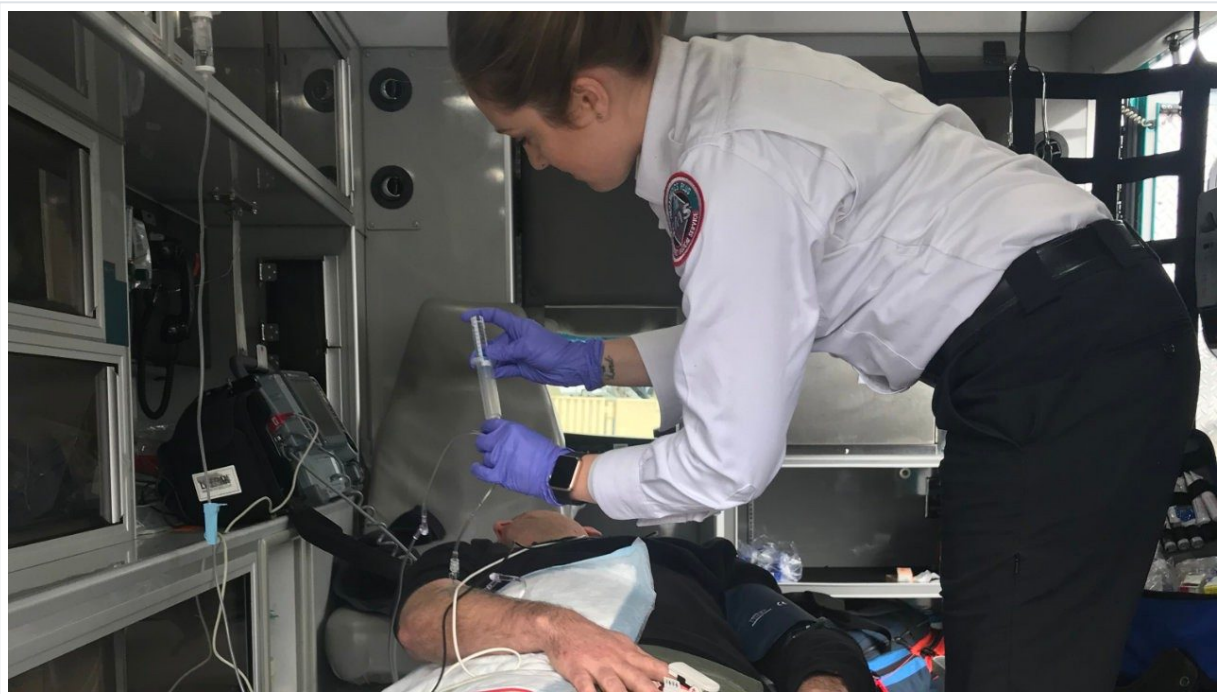




# A Push for Push Dose Epinephrine

Prehospital use of push dose epinephrine for hypotension

Thu, Mar 14, 2019 | By [Sammy Hodroge, MD](#), [Amelia Breyre, MD](#)



*Starting in 2018, push dose epinephrine replaced dopamine as the vasopressor of choice for the management of prehospital shock in Alameda County, California.*

You transport a 79-year-old woman to the hospital for fever and urinary incontinence. Her family mentions a history of frequent urinary tract infections. Her initial vital signs are a heart rate of 115 bpm, an oxygen saturation of 97% on room air, and a blood pressure of 105/75 mmHg.

You establish a peripheral IV line and begin a bolus of normal saline.

About 15 minutes away from the hospital, you note the patient becomes increasingly drowsy. Her heart rate has increased to 125 bpm and her blood pressure is now 85/47 mmHg. What are your next steps?

## Prehospital Shock

Starting in 2018, push dose epinephrine replaced dopamine as the vasopressor of choice for the management of prehospital shock in Alameda County, California.<sup>1</sup>

For the EMS system, properly managing shock is critically important as it's both common and life-threatening. One meta-analysis showed the prevalence of non-traumatic hypotension (systolic blood pressure [SBP] < 90 mmHg) to be around 2%. However, these patients had an in-hospital mortality between 33–52%.<sup>2</sup>

The empiric treatment of shock in the prehospital setting is difficult because of the multiple etiologies that lead to the final common pathway of decreased perfusion.<sup>3</sup>

In Alameda County, prehospital personnel treat according to suspected type of shock: anaphylactic, traumatic/hemorrhagic, septic, hypovolemic or cardiogenic.<sup>1</sup>

## Move to Epinephrine

For years, dopamine has been the first-line vasopressor for EMS, but a growing body of evidence has supported the preference of other agents. When compared to norepinephrine, for example, dopamine is associated with a higher incidence of arrhythmias, is a less potent vasopressor; and for those with cardiogenic shock, has been shown to increase mortality.<sup>4</sup>

Epinephrine, like norepinephrine, works through activation of adrenergic receptors to increase vasoconstriction (i.e., alpha-1), heart rate (i.e., chronotropy) and contractile force of the heart (i.e., inotropy; beta-1).

In addition, epinephrine has a higher affinity to the beta-2 receptor leading to bronchodilation.<sup>5</sup> When epinephrine was compared to norepinephrine plus dobutamine for the management of septic shock, there was no difference in mortality.<sup>6</sup>

With epinephrine's wide availability on ALS units for the management of cardiac arrest, extension of its use as a vasopressor is a logical progression.

## Push Dose Epinephrine

The “code” or “cardiac” epinephrine stored on ALS ambulances is in a 0.1 mg/mL concentration. To make push dose epinephrine, it needs to be diluted to a 0.01 mg/mL (10mcg/mL) concentration before being administered through a peripheral vessel. This is usually done using a 10-mL syringe and given in 1-mL aliquots known as a “push dose” or “bolus dose.”

For years, push dose vasopressors have been used by anesthesiologists prior to intubation or after epidural anesthesia as a temporary means of increasing blood pressure until the hypotension resolves.<sup>5</sup> This has opened the door for the administration of push dose vasopressors in the ED or the ICU for both transient hypotension and during a resuscitation before a central line can be established. Push dose phenylephrine, for example, was shown to improve peri-intubation hemodynamics in the ED.<sup>7</sup>

## Safety

Peripheral extravasation of a vasopressor can lead to complications of tissue ischemia. This is thought to be less likely with push dose vasopressors given their reduced concentration and short duration.

In 2016, a prospective observational study of 55 patients receiving vasopressors through a peripheral vessel, only three had extravasation and one developed thrombophlebitis. There were no serious complications and none required medical or surgical treatment.<sup>8</sup>

A meta-analysis in *Annals of Emergency Medicine* showed that a majority of local tissue injury and vasopressor extravasation events from peripheral lines occurred when the site involved was distal to the antecubital fossa. The average duration of infusion before injury or extravasation however was 56 hours, longer than the typical EMS transport time.<sup>9</sup>

## Protocol & Training

In the Alameda County EMS system, push dose epinephrine is in the protocol for management of shock suspected due to hypovolemia, sepsis and decreased cardiac output (i.e., cardiogenic). After empiric fluid resuscitation, 0.5 mL aliquots of 10 mcg/mL epinephrine is to be administered, titrating to SBP > 90 mmHg.

[View Table 1 as PNG file.](#)

Prior to protocol implementation, all paramedics in the county underwent training in the indication, mixing and administration of push dose epinephrine.

## Post-ROSC

Nine months after implementation of the Alameda County protocol, push dose epinephrine was used 34 times, mostly used for shock after achieving the return of spontaneous circulation (ROSC) after a cardiac arrest (61.8%).

This was followed by its use in patients suspected of septic shock (22.6%) and cardiogenic shock (19.0%). Paramedics commonly documented an improvement in patient condition after epinephrine administration including in every case of suspected septic shock.

[View Table 2 as PNG file.](#)

Overall however, push dose epinephrine was used relatively few times compared to the total number of patients with non-traumatic hypotension transported by EMS. This could be due to short transport times and the need for fluid resuscitation prior to utilizing a pressor. The process of mixing the medication could serve as a hinderance to protocol implementation. Finally, it could represent an opportunity for further training regarding shock recognition and aggressive treatment.

## Back to the Case

After attempts at fluid resuscitation, your 79-year-old patient remains hypotensive. She's likely in septic shock from a urinary tract infection. You prepare a syringe of push

dose epinephrine and administers a total of 10 mcg of epinephrine.

Her mean arterial pressure improves to 65 mmHg with a corresponding improvement in her appearance and mental status as you arrive to the hospital to prepare a handoff to the ED.

## Conclusion

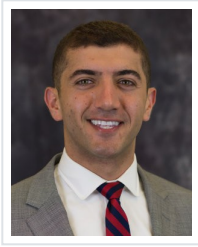
The Alameda County EMS System is confident that push dose epinephrine can be a temporary blood pressure rescue medication and serve as an important treatment in prehospital shock.

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