Dog Bites and Clinical Management

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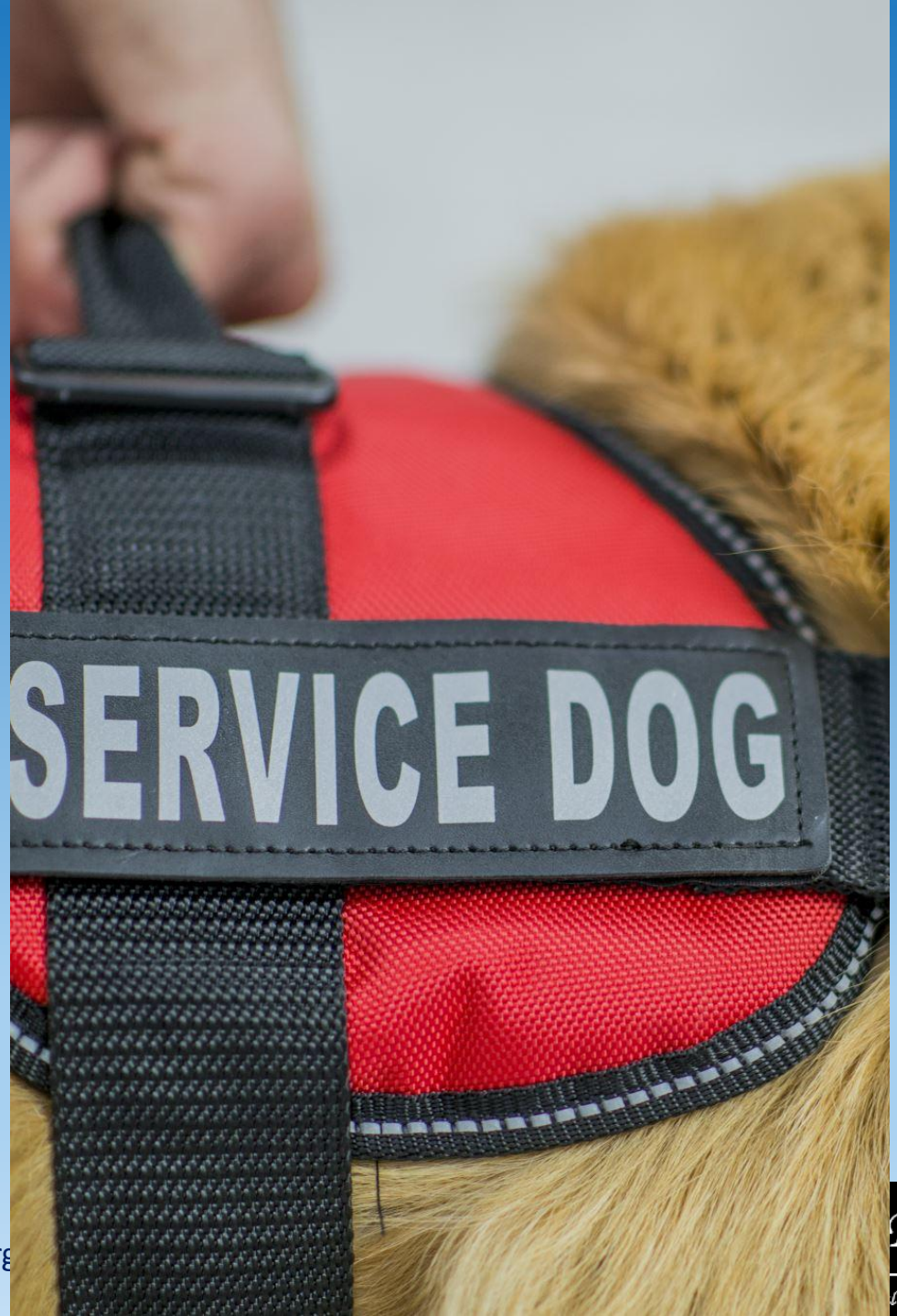

Disclosures

- None

Learning Objectives

- Upon completion of this lecture, learners will be able to:
- **Describe the epidemiology, morbidity, and mortality** of dog bite injuries across age groups and geographic settings, including populations at highest risk for severe outcomes.
- **Identify the polymicrobial pathogens** commonly associated with dog bite wound infections — including Pasteurella canis, Capnocytophaga canimorsus, and anaerobic organisms
- **Apply evidence-based wound management principles**, including appropriate irrigation techniques, wound closure strategies based on anatomic location and risk factors, indications for antibiotic prophylaxis, and selection of first-line and alternative antibiotic regimens for both adults and children.
- **Determine the need for tetanus and rabies immunoprophylaxis**, identify indications for specialist consultation and hospitalization, and recognize the psychological sequelae — including post-traumatic stress disorder — that may follow dog bite injuries in both pediatric and adult patients.

Purpose and Epidemiology

- 4.5–4.7 million dog bites occur annually in the U.S.
- ~885,000 seek medical care; ~370,000 ED visits
- ~30,000 reconstructive surgeries yearly
- Children (age 5–9) highest risk
- 75% occur at home with a known dog
- Infection develops in 10–20% of wounds

Background

- Dog bites represent a significant and growing global public health burden. In the United States alone, dog bites account for approximately 337,000 emergency department visits annually and generate up to $2 billion in medical costs per year (Ortiz & Lezcano, 2023).

Background

- An estimated 4.5 million Americans are bitten by dogs each year, with roughly 800,000 requiring medical attention (Ortiz & Lezcano, 2023).
- Approximately 10,000 hospitalizations and 20 deaths occur annually in the U.S. from dog and cat bites combined (Talan et al., 1999).
- Globally, bite rates range from 160 to 1,800 per 100,000 inhabitants (Duperrex et al., 2009).

Epidemiology and Demographics

- Dog bites account for approximately 60–90% of all animal bites and 1% of all emergency department visits (Oehler et al., 2009; Ellis & Ellis, 2014).
- Children, particularly boys aged 5–9 years, are disproportionately affected, with rates of 17.6 per 100,000 children (Ortiz & Lezcano, 2023).
- Children under 5 years have the highest rate of severe wounds (Duperrex et al., 2009).
- Most bites involving infants and preschoolers occur in their own homes with a familiar dog; adolescents are more often bitten by unfamiliar dogs (Ortiz & Lezcano, 2023).

Epidemiology and Demographics

- In adults, bites most commonly involve the hands and extremities; in children, the head, face, and neck are most frequently affected (51–74% of pediatric bites) (Duperrex et al., 2009; Oehler et al., 2009).
- Pit bull terriers, Rottweilers, and German shepherds are the breeds most commonly reported in serious attacks (Oehler et al., 2009).
- Larger breeds can exert greater jaw pressure, causing more severe crush injuries (Oehler et al., 2009).

Morbidity and Mortality

- Morbidity:
- Worldwide, approximately 50% of dog bites leave permanent scars, 10% require sutures, 5–21% require specialist attention, and 1–5% require hospitalization (Ortiz & Lezcano, 2023).
- Infection rates for dog bites range from 3% to 18%, compared with 28–80% for cat bites (Talan et al., 1999; Singer & Dagum, 2008).

Morbidity and Mortality

- Morbidity: continued
- Complications include cellulitis, abscess formation, septic arthritis, osteomyelitis, tendon injury, and nerve damage (Talan et al., 1999; Oehler et al., 2009).
- Disseminated infections can lead to septic shock, meningitis, and endocarditis, particularly with Capnocytophaga canimorsus and Pasteurella multocida (Oehler et al., 2009).

Morbidity and Mortality

- Mortality:
- In high-income countries, the death rate from dog bites is 0.004 to 0.05 per 100,000 inhabitants (Duperrex et al., 2009).
- In the U.S., approximately 20 deaths per year are attributed to dog attacks. From 1979 through 1994, 279 dog-bite-related fatalities were recorded (Talan et al., 1999; CDC MMWR, 1997).

Morbidity and Mortality

- Mortality:

- In Europe, 45 fatalities occurred in 2016 (incidence 0.009 per 100,000), with a significant upward trend over time (Sarenbo & Svensson, 2021).
- In low- and middle-income countries, mortality is substantially higher due to rabies, with death rates from animal bites reaching 2.5 per 100,000 children in Asian countries (Duperrex et al., 2009).
- A level I trauma center study found that pit bull attacks were associated with higher Injury Severity Scale scores, higher risk of a Glasgow Coma Scale ≤8 (17.2% vs. 0%), and higher mortality (10.3% vs. 0%) compared with other breeds (Bini et al., 2011).

Microbiology of Dog Bite Infections

- Dog bite wound infections are typically polymicrobial, with a median of 5 bacterial isolates per infected wound (Talan et al., 1999).
- Common aerobic pathogens:
- Pasteurella canis (most common isolate from dog bites, found in ~50% of infected wounds) (Talan et al., 1999)
- Staphylococcus spp. (including MRSA)
- Streptococcus spp.
- Moraxella spp.
- Neisseria spp.
- Capnocytophaga canimorsus (Oehler et al., 2009)

Microbiology of Dog Bite Infections

- Common anaerobic pathogens:
- Fusobacterium spp.
- Bacteroides spp.
- Porphyromonas spp.
- Prevotella spp. (Talan et al., 1999)

Microbiology of Dog Bite Infections

- Special considerations:
- Capnocytophaga canimorsus sepsis carries a case mortality of 31% and is particularly dangerous in asplenic, immunocompromised, and chronic alcohol-using patients (Oehler et al., 2009).
- MRSA is an emerging concern, with community-acquired strains (USA300 clone) cycling between pets and owners (Oehler et al., 2009).
- Aerobes and anaerobes together are isolated from 56% of infected wounds; aerobes alone from 36% (Talan et al., 1999).

Initial Assessment and Wound Evaluation

- A systematic approach to evaluation includes:
- History: Circumstances of the bite (provoked vs. unprovoked), time elapsed, animal identification, vaccination status of the animal, and patient's tetanus/rabies immunization history (Ortiz & Lezcano, 2023; Oehler et al., 2009).
- Physical examination:
  - Wound type classification: puncture, laceration, crush injury, avulsion
  - Depth assessment and exploration for tendon, bone, joint capsule, or neurovascular involvement
  - Assessment of neurovascular function (pulses, sensation) and range of motion of adjacent joints (Ortiz & Lezcano, 2023)
  - Documentation of wound location, size, and degree of contamination

Initial Assessment and Wound Evaluation

- Imaging: Plain radiographs if fracture, bone penetration, or retained foreign body is suspected. CT or MRI may be indicated for deep wounds or suspected osteomyelitis (Oehler et al., 2009).
- Laboratory studies: Generally not required unless infection, sepsis, or extensive injury is suspected (Ortiz & Lezcano, 2023).

Wound Management

- **Irrigation and Debridement**
- Copious irrigation with normal saline or tap water using a 20-mL or larger syringe irrigation is the cornerstone of wound management (Oehler et al., 2009; Ellis & Ellis, 2014).
- Debridement of devitalized tissue and removal of foreign bodies is essential (Ortiz & Lezcano, 2023).
- The synergistic effect of irrigation combined with antibiotic prophylaxis significantly reduces infection rates: 17% with irrigation alone vs. 75% with neither irrigation nor antibiotics (Coccolini et al., 2024).

Wound Management

- **Wound Closure**
- The decision regarding wound closure depends on wound characteristics, location, and infection risk:
- Primary closure may be performed for low-risk wounds, particularly facial lacerations (which benefit from the face's rich vascular supply and lower infection risk) (Stevens et al., 2014; Yu et al., 2025).
- Puncture wounds and scratches should heal by secondary intention (Singer & Dagum, 2008).
- Wounds of the hand carry higher infection risk with primary closure and are generally left open (Stevens et al., 2014).

Wound Management

- Delayed primary closure (3–5 days) may be considered for large, heavily contaminated lacerations (Singer & Dagum, 2008).
- A Cochrane review found very low-certainty evidence of no difference in infection rates between primary closure and no closure for dog bite wounds, with moderate evidence of a small cosmetic benefit from primary closure (Bhaumik et al., 2019).

Antibiotic Therapy

- **Prophylaxis Indications**
- Antibiotic prophylaxis should be considered for bites at increased risk of infection (Ortiz & Lezcano, 2023; Stevens et al., 2014):
- Puncture wounds (OR 4.1 for infection) (Tabaka et al., 2015)
- Wounds undergoing primary closure (OR 3.1 for infection) (Tabaka et al., 2015)
- Hand wounds (2% infection with antibiotics vs. 28% without; OR 0.1) (Coccolini et al., 2024)
- Wounds over cartilaginous structures (Appelbaum et al., 2024)
- Immunocompromised patients
- Wounds presenting >8 hours after injury (Oehler et al., 2009)

Antibiotic Therapy

Recommended Regimens (3–7 days)

Adults:

First line: Amoxicillin/clavulanate 875/125 mg every 12 hours

Alternative (penicillin allergy): Clindamycin 300 mg TID plus ciprofloxacin 500 mg BID

Antibiotic Therapy

- Children:
- First line: Amoxicillin/clavulanate 45 mg/kg/day divided every 12 hours
- Alternative: Clindamycin 10–25 mg/kg/day divided every 6–8 hours plus TMP/SMX 8–10 mg/kg/day (trimethoprim component) divided every 12 hours

Antibiotic Therapy

- Pregnant patients with penicillin allergy:
- Clindamycin 300 mg TID plus TMP/SMX 160 mg (trimethoprim component) every 12 hours (avoid TMP/SMX in first and third trimesters) (Ortiz & Lezcano, 2023)

Antibiotic Therapy

- **Antibiotic Selection Rationale**
- Amoxicillin/clavulanate provides excellent coverage against Pasteurella spp., Capnocytophaga spp., anaerobes, and susceptible S. aureus (Oehler et al., 2009). Monotherapy with dicloxacillin, cephalexin, clindamycin, or erythromycin should be avoided, as Pasteurella spp. are usually not susceptible to these agents (Oehler et al., 2009).

Antibiotic Therapy

- **Treatment of Established Infection**
- Obtain wound cultures (aerobic and anaerobic) before initiating therapy (Oehler et al., 2009).
- Empiric therapy should cover both aerobic and anaerobic organisms (Stevens et al., 2014).
- Indications for hospitalization: fever, sepsis, spreading cellulitis, substantial edema or crush injury, loss of function, immunocompromised status, or noncompliance (Oehler et al., 2009).

Immunoprophylaxis

- Tetanus toxoid booster should be administered for dirty wounds if >5 years since last dose, and for clean wounds if >10 years (Stevens et al., 2014).
- Tdap is preferred over Td if not previously given (Stevens et al., 2014).
- Patients who have not completed the primary series should receive it along with tetanus immunoglobulin (Oehler et al., 2009).

Immunoprophylaxis

- **Rabies**
- The need for rabies postexposure prophylaxis (PEP) should be evaluated for every patient with a dog bite (Ortiz & Lezcano, 2023; Ellis & Ellis, 2014).
- Bites that do not break the skin generally do not require rabies PEP (Ortiz & Lezcano, 2023).
- Rabies PEP consists of rabies immunoglobulin at presentation plus vaccination on days 0, 3, 7, and 14 (Ellis & Ellis, 2014).
- Consultation with local public health authorities is strongly recommended for bites from stray animals, unprovoked attacks, animals that cannot be apprehended, or animals with unknown vaccination status (Oehler et al., 2009).
- In low- and middle-income countries, rabies from dog bites remains a major cause of mortality (Duperrex et al., 2009).

Special Populations and Considerations

- **Pediatric Patients**
- Children under 5 years sustain the most severe wounds, predominantly to the head, face, and neck (Duperrex et al., 2009).
- Neurosurgical consultation may be indicated in children with possible cranial injury from bites (Oehler et al., 2009).
- Plastic surgery consultation should be considered for most head and neck bites (Oehler et al., 2009).

Immunocompromised Patients

- Asplenic patients are at particular risk for fulminant Capnocytophaga canimorsus sepsis (31% case mortality) (Oehler et al., 2009).
- Lower threshold for antibiotic prophylaxis and hospitalization (Oehler et al., 2009).

Hand Injuries

Hand infection rate: 28–36%

5–10% of patients require hospitalization

Mean inpatient stay: 3–4 days

Mean inpatient stay: 3–4 days

Orthopedic consultation is important, along with elevation, immobilization, and hand physiotherapy (Oehler et al., 2009).

Higher complication rates without antibiotic prophylaxis (Coccolini et al., 2024).

Psychological Sequelae

The psychological impact of dog bites is frequently underestimated:

Among 22 children bitten by dogs, 55% (12/22) developed symptoms of post-traumatic stress disorder (PTSD) within 2–9 months (Peters et al., 2004).

Violent attacks inflicting multiple and/or deep wounds are associated with higher risk of PTSD (Peters et al., 2004).

A study of 358 children found that severe injuries were significantly associated with PTSD development, and acute stress disorder was an early predictive indicator (Ji et al., 2010).

Psychological Sequelae

In adults, 4.1% of dog bite victims were clinically diagnosed with PTSD and 6.5% with specific phobias; 59.5% reported work absence (Tulloch et al., 2026).

Psychological sequelae range from fear and avoidance of dogs to full PTSD in both children and adults (Ortiz & Lezcano, 2023).

Patients and caregivers should be counseled about normal reactions to trauma and encouraged to seek care if symptoms persist (Ortiz & Lezcano, 2023).

Prevention and Reporting

Education of children about safe behavior around dogs is a key prevention strategy (Duperrex et al., 2009).

Risk factors include male gender, households with dogs, certain breeds, male dogs, and leashed dogs (Duperrex et al., 2009).

In most U.S. states, physicians are required by law to report animal bites (Ellis & Ellis, 2014).

Re-examination should be scheduled at 48 hours after initial treatment (Oehler et al., 2009).

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