



Pharmacy Grand Rounds

200 First Street SW
Rochester, Minnesota 55905

<https://ce.mayo.edu/pharmacy-grandrounds-2026>

Going with the Flow: Milrinone's Role in Cerebral Vasospasm

Session Date: 08/11/2026

Session Time: 11:00 – 11:45 AM (CST)

Target Audience

This continuing education (CE) session was planned to meet the needs of professional staff who deal with the selection and monitoring of medication(s) as part of their patient care duties, including pharmacists, RNs, APRNs, PAs, MDs.

Activity Overview

Aneurysmal subarachnoid hemorrhage (aSAH) is a neurologic emergency associated with significant morbidity and mortality. Delayed cerebral ischemia (DCI), which typically occurs several days after the initial hemorrhage, is a major contributor to poor neurological outcomes. Current strategies for the prevention and treatment of DCI remain limited, with guideline-directed management consisting of nimodipine and maintenance of euvolemia for prevention of DCI and induced hypertension for the treatment of symptomatic DCI. Intravenous milrinone, a phosphodiesterase-3 inhibitor, has emerged as a promising off-label treatment for cerebral vasospasm (CVS) and DCI. However, its role in clinical practice remains uncertain due to limited high-quality evidence and variability in treatment protocols. This presentation will review the mechanism of action and rationale for the use of milrinone in the context of the pathophysiology of CVS and DCI, evaluate the current literature assessing its efficacy and safety, and discuss the remaining knowledge gaps related to its incorporation into clinical practice.

Learning Objectives

At the conclusion of this knowledge-based CE session, participants should be able to:

1. Describe the pathophysiology of delayed cerebral ischemia (DCI) following aneurysmal subarachnoid hemorrhage (aSAH)s
2. Explain the mechanism of action and rationale for use of IV milrinone in the treatment of cerebral vasospasm and DCI
3. Evaluate current evidence regarding the efficacy and safety of IV milrinone for DCI and its use in clinical practice

Faculty Information

Ariel Musheyev, PharmD
PGY1 Pharmacy Resident
Mayo Clinic Hospital - Rochester, MN

Dr. Ariel Musheyev received his Doctor of Pharmacy degree from the University of Colorado Skaggs School of Pharmacy and completed his PGY1 Pharmacy Residency at Mayo Clinic. He is currently a PGY2 Critical Care Pharmacy Resident at Mayo Clinic Hospital – Rochester. His professional interests include neurocritical care, cardiovascular critical care, and emergency medicine.



Approved Provider Statement



In support of improving patient care, Mayo Clinic College of Medicine and Science is jointly accredited by the Accreditation Council for Continuing Medical Education (ACCME), the Accreditation Council for Pharmacy Education (ACPE), and the American Nurses Credentialing Center (ANCC) to provide continuing education for the healthcare team.

Credit Statements

AMA

Mayo Clinic College of Medicine and Science designates this live activity for a maximum of 0.75 *AMA PRA Category 1 Credits™*. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

AAPA



Mayo Clinic College of Medicine and Science has been authorized by the American Academy of Physician Associates (AAPA) to award AAPA Category 1 CME credit for activities planned in accordance with AAPA CME Criteria. This activity is designated for 0.75 AAPA Category 1 CME credits. PAs should only claim credit commensurate with the extent of their participation.

ACPE



ACPE Universal Activity Number (UAN): JA0000238-0000-26-051-L01-P

Mayo Clinic College of Medicine and Science designates this educational activity for a maximum of 0.75 ACPE Knowledge-based contact hours. Participants should claim only the credit commensurate with the extent of their participation in the activity

ANCC

Mayo Clinic College of Medicine and Science designates this activity for a maximum of 0.75 ANCC contact hours. Nurses should claim only the credit commensurate with the extent of their participation in the activity.

IPCE



This activity was planned by and for the healthcare team, and learners will receive 0.75 Interprofessional Continuing Education (IPCE) credit for learning and change.

Educational Format and CE Requirements

This CE session is available as a live presentation, including live webcast. Participants must complete the following to record attendance and obtain CE credit:

1. Attend the entire session.
2. Text the session code to 507-200-3010 within 48 hours of the live presentation to record attendance.
 - a. This number is only used for receiving text messages related to tracking attendance
 - b. Employees are encouraged to create a contact in their mobile phone, as the same number is used to record

attendance for every session

3. Complete the online evaluation for the respective session within 2 weeks of live presentation.

Pharmacist CE credit is electronically transferred to the National Association of Boards of Pharmacy CPE Monitor. To track CE, please go to [NABP CPE Monitor](#).

Non-pharmacist attendees can print out a record of attendance at ce.mayo.edu after completing the evaluation and claiming credit.

[Live Webcast](#) – Register from the Education SharePoint site

Disclosure Summary

As a provider accredited by Joint Accreditation for Interprofessional Continuing Education, Mayo Clinic College of Medicine and Science must ensure balance, independence, objectivity and scientific rigor in its educational activities. All who are in a position to control the content are required to disclose all financial relationships with any ineligible company. Faculty will also identify any off-label and/or investigational use of pharmaceuticals or instruments discussed in their content for FDA compliance.

Listed below are individuals with control of the content of this program who have disclosed:

The faculty report the following relationships:

- Ariel Musheyev, PharmD
 - Declares no financial relationship(s) pertinent to this session
 - Declares off-label use of Milrinone will be discussed during this presentation

Course Director and Planning Committee Members declare the following relevant financial relationship(s) pertinent to this session.

- No relevant financial relationship(s) with ineligible companies:
 - Jennifer Elmer, DNP, APRN, CCNS
 - Andrew Herber, PA-C
 - Sarah Jane Kotval, MEd, BSW, RSS Coordinator
 - Scott Nei, PharmD, BCPS, BCCCP, FCCM, FMSHP
- Relevant financial relationship(s) with ineligible companies:
 - Wayne Nicholson, MD, PharmD, BCPS - Intellectual Property - Anivive Lifesciences, Inc.

All relevant financial relationships have been mitigated.

For additional disclosure information regarding Mayo Clinic School of Continuous Professional Development accreditation review committee members visit ce.mayo.edu, About Us, Disclosures - or -

<https://ce.mayo.edu/content/disclosures>

System and Technical Requirements

For participants viewing the webcast, sessions are delivered via Mayo Clinic intranet web browser and Adobe® PDF. For participants viewing outside the Mayo Clinic firewall, a VPN connection is required for remote access. Recommended web browser includes Google Chrome. This session is planned and coordinated by **the Department of Pharmacy, Mayo Clinic**.