

Surgical Management of Human Bite Injuries to the Hand

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ABSTRACT

Human bite injuries to the hand are high-risk wounds because of their polymicrobial contamination, proximity to joints and tendons, and tendency to appear deceptively minor at presentation. Clenched-fist injuries, commonly known as “fight bites,” are particularly dangerous because they frequently occur over the metacarpophalangeal joints and may penetrate the extensor tendon, joint capsule, cartilage, or bone. Delayed diagnosis or inadequate initial treatment can lead to cellulitis, abscess, septic arthritis, tenosynovitis, osteomyelitis, stiffness, amputation, and permanent functional loss. Surgical management requires early recognition, copious irrigation, careful exploration, timely debridement, drainage when indicated, broad-spectrum antibiotic therapy, and delayed closure in contaminated or infected wounds. Antibiotics alone are insufficient when deep infection or joint involvement is present. Early treatment pathways, including emergency department washout, ambulatory or day-case surgery, and rapid access to operative debridement, may reduce hospital stay and cost without compromising outcomes in selected patients. This review summarizes the microbiology, clinical assessment, surgical indications, operative principles, antibiotic strategy, and outcome considerations in human bite injuries to the hand.

KEYWORDS: human bite; hand infection; fight bite; clenched-fist injury; septic arthritis; surgical debridement; metacarpophalangeal joint; hand trauma.

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INTRODUCTION

Human bite injuries to the hand are clinically important because they combine mechanical trauma with heavy bacterial inoculation. Although some wounds may initially appear superficial, the hand's compact anatomy allows rapid spread of infection into tendon sheaths, joints, deep fascial spaces, and bone. For this reason, human bites to the hand should be approached as potentially serious surgical injuries rather than simple skin lacerations.

The most classic pattern is the clenched-fist injury, or “fight bite,” which typically occurs when a closed fist strikes another person's teeth. These injuries are frequently located over the dorsal metacarpophalangeal joint and may penetrate the extensor tendon and joint capsule. Joint penetration has been reported in a high proportion of clenched-fist injuries, making many authors recommend a low threshold for

operative exploration and treatment as septic arthritis until proven otherwise [1,2].

The main goals of management are prevention of deep infection, preservation of joint and tendon function, adequate drainage, appropriate antimicrobial coverage, and avoidance of long-term disability. Delayed presentation, established infection, or missed joint involvement markedly increases the need for operative debridement and repeat procedures [3–5].

Methods

This narrative review was developed from the provided literature synthesis on surgical management of human bite injuries to the hand. The review focused on timing of presentation, operative indications, debridement principles, microbiology, antibiotic coverage, closure strategy, complications, functional outcomes, and service models for

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early management. References are presented in numerical order according to their first appearance in the manuscript.

Epidemiology and Mechanism of Injury

Human bite injuries to the hand commonly occur during interpersonal violence, but they may also result from accidental bites, occupational exposure, seizures, sports, or self-inflicted injury. Clenched-fist injuries are particularly important because the tooth may penetrate the dorsal skin over the metacarpophalangeal joint while the hand is flexed. When the fist opens, the skin wound may move away from the deeper injury, causing underestimation of tendon or joint penetration.

This dynamic anatomy explains why small dorsal wounds over the metacarpophalangeal joint should be treated with suspicion. A wound that appears minor externally may communicate with the extensor mechanism, joint capsule, or metacarpal head. Failure to recognize this mechanism can result in delayed septic arthritis, cartilage destruction, osteomyelitis, and stiffness.

Microbiology

Human bite wounds are polymicrobial. Common organisms include streptococci, staphylococci, anaerobes, and *Eikenella corrodens*. Because of this mixed flora, empiric antibiotics must cover aerobic and anaerobic oral organisms. Infected or high-risk wounds generally require intravenous therapy initially, whereas selected early, clean wounds may be treated with oral antibiotics and close follow-up [6–9].

Antibiotic selection should also consider local resistance patterns, allergies, immune status, and severity of infection. However, antibiotics cannot replace surgical management when abscess, septic arthritis, tenosynovitis, devitalized tissue, foreign material, or osteomyelitis is present.

Initial Clinical Assessment

Evaluation begins with a detailed history of the mechanism, timing, location of injury, hand position at the time of trauma, contamination, prior treatment, tetanus status, and risk of blood-borne virus exposure. The clinician should specifically ask whether the injury occurred during a punch, because patients may not volunteer this information.

Physical examination should document wound location, swelling, erythema, purulence, tenderness, range of motion, neurovascular status, tendon function, and pain with passive motion. Dorsal wounds over the metacarpophalangeal joint require special attention. Examination should be performed with the hand in the position of injury when possible, especially with the metacarpophalangeal joint flexed, to determine whether the skin wound aligns with deeper tendon or joint injury.

Radiographs are recommended when there is suspicion of fracture, tooth fragments, foreign body, joint involvement, osteomyelitis, or delayed presentation. Laboratory studies may assist in monitoring infection but should not delay surgical treatment when deep involvement is suspected.

Indications for Surgical Management

A low threshold for operative treatment is recommended in human bite injuries to the hand, particularly clenched-fist injuries. Clear indications for surgical exploration and debridement include delayed presentation with swelling, pain, cellulitis, or purulence; established infection; abscess; tenosynovitis; septic arthritis; osteomyelitis; open fracture; deep injury to tendon, joint capsule, bone, vessel, or nerve; and retained tooth fragments [3,4,7,10].

Early wounds presenting within 24 hours without infection may be managed with copious irrigation, exploration, antibiotics, and close follow-up, with outpatient or day-case surgery if needed [11]. However, delayed presentation between one and seven days with infection usually requires formal operative debridement, drainage, and sometimes repeat washouts [3–5]. Late presentations beyond seven days with severe infection may require aggressive debridement, skeletal management, soft-tissue reconstruction, or even amputation in extreme cases [5,12].

Operative Principles

The key operative principles are adequate exposure, exploration of deep structures, irrigation, debridement, drainage, and avoidance of premature closure. The wound should be extended as needed to visualize the extensor tendon, joint capsule, metacarpal head, bone, and surrounding soft tissues. In clenched-fist injuries, the metacarpophalangeal joint should be carefully inspected because joint penetration may be present despite a small skin wound [2,4].

Copious irrigation is essential. All devitalized tissue, foreign material, purulence, and nonviable tendon or capsule should be removed. If septic arthritis is suspected, the joint should be opened, irrigated, and drained. Repeat debridement may be necessary in severe infections, especially when presentation is delayed or there is extensive contamination [4,5].

Open packing, drainage, and delayed closure are commonly used because primary closure of contaminated human bite wounds may increase infection risk. Tendon, nerve, vessel, fracture, or soft-tissue reconstruction should be planned according to the contamination level and viability of tissues. In contaminated wounds, definitive reconstruction may need to be delayed until infection is controlled.



Figure 1. "fight bite".

Closure Strategy

Primary closure is generally avoided in infected or heavily contaminated human bite wounds of the hand. Delayed primary closure or healing by secondary intention may be safer after debridement and infection control. In selected clean, early wounds without deep involvement, primary closure may be considered cautiously, but the hand is a high-risk anatomical site and close follow-up is essential.

When significant tissue loss occurs, reconstructive options may include local flaps, regional flaps, skin grafting, or more complex reconstruction. In cases of extensive dorsal hand soft-tissue loss after bite injury, flap coverage such as a reverse posterior interosseous artery flap has been described [12]. The reconstructive plan should prioritize infection control first, then durable coverage and function.

Antibiotic Therapy and Prophylaxis

Empiric antibiotics are essential in human bite injuries to the hand. Coverage should include *Eikenella corrodens*, streptococci, staphylococci, and anaerobes [6–9]. Intravenous antibiotics are generally used for established infection, deep involvement, systemic signs, immunocompromised patients, or delayed presentations. Oral antibiotics may be appropriate for early, clean wounds after adequate irrigation and assessment.

Antibiotics alone are inadequate when there is established infection, abscess, septic arthritis, flexor tenosynovitis, osteomyelitis, or devitalized tissue. In these situations, operative drainage and debridement are central to treatment [7,8].

Tetanus immunization status should be assessed. Human bites also require evaluation for blood-borne virus transmission

risk, including hepatitis B, hepatitis C, and HIV, depending on the exposure circumstances and local protocols [6,9,11].

Complications

Complications of human bite injuries to the hand include cellulitis, abscess, septic arthritis, extensor tendon injury, flexor tenosynovitis, osteomyelitis, cartilage destruction, joint stiffness, chronic pain, tendon adhesions, scarring, functional loss, and amputation. The risk of complications increases with delayed presentation, inadequate exploration, missed joint penetration, insufficient debridement, and inappropriate closure.

Septic arthritis of the metacarpophalangeal joint is one of the most serious complications of fight bites. Cartilage destruction can occur rapidly, and delayed treatment may lead to stiffness, instability, chronic infection, or need for arthrodesis or amputation.

Service Models and Timing

Early management pathways have been developed to reduce delays and avoid unnecessary prolonged admission. Ambulatory or day-case surgery may be safe and cost-effective in selected bite injuries when early emergency department washout, antibiotic therapy, close follow-up, and rapid access to the operating room are available [11,13].

However, outpatient pathways are not appropriate for all patients. Deep infection, systemic illness, immunosuppression, unreliable follow-up, severe pain, progressive swelling, suspected septic arthritis, tendon sheath involvement, or osteomyelitis should prompt admission and operative management.

The central principle is timely escalation. Early recognition and treatment generally lead to good or excellent functional outcomes, whereas delayed or inadequate management

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increases the risk of repeat operations, osteomyelitis, amputation, and permanent disability [3–5].

Discussion

Human bites to the hand are surgical infections until proven otherwise. The most important concept is that external wound size does not reliably predict deep injury. This is particularly true for clenched-fist wounds over the metacarpophalangeal joint, where tendon and joint penetration are common. For this reason, a small dorsal puncture wound after a fight should not be dismissed as minor trauma.

The literature supports early irrigation, broad-spectrum antibiotics, and a low threshold for operative exploration. Surgical debridement is especially important in delayed presentations and established infections. Antibiotics alone may temporarily reduce cellulitis but cannot adequately treat pus, necrotic tissue, septic arthritis, or deep space infection.

Closure strategy should be conservative. Primary closure of contaminated or infected hand bite wounds may trap bacteria and increase complications. Delayed closure after adequate wound control is often safer. When tissue loss is substantial, reconstructive planning should be staged and based on infection status, tissue viability, and functional requirements. Modern service models suggest that not every patient requires prolonged inpatient admission. Early, structured ambulatory pathways can be safe for selected patients, but only when rapid surgical access and close follow-up are guaranteed. The priority remains early recognition of high-risk wounds and timely operative intervention when needed.

Table 1. Surgical Management of Human Bite Injuries to the Hand According to Presentation

Clinical scenario	Recommended approach	Surgical considerations	Closure strategy
Early presentation <24 h, no infection	Irrigation, careful exploration, antibiotics, close follow-up	Assess for fight bite, tendon injury, joint penetration, tooth fragments	Usually leave open or close selectively only if clean and superficial
Clenched-fist injury over MCP joint	Low threshold for operative exploration	Treat as possible joint penetration or septic arthritis until excluded	Avoid primary closure if joint/tendon involvement or contamination
Delayed presentation 1–7 days with swelling/pain	Formal operative debridement and drainage	Evaluate for abscess, cellulitis, tendon sheath or joint involvement	Delayed closure or secondary intention
Purulence or abscess	Incision, drainage, irrigation, debridement	Culture when possible; repeat washout if needed	Leave open with drainage
Septic arthritis	Urgent operative joint irrigation and debridement	Open and irrigate joint; assess cartilage and capsule	Delayed closure after infection control
Flexor tenosynovitis	Urgent surgical drainage and sheath irrigation	Avoid delay due to risk of tendon necrosis and stiffness	Leave incisions open or loosely approximated
Osteomyelitis or late severe infection	Aggressive debridement, possible staged reconstruction	May require bone debridement, fixation, or amputation in extreme cases	Delayed reconstruction
Large soft-tissue defect	Debridement followed by reconstructive coverage	Consider graft, local flap, regional flap, or reverse PIA flap	Coverage after infection control

CONCLUSION

Human bite injuries to the hand require careful assessment and a low threshold for surgical management. Clenched-fist injuries over the metacarpophalangeal joints are particularly dangerous because they may penetrate the extensor tendon and joint capsule despite a small external wound. Management should include early irrigation, broad-spectrum antibiotics, tetanus and blood-borne virus risk assessment, and operative exploration or debridement when deep involvement or infection is suspected. Delayed presentation and established infection require formal surgical drainage and often repeat washouts. Optimal outcomes depend on early recognition, aggressive infection control, appropriate closure timing, and rehabilitation to preserve hand function.

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