2026 ESO-EANS-ESMINT guidelines on management of aneurysmal subarachnoid hemorrhage

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Disclosures

Intellectual Disclosures:

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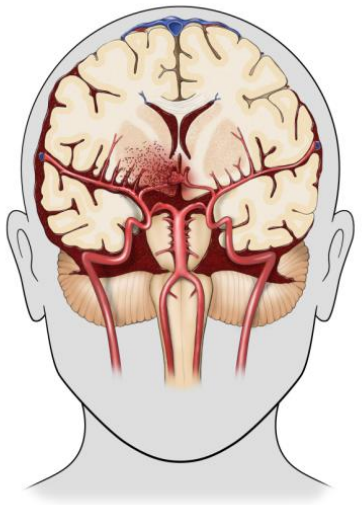
Aneurysmal subarachnoid hemorrhage (SAH)

- SAH incidence per year: 6 per 100,000 person-years
- Median age of SAH patients: 52 years
- Mortality up to 50 %, severe neurological deficits 30 %
- 700,000 new SAH cases globally in 2021
- 350,000 SAH deaths, > 10 million SAH-related disability-adjusted life-years globally



SAH remains one of the most common cardiovascular and neurological causes of death and disabilities in the world

Etminan et al., JAMA Neuro 2019;Ziebart et al, ESJ 2024;Naidech et al, Arch Neurol 2005;GBD Investigator, JAMA Neuro 2025

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› 6 Neurosurgeons, 5 Neurologists, 3 Neuroradiologists, 3 Fellows

10 Topics/PICOS on relevant aspects of management of SAH

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PICO 1a: Antifibrinolytic drug treatment


Mervyn Vergouwen


Thomas Gaberel

In adult patients with aSAH, does treatment with antifibrinolytic drugs compared to no antifibrinolytic drugs decrease the risk of poor functional outcome?

Evidence-based Recommendations	Quality of evidence	Strength
In adult patients with aSAH, we recommend against routine administration of antifibrinolytic drugs prior to treatment of the ruptured aneurysm to decrease the risk of poor functional outcome.	⊕⊕⊕	↓↓

Poor outcome: OR 1.03 (95%CI: 0.86-1.23) | Case fatality: OR 0.96 (95%CI: 0.81-1.15)
Rebleeding: RR 0.56 (95%CI: 0.37-0.83) – despite reduced rebleeding, no effect on outcome

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PICO 1b: Antihypertensive drug treatment


Mervyn Vergouwen


Thomas Gaberel

In adult patients with aSAH, does treatment with antihypertensive drugs compared to no antihypertensive drugs decrease the risk of poor functional outcome?

Evidence-based Recommendations	Quality of evidence	Strength
In adult patients with aSAH, no recommendation can be made on the administration of blood pressure lowering drugs prior to treatment of the ruptured aneurysm.	⊕	-

No RCTs identified; no data for meta-analysis

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Expert Consensus Statement

PICO 1b: Antihypertensive drug treatment

Mervyn Vergouwen

Thomas Gaberel

Expert Consensus Statements

- In adult patients with aSAH and systolic blood pressures higher than 160-180 mm Hg persisting after installment of analgesics, oral nimodipine and urinary catheter prior to aneurysm treatment, we suggest considering blood pressure lowering drugs to lower systolic blood pressure to around 160 mm Hg to reduce the risk of rebleeding.

Vote: 11/13

- If it is decided to give blood pressure lowering drugs, we suggest continuous infusion of short-acting drugs, e.g. labetalol, and avoiding diuretic drugs to maintain normovolemia. Care should be taken to ensure that the blood pressure reduction is gradual (no more than 10% reduction in MAP within 2 hours) to decrease the risk of DCI.

Vote: 11/13

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PICO 2: Timing of aneurysm treatment


Miika Korja


Raimund Helbok

In adult patients with aSAH, does early aneurysm occlusion compared to no early aneurysm occlusion decrease the risk of poor functional outcome?

Evidence-based Recommendations	Quality of evidence	Strength
In adult patients with aSAH, no recommendation can be made on treating the ruptured aneurysm as early as possible to decrease the risk of poor functional outcome.	⊕	-

Only 1 small RCT (n=211) from the pre-coiling era; no RCTs from the endovascular era

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Expert Consensus Statement

PICO 2: Timing of aneurysm treatment


Miika Korja


Raimund Helbok

Expert Consensus Statement

In adult patients with aSAH, we suggest treatment of the ruptured aneurysm **within 24 hours after ictus**. The timing should be optimized to ensure that the most dedicated team of experts is available when needed.

Vote: 13/13

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PICO 3a:
Endovascular or clipping for ruptured IA


Peter Vajkoczy


Gabriel Rinkel

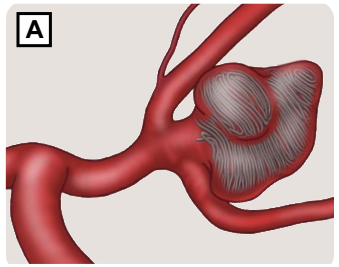

Christian Taschner

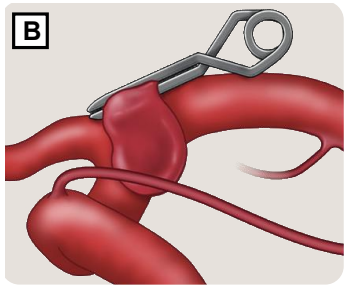

Thorstein Meling

In adult patients with aSAH, does any type of endovascular aneurysm occlusion compared to microsurgical aneurysm occlusion decrease the risk of poor functional outcome?

Evidence-based Recommendations	Quality of evidence	Strength
In adult patients with aSAH in good clinical condition (WFNS I-III) with aneurysms that can be treated by either regular coiling or neurosurgical clipping, we recommend regular coiling as the preferred strategy.	⊕⊕⊕⊕	↑↑

Cochrane: 4 RCTs, 2,458 patients; RR poor outcome: 0.77 (95%CI: 0.67-0.87)
10-year follow-up: RR 0.81 (95%CI: 0.70-0.92)





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Expert Consensus Statement

PICO 3a: Coiling or clipping


Peter Vajkoczy


Gabriel Rinkel


Christian Taschner


Thorstein Meling

Expert Consensus Statements

- We suggest that all patients with aSAH are discussed interdisciplinary, with **at least one neurosurgeon and one neuro-interventionalist**. (Vote: 13/13)

- We suggest that the team discuss which modality would result in the best clinical outcome of the specific patient. (Vote: 13/13)

- In patients **younger than 45 years**, the better long-term protection from clipping should be considered. (Vote: 12/13)

- In patients in **poor clinical condition (GCS < 13), we suggest a multidisciplinary approach for type and timing of treatment.** (Vote: 13/13)

- In patients with a poor/worsening, we **suggest immediate surgery for clipping and haematoma removal**. (Vote: 11/13)

condition from space-occupying haematoma

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PICO 3b: Endovascular options other than coiling


Peter Vajkoczy


Gabriel Rinkel


Christian Taschner


Thorstein Meling

In adult patients with aSAH, does any type of endovascular treatment other than coiling compared to coiling decrease the risk of poor functional outcome?

Evidence-based Recommendations	Quality of evidence	Strength
In adult patients with aSAH, no recommendation can be made on the use of endovascular treatment options other than regular coiling.	⊕	-

ISAT-2: 270/1,896 patients, prematurely halted; RR 0.90 (95%CI: 0.61-1.31)
Residual aneurysms: microsurgery 8% vs. EVT 20%

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Expert Consensus Statement

PICO 3b: Endovascular options other than coiling


Peter Vajkoczy


Gabriel Rinkel


Christian Taschner


Thorstein Meling

Expert Consensus Statements

- If regular coiling is not feasible, the multidisciplinary team should discuss the safety, effectiveness, and durability of microsurgical and alternative endovascular options. (Vote: 12/13)

- We suggest stent-assisted coiling in selected cases where other treatment options are not feasible. (Vote: 13/13)

- We suggest to reserve flow diversion as a last-line treatment option. (Vote: 12/13)

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PICO 4:
Prevention of delayed cerebral ischemia

Elisa Cuadrado-Godia

Nima Etminan

In adult patients with aSAH, does any type of treatment aiming to reduce the risk of DCI decrease the risk of poor functional outcome?

Evidence-based Recommendations	Quality of evidence	Strength
In adult patients with aSAH, we recommend prophylactic treatment with oral nimodipine to decrease the risk of poor functional outcome.	⊕⊕⊕⊕	↑↑
In adult patients with aSAH, we do not recommend treatment with tirilazad, statins, magnesium sulfate, or endothelin receptor antagonists.	⊕⊕⊕	↓↓

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PICO 4: Prevention of DCI (continued)

Elisa Cuadrado-Godia

Nima Etminan

In adult patients with aSAH, does any type of treatment aiming to reduce the risk of DCI decrease the risk of poor functional outcome?

Evidence-based Recommendations	Quality of evidence	Strength
In adult patients with aSAH, no recommendation can be made on prophylactic treatment with antiplatelet drugs or lumbar drainage until further RCT data are available.	⊕⊕	-

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PICO 5a: Medical treatment of DCI


Marios Psychogios


Peter Vajkoczy


Christian Taschner


Thorstein Meling

In adult patients with aSAH and clinical deterioration due to DCI, does hypertension induction decrease the risk of poor functional outcome?

Evidence-based Recommendations	Quality of evidence	Strength
In adult patients with aSAH and DCI, no recommendation can be made on hypertension induction to decrease the risk of poor functional outcome.	⊕⊕	-

1 RCT, halted (41/240 patients); aRR 1.0 (95%CI: 0.6-1.8); SAEs: RR 2.0 (95%CI: 0.9-5.0)

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Expert Consensus Statement

PICO 5a: Medical treatment of DCI


Marios Psychogios


Peter Vajkoczy


Christian Taschner


Thorstein Meling

Expert Consensus Statement

In adult patients with aSAH and clinical deterioration due to delayed cerebral ischaemia, we suggest considering induced hypertension, provided that the ruptured aneurysm is treated and after standard therapy has proven insufficient. Clinical contraindications and potential complications of induced hypertension should be considered.

Vote: 11/13

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PICO 5b:
Endovascular treatment of DCI


Marios Psychogios


Peter Vajkoczy


Christian Taschner


Thorstein Meling

In adult patients with aSAH and clinical deterioration due to DCI, does endovascular treatment of vasospasm decrease the risk of poor functional outcome?

Evidence-based Recommendations	Quality of evidence	Strength
In adult patients with aSAH and DCI, no recommendation can be made on endovascular treatment of vasospasm.	⊕⊕	-

2 RCTs; pooled OR for poor outcome: 2.33 (95%CI: 1.05-5.18)

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Expert Consensus Statement

PICO 5b: Endovascular treatment of DCI


Marios Psychogios


Peter Vajkoczy


Christian Taschner


Thorstein Meling

Expert Consensus Statements

- We suggest considering intraarterial pharmacological treatment as a rescue therapy in selected patients with refractory severe vasospasm. (Vote: 11/13)

- The evidence is insufficient to support routine balloon angioplasty. In selected cases, it may be considered as a last-line rescue treatment after careful multidisciplinary discussion. (Vote: 12/13)

- The current data are insufficient to support the use of temporary deployment of retrievable stents. (Vote: 13/13)

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Expert Consensus Statement

PICO 6a: Neuroimaging

Michael Hugelshofer

Elke Gizewski

No evidence-based recommendation possible

Expert Consensus Statements

- In patients with clinical deterioration, we suggest plain head CT in combination with CT-Perfusion (CTP) to detect the cause of deterioration. (Vote: 11/13)

- In neurologically not assessable patients at high risk for DCI, we suggest plain head CT and CTP at least once between day 4 and 14. (Vote: 10/13)

- We do not suggest routine DSA for screening of macrovascular vasospasm. (Vote: 13/13)

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Expert Consensus Statement

PICO 6b: Neuromonitoring

Michael Hugelshofer

Elke Gizewski

No evidence-based recommendation possible

Expert Consensus Statements

- No suggestion can be given on the use of TCD monitoring. (Vote: 10/13)
- In patients with radiological hydrocephalus who are neurologically not assessable, we suggest ICP monitoring via EVD if an EVD is in place. (Vote: 13/13)
- In patients without radiological hydrocephalus who are neurologically not assessable, no suggestion on ICP monitoring. (Vote: 11/13)
- We do not suggest invasive multimodal neuromonitoring (PbtO2/microdialysis) due to uncertain risk/benefit. (Vote: 10/13)
- We do not suggest routine continuous EEG monitoring. (Vote: 13/13)

Expert Consensus Statement

PICO 7: Hydrocephalus – Acute Management

Thomas Gaberel Michael Hugelshofer

No evidence-based recommendation possible

Expert Consensus Statements

- In patients with radiological hydrocephalus and decreased level of consciousness, we suggest CSF drainage. (Vote: 13/13)
- In patients with obstructive hydrocephalus and decreased consciousness, we suggest EVD placement. (Vote: 13/13)
- In patients with communicating hydrocephalus and decreased consciousness, we suggest LD or repeated LPs as first choice. (Vote: 11/13)
- In patients with radiological hydrocephalus and normal consciousness, we do not suggest CSF drainage. (Vote: 12/13)

Expert Consensus Statement

PICO 7: Hydrocephalus – Chronic Management

Thomas Gaberel

Michael Hugelshofer

Expert Consensus Statements (continued)

- When prolonged CSF drainage (EVD, LD or repeated LPs) carries a higher risk of severe complications than permanent CSF diversion, we suggest permanent CSF diversion. (Vote: 13/13)

- In patients with symptomatic chronic hydrocephalus, we suggest permanent CSF diversion. (Vote: 13/13)

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Expert Consensus Statement

PICO 8: Neuro-ICU vs. General ICU

Raimund Helbok

Thomas Gaberel

No evidence-based recommendation possible

Expert Consensus Statement

In adult patients with aSAH, we suggest admission and management in a dedicated neuro-ICU or high care unit to decrease the risk of poor functional outcome.

Vote: 13/13

Several observational studies suggest benefit, particularly for good-grade patients. However, prospective randomized trials are needed for higher levels of evidence.

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Expert Consensus Statement

PICO 9: Centre and surgeon volume

Gabriel Rinkel

Nima Etminan

No evidence-based recommendation possible

PICO 9a – Centre volume:

We suggest that all patients with spontaneous SAH are admitted or immediately transferred to centres that treat at least 70 patients with aSAH per year, or at least 35 patients with aSAH per year in remote areas. (Vote: 12/13)

PICO 9b – Surgeon volume:

We suggest that aneurysms are repaired by neurosurgeons or neurointerventionalists who perform the treatment of choice in more than 30 patients with aneurysms (ruptured and unruptured) per year. (Vote: 12/13)

Meta - analysis:
High-volume centres associated with reduced in-hospital mortality (OR 0.53; 95%CI: 0.42-0.68).

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Expert Consensus Statement


Elke Gizewski


Marios Psychogios

PICO 10: Follow-up imaging (Part 1)

No evidence-based recommendation possible

Expert Consensus Statements

- Patients treated with coils and adequate occlusion within 6 months: we suggest at least one additional radiological follow-up at or beyond 12 months. (Vote: 13/13)

- Patients treated with microsurgical clipping and adequate occlusion within 6 months: we do not suggest further radiological follow-up for recanalization. (Vote: 11/13)

- Patients with neck remnants or partially occluded aneurysms: we suggest follow-up beyond 6 months as long as re-treatment remains an option. (Vote: 13/13)

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Expert Consensus Statement

PICO 10: Follow-up imaging (Part 2)


Elke Gizewski


Marios Psychogios

Expert Consensus Statements (continued)

- Patients treated with endovascular devices other than coils: we suggest radiological follow-up at least 5 years after treatment, regardless of degree of occlusion. (Vote: 11/13)

- In patients with high-risk profile (young age, family history for aSAH, ADPKD): we suggest follow-up at 5-year intervals for de novo aneurysms. (Vote: 12/13)

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Summary

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TOPICS

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PICOs

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EXPERT CONSENSUS STATEMENTS

STRONG RECOMMENDATIONS

FOR

- Nimodipine
- Regular coiling in WFNS I–III

AGAINST

- Antifibrinolytics

KEY CONSENSUS

≤ 24 h
Time to treatment

≥ 70 / yr
aSAH cases per centre

≥ 30 / yr
Aneurysms per surgeon

CT + CTP
For clinical deterioration

NEW TOPICS COVERED

Neuroimaging & neuromonitoring · Hydrocephalus management · Neuro-ICU · Centre / surgeon volume · Follow-up imaging

NO EBR POSSIBLE FOR

BP lowering · Timing · Other EVT · Hypertension induction · EVT of vasospasm · Neuroimaging · Neuromonitoring · Hydrocephalus · Neuro-ICU · Volume · Follow-up

Stent-assisted coiling reserved for selected cases · Flow diversion as last-line option

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Thank you

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