Consequences of Pre-analytical Errors in Transfusion Medicine

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Pathology laboratories provide many complex services

The main aim for the diagnostic service is to:

– To get the correct result, on the correct patient, to the requesting doctor without unnecessary delays

It is also the role of the laboratory to:

– Protect patients from any wrong or potentially wrong results
• Three phases of laboratory testing: pre-analytical, analytical and post-analytical
• Pre-analytical—specimen collection, transport and processing
• Analytical—testing
• Post-analytical—testing results transmission, interpretation, follow-up, retesting.

• Pre- and post-analytical errors are estimated to constitute 90% of errors
• Errors at any stage of the collection, testing and reporting process can potentially lead to a serious patient misdiagnosis
• Errors during the collection process are not inevitable and can be prevented with a diligent application of quality control, continuing education and effective collection systems
• The pathology laboratory has many very established mechanisms within the laboratory to ensure the quality and integrity of the samples and the test results are accurate. These mechanisms are in the form of policies and procedures which are implemented in a quality system framework.

• A vital part to getting the correct result on the correct patient is the initial patient’s identification; sample collection and sample labelling
• Errors that occur in this phase are called pre-analytical errors.
• Pre-analytical error is anything that occurs before a sample is analysed that may compromise the accuracy or integrity of the result

• There are two main types of pre-analytical errors:

  1. Identification Problems
  2. Sample Problem

  1. Identification Problems

• When a sample is being collected, the collector has a very important task to ensure three aspects of identification are correct and identical. They check the patient identification matches the request by a verbal check and by the identification band and then the samples collected are labelled with the sample identification, at the bedside. This allows for a three-way check
1. Identification Problems

- If results are allocated to the incorrect patient this can lead to:
  - Unnecessary treatment or investigations
  - Lack of treatment
  - Death

- The greatest risk of causing a patient’s death is due to an identification problem that has no definitive way for the laboratory to detect.
2. Sample Problems

- A sample problem is when the sample supplied for testing is not suitable to be used for the tests requested. If these samples were analysed the test result reported will not give an accurate representation of the patient’s condition. This may mislead the doctor when interpreting the result for diagnosis or treatment.

2. Sample Problems

- There are several reasons why a sample may not be suitable for testing:
  - Sample not collected
  - Incorrect sample type
  - Haemolysed sample
  - Clotted sample
  - Incorrect fill level of sample – e.g. coagulation tests
  - Insufficient sample
  - Contaminated sample – e.g. sample taken from drip arm
  - Incorrect sample storage or transport
Consequences of Pre-analytical Errors in Transfusion
• What do we do in blood bank and why?
  – Blood group and antibody screen
  – Provide safe, compatible blood and blood products to our patients
Antigens and antibodies present in the 4 major ABO groups

The ABO Blood System

<table>
<thead>
<tr>
<th>Blood Type (genotype)</th>
<th>Type A (AA, AO)</th>
<th>Type B (BB, BO)</th>
<th>Type AB (AB)</th>
<th>Type O (OO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red Blood Cell Surface Proteins (phenotype)</td>
<td>A agglutinogen only</td>
<td>B agglutinogen only</td>
<td>A and B agglutinogens</td>
<td>No agglutinogens</td>
</tr>
<tr>
<td>Plasma Antibodies (phenotype)</td>
<td>b agglutinin only</td>
<td>a agglutinin only</td>
<td>No agglutinin</td>
<td>a and b agglutinin</td>
</tr>
</tbody>
</table>

Blood Group B Rh (D) Positive
Blood Group A Rh (D) Positive
3 cell Ab screen performed on 2 patients, both patients showing reactivity with the screening cells which will require Ab identification.
Haemolytic Transfusion Reaction

• Acute Haemolytic Transfusion Reactions (AHTR) are serious, potentially life-threatening reactions, usually caused by transfusion of ABO-incompatible red cells following clerical or system errors that result in incompatibility of the blood unit with the blood recipient.

Haemolytic Transfusion Reaction

• The morbidity associated with major ABO incompatibility remains one of the most common fatal complications of blood transfusion.
• Most of these events are due to avoidable procedural errors (such as patient/sample identification errors)
National Blood Authority

• Haemolytic reactions, risk per unit transfused:

  – Acute: 1: 12,000 to 77,000
  – Delayed: 1: 4,000 to 9,000

Haemolytic Transfusion Reaction

Antibody Binding

Erythrocyte + Antibody → Fo-Receptors (IgG 3 > IgG 1)
Lysis in the spleen
Haemolytic Transfusion Reaction

Complement Activation Terminating at C9

Erythrocyte + Antibody = Complement activation to C9
= intravascular haemolysis

Haemolytic Transfusion Reaction

Transfusion Reaction

Circulatory collapse
Disseminated Intravascular Coagulation (DIC)
And / or renal failure
Acute Haemolytic Transfusion Reaction

- Can result in renal failure, shock and coagulopathy
- Most severe reactions are caused by transfusion of incompatible cells with the patient's Anti A or Anti B antibodies
- Potentially fatal reaction
- Symptoms are due to red cell haemolysis

Acute Haemolytic Transfusion Reaction

- Early symptoms:
  - Rapid onset of pain at IV site, abdomen, back, chest
  - Shock/collapse
  - Impending sense of doom/anxiety
- Later symptoms
  - Haemorrhage (DIC)
  - Acute renal failure
  - Dark urine
Case Study 1-Near Miss

• Two patients in ED at same time!
• Blood sample taken from patient A labelled with pre-printed labels from patient B
• Sample label for Blood Bank hand written by copying from pre-printed label
• Disagreement with previous blood group results, suggested collection error
• Error would have resulted in group AB blood to Group A recipient

Case Study 2-Near Miss

• A GPH sample was collected for patient A with a request form requesting 1 unit of blood.
• A nurse came to collect the unit for patient A
• A couple of minutes later the Dr rang to say that the blood sample labelled with patient A’s details had actually been taken from Patient B.
• The unit of blood was immediately returned to the Blood Bank
• Dr admitted to taking samples away from patient to label, practise now changed
Case study 3

- A blood sample sent to a haematology laboratory showed an Hb of 79 g/L
- The laboratory requested a repeat sample as the patient had not previously been anaemic
- No repeat sample sent
- Instead a 3 unit transfusion was given

Case Study 3

- A post transfusion Hb was 187 g/L
- The patient was venesected but developed cardiac failure and died
- The blood sample giving an Hb of 79 g/L had been taken from the wrong patient

SHOT (Serious Hazards of Transfusion) Report 2004
Case Study 4

• An 80-year-old woman with a fractured hip
• Pre-op Hb 95 g/L, post-op 39 g/L (had not bled much during surgery)
• Transfused 6 units over 16 hours
• Hb 182 g/L, death from cardiac failure
• Sample had been taken from arm with IV infusion

SHOT (Serious Hazards of Transfusion) Report 2007

Error Prevention

• The human role in sample collection and processing makes complete elimination of errors associated with laboratory testing unrealistic. However, good practices and compliance with the strategies for error prevention can lead to a substantial reduction in pre-analytical errors. These practices include:
  – Increased error detection, reporting and tracking
  – Process and risk analysis
  – Process redesign
  – Enhanced healthcare professional training
  – Improved communication among healthcare professionals
Serious Hazards of Transfusion (SHOT 2010, UK)

• >50% transfusion related incidents due to preventable, hospital based errors

Error Prevention-Sample Collection

• **Patient Identification:**
  • Take the request slip to the patient’s bedside and while you are comparing information from ID band. Always ask the patient “What is your name?” **NOT** “Are you Mrs Jones?”
  • Always ask the patient “What is your date of birth?”
  • Always check an inpatient’s ID band for the patient’s name and UR number. If this is not attached, blood should not be taken. All steps should be taken to ensure that the nursing staff are aware of the situation.
Error Prevention-Sample Collection

- Both name check and ID band checks must be done on all inpatients.
- If the patient is unconscious ask a member of the nursing staff to positively identify the patient for you and note this on the request form.
- Do not depend on the names on beds or doors. You must verify the patient’s armband details with the patient.

Error Prevention-Sample Collection

- It is important to continually educate internal and external sample collectors, giving them not only the skills but the understanding of the consequences of pre-analytical errors.
- Reducing pre-analytical errors not only optimises patient safety and care but also improves efficiency of the pathology laboratory service by reducing rework.
Error Prevention-Sample Acceptance

• It is important to keep standards for sample acceptance high for patient safety.
• It is important that repetitive errors are not allowed to keep occurring when most are easily preventable.

Lumadue et al Transfusion (1997) 37,1169-1172

Error Prevention

• Specimens that failed to meet the criteria for specimen acceptance were 40 times more likely to have a blood grouping discrepancy.
Zero Tolerance!!!

Error Prevention-The Future

• Advances in instrument technology and automation have simplified tasks in laboratory diagnostics and improved the quality of test results.
Error Prevention-The Future

• However the automation of the pre analytical phase is still seen as radically innovative in the context of laboratory diagnostics
• Automated systems are in use in other areas of the world
  – Barcode scanning at the bedside and automatic ward order entry
  – Automated pre analytical sections in laboratories connected to LIS

Error Prevention-The Future

• The automation of several repetitive, error-prone and bio-hazardous processes provides several advantages.
• However the introduction of these measures seems a long way off because of problems with integration of existing IT systems and the cost of this technology and automation is huge
ANY QUESTIONS??

THANK YOU
References


• www.nba.gov.au
• www.shotuk.org