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Hypoglycemia from a look-alike, sound-alike medication error

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Abstract

Objective: To describe the effects of a look-alike, sound-alike medication error on the glycemic control and psychiatric well-being of a 23-year-old man.

Case Summary: A 23-year-old man presented to the university-based Integrated Multidisciplinary Program of Assertive Community Treatment (IMPACT) team with a diagnosis of schizoaffective disorder, most recent episode manic, and hypertension. The patient was prescribed chlorpromazine 100 mg daily to treat symptoms of psychosis and anxiety. The anxiety, however, persisted and escalated over the following 2 weeks. Upon physical examination of the patient's medications, it was discovered that the patient was inadvertently given chlorpropamide in place of the chlorpromazine. Evaluations, clinical presentation, the medication list, and criteria for an adverse drug event indicated a probable relationship (7 of 12) between the use of chlorpropamide and a hypoglycemic episode. The medication error was noted and corrective actions were taken. Within 1 week of the corrective actions, the patient's anxiety improved.

Discussion: When working with psychiatric patients, it is important to physically review all medications when expected responses are not achieved or when new psychiatric or physiological symptoms present. Approximately one-fourth of medication errors in the United States are drug name confusion errors. These errors must be universally addressed by all parties involved in the medication process. Effective safeguards are available and must be implemented by manufacturers, physicians, pharmacists, nurses, and all health care professionals to prevent look-alike, sound-alike medication errors.

Keywords: adverse drug reaction, anxiety, chlorpropamide, hypoglycemia, medication error

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Introduction

Medication errors continue to be a significant problem. The National Research Council estimates that in any given week, 4 of 5 adults in the United States will use prescription medications, over-the-counter medications, or dietary supplements.[1] Adverse drug events (ADEs) can occur any time a medication or supplement is dispensed and administered. Harm caused by an error in the prescribing, dispensing, or taking of a medication is a type of ADE that most often can be prevented. A report published by the Institute of Medicine (IOM) identified medication errors as the most common health care error and attributed 7000 deaths annually to medication errors.[2] The report also identified the confusion with look-alike, sound-alike drug names as a major contributor to medication errors. The IOM report encouraged pharmaceutical companies to analyze any proposed new drug for potential look-alike or sound-alike drugs already in existence. Additionally, the Food and Drug Administration (FDA) established screening guidelines to assist with the review of proposed drug

names.[3] Even with these recommended safeguards in place, some drug names currently on the market will look or sound alike merely because of the excessive number of drug names in existence. Ensuring drug safety from this type of error requires a unified commitment from health care professionals, the FDA and other government agencies, hospitals and other health care organizations, and patients.

We report a case where one such error occurred, and the ramifications of that error. The medications that were inadvertently confused are presented and discussed. We provide a review of case reports and evidence-based literature reporting risk factors that increase the incidence of a look-alike, sound-alike error, and solutions identified to prevent such errors from occurring. We specifically identify risk factors present in our case and solutions implemented to mitigate the occurrence of future errors. We also emphasize the importance of encouraging clinicians to physically review all medication containers when anticipated medication benefits are not achieved with adequate dosing and duration, or when new psychiatric or physiologic symptoms present after the initiation of a new medication.

Case Report

A 23-year-old white male was admitted to a university-based Integrated Multidisciplinary Program of Assertive Community Treatment (IMPACT) team. Diagnoses included schizoaffective disorder, most recent episode manic, and hypertension. Anxiety was a prominent symptom associated with the primary diagnosis of schizoaffective disorder and presented with shaking and sweating. In addition, rumination was also reported, which reinforced the patient's continuous negative repetition.[4] Medications (total daily doses) at the time of referral included benztropine 2 mg, carvedilol 6.25 mg, fluphenazine 15 mg, lithium 1500 mg, lorazepam 3 mg, and pantoprazole 40 mg. The patient was taking lorazepam as needed for anxiety symptoms, but he was hindered by excessive daytime drowsiness. Chlorpromazine 100 mg was added to address the anxiety symptoms and psychosis. During the course of the next 2 weeks, symptoms of anxiety, however, continued to present and escalated following the chlorpromazine prescription. The patient had thought-processing difficulty, increased anxiety, and extreme sweating upon follow-up. After a physical review of all medication bottles, it was discovered that, instead of chlorpromazine, the patient was receiving chlorpropamide, a first-generation sulfonylurea. Based on medication adherence reports, it appeared the patient received 10 to 12 doses before the error was discovered. It was determined a dispensing error occurred when a prescription for chlorpromazine was faxed to the pharmacy, and chlorpropamide was inadvertently filled and delivered. The medication error was noted and corrective action taken. Upon discovery of the error, a blood glucose reading (117 mg/dL) was obtained. It was not known whether the reading was fasting status. The American Diabetes Association identifies the normal range for impaired fasting glucose to be 100 to 125 mg/dL.[5] Follow-up blood glucose readings were within the normal range, whether fasting or nonfasting status. Within 1 week of discontinuation of chlorpropamide and initiation of chlorpromazine, the patient appeared less anxious and reported less anxiety. No changes in psychiatric stability with respect to the diagnosis of schizoaffective disorder were noted. Rapid speech and excessive perspiration had ceased. Criteria for the Naranjo ADR Probability Scale[6] were applied and indicated a probable relationship (7 of 12) between the use of chlorpropamide and hypoglycemic symptoms of anxiety and sweating.

Discussion

It is estimated that 1 in 4 medication errors in the United States is a drug name confusion error.[7,8] Errors can stem from all phases of medication use, from the initial naming of the drug product to the final administration to the patient. Solutions to prevent such errors have been designed to address various phases of drug use and are available for individuals and organizations involved in medication development, distribution, prescribing, dispensing, and administration.

The patient in our case report was prescribed chlorpromazine 100 mg daily, a standard starting dosage initiated to alleviate psychotic symptoms. Chlorpromazine is a first-generation antipsychotic[9] and may have a more favorable effect than more specific anxiolytic agents, such as benzodiazepines, for severe somatic anxiety with symptoms of fatigue, depression, insecurity on social contact, and aggressiveness.[10] Anxiety often accompanies schizophrenia and schizoaffective disorder.[11] The prescription written for chlorpromazine was inadvertently filled with chlorpropamide, a first-generation sulfonylurea used for type 2 diabetes. Decreased plasma glucose concentrations may cause symptoms that resemble anxiety: weakness, confusion, and drowsiness.[12] Neurogenic symptoms, such as tremulousness, shakiness, palpitations, nervousness, anxiety, sweating, hunger, and tingling, are also reported.[13] Hypoglycemia symptoms from chlorpropamide use possibly mimicked the anxiety symptoms that this patient reported. Because the patient was and is not an individual with diabetes, blood glucose readings were not being assessed while the patient was taking the chlorpropamide.

Anto and colleagues[14] identified specific innate human factors that play a part in drug name confusion, including

visual perception, short-term memory, and auditory perception, with verbal medication orders potentially being hindered by background noise, unfamiliarity with a drug name, and infrequency in prescribing of the drug. As described in the IOM report entitled "To Err is Human," mistake-proofing organizational procedures, as opposed to individual health care worker characteristics, have shown to be a more effective way to reduce errors.[15] Making organizational work flow impossible to advance with errors present is a more efficient way of preventing mistakes.

Several models exist to assist in predicting whether a look-alike, sound-alike drug name will result in a medication error. Ostini and colleagues[16] addressed both orthographic (spelling) and phonological (sound) similarities in drug names and concluded that both increased the probability of errors among both experienced and relatively new health care professionals. Lambert[17] developed a reliable automated model to predict look-alike and sound-alike medication errors based on orthographic similarity measurements for drug pairs. One such measurement employed by Lambert was the Levenshtein Distance test, a measurement in the similarity in the ordering of a string of letters. In a later study, Lambert and colleagues[18] employed phonetic distance models, in addition to orthographic models, to reliably predict not only look-alike, but also sound-alike drug name confusion. Lambert's automated prediction models exemplify a method to improve organizational processes and ultimately decrease look-alike, sound-alike errors. In 1995, the US Pharmacopeia promoted the formation of the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) to address the interdisciplinary causes of errors and to promote the safe use of medications. NCC MERP developed a system for categorizing medication errors. The system takes into consideration harm to the patient, monitoring of physiological and psychological signs, and any interventions required.[19] In accordance with these guidelines, the error from our report is classified as Category E: An error that may have contributed to, or resulted in, temporary harm to the patient and required intervention.

A recent systematic review of ADEs in an ambulatory care setting by Taché and colleagues[20] showed that the median preventable ADE rate in the ambulatory setting was 16.5%, and it was 52.9% in the hospital-based setting, with drug complications identified as the most common type of adverse event in the hospital setting. Studies to identify the risk factors for ADEs have been ongoing for years. Factors found to increase the risk that a patient would experience an ADE included the complexity of the disease, the quantity and variety of medications administered, the characteristics of the patients, the location where care was provided, and the medical nature of the intervention.[21]

Strategies and recommendations exist to minimize ADEs due to look-alike, sound-alike medication names, addressing all aspects of medication usage, from the initial naming of the medication to the final use by the patient, to ensure patient safety. Cafazzo and colleagues[22] endorsed the need for a comprehensive approach involving the entire medication delivery process. A brief review of each element is provided.

Manufacturers and Regulatory Agencies

Preventing such errors from occurring begins with the drug name selection process. Drug nomenclature must have commercial and professional appeal while still meeting safety guidelines for look-alike, sound-alike issues. In December 2012, the FDA released a draft guidance document detailing safety considerations for use by manufacturers during the drug development process. The FDA took input from health care professionals urging the FDA to standardize the naming of medications.[23] Worldwide acceptance of generic drug names is dependent on the World Health Organization (WHO) International Nonproprietary Names (INN) committee.[24] In the United States, the US Adopted Names Council is responsible for assigning generic names only after the final approval of the WHO INN. Proposed proprietary names (brand names) are evaluated by the Center for Drug Evaluation and Research (CDER) in the United States. The CDER considers the spelling of the name, the pronunciation of the name, and the appearance of the name when written, including expert assessment of assorted handwriting samples.[3]

Some errors can be attributed to product design, labeling, and packaging. When chlorpropamide was first released as a proprietary product, it was easily recognized by health care professionals and patients by its shape and color.[25] Today, however, with thousands of medications and many of these available in generic form, it is easy to confuse one tablet or capsule with another. Distinguishing between two similarly named medications based on product appearance is not as easy as it once was. Problems can also occur when the health care professional has difficulty distinguishing between product names or strengths on labels. Excessive information on the label or the use of small type accentuates the problem. Similarities in labeling and packaging are most problematic when the drug names are similar.[26] Manufacturers and regulatory agencies responsible for the drug approval process must take special care to address these issues. For health care providers, verification by barcode scanning of the product package has been shown to decrease these

error rates, as reported by Sakowski and Ketchel.[27] Separating look-alike packaging or medications with similar names on the pharmacy shelves provides additional help. Some retail pharmacy software applications now show an image of the tablet or capsule on the display screen or on the patient information leaflet that accompanies the prescription. This process provides an extra check system for both the pharmacist and the patient.

Before the FDA instigated regulatory guidance for the drug naming process, it recommended a system to manufacturers to help differentiate between confusing drug names already in existence.[14] The US FDA Name Differentiation Project lettering system was implemented to use uppercase lettering to differentiate between similar drug names. Many studies have been conducted to assess the effectiveness of so-called Tall Man lettering. One study recorded participants' eye movements as they searched for a target product. The target drug in the study was chlorpromazine. The drug with a similar name used as a "distractor" item was chlorpropamide. Study participants were less likely to mistake chlorpromazine for chlorpropamide when Tall Man lettering was used.[28] In a 2009 study by Filik and colleagues,[29] the use of Tall Man lettering reduced drug name confusion errors among samples of older participants, university students, and health care practitioners. In an additional study by Anto and colleagues,[14] the close proximity of drugs with similar names, either on pharmacy shelves or on computer display screens, contributed to medication errors. Irwin and colleagues[30] assessed the effects of Tall Man lettering, proximity, and time pressure on the accuracy of medication selection from a computer screen. Proximity appeared to have the biggest impact on both pharmacists and nonpharmacists, whereas time pressure affected mainly inexperienced pharmacy staff. In contrast to past studies, the Tall Man lettering appeared to slow down the reaction time of the pharmacy personnel without any associated increase in accuracy.[30]

Although most attention to look-alike, sound-alike problems involving drug names has been focused on the patient prescription arena, such discrepancies affect other areas of medicine as well. A recent study conducted by Moridani and Scott[31] reviewing laboratory tests exposed errors being made that resulted in cycloSERINE tests being performed instead of the desired cycloSPORINE tests. It is thought that the errors occurred at the level of the patient service centers that transferred physicians' orders into a computer system. To correct the problem, the laboratory moved the test code for cycloSERINE to a different location within its system. A pop-up notice was added as well—a technique that may hold value for retail pharmacy software designers.[31]

Physicians

The use and interpretation of poor handwriting continue to be obstacles in the accurate dispensing of correct medication. The situation is aggravated when medications have similar name appearances, strengths, dosing, or directions. Preprinted prescription forms with commonly prescribed medications may assist in avoiding errors. Writing both the brand name and the generic name on the prescription may add further clarification. Additionally, writing the indication for the medication on the prescription would be a distinguishing characteristic that would further assist the pharmacist in interpreting the prescription.

Electronic prescribing is becoming increasingly more popular and eliminates handwriting discrepancies. Hoffman and Proulx[8] urged that caution be taken when sending electronic prescriptions, however, because computer errors are becoming increasingly common as technology becomes widespread.[8] Errors have arisen when two orthographically similar drug names are listed close to one another in the selection menu of a computer system. With the click of a mouse, the wrong medication can easily be selected. Such problems may occur alternatively at the dispensing pharmacy terminal or with the Computer Physician Order Entry (CPOE) system, because both have menus where the similarity-proximity issue may exist.[14]

Software can also be used to control against such errors. Ojeleye and colleagues[32] reported that Electronic Patient Medication Record systems have implemented relevant safety features to protect against potential errors. Safety features and pop-up alerts at the point of physician and pharmacy order entry are available on some medication computer software programs to assist physicians, pharmacists, and pharmacy staff in avoiding errors, such as selecting and/or dispensing an erroneous look-alike or sound-alike drug.[32] Reliable and well-tested pharmacist-led information technology interventions have been shown to reduce medication errors. These interventions can involve communication from the pharmacist to the physician regarding unsafe medication.[33]

Ensuring that verbal medication orders are interpreted correctly is crucial. Spelling medication names, giving both the brand and generic names, mentioning the drug indication in the directions, and having the orders repeated back are all appropriate measures to improve accuracy.[8]

Pharmacists and Pharmacies

Pharmacies are continuously working to improve quality and accuracy in health care. Keeping pharmacists and

pharmacy staff up to date on potential look-alike, sound-alike medication is relevant. Storing similarly looking medications in nonadjacent locations is beneficial, as is placing alerts of possibly confusing drugs on shelves and in software applications. Repeating back dictated prescriptions to ensure the proper medication was heard and transcribed helps to ensure accuracy. Instigating standard operating procedures in the workplace that help ensure quality control and implementing a work flow system that helps mistake-proof the process are essential.[34]

Nurses

For the IMPACT patients, the nurses and case workers are often the final checkpoint for medication accuracy. After prescriptions are received from the pharmacy, the medications are sorted and delivered to patients by the team. Additional safeguards were implemented to prevent future look-alike errors from occurring. Compiling information from various studies, plans were implemented to provide the IMPACT team with a Tall Man lettering pocket guide with orthographically similar psychiatric medications. Plans to ensure that medications with look-alike names are separated on the medication room shelves have been implemented as well. Keeping health care professionals aware of medications that look or sound alike has become an additional priority.

Patients

In work done by Howard and colleagues,[35] communication failure is touted as one of the biggest problems leading to ADEs. Campaigns encouraging doctors, nurses, pharmacists, and other providers to communicate with the patient at each step during medical care have been emphasized. Medication education encourages patients to keep a current log of their medications and to report to the physician or pharmacist any changes in the appearance of their medications. Communication with health care providers to ensure compliance with correct medication(s) is extremely important for individuals with severe mental illness.

Conclusion

Following the identification and correction of the medication error, symptoms of anxiety abated in our patient. Clinicians should be encouraged to physically review all medication containers and bottles when anticipated medication benefits are not achieved with adequate dosing and duration and/or when new psychiatric symptoms present after the initiation of a new medication, as in our case report. In addition, a multifactorial approach to health care safety is important when look-alike, sound-alike medications are involved. Health care professionals and organizations, government agencies, and patients may all play a role in ensuring that the proper medication is dispensed and administered. Safety procedures to reduce look-alike, sound-alike drug errors may be instigated in all stages of medication use, from the initial naming and packaging design to the final dispensing and administration steps. Using Tall Man lettering with look-alike drugs, ensuring look-alike drugs are separated on pharmacy shelves, and keeping health care providers aware of look-alike, sound-alike medications are methods to employ to prevent such errors from occurring.

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