



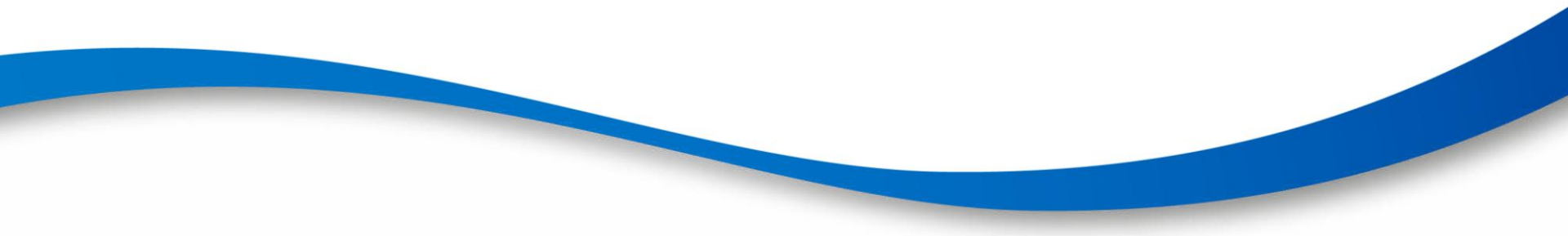
**North East  
& Yorkshire**

# **FBC Interpretation and Transfusion Triggers**

Presented by the North East & Yorkshire  
Non-Medical Authorisation working group

**Caring Expert Quality**

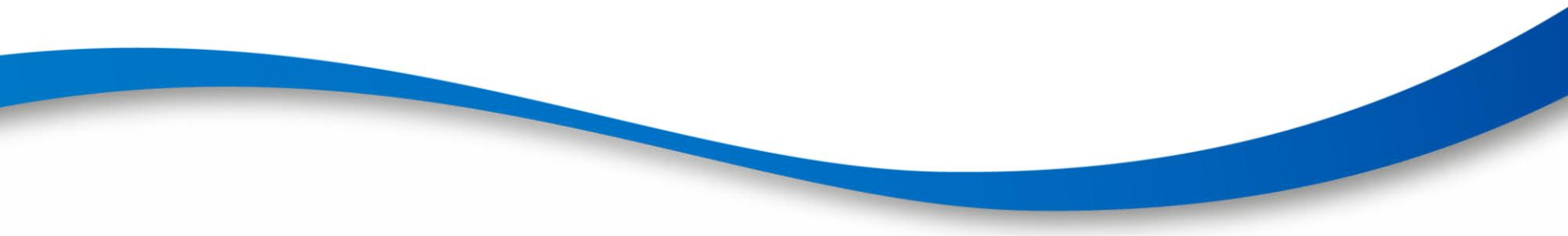
# Learning objectives

- Indicate the normal ranges for full blood count and explain what each measurement means
  - Recognise how to detect abnormal results and interpret possible causes
  - Give tools to help decision making around transfusing blood products (red cells and platelets)
- 

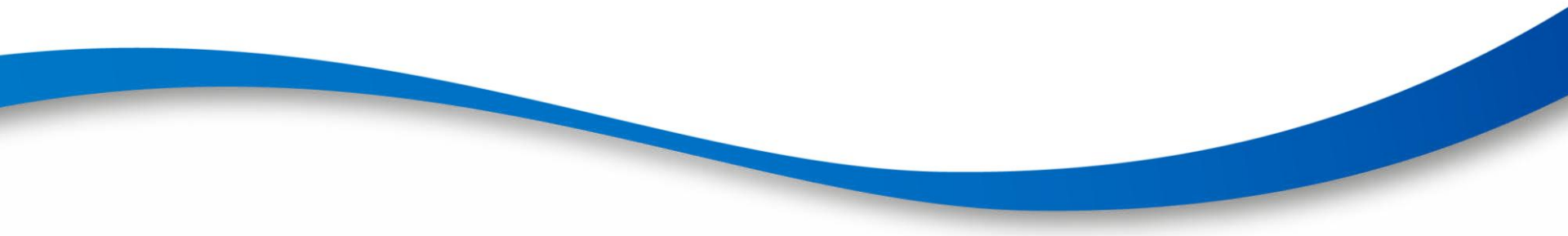
# Full blood count

| Parameter                     | Male         | Female       |
|-------------------------------|--------------|--------------|
| Haemoglobin g/l               | 135 - 180    | 115 - 160    |
| WBC x10 <sup>9</sup> /L       | 4.00 - 11.00 | 4.00 - 11.00 |
| Platelets x10 <sup>9</sup> /L | 150 - 400    | 150 - 400    |
| MCV fL                        | 78 - 100     | 78 - 100     |
| MCH pg                        | 27.0 - 32.0  | 27.0 - 32.0  |
| Neutrophils                   | 2.0 - 7.5    | 2.0 - 7.5    |
| Lymphocytes                   | 1.0 - 4.5    | 1.0 - 4.5    |
| Monocytes                     | 0.2 - 0.8    | 0.2 - 0.8    |
| Eosinophils                   | 0.04 - 0.40  | 0.04 - 0.40  |
| Basophils                     | < 0.1        | < 0.1        |

# Interpretation of Results

- FBCs, like all lab results, are like photos
  - They are only valid for the time at which they were taken
  - GIGO principle (Garbage In, Garbage Out)
    - If the sample was not taken properly and handled correctly, the results may be inaccurate
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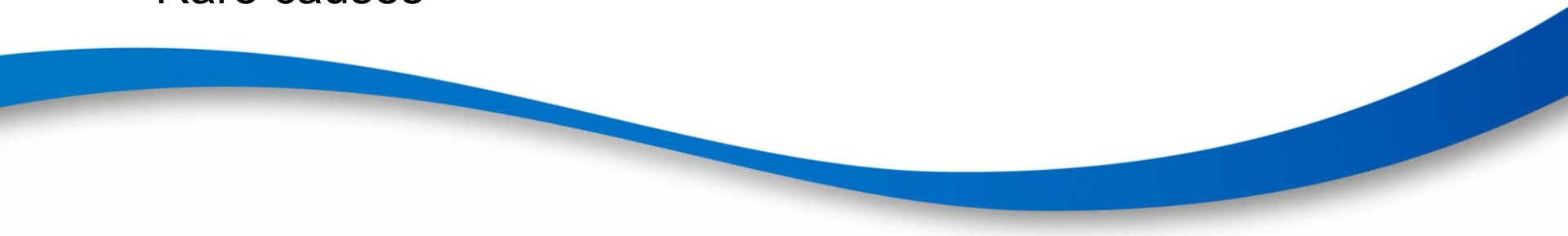
# Interpretation of Results

- If a result looks strange and does not fit the way the patient looks, check again!
  - (presuming it is not urgent)
  - And tell the lab you think it might be wrong
- 

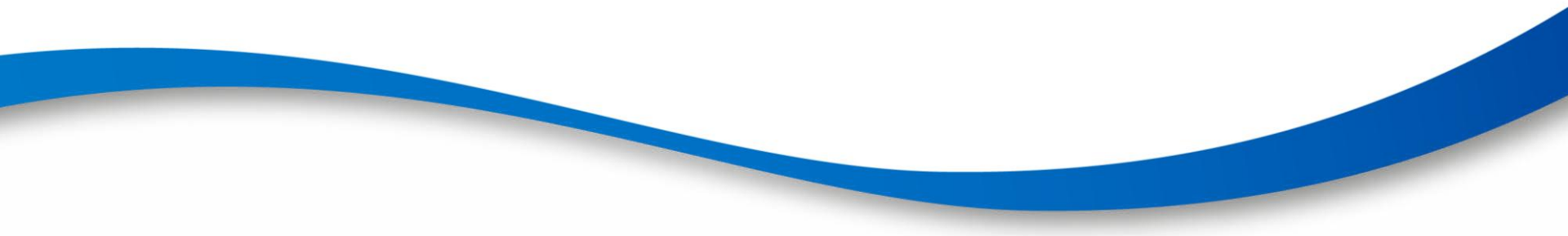
# Abnormal Results - Haemoglobin

- Focussing on interpretation of results that have relevance for transfusion skills
- Low – anaemia
  - Is this a haemorrhage situation?
  - If not...look at the size of the red cells (MCV)

# Anaemia

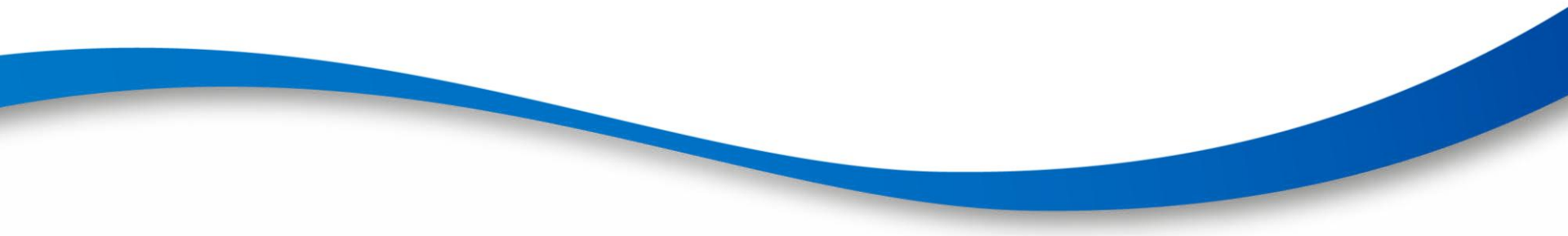
- Low MCV (small red cells)
    - Iron deficiency (by far the likeliest cause)
      - Dietary
      - Bleeding (GI, FCBP)
    - Haemoglobinopathy (thalassaemias mainly) – these people can also be iron deficient
    - Anaemia of chronic disease
    - Thyroid abnormalities
    - Rare causes
- 

# Anaemia

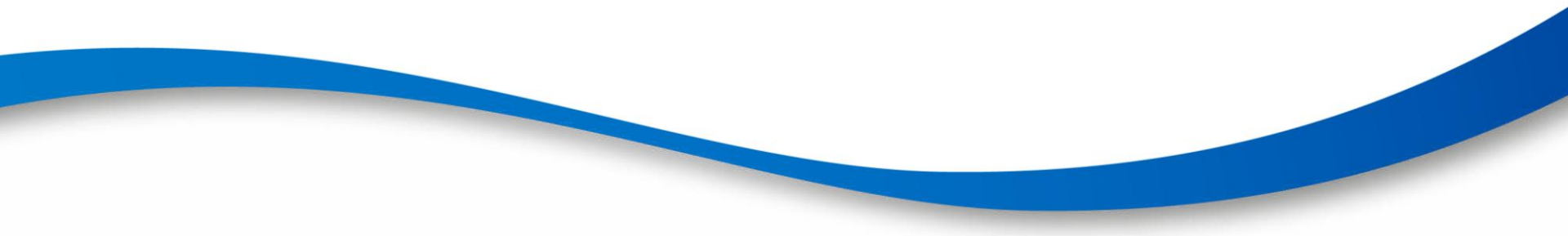
- High MCV (enlarged red cells)
    - B12 / folate deficiency
    - Excessive alcohol intake (chronic)
    - High red cell turnover (eg haemolysis, bleeding)
    - Myelodysplastic Syndrome (MDS)
    - Certain drugs (eg hydroxycarbamide, azathioprine)
    - Thyroid abnormalities
- 



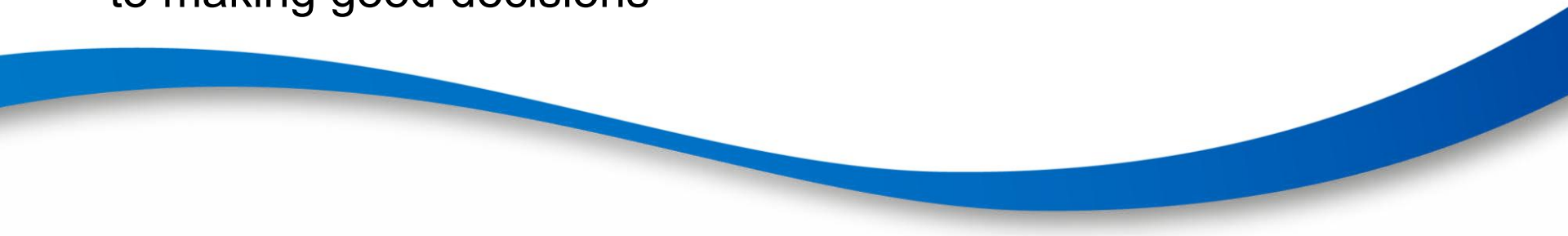
# Anaemia

- Normal MCV (red cell size normal on average)
    - Can happen with any of the previous causes
    - ‘Mixed’ picture of low/high MCV
    - Traditionally said to be likeliest with ‘anaemia of chronic disease’ or ‘renal anaemia’
- 

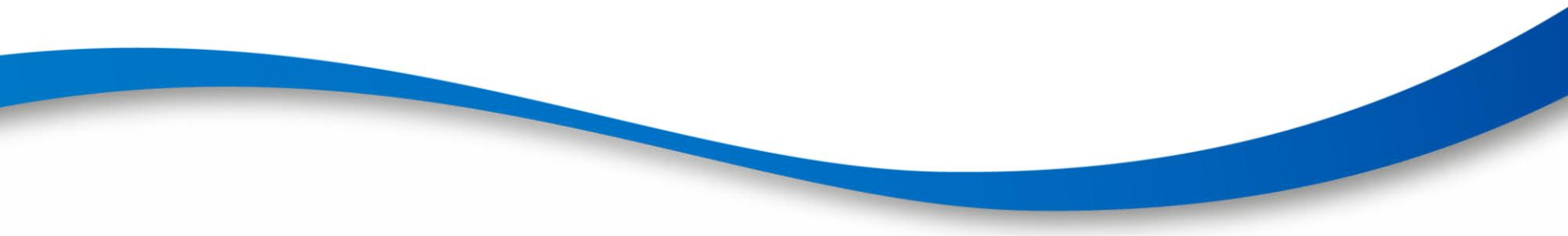
# Anaemia

- Other (possibly) useful investigations:
    - Ferritin, B12, folate levels
    - U&Es, LFTs, TFTs
    - Blood film
    - Reticulocyte count (and haemolysis screen)
  - Always look for the trend – is this new or old? Is it falling quickly or slowly?
- 

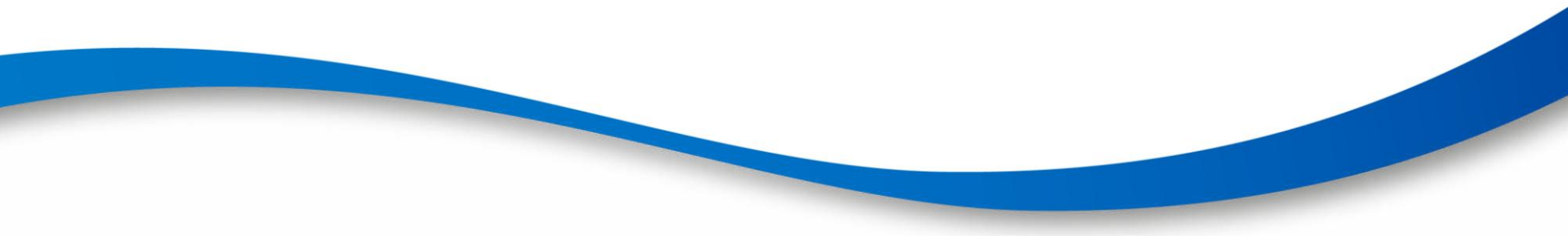
# Anaemia

- Patients may tolerate extremely low Hb levels if it has fallen slowly and they have had time to compensate
  - Conversely, rapidly falling Hb levels can make people feel ill even at moderately low levels
  - So history and examination / clinical picture is critical to making good decisions
- 

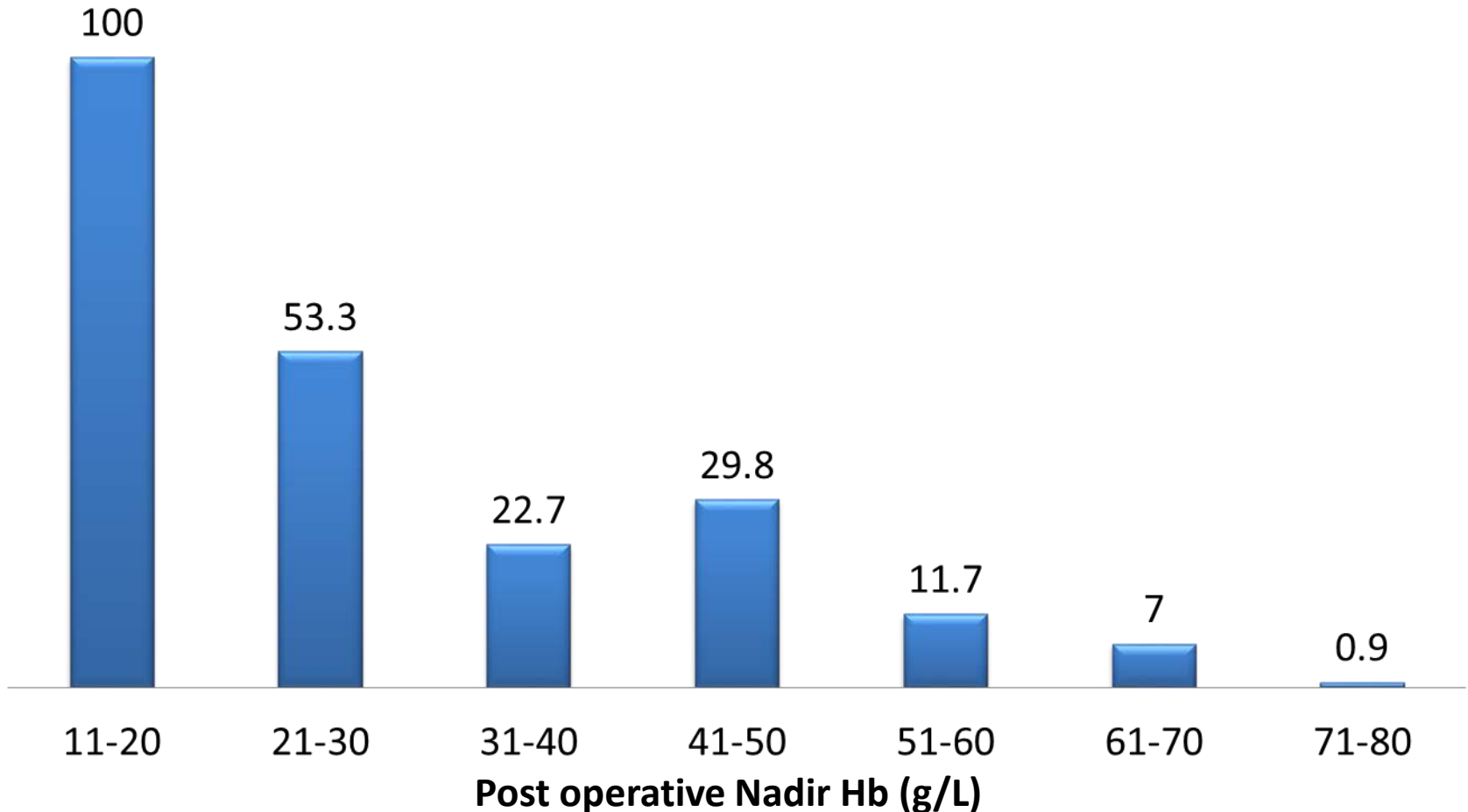
# Transfusion Dependent Patients

- These patients behave slightly differently to 'acute' or 'chronic' anaemia from other causes
  - Decisions to transfuse tend to be based on a particular Hb threshold established over time by the patient and their caring team
  - Some patients see marked benefit from transfusion, others very little
- 

**What triggers would you use?**



# Mortality (%) in patients with very low postoperative haemoglobin levels who decline blood transfusion



Shander et al Transfusion

Volume 54, Issue 10pt2, pages 2688-2695, 2014

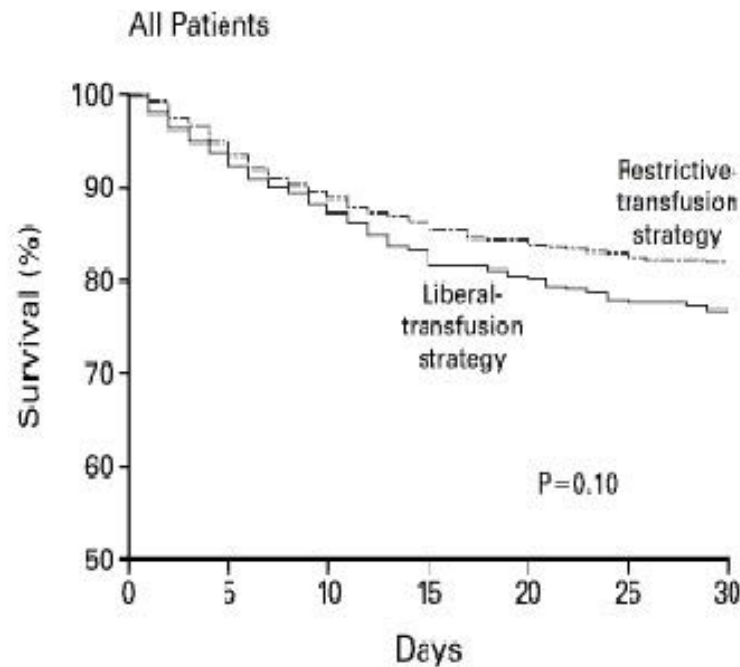
# What triggers would you use?

## Red cells - Transfusion Triggers

### TRICC Transfusion Requirements in Critical Care

Hebert PC et al. 1998 Crit Care Med 1998 26(3):482-7

Hb 70g/dl vs Hb 100g/dl, 30 day mortality similar

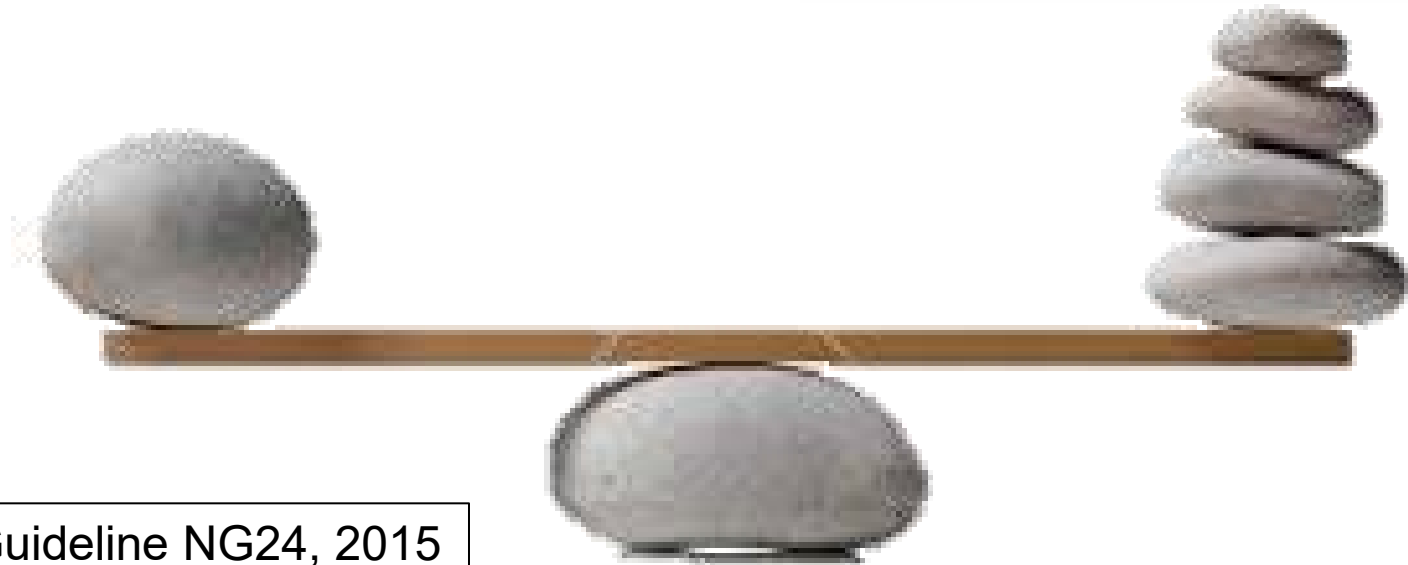


# Transfusion Thresholds

**Hb 70-  
80g/L**

except:

- Symptomatic patients
- Patients with acute coronary syndrome
- Patients with major haemorrhage



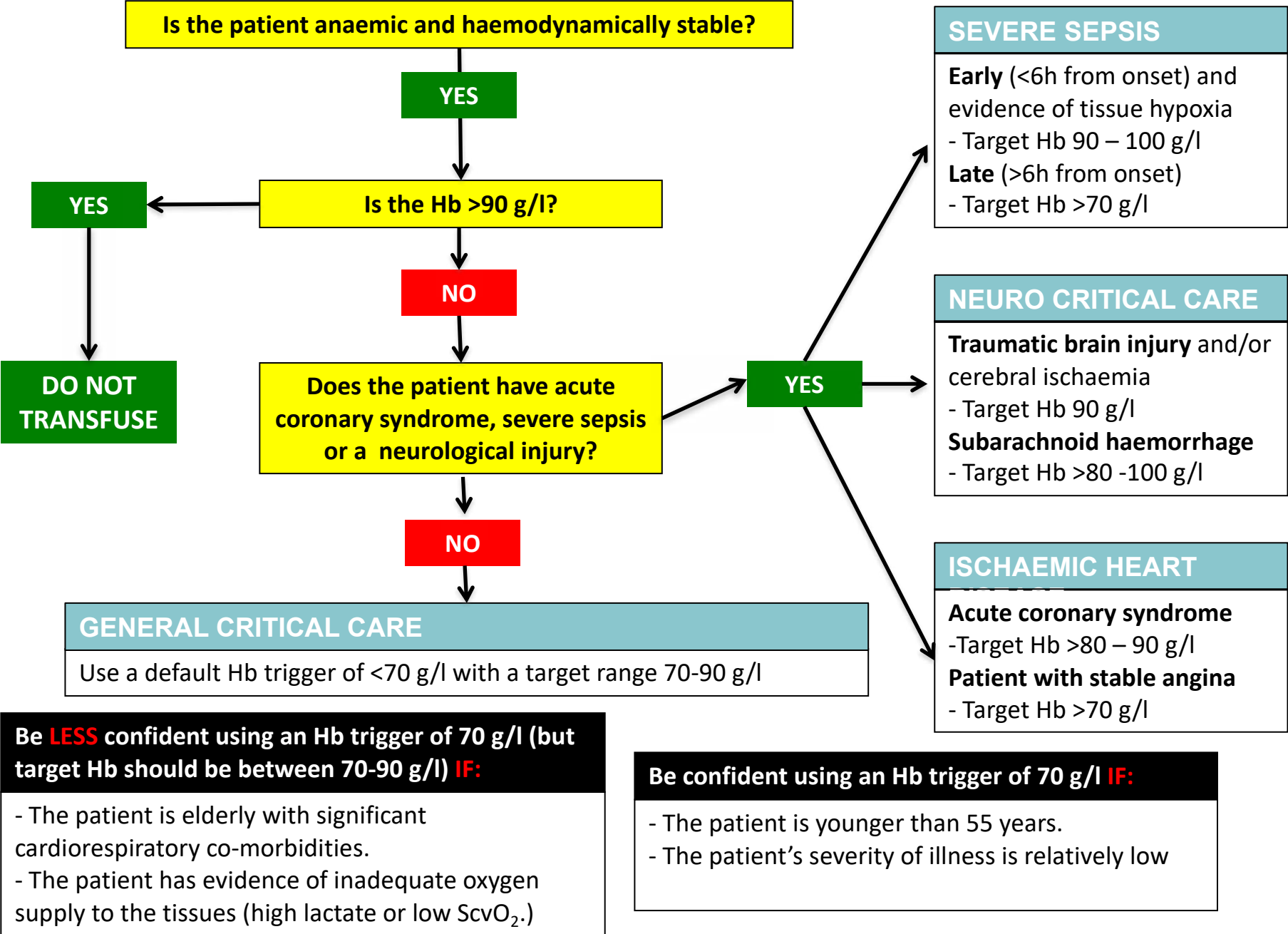
NICE Guideline NG24, 2015

‘For every complex problem there is an answer that is clear, simple, and wrong’

H.L. Mencken



Figure 1. A suggested approach to transfusion in critical care



# \*BSH Guideline 2016

**bjh** guidelines

## Guidelines on transfusion for fetuses, neonates and older children

Helen V. New,<sup>1,2</sup> Jennifer Berryman,<sup>3</sup> Paula H. B. Bolton-Maggs,<sup>4</sup> Carol Cantwell,<sup>2</sup> Elizabeth A. Chalmers,<sup>5</sup> Tony Davies,<sup>6</sup> Ruth Gottstein,<sup>7</sup> Andrea Kelleher,<sup>8</sup> Sailesh Kumar,<sup>9</sup> Sarah L. Morley<sup>10</sup> and Simon J. Stanworth,<sup>11</sup> on behalf of the British Committee for Standards in Haematology

<sup>1</sup>NHS Blood and Transplant, <sup>2</sup>Imperial College Healthcare NHS Trust, London, <sup>3</sup>University College Hospitals NHS Trust, London, <sup>4</sup>Serious Hazards of Transfusion, NHS Blood and Transplant, Manchester, <sup>5</sup>Royal Hospital for Sick Children, Glasgow, <sup>6</sup>NHS Blood and Transplant, <sup>7</sup>St. Mary's Hospital, Manchester/University of Manchester, Manchester, <sup>8</sup>Royal Brompton Hospital, London, UK, <sup>9</sup>Mater Research Institute, University of Queensland, Brisbane, Australia, <sup>10</sup>Addenbrookes Hospital/NHS Blood and Transplant, Cambridge, and <sup>11</sup>Oxford University Hospitals NHS Trust/NHS Blood and Transplant, Oxford, UK

**Keywords:** fetus, neonate, infant, paediatric, transfusion.

The guideline is a revision of the 2004 British Committee for Standards in Haematology (BCSH) guideline on transfusion in neonates and older children (BCSH, 2004). Although there has been little evidence on which to base paediatric clinical transfusion decisions in the past, there have been a number of studies and national audits published over recent years that contribute to decision-making in this area. In addition there have been changes to other guidance, including the management of neonatal jaundice National Institute for

which was subsequently revised by consensus following comment by members of the Transfusion Task Force of the BCSH and by a sounding board including UK haematologists, paediatricians/neonatologists. The 'GRADE' system was used to quote levels and grades of evidence ([http://www.bcsguidelines.com/BCSH\\_PROCESS/EVIDENCE\\_LEVELS\\_AND\\_GRADES\\_OF\\_RECOMMENDATION/43\\_GRADE.html](http://www.bcsguidelines.com/BCSH_PROCESS/EVIDENCE_LEVELS_AND_GRADES_OF_RECOMMENDATION/43_GRADE.html)). Recommendations entirely extrapolated from evidence from adult studies have been given a lower grade for children.

The objective of this guideline is to provide healthcare professionals with clear guidance on the management of

# \* BSH Guideline 2016

## \* Infants and Children:

### \* Red cells

- \* Evidence often extrapolated from adult studies
- \* TRIPICU (Lacroix, NEJM, 2007)
- \* Restrictive (70g/L) vs Liberal (90g/L)
- \* Mean restrictive (87g/L) non-inferior to liberal (108g/L)
- \* In stable, non-cyanotic patients

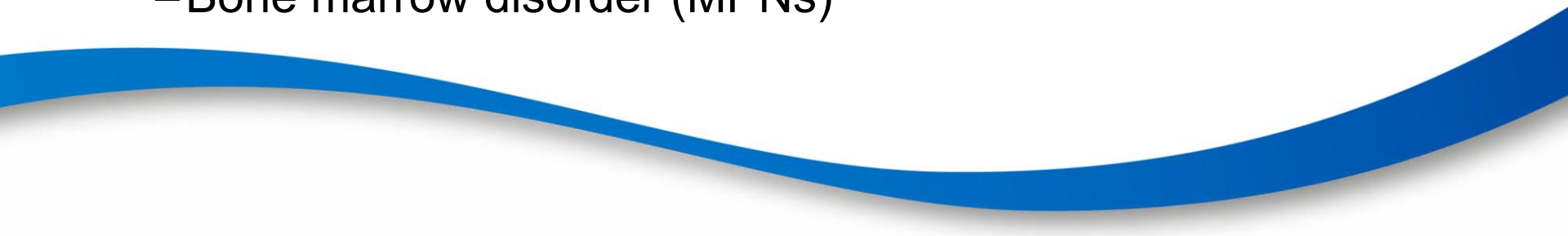
Table 1 Risk of NP/MODS: Subgroup Analyses of the TRIPICU Study

| TRIPICU Subgroup              | Planned Analysis | Patients Number | Absolute Risk Reduction<br>(95% confidence interval) |
|-------------------------------|------------------|-----------------|------------------------------------------------------|
| All patients in TRIPICU       |                  | 637             | 0.4% (-4.6 to +5.5)                                  |
| PRISM score                   | Yes              |                 |                                                      |
| 0 (1st quartile)              |                  | 128             | +1.5% (-6.3 to +9.4)                                 |
| 1-4 (2nd quartile)            |                  | 239             | -0.3% (-7.9 to +7.4)                                 |
| 5-7 (3rd quartile)            |                  | 121             | -2.2% (-13.0 to +8.7)                                |
| ≥8 (4th quartile)             |                  | 149             | +1.5% (-6.3 to +9.4)                                 |
| Cases of sepsis               | Yes              | 137             | +0.3% (-12 to +14)                                   |
| Pediatric noncardiac surgery  | Yes              | 124             | +1.1% (-8.9 to +11)                                  |
| Cardiac surgery (noncyanotic) | Yes              | 125             | +6.3% (-4 to +16.5)                                  |
| Respiratory dysfunction       | No               | 480             | +0.1%                                                |
| Acute lung injury             | No               | 73              | -6.3%                                                |
| ARDS                          | No               | 48              | -2.8%                                                |
| Neurological dysfunction      | No               | 40              | -10.6%                                               |
| Severe head trauma            | No               | 30              | +2.3%                                                |
| Severe trauma                 | Yes              | 40              | -5.8%                                                |

ARDS, acute respiratory distress syndrome; CI, confidence interval; NP/MODS, new or progressive multiple organ dysfunction syndrome;  
PRISM, pediatric risk of mortality score;<sup>1,2</sup> TRIPICU, transfusion requirements in pediatric intensive care units.<sup>3</sup>

Lacroix,  
Seminars in  
Perinatology,  
2012

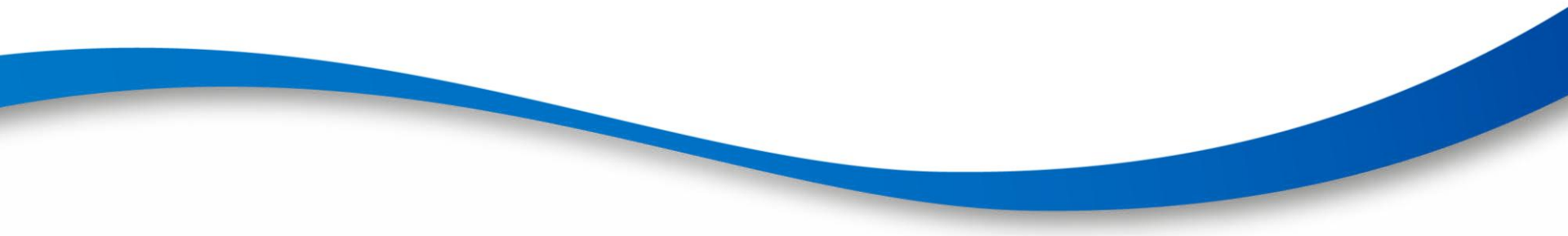
# Abnormal Results - Platelets

- High (thrombocytosis)
    - Reactive / Secondary
      - Infection
      - Inflammation
      - Hyposplenism
      - Iron deficiency anaemia
      - Malignancy
    - Primary
      - Bone marrow disorder (MPNs)
- 

# Abnormal Results - Platelets

- Low (thrombocytopenia)
  - Failure of production
    - Infection
    - Malignancy
    - Haematinic deficiency
    - Liver failure / alcohol / big spleen
    - Medications / Chemo
  - Destruction
    - Mechanical (eg bypass / dialysis / CVVH etc)
    - Idiopathic thrombocytopenic purpura (ITP)
    - Disseminated intravascular coagulation (DIC)
    - Thrombotic thrombocytopenic purpura (TTP – rare)
    - Heparin induced thrombocytopenia (HIT)
    - Vaccine-induced thrombosis and thrombocytopenia (VITT)

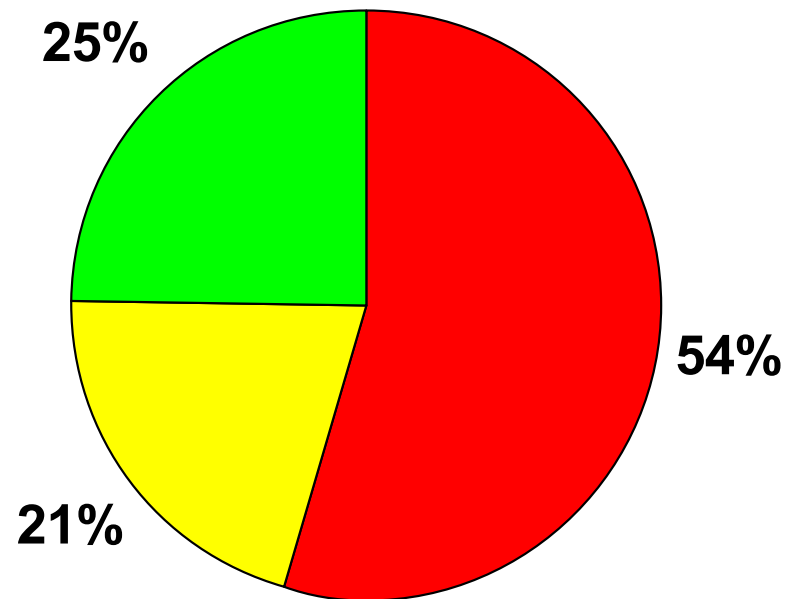
# Further Investigations

- Check trend – has it always been low?
  - Revisit history and examination
  - Investigate for underlying cause
  - Blood film is always useful!
- 

# Where do platelets go?

Tinegate et al 2012 NE  
England

N= 1937 units



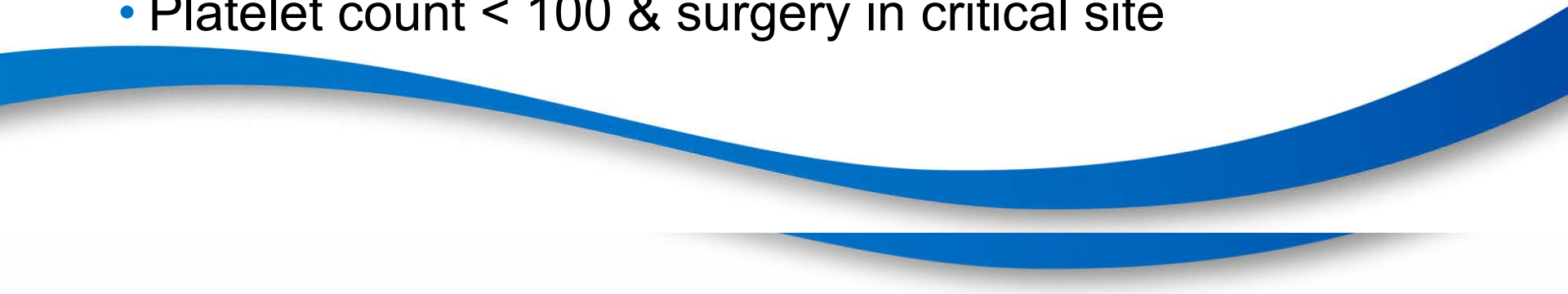
■ Haematology 1055 ■ Other medical 402 ■ Surgical 479

# When would you transfuse platelets?





# Triggers for platelet transfusion BSH 2016 Platelet Guidelines

- Platelet count < 10 reversible BM failure, Critical illness
  - Platelet count < 20 & additional defect e.g. sepsis and central venous line
  - Platelet count < 40 Lumbar puncture
  - Platelet count < 50 & invasive procedure and severe bleeding
  - Platelet count < 80 Epidural anaesthesia
  - Platelet count < 100 & surgery in critical site
- 
- A decorative blue wavy line that spans the width of the slide, starting from the left edge and ending at the right edge, positioned below the list of triggers.

# \*BSH Guideline 2016

## \*Infants and Children:

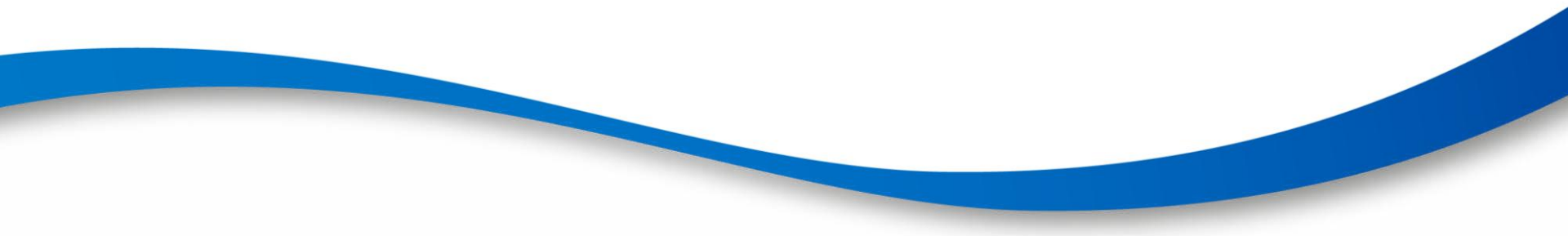
### \*Platelets

\*Evidence often extrapolated from adult studies

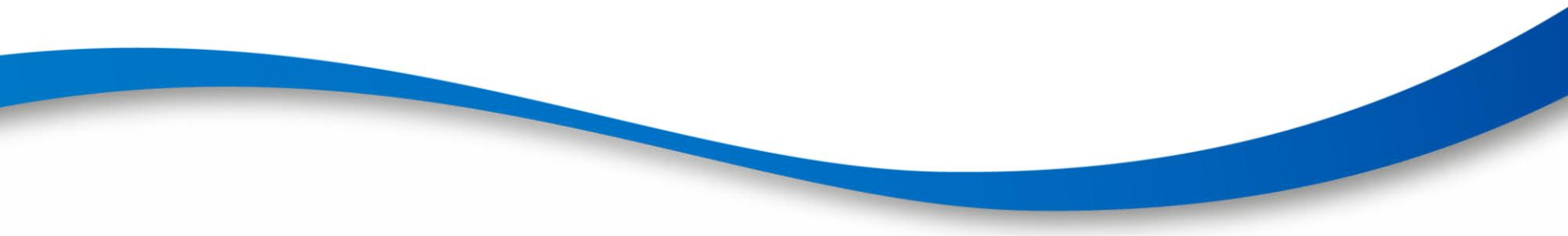
Table III. Suggested thresholds of platelet counts for platelet transfusion in children.

| Platelet count<br>( $\times 10^9/l$ ) | Clinical situation to trigger platelet transfusion                                                                                                                                                                          |
|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <10                                   | Irrespective of signs of haemorrhage<br>(excluding ITP, TTP/HUS, HIT)                                                                                                                                                       |
| <20                                   | Severe mucositis<br>Sepsis<br>Laboratory evidence of DIC in the absence<br>of bleeding*<br>Anticoagulant therapy<br>Risk of bleeding due to a local tumour infiltration<br>Insertion of a non-tunnelled central venous line |
| <40                                   | Prior to lumbar puncture†                                                                                                                                                                                                   |
| <50                                   | Moderate haemorrhage (e.g. gastrointestinal<br>bleeding) including bleeding in association<br>with DIC<br>Surgery, unless minor (except at critical sites)<br>• including tunnelled central venous line insertion           |
| <75–100                               | Major haemorrhage or significant post-operative<br>bleeding (e.g. post cardiac surgery)<br>Surgery at critical sites: central nervous<br>system including eyes                                                              |

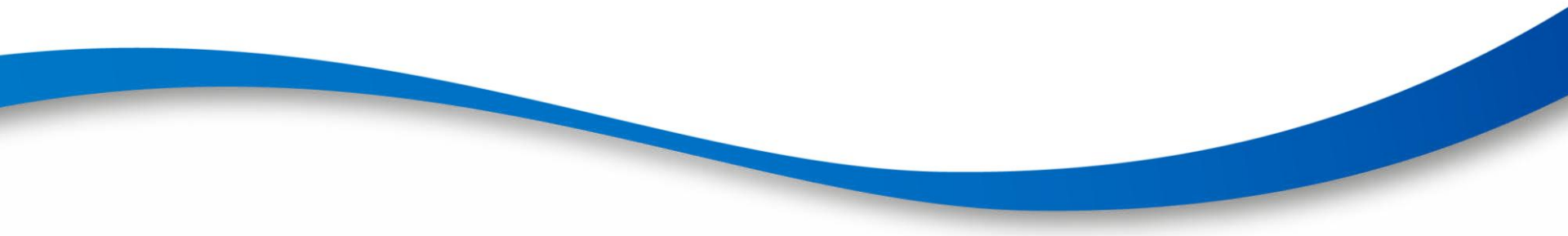
# Case 1

- A 24 year old woman is admitted to MAU after attending her GP with tiredness and having a FBC check:
  - Hb 64g/L, MCV 62 (80-100), WCC 7, Plts 500 (150-450)
  - What is the likeliest cause of her anaemia?
  - What other blood tests should be done?
  - What other questions should you ask her?
- 

# Case 1b

- You are asked to authorise a 2u red cell transfusion as she feels very tired, a bit breathless on climbing stairs, and has 3 young children to care for at home
  - How would you respond?
  - What are the options for treating her?
- 

## Case 2

- A 78 year old man is an inpatient on the gastro ward in your hospital, with weight loss and not eating or drinking - ? a possible upper GI malignancy. He has his routine FBC done one morning and Hb has dropped from 123g/L (2 days ago) to 55g/L this morning
  - You rush to see him
  - He says he doesn't feel well overall
- 

## Case 2b

- Once you have established his ABC are ok and observations are normal, what should you look at next?

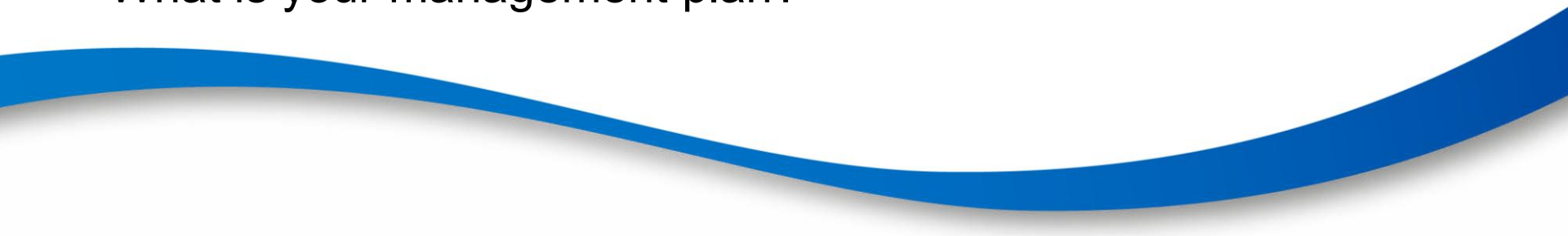
## Case 2

- FBC today:
  - Hb 55g/L
  - MCV 82
  - MCH 20
  - Plts 127
  - WCC 2.2
  - Neuts 1.8
- FBC 2 days ago:
  - Hb 123g/L
  - MCV 97
  - MCH 34
  - Plts 400
  - WCC 8.4
  - Neuts 3.3

What is the likeliest cause?

What should you do next?

# Case 3

- A 60 year old AML patient is 3 weeks out from induction chemo and attends the Day Unit for routine check FBC:
  - Hb 80g/L, Plts 11, Neuts 0.2
  - It's Friday afternoon and the Day Unit isn't open again until Monday
  - Is there anything else you want to know?
  - What is your management plan?
- 



# Learning objectives

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