Stability of N-Acetylcysteine (NAC) in Standardized Pediatric Parenteral Nutrition and Evaluation of N,N-Diacetylcystine (DAC) Formation

Isabelle Sommer [1,2], Hervé Schwebel [3], Vincent Adamo [3], Pascal Bonnabry [2,4], Lucie Bouchoud [4], Farshid Sadeghipour [1,2]

[1]*Department of Pharmacy, University Hospital of Lausanne, 1011 Lausanne, Switzerland*
[2]*Institute of Pharmaceutical Sciences of Western Switzerland, University of Geneva, University of Lausanne, 1211 Geneva, Switzerland*
[3]*B. Braun Medical AG, 1023 Crissier, Switzerland*
[4]*Department of Pharmacy, Geneva University Hospitals, 1205 Geneva, Switzerland*

Abstract

Background: The ESPGHAN/ESPEN/ESPR-Guidelines on pediatric parenteral nutrition (PPN) recommend the administration of the semiessential amino acid (AA) cysteine to preterm neonates due to their biochemical immaturity resulting in an inability to sufficiently synthetize endogenous cysteine. The soluble precursor N-acetylcysteine (NAC) is easily converted into bioavailable cysteine. Its dimer N,N-diacetylcystine (DAC) is almost unconvertable to cysteine when given intravenously resulting in a diminished bioavailability of cysteine.

Objectives: This study aims to understand the triggers and oxidation process of NAC to DAC to evaluate possibilities of reducing DAC formation in standardized PPN.

Methods: Different air volumes (21% O_2) were injected into the AA compartment of a standardized dual-chamber PPN. O_2 concentrations were measured in the AA solution and the headspaces of the primary and secondary packaging. NAC and DAC concentrations were analyzed simultaneously.

Results: The analysis showed that O_2 is principally delivered from the primary headspace. NAC oxidation exclusively delivers DAC, depending on the O_2 amount in the solution and the headspaces.

Conclusion: The reaction of NAC to DAC being containable by limiting the O_2 concentration, the primary headspace must be minimized during manufacturing, and oxygen absorbers must be added into the secondary packaging for a long-term storage of semipermeable containers.

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Contact: isabelle.sommer@chuv.ch