

# Wrong-Route Errors Associated With **Epinephrine** to Treat Severe Type I Allergic Reactions



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**T**he Patient Safety Authority has received multiple reports to the Pennsylvania Patient Safety Reporting System (PA-PSRS) describing wrong-route errors with epinephrine intended to treat anaphylaxis and other severe type I allergic reactions, in which epinephrine was incorrectly ordered and/or administered by the intravenous route instead of the intended intramuscular route. We previously identified wrong-route errors as the most frequent error type involving epinephrine.<sup>1,2</sup> Despite our published analyses and mitigation strategies,<sup>1-3</sup> we continue to receive PA-PSRS reports describing wrong-route errors with epinephrine to treat severe type I allergic reactions.

Epinephrine is a nonselective alpha- and beta-adrenergic agonist with various indications and routes of administration.<sup>4,5</sup> One of the indications for the use of epinephrine is the treatment of severe type I allergic reactions, including anaphylaxis. Administration of epinephrine for this indication is typically given by the intramuscular or subcutaneous route,<sup>4</sup> with the intramuscular administration in the thigh preferred and shown to provide the highest peak blood levels.<sup>6,7</sup> Intravenous bolus administrations of epinephrine are generally reserved for life-threatening situations such as cardiac arrest due to asystole or pulseless electrical activity.<sup>5,8</sup> According to PA-PSRS reports, patients have experienced several adverse effects following erroneous intravenous administrations of epinephrine to treat type I allergic reactions, including sudden rise in blood pressure, electrocardiogram (EKG) changes such as ventricular tachycardia and atrial fibrillation with rapid ventricular response, “excruciating pain” and feeling of “going to die,” as well as transfer to a higher level of care.

Erroneously administered intravenous doses of epinephrine have been associated with several factors based on PA-PSRS reports, including verbal orders, lack of scanning prior to medication administration, rapid response situations, formulary change from the use of autoinjectors to the use of vials, and confusing electronic orders that lack clear and simple instructions for the route of administration.

Another noteworthy aspect identified in the PA-PSRS reports is that several medications used to treat allergic reactions, such as steroids, diphenhydramine, and even famotidine, are typically administered intravenously and at the same time as epinephrine.

Facilities can mitigate the risk of wrong-route epinephrine errors by implementing the following safety strategies.

- Use autoinjectors, which are designed to deliver premeasured single doses of epinephrine by the intramuscular or subcutaneous route.<sup>2,3,9-11</sup>
- If not using autoinjectors, create an anaphylaxis kit that contains the vials or ampules of epinephrine, needles intended for intramuscular administration, auxiliary labels, clear instructions, and other necessary supplies.<sup>9,11</sup>
- Store epinephrine products used to treat anaphylaxis separately from those intended for resuscitation carts.<sup>10</sup>
- Ensure that the order is clear, concise, and easy to understand. Do not refer to epinephrine concentrations using ratios. The U.S. Food and Drug Administration (FDA) currently requires the labeling of epinephrine strengths in amount per volume (e.g., milligrams per milliliter [mg/mL]) instead of ratio expressions (e.g., 1:1000).<sup>12</sup>
- Distinguish the separate epinephrine orders for different indications, and ensure that the routes of administration are clearly visible.<sup>13</sup>
- Create a warning in the automated dispensing cabinet to remind the user of the intended route of administration, and, if applicable, consider affixing auxiliary labels on the top of the cubby.<sup>13</sup>
- Limit the use of verbal orders to urgent situations. Create and reevaluate facility guidelines to establish standardized processes for verbal orders, such as the readback method, to confirm the route of administration.<sup>9,10</sup>
- Follow proper protocol in labeling and scanning the medication prior to administration.<sup>13</sup>

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