Declarations of interest

None.

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Frequency of emergency medicine resident dosing miscalculations treating pediatric patients

We conducted a review of 500 consecutive IV orders placed by emergency medicine [EM] residents during the calendar year 2018 in the Pediatric Emergency Medicine Department of Mount Sinai St. Luke's Medical Center in New York City. We are located in an urban setting with an approximate census of 20,000 pediatric patient visits/year. We sponsor an active 3-year EM residency program during which residents [n = 50] work clinical shifts in the pediatric ER under the direct supervision of board-certified pediatric emergency medicine attending physicians.

EM residents ordered a variety of IV medications [ketorolac, morphine sulfate, various antibiotics, famotidine, etomidate, ondansetron, metoclopramide, various steroid preparations, sedative medications, magnesium sulfate, diphenhydramine, ketamine, acyclovir, insulin, glucagon, lorazepam, D25W, IV fluids with potassium chloride supplement]. Calculations identified deviation from recommended dosing [1] of >10% with 105 orders [21%].

Some examples of deviant dosing included:

Patient weight	Condition	Medication and dosage ordered
66 kg	DKA	Insulin continuous infusion 3 units/h
90 kg	Status asthmaticus	Methylprednisolone 185 mg
16.4 kg	Herpetic infection	Acyclovir 820 mg
5 kg	Fever/young infant	Ampicillin 90 mg/cefotaxime 130 mg

A complete review of all cases revealed no instance of a clinically significant adverse outcome due to medication dosing.

Pediatric medication dosing miscalculation [under/over-dosing] can result in devastating consequences. There is little published data on the frequency of resident dosing errors in a pediatric care setting. One prior study [2] noted a relatively lower rate of 6% prescribing errors by pediatric residents working in a clinic. We know of no prior published report specifically documenting the prevalence of medication dosing errors by EM residents training in a pediatric emergency department [ED], a common scenario at academic medical institutions.

In general, the ED setting can predispose to relatively higher risk for medication errors [3,4]. Over-dosage is the most commonly documented medication error occurring in the pediatric emergency medicine population [5]. Prescriber error-rates in emergency medicine, even among attending level physicians, has been shown to occur twice as frequently for pediatric vs adult medication dosage calculations [6].

Multiple factors can contribute to increased risk for medication dosing errors. The fast paced and frequently chaotic ED environment can augment risk for miscalculations. There can be insufficient oversite, as it is often impractical for supervisory attending level physicians to review all resident medication orders prior to their administration. In addition, EM residents are relatively inexperienced with pediatric weight-based dosing calculations.

Potential measures to decrease dosing calculation errors and ensure dosing accuracy include:

- pharmacist to double check all IV medication order dosages prior to administration
- protective feedback system in the electronic health record to automatically alert providers when ordered medication dosing deviates from recommended
- verbal confirmation of accuracy in resident ordered IV medication dosing between nurse and attending physician prior to administration.

Our ED has since converted to an electronic medical record program which prompts the provider with an automatic query whenever medication dosing ordered falls outside the recommended range.

Our data shows that 1 in 5 IV medication orders placed by EM residents caring for children deviates by >10% of recommended dosing. Pediatric emergency departments with EM resident training programs should be particularly cognizant of the potential for medication dosing errors, and promote oversight measures to decrease risk for miscalculation.

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A novel method of palpating the pancreas in children: Three cases of pediatric acute pancreatitis

Acute pancreatitis (AP) is a critical inflammatory process of the pancreas caused by the activation of pancreatic zymogens and resulting in pancreatic autodigestion and tissue damage [1,2]. While the mortality rate is high at 9.7%, diagnosing pediatric AP is still challenging due to the non-specificity of its clinical manifestations in children [3-5]. Therefore, a physical examination is clinically important for diagnosing this disease. Previous studies have demonstrated effective physical examination procedures in adults. Grott et al. proposed a special procedure for enhancing the accuracy of AP diagnosis in which the patient lies in the supine position with legs drawn up, with a fist placed under the lumbar vertebrae [6]. The physician then places one hand a top the other, moving them along the left side of the straight muscle of the abdomen, then from the periphery to the center of the abdomen. Kouyama proposed applying pressure over the left subcostal area along the left side of the straight muscle of the abdomen toward the vertebrae [7]. However, applying pressure in this way in pediatric patients has limited efficacy as the straight muscle of the abdomen is not clearly visible in children. The Desjardins point, defined as a "point on the abdomen 5 to 7 cm from the umbilicus on a line joining it to the right axilla (lying) over the head of the pancreas," may be useful, but there is no evidence as yet on its value for diagnosing AP [8]. Therefore, we developed Ihara's maneuver, a new maneuver for palpating the pancreas in children. In this maneuver (Fig. 1), a physician places his/her hand at the midpoint between the xiphoid process and umbilicus on the midclavicular line, then applies gentle pressure vertically, gradually increasing the pressure while moving the hands toward the spine to achieve deeper palpation. This maneuver allows the physician to apply manual pressure directly on the pancreatic body by displacing the stomach from the pancreas. Herein, we present three pediatric cases of AP diagnosed using Ihara's maneuver.

1. Case 1

A 13-year-old male with a past medical history of AP visited our Emergency Department (ED) due to epigastric pain. His vital signs were normal for his age. On physical examination using Ihara's maneuver, there was tenderness but no peritoneal signs. The serum lipase level (219 U/L) was elevated, and abdominal CT found

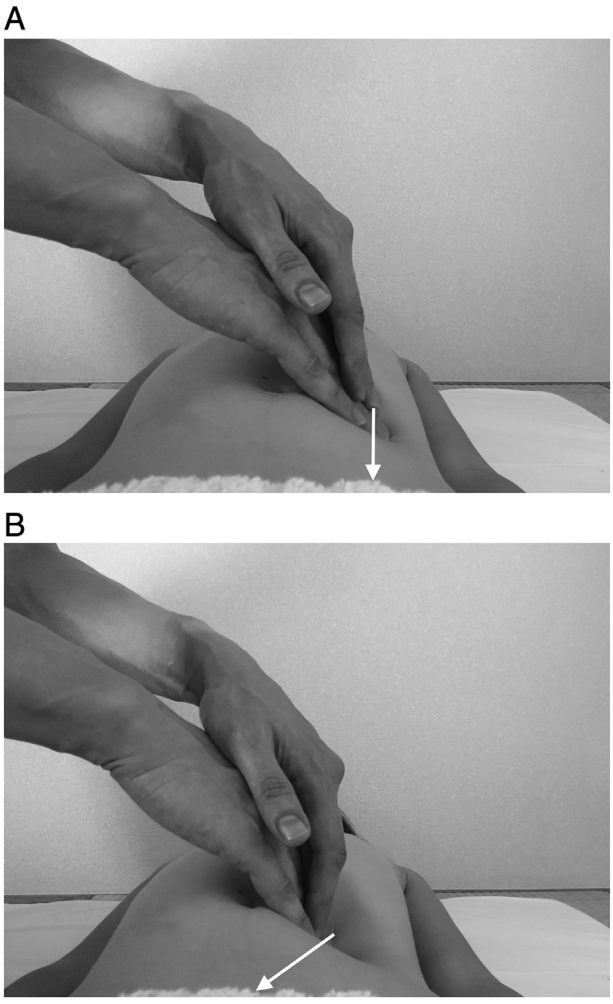

Fig. 1. How to apply pressure to the abdomen in Ihara's maneuver. Apply slight pressure vertically to the point shown on the patient's back (a), then increase the pressure while moving the hands toward the patient's spine to achieve deeper palpation (b).