Fever and Suspected or Confirmed Neutropenia: Empiric Guidelines

<table>
<thead>
<tr>
<th>Scope (Staff):</th>
<th>Clinical Staff – Medical, Nursing, Pharmacy</th>
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</thead>
<tbody>
<tr>
<td>Scope (Area):</td>
<td>Perth Children’s Hospital (PCH)</td>
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</table>

This document should be read in conjunction with this DISCLAIMER

Aim

To provide a guideline for the management of presumed bacteraemia/sepsis in an immunocompromised child greater than one month of age.

Key Points

- All oncology patients presenting with fever should receive initial management according to this guideline. Do NOT wait for blood results before initiating treatment.
- These recommendations may also apply to non-oncology patients with confirmed or suspected neutropenia.
- Rapid Central Venous Access Device (CVAD) or intravenous (IV) access is critical to facilitate prompt empiric antimicrobial therapy (as soon as possible, ideally within 30 minutes of triage). DO NOT ACCESS INFUSAPORT IF INSERTED WITHIN LAST 5 DAYS unless under instruction of Oncology Fellow.
- All oncology patients must be discussed with the on-call oncology fellow at PCH
- The Oncology ward provides a Patient Summary Sheet to the ED nurse co-ordinator for patients presenting to the Emergency Department. This summarises patient diagnosis, allergies, alerts, treatment regimen, CVAD details and recent weight.

Definitions

Fever: Temperature ≥ 38.5°C once or ≥ 38.0°C on two sequential occasions in a 12 hour period

Neutropenia: Absolute Neutrophil Count (ANC) < 0.5 x 10^9/L OR 0.5-1 x 10^9/L and likely to fall further in next 48h

High risk of infection patients:

- Haematopoietic Stem Cell Transplantation (HSCT) pre-engraftment or with significant myelo/immunosuppression
- Acute Myeloid Leukaemia (AML)
- Relapsed Acute Lymphocytic Leukaemia (ALL) on re-induction chemotherapy
- Infant ALL during intensive chemotherapy
Standard risk of infection patients:
- All oncology patients who do not meet the high risk (of infection) criterion above

Systemic compromise:
- Haemodynamic compromise
- Significant tachypnoea, increased work of breathing or oxygen saturation <90% on room air
- Confusion or decreased consciousness
- End organ dysfunction including renal or hepatic dysfunction, coagulopathy

Initial Assessment

All febrile oncology patients presenting to the emergency department should be triaged as ATS 2

1. Obtain prompt CVAD or IV access in all patients; **AND**
2. Send initial investigations; **AND**
3. **Administer empiric antibiotics (Table 1) within 30 minutes of arrival** **AND**
4. Discuss patient with the on call oncology fellow at PCH.

- The same approach is recommended in non-oncology patients with suspected or confirmed neutropenia presenting with fever

A) Initial investigations:
- Blood culture from each lumen of CVAD (or peripheral IV if no CVAD access)
- Full blood count
- C-reactive protein
- Urea electrolytes and creatinine
- Liver function tests
- Venous blood gas and lactate (if any concern regarding haemodynamic compromise)
### Table 1 – Antibiotics for febrile oncology patient / non-oncology patient with suspected or confirmed neutropenia

<table>
<thead>
<tr>
<th>CLINICAL SCENARIO</th>
<th>DRUGS/DOSES</th>
<th>Known or Suspected MRSA&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Penicillin allergy&lt;sup&gt;b&lt;/sup&gt; Delayed</th>
<th>Penicillin allergy&lt;sup&gt;b&lt;/sup&gt; Immediate</th>
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<tbody>
<tr>
<td><strong>Standard Protocol</strong></td>
<td>IV <strong>cefepime</strong> 50mg/kg (to a maximum of 2g) 8 hourly</td>
<td>As per standard protocol AND consider <strong>vancomycin</strong>&lt;sup&gt;d&lt;/sup&gt;</td>
<td>As per standard protocol</td>
<td>Discuss with ID or Microbiology service</td>
</tr>
<tr>
<td><strong>High risk of infection patient</strong> (see definitions above)</td>
<td>IV <strong>cefepime</strong> 50mg/kg (to a maximum of 2g) 8 hourly <strong>AND</strong> IV <strong>vancomycin</strong>&lt;sup&gt;d&lt;/sup&gt; 15mg/kg (to a maximum initial dose of 750mg) 6 hourly</td>
<td>As per standard protocol</td>
<td>As per standard protocol</td>
<td>Discuss with ID or Microbiology service</td>
</tr>
<tr>
<td><strong>Skin infection or erythema over CVAD or fever/rigors following accessing CVAD</strong></td>
<td>IV <strong>cefepime</strong> 50mg/kg (to a maximum of 2g) 8 hourly <strong>AND</strong> IV <strong>vancomycin</strong>&lt;sup&gt;d&lt;/sup&gt; 15mg/kg (to a maximum initial dose of 750mg) 6 hourly <strong>AND</strong> Stat dose of IV <strong>gentamicin</strong>&lt;sup&gt;e&lt;/sup&gt;</td>
<td>As per standard protocol</td>
<td>As per standard protocol</td>
<td>Discuss with ID or Microbiology service</td>
</tr>
<tr>
<td><strong>Fever with sepsis&lt;sup&gt;f&lt;/sup&gt; or septic shock&lt;sup&gt;g&lt;/sup&gt;</strong></td>
<td>IV <strong>cefepime</strong> 50mg/kg (to a maximum of 2g) 8 hourly <strong>AND</strong> IV <strong>vancomycin</strong>&lt;sup&gt;d&lt;/sup&gt; 15mg/kg (to a maximum initial dose of 750mg) 6 hourly <strong>AND</strong> Stat dose of IV <strong>gentamicin</strong>&lt;sup&gt;e&lt;/sup&gt; for all patients admitted to ICU contact the Infectious Diseases service for advice regarding additional therapy and follow the <strong>Presumed Bacteraemia/Sepsis Guideline</strong></td>
<td>As per standard protocol</td>
<td>As per standard protocol</td>
<td>Discuss with ID or Microbiology service</td>
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**Variations may apply to some patients (e.g. resistant organism colonisation<sup>c</sup>) please refer to the patient summary sheet for specific recommendations.**

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**B) History**

- New site-specific symptoms
- Underlying diagnosis and phase of therapy (to anticipate the degree and anticipated duration of immunosuppression).
- Is the patient considered high risk of infection? (see definition above)
- Unwell contacts, colonisation with multi-resistant organisms, micro alerts.
- Previous infectious and non-infectious complications of therapy.
- Central venous access device (CVAD).
Fever and suspected or confirmed neutropenia

C) Examination

- Be aware that clinical signs of inflammation may be subtle depending on phase of therapy and/or in the presence of neutropenia and become evident upon neutrophil recovery.
- Abnormal vital signs:
  - Haemodynamic compromise – hypotension, tachycardia, capillary refill time ≥ 2 seconds, wide pulse pressure
  - Tachypnoea, increased work of breathing or hypoxia
- Ears, nose and throat for mucositis or local infection.
- Abdomen for signs of colitis/typhilitis (generalised or localised tenderness) or organomegaly.
- Skin examination including flexural regions, nail beds and sites where the skin integrity has been breached e.g. bone marrow aspirate, lumbar puncture sites for signs of localised infection
- CVAD exit sites and subcutaneous tunnel for signs of infection.
- Central nervous system (CNS) for signs of confusion or impaired consciousness, meningism and focal neurological deficits.
- Perineum must be examined in all patients.

D) Additional investigations as clinically indicated:

- Respiratory symptoms: Chest X-Ray, Floq swab (preferable in thrombocytopenia) for respiratory virus PCR.
- Urinary symptoms, back pain, vomiting: urinalysis, urine M/C/S
- Diarrhoea or abdominal pain: Stool (M/C/S), viral studies, *Clostridioides difficile* antigen and toxin assay, abdominal ultrasound
- Skin rash and/or mouth ulcers: bacterial/fungal swab (M/C/S), Viral swab of mouth ulcers and vesicular lesions for HSV/VZV/enterovirus PCR
- CNS symptoms or signs: CNS imaging and lumbar puncture

Management

- Empiric antibiotics as per Table 1 (administer within 30 minutes of arrival)
- Fluid resuscitation as required if signs of haemodynamic compromise
- For patients requiring ICU admission contact infectious diseases or clinical microbiology for urgent advice and follow the Presumed Bacteraemia/Sepsis Guideline.
- Variations from these recommendations may apply – discussion with Infectious Diseases recommended for patients with:
  - known colonisation with multi-resistant gram negative bacteria (e.g. ESBL colonisation - variations recorded in MOSAIQ and the patient summary sheet provided to ED)
Fever and suspected or confirmed neutropenia
- suspected intra-abdominal focus of infection
- suspected meningoencephalitis
  - Discuss all patients with the on call oncology fellow at PCH

Subsequent Assessment and Management

Re-evaluation during treatment
- Physical examination and assessment at least once daily.
- Daily full blood count.
- Daily blood culture with ongoing fevers (maximum of one blood culture per day, for up to 72 hours) and additionally if clinical deterioration occurs or if fevers recur after being afebrile for ≥ 24 hours).
- Repeat blood culture following positive blood culture to confirm clearance of bacteraemia.
- Drug levels e.g. gentamicin, vancomycin as indicated.
- Additional investigations depending on progress of symptoms. If febrile neutropenia is prolonged >96 hours, in high risk patients, investigations for invasive fungal infection should be considered including serum galactomannan titre and appropriate imaging.

Table 2 – Modification of antimicrobials in fever in oncology patients

<table>
<thead>
<tr>
<th>Alteration of Antimicrobial Cover</th>
<th>Action</th>
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<tbody>
<tr>
<td>Blood culture positive - gram negative bacteria</td>
<td>ADD a stat dose of gentamicin to standard therapy and contact Infectious Diseases or clinical microbiology for urgent advice.</td>
</tr>
<tr>
<td>Blood culture positive - gram positive bacteria</td>
<td>ADD vancomycin to standard therapy, if already on vancomycin empirically, continue same. Contact infectious diseases or clinical microbiology for urgent advice.</td>
</tr>
<tr>
<td>Persistent fever 24 to 96 hours AND Negative culture to date AND clinically stable.</td>
<td>No change to therapy</td>
</tr>
<tr>
<td>Persistent fever 24 to 96 hours AND Negative culture to date AND clinically unstable.</td>
<td>Contact Infectious Diseases for advice regarding modifications to therapy. Consider formal consult. Consider adding vancomycin +/− gentamicin. For patients requiring ICU admission contact Infectious Diseases or clinical microbiology for urgent advice and follow the Presumed Bacteraemia/Sepsis Guideline.</td>
</tr>
<tr>
<td>Persistent fever &gt; 96 hours of antibacterial therapy</td>
<td>Consider imaging and testing serum galactomannan titre AND empiric antifungal therapy in high risk patients with expected prolonged neutropenia &gt;10 days.</td>
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**Rationalisation of Antimicrobial Cover**

<table>
<thead>
<tr>
<th>Blood culture negative at 24-48 hours AND clinically stable AND no signs of skin infection</th>
<th>Stop vancomycin (and gentamicin if commenced)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-neutropenic oncology patient AND clinically stable at 24 hours</td>
<td>Discuss with Infectious Diseases regarding rationalising or ceasing antibiotics</td>
</tr>
</tbody>
</table>

- **a.** Children known or suspected to be colonised with MRSA may need to have their therapy/prophylaxis modified. Children suspected of having MRSA include:
  - i. Children previously colonised with MRSA
  - ii. Household contacts of MRSA colonised individuals
  - iii. In children who reside in regions with higher MRSA rates (e.g. Kimberley and the Pilbara) a lower threshold for suspected MRSA should be given
  - iv. Children with recurrent skin infections or those unresponsive to ≥ 48 hours of beta-lactam therapy. For further advice, discuss with Microbiology or ID service.

- **b.** An immediate (IgE mediated) reaction is characterised by the development of urticaria, angioedema, bronchospasm or anaphylaxis within 1 to 2 hours of drug administration. Delayed reactions including maculopapular or morbilliform rashes, drug fever and cytopenias and are more in keeping with other forms of immunological reactivity. Isolated diarrhoea is not usually immune-mediated and does NOT contraindicate the future use of an antibiotic.

- **c.** Children known to be colonised with ESBL / CRE organism need to have their therapy modified. Discuss with infectious diseases or microbiology.
  - ESBL – extended-spectrum B-lactamase, CRE – carbapenem-resistant enterobacteriaciae.

- **d.** IV **vancomycin 15mg/kg/dose** (to a maximum initial dose of 750mg) 6 hourly. Therapeutic drug monitoring required for all patients.

- **e.** IV **gentamicin** Children ≥ 1 month old to 10 years old 7.5mg/kg/dose (to a maximum of 320mg) once daily. Children >10 years to 18 years old 6-7mg/kg/dose (to a maximum of 560mg) once daily. Therapeutic drug monitoring required for all patients.

- **f.** Sepsis is defined as life-threatening organ dysfunction caused by a dysregulated host response to infection.

- **g.** Septic shock is a subset of sepsis in which circulatory and cellular/metabolic abnormalities are profound and substantially increase mortality. It is characterised clinically by hypotension requiring vasoressor support and an elevated serum lactate level despite adequate volume resuscitation.

- **h.** CT imaging of the chest and targeted imaging of other clinically suspected areas of infection (e.g. abdomen/pelvis, brain, musculoskeletal imaging)

- **i.** IV **AmBisome® 3mg/kg/dose** once daily OR IV **caspofungin** - refer to monograph for dosing

- **j.** In case of signs of skin infection consider swabs for MRSA culture – if no growth of MRSA consider ceasing vancomycin.
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### Related internal policies, procedures and guidelines

- **Antimicrobial Stewardship Policy**
- **ChAMP Empiric Guidelines**
- **PCH ED Guideline – Fever - Oncology Patient**
- **MicroAlert Policy**

### References

2. Expert opinion – Paediatric Infectious Diseases Physicians

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