Clinical Guidance

Paediatric Critical Care: Oncological Emergencies

Summary
Guidance on management of patients who are suffering an oncology emergency.

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This clinical guideline has been produced by the South Thames Retrieval Service (STRS) at Evelina London for nurses, doctors and ambulance staff to refer to in the emergency care of critically ill children.This guideline represents the views of STRS and was produced after careful consideration of available evidence in conjunction with clinical expertise and experience. The guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient.	

Terms used:
G-CSF: granulocyte-colony stimulating factor, PTC: primary treatment centre, GvHD: Graft vs Host Disease

Change History		
Date	Change details, since approval	Approved by
03/2022	Format changes. Updated fluids/ inotropes as per UK resus changes. Pathophysiology added for TLS/ mediastinal mass. When to discuss with PTC added. Link to panlondon guidance. Approved by Marsden - Dr Sucheta Vaidya. Anti-microbial doses removed – to be checked in formulary as per other guidelines.	ELCCG March 2022 ASC Sept 2022

Paediatric Critical Care

Paediatric Oncological Emergencies

South Thames Retrieval Service for Children

- ~1900 new cases of childhood cancer in the UK every year, Leukaemias account for ~30% (mainly AML & ALL)
- Many children present with insidious symptoms worsening over weeks/ months - mild symptoms can belie the severity of the emergency

Discuss all cases with Primary Treatment Centre (PTC): Royal Marsden (Carshalton): 0208 642 6011 GOSH: 0207 405 9200

Febrile Neutropenia (FN)/ Neutropenic Sepsis

- Single temperature ≥38ºC, or signs of sepsis
- Neutrophil count <0.5x10^9 /L/ falling/ unknown (nadir 5-10 days post chemotherapy)
- ***Anyone with low neutrophils, who appears unwell (+/- fever) should be treated, even if not quite fitting definition of FN***

High Risk Tumours / Patients

- Acute haematological malignancies (Leukaemias/Lymphomas)
- Patients with chronic immune suppression
- Indwelling central venous catheter (CVC)

Presentation & Investigations

- Typically, warm shock: ↑HR, ↓BP, wide pulse pressure, bounding pulses, brisk CRT
- Meticulous examination for infection focus (including mucositis)
- Send: blood cultures (central + peripheral), urine culture, CXR, FBC, U&Es, LFTs, coagulation profile

Treatment

- If using indwelling line causes septic shower- site new line
- Fluid resuscitation – 10mL/kg aliquots, may need 40-100mL/kg
- Antibiotics within the 1st hour (see below)
- Early inotropes(peripheral or central – see STRS calculator/web)
  - Adrenaline if concerns about cardiac function
  - Noradrenaline for warm shock/ wide pulse pressure
- Early non-invasive ventilation for cardio-respiratory support
- Intubate early if fluid or inotrope resistant shock, or coma

Induction:

Ketamine 2mg/kg, fentanyl 2microgram/kg, rocuronium 1mg/kg

AVOID PROPOFOL *– CVS instability ++ in paediatric sepsis*

Antibiotic choices:

1) Usual first line → **piperacillin/ tazobactam** + **gentamicin** (level pre-second dose)
2) Add **teicoplanin** or **vancomycin** for suspected line/ port infection – give through indwelling line
3) **Meropenem** if suspected meningitis
4) Change **gentamicin** → **ciprofloxacin** if bone tumour/ renal impairment
5) Change **piperacillin/ tazobactam**→**ciprofloxacin** in penicillin allergy
6) Liposomal Amphotericin if suspected fungal infection – needs abdo US, chest HR-CT, +/- BAL/Echo/CT head

D/W PTC:

- Consider Lenograstim (G-CSF)
- Consider central line removal if: refractory shock, falling platelets, bacterial showering during use, persistent positive blood cultures >96hrs or obvious line tract/ port infection

Hyperleukocytosis (WCC >50x10^9)

10-30% leukaemias. Highest risk with AML type M5

Increased blood viscosity due to high number of cells. Blasts: less deformable & ↑metabolic demands→ localised hypoxia & cytokine release → micro-vascular sludging → **Leukostasis/ Hyperviscosity Syndrome**

- Risk of cerebral/ pulmonary/ renal infarction or haemorrhage
- May lead to spiral of worsening renal failure
- May need urgent exchange transfusion/Leukapheresis

*****Discuss with PTC & transfer urgently if suspected*****

Investigations:

Urgent blood film, coagulation profile, X-match, U&E, urate, LFTs, bone profile, LDH, Immunophenotyping, viral serology (CMV, VZV, Hepatitis), CXR

Management:

WBC >100x10^9/L + symptomatic → transfer to PICU within 2hr

WBC >100x10^9/L + asymptomatic → urgent transfer to PICU

WBC 50-100x10^9/L → transfer to PTC, continuous monitoring

- Avoid red cell transfusion →if essential, max 5mLs/kg over 4 hr
- Accept platelets >30x10^9/L unless active bleeding/ coagulopathy
- 0.9% sodium chloride & 5% glucose 3L/m^2/day (**NO added K+)**

Tumour Lysis Syndrome (TLS)

- Rapid cell death, release of cell contents into circulation: ↑urate, ↑potassium (K^+), ↑phosphate (PO_4^{2-}), ↓calcium (Ca^{2+})
- Progressive renal, and ultimately multi-organ failure
- Should be mitigated against in all suspected haematological malignancy & large bulk solid tumours

High Risk Tumours/ Predisposing conditions

- B & T Non-Hodgkin's Lymphoma (esp. Burkitt's Lymphoma), T-Cell ALL
- Large bulk solid disease incl. significant hepatosplenomegaly
- Oliguria, dehydration, renal infiltration or renal failure
- WBC>100 x10^9/L
- Highest risk at presentation and up to 72hrs post induction chemo

Prevention

- Hyperhydration 2.5-3L/m^2/day + furosemide PRN (0.9% sodium chloride + 5% glucose - **NO added K+**)
- Aim urine output >3mL/kg/h
- 6-8hrly TLS bloods
- Allopurinol 100mg/m^2/dose TDS

Treatment

- Hyperhydrate 3-4L/m^2/day + 4-6hrly TLS bloods + furosemide PRN
- Rasburicase 200micrograms/kg/dose OD
- If K^+ ≥ 5.5 mmol/L, start treatment (STRS Electrolyte Emergencies)
- Consider phosphate binder if hyperphosphataemia $^-$ ≥ 2.1mmoL despite hyperhydration
- Early haemofiltration if: unresponsive high K^+ & PO_4^{2-}; symptomatic ↓ iCa requiring correction; established renal failure/ fluid overload
- Intubation for cardio respiratory compromise, coma, or vascath insertion (ideally CT neck & chest prior to VASCATH insertion)

Mediastinal Mass - Airway / SVC Obstruction

Some tumours cause mediastinal masses, leading to compression of the airway +/or great vessels (affecting pre-load or cardiac output).

Highest risk**:** NHL + T-cell ALL, thymoma, teratoma

Presentation

- May be asymptomatic - DOES NOT reflect degree of obstruction
- Respiratory distress with orthopnoea.
- Neurological signs (headaches, dizziness, syncope) + ↑ ICP
- Cardiovascular compromise

Management

- Erect CXR in all suspected oncology presentations
- Do NOT lie flat, avoid sedation – gravity/ loss of airway tone will worsen obstruction
- Avoid CT – if done, must be prone/ lateral + without sedation
- Sit up, face mask oxygen, NIV if needed (often well tolerated)
- IV access (femoral if SVC obstruction) + bloods
- Immediate consultant anaesthetic review - avoid intubation/ ventilation unless essential for life-threatening obstruction

HIGH RISK INTUBATION: Anaesthetic/ PICU consultant to decide on timing/ location/induction method. Consider ENT + cardiothoracics support. Anticipate difficult ventilation- use cuffed standard ETT.

- ↑ ICP: 2.7% sodium chloride 3mL/kg IV bolus, normocapnia/ thermia
- If evidence SVC obstruction, avoid upper limb for IV fluids – risk exacerbation of facial swelling & cerebral oedema.

Transfusion (always d/w PTC)

Packed red cells:

- Hb <70g/L or patient specific - 5ml/kg aliquots, slow transfusion

Platelets:

<10 x 10^9/L
<20 + febrile, septic, expected to fall
<30 + brain tumour
<50 + bleeding, coagulopathy, due LP/surgery, heparinised
<100 + life-threatening bleeding

Irradiated products?

Residual lymphocytes can cause fatal transfusion-associated GvHD if severely immunocompromised. Irradiated needed. Refer to pan-London guideline below

References: NICE CG151, Creutzig. Ped Blood Canc 2016, Pan London Supportive Care Protocols 2020