PAEDIATRIC FEBRILE NEUTROPENIA CARE PATHWAY

**Purpose:** This document is intended as a guide to the investigation and management of children presenting in Salisbury District Hospital with suspected neutropenic sepsis. For further information please look at the “Management of Febrile Neutropenia” guideline on:

http://www.uhs.nhs.uk/Media/SUHTExtranet/Services/PaediatricOncology/Febrile-neutropenia.pdf

**Background:** Children with cancer are particularly susceptible to life-threatening infections. Chemotherapy affects the body's normal defences against infection by causing marrow depression and in some cases disrupts mucous membranes in the gut & mouth. Central lines and bone marrow sites are a potential focus of infection. The term febrile neutropenia includes patients who are haemodynamically stable with no obvious focus of infection, to those in septic shock.

Neutropenic Sepsis is a Medical Emergency, which can be life threatening. Intravenous antibiotics MUST be administered within 60 minutes of arrival to hospital or within 60 minutes of the signs and symptoms developing if the patient is an in patient. It requires prompt assessment and appropriate investigations and commencement of empirical treatment if neutropenia is suspected i.e. – do not wait for the low neutrophil count to be confirmed.

**Definition of Febrile Neutropenia**

Neutrophil count is 0.5 or lower and either
- Temperature 38°C and above on a single occasion or
- Signs and symptoms consistent with clinically significant infection

- Fever is usually the first (and may be the only) sign of neutropenic sepsis, but neutropenic sepsis can occur in the absence of fever, especially in patients on corticosteroids or following administration of paracetamol
- Children with leukaemia are usually neutropenic at presentation
- Children receiving treatment for ALL are likely to be neutropenic during delayed intensification and consolidation blocks
- Suspect neutropenia 7-10 days post chemotherapy in children with solid tumours
- Other symptoms and signs include: Influenza-like symptoms
  - **Drowsiness or confusion**
  - Hypotension
  - Tachycardia
  - Vomiting
  - Obvious focus of infection (e.g. mouth, chest, urine, diarrhoea)

Children who are neutropenic and unwell, even if normothermic, should be assumed to have infection and be treated appropriately.
Step 1: History
- Ask about pain around line site, cough, dyspnoea, abdominal pain, diarrhoea, fluid intake, line flushing.
- Onset of temperature or rigors and tachycardia within a few hours of having a central line flushed should be considered to be a line infection until proven otherwise.
- Children receiving chemotherapy that induces mucositis are at risk of Gram negative infections.

Step 2: Examination
- Check line entry & exit site & any recent bone marrow or lumbar puncture sites in addition to normal examination including ENT and perianal area
- Measure peripheral perfusion, blood pressure, respiratory rate, oxygen saturation if indicated, ongoing fluid losses & urinary output.
- Hypotension is not necessary for the diagnosis of septic shock

Step 3: Investigations
Immediate investigations should include
- Blood cultures
  Cultures should be taken from each lumen of the central line and appropriately labelled. Peripheral cultures are not routinely done, but there may be specific instances where this is appropriate.
  *(If clinically concerned about anaerobic infection, e.g. with severe mucositis remember to take anaerobic blood cultures.)*
- FBC, U&Es, CRP, LFT, Lactate and blood gas
These can be taken from the central line immediately on arrival to hospital, by a trained member of Nursing Staff or Doctor. Antibiotic therapy can then be instigated.

Other investigations should include
- MSU - if under 5 yrs old or urinary symptoms present but - Bacteriology and mycology
- Swab
  From skin lesions/central line sites if applicable (look for areas of redness and tenderness: pus not present when neutropenic)

Investigations to consider if clinically indicated
- Stool - MC&S, mycology and virology if diarrhoea
- CXR
- LP
- NPA/sputum/viral throat swab
- Swabs from sites of clinical infection – NB – pus usually absent when neutropenic

All culture specimens should ideally be done before antibiotics are given but **do not delay unnecessarily in giving antibiotics** (for example in collecting a urine sample).

Management of Pyrexia/Infection
Antipyretics can mask fever and should not be used in patients who might be neutropenic. Once there is a clear decision to start antibiotics (e.g. child is on their way to hospital with a fever) then paracetamol may be given. Pain can be managed with oramorph. Ibuprofen should be used with caution in thrombocytopenia as it affects platelet function and must be avoided in patients receiving iv Methotrexate and mifamurtide.

For more detailed information please refer to the Wessex Paediatric Oncology Regional Supportive Care Guidelines.
### Step 4: Treatment

The mainstay of treatment of febrile neutropenia is early use of empiric antibiotics, appropriate supportive care and regular review. Most children with febrile neutropenia will appear very well, but still need early treatment with antibiotics as infection could progress rapidly.

We no longer determine risk groups to assess antibiotic usage.

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**Empirical antibiotic treatment of Febrile Neutropenia in patients who are relatively well**

<table>
<thead>
<tr>
<th>Single agent Piperacillin/Tazobactam*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child 1 month-18 years 90 mg/kg (max. 4.5 g) 6 hourly</td>
</tr>
<tr>
<td>&lt; 1 month 90 mg/kg 8 hourly</td>
</tr>
<tr>
<td>*unless patient specific or local microbiological indications</td>
</tr>
</tbody>
</table>

**Empirical antibiotic treatment of febrile neutropenic patients with signs of severe sepsis**

e.g. poor peripheral perfusion, rigors, altered mental status or hypotension

**Dual agent Piperacillin/Tazobactam & Gentamicin* |

<table>
<thead>
<tr>
<th>Age</th>
<th>Piperacillin/Tazobactam</th>
<th>Age</th>
<th>Gentamicin</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1 month</td>
<td>90 mg/kg 8 hourly</td>
<td>&gt; 7days – 1month</td>
<td>5 mg/kg od*</td>
</tr>
<tr>
<td>child 1 month-18 years</td>
<td>90 mg/kg (max 4.5g) 6 hourly</td>
<td>child 1 month-18 years</td>
<td>7 mg/kg od*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*Trough level before 2nd dose (do not delay administration of 2nd dose by waiting for result unless known renal dysfunction)</td>
</tr>
</tbody>
</table>

**Specific considerations:**

Children known to be colonised with resistant bacteria should be started on patient specific antibiotic regimen

- Penicillin allergy – treat with meropenem +/- gentamicin
- Receiving high does methotrexate – Penicillins contraindicated – use meropenem
- Bone tumours with endoprosthesis – consider adding teicoplanin if focal signs
- Patient on cisplatin – avoid gentamicin but do not withhold initial dose if septic/unwell
- Abdominal/perianal infection – consider adding metronidazole – not usually needed for mucositis

See Guideline for further considerations/advice

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### Step 5: Risk Assessment – medical team to fill in

<table>
<thead>
<tr>
<th>Are any of these risk factors present?</th>
<th>Initial assessment on admission</th>
<th>48 hour assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>History</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inpatient at onset of FN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Down Syndrome</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PICU during past FN episode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>&lt;1 year</td>
<td></td>
</tr>
<tr>
<td>Diagnosis/treatment</td>
<td>ALL (except maintenance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Infant ALL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AML</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intensive B-NHL protocols</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Anaplastic lymphomas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stage 4 neuroblastoma</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PBSC pre engraftment</td>
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<tr>
<td></td>
<td>Ewing’s sarcoma</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aplastic Anaemia</td>
<td></td>
</tr>
<tr>
<td>Clinical features</td>
<td>Shock or compensated shock</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Haemorrhage</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dehydration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Metabolic instability</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Altered mental state</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pneumonitis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Significant mucositis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Respiratory distress/compromise</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Perirectal infection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Soft tissue abscess/infection (other than minimal redness around central line site)</td>
<td></td>
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<tr>
<td></td>
<td>Rigors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Irritability/meningism</td>
<td></td>
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<tr>
<td></td>
<td>Organ failure</td>
<td></td>
</tr>
<tr>
<td>Compliance with outpatient treatment</td>
<td>Inability to take oral meds</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Poor compliance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Social/family concerns</td>
<td></td>
</tr>
<tr>
<td>48 hours assessment</td>
<td>Neuts&lt;0.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Positive blood cultures</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not clinically well</td>
<td></td>
</tr>
</tbody>
</table>

If none of the above features are present then patient may be considered “Low Risk” for conversion to oral antibiotics at 48 hours or stopping antibiotics all together

If any risk factors are present at 48 hours the patient is treated as “Standard Risk”

See Wessex Paediatric Oncology Supportive Care Guideline – Management of Febrile Neutropenia for further guidance
Patient Clerking - Nursing

Integrated Care Pathway for the Paediatric Neutropenic Patient, Salisbury NHS Foundation Trust

Consultant…………………………………………………

Date……………………………

Date and time of admission:

______________________________________________

Nursing observations: (please complete each area)

Temperature: _____°C O₂ saturation: _________% on air Weight _________ Kg

Pulse rate: _____/min Respiratory rate: _____/min BP: _____

- CALL DOCTOR

Doctor MUST be aware that an URGENT response is required- should be seen within 30 minutes

Time doctor called: ______________________

Initial Nursing Assessment

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Signature ____________________________
Patient Clerking- Nursing

Integrated Care Pathway for the Paediatric Neutropenic Patient, Salisbury NHS Foundation Trust

Date...........................................

Hospital Number D of B

Intravenous Access:

- If patient has a central venous catheter/portacath a trained member of staff, if available, should take bloods from the line as indicated below.

<table>
<thead>
<tr>
<th>Investigation</th>
<th>Yes ☐ No ☐</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Cultures from each lumen</td>
<td></td>
</tr>
<tr>
<td>FBC</td>
<td>Yes ☐ No ☐</td>
</tr>
<tr>
<td>U&amp;E/LFT</td>
<td>Yes ☐ No ☐</td>
</tr>
<tr>
<td>CRP</td>
<td>Yes ☐ No ☐</td>
</tr>
<tr>
<td>G&amp;S</td>
<td>Yes ☐ No ☐ N/A ☐</td>
</tr>
<tr>
<td>Coagulation Screen</td>
<td>Yes ☐ No ☐ N/A ☐</td>
</tr>
<tr>
<td>Lactate</td>
<td>Yes ☐ No ☐</td>
</tr>
</tbody>
</table>

Other Investigations:

<table>
<thead>
<tr>
<th>Test</th>
<th>Yes ☐ No ☐</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSU</td>
<td></td>
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<tr>
<td>Line swab</td>
<td></td>
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<tr>
<td>Stool culture (mc&amp;s/virology)</td>
<td></td>
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<tr>
<td>Throat swab</td>
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</tbody>
</table>

If patient not seen by Doctor within 30 minutes of admission, please contact on call Registrar/ Consultant.

If any oncology patient is admitted please phone 02381 205778

Leave details of your name, patient name, Salisbury hospital, date of admission and reason for admission

Please note this is not for advice. If advice is required phone the Piam Brown clinical team

Phone call completed by ________________________
Patient Clerking –Medical

Integrated Care Pathway for the Paediatric Neutropenic Patient, Salisbury NHS Foundation Trust

Date……………………………..

Time of medical assessment: _______________________________

History: (please complete each area)

Presenting symptoms:
_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________

Underlying condition:
_______________________________________________________________________________
_______________________________________________________________________________

Stage of Treatment and Recent Treatment:
_______________________________________________________________________________
_______________________________________________________________________________

Medications:
_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________

Allergies: (including concerns regarding use of Gentamicin or cisplatin)
_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________

Previous reaction to Blood products:  Yes □  No □
if so, which:
_______________________________________________________________________________

Most recent blood count:
Date: ______________________________
Result: ______________________________
Patient Clerking – Medical

Integrated Care Pathway for the Paediatric Neutropenic Patient, Salisbury NHS Foundation Trust

Date……………………………

Attach Patient Label Here
Name
Address

Hospital Number D of B

Clinical Examination: (please complete each area)

Conscious Level:

______________________________________________________________________________

Mouth: Clean ☐ Mucositis ☐ Ulcerated ☐ Candida ☐
Line Site: Clean ☐ Inflamed ☐ Purulent ☐ Tracking ☐

CVS:
Blood Pressure: Pulse: CRT:

Heart Sounds:

___________________________________________________________________________

Respiratory:
Respiratory rate:
Oxygen Saturations:

Abdominal:


Perineum: Clean ☐ Inflamed ☐ Ulcerated ☐
LP or bone marrow sites Normal ☐ Abnormal ☐ Not applicable ☐
Other:

___________________________________________________________________________
Patient Clerking –Medical

Integrated Care Pathway for the Paediatric Neutropenic Patient, Salisbury NHS Foundation Trust

Date……………………………

Investigations:

Note: Bloods may have already been taken by nursing staff.

FBC
U&E/LFT
CRP
G&S
Coagulation Screen
Lactate

Yes☐ No☐
Yes☐ No☐
Yes☐ No☐
Yes☐ No☐ N/A☐
Yes☐ No☐ N/A☐
Yes☐ No☐

Blood Cultures
Central ☐ Peripheral (if no central access) ☐

Consider

MSU☐ Line swab ☐ Stool culture (MC&S/virology)☐ CXR☐ Throat swab ☐

Doctor’s Signature ______________________

Version 3.0
Created by Dr P Ridley April 2016
Review: April 2019
Patient Clerking – Medical

Integrated Care Pathway for the Paediatric Neutropenic Patient, Salisbury NHS Foundation Trust

Date…………………………….

Management:

Details of Emergency Resuscitation if required:
___________________________________________________________________________
___________________________________________________________________________
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Antibiotic Therapy (please tick chosen therapy):

Tazocin …/kg □ Gentamicin …/kg □
(Piperacillin and Tazobactam) If signs of severe sepsis – see page 3

Penicillin allergy or receiving high dose methotrexate Yes □ No □

If yes to either of the above treat with Meropenem (20mg/kg 8 hourly) +/- Gentamicin if required

Be aware Gentamicin is contraindicated if
• patient is about to receive Cisplatin,
• patient has had Cisplatin in the last 6 weeks, or during high dose Methotrexate treatment & rescue.
• Caution in renal impairment or if significant risk there of e.g. tumour lysis.

Continue Co-trimoxazole prophylaxis if taking.

Please record time of antibiotics given:

Antibiotic 1: ____________________________ Antibiotic 2 (if applicable) ____________________________

Time first dose administered: ________________________________________________________________
(should be within 60 minutes of arrival)
Integrated Care Pathway for the Paediatric Neutropenic Patient, Salisbury NHS Foundation Trust

Date...........................................

Management:

Additional Therapy required:

- Analgesia: Yes ☐ No ☐
- Maintenance fluids: Yes ☐ No ☐
- Blood Products: Yes ☐ No ☐
- Nutrition: Yes ☐ No ☐

Please inform Middle Grade/Consultant of admission at appropriate time.

Date and Time informed: ______________________________

Senior Review:

________________________________________________________________________________________
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Signature

Patient Clerking –Medical
## Integrated Care Pathway for the Paediatric Neutropenic Patient, Salisbury NHS Foundation Trust

### Results

<table>
<thead>
<tr>
<th>Date</th>
<th>Hb</th>
<th>WCC</th>
<th>Plt</th>
<th>Neutrophils</th>
<th>Na</th>
<th>K</th>
<th>Urea</th>
<th>Creatinine</th>
<th>CRP</th>
<th>Alb</th>
<th>Protein</th>
<th>ALP</th>
<th>ALT</th>
<th>Bilirubin</th>
<th>Ca</th>
<th>PO4</th>
<th>Mg</th>
</tr>
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</tr>
</tbody>
</table>

### Microbiological Results

<table>
<thead>
<tr>
<th>Date sent</th>
<th>Culture site</th>
<th>Result – Organism, Sensitivities and Date Reported</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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</tbody>
</table>
Patient Clerking – Medical

Integrated Care Pathway for the Paediatric Neutropenic Patient, Salisbury NHS Foundation Trust

Date……………………………

Discharge Check List:

Standard Discharge letter with TTO’s completed: Yes ☐ No ☐

Piam Brown Discharge (page 15) form completed and faxed: Yes ☐ No ☐

Date of next blood test arranged: Yes ☐ No ☐

Date of next Hospital appointment arranged: Yes ☐ No ☐

Community Nurses informed of admission/discharge: Yes ☐ No ☐

Dr Staples/Dr Ridley aware of admission/discharge: Yes ☐ No ☐

Attach Patient Label Here
Name
Address
Hospital Number D of B
Intentionally left blank
Paediatric Oncology Patients - Summary of treatment received at POSCU

Information that will be useful to us: reason for admission & other problems e.g. febrile neutropenia (inc duration of antibiotics & culture results), nausea, vomiting, need for iv fluids, mucositis & severity, duration of TPN (if applicable) & blood results. Toxicity chart may help with grading (tick appropriate box)

Name ___________________________ DOB ___________________________

Date of admission ____________ Date of discharge ____________

Weight O/A _______________ Weight at discharge _______________

**Blood counts & transfusions**: ensure parent held record up to date with blood counts & dates of transfusions

**Main Issues** (febrile neutropenia, vomiting etc) please list or code as below: -

1. 
2. 
3. 
4.

<table>
<thead>
<tr>
<th>Toxicity</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral</td>
<td>None</td>
<td>Soreness</td>
<td>Ulcers/able to eat solids</td>
<td>Unable to eat solids</td>
<td>TPN due to stomatitis</td>
</tr>
<tr>
<td>Vomiting (no. episodes/24 h)</td>
<td>0</td>
<td>1</td>
<td>2-5</td>
<td>6-10</td>
<td>&gt;10 or TPN necessary</td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>None</td>
<td>Transient 1-2 days</td>
<td>Tolerable &gt; 2 days</td>
<td>Intolerable</td>
<td>Bloody diarrhoea or TPN needed</td>
</tr>
<tr>
<td>Constipation</td>
<td>None</td>
<td>Mild</td>
<td>Moderate</td>
<td>Abdominal distension</td>
<td>Distension &amp; vomiting</td>
</tr>
<tr>
<td>Infection</td>
<td>None</td>
<td>Minor: oral antibiotics</td>
<td>Moderate: well IV antibiotics</td>
<td>Major: unwell</td>
<td>Unwell &amp; hypotension</td>
</tr>
<tr>
<td>Fever (°C)</td>
<td>None</td>
<td>37.1 – 38</td>
<td>38.1 – 40</td>
<td>&gt; 40 for &lt; 24 hr</td>
<td>&gt; 40 for &gt; 24 hr</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In addition for febrile neutropenia dates of starting/changing antibiotics & any positive culture results

<table>
<thead>
<tr>
<th>Antibiotic e.g.</th>
<th>Date started</th>
<th>Date stopped</th>
<th>Reason for change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tazocin</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Microbiology</th>
<th>Date</th>
<th>Culture results</th>
<th>Sensitivities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

Other issues TPN etc: Drugs on discharge: