

Management of odontogenic infections and sepsis: an update

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Abstract

The management of odontogenic infections has improved over recent decades, but further improvements are still required. The ongoing education of GDPs and their dental teams on this issue continues to be important, especially during the current COVID-19 pandemic, where remote triage poses additional difficulties and challenges.

Odontogenic infections can lead to sepsis, a potentially life-threatening condition caused by the body's immune system responding in an abnormal way. This can lead to tissue damage, organ failure and death. A patient with non-odontogenic-related infection could also present with sepsis at a dental practice. Early recognition and prompt management of sepsis improves outcomes. GDPs and their dental teams should be trained in the recognition and management of sepsis. Age-specific sepsis decision support tools have been developed by the UK Sepsis Trust to help dental staff recognise and manage patients with suspected sepsis.

The aim of this article is to provide an update on the management of odontogenic infections and sepsis.

Introduction

Although the management of odontogenic infections has improved over recent decades, further improvements are needed and the ongoing education of GDPs and their dental teams on this issue is essential. In addition, the COVID-19 pandemic has imposed new difficulties and challenges; for example, telephone triage and prescription of antibiotics, and it is important to be up-to-date with current guidelines.^{1,2}

Odontogenic infections can lead to sepsis,^{3,4} a potentially life-threatening condition caused by the body's immune system responding abnormally. This can lead to tissue damage, organ failure and death.⁵ A patient with non-odontogenic-related infection could also present with sepsis at a dental practice.

Early recognition and prompt effective treatment of sepsis improves outcomes.⁵ The dental team should be trained in the principles of the management of sepsis.⁶ Age-specific sepsis decision support tools have been developed by the UK Sepsis Trust⁷ to assist the dental team to recognise and manage patients with suspected sepsis.

The aim of this article is to provide an update on the management of odontogenic infections and sepsis in the dental practice.

Management of odontogenic infections

The morbidity and mortality rate of odontogenic infections has dropped significantly over the past 70 years.^{8,9,10} This dramatic drop is undoubtedly linked to the discovery of antibiotics, the improvement of the general population health standards, and a better understanding of appropriate medical and surgical management of these cases.

Further improvements are needed and ongoing education of the dental team on this issue is very important.

Odontogenic infections pass through three key stages:¹¹

- Stage 1: 1–3 days; soft and mildly tender swelling
- Stage 2: 2–5 days; hard, red and severely sore swelling
- Stage 3: 5–7 days; abscess formation.

There is a strong belief that once the abscess has formed, surgical drainage is mandatory to achieve resolution.¹² Medical management has a role in selected cases.¹³

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Principles of effective management of odontogenic infections

Seven principles have been proposed to achieve the best outcome in managing odontogenic infections:¹¹

1. Establish the severity of the infection
2. Assess host defences
3. Elect the setting of care
4. Surgical intervention
5. Medical support
6. Antibiotic therapy
7. Frequently evaluate the patient.

Establish the severity of infection

A careful history and thorough clinical examinations are essential to determine the severity of any infection. History-taking will highlight factors like immune system competence and the level of systemic reserves to fight infections. A physical examination can identify clinical observations outside normal limits. Several clinical and haematological parameters have been used as prognostic indicators for the severity of the infection.

C-reactive protein (CRP), fever and anatomical locations have been investigated for the assessment of the extent of odontogenic infections and presumed duration of hospital stay.¹⁴

Additional factors must be considered to establish the infection severity:

- Anatomical location
- Airway compromise.

There are a number of potential spaces between the musculoskeletal head and neck structures and the regional fasciae and organs better known as fascial spaces. A summary of these spaces and their level of risk^{11,12} is found in Table 1.

In healthy and systemically well patients without trismus, infections of low-risk spaces can be initially treated in a primary care dental practice, while infections spreading to higher risk spaces should be managed more aggressively and may need to be treated in a secondary care centre.

Ludwig's angina

Ludwig's angina was described by Karl Friedrich Wilhelm von Ludwig in 1836 as a rapidly and frequently fatal progressive gangrenous cellulitis and oedema of the soft tissues of the neck and floor of the mouth.¹⁵ Thankfully, mortality rates have reduced significantly with the introduction of antibiotics, improved oral and dental hygiene, and timely surgical intervention.¹⁵ The majority of Ludwig's angina infections are odontogenic;¹⁶ peritonsillar or parapharyngeal abscesses, mandibular fractures, oral lacerations/piercing and submandibular sialoadenitis are other

Table 1 Risks associated with anatomical location

| Risk | Low | Moderate | High | Extreme |
|--------|--------------|-------------------|--------------------|------------------------|
| Spaces | Vestibular | Submandibular | Lateral pharyngeal | Mediastinum |
| | Infraorbital | Submental | Retropharyngeal | Intracranial infection |
| | Buccal | Sublingual | Pretracheal | |
| | | Pterygomandibular | | |
| | | Submasseteric | | |
| | | Temporal | | |

Box 1 Factors that can compromise the immune system

- Diabetes steroid therapy
- Organ transplants
- Malignancy
- Chemotherapy
- Chronic renal disease malnutrition
- Alcoholism.

recognised causes.¹⁵

A compromised airway is synonymous with Ludwig's angina and the initial assessment of a patient with Ludwig's angina should follow the familiar 'Airway, Breathing, Circulation, Disability, Exposure' (ABCDE) approach. Signs of a compromised airway in these patients could include noisy (gurgling) breathing with drooling saliva, stridor, dyspnoea, tachypnoea, tachycardia, dysphagia and trismus. The initial immediate management usually includes positioning the patient in an upright position and administering oxygen 15 litres/minute,¹⁵ while colleagues call 999 for an ambulance.

Assess host defences

A healthy immune system is essential to the maintenance of host defence against infection. Multiple medical conditions can affect it.¹⁷ Box 1 summarises the common factors that can cause immune system compromise.

The concept of 'physiologic reserve' represents a significant driver of outcome in patients fighting infection. This can be defined as the capability of an organ to carry out its activity under stress.¹⁸ Age is an essential factor that is inversely related to the physiologic reserve; that is, decreased respiratory, cardiovascular and metabolic reserve.¹⁹

Elect the setting of care

An uncomplicated localised dental abscess in a healthy young person, who does not show signs and symptoms of a worsening immune

response, can be safely treated in a dental practice. Early and adequate intervention is essential in order to prevent avoidable deterioration with invasion of adjusted anatomical spaces and symptoms of sepsis (Fig. 1).

Similarly, severe neck infection in an immunocompromised elderly person warrants treatment in a secondary care setting. The clinical decision to choose the setting of care is not always straightforward though, prompting the need for clear secondary care referral criteria. Although there are no agreed national guidelines on when to admit to a secondary care setting, criteria for hospital admission have been proposed^{2,20} (Box 2).

A careful history, thorough clinical examinations and a high index of suspicion will enable the GDP to diagnose and appropriately manage patients presenting with odontogenic sepsis.

Surgical intervention

Early surgical intervention has been advocated to improve the clinical outcome of odontogenic infection. The dramatic improvement in the outcome of severe odontogenic infection is directly linked to the immediate establishment of a safe airway, followed by early surgical intervention.

Once the airway has been deemed patent and not at risk of being compromised, in either a hospital setting or dental practice, the principles of management are very similar. Thorough knowledge of head and neck anatomy will

enable the surgeon to access the abscess cavities using incisions in safe places without damaging any vital structures like blood vessels or nerves. Most of the odontogenic infections can be drained through intraoral access.

Five principles must be followed:^{11,12}

- Elimination of the source of the infection. This can be achieved by either removing the tooth or commencing root canal treatment
- Incisions to be made on healthy skin or mucosa
- Blunt dissection to explore the abscess cavity without damaging vital structures A microbiology swab should be obtained
- Copious irrigations will ensure the dilution of the bacterial load
- Drainage is maintained by placement of a drain to keep the abscess cavity open.

Blunt dissection is achieved by inserting a closed haemostat, then open it at a depth of penetration and remove the instrument while it is still open. A haemostat should never be closed while it is inside the wound. Different surgical drains are available to use and should be removed when the drainage ceases, usually between 48–72 hours.²¹

Although abscess formation takes place between the fifth and seventh days, early elimination of the infection source and surgical intervention will decompress the involved anatomical spaces.¹⁴ Relying on antibiotics only in relieving dental infection is likely to be less effective and can cause antimicrobial resistance.²²

Two of the challenges to performing adequate drainage of any odontogenic infection in dental practice are:²³

1. Achieving adequate local anaesthesia
2. Risk of spreading the infection to other anatomical spaces.

The ability to deliver safe, adequate local anaesthesia is essential for any dental procedure. The mechanism of action of the local anaesthetic solution depends on the tissue pH. In the presence of infection, tissue pH becomes more acidic, which slows down the degree of ionisation, resulting in less optimal or failed anaesthesia.²³

To overcome this problem, the injection of the anaesthetic solution at a distance from the inflammatory site is required (nerve blocks). It will also avoid infection spread to different tissue spaces.

Medical support

Although surgical drainage is the classic approach to most of the odontogenic infection, medical support has a critical role in controlling



Fig. 1 a) Even a mild pericoronitis b) if left untreated may progress to the formation of an abscess that could expand in the submandibular and submental spaces c) or further to the neck and pretracheal spaces d) requiring extensive drainage and airway protection through a tracheostomy

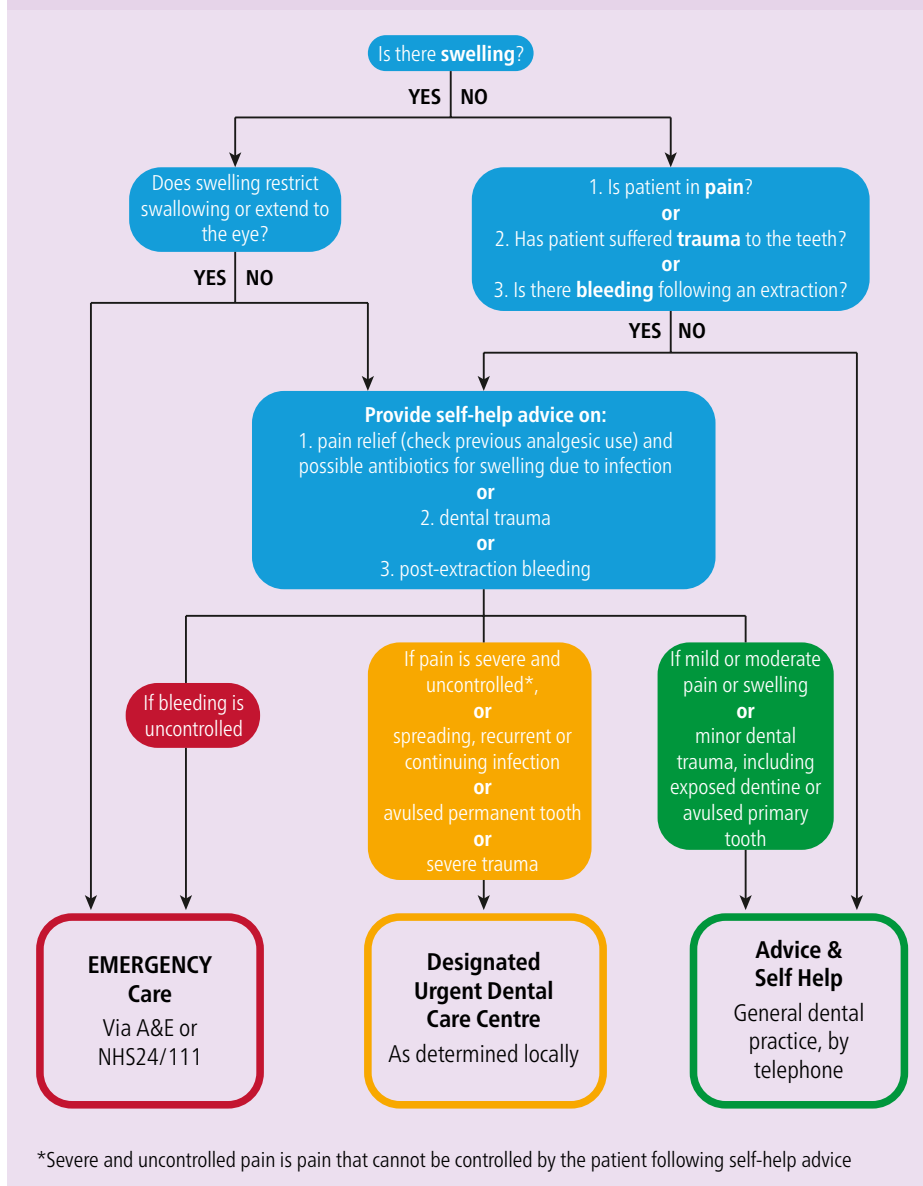
Box 2 Criteria for referral to secondary care^{2,20}

- Difficulty in swallowing and dehydration
- Threat to the airway or vital structures
- Infection in moderate- or high-severity anatomic spaces
- Involvement of orbital contents
- Need for general anaesthesia
- Need for inpatient control of systemic disease.

Table 2 Recommended antibiotics and doses^{1,28}

| Issue to treat | Antibiotic dose |
|---|--|
| First-line antibiotics for dental abscess in dental practices (adults and children more than 12 years) | Amoxicillin 500 mg TDS for five days (the dose can be doubled in severe infection) |
| | Phenoxymethylpenicillin 500 mg QDS for five days (the dose can be doubled in severe infection) |
| | Metronidazole 400 mg TDS should be used as an alternative if the patient is allergic to penicillin or as adjunct to the above antibiotics in spreading infection |
| Second-line antibiotics for dental abscess (if a patient has not responded to the first-line treatment) | Clindamycin 150 mg QDS for five days |
| | Co-amoxiclav 375 mg TDS for five days |
| | Clarithromycin 250 mg BD for five days |

Fig. 2 'Triage of commonly presenting dental problems' from Management of acute dental problems during COVID-19 pandemic,¹ reproduced with kind permission from the SDCEP



the disease.²⁴ Adequate hydration, nutrition and control of fever are essential to optimise the medical care for patients presenting with odontogenic infections. Stabilisation of any underlying systemic disease (for example, uncontrolled diabetes) is extremely important.²⁴

Antibiotic therapy

Odontogenic infections are multi-microbial with a combination of facultative and anaerobes species. Facultative *Streptococcus viridans* group are commensal Gram-positive bacteria and include *S. anginosus*, *S. intermedius* and *S. constellatus*. These organisms are associated in the mouth and most frequently associated with orofacial cellulitis and abscess. After a few days, the anaerobes (*Prevotella* and *Porphyromonas*) predominate. The majority of the facultative streptococci that cause odontogenic infections are sensitive to penicillin.²⁵ Approximately a quarter

of strains of *Prevotella* and *Porphyromonas* are penicillin-resistant.²⁶

The Scottish Dental Clinical Effectiveness Programme (SDCEP) has published evidence-based guidance on antibiotic prescription in dental practice. Penicillin-based antibiotics remain the first line for the treatment of odontogenic infections. Metronidazole is effective against anaerobic bacteria.^{1,27,28}

The antibiotic doses recommended in the SDCEP's guidance are based on the doses recommended by the British National Formulary (BNF)¹³ (Table 2).

In secondary care settings, the antibiotics are prescribed in accordance with the local hospital antimicrobial therapy. Consultation with the on-call microbiologist is a common practice for severe cases and cases which are not responding to first-line treatment.

Frequently evaluate the patient

The last principle, but as vital as the previous ones, is the periodic re-evaluation of these patients. In outpatient settings, the recommended follow-up is after two days.²⁹ Forty-eight hours will allow the drainage to cease and the immune system to overcome the initial insult from the infection. If no improvement or deterioration of symptoms is noted, further escalation in care must be provided. The review interval, however, depends on the clinical course of the infection. A patient with a rapidly developing swelling and mild temperature may need review within 24 hours, but a patient with a chronic abscess and no systemic symptoms will need to be reviewed at the end of the antibiotic treatment.

Causes of treatment failure include:

- Failure to remove the source of infection
- Underlying systemic disease; for example, uncontrolled diabetes
- Antibiotic-related factors – patient non-compliance, drug not reaching site secondary to inadequate drainage, wrong antibiotic choice or incorrect dose.

In hospital settings, more frequent evaluations are essential as the disease is expected to be more aggressive.

Management of odontogenic infections during the COVID-19 pandemic

The COVID-19 pandemic has dramatically changed dental practice since March 2020. Guidance on the management of acute dental problems is available.^{2,30} This is likely to change as the situation evolves. Advice, analgesia and antimicrobials (when indicated) should form the basis of primary care dental triage when using remote consultation (telephone call or video call).¹

While assessing the patient, COVID-19 status should be established and documented, as this will determine how the patient's care will be managed should referral to an urgent dental care centre or secondary care be required. Patients should be advised that dental treatment options are currently severely restricted and that they should call back in 48–72 hours if their symptoms have not resolved.²

The SDCEP's flowchart (Fig. 2) helps the remote management of patients by guiding the GDP to categorise the patient into one of three management groups.²

The SDCEP has also recently updated their *Drugs for the management of dental problems during COVID-19 pandemic* guidance.¹ This guidance supplements their *Management of acute dental problems during COVID-19*

pandemic document.² It lists the drugs, including antibiotics, which GPs are most likely to remotely advise or prescribe for their patients during the COVID-19 pandemic and emphasises the following:

- Antibiotics are not indicated in the absence of swelling or other signs of infection
- The need to establish the patient's self-management to date and to check whether the patient may have overdosed, particularly with paracetamol
- The importance of checking with local pharmacies that the drugs being prescribed are actually in stock
- There is currently insufficient evidence linking the use of ibuprofen or other NSAIDs with contracting or worsening of COVID-19 and, as such, they should continue to be prescribed if indicated, regardless of the patient's COVID-19 status.

Worryingly, there has been a rise in anecdotal reports of antibiotics apparently being overprescribed for dental pain since the outbreak of COVID-19.³¹ This pandemic has demonstrated the havoc a pathogen can unleash when we have no protection against it. Inappropriate use of antibiotics increases the likelihood that resistant bacteria will evolve³¹ and it is essential that GPs remain guardians against antimicrobial resistance.^{1,32} Antibiotics should only be prescribed if it is likely that the patient has a bacterial infection, and the principles of prescribing and follow-up (as detailed earlier) should be followed.

Management of sepsis: background
Incidence of sepsis

It is estimated that 234,000 patients develop sepsis in the UK every year,⁵ with 70% of sepsis cases originating in the primary care setting. Annually, there are approximately 44,000 deaths from sepsis in the UK⁵ and six million deaths worldwide.³³ Although deaths from sepsis due to odontogenic infection are very rare, they have been reported.³⁴

The incidence of sepsis is on the increase, possibly due to:³⁵

- A growing elderly population
- An increased use of invasive surgery
- An increased incidence of bacterial resistance
- An increased number of immunocompromised patients.

Causes of sepsis

A localised infection which progresses into an uncontrolled systemic response is usually the cause of sepsis. Progression to acute physiological deterioration with the risk of multiple organ failure and death can be swift. In normal circumstances, the body's immune

Box 3 Sources of sepsis infection (approximate percentages)⁵

- Pneumonia: 50%
- Urinary tract: 20%
- Abdomen: 15%
- Skin, soft tissue, bone and joint: 10%
- Endocarditis: 1%
- Device-related infection: 1%
- Meningitis: 1%
- Others: 2%.

GDP Sepsis Decision Support Tool For Primary Dental Care

To be applied to **all adults & young people 12 years and over** with fever (or recent fever) symptoms presenting with a source of orofacial/dental infection (including postoperative infection) or have clinical observations outside normal limits



1. In the context of presumed infection, are any of the following true:
(consider other common sources: chest, UTI, abdominal organs)

Patient looks very unwell

Family or carer is very concerned

There is ongoing deterioration

Physiology is abnormal for this patient (check HR, Oxygen Saturation & BP)

Tick

N →

Y ↓

2. Is ONE Red Flag present?

New deterioration in GCS/ AVPU

Systolic B.P ≤90 mmHg (or ≥40 mmHg below normal)

Heart rate ≥130 per minute

Respiratory rate ≥25 per minute

Needs oxygen to keep SpO₂ 92% (88% in COPD)

Non-blanching rash or mottled/ ashen/ cyanotic

Not passed urine in last 18 hours

Recent chemotherapy (within last 6 weeks)

Tick

N →

Y ↓

3. Is any ONE Amber Flag present?

Relatives worried about mental state/ behaviour

Acute deterioration in functional ability

Immunosuppressed (without recent chemotherapy)

Trauma, surgery or procedure in last 6 weeks

Respiratory rate 21-24 OR dyspnoeic

Systolic B.P 91-100 mmHg

Heart rate 91-130 OR new dysrhythmia

Not passed urine in last 12-18 hours

Tympanic temperature ≤36 °C

Clinical signs of wound, device or skin infection

If under 17 & immunity impaired treat as Red Flag Sepsis

Tick

N →

Y ↓

Low risk of sepsis. Consider other diagnoses.
Use clinical judgement to diagnose and treat potential sources of infection e.g. perform tooth extraction.

Give safety netting advice: call 999 if patient deteriorates rapidly, or call 111/ arrange to see GP or GDP if condition fails to improve or gradually worsens. Provide an information leaflet on the signs/symptoms of sepsis and emergency contact details.

Sepsis likely

Use clinical judgment to determine whether patient can be managed in the primary care setting. If treating in the primary care setting, consider:

- identifying and treating potential sources of infection
- planned second assessment +/- blood results
- brief written handover to colleagues
- specific safety netting advice

Red Flag Sepsis!

Immediate actions:

Dial 999 and state the patient has 'Red Flag Sepsis'

Arrange blue light transfer

Administer oxygen to maintain saturations >94%

Communication:

Write a brief clear handover including observations and antibiotic allergies where present

Ensure Paramedics pre-alert as 'Red Flag Sepsis'

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Fig. 3 GDP sepsis decision support tool for primary dental care should be applied to all adults and young people aged 12 years and over with fever (or recent fever), symptoms presenting with a source of orofacial/dental infection (including post-operative infection) or have clinical observations outside normal limits, reproduced with kind permission from the UK Sepsis Trust⁵

system will prevent or fight infection (bacteria, viruses, fungi). However, the immune system can sometimes go into overdrive, resulting in vital organs and other tissues being targeted. This can result from any injury or infection in

the body. Although a wide variety of different microorganisms (for example, *Streptococcus*, *E. coli*, MRSA or *Clostridium difficile*) can cause sepsis, it is usually caused by common bacteria

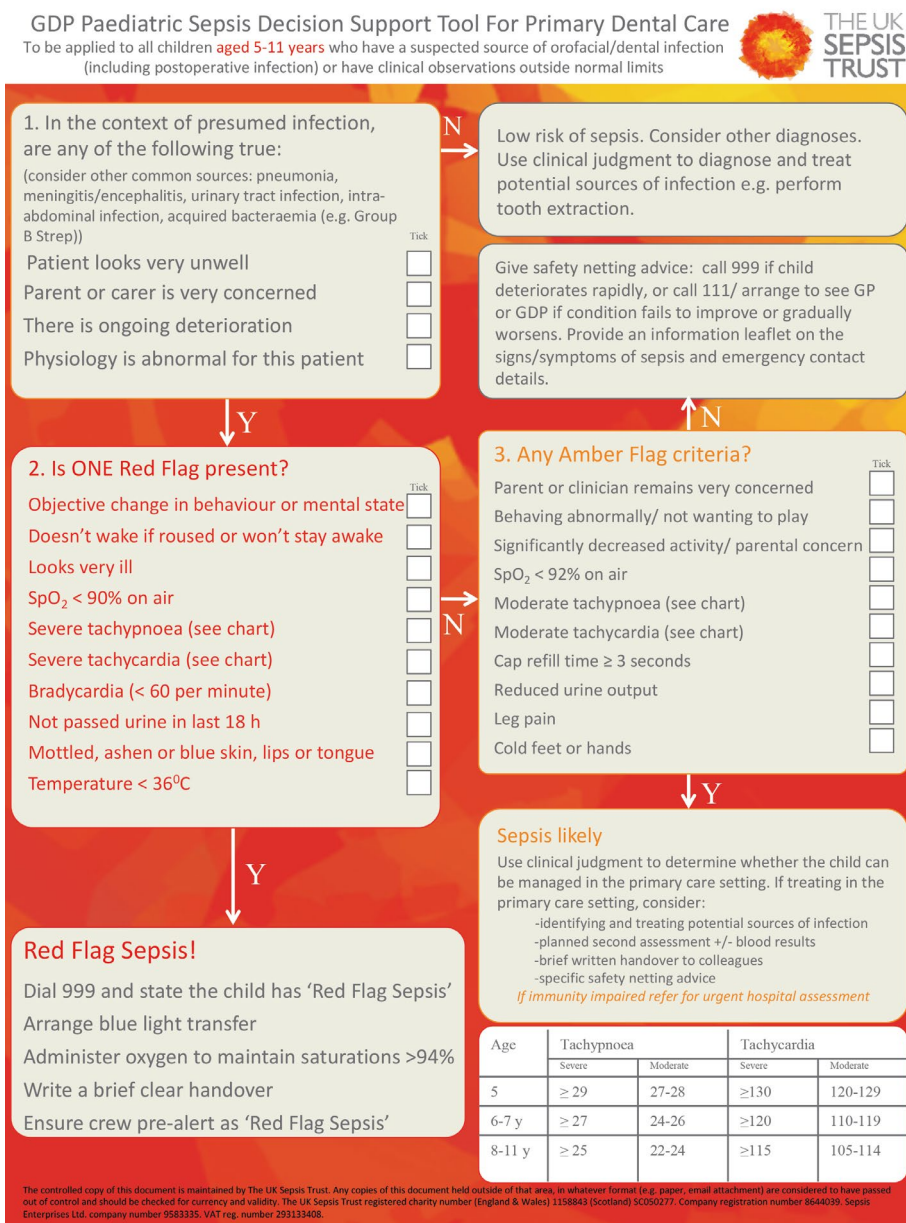


Fig. 4 'GDP paediatric sepsis decision support tool for primary dental care' should be applied to all children aged 5-11 years who have a suspected source of orofacial/dental infection (including post-operative infection) or have clinical observations outside the normal range, reproduced with kind permission from the UK Sepsis Trust⁶

that don't normally make patients ill.³⁶

Any infection can lead to sepsis (Box 3), though pneumonia (commonly referred to as chest sepsis) is the cause in half of the cases.⁵

Risk factors for developing sepsis

The National Institute for Health and Care Excellence (NICE)⁶ has highlighted the following risk factors for sepsis:

- Children under one year of age and people >75 years old
- Frailty
- Impaired immune systems because of illness or drugs, including patients:
 - ◆ On chemotherapy for cancer
 - ◆ Taking long-term steroids
 - ◆ Taking immunosuppressant drugs to

treat non-malignant disorders such as rheumatoid arthritis

- ◆ With an impaired immune function; for example, diabetics, previous splenectomy and sickle cell disease
- Recent surgery, or other invasive procedures, in the past six weeks
- Breach of skin integrity; for example, cuts, burns, blisters or skin infections
- Intravenous drug users
- Existing indwelling venous line or urinary catheter
- Pregnancy and within six weeks following birth, termination of pregnancy or miscarriage.

Management of sepsis: sepsis

decision support tools

The UK Sepsis Trust has developed age-specific sepsis decision support tools to assist the dental team to assess both adult and paediatric patients who may have sepsis.⁷ Utilisation of these sepsis decision tools will help determine if Red Flag sepsis (see below) is present, prompting appropriate timely action. The prompt transfer of patients presenting with orofacial infections suspected of sepsis to an acute hospital setting for early treatment should ultimately improve sepsis survival rates.³⁷

The Care Quality Commission (CQC)³⁸ endorses these sepsis decision tools and, ideally, all three should be readily available in the dental practice.

Sepsis decision tool for adults/young people aged 12 years and over

The 'GDP sepsis decision support tool for primary dental care' (Fig. 3) should be applied to all adults and young people aged 12 years and over with fever (or recent fever), symptoms presenting with a source of orofacial/dental infection (including post-operative infection) or have clinical observations outside normal limits.⁷ It details what to look out for if the patient has presumed infection and, in particular, what constitutes Red Flag sepsis.

Red Flag sepsis

Red Flag sepsis is a definition from the UK Sepsis Trust which lists a set of easy-to-assess clinical parameters, the presence of one of which in the context of infection identifies sepsis with a high risk of death and a requirement for urgent treatment (Fig. 3).⁷

If Red Flag sepsis is present:

- Call 999 for an ambulance and state Red Flag sepsis⁷
- Follow the ABCDE approach to assess and treat the acutely ill patient³⁹
- Administer oxygen 15 litres/minute using a non-rebreather oxygen mask⁴⁰
- Print off the patient's medical history and ensure effective communication to the ambulance service (situation, background, assessment, recommendation [SBAR]).⁴¹

Paediatric sepsis decision tools

There are two paediatric sepsis decision tools, one for children aged 5-11 years (Fig. 4) and one for children <5 years (Fig. 5). These should be used in children who have a suspected source of orofacial/dental infection (including post-operative infection) or have clinical observations outside the normal range.⁷ The paediatric sepsis decision tools take into account paediatric considerations, including differences in paediatric physiology.

COVID-19 and sepsis

COVID-19 infection can cause sepsis on its own.⁵ Unfortunately, the sepsis signs and symptoms for a number of initial conditions can be very similar. This stresses the importance for dental teams to be familiar with sepsis and the decision tools described here for safe management of such patients. In addition, evidence suggests that, for a period of time following sepsis, patients may be vulnerable and develop further infections including COVID-19; therefore, they have an increased risk of readmission with infective complications (including sepsis).⁵

The NICE and sepsis

The NICE advises that patients with suspected sepsis are assessed following a structured set of observations to stratify the risk of acute illness or death.⁶ The Royal College of Physicians' National Early Warning Score (NEWS) 2 is widely used by the ambulance service and in hospitals, and reliably detects deterioration in adults, triggering review, treatment and escalation of care, particularly sepsis.⁴¹ Although NEWS2 hasn't yet been validated for use in primary care, NHS England is encouraging its widespread use in this sector.⁴²

The CQC and sepsis

The CQC has created a webpage titled 'Dental mythbuster 25: sepsis' on its website,³⁸ providing helpful information relating to the management of sepsis in the dental practice, including online links to professional guidelines (NICE and UK Sepsis Trust) as well as what to expect from the CQC, relating to sepsis, when they review dental practices to determine whether they are safe and well-led.

When reviewing dental practices, the CQC will ask dental staff what systems and processes are in place to manage a patient with a bacterial infection, including procedures for follow-up and referral to specialist care when necessary. This will include treating patients who:

- Are not responding to conventional oral antibiotic treatment
- Cannot have their infection drained at an initial appointment.

The CQC will also ask what advice is given to patients, including when they should seek emergency advice or treatment, if symptoms worsen or when the dental surgery is closed.

Conclusion

Odontogenic infections can lead to sepsis, which can result in tissue damage, organ failure and death. This article has outlined the management of odontogenic infections, including the latest COVID-19 guidelines. The recognition and

GDP Paediatric Sepsis Decision Support Tool For Primary Dental Care

To be applied to all children **under 5 years** who have a suspected source of orofacial/dental infection (including postoperative infection) or have clinical observations outside normal limits



1. In the context of presumed infection, are any of the following true:
(consider other common sources: pneumonia, meningitis/encephalitis, urinary tract infection, intra-abdominal infection, acquired bacteraemia (e.g. Group B Strep))

Patient looks very unwell
 Parent or carer is very concerned
 There is ongoing deterioration
 Physiology is abnormal for this patient

Tick

N

2. Is ONE Red Flag present?

Unresponsive to social cues/ difficult to rouse
 Health professional very worried
 Weak, high pitched or continuous cry
 Grunting respiration or apnoeic episodes
 SpO₂ < 90%
 Severe tachypnoea (see table)
 Severe tachycardia (see table)/ bradycardia < 60
 No wet nappies/ not passed urine in last 18 h
 Non-blanching rash or mottled/ ashen/ cyanotic
 Temperature < 36°C
 If under 3 months, temperature > 38°C

Tick

N

3. Any Amber Flag criteria?

Parent or clinician remains very concerned
 Abnormal response to social cues/ not smiling
 Reduced activity, very sleepy
 Parent/ carer reports behaviour is abnormal
 Moderate tachypnoea (see table)
 SpO₂ < 91% OR nasal flaring
 Moderate tachycardia (see table)
 Capillary refill ≥ 3 seconds
 Reduced urine output
 Pale or flushed
 Leg pain or cold extremities

Tick

N

Red Flag Sepsis!

Dial 999 and state the child has 'Red Flag Sepsis'
 Arrange blue light transfer
 Administer oxygen to maintain saturations >94%
 Write a brief clear handover
 Ensure crew pre-alert as 'Red Flag Sepsis'

Sepsis likely

Use clinical judgment to determine whether child can be managed in the primary care setting. If treating in the primary care setting, consider:

- identifying and treating potential sources of infection
- planned second assessment +/- blood results
- brief written handover to colleagues
- specific safety netting advice

If immunity impaired refer for urgent hospital assessment

| Age | Tachypnoea | | Tachycardia | |
|-------|------------|----------|-------------|----------|
| | Severe | Moderate | Severe | Moderate |
| < 1 y | ≥ 60 | 50-59 | ≥160 | 150-159 |
| 1-2 y | ≥ 50 | 40-49 | ≥150 | 140-149 |
| 3-4 y | ≥ 40 | 35-39 | ≥140 | 130-139 |

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Fig. 5 'GDP paediatric sepsis decision support tool for primary dental care' should be applied to all children aged <5 years who have a suspected source of orofacial/dental infection (including post-operative infection) or have clinical observations outside the normal range, reproduced with kind permission from the UK Sepsis Trust⁶

management of sepsis in the dental practice has also been discussed, including the age-specific sepsis decision support tools developed by the UK Sepsis Trust.

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This article was originally published in the BDJ on 25 September 2020 in Volume 229 issue 6, pages 363-370.

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<https://doi.org/10.1038/s41407-021-0520-4>