical treatment we recommend that aerobic and anaerobic culturing with susceptibility tests always are carried out, that primary antibacterial therapy should consist of an antistaphylococcal agent, such as dicloxacillin plus metronidazole, and that free injection paraphernalia with disinfection swabs are easily available.

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White (1973) found that infections were the cause of 28 percent of drug addiction-related hospitalizations, and that abscess formation at the injection site was the commonest form of infection. The infections are often encumbered with local and/or systemic complications (Hussey and Katz 1950) that are protracted, and they are also characterized by special microbiologic features (Webb and Thadepalli 1979, Orangio et al. 1984, Biderman and Hiatt 1987). In Denmark, with a population of about 5 million, there are an estimated 8,000–10,000 intravenous drug abusers (IVDA) (Kringsholm and Helweg-Larsen 1986). We reviewed the clinical and microbiologic aspects in cases of soft tissue infections in IVDA admitted to the department of orthopedics in a Copenhagen hospital.

Patients and methods

A retrospective study was made of the clinical records of all IVDA admitted to the Department of Orthopedics of Bispebjerg Hospital in Copenhagen during the 5-year period January 1985 to December 1989. There were 89 patients, 57 men and 32 women, with median ages of 31 (23–53) years and 32 (19–40) years. The patients were admitted 145 times with an acute infection as a direct result of intravenous injections or attempts to inject. The patients were addicted to heroin (33 cases), ketobemidone (22), methadone (8), amphetamine (6), and in 6 cases other drugs (morphine, buprenorphine, phenobarbital and cocaine). No information was given on the drug used in 70 cases.

Microbiologic studies

Bacterial isolates were identified in accordance with the routine procedures of the department, and a disc diffusion method (Rosco, Denmark) was used to determine antibiotic susceptibility. Material for this investigation was taken from 86 of the 145 foci of infection (56 swabs and 30 pus or tissue samples). Relevant microbiologic examination (aerobic and anaerobic) was performed in 78 cases.

1 case of abscess was not categorized in greater detail because the patient left the hospital without having received surgical treatment.

Chi-2 test, Fischer's exact test and Student's unpaired *t*-test were used.

Results

There was an equal distribution of the various types of infection at the various locations (Figure). No relationship was found between the substance

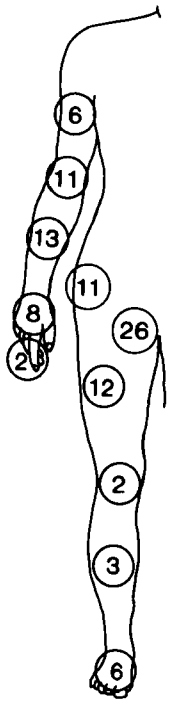

Figure. Distribution of 145 soft tissue infections (percent).

Table 1. Clinical diagnoses of 145 soft tissue infections

Superficial abscess[a]	58
Deep abscess[b]	27
Cellulitis[c]	57
Septic tenosynovitis	1
Septic arthritis	1
Abscess not categorized	1

[a] Limited to the skin and subcutis.
[b] Involves structures deeper than the subcutis, e.g., the fascia, musculature and/or central vessels.
[c] Phlegmonous infection with or without acute ulcer.

Table 2. Serious complications in 17 out of 89 drug addicts admitted with soft tissue infections

Lesions or thrombosis of the femoral artery with amputation	4
Deep venous thrombosis [a]	5
Pneumonia (1 death)	3
Septicemia[b]	4
Compartment syndrome	2
Total	18

[a] One death due to pneumonia as well
[b] *Staphylococcus aureus* (2 cases), group A streptococci (1) and *Klebsiella pneumoniae* (1).

Table 3. Bacterial species (n 150) isolated in 71 soft tissue infections

Staphylococci (41)	
S. aureus	30
S. epidermidis (coagulase negative cocci)	11
Streptococci (52)	
ß-hemolytic	22
Microaerophilic[a]	19
Nonhemolytic	7
Enterococcus faecalis	4
Gram-negative enteric rods (13)	
Escherichia coli	2
Klebsiella sp.	3
Enterobacter sp.	6
Citrobacter freundii	1
Proteus sp.	1
Pseudomonas spp.	2
Hemophilus spp.	2
Acinetobacter calcoaceticus	1
Corynebacterium spp.	9
Anaerobic species (30)	
Bacteroides spp.	15
Fusobacterium sp.	5
Peptostreptococcus spp.	4
Clostridium perfringens	1
Anaerobic gram-positive rods	5

[a]Organisms that grow poorly or not at all in air, but which grow distinctly better under 10% CO_2 in air or anaerobically (Finegold 1989), i.e., *Streptococcus viridans*.

injected and the clinical diagnoses (Table 1). Serious complications occurred in 17 cases (Table 2). No correlation was found between individual types of infection and the types of complication, with the exception of 2 arterial pseudoaneurysms and 2 compartment syndromes, all of which occurred in connection with deep abscesses.

Samples from 7 foci of infection (3 superficial abscesses, 2 deep abscesses and 2 cellulitis) with optimal culturing showed no growth. From the other 71 foci (43 superficial abscesses, 22 deep abscesses, 4 cellulitis and the single cases of tenosynovitis and arthritis) a total of 150 species of bacteria were found (Table 3).

30 of the cultures contained only a single strain: 13 of these were *Staphylococcus aureus* and 11 ß-hemolytic streptococci. The remaining monobacterial cultures were 2 *Streptococcus microaerophilus*, 2 enterococci, 1 *Corynebacterium* species and 1 *Clostridium perfringens*. The latter was the only *Clostridium* species present in the samples, and it was the only anaerobic monobacterial culture.

41 of the cultures were polybacterial (2–7 different bacteria per culture). *Staphylococcus aureus* and ß-hemolytic streptococci were present in 17 and 13 of these cases, respectively. These cases were also characterized by the presence of 17 of the total of 20 aerobic intestinal organisms found, 17 of the 19

Streptococcus microaerophilus and 29 of the 30 anaerobic organisms. Only 1 culture produced exclusively anaerobic growth (*Fusobacterium* sp. and peptostreptococci from a deep groin abscess). The frequency of ß-hemolytic streptococci was higher in infections in the upper extremities than in the lower extremities ($P < 0.05$). As regards the other bacteria and the mono- and polybacterial infections, there was no difference in frequency with respect to location of the infection.

There was no significant predominance of polybacterial infections in the deep abscesses (68 percent) compared with the superficial ones (51 percent). The 4 positive cultures from cellulitis infections showed a growth of ß-hemolytic streptococci in all cases and *Staphylococcus aureus* in 3 cases. None of them contained anaerobic bacteria.

All but 1 of the *Staphylococcus aureus* isolates were penicillin-resistant but susceptible to dicloxacillin (methicillin), cephalosporin and erythromycin. 14 out of 15 *Bacteroides* species were resistant to penicillin and cephalosporin, but all were susceptible to metronidazole. All streptococci, except for enterococci, and anaerobes other than *Bacteroides* spp. were susceptible to penicillin, cephalosporin and erythromycin. The enterococci isolates and gram-negative enteric rods were fully susceptible only to aminoglycoside.

In 35 cases, antibiotic treatment had been initiated before the hospitalization: phenoxymethylpenicillin (24 cases), ampicillin (4 cases), dicloxacillin (3 cases), doxycycline (3 cases) and erythromycin (1 case). 23 of the cases were abscesses and 12 were cellulitis. Samples for cultures were taken from 21 abscesses which received revision. Comparing the microbiological findings and susceptibility tests, 7 cases had been treated with the correct antibiotics: 5 phenoxymethylpenicillin and 2 dicloxacillin. 2 other cultures showed no growth: 1 phenoxymethylpenicillin and 1 doxycyclin. The remaining 12 cases had been treated with incorrect antibiotics (9 phenoxymethylpenicillin, 2 ampicillin and 1 doxycyclin) due to the presence of *Staphylococcus aureus* and/or *Bacteroides* species.

Revision under general anesthesia and antibiotic treatment was performed in 70 cases. 16 cases were treated with revision and 44 cases with antibiotics only. 15 cases were treated with only immobilization and wound care. The antibiotic treatment was dicloxacillin plus ampicillin (27 percent), dicloxacillin plus benzylpenicillin/phenoxymethylpenicillin (24 percent), benzylpenicillin/phenoxymethylpenicillin (23 percent), dicloxacillin (11 percent) or ampicillin (6 percent). In a few cases, cephalosporin or erythromycin were used (9 percent) due to penicillin allergy in the patient. The treatment was adjusted according to the results of cultures. However, no patient received specific treatment against *Bacteroides* species with metronidazole.

Deep abscesses were characterized by a longer median hospitalization time (13 days) than both the superficial abscesses and cellulitis (4 and 2 days, respectively). Furthermore, the deep abscesses more often required more than 1 surgical intervention: in half the cases compared to about 1/10 of the superficial abscesses.

The wound was not sutured primarily after revision. Secondary suturing was performed in only 1 case and skin transplantation in 2 cases. The patients were usually discharged when there was clean granulation or when the cellulitis was clearly healing. In 113 of the cases, treatment as out-patients was planned, but 80 of these were lost to follow-up. For this reason it was impossible to determine the final results of the treatment.

Discussion

Our microbiologic findings (Table 3) differ from those published previously (Webb and Thadepalli 1979, Orangio et al. 1984, Biderman and Hiatt 1987). This is not surprising, since the microbiological features in skin and soft tissue infections suffered by IVDA vary between populations (Orangio et al. 1984, Biderman and Hiatt 1987). They do, however, have one characteristic in common: most of the infections were polymicrobial. In addition, our microbiologic findings differ considerably from those in patients who were not IVDA. Thus Bak et al. (1987) found that in cases of subcutaneous abscesses in non-IVDA at a Danish department of orthopedics there were substantially fewer polymicrobial infections (8 percent compared with 48 percent in our studies), almost no anaerobic bacteria (6 percent compared with 22 percent in our studies) and no streptococci. *Staphylococcus aureus* was present to the same extent as in our study. The polymicrobial infections indicate that IVDA have other sources of infection and other ways of spreading infection than the standard orthopedic patient. This is hardly due to contamination of the substances injected intravenously (Tuazon et al. 1974, Moustoukas et al. 1983), nor can it be blamed on the common practice of dissolving these substances in tap water. Contaminated hypodermic needles and syringes seem to us to be the probable source of these infections. The presence of many oropharyngeal bacteria is presumably due to

the practice of putting the needle to one's mouth to blow the blood coagulum out in order to reuse the needle and cleaning the skin with saliva before injecting, a practice confirmed by several IVDA.

In the case of a suppurative or necrotizing infection, surgical treatment is most important, cf. the 7 cases of abscesses that prior to hospitalization had been treated with correct antibiotics in relation to subsequent microbiological findings. However, revision is not always enough: there could be phlegmonous surroundings, or the infection could be spreading to deep structures such as sheaths of vessels or fasciae. The need for repeated surgical revision, especially in the case of deep abscesses, underscores this problem. An adjuvant antibiotic treatment would be indicated in these cases. In the light of the many complications, both local and systemic, antibiotic treatment should be used in most cases.

Since staphylococci and streptococci in combination with anaerobic bacteroides species may exhibit necrotizing features and may spread rapidly, a first-choice antibiotic treatment should include a specific antistaphylococcal, and in addition antistreptococcal, agent. We prefer a penicillinase stable penicillin like dicloxacillin, which also would be effective against anaerobes, except the *Bacteroides* species. The common choice of phenoxymethylpenicillin in our material is obviously insufficient because of the many penicillin-resistant *Staphylococcus aureus*. The antibiotic treatment should be supplemented with metronidazole, effective against *Bacteroides* species. Oral cephalosporin, like cefuroxime axetil or erythromycin could replace dicloxacillin, especially as alternative treatment in penicillin-allergic patients. These conclusions are valid for the treatment of abscesses and for cases of cellulitis as well. Although only 7 percent of the cellulitis cases were cultured optimally, the microbiological findings in these are in accordance with those described by George (1989).

Gram-negative rods were present only in a mixed flora together with gram-positive cocci and/or anaerobic bacteria and in a total of only 18 percent of the infections. Enterococci were very rarely present (5 percent). Antibiotic treatment against these bacteria (e.g., aminoglycoside and ampicillin) is indicated only when the results of cultures and the susceptibility test are known. The polymicrobial flora make it especially important always to collect satisfactory material for cultures: preferably as tissue samples and/or pus for both aerobic and anaerobic cultivation.

The results of our study show that the routine sampling for microbiological investigation as well as rational antibacterial therapy are insufficient in this group of patients. Considering the serious complications of soft tissue infections, we suggest the following strategy of prophylaxis and treatment:

1) If possible, it should be made even easier for IVDA to receive free injection paraphernalia kits and these kits should be supplied with disinfection pads.

2) Sample material for cultivation and susceptibility testing, preferably pus or tissue to be cultivated both aerobically and anaerobically.

3) Revision under general anesthesia followed up by active care of the wound.

4) Primary treatment with penicillinase-stable penicillin like dicloxacillin (or if the patient is allergic to penicillin, oral cephalosporin or erythromycin) plus metronidazole in all cases where antibiotic treatment is indicated. Therapy must be adjusted according to the clinical outcome and the results of cultivation and susceptibility tests.

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