Systematic Review Snapshot

TAKE-HOME MESSAGE

Although the safety profile of peripheral administration of vasopressors remains uncertain, most reported adverse events are associated with a distal peripheral site or prolonged duration of administration.

METHODS

DATA SOURCES

The authors searched MEDLINE from 1946 to 2014, EMBASE from 1947 to 2014, and the Cochrane Library databases from 1992 to 2014. No language limitations were imposed.

STUDY SELECTION

Case reports, case series, observational cohorts, and randomized controlled trials of adult human subjects (>18 years) receiving intravenous vasopressors through either a peripheral site or a central venous catheter and adverse events attributed to the vasopressor were reviewed. Studies involving populations of patients with cardiac arrest were excluded.

DATA EXTRACTION AND SYNTHESIS

Data were extracted with a standardized data abstraction tool. Although aggregation of data was planned, because of significant heterogeneity among the study populations and designs, neither an assessment for bias nor a meta-analysis was performed.

Can Vasopressors Safely Be Administered Through Peripheral Intravenous Catheters Compared With Central Venous Catheters?

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Results

A total of 85 studies were included in the final analysis, the majority of which presented individual data in the form of case studies and case series; only 1 randomized controlled trial was included.[1] No studies directly compared extravasation and local tissue injury from vasopressors through peripheral intravenous lines and central venous catheters. A total of 270 patients with 325 separate events of local tissue injury or vasopressor extravasation were included (Figure).

The majority of local tissue injury and vasopressor extravasation events from peripheral intravenous lines involved medication delivery at a site distal to the antecubital or popliteal fossa. The average duration of vasopressor infusion before local tissue injury and extravasation was 56 hours (SD 68 hours) and 35 hours (SD 51 hours), respectively. Most events of local tissue injury and extravasation from a peripheral site resulted in no long-term sequelae or only minor disability; however, gangrene represented 7% (24/318) of reported events.

Local tissue injury events resulting from vasopressor administration through central venous catheters occurred at multiple sites and began after an average infusion duration of 55 hours (SD 47 hours). Only 1 event of vasopressor extravasation included the access site, which was the subclavian vein. No information about the average infusion duration before extravasation was provided. The development of gangrene accounted for 14% of reported adverse events with vasopressor administration through the central venous catheter.

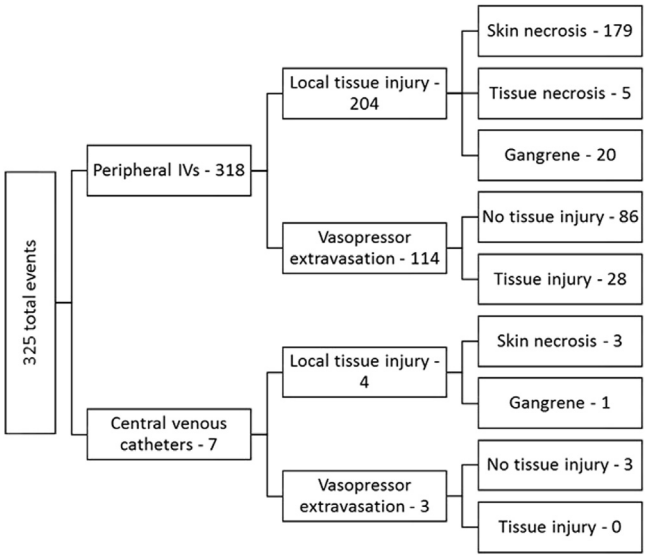

Figure. Summary of adverse events associated with administration of vasopressors through peripheral versus central venous catheters.

Commentary

Vasopressor agents are commonly administered to treat the hemodynamic instability associated with shock, typically through a central venous catheter,[2] given concerns about adverse events resulting from administration through peripheral intravenous lines. In some patients, however, placement of a central venous catheter may be delayed for a variety of reasons, resulting in extended time to administration of 1 or more vasopressors. Alternatively, use of a peripheral intravenous line may allow earlier vasopressor administration. This is a difficult clinical situation because the risk of adverse events associated with peripheral vasopressor infusion must be weighed against the risk of ongoing global tissue hypoperfusion. Because recent data suggest that earlier administration of vasopressors may be associated with improved clinical outcomes,[3] this topic is of increasing relevance to emergency physicians. Unfortunately, the relative risk of peripheral vasopressor administration is poorly defined, making a true assessment of risk-benefit difficult.

This systematic review sought to evaluate the evidence for (or against) the use of peripheral intravenous lines compared with central venous catheters in the context of adverse events including extravasation and local tissue injury. A total of 85 studies, including case studies, case series, and 1 randomized controlled trial (that did not specifically investigate complications of vasopressors),[1] were evaluated. However, none directly compared the 2 routes of administration and no meta-analysis was performed because of significant heterogeneity among the study populations and design.

Several limitations to this systematic review exist. First, reporting bias may result in underreporting of adverse events associated with vasopressor administration and weakens the conclusions of the review. Furthermore, no conclusions about the actual incidence of adverse events can be drawn from this relatively small sample of mainly case reports and series. Another limitation lies in the inconsistency of reporting among published reports, resulting in missing outcomes and variables of interest (such as time and location of peripheral intravenous line) that were desirable for the intended data analysis.

Although systematic reviews are important for assessing the effectiveness and safety of health care interventions, the study of harmful effects can be more challenging.[4] In general, more reliable and robust data from randomized controlled trials are available for benefits of treatment compared with harm. As a result, systematic reviews may have to rely on studies of lower methodological strength. Harms associated with treatment may vary between subgroups in a population, some of which may be excluded from randomized clinical trials, although this is less of a concern because the current systematic review results primarily from case series. The available data do allow the conclusion that administration of vasopressors through the peripheral intravenous line appears to be associated with more local tissue and extravasation events compared with that through central venous catheters, although the events occur with both types of venous access. Additionally, when peripheral intravenous lines are used, local tissue and extravasation events seem to increase when vasopressors are administered through distal sites for an extended period. Therefore, peripheral catheters should be viewed as a bridge to central access, given the

apparent higher rate of adverse events with prolonged peripheral administration of vasopressors.

Editor's Note: This is a clinical synopsis, a regular feature of the *Annals*' Systematic Review Snapshot (SRS) series. The source for this systematic review snapshot is: **Loubani OM, Green RS. A systematic review of extravasation and local tissue injury from administration of vasopressors through peripheral intravenous catheters and central venous catheters. *J Crit Care*. 2015;30:653e9-e17.**

1. Ricard JD, Salomon L, Boyer A, et al. Central or peripheral catheters for initial venous access of ICU patients? a randomized controlled trial. *Crit Care Med*. 2013;41:2108-2115.
2. Taylor RW, Palagiri AV. Central venous catheterization. *Crit Care Med*. 2007;35: 1390-1396.
3. Beck V, Chateau D, Bryson GL, et al. Timing of vasopressor initiation and mortality in septic shock: a cohort study. *Crit Care*. 2014;18:R97.
4. Boyd CM, Singh S, Varadhan R, et al. *Methods for Benefit and Harm Assessment in Systematic Reviews. Methods Research Report*. AHRQ Publication No. 12(13)-EHC150-EF. (Prepared by the Johns Hopkins University Evidence-based Practice Center under contract No. 290-2007-10061-I). Rockville, MD: Agency for Healthcare Research and Quality; 2012.