
Management of Hypocalcaemia during Apheresis

1. PURPOSE

To prevent symptomatic hypocalcaemia during Apheresis procedures by monitoring ionised serum calcium levels and treating pre symptomatic hypocalcaemia.

2. SCOPE

This procedure applies to medical staff from Children's Cancer Centre (CCC) and Apheresis nursing staff from the Ambulatory Care Centre (ACC) caring for donors under the care of the Haemopoietic Stem Cell Transplant (HSCT) Programme.

3. RESPONSIBILITY

It is the responsibility of the **Head of the HSCT Programme or delegate** to:

- Oversee the care of the donor during Apheresis Haemopoietic Progenitor Cell (HPC-A) collection.

It is the responsibility of the **CCC Ward Registrar or Resident Medical Officer (RMO)** to ensure that;

- Baseline electrolytes and Ionised Serum Calcium levels are completed for each HPC-A donor prior to commencement of the Apheresis procedure.
- Pathology requests (marked urgent) for electrolytes and Ionised Serum Calcium levels during (after each blood volume processed) and post Apheresis procedure, accompany the donor to the collection facility (either ACC or Paediatric Intensive Care Unit).
- An order for Calcium Gluconate is completed on the donors Medication Chart (MR690/A).

It is the responsibility of the **Apheresis Nurse (Ambulatory Care Centre)** to;

- Take blood samples and despatch to RCH Laboratory Services for urgent electrolytes and Ionised Serum Calcium levels as requested or at presentation of the first symptoms of hypocalcaemia.
- Assess results and communicate **ANY** abnormal results promptly to the CCC Ward Registrar or Fellow or the Head of the HSCT Programme.
- Commence Calcium Gluconate infusion as confirmed by Medical Officer.

It is the responsibility of the Quality Manager (QM) or equivalent to ensure implementation, maintenance and compliance with this procedure.

4. DEFINITIONS

CCC – Children's Cancer Centre within The Royal Children's Hospital

Donor – A person who is the source of cells or tissue for a cellular therapy product.

HPC – Haemopoietic Progenitor Cell.

HPC-A – Haemopoietic Progenitor Cells-Apheresis. Peripheral blood collected by apheresis as a source of haemopoietic progenitor cells. Mobilised unless otherwise stated.

Reference Range for Serum Ionised Calcium – 1.17-1.31mmol/L

TBV – Total Blood Volume.

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5. EQUIPMENT AND SUPPLIES

1g/10ml (10%) Calcium Gluconate 10ml. Phebra. Cat No: INJ022
(Note as approved by RCH Drug Usage Committee)
0.9% NaCl 10ml. (x2) Pfizer. Cat No: 61045033

6. PROCEDURE

NOTE: The Head of the HSCT Programme or delegate will be available for consultation.

6.1 Background

During the Apheresis procedure anticoagulant must be used to prevent clotting in the extracorporeal circuit. The most commonly used anticoagulant is Acid Citrate Dextrose Solution Formula A (ACD-A) at an anticoagulant: whole blood ratio of 1:12 to 1:15. Citrate is metabolised in the liver and excreted by the kidneys, so patients with poor hepatic or renal function will more readily experience citrate toxicity. Citrate binds free ionised Calcium (Ca^{2+}) (not albumin bound Calcium) resulting in a transient decrease in Ca^{2+} levels (normal range 1.17-1.31mmol/L). The fall in Ca^{2+} is most significant in the first 15-30minutes after commencing the ACD-A infusion.

If hypocalcaemia ($\text{Ca}^{2+} < 1.17\text{mmol/L}$) develops, mild to moderate symptoms to note and action are;

- Anxiety.
- Nausea and vomiting.
- Acute Abdominal Pain.
- Tingling in fingers, toes and lips.
- Peripheral paraesthesia and tingling.
- Carpopedal spasm.
- Agitation.
- Pallor and sweating.

More severe hypocalcaemia may cause prolongation in the QT interval, arrhythmia, tachycardia and hypotension.

6.2 Prior to commencement of the Apheresis Procedure

- The CCC Ward Registrar or RMO will ensure that the following baseline Pathology investigations have been completed pre commencement of Apheresis;
 - FBE, electrolytes, serum Ca^{2+} , peripheral blood CD34 and clotting profile-if indicated.
 - Valid crossmatched unit of Packed Cells (leucodepleted and irradiated) is available, where machine blood prime is required (i.e. for donors weighing less than 25Kg and a TBV (80mls/Kg) $\leq 1,900\text{ml}$).
- The CCC Ward Registrar or RMO will ensure that Pathology Requests have been completed and accompany the donor to the collection facility.
 - Following each blood volume processed - Electrolytes and serum Ca^{2+} .
 - Post procedure - FBE, electrolytes, serum Ca^{2+} and clotting profile.

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- The CCC Ward Registrar or RMO will ensure all medication orders are completed on the donors Medicine Chart which accompanies the donor to the collection facility.
 - Single infusion of 0.5ml/Kg, 10% Calcium Gluconate to a maximum of 30mls, diluted in 20-50mls of 0.9% Normal Saline. To be infused over one hour.
 - Post procedure – Heparin infusion, for Vascath care, at 5IU/ml (dilute heparin in 0.9% Normal Saline) at a rate of 2ml/hr.

6.3 During the Apheresis Procedure

- The Apheresis Nurse is responsible for taking blood samples at the above mentioned time points and sending the samples for **URGENT** analysis by Laboratory Services.
- The Apheresis Nurse will urgently take and despatch additional samples for analysis (electrolytes and Ca^{2+}) at the first onset of symptoms suggestive of hypocalcaemia (anxiety, restlessness, tingling, paraesthesia or tetany).
- The Apheresis Nurse will promptly communicate **ALL** abnormal results to the CCC Ward Registrar, Fellow or the HSCT Physician, who will authorise commencement of the calcium infusion as applicable.
- The Apheresis Nurse will prepare and infuse the calcium as charted. The infusion should preferably run into an independent line, i.e. Hickman / peripheral IV, but may run into the return line (return line from the Cobe Spectra™) of the Vascath if no other access is available. The donor's Ca^{2+} level is checked post infusion.

- If there is a delay in accessing medical staff and the donor **HAS SYMPTOMATIC HYPOCALCAEMIA**, the calcium infusion may commence prior to discussion with medical staff. If the ACD: Blood ratio is greater than 1:15 (i.e. 1:12), slow ACD (citrate) infusion to 1:15 until symptoms resolve.

- If further calcium replacement is required the CCC Ward Registrar or Fellow must review the donor and write a further Medication Order on the donor's Medicine Chart.

7. ENDPOINT

Haemodynamically stable and comfortable donor with acceptable electrolytes and Ca^{2+} levels.

8. ATTACHMENTS

Nil.

9. REFERENCES

9.1 Therapeutic Paediatric Apheresis. Haewon C. Kim. Journal of Clinical Apheresis. 15:129-157, 2000.

9.2 Evaluation of Hemopoietic Stem Cell Donors. Mary M. Horowitz and Dennis L. Confer. American Society of Haematology Education Program Handbook. 1:469-481. 2005.