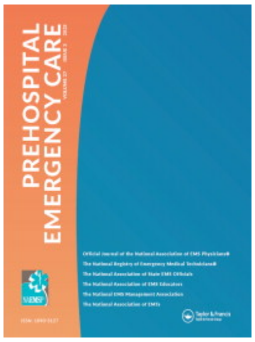

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CASE CONFERENCE

Mass Casualty Incident Involving Rapid Acting Insulin

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ABSTRACT

We report on an unusual prehospital incident involving the inadvertent administration of short-acting insulin among a group of high school students. Sixteen students iatrogenically received 10 units of insulin lispro intradermally instead of tuberculin purified protein derivative (PPD), resulting in several students experiencing symptomatic hypoglycemia. A mass casualty incident was declared and the local poison center consulted. An incident command system, with the support of on-scene EMS physicians, was established to track, treat, and transport the involved patients.

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Introduction

Insulin lispro is a rapid acting insulin that is commonly used to improve glycemic control in diabetics and frequently prescribed for use at mealtimes. Its onset time is approximately 15 minutes after subcutaneous injection with a duration of action between 3 to 5 hours (1), though can be as long as 8 hours (2). To prevent hypoglycemia, the manufacturer recommends that a meal be eaten within 15 minutes or immediately after administration (3). It can be packaged in a 10 ml glass vial and is stored refrigerated.

Tuberculin purified protein derivative (PPD) is derived from *Mycobacterium tuberculosis* and is used to detect tuberculosis infection. It is commonly administered as a pre-employment requirement to ensure an applicant does not have latent tuberculosis. It is administered intradermally at a dose of 0.1 ml and is stored refrigerated in a 5 ml glass vial (4).

Medications errors involving look-alike glass vials are well documented. The Institute of Safe Medication Practices has highlighted several medication errors related to look-alike vials such as insulin (5), including a case report in which a patient received intravenous insulin glargine instead of intravenous pantoprazole. Other errors between look-alike vials have include pantoprazole/bupivacaine (6) and naloxone/verapamil (7).

Consent and Ethics Review

This case report was deemed exempt by the Indiana University Human Research Protection Program. The waiver of authorization criteria was satisfied in accordance with 45 CFR 164.512(i)(2)(ii) and waiver of authorization approved in accordance with 45 CFR 164.512(i).

Case Report

A joint fire department and emergency medical services (EMS) response to a career exploration school, attended by high school-aged students, was dispatched as an overdose at approximately 11 am. The initial dispatch notes reported concern for accidental insulin administration to several students. Given the unusual dispatch circumstances, a fire department EMS duty officer attached himself to the response to gather more information. Upon arrival, the duty officer interfaced with school staff.

The duty officer determined that more than one dozen students participated in a pre-employment screening earlier in the day, including tuberculosis screening using intradermal tuberculin PPD. However, because a student's insulin vial and the screening PPD vial were stored in the same medication refrigerator, the students were each erroneously given 10 units of insulin lispro intradermally instead of the intended 0.1 ml tuberculin PPD. Several students reported symptoms of feeling unwell, including fatigue, headache, and nausea. School staff identified at least one student with hypoglycemia and subsequently activated the EMS system.

Given the number of possible patients, the EMS duty officer declared a mass casualty incident (MCI), which automatically sent additional fire department apparatus, EMS transport officers, and four ambulances. Additionally, a dedicated radio channel was assigned for incident management (Figure 1). Two EMS physicians were aware of the unusual situation and also responded emergently. Responding clinicians created an incident command structure (Figure 2). During this time, identified patients were given snacks from the cafeteria to support euglycemia. The school initiated emergency notification of parents and guardians.

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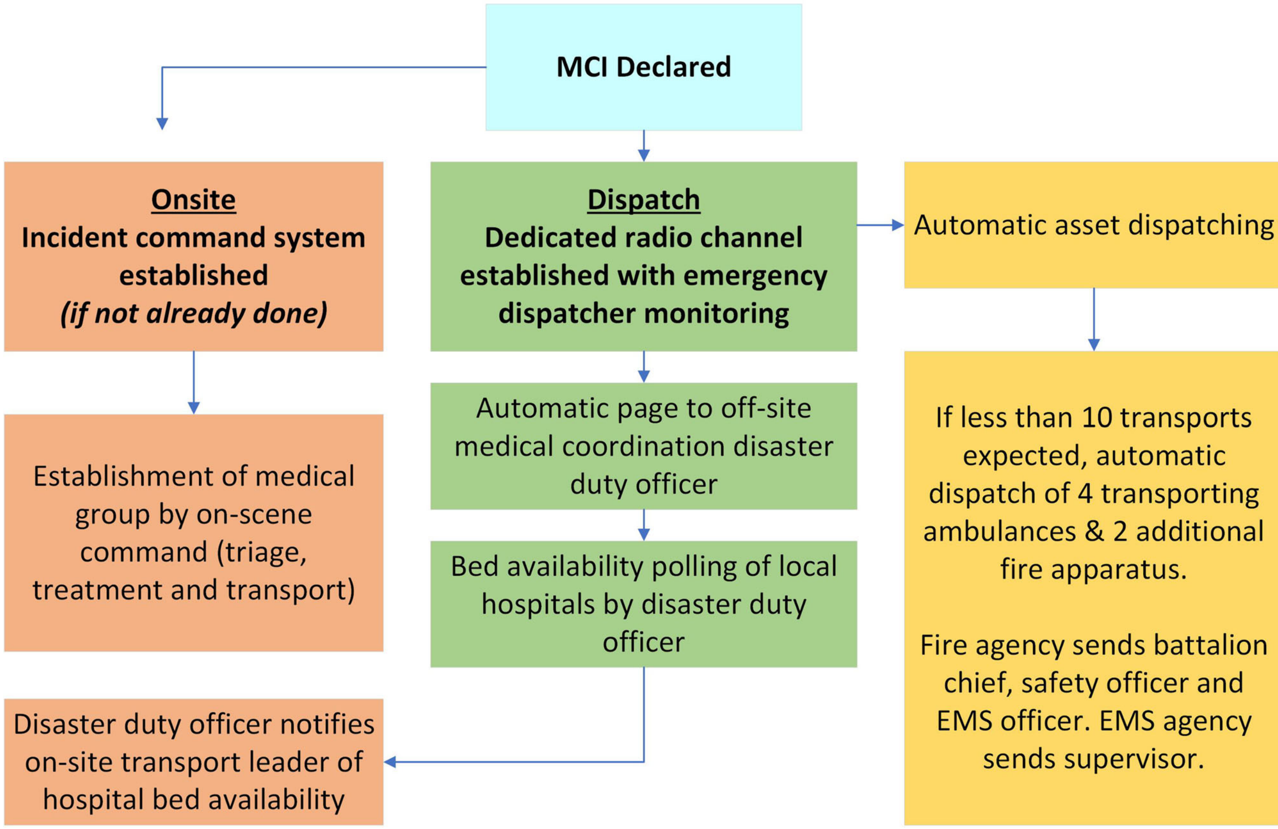

Figure 1. MCI declaration workflow.

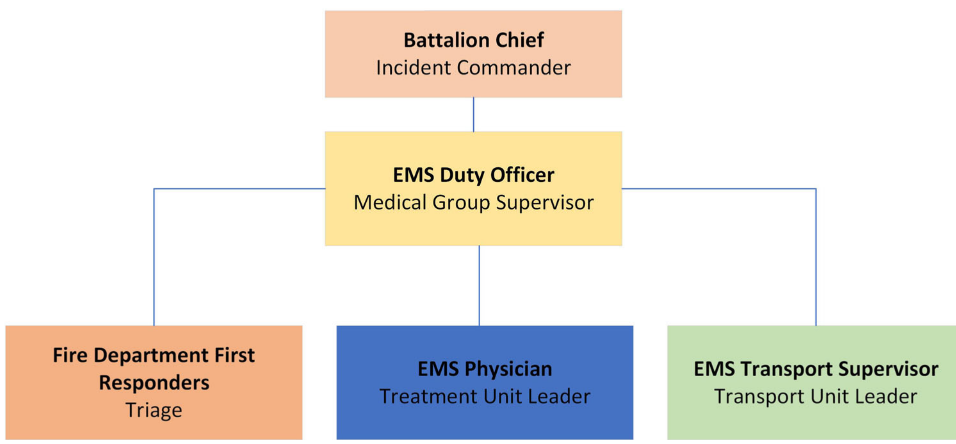

Figure 2. Incident command structure for the responding providers.

A total of 16 patients were identified, with ages range between 17 and 18 years of age. Three patients had already departed the school prior to EMS arrival, so law enforcement was dispatched to their homes for wellness checks, and they were evaluated for medical treatment off-site. A patient tracking system was established with serial blood glucose testing and paper notes to record test results. The EMS supervisor and EMS physicians further triaged patient severity based on symptoms and blood glucose values. The local poison center recommended at least 6 hours of observation to determine a safe disposition for the affected students. As the incident occurred in the middle of the school day, the incident command leadership decided to transport all affected students to local hospitals. Patients were again

Table 1. Lowest blood glucose documented by EMS for affected patients.

Patient number	Lowest documented blood glucose (mg/dL)
1	*N/A Departed prior to EMS arrival*
2	*N/A Departed prior to EMS arrival*
3	*N/A Departed prior to EMS arrival*
4	88
5	111
6	84
7	96
8	84
9	69
10	63
11	71
12	102
13	114
14	100
15	93
16	LOW (<20 mg/dL)

Table 2. Modified triage system for hypoglycemia MCI.

Immediate	Delayed	Minimal	Expectant
Capillary blood glucose <70 mg/dL (3.9 mmol/L) with signs and symptoms of hypoglycemia 3 patients	Capillary blood glucose **>70 mg/dL** (3.9 mmol/L) with signs and symptoms of hypoglycemia 4 patients	Capillary blood glucose **>70 mg/dL** (3.9 mmol/L) without signs or symptoms of hypoglycemia 6 patients	N/A

reassessed during EMS transport and given oral carbohydrates as indicated. Serial blood glucose levels were documented for each of the 16 patients affected (Table 1).

Of 13 patients with documented blood sugars, three had levels documented below 70 mg/dL (3.9 mmol/L), including one case for which the glucometer read "low", indicating blood glucose below 20 mg/dL (1.1 mmol/L) (8). All patients remained awake and were treated with oral carbohydrate sources. All 13 patients from the school were transported within 1 hour 45 minutes from the initial 9-1-1 call. There was no known serious sequalae for any of the patients.

Discussion

A multi-patient overdose of rapid acting insulin has not been previously described. Fortunately, the injected dose did not result in obtundation in any of the involved patients, who were all safely managed with oral carbohydrates. It is possible that the intradermal route of the insulin, which is normally given subcutaneously, may have ameliorated hypoglycemia in some of the patients. In debriefing the incident, several themes were noted:

- Early identification of the injected agent proved helpful for prognostication and anticipated clinical course.
- The declaration of an MCI and establishment of an incident command system early in the incident improved EMS operational efficiency and ensured patients were properly tracked, tested for hypoglycemia, and transported. For this particular EMS system, an MCI declaration automatically notifies a disaster coordination center, which uses an offsite disaster officer to poll availability of hospital beds in the nearby area. These nearby hospitals, who were made aware of the unusual circumstances, were prepared and willing to accept patients as a result of this early notification. Early on-onsite intelligence by EMS clinicians regarding the nature of the overdoses allowed these hospitals to be aware that the transported patients likely would not require long-term intensive medical care.
- The use of an incident command system allowed for the quick formation of small medical strike teams of EMTs/paramedics to monitor groups of students and allowed for the efficient request of very specific medical equipment (i.e., glucometers). For this EMS system, the establishment of the incident command structure automatically dedicates a radio channel for tactical communications, and assigns a 9-1-1 telecommunicator to monitor and document radio traffic. Communication was fundamental to the success of the MCI's mitigation.
- The availability of EMS physicians further benefited the management of the MCI as it allowed for real-time modification of local existing medical protocols to support the incident. For example, local protocols only permit treatment of hypoglycemia based on blood sugar testing readings, whereas symptom-based treatment was authorized by on-scene EMS physicians.
- In the rush to manage hypoglycemia with oral carbohydrates, caution was indicated to prevent patients from consuming products to which they might have been allergic. Prior to eating cafeteria-provided snacks, one student was discovered to have a peanut allergy, and some of the provided snacks did contain peanut products. These snacks were kept away from the student once identified.
- Traditional START or SALT triage algorithms were not appropriate for triaging these patients given the medical etiology of the mass casualty incident. Instead, consultation with EMS physicians and the local poison center were helpful in determining transport priority. A modified triage process was subsequently used in this MCI after this consultation (Table 2).
- While there is no universally agreed upon triage algorithm for toxicological exposures, recommendations from military experts suggest using systems that prioritize patients based on a sign/symptom-based approach when the agent is known, which is currently used when responding to a chemical agent attack (9).
- An area of uncertainty that existed for all response agencies involved was whether or not there was any role for the fire department or EMS responders in the investigation of the iatrogenic medication administration and debriefing of the individuals involved in the error. It was determined that this would be left to the discretion of local law enforcement as we believed such an investigation was outside the scope of the statutory responsibilities of the fire and EMS agencies.

Conclusion

In nontraditional multiple patient situations such as iatrogenic medication overdoses, the use of an incident command system and mass casualty protocols can still prove helpful despite the lack of applicability for the use of START or SALT triage algorithms. Triage priority criteria will likely need to be adjusted after consultation with EMS and toxicology specialists in such situations to address the severity of presenting toxidromes.

Disclosure Statement

The authors report there are no competing interests to declare.

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References

1. Noble SL, Johnston E, Walton B. Insulin lispro: A fast-acting insulin analog. Vol. 57. Leawood: AFP; 1998. p. 279–286.
2. Olson K. Poisoning and drug overdose. 6th Ed. New York: McGraw-Hill Publishing; 2011.
3. Lilly E, Company. Humalog (insulin lispro injection, USP [rDNA origin]) for injection [Internet]. FDA; 2013. Available from: https://www.accessdata.fda.gov/drugsatfda_docs/label/2013/020563s115lbl.pdf.
4. Sanofi Pasteur. Tuberculin Purified Protein Derivative (Mantoux) [Internet]. FDA. Available from: https://www.fda.gov/media/74866/download.
5. A Clinical Reminder About the Safe Use of Insulin Vials [Internet]. Institute For Safe Medication Practices; 2018. Available from: https://www.ismp.org/resources/clinical-reminder-about-safe-use-insulin-vials.
6. Risk of IV bupivacaine administration [Internet]. Institute For Safe Medication Practices; 2022. Available from: https://www.ismp.org/resources/risk-iv-bupivacaine-administration.
7. Verapamil-Naloxone Look-Alike Vials [Internet]. Institute For Safe Medication Practices; 2018. Available from: https://www.ismp.org/alerts/verapamil-naloxone-look-alike-vials.
8. Cambridge Sensors USA. microdotxtra Operations and Quality Assurance Procedure Manual [Internet]. Available from: https://www.microdotcs.com/assets/microdotxtra_operations-manual.pdf.
9. Tourinsky SD, Caneva DC, Sidell FR. Triage of Chemical Casualties. Textbook of Military Medicine. Washington DC: Library of Congress; 2008.