Describe the control of cerebral blood flow

Cerebral blood flow = 50ml/min/100g of brain tissue (or 750ml/min)

Brain oxygen consumption = 3.3ml/100mg/min

Cerebral perfusion pressure = MAP – CVP

If ICP > CVP, then: CPP = MAP – ICP (Starling resistor effect)

Normal ICP – 5-15mmHg

Cerebral blood flow = CPP / CVR (cerebrovascular resistance)

As with all organs, increase in viscosity reduces flow (in accordance with the Hagen-Poiseuille law)

Determinants of cerebral blood flow

Cerebral blood flow is maintained at 750ml/min between CPP of 50-150mmHg

This is due to local vasomotor autoregulation

- Increase in vascular wall tension induces vasoconstriction, and vice versa

Some metabolic effects (pH, adenosine, NO)

This curve shifts to the right in hypertensives (i.e. limits of autoregulation are set higher)

Determinants of regional flow:

$\text{PaO}_2$

Within the normal range, $\text{PaO}_2$ causes no change in cerebral blood flow

Below a $\text{PaO}_2$ of 60mmHg, CBF increases along a steep curve

$\text{PaCO}_2$

CBF is proportional to $\text{PaCO}_2$ within the normal range

Below $\text{PaCO}_2$ of 20mmHg, arterioles are maximally vasoconstricted

Above a $\text{PaCO}_2$ of 80mmHg, arterioles are maximally vasodilated

This is to maintain a homeostatic pH
Temperature

Hypothermia reduces CMRO$_2$ by 7% for each 1°C fall in body temperature

↑PaO$_2$ -> leads to vasoconstriction by above method

Drugs

Anaesthetic agents e.g. barbiturates reduce CMRO$_2$, and thus cause cerebral vessel vasoconstriction

Other metabolic mediators

Adonisine vasodilates

NO vasodilates

Hydrogren ions vasodilate

Examiners Comments:

Good answers included an equation and then explored the various components of the equation. Main points for a pass included pressure and metabolic autoregulation and the various factors that affect cerebral vascular resistance. Graphs were a useful way to answer this question but were generally underutilised. Several candidates wrote about the Monroe-Kellie doctrine which was not directly relevant to the question.

Pass rate: 50%