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ORIGINAL ARTICLE

Transition from intravenous insulin to subcutaneous long-acting insulin in critical care patients on enteral or parenteral nutrition

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KEYWORDS
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Abstract
Background and aims: The optimal initial dose of subcutaneous (SC) insulin after intravenous (IV) infusion is controversial, especially in patients receiving continuous enteral nutrition (EN) or total parenteral nutrition (TPN). The aim of this study was to evaluate the strategy used at our hospital intensive care unit (ICU) in patients switched from IV insulin to SC insulin glargine while receiving EN or TPN.
Design and methods: A retrospective analysis was made of 27 patients on EN and 14 on TPN switched from IV infusion insulin to SC insulin. The initial dose of SC insulin was estimated as 50% of the daily IV insulin requirements, extrapolated from the previous 12 h. A corrective dose of short-acting insulin (lispro) was used when necessary.
Results: Mean blood glucose (BG) level during SC insulin treatment was 136 ± 35 mg/dL in the EN group and 157 ± 37 mg/dL in the TPN group ($p = 0.01$). In the TPN group, mean BG was >180 mg/dL during the first three days after switching, and a 41% increase in the glargine dose was required to achieve the target BG. In the EN group, mean BG remained <180 mg/dL throughout the days of transition and the dose of glargine remained unchanged.
Conclusions: In the transition from IV to SC insulin therapy, initial insulin glargine dose estimated as 50% of daily IV insulin requirements is adequate for patients on EN, but inadequate in those given TPN.

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PALABRAS CLAVE
Transición;
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Glargina;
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Transición de insulina intravenosa a insulina de acción prolongada subcutánea en pacientes de cuidados críticos con nutrición enteral o parenteral

Resumen
Introducción y objetivo: La dosis óptima inicial de insulina subcutánea (SC) después de la infusión intravenosa (IV) es controvertida, especialmente en pacientes que reciben nutrición enteral continua (NE) o nutrición parenteral total (NPT). El objetivo de este estudio fue evaluar la estrategia utilizada en nuestra unidad de cuidados intensivos (UCI) en pacientes sometidos a transición de infusión IV a insulina glargina SC mientras recibían NE o NPT.
Diseño y métodos: Se analizaron retrospectivamente 27 pacientes con NE y 14 con NPT que cambiaron de infusión IV a insulina SC. La dosis inicial de insulina SC se estimó como el 50% de los requerimientos diarios de insulina IV, extrapolado de las 12 horas anteriores. Se utilizó dosis correctiva de insulina ultrarrápida (lispro), cuando fue necesaria.
Resultados: La media de glucemia plasmática (GP) con insulina SC fue de 136,35 mg/dl en el grupo NE y de 157,37 mg/dl en el grupo NPT, $p = 0.01$. En el grupo de NPT la GP media fue > 180 mg/dL durante los tres primeros días después de la transición y fue necesario un aumento del 41% en la dosis de glargina para alcanzar la GP objetivo. En el grupo NE, la GP media permaneció < 180 mg/dl durante los días de transición y la dosis de glargina permaneció sin cambios.
Conclusiones: En la transición de la terapia de insulina IV a insulina SC, la dosis inicial de insulina glargina estimada como el 50% de los requerimientos diarios de insulina IV es adecuada para los pacientes que reciben NE, pero insuficiente para los que reciben NPT.

Introduction

Hyperglycemia is associated with an increase death and infection among patients hospitalized in ICU.[1,2] Insulin is the preferred agent for glycemic control in hospitalized patients and, in the ICU setting, insulin is usually administered as IV continuous infusion, which is the most effective and safe method for achieving the glycemic targets.[3,4] When a patient's condition improves many guidelines and recommendations suggest switching from IV insulin to SC insulin.[5–8] The decision to transfer the patient from IV to SC insulin should be made carefully, evaluating the patient clinical situation, recognizing factors that influence a safe transition and calculation of proper SC insulin doses.[9]

Outside ICU setting, use of basal-prandial-correction therapy with SC insulin analogs constitutes the preferred regimen[5–7,10] with careful monitoring of BG to achieve the target range and avoid hypoglycemia. In patients receiving continuous EN or TPN, basal-correction therapy constitutes a suitable method for managing hyperglycemia[6,11,12] and the dose of insulin is normally higher for maintained target BG.

Few studies have focused on the optimal transition from IV insulin infusion to SC insulin therapy[13–16] and the optimal dose of initial SC insulin is highly uncertain, particularly in patients in whom artificial nutrients are delivered continuously.[12,17]

This study attempts to evaluate the strategy used in hospitalized patients in ICU undergoing transition from IV insulin infusion to SC long-acting insulin glargine while receiving EN or TPN, and has tried to determine the optimal dose of insulin needed to maintain glycemic goals.

Material and methods

We established a program of intensive insulin management for hyperglycemia, designed to achieve a glycemic target of 100–140 mg/dL in a 16-bed medical-surgical ICU. BG was measured on admission to the ICU, and IV insulin was begun for all patients whose glucose levels were greater than 140 mg/dL. During a period of 6 months, 120 patients requiring a continuous insulin infusion were included in this retrospective study. Transition to SC insulin occurred in 74 patients requiring >1 IU/h IV insulin when critical illness was resolved and nutritional status was stable. Patients receiving EN ($n = 27$) or TPN ($n = 14$) and treated with basal insulin glargine plus correction insulin lispro were eligible for inclusion in the study.

The insulin drip rate in the preceding 12 h was used to calculate initial SC insulin dose. The average rate was multiplied by 24 to calculate the total daily insulin requirements, and 50% was administered SC as the first daily injection of glargine. On the basis of capillary BG monitoring (Accu-Chek Sensor, Roche, Mannheim, Germany) every 6 h, correction doses of insulin lispro were administered if glycemia remained above 140 mg/dL. Glargine insulin dose was increased or decreased by 10–20% every day to achieve a glycemic goal of 100–140 mg/dL. Mean BG levels and mean insulin dose were evaluated during IV and SC insulin treatment.

The study was approved by the Ethics Committee of our institution.

Data are given as mean ± SD. Group differences were analyzed by χ^2 test for categorical variables and t-test for continuous variables. The SPPS V 20.0 was used to