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Paediatric transfusion in Haematology and Oncology

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Who uses transfusions at our Paediatric Trust?

- Paediatric Surgery
- Paediatric Intensive Care
- **Haematology and Oncology Patients**
- General Medical Patients

Where does blood go?

- 20% surgery, NSU, PICU, general paediatric patients
- 80% to haematology / oncology patients (including haemoglobinopathies)
- No liver or cardiac surgery carried out at SCH
- Spinal surgery the largest surgical use
- Even that is much less since cell salvage

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Review of randomly chosen 7 day period in blood bank register – red cells

- Haem/Onc Ward - 55% of hospital red cell use
- PICU - 20%
- Theatres – 20%
- Medical Wards) 5%
- Surgical wards) together
- Neonatal Surgical Ward 0
- HDU 0

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Review of randomly chosen 7 day period in blood bank register - platelets

- Haem/Onc Ward - 70% of hospital platelet use
- PICU - 30% (all of whom were BMT patients)
- Theatres – 0
- Medical Wards - 0
- Surgical wards - 0
- Neonatal Surgical Ward - 0
- HDU - 0

Why are we such big users?

- Oncology
- Malignant Haematology
- HSCT
- Haemoglobinopathies
- Other benign haematology

Oncology

- At diagnosis
- Supportive after chemotherapy
- To allow surgery
- Supportive through radiotherapy
- Supportive through high dose procedures (autografts)

Example case, oncology at diagnosis

- 22 months
- Referred from paediatric outpatients
- Microcytic anaemia (Hb 68g/l)
- Abdominal distension, mass palpable

Investigations

- CT:large abdominal mass displacing the liver, pancreas and right kidney and extending into the lower mediastinum bilaterally.
- Large thrombus in IVC extending into and almost filling the right atrium

Biopsy

- Theatre planned for
  - Biopsy of mass
  - Venous access
  - Bone marrow aspirate
    - Red cell transfusion given (clotting and platelets normal)

Progress

- Close observation post procedure (HDU)
- ‘well’
- Heparin for extensive clot started 24 hours post biopsy
- Presumptive diagnosis of neuroblastoma, chemotherapy started asap

Problems

- 48hrs post biopsy
- Fever, loose stools overnight, no bowel sounds
- Obs stable but looks pale
- Hb 33g/l
- Heparin stopped, red cell transfusion given
- Clotting checked , PT prolonged, vit K given
- Surgical r/v – conservative management

Problems continue

- Abdominal distension
- Tachycardia
- Clotting normal but plts falling and D dimers raised
- CT - intratumour and intraperitoneal bleeding
- Inoperable
- Factor VIIa given
- Red cells given to keep up with loss
- Plan for platelets if further fall/continued bleeding

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5 years on……

- Alive and well
- Off treatment for 3½ yrs
- Transfusion allowed positive diagnosis

Case 2. Transfusion in high dose (autograft) procedures

- 15yr old with stage 2B abdominal Neuroblastoma
- 5 courses of chemotherapy
- Surgical resection of residual tumour Feb 2013
- Radiotherapy
- High dose Busulphan/Melphalan with auto stem cell rescue April 2013

Progress

- Coped well with conditioning and stem cell re infusion procedure
- Developed haematuria day +13
- Hydration increased
- Home at day +21, but still platelet transfusion dependent

Clinic day +28

- Tired, weak and dizzy
- Gross haematuria with clots
- Hb 67g/l, plts 25
- Urology advice – procedure related haemorrhagic cystitis
- Supra pubic catheter for irrigation and drainage, sodium pentosan polysulphate
- Bladder instillation of prostaglandin

Blood component usage

- Over 2 weeks
- 3 units red cells on 4 occasions
- 2 units on 1 occasion
- Almost daily platelets
- Total 14RBC units, 10 adult units platelets

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Learning points

- Serious complications can occur after discharge
- Transfusion support enables high dose procedures to go ahead
- Replace losses and frequently review
- Treat the underlying cause

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Use of transfusion in Malignant Haematology

- At diagnosis
- Supportive through episodes of bone marrow suppression
- Supportive through less common complications

Malignant haematology – at diagnosis
Case 3

- 5 year old boy presented to local hospital
- 6 week history diarrhoea, vomiting, lethargy, pallor, night sweats
- 2 day history of bruises and spots
- Examination: bruises and petechiae, enlarged liver and spleen, fever

Test results

- Hb 58g/l
- WCC 17.8
- Platelets 13
- Blood film: circulating blasts
- Antibiotics, fluids, transfer

Actions on arrival SCH

- Recheck FBC on arrival SCH, 32g/l, plts 10
- Need BMAsp for diagnosis - GA
- 1 adult unit of platelets (child's weight = 18kg)
- Raise Hb by 40g/l initially – 288mls calculated, whole unit prescribed and given
- Careful watch of fluid balance and U+Es, BP
- Post transfusion Hb 58g/l
- Further unit given prior to theatre
- Another unit the next day, post theatre, achieved Hb118g/l
- BM confirms ALL

Learning points

- Trying to prioritize – red cells? platelets?, fluids, antibiotics
- Need to avoid TACO – consider frusemide
- Frequent rechecking of FBC vital

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Leukaemia: 'unexpected' transfusion support: Case 4

- 4½ year old girl. ALL
- On interim maintenance phase
- Planned clinic visit
- Feeling unwell for 2 days
- Jaundice today
- Abdo pain and BNO 3/7
- Feels dizzy and sleepy

Exam and investigations

- BM 1.1
- Abdomen tender
- Jaundiced
- Confused but obeying commands

progress

- Large coffee ground vomit
- BP 59/29
- Pulse 55 initially

What's going on?

- Upper GI bleed
- Possible liver failure
  - Infection?
    - Bacterial
    - viral
  - Chemotherapy?

Results

- Hb 129, wcc 1.66, neuts 0.82, plts 579
- PT 24.1(14), APTT32.9 (35) Fib 2.3

Actions

- Vitamin K, FFP 20mls/kg
- PICU admission
  - Hypovolaemic shock, over 1st 24 hours required:
    - 40ml/kg 0.9% saline
    - 30ml/kg colloids
    - 20ml/kg FFP
    - 10ml/kg red cells
- Surgical r/v – antral ulcers, no varices
- Gastro/hepatology r/v – VOD (SOS)

2 years later……..

- Alive and well and coming to the end of treatment

Learning points

- Most children with ALL require blood components at certain points through treatment
- Occasional unexpected support needed for more unusual complications
- Blood component availability allows us to deliver toxic protocols that would not otherwise be possible

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Transfusion support in allo HSCT patients Case 5

- 17yr old
- Good risk AML
- treated ADE – ADE - HDAraC – HDAraC 2012
- Isolated marrow relapse January 2014
- Remission February 2014

Sibling donor BMT March 2014

- Blood component support:

- 3 units of platelets (irradiated)

  - Day +3
  - Day +4
  - Day +7
  - Discharged day +21

  Component usage is very variable……

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Transfusion in post transplant complications Case 6

- 9 year old girl
- Refractory Hodgkin's Lymphoma
- Unrelated donor transplant July 2013
- Straightforward early post transplant course
- CMV reactivation – successfully treated
- 6 month marrow - no relapse

7 months post transplant

- Headaches 2 days
- Feeling unwell
- Local FBC Hb 54g/l, retics 241x10^9/l
- Film, polychromasia, spherocytes
- Antibody screen positive
- DAT positive
- **Post transplant autoimmune haemolytic anaemia**

Post transplant auto immune haemolytic anaemia

- Since then has required 3 units RBCs/week (weight 24.75 kg)
- NHSBT investigation found auto anti M
- Need for transfusion support is not only acutely around the time of the diagnosis and transplant

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Transfusion in the haemoglobinopathies

Transfusion in other benign haematology conditions (1) Case 7

- 6 year old boy
- Neonatal jaundice requiring phototherapy, otherwise well
- No FHx of note
- 1 week, vomit, fever, unsteady
- FBC done via GP

results

- Hb 36g/l
- Retics 11 x 10^9/l
- Wcc 3.78 x 10^9/l
- Plts 150 x 10^9/l
- ?abnormal white cells on film

What other test would you do pre transfusion?

- Parvovirus pcr
- 334 million parvovirus DNA IU/ml
- Test Mum and Dad for HS
- Diagnosis: previously undiagnosed HS with aplastic crisis caused by Parvovirus infection
- Transfused uneventfully
- Spontaneous recovery

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Transfusion in other benign haematology conditions (2) Case 8

- Presented 10 days old, Hb 51g/l
- Reticulocytopenic
- Transfused and referred
- No raised ADA
- Initial bone marrow unremarkable
- No RPS19 mutation

Management

- Transfusion support to keep Hb between 80 and 120g/l
- Repeat BMAsp at 7 mths of age consistent with Diamond Blackfan Anaemia
- Plan to continue transfusions to age 1yr and then give trial of steroids

progress

- Parents unwilling to use steroids at 1 year
- 4 weekly transfusions continued to age 2yrs
- Trial of steroids – only partially responsive
- Transfusion dependent – started on iron chelation
- Consider transplant

Talking points

- Parents preferred transfusion to steroids
- 1/3 DBA patients transfusion dependent
- Successful sibling transplants have taken place

Transfusion in other benign haematology conditions (3) Case 9

- 6 year old boy referred by Gastroenterology team
- Auto immune hepatitis diagnosed 6 weeks previously after presenting with jaundice
- Started on Prednisolone after liver biopsy
- New problem: severe thrombocytopenia
- Hb and neutrophils in NR

Further investigations

- Bone marrow aspirate consistent with aplastic anaemia
- Peripheral counts fall as expected over the next few weeks
- Sibling donor transplant would be the best option
- 16 month old baby brother is an HLA match

Moral/logistical/practical dilemma

- E needs HSCT asap
- Potential sibling donor available, but very young
- Independent assessment - medical and psychological (parents)

Surprise! Counts recovering

- Apparent spontaneous recovery of red cells and neutrophils
- Requiring weekly platelet transfusions
- No red cell transfusion for 3 months

But, 5 months after diagnosis

- Platelet transfusion dependent
- Occasional red cell transfuion
- Neutrophils 0.7- 1.0
- Long discussion
- Decision to transplant

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Prior to transplant

- 3 units red cells
- 18 units platelets

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During transplant

- 2 units red cells
- 6 units platelets

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Paediatric transfusion: similarities to adults

- Equivalent conditions exist in adults
- Principles are the same
  - Appropriate transfusion
  - Avoid unnecessary transfusion
  - Carry out the transfusion as safely as possible
- Transfusion support is necessary to allow the treatments used for malignancy and transplant
- Transfusion with iron chelation allows a near normal life for a number of inherited conditions

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Paediatric transfusion: differences

- More precise calculations of volumes required
- Care needed with rates of transfusion
- Children have their whole life before them – careful balance of risks and benefits