Clinical Guideline
BURNS (PAEDIATRIC): TOXIC SHOCK SYNDROME AND SEPSIS

SETTING         Bristol Royal Hospital for Children (BRHC)
FOR STAFF       All staff treating paediatric burns
PATIENTS        Paediatric burns patients

Introduction
Toxic shock syndrome (TSS) is a very rare but potentially fatal illness caused by a bacterial toxin. If managed appropriately and early, outcome is usually good. The causative bacteria include *Staphylococcus aureus* and *Streptococcus pyogenes*.

Symptoms and signs
Simplified Criteria for TSS:

- Pyrexia \(>39^\circ\text{C}\)
- Rash (non-specific of any type)
- Diarrhea +/- vomiting
- Irritability
- Lymphopaenia/Hyponatraemia

Burn Sepsis
Due to the nature of burn injury, burn patients of >20% total body surface area (TBSA) will exhibit the "systemic inflammatory response syndrome" (SIRS) so diagnosing sepsis is difficult. Current definitions for sepsis have many criteria in common with SIRS: fever, tachycardia, tachypnoea, leukocytosis and raised C-reactive protein (CRP). In order to aid diagnosis the following criteria can be applied.
Symptoms of sepsis include any change in the burn patient that triggers concern for infection

Age Specific Values
These triggers include at least three of the following:

- Temperature >39°C OR < 36.5°C;
- Progressive Tachycardia;
- Progressive Tachypnoea;
- Hypotension;
- Rash – of any type;
- Capillary Refill Time >3 – 4 seconds;
- ↓GCS, disinterest in surroundings /family /feeding;
- Thrombocytopenia;
- Abnormal Coagulation profile;
- Leucopenia OR;
- Hyperglycaemia (no pre-existing diabetes mellitus);
- Inability to continue tolerating enteral feeds once established.

Formal identification of sepsis will require:
- Culture positive infection;
- Pathologic tissue source identified, or;
- Clinical response to antimicrobials.

### Age Specific Values

<table>
<thead>
<tr>
<th>AGE</th>
<th>Tachycardia/Bradycardia (Heart Rate)</th>
<th>Tachypnoea (Resp. Rate)</th>
<th>Hypotension (Systolic BP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 1 week</td>
<td>&gt;180/&lt;100</td>
<td>&gt;60</td>
<td>&lt;59</td>
</tr>
<tr>
<td>1wk – 1mth</td>
<td>&gt;180/&lt;100</td>
<td>&gt;50</td>
<td>&lt;75</td>
</tr>
<tr>
<td>1mth – &lt;2yrs</td>
<td>&gt;35</td>
<td>&gt;35</td>
<td>&lt;75</td>
</tr>
<tr>
<td>2yrs – 5yrs</td>
<td>&gt;140/&lt;90</td>
<td>&gt;30</td>
<td>&lt;75</td>
</tr>
<tr>
<td>6yrs – 12yrs</td>
<td>&gt;130/&lt;60</td>
<td>&gt;20</td>
<td>&lt;83</td>
</tr>
<tr>
<td>&gt;12yrs</td>
<td>&gt;110/&lt;60</td>
<td>&gt;20</td>
<td>&lt;90</td>
</tr>
</tbody>
</table>

N.B.
- When reviewing observations take note of individual patients normal values and make considerations to the effect of current medications masking symptoms i.e. Propranolol.
- Hypotension is a late symptom and should not be waited for in order to act.

**Burn Sepsis/TSS escalation pathway ‘sticker’**

All children showing any signs and symptoms for sepsis and or TSS are to have sticker inserted into notes and the actions followed within the critical time periods stated.
Burns patients with presumed septicaemia/burn wound infection

- **Penicillin allergy** – patients with a history of anaphylaxis, urticaria or rash immediately after penicillin administration (type 1 allergy) should not receive a penicillin, cephalosporin or other β-lactam antibiotic.

- For patients with burns of ≥2 weeks duration and/or who are colonised with multidrug resistant Gram-negative bacilli: Seek advice from a clinical microbiologist.

- If patient is known to be colonised with MRSA and/or is moribund, use a teicoplanin based regimen.

- Modify therapy in light of culture and susceptibility test results (blood culture and burn wound surveillance cultures).

- **Duration of treatment:**
  - If blood culture positive – discuss with Microbiology team;
  - If blood culture negative and assumed TSS – give a minimum of 24 hours of IV antibiotic followed by an oral equivalent totalling 5 days treatment;
  - If blood culture negative and TSS not assumed – stop antibiotics.
<table>
<thead>
<tr>
<th>Number of days after burn/previous antibiotics</th>
<th>Likely pathogen</th>
<th>Treatment</th>
</tr>
</thead>
</table>
| ≤5 days                                       | S. aureus β haemolytic streptococcus | **Flucloxacillin**  
- <7 days: 50mg/kg IV bd  
- 7 – 21 days: 50mg/kg IV tds  
- 21 days – 18 years: 50mg/kg IV qds  
(Max 2 grams/dose) |
|                                               |                | **Cefuroxime**  
- <7 days: 50mg/kg IV bd  
- 7 – 20 days: 50mg/kg IV tds  
- 21 – 28 days: 50mg/kg IV qds  
- >1 month: 50mg/kg IV tds  
(max 1.5 grams/dose) |
| Penicillin allergy (not type 1)               |                | **Teicoplanin**  
≤28 days: 16mg/kg IV loading dose then 24 hours later 8mg/kg IV daily (intravenous infusion over at least 30 minutes in neonates)  
- >1 month: 10mg/kg IV bd (3 doses) then 10mg/kg daily  
(max 400mg/dose) |
| Penicillin allergy type 1 or MRSA positive    |                | **Penicillin allergy type 1 or MRSA positive** |
| 6 – 9 days                                    | S. aureus β haemolytic streptococcus Coliforms | **Co-amoxiclav**  
- <3 months: 30mg/kg IV bd  
- >3 months: 30mg/kg IV tds  
(max 1.2 grams/dose) |
|                                               |                | **Cefuroxime**  
- <7 days: 50mg/kg IV bd  
- 7 – 20 days: 50mg/kg IV tds  
- 21 – 28 days: 50mg/kg IV qds  
- >1 month: 50mg/kg IV tds  
(max 1.5 grams/dose) |
| Penicillin allergy (not type 1)               |                | **Teicoplanin**  
≤28 days: 16mg/kg IV loading dose then 24 hours later 8mg/kg IV daily (intravenous infusion over at least 30 minutes in neonates)  
- >1 month: 10mg/kg IV bd (3 doses) then 10mg/kg daily  
(max 400mg/dose) |
| Penicillin allergy type 1 or MRSA positive    |                | **Penicillin allergy type 1 or MRSA positive** |
| ≥10 days                                      | S. aureus Coliforms P. aeruginosa | **Piperacillin-tazobactam**  
90mg/kg IV tds  
(max 4.5 grams/dose) |
|                                               |                | **Teicoplanin**  
≤28 days: 16mg/kg IV loading dose then 24 hours later 8mg/kg IV daily (intravenous infusion over at least 30 minutes in neonates)  
- >1 month: 10mg/kg IV bd (3 doses) then 10mg/kg daily  
(max 400mg/dose) |
| Penicillin allergy (not type 1)               |                | **Teicoplanin [As per above]**  
- AND  
**Ceftazidime**  
< 7 days: 50mg/kg IV od  
≥7–20 days: 50mg/kg IV bd  
≥21–28 days: 50mg/kg IV tds  
(max. 6g per day) |
| Penicillin allergy type 1 or MRSA positive    |                | **Penicillin allergy type 1 or MRSA positive** |

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Author(s) S.Pomeroy, AE Young, P Williams
Administration of Fresh Frozen Plasma (FFP)

Transfusion of Fresh Frozen Plasma (FFP) to Children

Indications for Use

- Active bleeding in the presence of abnormal clotting tests.
- Massive transfusion (see Guidelines for the Management of Massive Haemorrhage in Children).
- Proven or suspected toxic shock if immunoglobulin is inappropriate, with the approval of a PHDU/PIC consultant.
- To correct abnormal clotting parameters in the absence of active bleeding prior to invasive procedures (aim for PT within the normal range).
- Following invasive neurosurgical procedures FFP may be necessary to correct abnormal clotting parameters on the advice of a senior doctor.

Requesting and cross match

FFP should be ABO compatible. For extreme emergency with no time for blood grouping: non-group-specific AB Methylene Blue Treated FFP (MBFFP) may be issued.

Product specification

MBFFP: virally inactivated, single donor, 50 – 75 ml or 250ml bags (US-sourced) if born on or after 1st January 1996.

Issuing guidelines for FFP

FFP takes approximately 20 minutes to defrost. It must be used within 4hrs of defrosting if factor VIII replacement is needed e.g. DIC. Otherwise it may be stored at 4°C (in a designated blood issue fridge) before administration to the patient providing the infusion is completed within 24hrs.

Prescription and Volume

Current paediatric transfusion guidelines recommend 10ml/kg. In older children the dose should be rounded down to the nearest whole unit to minimise donor exposure. Repeat clotting profile after administration. Multiple doses may be required. Prescribe the volume of FFP in millilitres and the duration of the transfusion on the Blood Transfusion Record and the child’s fluid chart.

Administration and Monitoring

FFP should be transfused through a standard blood giving set with a screen filter (170 – 200mm). Where small volumes are drawn into a syringe an appropriate filter must be used.
Guideline for administration of intravenous FFP for suspected TSS in paediatric burns

Decision to treat with FFP made by on call paediatric HDU/PIC consultant and the burns consultant.

Verbal consent obtained from the parents/carers of the decision to treat with a blood product.

Prescribe Dose: **10mls/kg**
**Phone through as urgent request to haematology.**

Solution can be administered via a blood giving set as soon as it is available.

Rate of infusion: over 1 hour.

Observations to be carried out every 15 mins until fully administered as per Blood Transfusion Guidelines.

Potential side effects:
- Fever;
- Headache;
- High or low BP;
- Nausea/sickness;
- Tiredness/drowsiness;
- Spotty rash/flushing of the skin;
- Joint pain/stiffness.

Notification to GP to be sent at discharge from hospital regarding burns complication and treatment with blood products received.
Guideline for administration of intravenous immunoglobulin (IVIG) for suspected TSS in paediatric burns

Decision to treat with IVIG made by on call paediatric HDU/PIC consultant and the burns consultant.

Request PRIVIGEN® liquid.

Dose: $2g/Kg = 20ml/kg$ of 10% solution.

Solution is stored at room temp, so can be given straight away.

Rate of infusion: Refer to table overleaf per weight.

Observations to be carried out every 15mins until max rate has been achieved. Then hourly obs.

Potential side effects:
- Fever;
- Headache;
- High or low BP;
- Nausea/sickness;
- Tiredness/drowsiness;
- Spotty rash/flushing of the skin;
- Joint pain/stiffness.

A letter to the patient’s GP is sent to inform them that IVIG can interfere with live vaccines for a period of at least six weeks and up to three months after administration.
ADMINISTRATION OF PRIVIGEN®

Privigen® should only be administered to the patient for whom it is labelled due to drug accountability records. See section 3.5 for the recommended monitoring requirements.

The batch number of each vial must be recorded on the patient’s drug chart using the stickers provided.

Privigen® solution does not contain anti-microbial preservatives, so it is recommended that administration should begin immediately after piercing the stopper.

Privigen® should be administered as an intravenous infusion at an initial rate of 0.3mL/kg/hour for approximately 30 minutes. If this rate is well tolerated, the rate of administration may be gradually increased, by doubling the rate every 30 minutes to a maximum of 4.8mL/kg/hour for the remainder of the infusion.

This table provides example infusion rates for a range of body weights as a guide:

<table>
<thead>
<tr>
<th>Administration rate: mL/Kg/hour</th>
<th>0.3</th>
<th>0.6</th>
<th>1.2</th>
<th>2.4</th>
<th>4.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (kg)▼</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1.5</td>
<td>3</td>
<td>6</td>
<td>12</td>
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</tr>
<tr>
<td>10</td>
<td>3</td>
<td>6</td>
<td>12</td>
<td>24</td>
<td>48</td>
</tr>
<tr>
<td>15</td>
<td>4.5</td>
<td>9</td>
<td>18</td>
<td>36</td>
<td>72</td>
</tr>
<tr>
<td>20</td>
<td>6</td>
<td>12</td>
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<td>25</td>
<td>7.5</td>
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<td>120</td>
</tr>
<tr>
<td>30</td>
<td>9</td>
<td>18</td>
<td>36</td>
<td>72</td>
<td>144</td>
</tr>
<tr>
<td>35</td>
<td>10.5</td>
<td>21</td>
<td>42</td>
<td>84</td>
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<td>40</td>
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<tr>
<td>45</td>
<td>13.5</td>
<td>27</td>
<td>54</td>
<td>108</td>
<td>216</td>
</tr>
<tr>
<td>50</td>
<td>15</td>
<td>30</td>
<td>60</td>
<td>120</td>
<td>240</td>
</tr>
</tbody>
</table>

For further information regarding the administration of PRIVIGEN® see link below:


References


**RELATED DOCUMENTS**


**AUTHORISING BODY**

- Children’s Clinical Effectiveness
- Plastic and Burns Governance

**SAFETY**

If there are unusual or unexpected safety concerns (to staff or patient), emphasize them here

**QUERIES**

Contact Shirin Pomeroy ext 27910/bleep 6780, or on call Burns Consultant if out of hours
Dear

Ref: [insert patient name, DOB, address]

This is to inform you that the above named patient presented to the Paediatric Burn Service in Bristol on [date] with a burn injury.

During the course of the child’s recovery the child was suspected to have a toxic shock like illness which required [him/her] to need to be given a 2g/kg dose of IV immunoglobulin on [date] as is our standard treatment protocol for all suspected cases.

Whilst there is good evidence to support IV immunoglobulin as first line treatment in this instance, there is also reported information that it can interfere with the effectiveness of live vaccines for 6 weeks and up to 3 months after administration.

We felt it necessary to convey this information to you as it may delay this child’s immunisation schedule.

If you have any further questions in regard to this, then please do not hesitate to contact me on behalf of the service.

Laurie Sparks
Paediatric Burn Service Co-ordinator