

Accelerated Red Cell Transfusion for Selected Patients at Home

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Background: Bolton Community IV

Therapy Service

- Home transfusion is not new!
- Bolton service started in 1995 (1997 transfusion of red cells and platelets)
- Scale of service provision in UK is unclear
- Guidelines now exist to guide governance and safe practice (Green and Pirie, 2013)
- Patients are triaged to receive home transfusion (current demand outstrips capacity)

Most patients are on regular transfusion regimes

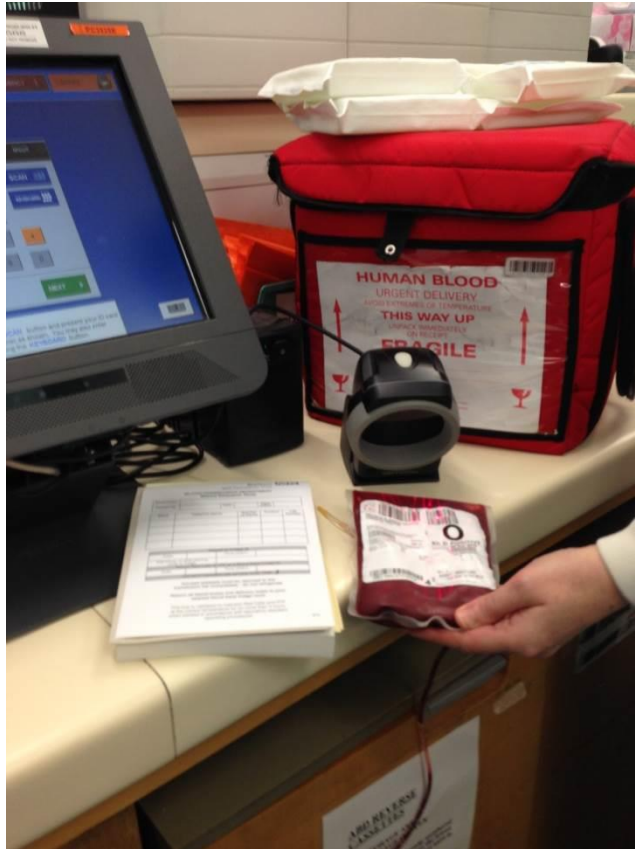
FBC checked at a clinic visit or done by BCIVTT at home



- Request for transfusion generated by haematology nurse or specialty doctor
- Checked and prescribed by specialty doctor
- Form collected by BCIVTT staff
- Sample taken in patient's home (home-held ID)
- Sample and form brought to transfusion lab for processing



- The BCIVTT Nurse or support staff can 'self-serve' crossmatched blood from a designated place in the blood bank fridge in the lab
- The blood prescription is the 'collection document' used to identify blood for the patient



- Using the blood prescription, the blood is scanned out securely using the Blood Tracking system
- The BCIVTT nurses and support staff are trained and competency assessed to use the Blood Tracking system and to pack blood boxes in accordance with the SOP
- The boxes are annually validated for 4-hour temperature maintenance (2-6c)



- BCIVTT nurse arrives at the patient's home with the blood box and required equipment for the procedure
- All patients have a 'BL' postcode and are within a 30 minute drive from the lab
- Sometimes BCIVTT support staff collect the blood from the lab and meet the nurse at the patient's home



- The patient has pre-transfusion vital observations recorded and their general health assessed
- A cannula is then inserted
- Check between prescription and blood unit
- Check between unit and home-held ID and verbal check



- Vital sign observations are repeated at 15 minutes after the start of the unit
- The general well-being of the patient is under constant 1:1 observation



- The patient can now pass the time as they wish (within reason!)
- 2 units of red cells are usually administered over 90 min each (4 hour visit) – *Standard rate transfusion*



- Vital sign observations are repeated when each unit has completed



- The BVIVTT nurse completes the documentation and returns the documentation, blood box etc to the lab
- Note the box of medical equipment – includes anti-anaphylaxis medication with can be administered under a PGD

Developing the Service - Challenges

- Can the capacity of the service be increased **using current resources**?
- Can this be achieved by shorter treatment times (two units over 60 min each (**Accelerated Transfusion**), instead of 90 min each (**Standard Transfusion**)?
- Can this be done **safely**? – the recommended rate of transfusion is based on experience rather than experimentally designed studies
- Can this be achieved while **improving patient and practitioner experience**?

Generating Evidence for Change

Patient Safety

- Medical selection criteria (risk of circulatory overload)
- Cohort study (standard rate/accelerated rate transfusion) – endpoint is Transfusion-Associated Circulatory Overload

Service Capacity

- Patient eligibility for accelerated rate transfusion (%)
- Home transfusion workload and service capacity analysis

Patient & Practitioner Experience

- Thematic analysis of semi-structured interviews from patients and nursing staff

Patient Safety: Risk of TACO

- TACO is a pulmonary complication of transfusion that causes pulmonary oedema due to iatrogenic fluid overload (but may more complicated!)
- Leading cause of transfusion-related morbidity and mortality
- HV data provide insight into patient characteristics and co-morbidities associated with TACO

Pre-existing heart failure
Positive fluid balance (blood/non-blood)
Hypoalbuminaemia, Liver failure
Renal failure
Age over 70
Low body weight



Serious Hazards Of Transfusion

SHOT



Thematic analysis
TACO Risk Assessment
Retrospective validation

TACO Checklist

Red cell transfusion for non-bleeding patients



Does the patient have a diagnosis of 'heart failure' congestive cardiac failure (CCF), severe aortic stenosis, or moderate to severe left ventricular dysfunction?

Is the patient on a regular diuretic?



Is the patient known to have pulmonary oedema?

Does the patient have respiratory symptoms of undiagnosed cause?



Is the fluid balance clinically significantly positive?

Is the patient on concomitant fluids (or has been in the past 24 hours)?

Is there any peripheral oedema?

Does the patient have hypoalbuminaemia?

Does the patient have significant renal impairment?

If 'yes' to any of these questions

1

- Review the need for transfusion (do the benefits outweigh the risks)?

2

- Can the transfusion be safely deferred until the issue can be investigated, treated or resolved?

3

- Consider body weight dosing for red cells (especially if low body weight)
- Transfuse one unit (red cells) and review symptoms of anaemia
- Measure the fluid balance
- Consider giving a prophylactic diuretic
- Monitor the vital signs closely, including oxygen saturation

Due to the differences in adult and neonatal physiology, babies may have a different risk for TACO. Calculate the dose by weight and observe the notes above.

Methods – Exclusion Criteria

Pre-existing heart failure	Check if Echo previously performed <ul style="list-style-type: none"> • Moderate to severe LV dysfunction • Severe aortic stenosis
Positive fluid balance (blood/non-blood)	Home transfusion patients do not receive concomitant fluids and would not have had recent transfusion
Hypoalbuminaemia	Serum albumin <35g/L
Liver failure	Bilirubin >30μmol/L
Renal failure	eGFR <30ml/min
Age over 70	Not excluded if no other criteria
Low body weight	<50Kg
Dyspnoea, Tachypnoea	>20 breaths per min
Tachycardia	>100 beats per min
Untreated or uncontrolled hypertension	>160/95 mmHg
Other pre-existing symptoms and signs	Peripheral oedema, cough

Characteristics and comorbidities for TACO from HV data

Additional pre-transfusion criteria (risk factors and/or would complicate identification of TACO post-transfusion)

Patient Safety: Infusion Rate and Risk of TACO

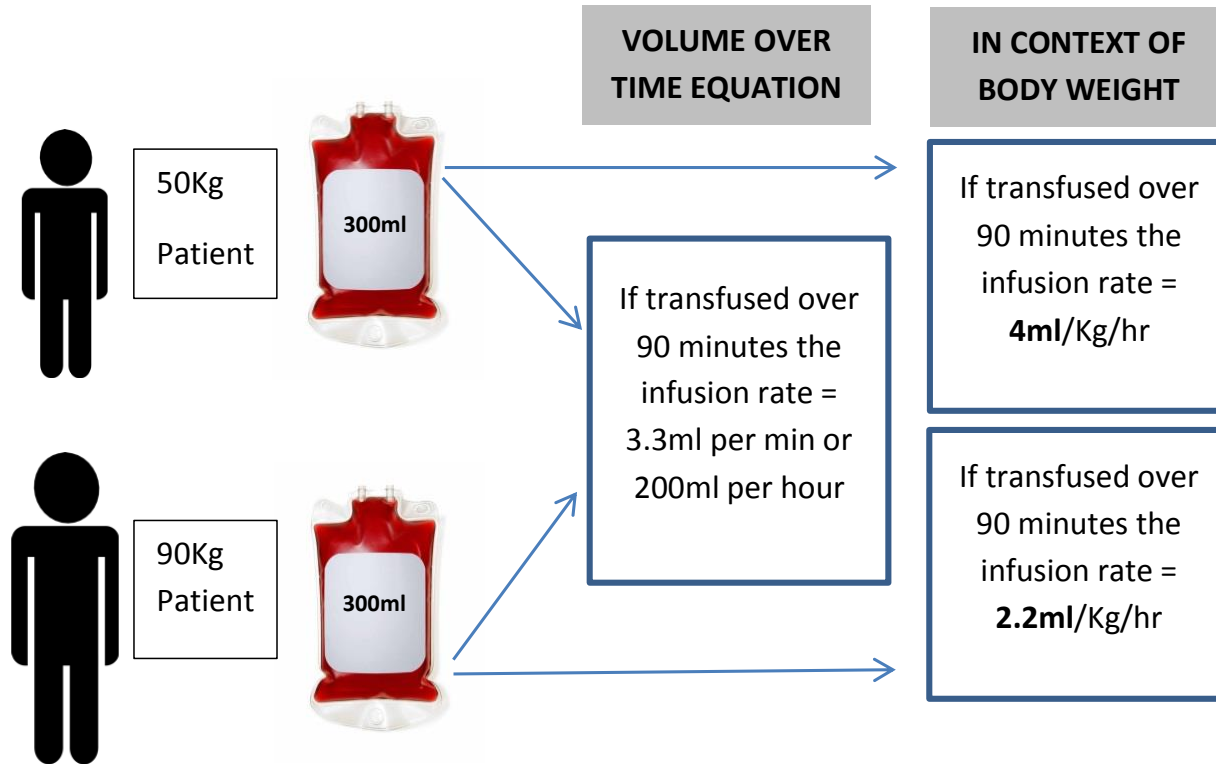
- Some studies have reported higher incidence of TACO at higher infusion rates (Andrzejewski et al, 2012)
- No previous studies in adults have reported incidence of TACO using a standardised infusion rate (ml/Kg/hr)
- Fluid overload theoretically possible at 'high' flow rate in any patient
- Predisposing comorbidities and risk factors > infusion rate as an independent risk factor for TACO
- Limiting flow rate in patients at risk of TACO is important

Defining the Infusion 'Rate'

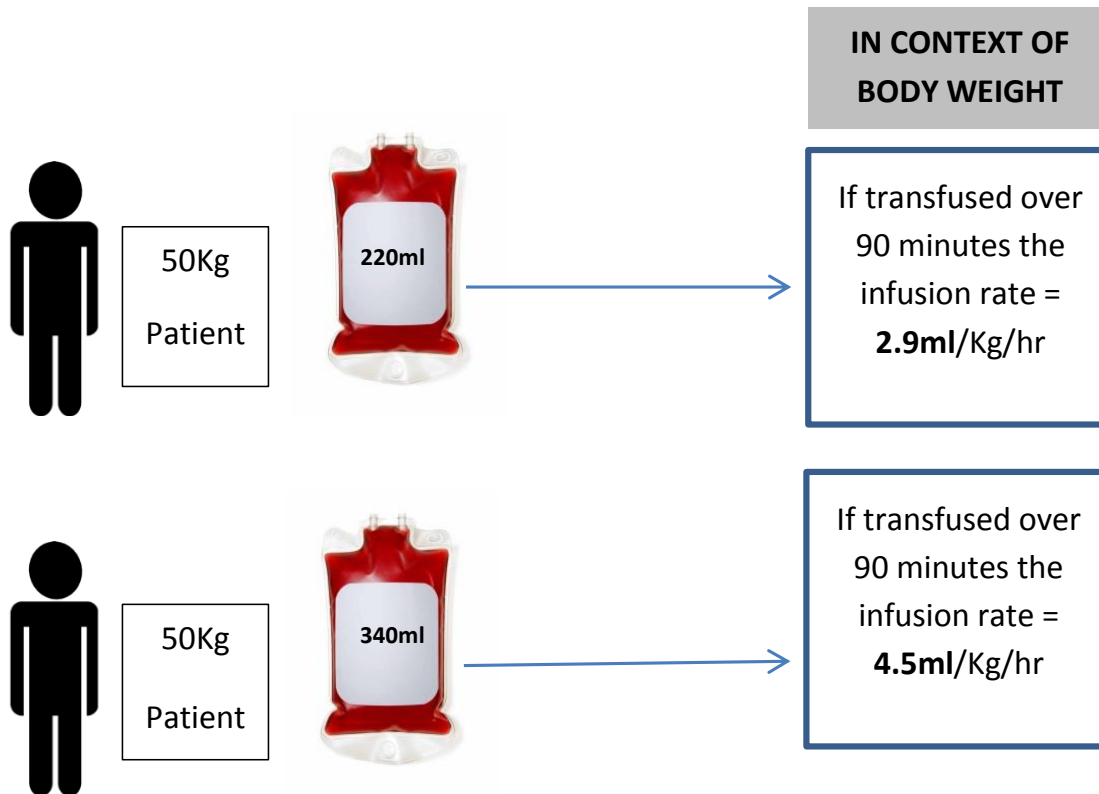
- 90-120 minutes (max 4 hours from storage) (BSH, 2017)
- Lengthy treatment time for patients receiving regular elective transfusions
- 60- 180 minutes (max 4.5 hours from storage) (Australian and New

Zealand Society of Blood Transfusion Ltd and RCN Australia, 2011).

- But...UK and Australian mean bag volumes are not the same and patients are different sizes



effect of body weight on infusion rate



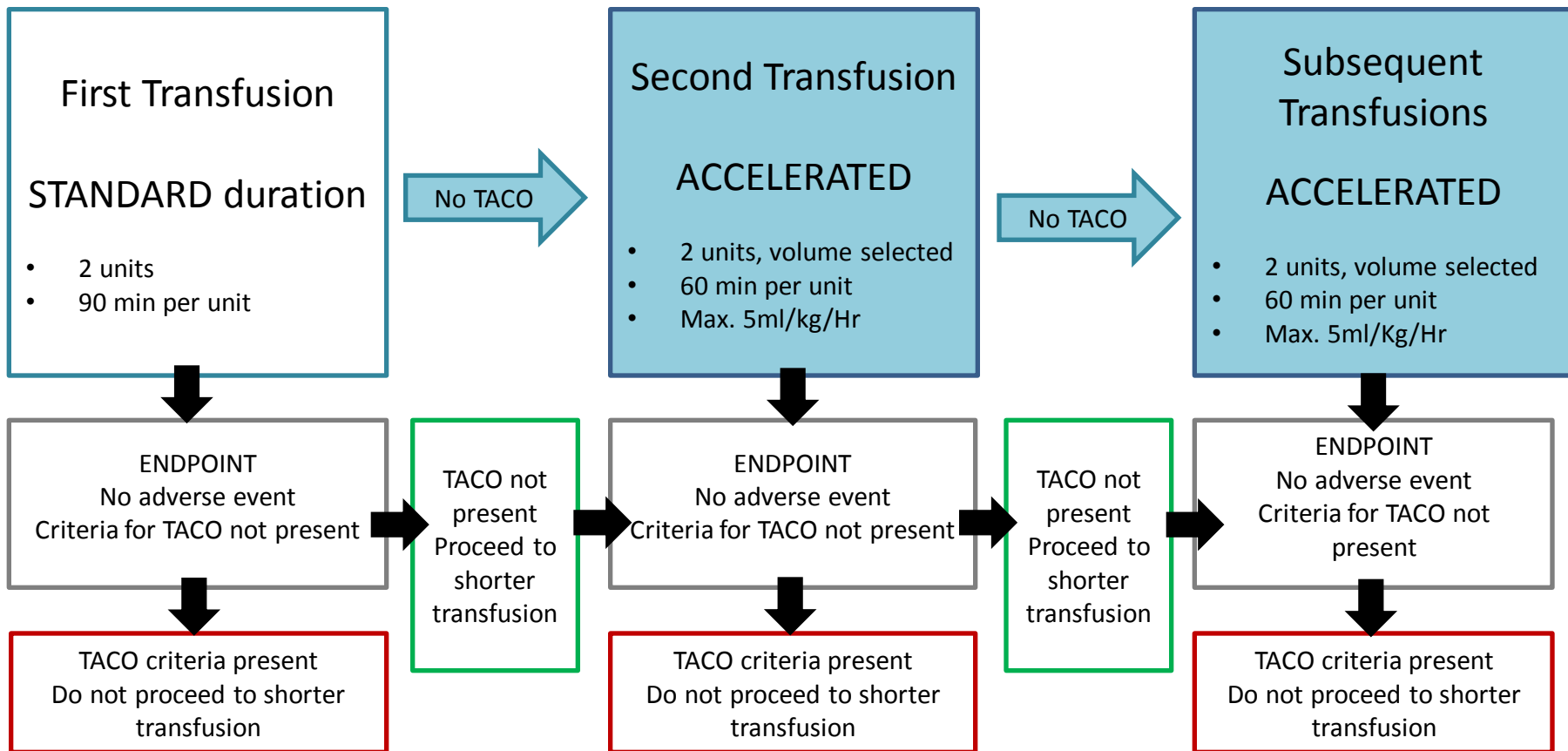
effect of unit volume variability on infusion rate

Blood Unit Volume

- Australian standard red cell unit is 236-282 ml (Australian Red Cross Blood Service, 2012).
- UK (NHSBT) standard red cell unit is 220-340 ml (NHSBT, 2012).
- In a small (50 Kg) adult this is equivalent to 5.2ml/Kg/hr based upon an average 'Australian' unit, and 5.6 ml/Kg/Hr based upon an average UK red cell unit
- A 5ml/Kg/hr dose was chosen for ease of calculation and provides a margin that does not exceed the 'Australian' rate of transfusion.
- Patients weighing <67Kg require volume selected units

Methods - Protocol

Each transfusion: pre-transfusion clinical assessment and baseline vital signs



Methods – Post Transfusion Assessment

TACO Diagnostic Criteria (SHOT and some ISBT)	24 hour Post-Transfusion Clinical Assessment	Expected Range
Tachycardia	Heart rate (beats per minute)	Less than 100 beats per minute
Increased Blood Pressure	Blood Pressure (systolic mmHg)	Mean Arterial Pressure 70-110
	Blood Pressure (diastolic mmHg)	
Acute respiratory distress	Respiratory rate (breaths per minute)	Less than 20 breaths per minute
Clinical signs of pulmonary oedema, 'heart failure'/fluid overload	Cough and/or dyspnoea	Not present
	Significant peripheral oedema	Not present
To ensure all symptoms and signs not meeting TACO criteria can be independently assessed	Are there any other signs of acute illness?	Not present
	Has there been ANY adverse event in the past 24 hours?	No

Vital Sign Observation Analysis

- MAP was increased* 24 hours after transfusion regardless of whether standard or accelerated rate (standard rate $p=0.0441$, accelerated rate $p=0.009$)
- No difference between pre and post transfusion MAP when standard and accelerated rate transfusion were compared ($p=0.437$)
- Accelerated transfusion itself did not cause increased MAP above that of standard rate transfusion

MAP = Mean Arterial Pressure

* Not pathological range

A Case for Change – Summary of Results

Patient Safety

- 25 Patients, 269 transfusions (1 – 39 per patient over mean 122 mins/2 units)
- 0 adverse events

Service Capacity

- Medically Eligible Patients = 57% (26/46)
- Of 459 haematology patient transfusion episodes, 224 transfusions eligible for accelerated rate (49%)
- Accelerated transfusions could save 105 nursing hours (26 four hour visits, or 35 three hour visits per year)

Patient & Practitioner Experience

- Less time in healthcare, freedom, comfort, time for other commitments/interests
- Capacity, scheduling, patient continuity, job satisfaction, clinical autonomy, working conditions

Conclusions/Summary

- Data suggests 2 units infused at 60 min per unit ($<5\text{ml/Kg/Hr}$) red cell transfusion is safe in medically selected patients
- MAP increased 24 hours post-transfusion regardless whether standard or accelerated rate
- Patients $<67\text{Kg}$ require volume selected units (to not exceed 5ml/Kg/Hr)
- Could be applied to any day-case transfusion meeting inclusion criteria
- Significant proportion of patients meet inclusion criteria
- Service capacity could potentially be increased
- Positive patient and practitioner experience

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Accelerated Red Cell Transfusion for Selected Patients

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Accelerated Red Cell Transfusion for Selected Patients. S. Grey, S. Roberts, C. Patalappa, K. Lipscomb, H. Hashim, K. Porczynska, L. Merrick, J. Bowman, K. Buckley, I. Sofield.
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