

# SAH fluid management protocol with transpulmonary thermodilution

## Basic tenets underlying the protocol:

- Hypovolemia is to be avoided and increases DCI risk
- Cardiac wall motion abnormalities (CWMA) are frequent but clinically evident signs of heart failure much less so
- Hypotension after SAH (systole < 100 mmHg or MAP < 65 mmHg) is unusual and requires an investigation into its cause and prompt management
- Neurogenic pulmonary edema (NPE) and cardiac wall motion abnormalities pose risks to adequate CBF and oxygenation and are associated with worse outcomes and occurrence of DCI
- In general a diagnosis of NPE or CWMA requires invasive hemodynamic monitoring (IHM)
- IHM to assess volume status after SAH is focussed on fluid responsiveness as a primary dynamic hemodynamic parameter, instead of only static parameters
- It is not advised to start inotropes in case of NPE or CWMA without the concurrent initiation of IHM to guide their use
- In patients with a Glasgow Coma Scale (GCS) > 8, improvements of consciousness are also an important end-point of fluid management next to the hemodynamic parameters
- Considering the previous point, a perfectly awake patient with a GCS = 15 is considered to be “euvolemic” with regard to CBF

**Aneurysmal SAH**

**GCS=15**

yes

**Standard fluid management:  
3 Litres daily fluid input or  
Fluid balance +500ml**

no

**GCS<15**

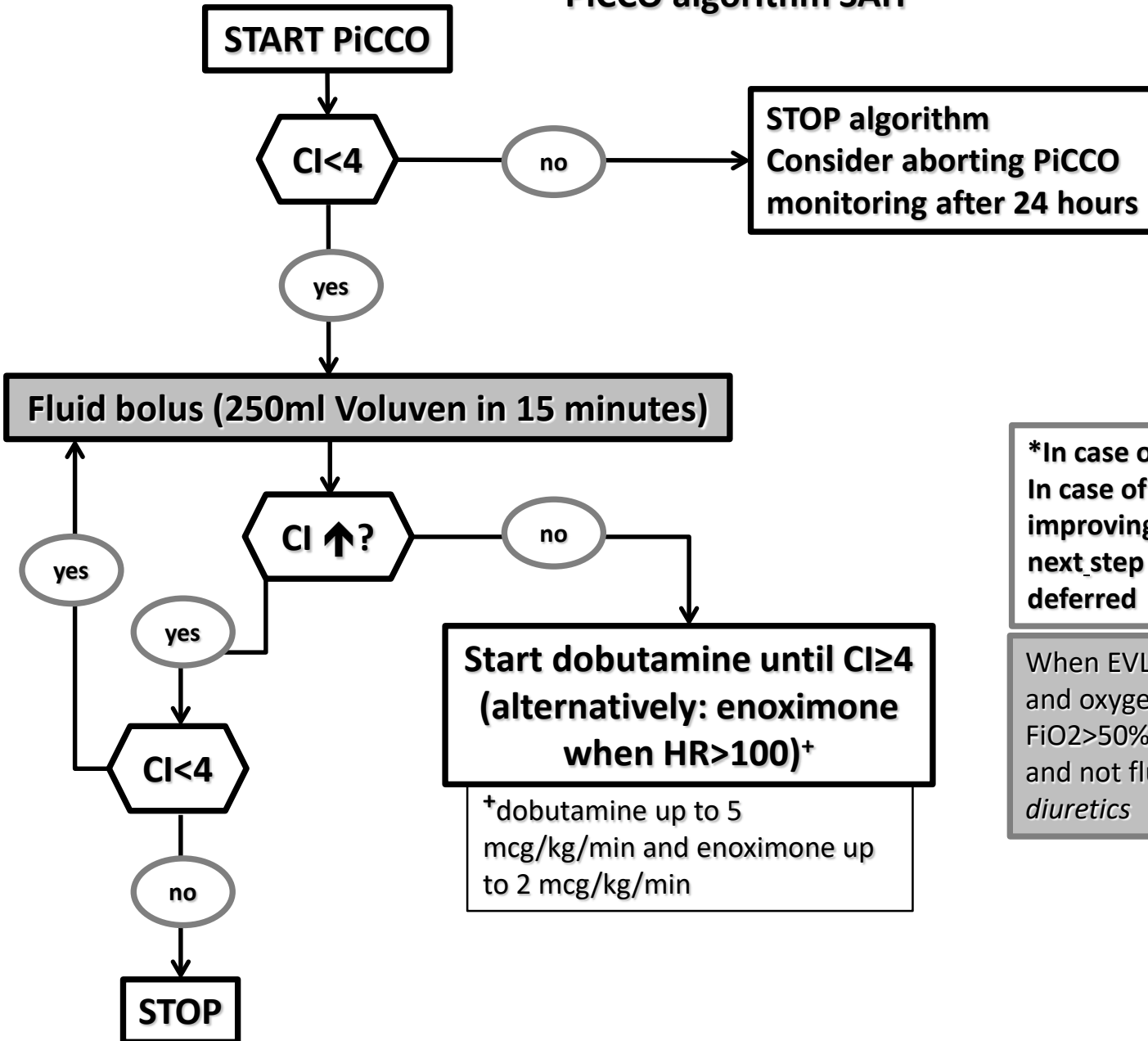
**One or more of:**

- Systolic BP<100 or MAP<65, not responding to fluids such that MAP≥80
- Pulmonary edema (chest x-ray) or clinical signs of heart failure (echo cor)
- Very negative fluid balance* (less than -1000ml for at least 24h)
- Delayed cerebral ischemia and either a persisting negative fluid balance (less than -500ml/≥24h), or progressive neurological deterioration in spite of extra fluid

yes

**START transpulmonary thermodilution (PiCCO)  
(next page algorithm)**

# PiCCO algorithm SAH\*



**\*In case of DCI:  
In case of improvement of GCS ≥ 2 or  
improving focal neurological deficit a  
next\_step in the flowchart may be  
deferred**

When EVLWI ≥ 13 and PEEP ≥ 10  
and oxygen saturation < 92% with  
FiO2 > 50%  
and not fluid responsive: *consider  
diuretics*

+dobutamine up to 5  
mcg/kg/min and enoximone up  
to 2 mcg/kg/min