

Joint Trust Guidelines for Management of Central Venous Catheter Infection in Children Receiving Parenteral Nutrition

For Use in:	Children's services, Neonatal Intensive Care Unit, Paediatric Gastroenterology and Paediatric Surgery
By:	Children's healthcare providers in the above areas
For:	Neonate, infants and children under age of 16 years
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The Trust's guidelines are made publicly available as part of the collective endeavour to continuously improve the quality of healthcare through sharing medical experience and knowledge. The Trust accepts no responsibility for any misunderstanding or misapplication of this document.

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Objective

This guideline will set the standard of care for the management of **central venous catheter (CVC)** infection in children receiving **parenteral nutrition (PN)**. It will define the various types of CVC infection and specify the initial assessments, investigations and treatments required in these patients.

It will also form a part of the trust guideline in management of central venous catheter related infections and compliments the guideline on central line care.

Background

CVC infection accounts for 42% of all **blood stream infection (BSI)** in England.¹ It is potentially life threatening. A logical approach in its management is especially important due to the limited number of sites available for CVC insertion, and the significant morbidity and mortality associated with CVC infection.

The mainstay of treatment remains adopting meticulous, excellent CVC care to prevent infection, echoing the National Patient Safety Agency's recommendations and the trust's CVC care bundle.² A series of risk reduction measures are in place to achieve the optimal outcome of near zero CVC associated BSI (**Catheter Associated (CA) BSI**).³

By standardising management of CVC infections, this guideline aims to reduce morbidity and mortality, and to improve catheter salvage rate, following suspected CVC associated infection.

Definitions

Most patients on long term PN will be receiving PN via a tunnelled CVC (e.g. Hickman, Broviac, port), although some patients may receive short term PN via a non-tunnelled CVC. The guideline covers both types of CVC. Definitions are as follow:

Exit site infection

Erythema, tenderness, induration or purulence within 2cm of the skin at the exit site of the catheter. This distance may be less in smaller infants/toddlers, and if in doubt, it should be considered to be a tunnel infection.

Tunnel infection

Erythema, tenderness and induration in the tissues overlying the catheter and > 2cm from the exit site. This distance may be less in smaller infants/toddlers, and if in doubt, it should be considered to be a tunnel infection.

Blood stream infection (BSI)

≥1 **Blood culture (BC)** positivity with pathogens *or*
≥2 BC positive skin organism plus ≥2 systemic inflammatory response syndrome (SIRS) criteria

Catheter associated blood stream infection (CA BSI)

BSI *and*

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CVC present (or ≤ 48 h removal) during BC *and*
No other source found

Catheter related blood stream infection (CR BSI)

BSI *and*
CVC present (or ≤ 48 h removal) during BC *and*
CVC BC positive / tip positive / peripheral culture positive

Catheter suspected blood stream infection (CS BSI)

BC negative *and*
SIRS *and*
Improved with CVC removal *and*
No other source likely

Systemic inflammatory response syndrome (SIRS)

In general *adult* practice, SIRS is defined by 2 or more of the following 4 criteria fulfilled⁴:

- Temperature $< 36^{\circ}\text{C}$ or $> 38^{\circ}\text{C}$
- Tachycardia with heart rate $> 90/\text{min}$
- Tachypnoea respiratory rate $> 20/\text{min}$; $\text{PaCO}_2 < 4.3 \text{ kPa}$ (32 mmHg)
- White blood cell count $< 4 \times 10^9/\text{L}$ or $> 12 \times 10^9/\text{L}$

However, in *children*, the modified SIRS criteria⁵ is clinically difficult to be applicable due to its changing physiology and vital signs with age. Therefore a more pragmatic approach agreed among consultant paediatricians and surgeons is to adopt the trust's pre-existing Children's Early Warning Score (CEWS) chart. This means any deviation of temperature, heart rate, or respiratory rate out with the normal range on the CEWS chart, corrected for age, will be regarded as meeting the criteria; similarly, any deviation of white blood cell count out with the normal range will also be regarded as meeting the criterion. Therefore if any 2 or more of the 4 criteria are fulfilled, it is regarded as SIRS.

Clinical Assessments

Signs and symptoms

After excluding other sources of infection e.g. pneumonia, ENT, urinary tract and meningitis, the following features should raise clinical suspicion of CA BSI:

- Temperature $> 38.5^{\circ}\text{C}$
- Erythema at line site
- Tachypnoea / grunting
- Tachycardia
- Fall in blood pressure

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- Poor perfusion
- Irritability / lethargy
- Increase in diarrhoea / stoma output / vomiting
- Hyperglycaemia

As a general rule – any temperature greater than 38.5°C in a patient with a CVC should be assumed to be CVC sepsis until proven otherwise, and should be acted on the first temperature.

The following features should raise concern of severe line sepsis:

- Haemodynamic instability / poor perfusion
- Rigor when CVC is flushed
- Fluid bolus requirement > 20ml/Kg
- Falling or low platelets

Investigations

- Central blood cultures (both lumens if double lumen)
- Peripheral blood cultures
- Exit site swab cultures (if suspected)
- FBC, CRP, U&E, LFT, Ca, Mg

Perform other investigations as clinically indicated to exclude alternative sepsis source e.g. urine MC&S, lumbar puncture, chest x-ray, and nasopharyngeal aspirate for upper respiratory tract viral illnesses.

Treatments

(1) Consider HDU / PICU care

(2) Microbiology:

- Take blood cultures from central and peripheral line (preferably away from an indwelling device) , and swab from exit sites
- Check previous culture results from this patient
- Give antipyretics to a child in distress or pain, but not just for control of fever, in order to avoid masking a rising temperature
- Administer first line antibiotics for 48h (see **Table 1**) and chase sensitivities
- If bacteraemia (BSI) is suspected, give Tazocin and Vancomycin
- Once positive culture is obtained, give definitive oral or IV antibiotics ≥10 days

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(3) Fluid / electrolyte / nutrition:

- If severely unwell and shocked, please refer to the **Meningitis Guideline / Shock Guideline**
- If bacteraemia (BSI) is present, stop PN running in CVC, pending discussion with Paediatric Gastroenterology team
- Establish alternative peripheral IV access if possible
- Monitor electrolytes including Ca/Mg/PO4

(4) Consideration for line removal:

- Other than exceptional emergency situation, CVC removal should be a balanced decision following discussion with the main consultant in charge of the patient
- Worth preserving CVC if:
 - Any site – *S. epidermidis*
 - Exit site – any infection
- Consider removing CVC if:
 - BSI – Gram negative bacteria
- Strongly consider removing CVC if:
 - BSI – *S.aureus*, MRSA, candida

Table 1: First line actions and antibiotics for suspected infections of CVC

Exit site infection	Tunnel infection	Bacteraemia (BSI)
Oral/IV Flucloxacillin*	IV Flucloxacillin* (+/- Gram negative cover)	Vancomycin and Tazocin
Clean & swab exit site	Clean & swab exit site	Consider change in antibiotics if fever persists > 48h
Continue CVC PN**	Continue CVC PN**	Consider stopping CVC PN & minimise use, establish peripheral access**
Guided by cultures	Guided by cultures	Guided by cultures

*Antibiotics to be modified in light of culture results and discussion with Microbiologist

**Other than bacteraemia (BSI) present, do not stop PN unless consultant on-call considers this necessary.

Further Considerations

- The use of antibiotic impregnated CVC is available for patients requiring short term non-tunnelled CVC (e.g. Cook Spectrum catheter) and may be considered. Evidence

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suggested that it can be money saving (7 BSI is avoided for every 1000 catheter day) and life saving (1 death prevented for every 300 impregnated CVC)⁶

- As a part of BSI prevention strategy, antibiotic (Rifampicin/minocycline) or antimicrobial (taurolidine in Taurolock) coated central line should be used during periods when CVC is not used for continuous infusion. ⁷ Taurolock is considered on a named patient basis in NNUH and directly coordinated by Consultant Paediatric Gastroenterologists
- There is a lack of high quality evidence to recommend antibiotic line lock as a standard approach for the treatment of colonised central lines. In selected patients, judicious use of antibiotic line lock is a safe technique to eradicate bacterial colonisation and can potentially avoid catheter removal. This is a consultant decision in collaboration with Microbiology

Development and Consultation Process Undertaken Before Registration and Dissemination

The author listed above drafted this guideline on behalf of the departments of Paediatric Surgery and Paediatric Gastroenterology who have agreed the final content. During its development it has been circulated for comment to:

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Dr Briars, Consultant Paediatric Gastroenterologist
Dr Morris, Consultant Paediatric Gastroenterologist
Dr Armon, Consultant Paediatrician
Mr Tsang, Consultant Paediatric & Neonatal Surgeon
Mr Mathur, Consultant Paediatric Surgeon and Urologist
Mr Kulkarni, Consultant Paediatric Surgeon and Urologist
Mr Minocha, Consultant Paediatric & Neonatal Surgeon
Mr England, Consultant Paediatric & Neonatal Surgeon

This version has been updated and, reviewed in 2016 by the above. This document has been produced following discussion and presentation with a committee, in presence of the consultants above, before submitting for approval to the Clinical Guidelines Assessment Panel.

Distribution List

Trust intranet
Buxton ward
CAU
A&E

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Version No	Updated By	Updated On	Description of Changes
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JCG0033 v2	Ami Pederson	July 2016	Stakeholders confirmed guidelines up to date. Minor amendments to text for clarification.