Guidelines for the neurocritical care management of aneurysmal subarachnoid hemorrhage.

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Treggiari MM, Rabinstein AA, Busl KM, et al. Guidelines for the neurocritical care management of aneurysmal subarachnoid hemorrhage. Neurocrit Care. 2023 Aug;39(1):1-28. [160 references] *PubMed*

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Overview

Guideline Objective

To provide recommendations on the medical management of patients with aneurysmal subarachnoid hemorrhage (aSAH) based on a rigorous review of the available literature

Patient Population

Adult patients with aSAH

Recommendations

Recommendation Statements

Blood Pressure Targets for the Prevention of Rebleeding of Ruptured Aneurysm

In patients with aneurysmal subarachnoid hemorrhage (aSAH), what is the impact of blood pressure reduction compared with no blood pressure reduction before aneurysm treatment on mortality, modified Rankin scale (mRS) score, Glasgow outcome scale (GOS) score, new cerebral infarction, rebleeding, and delayed cerebral ischemia (DCI)?

There is insufficient evidence to recommend a blood pressure reduction goal for the treatment of hypertension before aneurysm treatment in aSAH. Lack of evidence to recommend a specific blood pressure reduction goal does not necessarily imply that blood pressure reduction is not helpful before aneurysm treatment.

Antifibrinolytics for the Prevention of Rebleeding of Ruptured Aneurysm

In patients with aSAH, what is the impact of administering antifibrinolytics prior to aneurysm treatment compared with no antifibrinolytics on mortality, mRS, GOS, new cerebral infarction, rebleeding, DCI, and thrombotic events?

We recommend against the administration of antifibrinolytic therapy to prevent rebleeding of ruptured aneurysms in patients with aSAH. (**Strong recommendation; High-moderate quality of evidence**)

Calcium Channel Blockers

In patients with aSAH, what is the impact of administering calcium channel blockers compared with no calcium channel blockers on mortality, mRS, GOS, new cerebral infarction, and prevention of DCI?

1. We recommend the administration of oral nimodipine in patients with aSAH to reduce DCI and cerebral infarction, and to improve functional outcome. (**Strong recommendation; Moderate quality of evidence**)

2. We recommend against the administration of intravenous (IV) nicardipine for the prevention of DCI because of increased risk of adverse effects. (**Strong recommendation; Moderate quality of evidence**)

3. There is insufficient evidence to recommend for or against the administration of calcium channel blocker other than nicardipine by intravenous or intraventricular routes.

Endothelin Antagonists

In patients with aSAH, what is the impact of endothelin antagonists compared with no endothelin antagonists on mortality, mRS, GOS, new cerebral infarction, and prevention of DCI?

We recommend against endothelin receptor antagonist administration because of lack of benefit on mortality and functional outcomes and an increased risk of adverse events. (**Strong recommendation; High quality of evidence**)

Statins

In patients with aSAH, what is the impact of statin treatment compared with no statins on mortality, mRS, GOS, new cerebral infarction, and prevention of DCI?

We recommend against starting statin treatment to reduce DCI or improve functional outcomes in aSAH because of lack of benefit. (**Strong recommendation; High quality of evidence**)

Magnesium/Therapeutic Hypermagnesemia

In patients with aSAH, what is the impact of targeted therapeutic hypermagnesemia compared with no targeted hypermagnesemia on mortality, mRS, GOS, new cerebral infarction, and prevention of DCI?

We recommend against the use of targeted hypermagnesemia to improve outcomes in aSAH due to lack of benefit. (**Strong recommendation; Moderate quality evidence**)

Hemodynamic Management: Fluid Administration

In patients with aSAH at risk for DCI, what is the impact of high volume (liberal, targeting hypervolemia) fluid administration compared with conventional fluid management, targeting euvolemia, on mortality, mRS, GOS, new cerebral infarction, DCI, and pulmonary edema?

1. We suggest against liberal fluid administration because of an increased risk of pulmonary edema. (**Conditional recommendation; Low quality of evidence**)
2. We suggest using targeted fluid administration to achieve euvolemia, which may include goal directed hemodynamic therapy, to reduce the risk of pulmonary edema, prevent DCI, and improve functional outcome. (**Conditional recommendation; Very low quality of evidence**)

Hemodynamic Management: Blood Pressure and Cardiac Output Augmentation

In patients with aSAH at risk for DCI or diagnosed with DCI, what is the impact of blood pressure and/or cardiac output augmentation compared with no blood pressure or cardiac output augmentation on mortality, mRS, GOS, new cerebral infarction, DCI prevention, pulmonary edema, myocardial infarction, and arrhythmia?

There are insufficient quality data to recommend for or against blood pressure or cardiac output augmentation for the prevention and treatment of DCI. Due to the associated risks, use of these interventions should be judicious and tailored to the patient's individual hemodynamic profile.

DCI Management: Triggers for Interventional Procedures for Treatment of DCI

In patients with aSAH, is treatment triggered by change in examination plus advanced neuroimaging (CT angiography, CT perfusion, transcranial Doppler)

versus examination alone superior in improving mortality, mRS, GOS, and preventing new cerebral infarction?

There is insufficient evidence to provide a recommendation on the optimal trigger (change in neurological exam plus findings on advanced neuroimaging versus change in exam alone) for interventional procedures for the treatment of DCI.

Mineralocorticoid Therapy for the Management of Hyponatremia

In patients with aSAH, what is the impact of treatment with mineralocorticoids compared with no treatment with mineralocorticoids on mortality, mRS, GOS, new cerebral infarction, serum sodium levels, and fluid balance?

There is insufficient evidence to support mineralocorticoid administration to maintain normal serum sodium concentrations and/or even fluid balance or to improve functional outcome.

Management of Anemia

In patients with aSAH, is a more aggressive transfusion strategy (to keep a hemoglobin >10 g/dL) more effective than a conservative transfusion strategy (to keep a hemoglobin >7 g/dL) to improve mortality, mRS, GOS, new cerebral infarction, DCI prevention, and transfusion-related complications?

There is insufficient evidence to provide a recommendation for using a transfusion threshold higher than a hemoglobin of >7 g/dL in patients with aSAH.

Management of Hydrocephalus

In patients with aSAH and an indwelling external ventricular drain (EVD), is a strategy based on direct clamping superior to gradual weaning on mortality, mRS, GOS, new cerebral infarction, incidence of ventriculoperitoneal (VP) shunt placement, rate of infection, and EVD complications?

There is insufficient evidence to provide a recommendation on direct clamping versus gradual weaning strategy for EVD removal for the management of hydrocephalus in patients with aSAH.

Evidence Rating Scheme

Grading of Recommendations Assessment, Development, and Evaluation (GRADE) Working Group Grades of Evidence

High certainty: Very confident that the true effect lies close to that of the estimate of the effect.

Moderate certainty: Moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.

Low certainty: Limited confidence in the effect estimate: the true effect may be substantially different from the estimate of the effect.

Very low certainty: Very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Recommendation Rating Scheme

As per GRADE methodology, recommendations are labeled as "strong" or "conditional" or "insuffcient evidence." The statement "we recommend" or "we recommend against" indicate strong recommendations, and "we suggest" indicate conditional recommendations.

Related Content

Supporting Documents

- Supplementary Material Table 1. List of Specific Outcomes Selected for Data Abstraction of Each PICO Question.

- Supplementary Material Table 2. aSAH Search Strategies.
- Supplementary Material Table 3. Detailed Evidence Tables.

Implementation Tools

No implementation tools available.

Patient Education

No patient education materials available.

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TRUST Scorecard

Composition of Guideline Development Group (GDG)

Multidisciplinary GDG Members	**Yes**
Methodologist Involvement	**Yes**
Incorporation of Patient and Public Perspective	

Systematic Review of Evidence

Literature Search	
Study Selection	
Evidence Synthesis	

Foundations for Recommendations

Strength of Evidence Grade	
Description of Benefits and Harms of Recommendations	
Summary of Evidence Supporting Recommendations	
Strength of Recommendations Rating	
Clear Articulation of Recommendations	

Funding Source

Yes

Disclosure and Management of Financial Conflicts of Interests



External Review



Updating



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