Fascial space infections

د.سلوان يوسف

The majority of infections of the head and neck region are of odontogenic origin, and they manifest with classic signs and symptoms of an infectious disease process (e.g., pain, swelling, heating, surface erythema, limitation of function).

Most patients with odontogenic infection are managed in an outpatient setting with incision and drainage and tooth extraction, and they follow a predictable clinical course, nevertheless these infections may carry a significant risk of morbidity and mortality because of their close proximity to vital anatomic structures and increasing microbial antibiotic resistance.

Mixed aerobic-anaerobic flora are the organisms most commonly identified in odontogenic infections in otherwise healthy patients. Serious dental infection spreading beyond the socket is more commonly the result of pulpal infection than of periodontal infection. Once infection extends past the apex of the tooth, the pathophysiological course of a given infectious process can vary, depending on the number and virulence of the organism, host resistance, and anatomy of the involved area.

When dental infection spreads deeply into soft tissue rather than exiting superficially through oral or cutaneous routes, fascial spaces can be affected. The concept of fascial “spaces” is based on the notion that all spaces exist only potentially until fasciae are separated by pus, blood, drains, or a surgeon’s finger.

Deep fascial space infections can occur as a result of odontogenic, pharyngeal and tonsillar infections, trauma, reconstructive surgery, cancer surgery, and sialadenitis of major salivary glands.

Imaging

Plain film radiographs such as orthopantogram, dental periapical radiographs are limited to the identification of the causative teeth in odontogenic infection. For severe infections of the head and neck, contrast-enhanced CT is the most widely used imaging modality. When contrast medium is used, it is necessary to evaluate renal function by measuring serum creatinine.

MRI has a longer acquisition time, requiring patients to lie in the supine position for an extended period of time, which may precipitate airway obstruction in the patient with an infection of moderate or high severity.

Ultrasound has the advantages of avoiding radiation; however, ultrasound for deep neck structures is a sensitive technique and operator dependent.

Classification of fascial spaces

Fascial spaces can be classified according to their relation to the source of infection from the upper or lower jaw. Another classification of fascial spaces is **primary spaces**; which are directly adjacent to the origin of infections, and **secondary spaces**; that become involved following the spread of infection to the primary spaces. Fascial spaces of the head and neck can be generally divided into spaces of the head or face, suprahyoid, infrahyoid and spaces of the total neck:

Face

- ✓ Buccal space.
- ✓ Canine (infraorbital) space.
- ✓ Masticator spaces.

Suprahyoid

- ✓ Sublingual
- ✓ Submandibular
- ✓ Submental
- ✓ Lateral pharyngeal
- ✓ Peritonsillar

Infrahyoid

- ✓ Anterovisceral (pretracheal)

Space of total neck

- ✓ Retropharyngeal
- ✓ Danger space
- ✓ Space of carotid sheath

Complications of fascial space infections

The most important life threatening complications of fascial space infections include:

- ✓ Airway obstruction.
- ✓ Necrotizing fasciitis.
- ✓ Descending necrotizing mediastinitis.
- ✓ Internal jugular vein thrombosis.
- ✓ Cavernous sinus thrombosis.
- ✓ Carotid artery pseudoaneurysm or rupture.
- ✓ Systemic inflammatory response syndrome.

Systemic inflammatory response syndrome (SIRS)

It is an exaggerated defense response of the body to a noxious stressor such as infection, trauma, surgery, acute inflammation, ischemia or reperfusion, or malignancy to localize and then eliminate the endogenous or exogenous source of the insult. It involves the release of acute-phase reactants which are direct mediators of widespread autonomic, endocrine, hematological and immunological alteration in the subject.

Even though the purpose is defensive, the dysregulated cytokine storm has the potential to cause massive inflammatory cascade leading to reversible or irreversible end-organ dysfunction and even death.

SIRS with a suspected source of infection is termed **sepsis**. Sepsis with one or more end-organ failure is called **severe sepsis** and with hemodynamic

instability in spite of intravascular volume repletion is called **septic shock**. Together they represent a physiologic continuum with progressively worsening balance between pro and anti-inflammatory responses of the body.

Diagnostic criteria of SIRS

If two or more of the following exist:

- ✓ 36° C < Temperature > 38° C.
- ✓ Pulse > 90 beats/min.
- ✓ Respiratory rate > 20 breaths/min or partial pressure of CO2 less than 32 mmHg.
- ✓ White blood cell count < 4000 cells/mm^3 or > 12,000 cells/mm^3 or over 10% immature forms or bands.

Principles of management of fascial space infections

1. Determination of the severity of infection

Determining the severity of an infection requires assessment of three main factors: (1) airway patency, (2) anatomic location, and (3) rate of progression.

Airway patency

Signs of impending upper airway obstruction include pooling or drooling of saliva, use of the accessory muscles of respiration, orthopnea or stridor (or both), and the tripod position. If a patient develops signs of impending upper airway obstruction, this should alert the practitioner to the urgency of securing the patient's airway. The surgeon must always be prepared to establish a surgical airway if the anesthesia team is unable to do so with noninvasive airway techniques.

Anatomic location

Accurate determination of the anatomic location of the infection allows the surgeon to stratify the severity of the infection into low-, moderate-, and high-risk categories, based on the likelihood of swelling in the involved anatomic

spaces causing airway obstruction; hindering access to the airway for intubation; or directly impinging on vital structures, such as the brain or heart.

- ✓ Low risk spaces include; vestibular, subperiosteal, canine space (infraorbital) and buccal.
- ✓ Moderate risk spaces include; submandibular, submental, sublingual, pterygomandibular, submasseteric, superficial and deep temporal.
- ✓ High risk spaces include; retropharyngeal, pretracheal, danger space (space 4), mediastinum and intracranial infection.

The clinical presentation of the patient is dependent on the involved anatomic spaces, the most common subjective complaints in patients are dysphagia, odynophagia and trismus

Rate of progression

Obtaining history from the patient can determine the rate of progression, a patient with a massive swelling that started only in the past few hours has a more virulent infection than one with a similar swelling of long duration.

2. Evaluation of host defenses

The presence of systemic diseases such as metabolic disorders e.g., diabetes mellitus), immunodeficiency disorders e.g., long-term steroid use, human immunodeficiency virus (HIV) infection and the presence of renal dysfunction can worsen the clinical course of infections and predispose to infection with atypical pathogens.

3. Determination of the setting of care

In general, low-severity infections in healthy patients can be managed with outpatient surgery, local anesthesia or conscious sedation, oral antibiotics and analgesics, and periodic follow-up. However, hospital admission for even low-severity infections may be indicated when general anesthesia is necessary such as for uncooperative child or inpatient management of systemic conditions is required, such as control of diabetes or reversal of anticoagulation.

Moderate to severe infections are usually managed in the hospital, which allows for securing the airway, incision and drainage of deeper anatomic spaces, intravenous fluids and medications, advanced imaging, closer monitoring, and consultation with other specialists.

Criteria for hospital admission

- ✓ Temperature > 38° C.
- ✓ Dehydration.
- ✓ Threat to the airway or vital structures.
- ✓ Infection in moderate- or high-severity anatomic spaces.
- ✓ Need for general anesthesia.
- ✓ Need for inpatient control of systemic disease.

4. Medical treatment

The role of medical therapy in infections is primarily supportive of the surgical management, and it consists of appropriate antibiotic therapy, identification and management of existing comorbidities, and support with attention to hydration and nutrition.

Principles of antibiotic therapy

1. Surgery to remove the cause and establish drainage is primary. Antibiotics are adjunctive treatment.
2. Use therapeutic antibiotics only when clinically indicated.
3. Use specific antibiotic therapy as soon as possible, based on culture and sensitivity testing.
4. Use evidence-based medicine and guidelines when available.
5. Use the narrowest spectrum empiric antibiotic effective against the most likely pathogens.
6. Use the least toxic indicated antibiotic, considering drug interactions.
7. Use combination antibiotics only when necessary.
8. Minimize the duration of antibiotic therapy, as appropriate, to the presenting type of infection.

9. Use the most cost-effective, appropriate antibiotic.
10. Use prophylactic antibiotics only where proved effective or according to professional guidelines.

5. Surgical treatment

It includes:

- ✓ Removal of the cause of infection.
- ✓ Incision and drainage of the involved spaces.
- ✓ Continuous clinical and radiographic assessment.

Methods of drainage

- Through the root canal after access opening.
- Through the socket by extraction of the offending tooth.
- Through fenestration of alveolar bone using surgical handpiece and bur, made at the level of the root apex, to drain periapical abscess, after reflection of a semilunar mucoperiosteal flap.
- Through incision and drainage of an abscess.

Timing of drainage

Early incision and drainage of all deep fascial spaces affected by cellulitis or abscess can hasten resolution, abort the spread of the infection into deeper anatomic spaces that involve a greater threat to the airway and other vital structures, and is not associated with increased complications.

The incision and drainage of fascial spaces allows for insertion of culture swabs for sampling of the infecting pathogens.

Indications of incision and drainage

- When there are signs of accumulation of pus, ideally abscess should be drained when fluctuant, prior to spontaneous rupture and drainage.

- When the involved compartment is inaccessible; like **pterygomandibular** or **pharyngeal spaces**, where it is not possible to elicit the classic signs of suppuration, such as; when there is no improvement with adequate doses of antibiotic, recurrence of pyrexia or a sudden increase in temperature and severe trismus.
- Serious and rapidly evolving infections of the neck and floor of the mouth, like Ludwig's angina.

The following principles should be used when possible with incision and drainage:

1. Incise in healthy skin and mucosa when possible. An incision placed at the site of maximum fluctuance where the tissues are necrotic or beginning to perforate can result in a puckered, unesthetic scar.
2. Place the incision in an esthetically acceptable area, such as under the shadow of the jaw or in a natural skin fold or crease.
3. When possible, place the incision in a dependent position to encourage drainage by gravity.
4. Dissect bluntly, with a closed surgical clamp or finger, through deeper tissues and explore all portions of the abscess cavity thoroughly so that compartmentalized areas of pus are disrupted and excavated. Extend the dissection to the roots of teeth responsible for the infection. **Intraorally**, in vestibular abscess, the pus accumulates under the mucosa with no intervening vital structures, so incision and drainage is made by the scalpel through the abscess cavity, here scalpel blade no. 11 is preferably used.
5. Generally all portions of the abscess cavity should be explored to ensure evacuation of all compartments, sometimes through and through drainage is necessary.
6. Place a drain and stabilize it with sutures.
7. Consider the use of through-and-through drains in bilateral, submandibular space infections.

8. Drains should not be left in place for an overly extended period; remove them when drainage becomes minimal. The presence of the drain itself can produce some exudate and can be a portal for secondary bacterial invaders.
9. Clean wound margins daily under sterile conditions to remove clots and debris.
10. **Frequent re-evaluation**

Follow-up of the initial therapy is important because:

1. Infections can progress into deeper anatomic spaces even after thorough drainage of all spaces affected by cellulitis or abscess.
2. Failure of host response to the infection may occur, especially in the setting of comorbidities that compromise the immune system.
3. The incidence of antibiotic-resistant bacteria in head and neck infections is increasing.

If hospitalized, the patient can be discharged when the infection subsides with minimal or no drainage, stable airway, the patient resume oral feeding, control of any systemic disease and ambulation.

Failure of treatment

Deterioration of the clinical course of infection after treatment may be caused by:

- ✓ Inadequate surgery; undrained pus.
- ✓ Depressed host defense such as in poorly controlled diabetes.
- ✓ The presence of foreign bodies such as plates or dental implant.
- ✓ The presence of devitalized tissues such as sequestrum in osteomyelitis.
- ✓ Presence of tumor.
- ✓ Problems with antibiotic selection, dose, toxicity or compliance.
- ✓ Superinfection or reinfection.
- ✓ Obstruction of anatomic drainage such as in sialolithiasis and sinusitis.