Down the Tube

Tony Greenfield
NSW Health Pathology – South Liverpool Hospital
Pneumatic Tube Transport Systems

- These systems propel cylindrical containers through networks of tubes by compressed air or partial vacuum.
- They gained acceptance around 1900 for offices that needed to transport small, urgent packages (such as mail, paperwork, or money) over relatively short distances.
Pneumatic Tube Transport Systems

• Tube use for communicating information and money has been to some extent superseded by electronic transmission.

• Pneumatic tubes are still widely used for transporting small physical objects, where convenience and speed in a local environment are important.
McDonald’s in Minnesota claimed to be the “world’s only pneumatic air drive through”

They can send burgers and fries from their main restaurant to a drive-through kiosk in the middle of a parking lot.
Pneumatic Tube in Hospitals

• Modern hospitals are increasingly networked with tube systems.
• Hospitals commonly have a computer-controlled pneumatic tube system to deliver drugs, documents and specimens to and from laboratories and nurse’s stations.
• In 1994 the pathology building built at Liverpool hospital was linked to distant critical care areas by pneumatic tube.
Pneumatic Tube for Blood Products

• The concept of moving blood and blood products by tube was tested by sending blood specimens and expired blood bags back and forward then observing for breakage and testing for haemolysis.

• Pathology specimens and any blood product that would fit into a tube carrier was apparently able to be transported safely and quickly.

• The tube quickly became an essential system integrating pathology to the rest of the hospital.
Don’t worry the tube will know what to do
Is there Blood Wastage? YES
Wastage due to Dispensing Delays

- Delay until Blood Bank receives issue authority
- Delay until Blood Bank dispenses blood product
- Delay while system processes it’s queue to send
- Actual Transport time
- Delay until ward picks up product from station
- If product is not to be used - 30 minute rule for RBC may be exceeded resulting in wastage
Wastage due to Breakage

• Tubes might arrive but sometimes blood products are damaged
• Small nicks and cuts on blood bag, were also present on plastic overpack
  – Use “Blood Bank Only” tubes with sharp edges removed
  – Use heavy duty plastic overpack
• Occasionally a product might be returned from ward without properly closing tube lid
A bloody mess!
Wastage due to Failure to Arrive

• Sometimes the tubes with blood products just do not arrive
  – Perhaps Sent to the wrong location
  – More often due to technical failures diverting to default stations or dump stations

• Precious specimens and blood products that could not be readily replaced if lost were excluded from the tube
  – HLA matched platelets
  – RBC for high incidence or multiple antibodies
  – RBC for neonates
Tube for Emergency Use

- MTP tube use was avoided from the beginning due to uncertainty of arrival time and arrival (at all) in life threatening situations
- Multiple units require multiple tube carriers
- Multiple units = multiple wastage
- Wastage would frequently occur in OT when multiple units were requested for bleeding patients – they opted out and used orderlies
Confirmation of Arrival

• Confirming that blood sent was received in a timely manner was problematic
• Simple log sheet was used for RBC dispenses
• Wards would not answer phone calls
• Wards would not return the carrier
• Best way was to use highly visible Blood Bank Only carriers coded with a unique ID number
• Rare to get confirmation of receipt or return of pack within the 30 minute window.
• Best use of log sheet was to provide information when submitting a blood wastage IIMS
Dedicated System verses Integrated Networks

• Direct dedicated lines between 2x stations are simple and reasonably trouble free

• Complex systems integrating hospital tube networks via interchanges are more prone to delays, breakdowns and failures

• In 1994 our system was simple but with growth of the hospital campus over 20 years the system is now very complex
Total Dependence

• During downtime wards 100m away would not accept manual delivery alternatives without complaint
• Convenience made the tube seem indispensible to the hospital – they would complain, but still forgive the tube.
• The alternative was unthinkable
• A small amount of wastage was considered the cost of doing business
Breakage Increasing

• Over the last year there were increasing number of wastage events occurring due to breakage / leakage of RBC

• Red Cross had received complaints from multiple sites

• When reported to Red Cross they referred to a report Macopharma had previously provided about loss of flexibility after storage at 4oC
PVC loses some of its mechanical properties when temperature is low. Therefore we recommend that all means possible are employed to minimize the risk of physical stress when packs are handled.

We recommend to handle the chilly bags with an additional care in order to avoid any unnatural shock forces applied on PVC material.

The level of DEHP in Macopharma packs is lower than most of our competitors. These lower levels can potentially make our packs more susceptible to damage through mishandling at low temperature.
Red Cross Customer Feedback

• “as a result we do not recommend putting red cell packs in the pneumatic tube system”
• OK – but lets be practical
• Tube system is entrenched with more than 20 years of use distributing 60% of RBC dispenses
• We send almost 700 RBC each month by tube
• How can we just stop using it?
RBC wastage
But Tube RBC wastage would not go away

July’15 to June’16

July’16 to June’17

RBC DAPI in 2015/16 was 1.6%
but in 2016/17 DAPI had increased to 2.2%
RBC Wastage 2016 Jan-July

- Main reason for RBC wastage is cold chain non-compliance (blood out of fridge >30min)
- However Cold Chain non-compliance is unchanged

RBC Wastage 2017 Jan-July

- Reason for increased RBC wastage is pneumatic tube breakage in transport
5.3.2 Pneumatic tube system

5.3.2.1 The PTS must be appropriately validated for the transport of blood products (see 8.8).

5.3.2.2 The PTS must not expose blood products to physical forces or environmental factors (including temperature) that could result in adverse changes to the quality of the product.

5.3.2.3 The laboratory must have procedures for dealing with blockages in the PTS or for decontamination following blood product breakages or leaks during passage through the system. The procedures should include system access points and canister dumping stations.

5.3.2.4 The laboratory should ensure that the clinical area requesting the blood products is alerted to expect delivery through the PTS.

5.3.2.5 The receiving area should have a procedure for notifying the laboratory as to receipt of the blood product and its removal from the PTS (or failure of the blood product to arrive as expected).
What If We Could

• Ceasing pneumatic tube transport would reduce wastage by 40 units each year and drop our DAPI by at least 0.3%

• Presented proposal to cease tube transport of RBC to PBM committee

• Hospital has NSQHS accreditation coming up early 2018. This was an improvement opportunity
Liverpool Hospital
General Information Circular

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Red Blood Cell (RBC) Transportation

There has been a change in the manufacturing of red cell bags resulting in an increased risk of breakage. As a result red cells must no longer be transported by the pneumatic tube.

Effective from 10th September 2017, all RBC bags are to be picked up from the ground floor of the pathology building near Specimen Reception (Entrance N).

This can be facilitated via logging a task on the Central Ward Orderly Service (CWOS) logger system. The patient's full name, medical record number (MRN) and 'RBC collection' must be entered into the logger.

Departments with their own based ward orderlies will be required to have them collect any red blood cell products.

Once a unit of RBCs is dispensed, the infusion must be set up and commenced within 30 minutes. If this does not occur, then this unit of blood needs to be returned to Specimen Reception (Entrance N) within 30 minutes to avoid discarding.

The above changes are only applicable to RBCs. Other blood products such as can continue to be transported via the pneumatic tube.

Robynne Cooke
General Manager

14 SEP 2017
Red Blood Cell (RBC) collection from Blood Bank

1. Request logged into Central Ward Orderly Service (CWOS) logger system. Note the patient’s full name & medical record number (MRN) and state Red Blood cells.

2. Collect bag of red blood cells (RBC) from the ground floor (blood bank) of the pathology building near Specimen Reception (Entrance N). Check blood against the patient’s full name & medical record number (MRN).

3. Take blood directly to the requesting ward/department. This must be achieved within 15 minutes, via a direct route. No other jobs are to be undertaken on the way.

4. Upon arrival to the ward/department the blood is to be directly handed to the member of nursing staff looking after the patient who will be receiving the blood. Blood must not be left with non-clinical staff, on beds, reception areas etc.

5. If the blood is no longer required, then this unit of blood must be returned to Specimen Reception (blood Bank) (Entrance N) immediately. Blood can only remain un-refrigerated for 30 minutes before it is no longer viable for use.
2 week review

• Direct pickup is working well
• Users say that the new service is quicker and there is more certainty about arrival time
• No wastage due to return after 30 minutes
• No wastage due to breakage
• Immediacy of pickups can be more demanding making prioritization more challenging for lab