A Mid-Summer Fog

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The Case

A 33-year-old woman with type I diabetes mellitus was admitted for symptoms of left flank pain, dysuria, and emesis, concerning for pyelonephritis. The patient was taking 40 units of Lantus daily and 10 units of NovoLog with meals and reported good glycemic control on this regimen. On exam, she was febrile but with otherwise normal vital signs, and her laboratory studies were notable for a leukocytosis and glucose of 275. A computed tomography (CT) study confirmed pyelonephritis but also showed marked left-sided hydroureter and hydronephrosis. Urology recommended that the patient be kept NPO overnight in case a procedure was required the following morning. The patient was started on ceftriaxone and intravenous fluids while the new intern, working on his first call night in July at a new hospital, thumbed through the different insulin order forms.

The intern came from a hospital system (as a medical student) that relied entirely on paper orders. This particular hospital used different insulin order forms depending on whether the patient was insulin-dependent, eating, or NPO. The confused intern chose the wrong form, causing the patient to receive insulin in doses that failed to account for her NPO status. At 6:00 the following morning, the intern was called when the patient became unresponsive with a glucose level of 32. The patient responded quickly to treatment with D50 and had a full recovery once the error in insulin order forms was discovered around the hypoglycemic event.

The Commentary

Iatrogenic hypoglycemia remains a common yet preventable event in hospitals in the United States, with up to 10% of inpatients experiencing at least one episode.(1) The Joint Commission considers insulin one of the top five high-risk medications for this reason. As a result, several professional societies, including the Society for Hospital Medicine (SHM) and American Diabetes Association, have targeted inpatient glycemic control and prevention of iatrogenic hypoglycemia for major quality improvement initiatives. Hospital-acquired hypoglycemia is also on the list of Medicare's new "no pay for errors" diagnoses.

This case clearly demonstrates the magnitude and frequency of iatrogenic hypoglycemia as a patient safety concern, and how easily a well-intentioned protocol designed to improve glycemic control may not only fail to do so, but may even contribute to the occurrence of hypoglycemia. Such protocols are particularly prone to misapplication when used by physicians unfamiliar with their intent, or lacking knowledge or experience in inpatient glycemic control. At no time of year is this concern more evident than in July, when every US teaching hospital experiences an influx of brand new postgraduate residency trainees.

Fresh from medical school graduation and a crash course politely referred to as "resident orientation," these frontline physicians make hundreds of decisions each day for acutely ill inpatients. So common is the impression that these physicians are prone to mistakes or missteps that many physicians and nurses use the jargon phrase, the "July effect."

The *July effect* refers to the expectation that processes and outcomes of patient care in the month of July will suffer, as a result of so many critical aspects of health care delivery resting in the hands of often ill-prepared young physicians. Each year, many clinicians and organizational leaders dread this otherwise lovely month, concerned about patient welfare. This case raises several questions, including: Is the July effect real? How can new interns and residents be more effectively prepared for the multitude of complex decisions they will need to make? How can patient safety systems be designed to be more impervious to the impact of new, inexperienced physicians?

Is the July effect real?

Despite the rich lore around the July effect, there is actually very little evidence to confirm its existence. One study suggests that the July effect may be real. A multicenter study of surgical mortality done as part of the NSQIP program compared the postoperative morbidity and mortality of patients in the period July 1–August 30 to those treated April 15–June 15, and found an 18% increased risk of morbidity and 41% increased risk of mortality in the July/August period.(2) Yet this finding stands in contrast to numerous studies that have failed to demonstrate increases in adverse outcomes in morbidity or mortality in areas that include trauma surgery, OB/GYN, critical care, and surgery.(3-6) Overall, then, there is little evidence to suggest that the July effect is real. Nevertheless, there is enough shared anecdotal experience (and a small amount of literature) to suggest that teaching hospitals should continue to strive toward better preparing new residents to avoid the kinds of errors that one might expect from lack of experience or familiarity with the system of care.

How can new interns and residents be more effectively prepared for the multitude of complex decisions they will need to make?

Almost every teaching hospital holds new resident orientation. These programs include externally mandated programs and content, such as HIPAA and blood-borne pathogen training; human resource–related activities, such as getting identification cards and lab coats; and an increasing number of didactic activities. So bloated with content have these programs become that one resident referred to orientation as "drinking from a firehose with a straw."

Basic principles of adult learning suggest that content-heavy approaches to orientation are likely to have limited effectiveness in changing clinical practice. Recognizing this, many teaching hospitals have begun to migrate from classroom, lecture-based formats to more experiential, interactive formats. As one example, a simulation center has every new resident practice the use of bedside ultrasonography for central line placement. Each resident practices use of the probe for catheter insertion into a chicken breast with tubing inserted beneath the skin to simulate vessels, a model that is remarkably realistic. Residents practice this approach until proficiency is demonstrated. With this approach, this hospital has seen a measurable decrease in the rates of iatrogenic pneumothorax from central line placement.(6)

Other applications of simulation approaches include team training in cardiac arrest teams.(7) The combination of re-creation of scenarios, which include real interactions between health care providers, with the realism of simulation technology and deep debriefing has opened a new frontier for ways to "orient" residents to their new roles. I believe that these approaches will have a larger positive impact on quality and patient safety than more traditional approaches, although presently evidence is lacking. Though they are more time consuming, the added value for patient care will most certainly be worth it.

There are other less time-consuming and more tried-and-true methods for increasing the safety of early clinical practice of new interns. Pairing new interns with their second-year colleagues during their early days or reviewing all or a sample of orders by new interns are just two of the many approaches that hospitals take to assuage their anxiety about entrusting new trainees to make the myriad decisions that comprise the early life of an intern. Many other health professions have a tradition of close supervision and oversight of new practitioners, while medicine has traditionally prided itself on throwing the brand new intern into the deep end of the patient care pool, almost as a rite of passage. Despite these traditions, there is little evidence on the impact of these approaches on patient safety and quality. Clearly, this is a field in need of study.

How can patient safety systems be designed to be more impervious to the impact of new, inexperienced physicians?

This case also demonstrates how well-intentioned protocols can inadvertently impede quality. Designed in an attempt to address a variety of situations—and sometimes a variety of opinions on best approaches—insulin protocols are often very complex. Furthermore, the protocolized portion does not always include guidance on the specific category for glycemic control, leaving that instead to clinician judgment. For example, in the SHM "Improving Glycemic Control and Preventing Hypoglycemia" workbook (8), the authors promote movement from menu-like order sets to highly protocolized decision support programs. The latter often integrate guidelines and best evidence into every step of insulin ordering, factoring in a wide variety of factors such as patient weight, caloric intake, insulin sensitivity, and stringency of targets for glycemic control.(8) The computerized physician order entry (CPOE) system thereby takes significant portions of clinical judgment out of the ordering process, a key step in reducing human error as a contributor to medical mistakes. In our case, the resident selected a protocol for a patient with type 2 diabetes with acute medical illness, but not for the NPO patient. A CPOE system like the one described may have helped avert this critical error in judgment by the new intern, by recognizing the disconnect between the insulin form chosen and the patient's NPO status (ordered through the CPOE system).

Finally, the variety of approaches that hospitals take to improve the quality and safety of glycemic control better resembles a patchwork than a consistent approach across institutions. This variety invites error, by requiring both experienced and inexperienced clinicians to "re-learn" glycemic control approaches each time they move into a new health care system. Hospital systems, the Joint Commission, professional organizations, and CPOE vendors can help reduce this inter-hospital variation in practice by implementing like approaches for glycemic control.

Take-Home Points

- Iatrogenic hypoglycemia is one of the top five most common preventable medication errors.
- Although there are few data to support a general July effect, in which new interns bring with them a decrease in quality of care, the entry of new trainees highlights challenges and opportunities on how best to prepare them for practice within health care organizations.
- New approaches to resident orientation that are experiential and incorporate immersive and simulation learning methods are likely to be more effective in enhancing actual practice.
- CPOE systems that support clinical judgment rather than rely on it can enhance error prevention.
- Efforts should begin to standardize approaches to glycemic control across institutions, to reduce the variability of approaches to which clinicians must adapt.

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