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ORIGINAL ARTICLE

Benefit of an electronic medical record-based alarm in the optimization of stress ulcer prophylaxis

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Abstract
Background: The use of stress ulcer prophylaxis (SUP) has risen in recent years, even in patients without a clear indication for therapy.
Aim: To evaluate the efficacy of an electronic medical record (EMR)-based alarm to improve appropriate SUP use in hospitalized patients.
Methods: We conducted an uncontrolled before-after study comparing SUP prescription in intensive care unit (ICU) patients and non-ICU patients, before and after the implementation of an EMR-based alarm that provided the correct indications for SUP.
Results: 1627 patients in the pre-intervention and 1513 patients in the post-intervention cohorts were included. The EMR-based alarm improved appropriate (49.6% vs. 66.6%, $p < 0.001$) and reduced inappropriate SUP use (50.4% vs. 33.3%, $p < 0.001$) in ICU patients only. These differences were related to the optimization of SUP in low risk patients. There was no difference in overt gastrointestinal bleeding between the two cohorts. Unjustified costs related to SUP were reduced by a third after EMR-based alarm use.
Conclusions: The use of an EMR-based alarm improved appropriate and reduced inappropriate use of SUP in ICU patients. This benefit was limited to optimization in low risk patients and associated with a decrease in SUP costs.

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PALABRAS CLAVE
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Úlcera gástrica;
Agentes gastrointestinales

Beneficio de una alarma electrónica de la historia clínica en la optimización de la profilaxis de la úlcera por estrés

Resumen
Antecedentes: El uso de la profilaxis de úlceras por estrés (PUE) ha aumentado en los últimos años, incluso en pacientes sin indicación.
Objetivo: Evaluar la eficacia de una alarma electrónica en la historia clínica (AEHC) para mejorar el uso apropiado de la PUE en pacientes hospitalizados.
Métodos: Estudio no controlado antes-después para comparar la prescripción de la PUE en pacientes de la unidad de cuidados intensivos (UCI) y sala general, antes y después de la implementación de una AEHC que proporcionaba las indicaciones correctas de la PUE.
Resultados: Se incluyeron 1.627 pacientes en la cohorte previa a la intervención y 1.513 pacientes en la cohorte posterior a la intervención. La AEHC mejoró el uso apropiado (49,6 vs. 66,6%; $p < 0,001$) y redujo el uso inapropiado de la PUE (50,4 vs. 33,3%; $p < 0,001$) solo en pacientes de la UCI. Estas diferencias se relacionaron a la optimización del uso de la PUE en pacientes de bajo riesgo. No hubo diferencias en la frecuencia de hemorragia digestiva manifiesta entre ambas cohortes. El uso de la AEHC redujo un tercio del costo injustificado relacionado con la PUE.
Conclusiones: El uso de una AEHC mejoró el uso apropiado de la PUE y redujo el uso inapropiado de la PUE en pacientes de la UCI. Este beneficio fue limitado a la optimización del uso de la PUE en pacientes de bajo riesgo y se asoció a una disminución del costo de la PUE.

Introduction

Gastrointestinal (GI) stress ulcers represent an important problem in hospitalized patients. The development of clinically significant GI hemorrhage in admitted patients has been associated with an increase in morbidity and mortality.[1]

Endoscopic studies have demonstrated gastric lesions in 75–100% of intensive care unit (ICU) patients within 24 h of admission.[2] Additionally, overt bleeding rates have been reported to occur in 5–25% of critically ill patients who do not receive stress ulcer prophylaxis (SUP).[3] Mechanical ventilation and coagulopathy have been identified as the main risk factors associated with stress ulcers.[4] SUP consists of the administration of acid-suppression therapy (AST), such as proton pump inhibitors (PPI) and histamine-2 receptor blockers (H2RB), to reduce gastric acid secretion and the risk of GI bleeding.[4] Despite the lack of evidence in favor of universal SUP, use of AST has markedly increased in recent years. Some studies indicate that approximately 90% of ICU patients and nearly 70% of non-ICU patients receive SUP during admission.[5]

The use of SUP may have adverse effects, and place patients at a higher risk of hospital-acquired pneumonia and *Clostridium difficile* (*C. difficile*) infections.[6,7] Moreover, inappropriate use of SUP increases healthcare costs.[7] The implementation of training programs or clinical practice guidelines aimed at reducing inappropriate prescription of AST have been shown to have favorable results in several studies.[6,8] There are currently no studies investigating the use of electronic medical record (EMR) based alarms to improve the appropriate use of SUP. However, the use of EMR-based alarms have been demonstrated to positively affect provider medication administration, in similar clinical situations.[9]

In this study, we aim to evaluate the impact of an EMR-based alarm to improve the appropriate SUP use in ICU and non-ICU patients.

Methods

This study was conducted at a tertiary-care academic hospital located in Córdoba, Argentina. The hospital has 210 beds and averages 13,000 admissions annually. The study protocol was approved by the institutional review board of the hospital.

Study design and population

We developed an uncontrolled before-after study that included two, four-month study periods: a pre-intervention period (June 2015 to September 2015) and a post-intervention period (March 2016 to June 2016). During the first period, prescription of AST for SUP was recorded to obtain a pre-intervention baseline. Six months after the first stage, a digital alarm was incorporated into the EMR of all admitted patients and all physicians were instructed about the use of this alarm. This alarm consisted of a chart that listed the main risk factors for SUP and specified indications for AST. This alarm appeared on the physician's computer screen every time they prescribed AST medications. During the second period, prescription of AST for SUP was also recorded to evaluate the intervention impact. There was no other intervention related to SUP in the post-intervention period.