Focus on patient safety

MEASURING & IMPROVING QUALITY

Medicinal product dose calculation

The rule of three must remain the rule

16 December 2021

It could happen to you too

Event 1

POTASSIUM UNDERDOSAGE LEADING TO SEVERE HYPOKALIEMIA

A male patient over age 65 is admitted to the internal medicine department for deterioration in general condition and hypokaliemia. POTASSIUM RICHARD® (440 mg/15 ml) syrup in single-dose sachet was prescribed to him at 880 mg potassium ions 3 times a day, morning, midday and evening. He was then transferred to follow-up and convalescence care with the same prescription. Despite potassium syrup supplementation, severe hypokaliemia was detected (2.20 mmol/L), leading to the prescription of IV potassium by syringe pump.

What happened? *Immediate cause*

The patient received 25 mg of potassium ions instead of 880 mg.

Why did it happen? *Root causes, barriers absent or deficient*

- Further to a supply shortage, the hospital pharmacy delivered GLUCONATE DE POTASSIUM® syrup to replace POTASSIUM RICHARD® syrup in single-dose sachet-dose on the hospital's medicinal product log.
- On dispensing, the hospital's healthcare professionals were not informed of the supply shortage or of the medicinal product actually delivered: GLUCONATE DE POTASSIUM® syrup (25 mg/ml) delivered as like-for-like replacement has a different concentration from the POTASSIUM RICHARD® syrup in single-dose sachet (440 mg/15 ml), initially prescribed.
- The name in the prescription software does not specify the potassium sachet dosage.
- The initial prescription (POTASSIUM RICHARD® syrup) was approved in the prescription software, whereas the equivalent was administered and the patient was transferred from the internal medicine department to the follow-up and convalescence care department with their bottle of GLUCONATE DE POTASSIUM®.
- There was a preparation error. 1 ml of GLUCONATE DE POTASSIUM® syrup, i.e. 25 mg of potassium ions 3 times daily was taken and given to the patient instead of the 30 ml POTASSIUM RICHARD® syrup in single-dose sachet, i.e. 880 mg potassium ions 3 times/day.

HAS
HAUTE AUTORITÉ DE SANTÉ

Event 2

BENDAMUSTINE OVERDOSE LEADING TO CHEMOTHERAPY CYCLE INTERRUPTION

A male patient over the age of 60 was hospitalised in oncology for 2 chemotherapy sessions in 2 days, with the following prescription: 70 mg BENDAMUSTINE on D1 and D2. Each chemotherapy dose is prepared by the pharmacy in the chemotherapy reconstitution laboratory then sent to the oncology department for administration to the patient. However, on D2, reconstitution was not possible as no more BENDAMUSTINE vials were available. The chemotherapy session could not take place.

What happened? *Immediate cause*

The patient received 140 mg of BENDAMUSTINE on the first day instead of 70 mg, which is the dose which should have been administered over 2 days.

Why did it happen? *Root causes, barriers absent or deficient*

- Two BENDAMUSTINE vials (for D1 and D2) were placed in the chemotherapy isolator system whereas only one vial was required for the D1 dose.
- An error reconstituting the product was made by the hospital pharmacy. Rather than reconstituting 1 vial of 100 mg of BENDAMUSTINE with 40 ml water for injection, 2 vials of 100 mg were reconstituted each with 20 ml water, which is twice the prescribed concentration.
- The dispenser did not follow the product reconstitution recommendations as specified in the Summary of Product Characteristics. It is recommended reconstituting each vial of BENDAMUSTINE containing 100 mg of BENDAMUSTINE hydrochloride in 40 ml water for injection.

Event 3

CLONIDINE OVERDOSE IN A CHILD LEADING TO THEIR TRANSFER TO INTENSIVE CARE

A 9-year-old child with multiple disabilities presenting with epileptic encephalopathy was hospitalised in the day hospital for a diagnostic MRI-scan under general anaesthesia. Premedication with* oral *CLONIDINE 60 µg was prescribed (usual off-label protocol) by the anaesthetist. However, 30 minutes after administration of the premedication, the patient presented with hypoventilation, bradypnoea and altered state of consciousness. They were transferred to intensive care where they were intubated and placed on assisted ventilation.

What happened? *Immediate cause*

The patient received 10 times the prescribed dose, i.e. 600 µg of CLONIDINE instead of 60 µg.

Why did it happen? *Root causes, barriers absent or deficient*

- CLONIDINE does not have MA in children but is sometimes used in paediatrics, especially as premedication in anaesthesia.
- The formulations marketed are not suitable for use in paediatrics. In France, CLONIDINE is marketed in two forms:
  - solution for injection: ampoule of 1 ml at 0.15 mg/ml;
  - scored tablet: 0.15 mg/tab.
- The hospital's protocol for administration of CLONIDINE in children (which the nurse knew) created in the hospital's prescription software recommends using the solution for injection and diluting it to one tenth before administration. However, the notion of diluted solution is not found in the summary stating the volume to be administered.
- There was a preparation error during dilution. Instead of diluting one ampoule in 10 ml and taking 4 ml of diluted solution, the nurse took 4 ml of pure CLONIDINE (i.e. 4 ampoules of 1 ml at 0.15 mg/ml).
- Good administration practices were not followed:
  - the nurse preparing the product was not the one administering it, which is why the preparation was not checked against the prescription;
  - the nurse prepared the medicinal product looking at the label prepared to label the syringe and not at the computer prescription.
- The nurse had worked 2 nights previously with one day off before returning to work on the fourth morning and not the afternoon as is usually the case in the department. Her tasks were also interrupted on top of that.

Key words: *dose calculation - medication error – preparation - overdose – underdose*

So it doesn't happen again

Dose calculation can be necessary at all stages of medication management and concerns all involved in such management.

It is therefore essential that all healthcare professionals:

- are **able to manage the rule of three**;
- **are able to manage the basics of calculation** (units of weight, volume, time, conversions, concentrations, dilutions, flow rates, etc.);
- **ensure double checking becomes routine:**
  - for medicinal products considered to be high risk, medicines for injection, and generally for all preparations needing to be made up first,
  - as soon as there is any doubt as to dose calculation, and this, regardless of the stage of medication management,
  - when writing the prescription, analysing it, preparing it and administering it;
- **ensure tasks are not interrupted** and **prohibit** their interruption;
- **standardise** preparation methods as far as possible and provide professionals with memos such as conversion tables, correspondence table, dose calculation table adapted to the given sector of activity.

More broadly, it is advisable:

- to **reinforce** learning and proficiency in mathematical reasoning as part of training for all healthcare professionals;
- to**use** and **to develop** as far as possible, dose calculation applications;
- to **ensure** feedback concerning formulations that are not appropriate for a given sector of activity is provided to pharmaceutical companies, to the ANSM, and any other bodies concerned.

Patient safety information collection

The "Focus on patient safety" collection aims to draw the attention of and raise awareness among healthcare professionals as to risk management. Each focus covers a specific and recurrent risk based on care-related adverse events, identified and selected from national care-related serious adverse event reporting databases or doctors' accreditation. This information sheet focusses on the occurrence of adverse events incriminating medication errors related to dose calculation errors. This sheet relates events with which healthcare professionals have been confronted and which are always associated with a series of dysfunctions.

Find out more:

- **If I want to assess myself**

  E-learning

  – *Dose calculation (the basics)*
  www.omedit-centre.fr/Calculsdedose_web_gen_web/co/module_Calculs_de_dose_1_Notions_de_Base_1.html

  – *Injectable form dose calculation (advanced)*
  www.omedit-centre.fr/calcul2dose-2/co/I_Introduction.html

  – Most IFSIs offer on line exercises and corrections.

- **If I want to train**

  The guide "Outils de sécurisation et d'autoévaluation des médicaments" - Tools for securing and self-assessment of drug administration (HAS 2013)
  www.has-sante.fr/upload/docs/application/pdf/2011-11/guide_outil_securisation_autoevalusation_medicaments_complet_2011-11-17_10-49-21_885.pdf

  The guide "Interruption de tâche lors de l'administration des médicaments" - Task interruption during medicinal product administration (HAS 2016)
  www.has-sante.fr/jcms/c_2618396/fr/interruptions-de-tache-lors-de-l-administration-des-medicaments

  Double checks: quality approach in pharmacies
  www.demarchequaliteofficine.fr/outils/m11.-double-controle

  (Double) checks for high risk medicinal products: recommendations for Swiss hospitals
  www.securitedespatients.ch/fileadmin/user_upload/2_Forschung_und_Entwicklung/DOKO/Doppelkontrolle_Empfehlung_FR.pdf

  (Double) checks for high risk medicinal products: recommendations for Swiss hospitals (Memo)
  www.securitedespatients.ch/fileadmin/user_upload/2_Forschung_und_Entwicklung/DOKO/Doppelkontrolle_Flyer_FR.pdf

  Dose calculation: the essential
  www.omedit-centre.fr/calcul2dose/res/Fiche_Memo.pdf

  Serious game "Learning how to make a dose calculation for an infusion or electric syringe or syringe pump"
  www.omeditpacacorse.fr/wp-content/uploads/2019/11/Serious-Game-OMEDIT.pdf

The HAS would like to extend its thanks to the OMéDITS who helped proofread this flash.

HAS
HAUTE AUTORITÉ DE SANTÉ
Advancing quality in health and social care services