Letter to the Editor

Regarding Blotske et al: "Evaluating the Utilization and Cost Analysis of High-dose Thiamine when Compounded or Administered via Intravenous Push at an Academic Medical Center"

KEYWORDS: THIAMINE | ALCOHOL WITHDRAWAL | COMPOUNDING | STERILE COMPOUNDING | ECONOMIC EVALUATION | SAFETY

Robert S. Hoffman, MD


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Evaluating the Utilization and Cost Analysis of High-dose Thiamine when Compounded or Administered Via Intravenous Push at an Academic Medical Center

Kaitlin Blotske, Brian Murray, Rob MacLaren, and Tyree H. Kiser are affiliated with the University of Colorado Hospital, Department of Pharmacy, Aurora, CO, and Skaggs School of Pharmacy and Pharmaceutical Sciences, Aurora, CO. Scott Mueller and Shelby Pons are affiliated with the University of Colorado Hospital, Department of Pharmacy, Aurora, CO. Garth Wright is affiliated with the Skaggs School of Pharmacy and Pharmaceutical Sciences, Aurora, CO.

Abstract

PURPOSE: Thiamine doses greater than 200 mg are typically prepared as an IV piggyback (IVPB) and administered over 30 minutes to reduce the risk of adverse events (AE) associated with administration. Administration of high-dose (HD) thiamine as an IV push may reduce cost and clinical burden without increasing risk of AE.

METHODS: This was a retrospective, single-center cohort analysis of hospitalized patients over the age of 18 years old admitted to the University of Colorado Hospital and receiving HD thiamine from June 1st, 2024 to October 31st, 2024. In August 2024, the preparation and administration of HD IV thiamine was changed from 500 mg IVPB administered over 30 minutes to 400 mg undiluted IV push over 2 minutes. The primary outcome was the average total cost comparing thiamine 500 mg IVPB versus 400 mg IV push. Secondary outcomes included cumulative dose administrations and AE.

RESULTS: A total of 731 patients met inclusion criteria with 339 (46%) receiving thiamine 500 mg IVPB infusion (2,493 doses) and 392 (54%) receiving thiamine 400 mg IV push (3,145 doses). The average total cost of HD thiamine therapy per patient was $91.12 for the 500 mg IVPB cohort and $59.05 for the 400 mg IV push cohort (p < 0.001). Additionally, the mean cumulative dose of thiamine administered was higher in the 500 mg IVPB cohort compared to the 400 mg IV push cohort (p = 0.002). Hypotension (0.5%) and burning sensation (1.0%) were only reported in the thiamine 400mg IV push group and were not statistically significant.

CONCLUSION: The institutional change from thiamine 500mg IVPB to thiamine 400mg undiluted IV push resulted in significant cost savings with minimal risk for adverse events.

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Introduction

The active form of thiamine (vitamin B1) is a key cofactor in the enzymatic process of breaking down glucose into an energy source.[1,2] This water-soluble vitamin has limited stores within the body and can be depleted within weeks during periods of malnutrition. Metabolism to its active form, thiamine pyrophosphate (TPP), occurs primarily in the liver which leads to reduced access to this cofactor in patients with severe liver dysfunction. TPP contributes as a coenzyme to a number of metabolic reactions, especially those surrounding the breakdown and utilization of glucose into energy and nerve function.

Thiamine administration for treatment and preventative purposes is often used in clinical practice for high-risk populations (e.g., alcohol use disorder, critically ill, malnourished, bariatric surgery, etc.).[1,2] Many institutions have a low threshold for initiating thiamine due to the acceptable safety profile and low cost of therapy.[3]

There is adequate evidence to support the safety of IV push administration of thiamine at doses of 200 mg or less, demonstrating a low risk of anaphylaxis and injection site reactions with undiluted administration.[4,5] However, the safety of IV push administration for doses higher than 200 mg has not been well defined. A recent study published in 2023 assessed the safety of administering 500 mg of thiamine as an IV push over 1 to 2 minutes due to previous concerns for anaphylaxis and injection site reactions.[6] Following 463 administrations of 500 mg thiamine as an IV push in 69 total patients, no episodes of anaphylaxis and 4 (0.86%) injection site reactions were documented, including phlebitis and extravasation.

Historically, ordering of high-dose thiamine at the UCHealth University of Colorado (UCH) Hospital defaulted to 500 mg prepared as an intravenous piggyback (IVPB) and administered as a 30-minute IV infusion three times a day (TID). High utilization of this product places a significant burden on pharmacy IV room compounding resources and personnel, and this administration method occupies patient IV access for longer periods. In August 2024, UCH amended default orders for high-dose thiamine to 400 mg undiluted and administered as an IV push over 2 minutes TID. This change was instituted with the hopes of reducing time of occupied IV access, drug incompatibilities, and IV compounding demands.

The purpose of this evaluation is to determine if the recent practice change to high-dose thiamine being administered as a 400 mg IV push resulted in cost-savings. A key secondary outcome evaluated safety of IV push administration for high-dose thiamine.

Methods

This was a retrospective, single-center cohort study conducted at the UCHealth University of Colorado Hospital from June 1st, 2024 to October 31st, 2024. Hospitalized patients who were 18 years or older and receiving high-dose thiamine (either 500 mg IVPB or 400 mg undiluted IV push) during the admission were eligible for inclusion. Patients were excluded if they received any other dose or route of administration of thiamine. The 500 mg IVPB thiamine product was compounded in the pharmacy IV room diluting 5 mL thiamine (100 mg/mL) in 50-mL bags of 0.9% NaCl; the 400 mg undiluted IV push thiamine product was prepared by nurses on patient care units from thiamine 200 mg / 2 mL vials available in automated dispensing cabinets.

Patient eligibility and data extraction from the UCH EPIC electronic health record was conducted by data analysts from Health Data Compass, a comprehensive data integration platform and warehouse serving the University of Colorado system and UCHealth affiliates. Data collected included: age, sex, race, comorbidities, type of IV access, number of thiamine doses received, cumulative thiamine dose administration, and adverse events potentially related to thiamine administration. Data was organized and loaded into REDcap and Microsoft Excel 2024 for secure storage and accessibility.

The primary outcome was to compare the average total cost per course of thiamine for 500 mg IVPB vs 400 mg undiluted IV push dosage forms. Total cost was determined by multiplying the mean administrations from each thiamine cohort by the cost of materials [18G needles, 3ml syringes, wholesale acquisition cost of thiamine 200mg vials, and 50-ml 0.9% NaCl bags]. Secondary outcomes included cumulative dose administrations and adverse events potentially attributable to thiamine administration (i.e., anaphylaxis, angioedema,

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Dear Editor-in-Chief:

I read with interest the recent publication by Blotske and colleagues that compared the cost of compounded thiamine versus a simple intravenous bolus.[1] While it is incumbent on every member of the healthcare team to attempt to reduce the cost of care and improve efficiency, cost-cutting measures must be evaluated in the context of clinical efficacy. In a study of over 1,000 intravenous bolus administrations of 100 mg thiamine doses, only a single patient (0.093%) had a major reaction described as "generalized pruritus".[2] Similarly, as noted by Blotske and colleagues, intravenous bolus administration of 500 mg thiamine doses appear to offer no greater risk to patients than the lower dose administration.[3] However, data suggest that slower infusion rates increase tissue uptake of thiamine largely by reducing urinary elimination.[4] As a result, bolus-administration of high-dose thiamine might result in undertreatment of the most vulnerable subset of patients (i.e., those presumed to be suffering from Wernicke's encephalopathy).

Before the recommendations of Blotske and colleagues are adopted into routine clinical practices it is essential that either clinical or biochemical equivalency of the two regimens

Robert S. Hoffman *is a Professor of Emergency Medicine, at Ronald O. Perelman Department of Emergency Medicine NYU Grossman School of Medicine, New York, NY, USA.*

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is demonstrated. Simple guidelines that allow nursing to add high-dose thiamine to maintenance infusions using accepted sterile techniques might be acceptable. In addition, for those patients who require high-dose thiamine it is reasonable to add magnesium (unless contraindicated) as this practice is demonstrated to be both biochemically and clinically desireable.[5,6]

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Address correspondence to Robert S. Hoffman at:
Robert.Hoffman@nyulangone.org