Titration of Vasoactive Medications in Septic Shock

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Disclosures

- Conflict of Interest: None

Objectives

Discuss	Discuss vasopressor titration in patients with septic shock.
Identify and prioritize	Identify and prioritize titration of vasoactive drugs.
Apply	Apply the Surviving Sepsis Campaign Guidelines to titrate vasoactive medications.

Background

Sepsis is a top 15 leading cause of death in the United States (Heron, 2019)

Approximately 50% of all hospital deaths are attributed to sepsis (Liu et al., 2014)

2.5 million cases were reported between Sept 2010 and Sept 2016 (Paoli, Reynolds, Sinha, Gitlin, & Crouser, 2018)

Mortality rate varies based on severity of disease (Mayr, Yende, & Angus, 2014)

Use of vasopressors increases mortality rate to 50% (Brown et al., 2013)

“Except on few occasions, the patient appears to die from the body's response to infection rather than from it.”

- Sir William Osler – 1904
- The Evolution of Modern Medicine

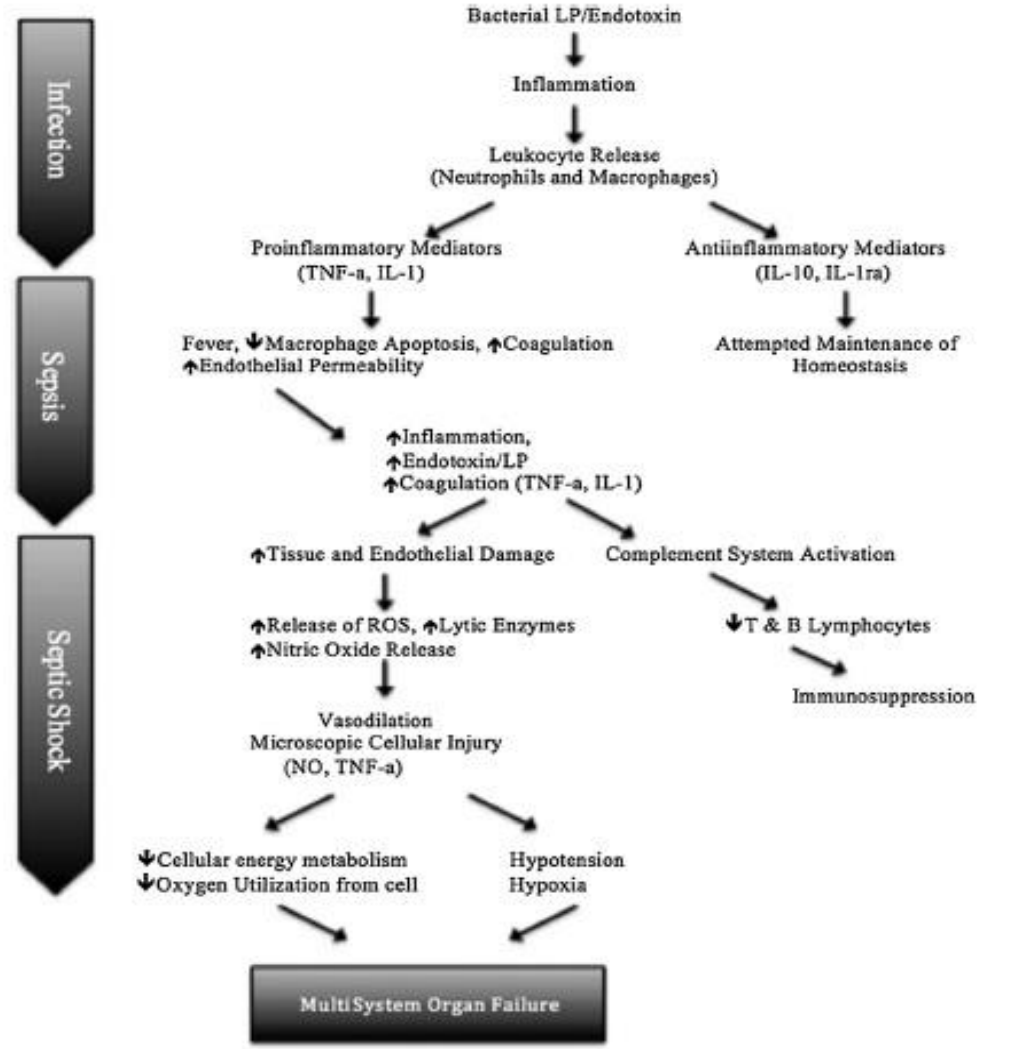


Fig. 1. Pathophysiology of septic shock.

Arellano, Daniel L., and Sandra K. Hanneman. "Vasopressor weaning in patients with septic shock." *Critical care nursing clinics of North America*26.3 (2014): 413-425.

Surviving Sepsis Campaign®

BUNDLE

HOUR-1 BUNDLE: INITIAL RESUSCITATION FOR SEPSIS AND SEPTIC SHOCK:

1) Measure lactate level.*
2) Obtain blood cultures before administering antibiotics.
3) Administer broad-spectrum antibiotics.
4) Begin rapid administration of 30mL/kg crystalloid for hypotension or lactate ≥4 mmol/L.
5) Apply vasopressors if hypotensive during or after fluid resuscitation to maintain a mean arterial pressure ≥ 65 mm Hg.

*Remeasure lactate if initial lactate elevated (> 2 mmol/L).

Surviving Sepsis Campaign®

1. *Act quickly upon sepsis & septic shock recognition
2. Minimize time to treatment - sepsis & septic shock are medical emergencies
3. Monitor closely for response to interventions
4. Communicate sepsis status in hand-offs

*All elements of the Hour-1 bundle may or may not be completed in the first hour after sepsis recognition

survivingsepsis.org

Resuscitation

Crystalloids as the initial fluid of choice in the resuscitation of severe sepsis and septic shock

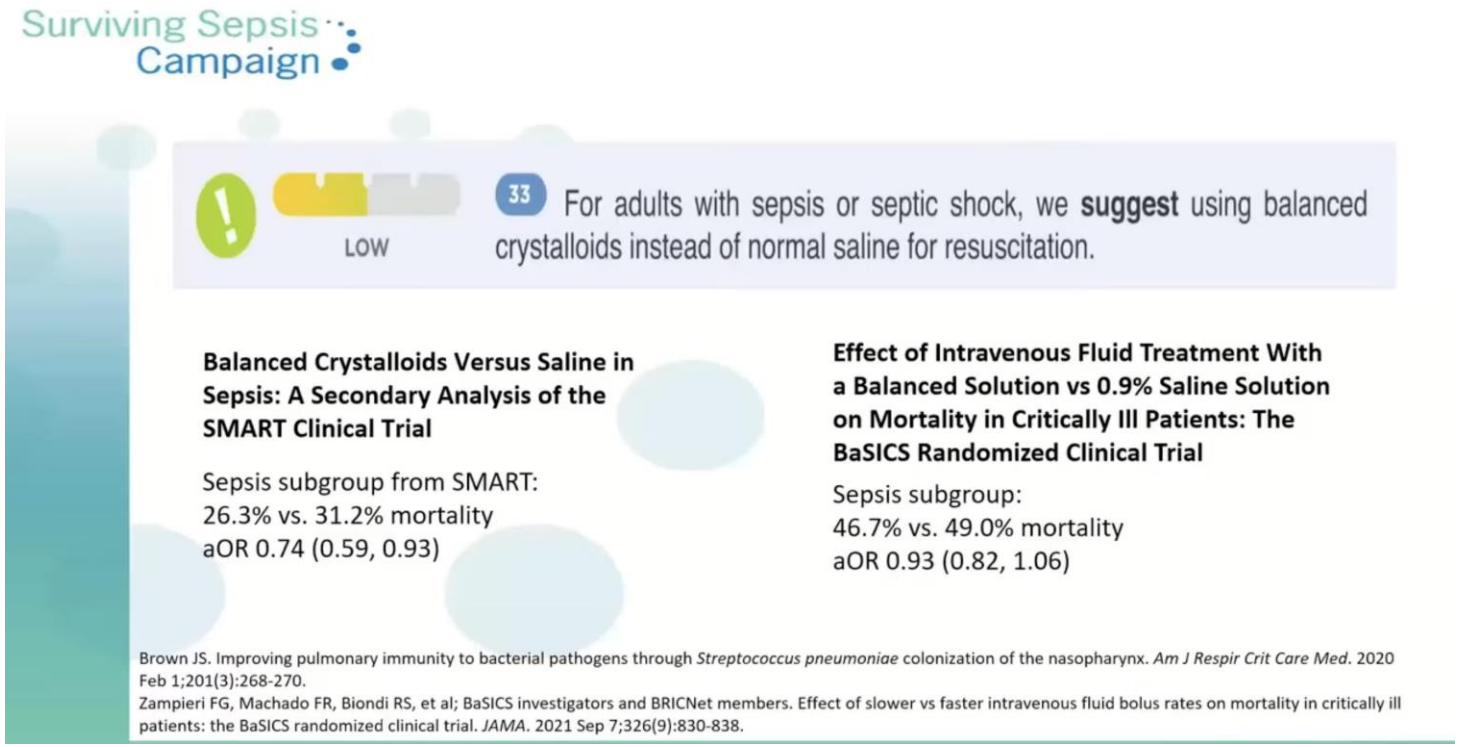
Avoid Hetastarch or Hespan compounds

Albumin in the fluid resuscitation of severe sepsis and septic shock when patients require substantial amounts of crystalloids

Initial fluid challenge in patients with sepsis induced tissue hypoperfusion with suspicion of hypovolemia to achieve a minimum of 30 mL/kg of crystalloids. More rapid administration and greater amounts of fluid may be needed in some patients

Types of Fluids

- Is normal saline normal?
- Lactated Ringers vs normal saline – are they comparable?
- Albumin vs NS



Administration of Vasopressors

Remember less than 6 hours

Proximal veins if possible

VERY LOW

44 For adults with septic shock, we **suggest** starting vasopressors peripherally to restore mean arterial pressure rather than delaying initiation until a central venous access is secured.

Rationale: Low complication rate, facilitates faster time to shock resolution, may avoid CVC placement altogether.

Safety of Peripheral Administration of Vasopressor Medications: A Systematic Review

A Systematic Review of Extravasation and Local Tissue Injury From Administration of Vasopressors Through Peripheral Intravenous Catheters and Central Venous Catheters

Safety of Peripheral Intravenous Administration of Vasoactive Medication

Central or Peripheral Catheters for Initial Venous Access of ICU Patients: A Randomized Controlled Trial

Brown JS. Improving pulmonary immunity to bacterial pathogens through *Streptococcus pneumoniae* colonization of the nasopharynx. *Am J Respir Crit Care Med*. 2020 Feb 1;201(3):268-270.

Cardenas-Garcia J, Schaub KF, Belchikov YG, Narasimhan M, Koenig SJ, Mayo PH. Safety of peripheral intravenous administration of vasoactive medication. *J Hosp Med*. 2015 Sep;10(9):581-585.

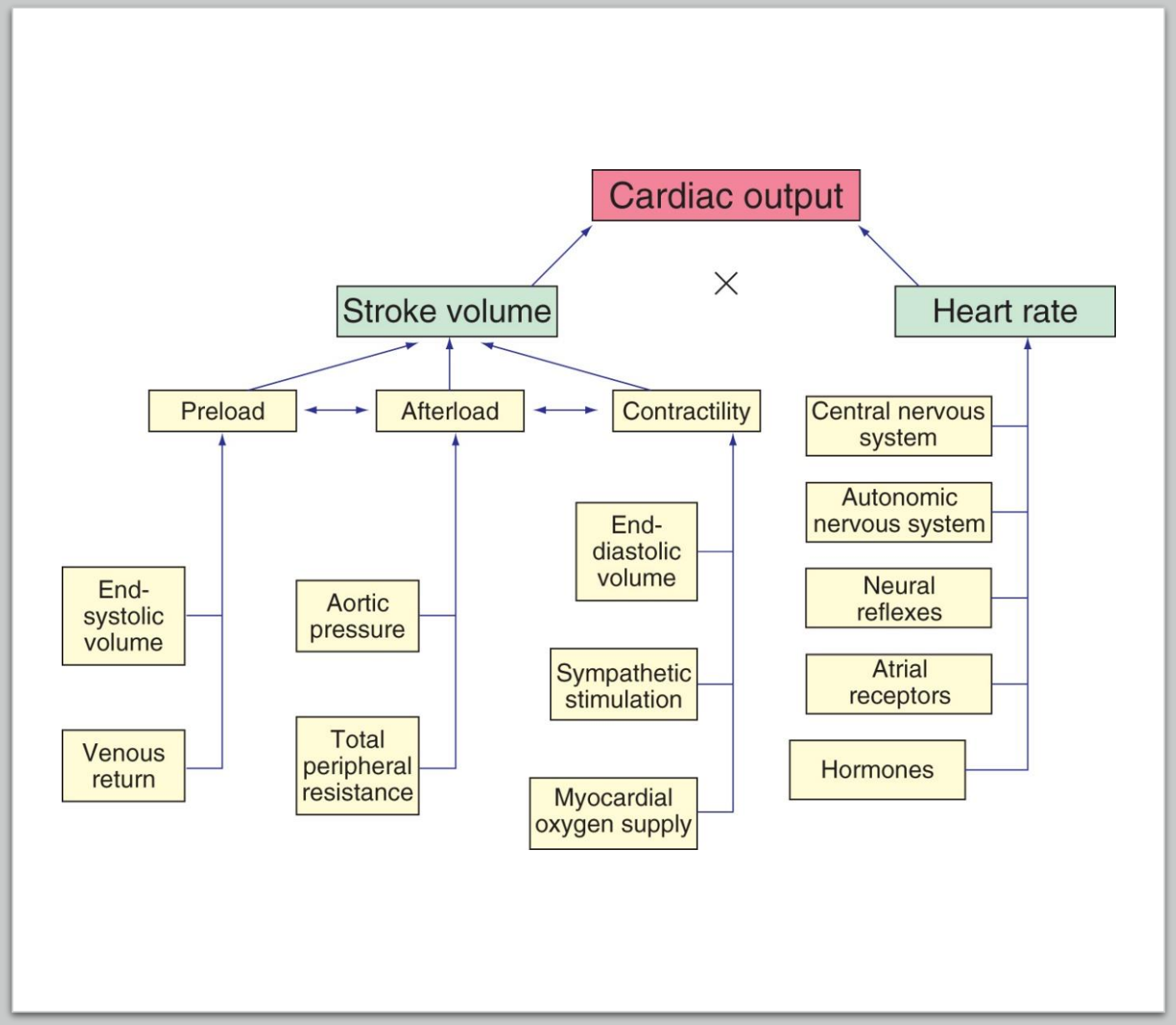
Tian DH, Smyth C, Keijzers G, et al. Safety of peripheral administration of vasopressor medications: a systematic review. *Emerg Med Australas*. 2020 Apr;32(2):220-227.

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 Jun;30(3):653.e9-e17.

Review of Hemodynamics & Vasopressors in Septic Shock

Factors of Cardiac Performance

- Preload-fill
    - Volume/pressure inside ventricle at end of diastole
    - Left ventricular end-diastolic volume
- Afterload-resistance pressure
    - Resistance to ejection of blood from left ventricle
    - Determined by system vascular resistance in aorta
- Myocardial contractility
    - Stroke volume and preload
    - Ejection fraction
- Heart rate



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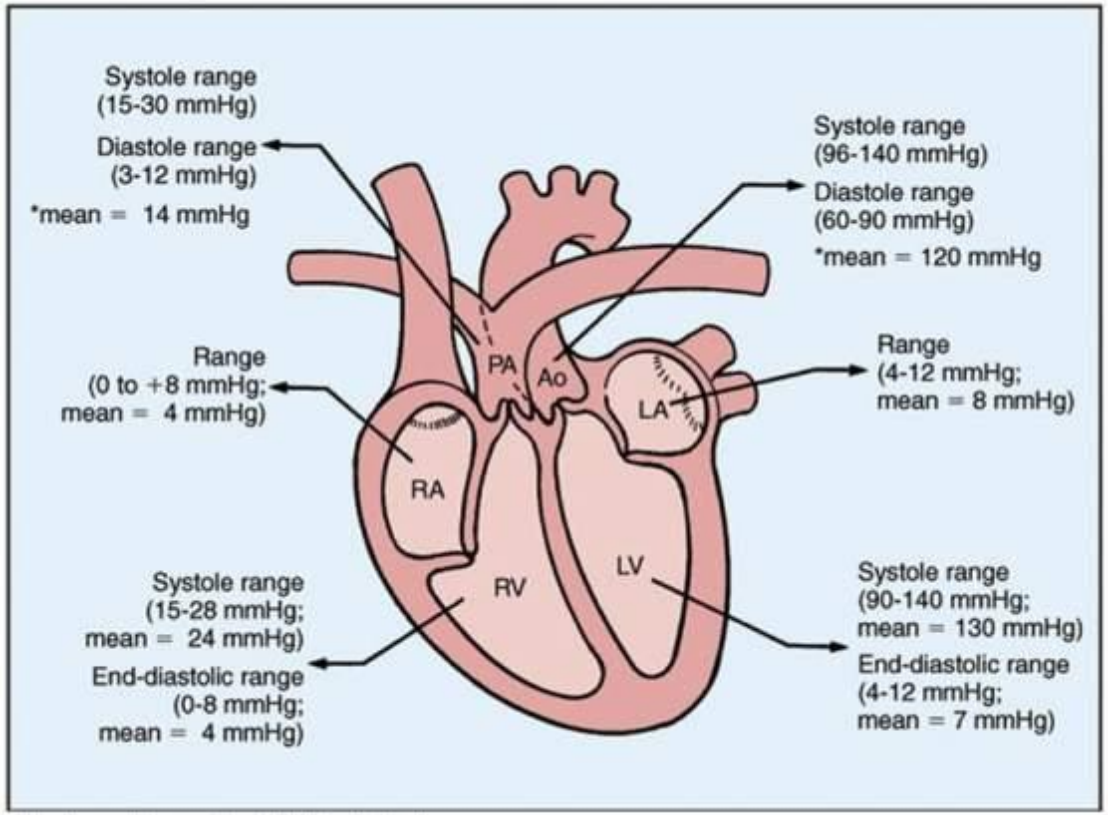
	Mean (mm Hg)	Range (mm Hg)
Right atrium	4	0-8
Right ventricle		
Systolic	24	15-28
End-diastolic	4	0-8
Left atrium	7	4-12
Left ventricle		
Systolic	130	90-140
End-diastolic	7	4-12



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Receptor Type	Tissue Distribution	Mechanism of Action	Agonist Potency	Physiological Effects	Agonist	Antagonist
α1	Vascular Smooth Muscles, Visceral smooth Muscles	Gq-protein coupled activates Phospholipase C, IP3+DAG	Epi ≥ NE >> Iso	Smooth muscle contractions, Gluconeogenesis, Vasoconstriction	Norepinephrine, Phenylephrine, Methoxamine	Doxazosin, Phentolamine, Prazosin
α2	Pre-synaptic terminals, pancreas, platelets, Ciliary epithelium, Salivary Glands	Gi-protein coupled inhibits Adenyl cyclase	Epi ≥ NE >>Iso	Inhibits release of Neurotransmitter	Clonidine, Monoxidine	Yohimbine, Idazoxan, Tolazoline
β1	Heart, Kidney, some pre-synaptic terminals	Gs-protein coupled activates Adenyl cyclase +PKA	Iso > Epi ≥ NE	Increase heart rate and Renin secretion	Isoproterenol, Norepinephrine, Dobutamine	Propranolol, Metoprolol, Atenolol
β2	Visceral smooth muscles, Bronchioles, Liver, Skeletal Muscles	Gs-protein coupled activates Adenyl cyclase +PKA, Ca-channels	Iso > Epi >> NE	Vasodilation, Bronchodilation, Inhibits insulin secretion	Isoproterenol, Salbutamol, Salmeterol, Albuterol, Formoterol, Terbutaline, Levalbuterol	Propranolol, ICI-118,551, Nadolol, Butoxamine
β3	Adipose Tissue	Gs-protein coupled activates Adenyl cyclase +PKA	Iso = NE > Epi	Increase lipolysis	Isoproterenol, Amibegron, Solabegron	SR59230A

NE: Norepinephrine, **Epi:** Epinephrine and **Iso:** Isoproterenol

Table 1. Common vasopressors used in the ICU setting for hypotension associated with septic shock.

Vasopressor	Usual Dose Range	Receptor Affinity	Side Effects	Titration Recommendation
Norepinephrine	0.5-30mcg/min 0.01-3mcg/kg/min	α1 and β1 α1 > β1	Tachycardia, arrhythmias, cardiac and tissue ischemia	2-5 mcg/min every 3-5 minutes
Epinephrine	0.5-10mcg/min 0.01-1mcg/kg/min	β1 > α1 Low doses = β High doses = α	Tachycardia, arrhythmias, cardiac and tissue ischemia	0.5-2mcg/min every 3-5 minutes
Vasopressin	0.01-0.1 U/min (Fixed dose 0.04 U/min)	V1 Receptors	Arrhythmias, cardiac, tissue, visceral and splanchnic ischemia	0.01 U/min every 10-15 minutes
Dopamine	2-20mcg/kg/min	DA = <5 mcg/kg/min β1 =5 – 10 mcg/kg/min α1 = 10 – 20 mcg/kg/min	Tachycardia, arrhythmias, cardiac and tissue ischemia	2-5 mcg/kg/min every 5-10 minutes
Phenylephrine	10-200 mcg/min	Pure α1	Reflex bradycardia, Tissue and visceral ischemia	10-20 mcg/min every 3-5 minutes

Vasopressors

- Vasopressor therapy initially to target a mean arterial pressure (MAP) of 65 mm Hg
- Norepinephrine as the first choice vasopressor
- All patients requiring vasopressors have an arterial catheter placed as soon as practical if resources are available

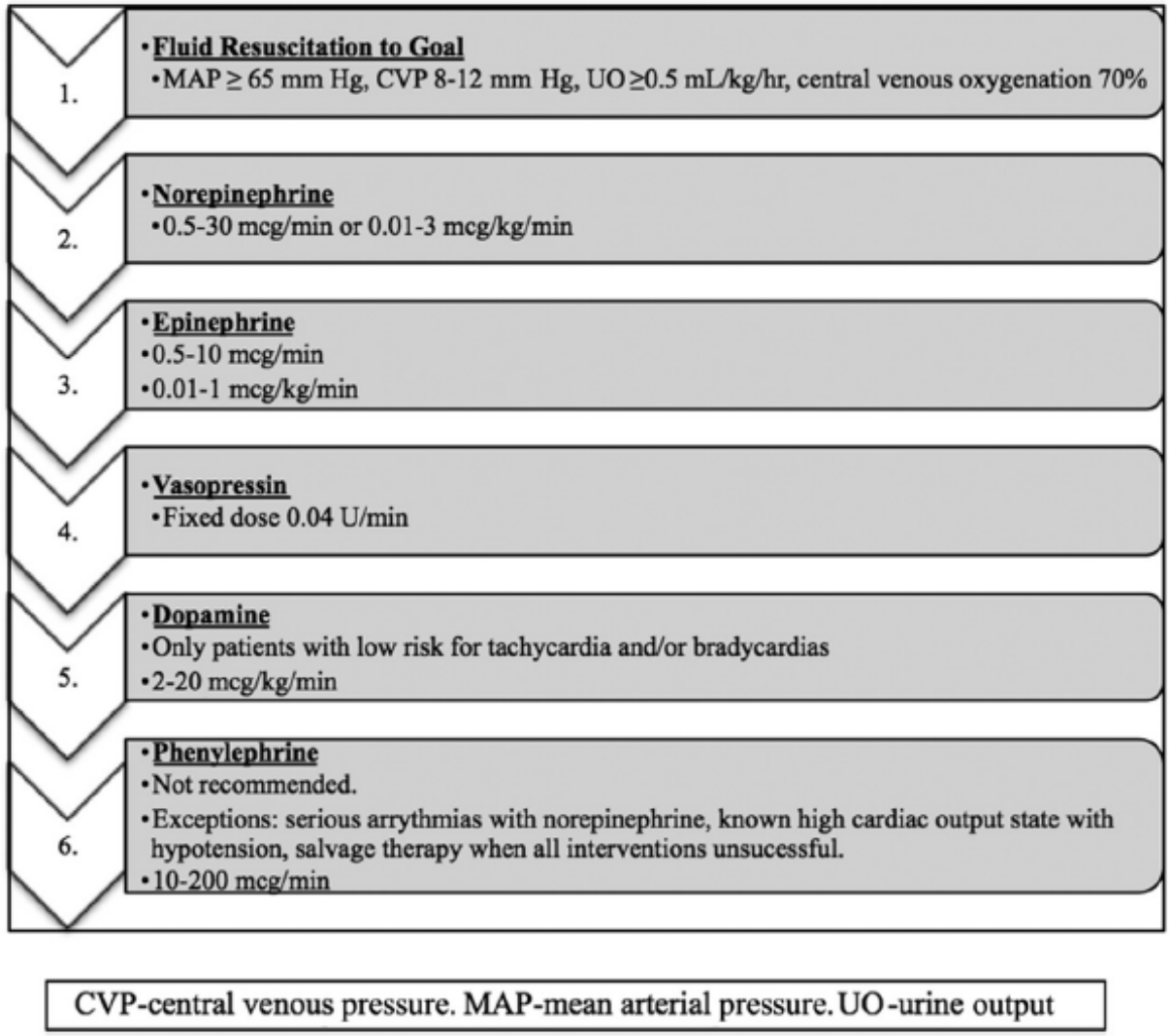


Fig. 2. Algorithm for treating hypotension in septic shock.

Catecholamine Sparing Strategies

Adverse Effects of Catecholamines

Arrhythmias	Ischemia	Increased myocardial O2 demand	Hyperglycemia
Decreased cardiac output	Inflammation	Immunosuppression	Increased mortality??

Corticosteroids

Indicated with persistent hemodynamic instability

Hydrocortisone 50mg IV every 6 hours. OR Hydrocortisone 100mg IV every 8 hours

DO NOT use the ACTH stimulation test (grade 2B)

In treated patients hydrocortisone, taper when vasopressors are no longer required

Corticosteroids not be administered for the treatment of sepsis in the absence of shock

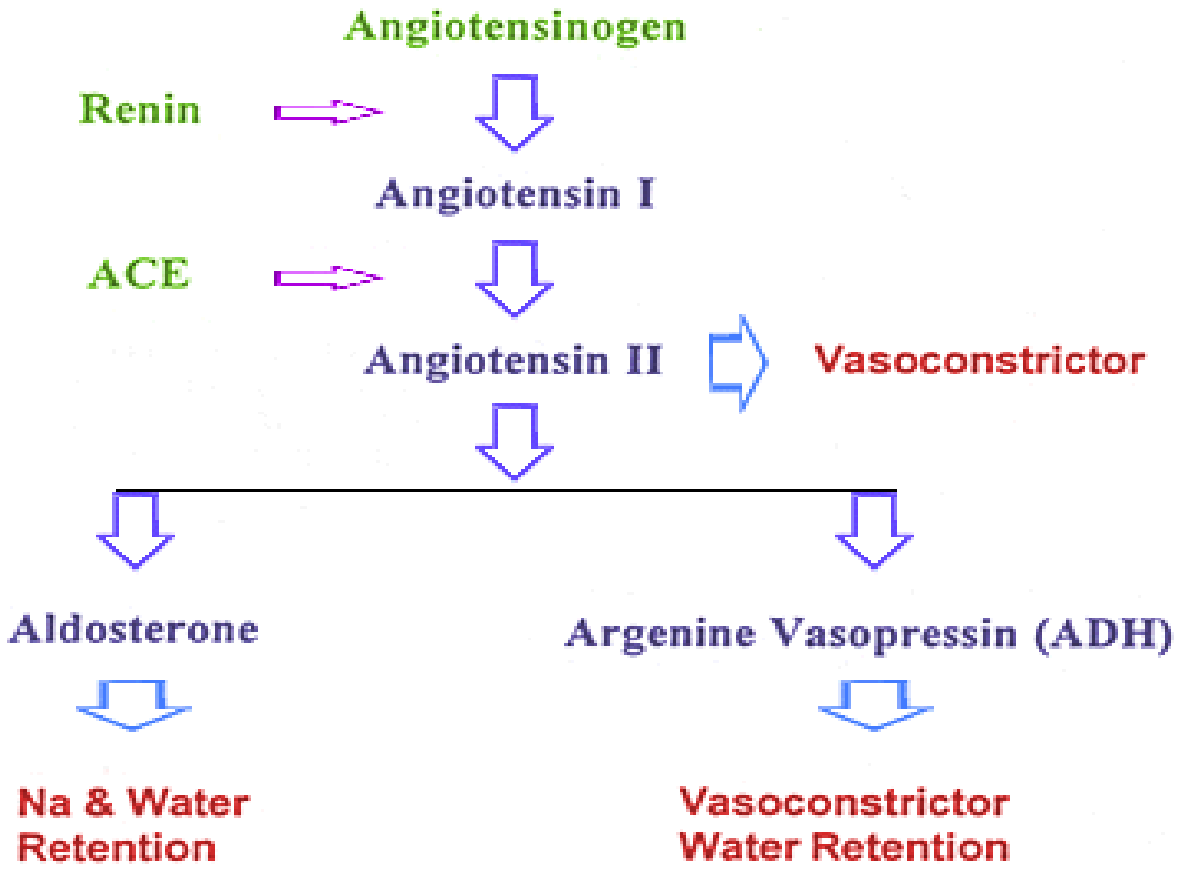
Multiple studies have shown decreased time on vasopressors. No mortality benefit

Complications associated with steroids

Vasopressin

- VASST Trial: Evaluated vasopressin (AVP) versus norepinephrine (NE) effect on 28 day mortality in septic shock
  - Multicenter, randomized, double-blind; N = 778
  - Stratified by baseline NE dose
  - No difference in primary outcome (35.4% vs. 39.3%) 28- day Mortality
  - Secondary outcomes: No difference in 90 day mortality, any organ dysfunction subgroup, or LOS
  - No difference in adverse effects
  - Conclusions▫ AVP significantly decreased NE doses at day 4 ($p < 0.001$)▫ AVP MAY improve mortality in patients with less severe shock

Renin-angiotensin-aldosterone system



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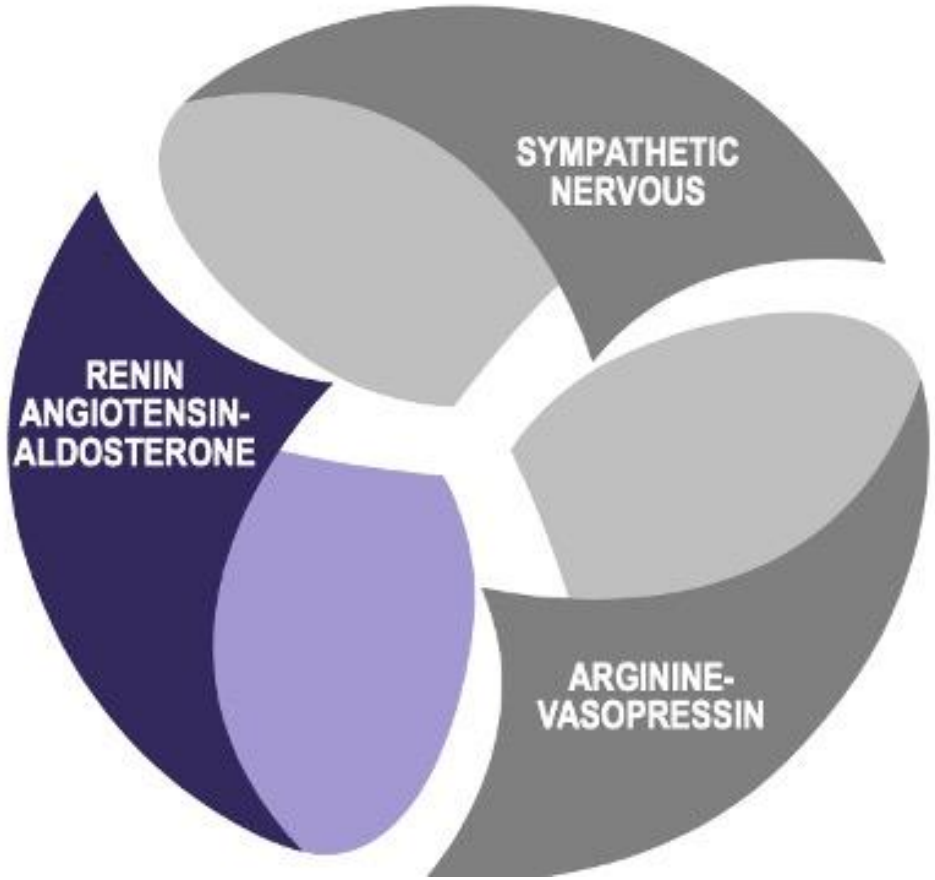


THERAPIES AND MECHANISMS

(angiotensin II)
Injection for Intravenous Infusion

RENIN ANGIOTENSIN-ALDOSTERONE

CATECHOLAMINES[1]: SYMPATHETIC NERVOUS

VASOPRESSIN: ARGININE-VASOPRESSIN

Khanna, A., English, S. W., Wang, X. S., Ham, K., Tumlin, J., Szerlip, H., ... & Deane, A. M. (2017). Angiotensin II for the treatment of vasodilatory shock. *New England Journal of Medicine*, *377*(5), 419-430.

ADMINISTERING [redacted] (angiotensin II) injection for intravenous infusion

[redacted]

INITIATE

Recommended starting dose [redacted] is 20 ng/kg/min, which is equivalent to 0.02 mcg/kg/min via continuous intravenous infusion

// **Dosage is measured in NANOGRAMS (ng)**

// Monitor blood pressure closely

ASSESS

The median response time was approximately 5 minutes

// The median dose [redacted] was 10 ng/kg/min at 30 minutes

OPTIMIZE

Titrate [redacted] to effect in each patient

// Titrate up every 5 minutes by increments of up to 15 ng/kg/min

// Once the underlying shock has sufficiently improved, down-titrate every 5 to 15 minutes in increments of up to 15 ng/kg/min based on blood pressure

- Half-life of [redacted] is less than 1 minute

// During the first 3 hours, the maximum dose should not exceed 80 ng/kg/min. Maintenance dose should not exceed 40 ng/kg/min

Khanna, A., English, S. W., Wang, X. S., Ham, K., Tumlin, J., Szerlip, H., ... & Deane, A. M. (2017). Angiotensin II for the treatment of vasodilatory shock. *New England Journal of Medicine*, *377*(5), 419-430.

Fluid and Vasoactive-Inotrope Management Algorithm For Children

Surviving Sepsis Campaign

Abnormal Perfusion with or without Hypotension

- If signs of fluid overload are absent, administer fluid bolus, 10-20 mL/kg.
- Repeat assessment of hemodynamic response to fluid and consider fluid boluses, 10-20 mL/kg, until shock resolves or signs of fluid overload develop.
- Assess cardiac function.
- Consider epinephrine if there is myocardial dysfunction or epinephrine/norepinephrine if shock persists after 40-60 mL/kg (or sooner if signs of fluid overload develop).

Abnormal perfusion WITHOUT hypotension

- Do NOT give fluid bolus unless there are signs of dehydration with ongoing fluid losses (eg, diarrhea).
- Start maintenance fluids.
- Monitor hemodynamics closely.
- Consider vasoactive-inotropic support (if available).

Abnormal perfusion WITH hypotension*

- If signs of fluid overload are absent, administer fluid bolus, 10-20 mL/kg.
- Assess hemodynamic response to fluid and repeat fluid boluses, 10-20 mL/kg, until hypotension resolves or signs of fluid overload develop.
- Assess cardiac function (if available)
- Consider epinephrine/norepinephrine if hypotension persists after 40 mL/kg or sooner if signs of fluid overload develop.

Fluid in mL/kg should be dosed as ideal body weight.

Shock resolved, perfusion improved

- Do not give more fluid boluses.
- Consider maintenance fluids.
- Monitor for signs/symptoms of recurrent shock.

*Hypotension in healthcare systems WITHOUT intensive care is defined as either:

- SBP < 50 mm Hg in children aged < 12 months
- SBP < 60 mm Hg in children aged 1 to 5 years
- SBP < 70 mm Hg in children aged > 5 years

OR

- Presence of all 3 World Health Organization criteria: cold extremities, prolonged capillary refill > 3 seconds, weak/fast pulse

www.sccm.org/SurvivingSepsisCampaign/Guidelines/Pediatric-Patients

Society of Critical Care Medicine

ESICM

Vasopressor Discontinuation

POLICY AND RESEARCH

Background

POOR TITRATION COMPLIANCE

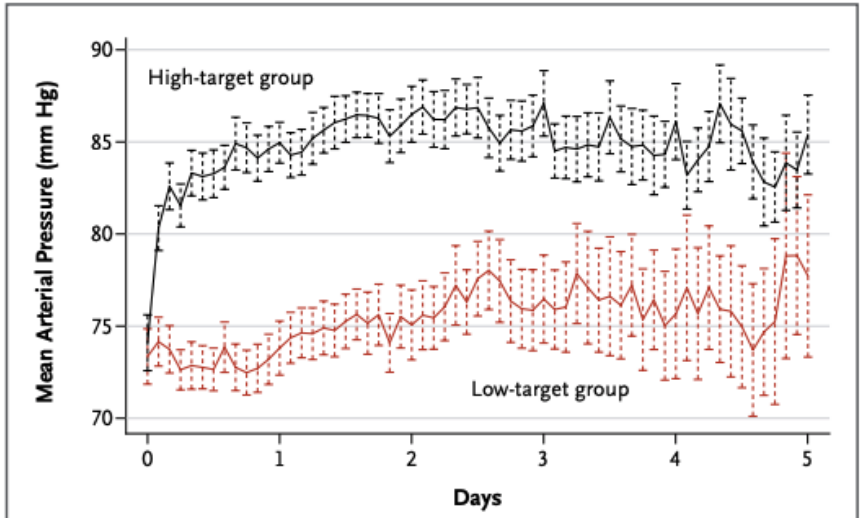


Figure 2. Mean Arterial Pressure during the 5-Day Study Period.

Mean arterial pressures were significantly lower in the low-target group than in the high-target group during the 5 protocol-specified days (P=0.02 by repeated-measures regression analysis), although the values exceeded the target values of 80 to 85 mm Hg in the high-target group and 65 to 70 mm Hg in the low-target group. The I bars represent 95% confidence intervals.

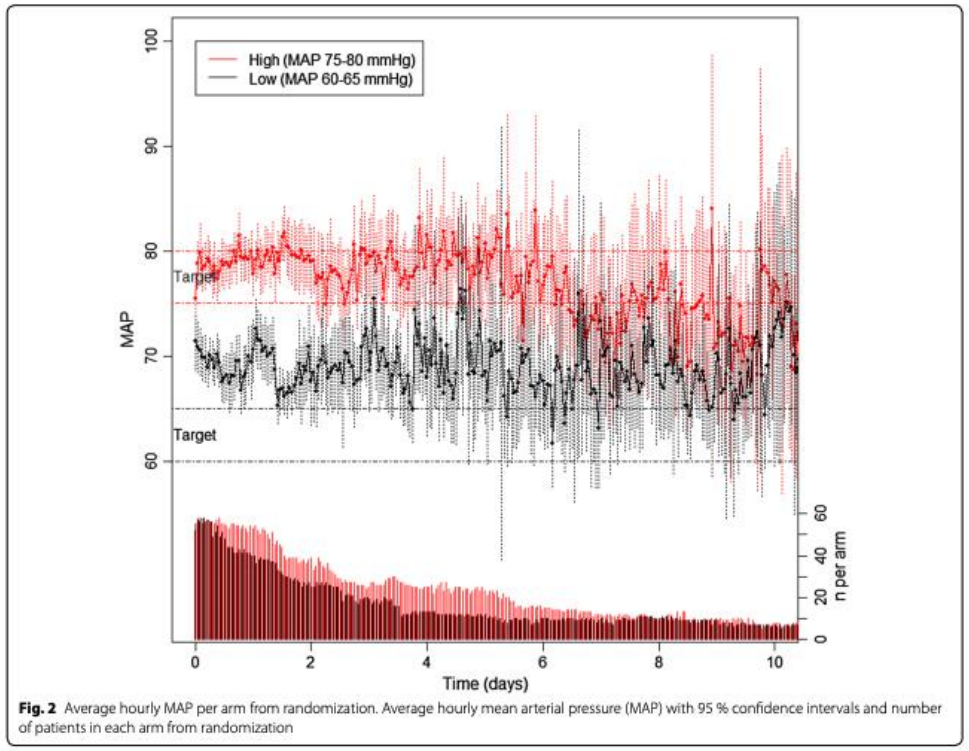


Fig. 2 Average hourly MAP per arm from randomization. Average hourly mean arterial pressure (MAP) with 95 % confidence intervals and number of patients in each arm from randomization

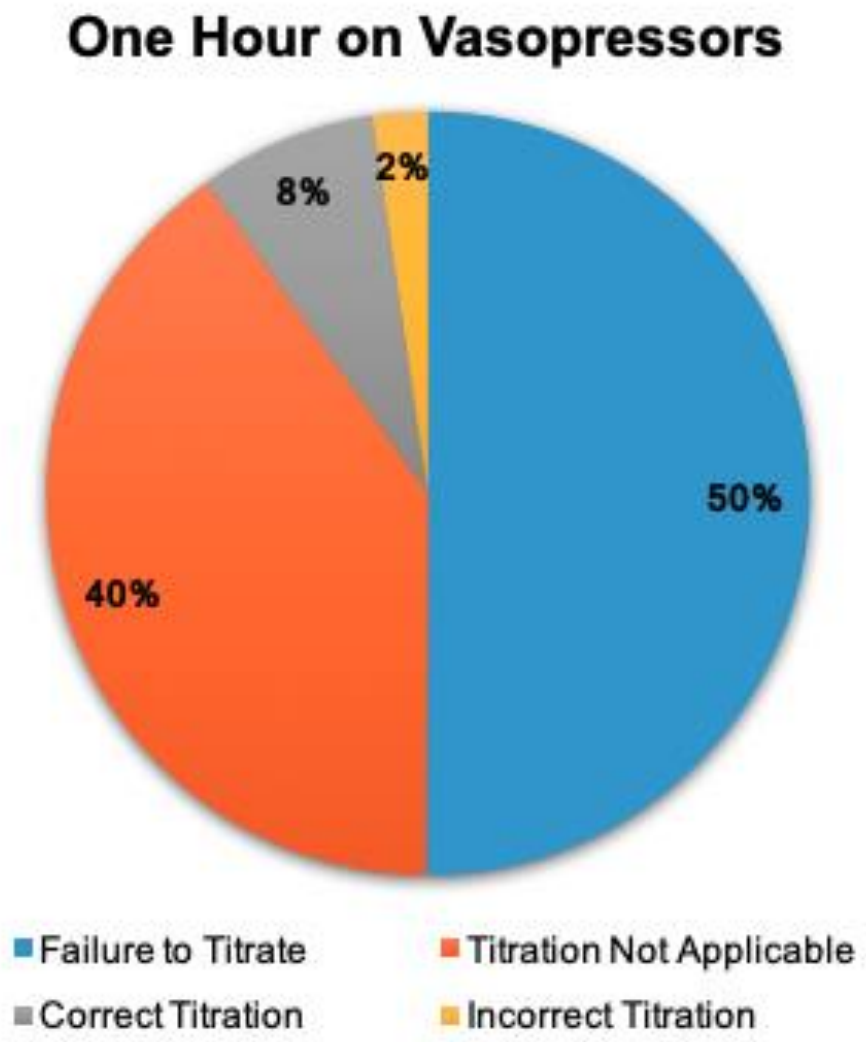
Asfar, P., Meziani, F., Hamel, J. F., Grelon, F., Megarbane, B., Anguel, N., ... & Radermacher, P. (2014). High versus low blood-pressure target in patients with septic shock. *N Engl J Med*, *370*, 1583-1593.

Lamontagne, F., Meade, M. O., Hébert, P. C., Asfar, P., Lauzier, F., Seely, A. J., ... & Heyland, D. K. (2016). Higher versus lower blood pressure targets for vasopressor therapy in shock: a multicentre pilot randomized controlled trial. *Intensive care medicine*, *42*(4), 542-550.

Results

- Aggregate titration data divided by Aggregate vasopressor hours
- Failure to Titrate: 5395/2598= 2.07
- Incorrect Titration: 316/2598= 0.12
- Correct Titration:
- 704/2598= 0.27
  - Titration N/A
- 3977/2598=1.53

  - 4 opportunities per hour



Other Results

- Nurses were more likely to titrate vasopressors (upward or downward) during medication bag replacement.
- Nurses were less likely to titrate vasoactive therapy while outside of the ICU environment for a procedure or diagnostic test.
- Titrations notably decreased 2 hours before shift change but then increased after shift change. If a titration was attempted several times without success, nurses were less likely to attempt titration again within that hour.
- Patients on continuous venous-to-venous hemodialysis were less likely to receive aggressive vasopressor titration.

Background

- 5 minutes to correctly initiate the first titration of vasopressors (Fadale, Tucker, Dungan, & Sabol, 2014)
- Deviations from titration protocols
- Medication management standards to maintain consistent administration practices and decrease variation among nurses

Medication Management- Top Non-Compliant Standards/NPSGs for Hospitals (Jan-June, 2017)

Standard/NPSG	% Non-compliant
MM.04.01.01 Medication Orders	49.28%
MM.03.01.01 Storage and Security of Meds	47.84%
MM.05.01.01 Medication Order Review	14.94%
MM.05.01.07 Preparing medications	14.15 %
NPSG.03.04.01 Labeling in OR/procedures	8.8%
MM.03.01.03 Emergency Medication	8%
NPSG.03.06.01 Reconciling Medications	6.7%
MM.09.01.01 Antimicrobial Stewardship	4.2%
MM.05.01.11 Safe Dispensing of Medications	4.06%

Background

- In 2017, The Joint Commission updated standards related to medication management of titratable infusions with the intention of promoting safe practices.
  - Required elements for titration orders:
    - Medication Name
    - Medication Route
    - Initial or starting dose/rate of infusion (or both)
    - Incremental units for increasing or decreasing the dose/rate
    - Frequency of incremental changes
    - Maximum dose/rate
    - Objective clinical end point
  - Expectation to document each change in dose/rate as it occurs

Background

- Detailed titration instructions increased the amount of time for hemodynamic stability (Chen et al. 2019)
- Closed loop controllers to improve titration and reduce norepinephrine dosing (Joosten et al., 2019; Rinehart, Ma, Calderon, & Cannesson, 2018; Merouani, et al., 2008)

Problem/Purpose

Problem

- Managing orders
- Burden of documentation
- Limited scope of practice and loss of autonomy
- Delays in care
- Concern for moral distress
- Lack of evidence regarding best practices

Purpose

✓To explore the practices and purposes of nurses regarding The Joint Commission standards for titration of continuous medication infusions

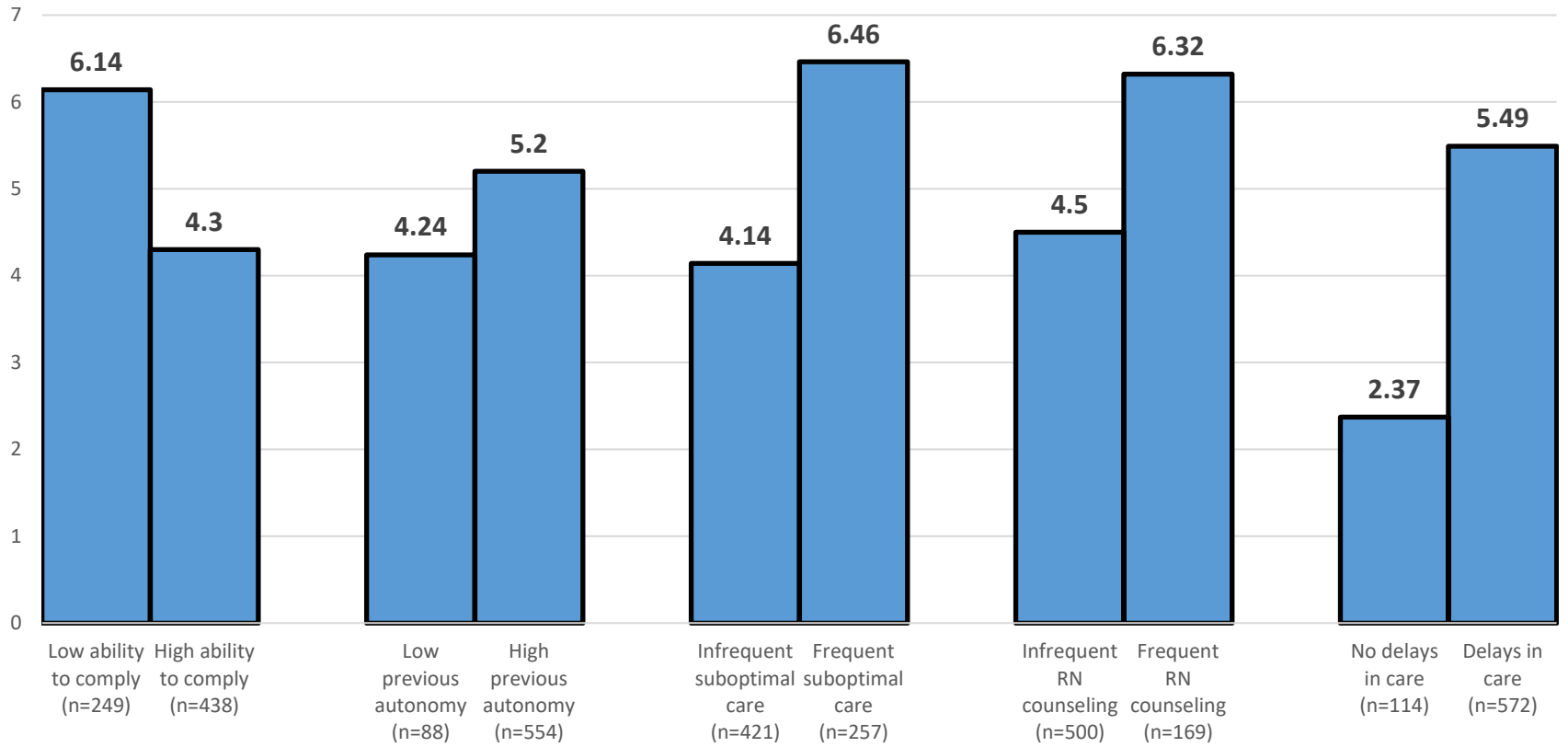
Results

- 941 responded; 781 included after removing those who did not consent, had no experience with titration, or were unable to complete the survey

Experience	Results
Years of experience with titrating medications	12.27 years (SD, 10.10; median, 9)
Working in an ICU:	82%
Prior to new standards, always or often titrated to goal parameter	86%
Counseled or witnesses a nurse being counseled as a result of not following orders	24%
Perceived new standards contributed to delays in care	80%
Experienced moral distress	93%
Inability to comply with titration orders as written	34%
Suboptimal care and inability to meet patient needs	68%
Titration of medication outside of orders	70%
Request for revision of goal parameter orders to meet patient needs	84%

Davidson, J. E., Doran, N., Petty, A., Arellano, D. L., Henneman, E. A., Hanneman, S. K., ... & Rincon, T. (2021). Survey of nurses' experiences applying The Joint Commission's medication management titration standards. American Journal of Critical Care, 30(5), 365-374.

Correlates to Moral Distress (scale 0-10)



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Conclusions

- Critical care nurses perceive the medication titration standards as adversely impacting patient care and contributing to moral distress.
- The recent 2020 TJC updates attempted to address reported concerns, yet they do not address the delays in care and moral distress associated with inability to comply with orders that do not match the individual patient's response to these titrated medications.
- Ongoing collaboration with The Joint Commission is indicated to share these findings and identify modifications to the standards that meet the patient's clinical needs, optimizes patient safety, and prevents moral distress amongst nurses on the front line.

Acknowledgements

Survey of Nurses' Experiences Applying The Joint Commission's Medication Management Titration Standards

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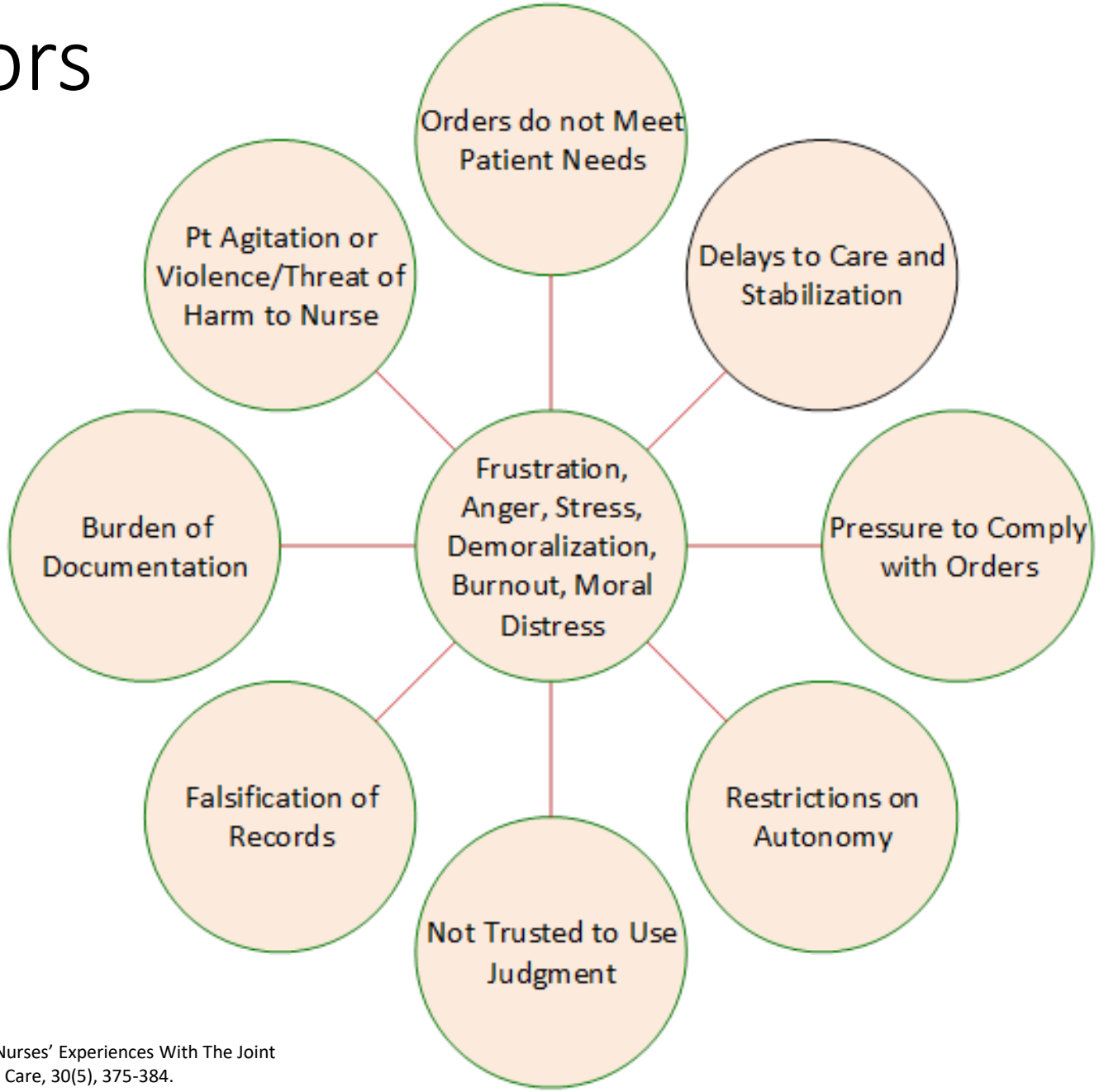
- Society of Critical Care Medicine Nursing Section
- Anesthesia and pharmacy members who worked tirelessly to develop this Medication Titration Survey and advocate for change
- Connie Barden, MS, RN, CCO, of the AACN, for advocating with TJC on behalf of the nurses she serves
- The more than 900 nurses who took time to participate in nursing research despite the challenges imposed by the COVID-19 pandemic

Thematic Analysis of Nurses' Experiences With The Joint Commission's Medication Management Titration Standards

By Judy E. Davidson, DNP, RN, MCCM, Laura Chechel, MSN, RN, CNS, CCRN, Jose Chavez, DNP, RN, ACCNS-AG, CCRN, Carol Olff, MSN, RN, CCRN-K, NEA-BC, and Teresa Rincon, PhD, RN, CCRN-K

Model of Stressors and Outcomes



Davidson, J. E., Chechel, L., Chavez, J., Olff, C., & Rincon, T. (2021). Thematic Analysis of Nurses' Experiences With The Joint Commission's Medication Management Titration Standards. American Journal of Critical Care, 30(5), 375-384.

Harm: Erosion of Workplace Wellness

“When an ETOH patient escalates rapidly, RNs are often times put in harm’s way trying to comply with inadequate titration orders.” (R70)

“I cannot even tell you the amount of frustration this issue has caused among the bedside nurses in my unit. It is constant and very real. We are audited continuously and get "reminders" if every titration is not correctly documented. It creates extraordinary, unnecessary pressure...” (R9)

Harm: Moral Dilemma

“Due to JC finding, we are forced to LIE about what we are doing. Example if patient is crumping & order is to titrate levo by 1, I am going to titrate how I need to keep patient alive & then fake my documentation.” (Row 79)

Harm: Patient Safety

“My main concern in titration parameters is delay in care. Too often I have had patients or been involved in helping another nurse’s patients, who require much more large titrations upwards to control severe agitation or profound hypotension.”(R27)

Professionalism: Autonomy

- *"I appreciate the effort to put the titration of vasoactive medications back into the hands of the critical care RN so she/he can respond to the changing patients needs. This is the art of critical care nursing and belongs at the bedside."* (row 66)

- *"The titration parameters recommended by TJC are profoundly unrealistic in an ICU setting. Nurses in an ICU setting have received the training and classes to be able to titrate an infusion without strict parameters..." (row 15)*

Professionalism: Nurse Proficiency

"I really appreciate this survey. In my experience, the providers writing the titration amounts and frequency have little or no experience with actually titrating IV drips at the bedside. These strict titration parameters do not take into account differences between patients (sensitivity to meds, pain med tolerance, other hemodynamic issues etc)--which is why nursing judgement/autonomy should not be limited by these TJC requirements." (row 108)

Conclusion

The standards impose harm through

- erosion of workplace wellness
- introduction of moral dilemmas
- patient safety concerns

Professionalism is threatened through

- limits on scope and autonomy

Nurses may be better suited than physicians to determine titration specifics

- Moment by moment changing patient needs

The Joint Commission Clarifies Expectations for Implementing Medication Titration Orders

The clinical care of patients can require the use of complex medication orders such as titration orders. To continue its efforts to keep its standards up to date and increase quality and safety of patient care, The Joint Commission recently collaborated with accredited organizations and key stakeholders to identify risks associated with ordering and implementing these order types. As a result, The Joint Commission revised its requirements to clarify administration and documentation of titrated medications, along with the minimum elements of a complete medication order.

Ordering Titratable Medications

The Joint Commission modified "Medication Management" (MM) Standard MM.04.01.01, Element of Performance (EP) EP 2, to clarify the minimum components of a medication order for **ambulatory health care** organizations, **behavioral health care and human services** organizations, **critical access hospitals**, **home care** organizations, **hospitals**, and **nursing care centers**. In addition, further guidance is provided for orders written for administering titrated medications for health care organizations with policies stipulating titration orders acceptable for use. These revisions (*see* the underlined text in the following box) are **effective January 1, 2021**.

Joint Commission

Requirement

Official Publication of Joint Commission Requirements

Revised Requirements Related to Medication Titration Orders

APPLICABLE TO AMBULATORY HEALTH CARE ORGANIZATIONS, BEHAVIORAL HEALTH CARE AND HUMAN SERVICES ORGANIZATIONS, CRITICAL ACCESS HOSPITALS, HOME CARE ORGANIZATIONS, HOSPITALS, AND NURSING CARE CENTERS

Effective January 1, 2021

Medication Management (MM)

Standard MM.04.01.01: Medication orders [or prescriptions] are clear and accurate.

Element of Performance for MM.04.01.01

2 Ⓓ The [organization] follows a written policy that defines the following:

- The minimum required elements of a complete medication order, which must include medication name, medication dose, medication route, and medication frequency
- When indication for use is required on a medication order
- The precautions for ordering medications with look-alike or sound-alike names
- Actions to take when medication orders are incomplete, illegible, or unclear
- For medication titration orders, required elements include the medication name, medication route, initial rate of infusion (dose/unit of time), incremental units to which the rate or dose can be increased or decreased, how often the rate or dose can be changed, the maximum rate or dose of infusion, and the objective clinical measure to be used to guide changes

Note: *Examples of objective clinical measures to be used to guide titration changes include blood pressure, Richmond Agitation–Sedation Scale (RASS), and the Confusion Assessment Method (CAM).*

ICU Nurse: **Published**: Dec 2020

Block Charting Available for Vasoactive IV Medications

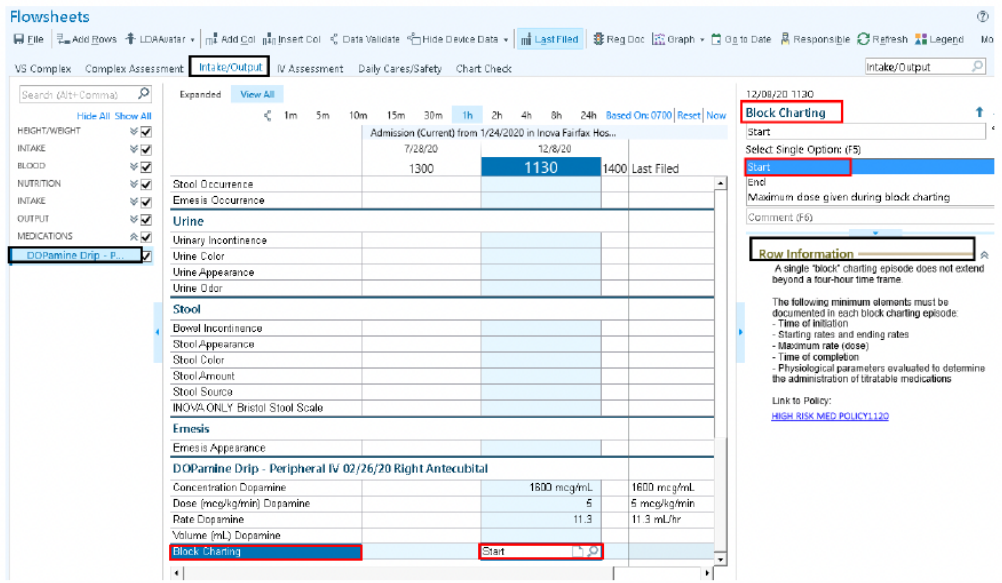
Summary: Block Charting is now available in Epic flowsheets for documentation of a defined group of high risk continuous medications including Dopamine, Nicardipine, Norepinephrine, Nitroprusside, Nitroglycerin, Epinephrine, Angiotensin II, and Phenylephrine.

A. **Policy/ Workflow Considerations**:

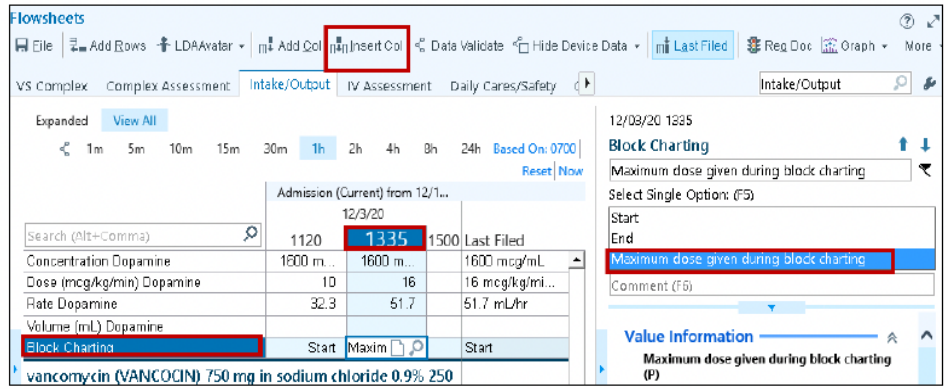
1. Block Charting is to be used in coordination with High Risk Medication Inova Policy 1120.

2. A single 'block' charting episode does not extend beyond a four (4) hour time frame. If a patient's urgent/emergent situation extends beyond 4 hours and block charting is continued, a new charting 'block' period must be started.
3. The following must be documented with each block charting episode:
   - Start time of initiation of block charting
   - Name of medication administered during block
   - Starting rates and ending rates of medication administered during block
   - Maximum rate (dose) of medication administered during block
   - Time of completion of block
   - Physiological parameters evaluated to determine the administration of titratable medication during the block (ie: blood pressure for dopamine)

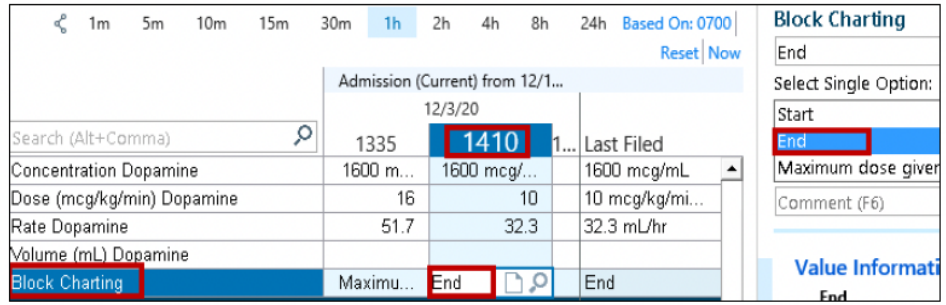
B. **Start Block Charting:** Acknowledge order, review with 2nd RN, document administration in MAR, go to Flowsheets click Intake/Output tab. Insert column to note time and document **'Start'** on **Block Charting Row.** Note Row information regarding Block Charting included with link to High Risk Medication Policy.



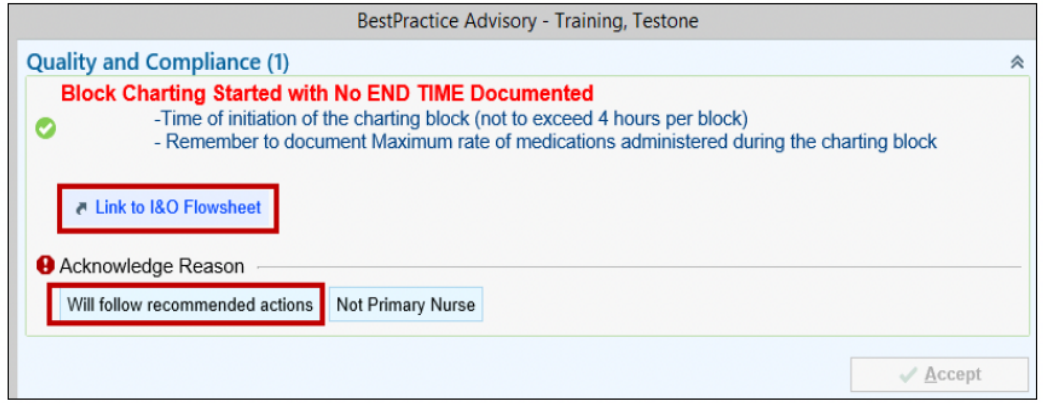
C. **Chart Maximum Dose given** during 4 hour block charting episode chart the maximum dose of medication in flowsheets: go to intake/output tab, click on medication, click insert coln, type time of maximum dose, choose "**Maximum dose given during block charting**" and record dose in dose row



D. **Chart End of block charting:** go to intake/output tab, click on medication, click insert coln, type time of ending chart block by choosing "End"



E. **BPA for incomplete documentation**: If block charting has been going for longer than 4 hours and no end time has been charted, a BPA will fire for nurses to click on link to flowsheets to complete documentation:



Vasopressor Discontinuation

STRATEGIES FOR SUCCESS

TARGET Population for lower MAP goals

- Per multiple guideline recommendations, all patients with septic shock should target MAP ≥65mmHg
- Populations where Lower MAP Goals have the highest recommendation:
  - Clinically-relevant bleeding
  - Major persistent arrhythmias
  - Myocardial infarction
  - Mesenteric ischemia
  - Distal-limb ischemia
  - ESRD patients
- Evolving literature in patients with TBI or delirium
  - Brain Trauma Foundation recommends a target CPP between 50 and 70 mmHg

Bratton, S. L., Chestnut, R. M., Ghajar, J., McConnell, F. H., Harris, O. A., Hartl, R., ... & Schouten, J. (2007). Guidelines for the management of severe traumatic brain injury. IX. Cerebral perfusion thresholds. *Journal of neurotrauma*, *24*, S59-64. Kato, R., & Pinsky, M. R. (2015). Personalizing blood pressure management in septic shock. Annals of intensive care, 5(1), 41.

BE A WEAN-ER!

Figure 3: Prototype for Vasopressor Weaning

1) Patient maintaining stable hemodynamics and adequately fluid resuscitated
2) Determine priority of vasopressor weaning and/or collaborate with provider
3) Change monitor alarms to promote rapid weaning • MAP goal (e.g., 65-70 mmHg) • HR goal (e.g., 80-120 BPM)
4) Wean vasopressors based on Table 1 or hospital/unit policy
5) Closely monitor perfusion • Other vital signs: O2 saturation, HR, RR • Central venous oxygen saturation (if present) • Urine output
6) Discontinue vasopressors

*Patient specific
MAP-mean arterial pressure, HR-heart rate, BPM-beats per minute, O2-oxygen, HR-heart rate,

norepinephrine (LEVOPHED) 8 mg in sodium chloride 0.9% (NS) 250 mL (32 mcg/mL) infusion (CMPD) (USE ORDER SET)	1-30 mcg/min (1.875-56.25 mL/hr, rounded to 1.9-56.3 mL/hr), intravenous Titrated, Starting today at 0500, Until Discontinued Initiate infusion at 5 mcg/min and titrate to achieve target MAP of 65 mm Hg to 75 mm Hg to a maximum dose of 30 mcg/min. Upward titration: • If MAP less than or equal to 45 mm Hg, titrate UP by 10 mcg/min every 5 minutes. • If MAP 46 to 55 mm Hg, titrate UP by 5 mcg/min every 5 minutes. • If MAP 56 to 65 mm Hg, titrate UP by 2.5 mcg/min every 5 minutes. • If MAP 66 to 75 mm Hg, NO change. Downward titration until infusion is off: • If MAP 76 to 85 mm Hg, DECREASE by 2.5 mcg/min every 10 minutes. • If MAP greater than 85 mm Hg, DECREASE by 5 mcg/min every 10 minutes. If patient is on multiple vasopressor agents, refer to nursing order "Multiple Continuous Infusions Titration Instructions" for titration sequence. High alert. Vesicant - avoid extravasation. See cardiac medication monitoring guidelines. Protect from light.

phenylephrine (NEO-SYNEPHRINE) 50 mg in dextrose 5% (D5W) 250 mL (200 mcg/mL) infusion	10-300 mcg/min (3-90 mL/hr), intravenous Titrated, Starting today at 0815, Until Discontinued Initiate infusion at 10 mcg/min and titrate to achieve target MAP of 65 mm Hg to 75 mm Hg to a maximum dose of 300 mcg/min. Upward titration: • If MAP less than or equal to 45 mm Hg, titrate up by 50 mcg/min every 5 minutes. • If MAP 46 to 55 mm Hg, titrate UP by 20 mcg/min every 5 minutes. • If MAP 56 to 65 mm Hg, titrate UP by 10 mcg/min every 5 minutes. • If MAP 66 to 75 mm Hg, NO change. Downward titration until infusion is off: • If MAP 76 to 85 mm Hg, DECREASE by 10 mcg/min every 10 minutes. • If MAP greater than 85 mm Hg, DECREASE by 20 mcg/min every 10 minutes. If patient is on multiple vasopressor agents, refer to nursing order "Multiple Continuous Infusions Titration Instructions" for titration sequence. High alert. Vesicant - avoid extravasation. See cardiac medication monitoring guidelines. Do NOT refrigerate.
vasopressin (PITRESSIN) 60 Units in sodium chloride 0.9% (NS) 60 mL (1 unit/mL) infusion	0.01-0.03 Units/min (0.6-1.8 mL/hr), intravenous Titrated, Starting today at 0745, Until Discontinued • Initiate infusion at 0.03 units/minute. • Weaning parameters: AFTER primary vasopressor is turned off: if MAP greater than 75 mm Hg, decrease dose by 0.01 units/minute every 60 minutes until infusion is off. • If patient is on multiple vasopressor agents, refer to nursing order "Multiple Continuous Infusions Titration Instructions" for titration sequence. High alert. Vesicant - avoid extravasation. See cardiac medication monitoring guidelines. Do NOT refrigerate.

New Orders

Multiple Continuous Infusions Titration Instructions

Routine, Admin instructions - Patient is receiving multiple infusions for {Indication:304210001}.
- First, increase *** infusion per medication administration instructions as needed to a rate of *** to achieve the therapeutic goal. If therapeutic goal is not achieved after the above is done, then increase *** infusion rate per medication administration instructions. Contact ICU provider if therapeutic goal unable to be achieved. - Once therapeutic goal is achieved, first wean *** infusion down per medication administration instructions as tolerated to a rate of {Titration Off:304210002}, then initiate weaning of *** infusion per medication administration instructions.

Individual titration

- Tailored titration of catecholamines to each patient. Avoid wide fluctuations in MAP
- Establish an individualized target MAP goal based on the patient scenario
- Change alarm limits on the monitor to reduce nuisance alarms and to encourage nursing titration
- WEAN. Less is More.

Case Study 1*

- 65yo with gram negative, septic shock
- Arterial BP: 120/76 (91)
- Heart Rate: 110
- CVP: 16
- Not intubated
- Non-Invasive CO:
  - SVR: 900
  - CO/CI: 5/2.5

- Norepinephrine 10 mcg/min
- Phenylephrine 100 mcg/min
- Vasopressin 0.04 u/min

- **Which vasopressor to wean first? Why?**
- Norepinephrine vs Phenyl

Case Study 2

- 56yo with COVID pneumonia
- Arterial BP: 140/56 (84)
- Heart Rate: 126
- RASS -2, intubated
- CVP: 12
- Non-Invasive CO:
  - SVR: 1400
  - CO/CI: 6/3.2

- Norepinephrine 30mcg/min
- Vasopressin 0.03u/min
- Epinephrine 15mcg/min
- Ang II 40ng/kg/min

- **Which vasopressor to wean first? Why?**

Case Study 3

- 78yo F with hx AF s/p Ao Valve replacement and Maze Procedure
- Arterial BP: 142/60 (87)
- Hear Rate: 140 irregular
- RASS -2, intubated
- CVP: 10
- Swan:
  - SVR: 1000
  - CO/CI: 6/3.0

- Norepinephrine 24mcg/min
- Phenylephrine 25mcg/min
- Vasopressin 0.03u/min

- **Which vasopressor to wean first? Why?**

Case Study 4

- 45yo M with cellulitis
- Arterial BP: 100/64 (76)
- Hear Rate: 82
- Not intubated

- Norepinephrine 10mcg/min
- Vasopressin 0.04u/min

- **Which vasopressor to wean first? Why?**

Questions?

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