

MANAGEMENT OF SOFT TISSUE INFECTIONS

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The management of soft tissue infections is based on several factors. First, the physician must make a quick and accurate diagnosis to determine the severity and extent of the infection. Next, it must be decided if hospitalization is necessary. Many soft tissue infections may be treated on an outpatient basis. However, there are important criteria to consider when hospitalization may be necessary. Finally, a treatment plan needs to be formulated based on criteria involving surgical intervention, antibiotics, and local wound care. The authors will present an organized and systematic approach to the diagnosis and management of soft tissue infections.

INITIAL ASSESSMENT

The most important aspect in diagnosing soft tissue infections is obtaining an accurate history and performing a thorough clinical evaluation. Infection may be diagnosed by assessing the five cardinal signs of inflammation: tumor (swelling), rubor (erythema), calor (increased temperature), dolor (pain), and loss of function. Clinically, infection and inflammation can be separated by the intensity of these signs. In particular, pain is one of the primary indicators that infection may be present. Even in neuropathic patients such as diabetics, this is a very important sign indicating an infectious process may be occurring. The severity of the infection can be assessed by ancillary tests such as laboratory evaluation, cultures and sensitivities, conventional radiographs, nuclear medicine studies, and special imaging studies such as computed tomography or magnetic resonance imaging. These tests should be used mainly to support the clinical findings. The clinical findings and impressions are, however, the most important factors in assessing and diagnosing an infection process.

Once an infection is suspected, the next decision is to determine if the patient can be treated as an outpatient or if the infection is severe

enough to require hospitalization. Although the need for hospitalization is based on several factors, the severity of the infection and extent of systemic involvement are of primary concern. In general, patients presenting with constitutional signs such as fever, chills, night sweats, nausea and vomiting should be considered as candidates for immediate hospitalization. These are indicators of systemic involvement and suggest much more than a localized and confined infection process.

Laboratory values revealing a leukocytosis with a shift to the left also suggest the need for hospitalization. However, there are patients who do not display systemic manifestations of infection due to an underlying immuno-compromised disease state such as diabetes and rheumatoid arthritis. In these patients, the need for hospitalization may be based solely on the history and physical examination.

The wound should be inspected to determine the extent of the infection. The extent of erythema or cellulitis must be assessed and correlated with this finding to determine the proximal extent of the infection. The area of the infection must be carefully inspected for the presence of drainage. The drainage should then be evaluated to determine its quantity, consistency, color and odor. In general a grayish drainage indicates significant tissue damage which requires immediate incision, drainage, and debridement. The wound should be probed to determine if there is any tracking to deeper fascial planes, tendon sheaths, or bone. If any of these situations are present, the patient should be hospitalized and incision and drainage should be contemplated. The presence of lymphangitis and lymphangitis must also be assessed to determine the systemic nature of the infection.

The patient can be treated in an outpatient setting when the infection is well-confined, localized, exhibits minimal drainage, and has no evidence of tracking. The exception to this, is the patient with a systemic illness which renders them

immuno-compromised or medically unstable (diabetes, peripheral vascular disease, rheumatoid arthritis).

TREATMENT

After establishing a diagnosis and assessing the severity of the infection, a proactive treatment plan should be formulated. Reactionary plans should be avoided so that the infection can be quickly eradicated, and damage minimized. The treatment plan can be separated into two categories, systemic and local.

Systemically, the physician must initiate appropriate antibiotics based on the severity and appearance of the infection and overall medical condition of the patient. In addition, the suspected organism should be considered. Infections secondary to gram positive organisms tend to be very aggressive and should be handled in an expedient manner. The physician must decide upon the route of delivery, parenteral versus oral. An extensive infection in a medically unstable patient suggests the need for immediate hospitalization with intravenous antibiotics. A localized infection with a medically stable patient can be treated with an oral antibiotics if there is an adequate vascular supply to the area. Antibiotics must be started empirically until an organism can be classified based on clinical presentation and Gram's stain. The antibiotics should be adjusted based upon the results of the wound culture and sensitivity, and the general response to the initial antibiotic employed. Patients must be followed very closely and should be re-evaluated within 48 hours to determine the response to initial antibiotic therapy. It is beyond the scope of this paper to address specific antibiotics and their spectrum of coverage.

Procurement of an accurate, deep culture is critical in the overall treatment plan of the seriously infected patient. The superficial swab is usually not representative of the organism responsible for the infectious process. In most instances they will grow normal skin flora, or other contaminants that will mislead the physician and result in less than optimal antibiotic therapy. One must be careful with long-standing open wounds such as ulcers because there are usually many contaminants present on these areas. If a deep culture is not obtainable, as in the case of an ulcer, the wound

should be scrubbed with normal saline prior to culturing. This process decreases the bacterial concentration and yields a more reliable culture. Purulence is another poor medium to culture because it is filled with leukocytes and dead bacteria. A swab of purulence will often reveal no growth of organisms. The surgeon should strive, when possible, to obtain a deep culture which will be the most reliable and accurate in revealing the primary infecting organism.

The degree and extent of wound debridement must be determined. The first aspect is to address whether the infection site needs to be incised and drained, and if so, whether it can be performed at bedside or in the operating room. The severity and extent of the infection will determine whether or not an incision and drainage is required. Patients with severe infections and proximal extension should have an incision and drainage in the operating room. If the infection site is filled with copious amounts of drainage and purulence, and appears to track beyond the visual border of the wound, the patient will require surgical intervention. In situations where blood supply is in question, the patient should still undergo an initial incision and drainage to stabilize the wound, followed by arterial assessment. If the infection is not severe and the patient is stable, a vascular examination should be performed prior to surgical intervention.

There is no substitute for adequate debridement of the wound. Aggressive debridement will result in a reduced bacterial count and improve efficacy of the antibiotic. The primary purpose of an incision drainage is to reduce the bacterial concentrations and remove necrotic tissue and debris. A goal of incision and drainage is to minimize soft tissue damage. The longer the infection remains within the tissues, the greater the opportunity to create severe damage to soft tissue and bone. Surgical incision and drainage will release the trapped bacteria, remove unhealthy tissue and debris, and allow the physician to obtain a deep culture.

When performing incision and drainage several factors must be taken into consideration. Placement of the skin incision is of the utmost importance. The incision should be extended until healthy, vascularized tissue is evident and the surgeon has exposed the most peripheral aspects of the infection site. When surgically managing soft

tissue infections, the goal is to control the infection and heal the wound. Placement of skin incisions should be carefully planned so that skin closure is an achievable long-term goal.

Once the infection is incised, all necrotic (avascular) tissue must be removed. Avascular tissue does not promote growth of capillary vessels necessary for healing; therefore, necrotic tissue must be resected until healthy vascular tissue with a potential for healing has been reached. Debridement is accomplished through various techniques; most commonly curettage and irrigation. Sharp dissection is usually avoided unless other debridement techniques have failed to remove the unhealthy tissue. Necrotic tendons and ligaments are tissues which may require removal by sharp dissection. Sterile toothbrushes or scrub brushes are very useful in debriding infected wounds.

High volume and high pressure irrigation is another important debridement technique. The solution itself is unimportant; it is the high pressure that accomplishes the debridement. Saline and Ringers are common solutions utilized for irrigation. Copious amounts of irrigation under high pressure will loosen and flush the bacteria from the wound. Irrigation can be performed intra-operatively with devices such as a pulse lavage system. Six to twelve liters of solution are commonly used during the initial debridement. Bedside irrigation can be accomplished with a large syringe and blunt tip needle or catheter. The change in diameter from the syringe to the needle results in high pressure at the needle tip. Bottles of irrigant can also be used. Several small holes can be punched through the top with a large bore needle. Then the bottle can be squeezed manually, and the irrigant delivered under pressure very efficiently. Once the area has been incised, cleaned and debrided, the wound should be packed and left open.

There is no advantage to closing the wound at this time, even if the wound appears to be extremely clean. Studies have shown that if closed immediately, bacterial counts may reside in concentrations high enough to continue the infectious process. The wound is typically packed with iodoform or plain gauze dressing material. If the wound is large, gauze or any absorbent material can be used such as Kerlix rolls or sterile sponges. It is important to use non-fraying materials which might adhere to the wound edges, making removal difficult.

Following the initial incision and drainage, the wound should be followed closely with daily dressing changes. At each dressing change the wound should be inspected, and the packing removed. Any additional debridement can be performed at this time followed by thorough irrigation. The wound should be managed in this fashion until a clean, healthy wound is obtained and closure can be considered. If the wound does not respond, or continues to progress then additional debridement should be considered.

The management of soft tissue infections is a serious challenge for podiatric physicians. The diagnosis must be established quickly and accurately. Systemic treatment with antibiotics and local treatment with wound debridement should be initiated quickly to eradicate the infection and prevent its spread. Delays in the diagnosis and treatment of soft tissue infections will result in progression of the infection and increased damage to the soft tissues and bone with eventual loss of structures and function.