BP Management after Stroke

Acute and Long term

SI Stroke Study Day

9/9/25

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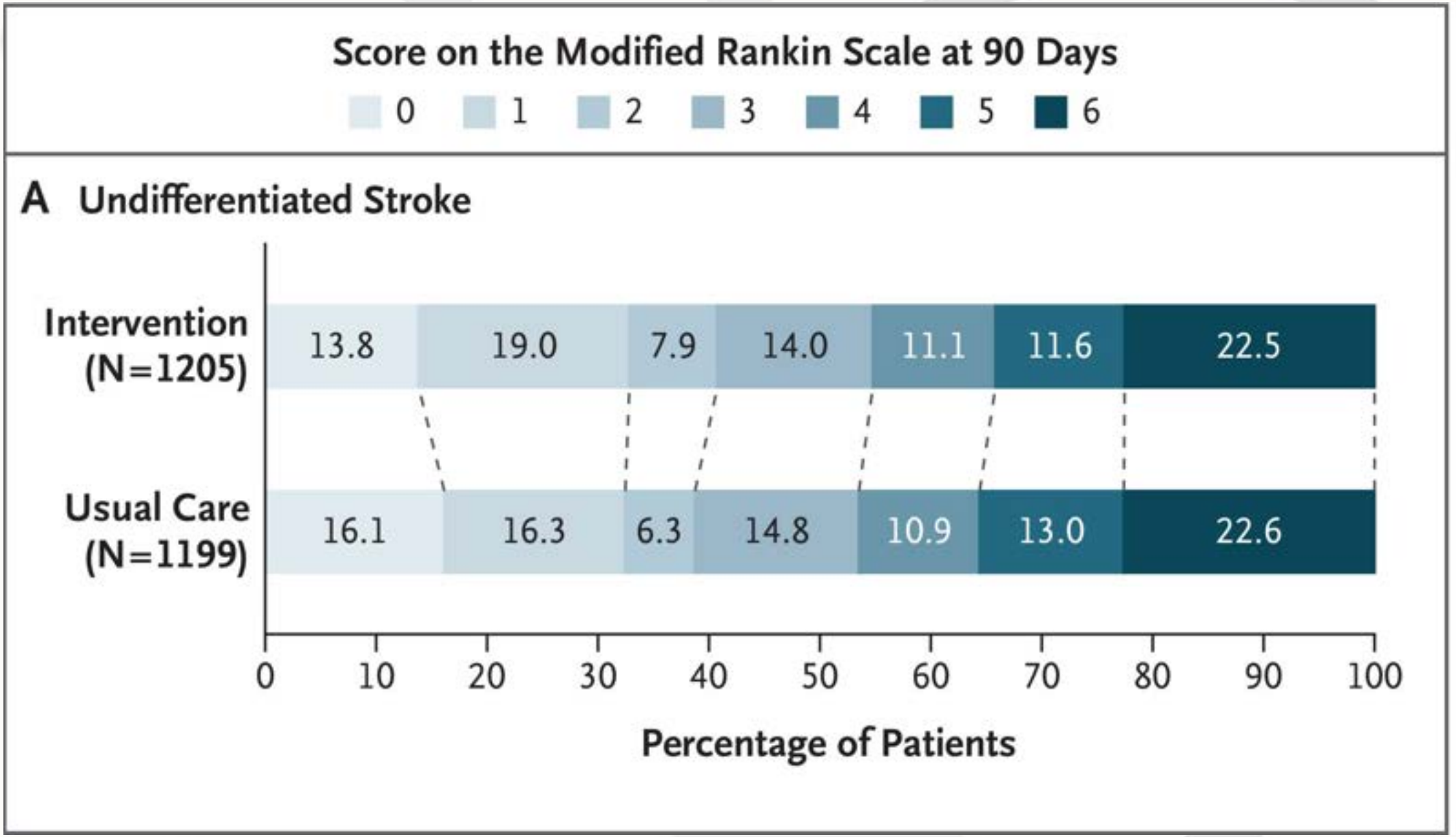
Discussion Points

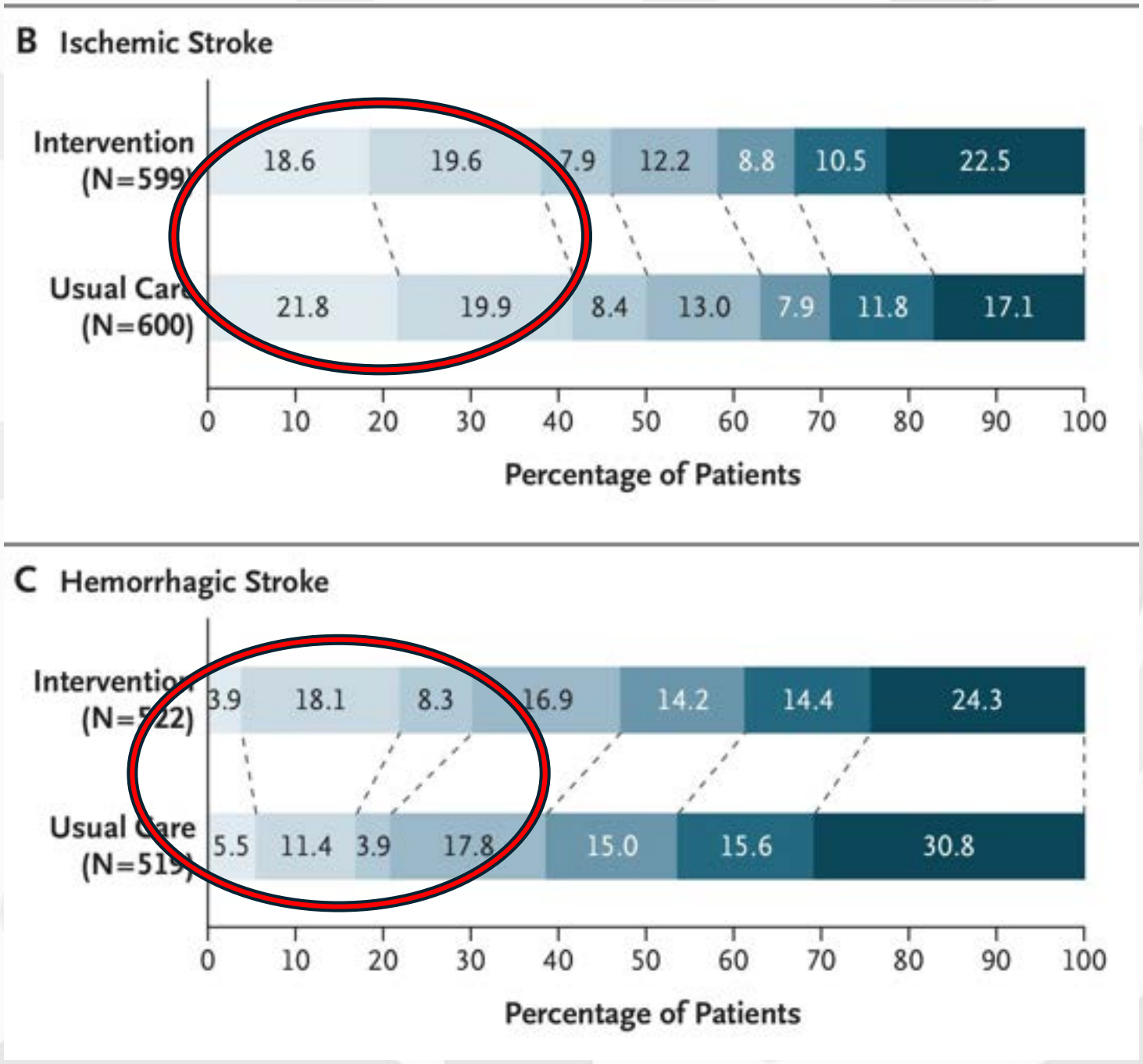
- Is treating Hypertension acutely post stroke good to do?
- Normal Cerebral Autoregulation
- Cerebral Autoregulation / Blood Pressure in acute stroke
- Acute BP management in Ischaemic Stroke
- Acute BP Management in Haemorrhagic Stroke
- Restarting usual antihypertensives
- Longer term secondary prevention BP Management post Stroke

- Hypertension in acute stroke is bad and should be treated urgently?

Pre Hospital Treatment of Hypertension in suspected acute stroke

- INTERACT4 study – 2404 Chinese patients (confirmed stroke = 2240)
  - Ambulance assessed – FAST score, BP>150mmHg systolic, able to treat within 2 hours of symptom onset / last known well.
  - Treated with the intravenous antihypertensive, Urapidil (α1 Adrenoceptor blocker / Serotonin agonist)
- Demographics
  - Mean age 70 years, Mean BP at randomization 178/98
  - 46.5% were haemorrhagic stroke
- Outcomes
  - BP at hospital arrival — 159mmHg in Treated group; 170mmHg in control group


Score on the Modified Rankin Scale at 90 Days
0
1
2
3
4
5
6
A Undifferentiated Stroke
Intervention (N=1205)
13.8
19.0
7.9
14.0
11.1
11.6
22.5
Usual Care (N=1199)
16.1
16.3
6.3
14.8
10.9
13.0
22.6
0
10
20
30
40
50
60
70
80
90
100
Percentage of Patients


B Ischemic Stroke
Intervention
(N=599)
18.6
19.6
7.9
12.2
8.8
10.5
22.5
Usual Care
(N=600)
21.8
19.9
8.4
13.0
7.9
11.8
17.1
0
10
20
30
40
50
60
70
80
90
100
Percentage of Patients
C Hemorrhagic Stroke
Intervention
(N=522)
3.9
18.1
8.3
16.9
14.2
14.4
24.3
Usual Care
(N=519)
5.5
11.4
3.9
17.8
15.0
15.6
30.8
0
10
20
30
40
50
60
70
80
90
100
Percentage of Patients

PreHospital Rx

- Pre hospital treatment of undifferentiated stroke patients with high blood pressure is not recommended
  - Treatment does result in lower BP at hospital presentation
  - No difference in functional outcomes in general but;
    - ICH patients – reduced odds of a poorer outcome
      OR=0.75 (did Better)
    - Ischaemic stroke – increased odds of a poorer outcome
      OR=1.3 (did worse)

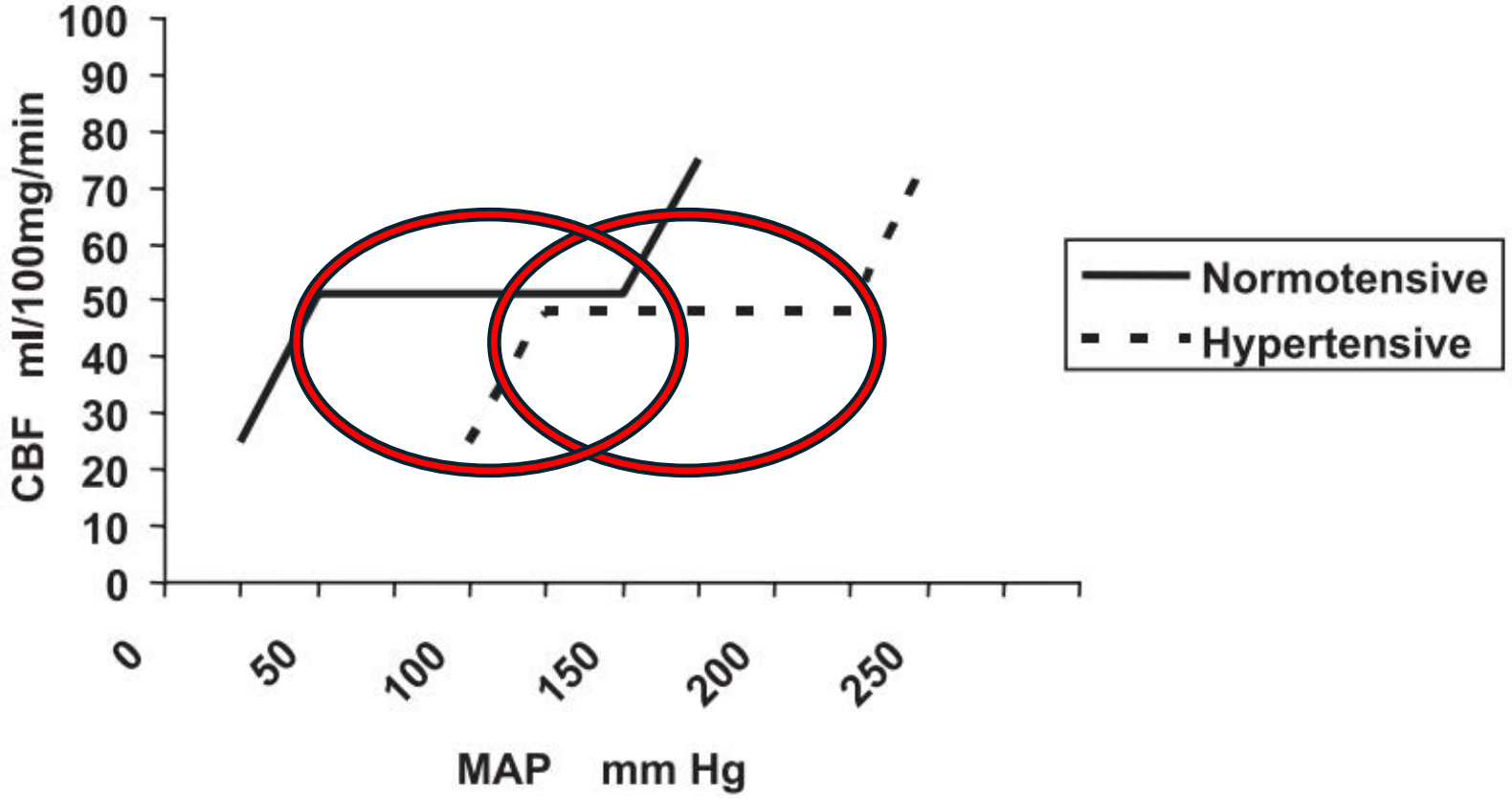
Normal Cerebral Autoregulation

The Brains ability to maintain a constant cerebral blood flow (CBF) despite fluctuations in blood pressure, preventing ischaemia and preserving brain function;

- Maintains stable cerebral blood flow within a range of mean arterial pressures (MAP), typically 50 -150mmHg
  - Outside of these parameters flow is largely pressure dependent

- Symptoms of cerebral ischaemia occur once CBF reaches 35-40% of baseline

- Chronic Hypertension alters cerebral autoregulation resulting in a shift of the stable cerebral blood flow to higher blood pressures



CBF=cerebral blood flow; MAP=mean arterial pressure

Autoregulation maintains cerebral blood flow relatively constant between 50 and 150 mm Hg mean arterial pressure. The range is right shifted in chronically hypertensive patients.

Mechanisms of Autoregulation

- Arteriolar vasoconstriction / vasodilatation
- Neurogenic – Sympathetic (↓CBF), Parasympathetic (↑CBF)
- Metabolic demand matching
  - Adjusts blood flow to meet the brains metabolic needs, ensuring optimal function during rest and activity
  - E.g. ↑ CBF: ↑$PaCO_2$, PaO_2<50mmHg, ↓pH
    ↓CBF: ↓$PaCO_2$, ↑pH
- Endothelial factors

Blood Pressure and Cerebral Autoregulation in Acute Stroke

- High blood pressure is present in up to 75% of acute stroke patients. Combination of;
  - Background hypertension contributing to the acute stroke
  - Hypertension occurring as a response to the acute stroke (Multifactorial);
    - Excessive sympathetic & Renin-Angiotensin-aldosterone system activity
    - Increased Cortisol & inflammatory cytokines
    - Baroreceptor dysfunction
    - Increased intracranial pressure
    - Pain and stress of acute hospitalisation
- A spontaneous drop in BP occurs in 2/3 of patients over the first week of hospital admission

Blood Pressure and Cerebral Autoregulation in Acute Stroke cont

- In acute ischaemic stroke cerebral autoregulation is impaired
  - Multifactorial, varies related to type of ischaemic stroke
  - Cerebral Blood flow is more dependent on blood pressure
    - lowering blood pressure will likely lower cerebral blood flow and risk penumbral tissue to become even more vulnerable to irreversible damage
    - Higher blood pressure may lead to hyperperfusion related oedema and haemorrhage
  - **Goal of blood pressure management therefore is to limit stroke severity from hyperperfusion without causing harm through cerebral hypoperfusion, optimizing longer term functional recovery**

Current Guidelines- Acute Ischaemic Stroke
(Australia and New Zealand Clinical Guidelines for Stroke)

- All acute stroke patients should have their blood pressure closely monitored in the first 48 hours after stroke onset.
- Patients with acute ischaemic stroke eligible for treatment with intravenous thrombolysis / ECR **should have their blood pressure reduced** to below 185/110 mmHg before treatment and in the first 24 hours after treatment.
- Patients with acute ischaemic stroke with blood pressure > 220/120 mmHg should have their blood pressure cautiously reduced (e.g. by no more than 20%) over the first 24 hours.
- Intensive blood pressure lowering in the acute phase to a target <140mmHg is not recommended

Evolving areas in Acute Ischaemic Stroke

- Induced Hypertension
  - Actively increasing blood pressure with inotropes to improve cerebral blood flow in situations of systemic hypotension / carotid occlusion / large and small vessel occlusion
  - 3 small studies suggest potential improved outcomes
    - Within 24 H of symptom onset, duration of at least 24 hours
    - Target BP varied, but suggestive of 150-180mmHg systolic

Evolving areas in Acute Ischaemic Stroke

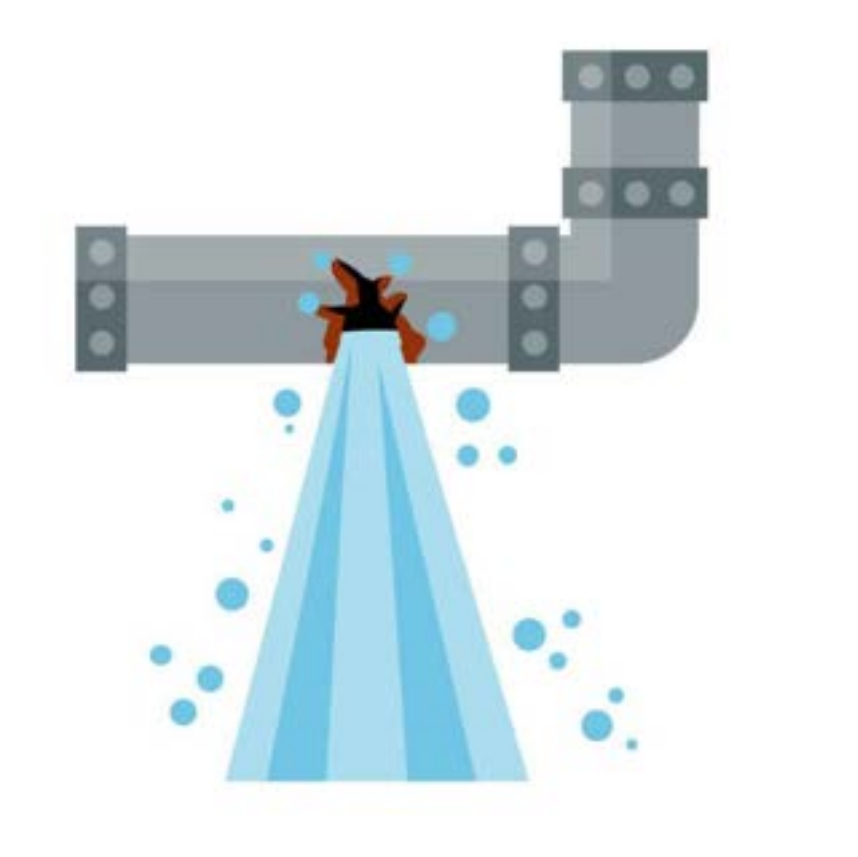
- Blood Pressure Variability
  - Higher variability in blood pressure post acute stroke is associated with worse outcomes including early neurological deterioration, functional disability, stroke recurrence and death
  - Currently no studies have been undertaken to look at management of this

Acute Blood Pressure Management in Acute Intracerebral Haemorrhage

- Haemorrhagic Stroke, the balance is between;
  - Reducing the driving force of haematoma expansion (mostly occurs in first 3 hours)
  - Risk of adversely affecting cerebral perfusion when autoregulation is partially impaired

Goal is to limit stroke severity without causing harm through cerebral hypoperfusion, optimizing longer term functional recovery

Acute Haemorrhagic Stroke



Need to reduce the pressure



Current Guidelines- Acute Haemorrhagic Stroke
(Australia and New Zealand Clinical Guidelines for Stroke)

- **Early** blood pressure lowering should be undertaken with a target systolic blood pressure of 130-140mmHg within **one hour** of commencing treatment
  - NB. In reality the median time to reach this blood pressure target is several hours, but the early initiation of treatment is key.
- Avoiding rapid, large reduction in systolic BP may be important, reductions >70mmHg in one hour are associated with poorer functional recovery. Better target is 30-45mmHg drop over 1 hour
- Achieving lower and more stable BP during 1 to 24 hours after ICH is associated with lower odds of haematoma growth and neurological deterioration and better functional recovery over 90 days

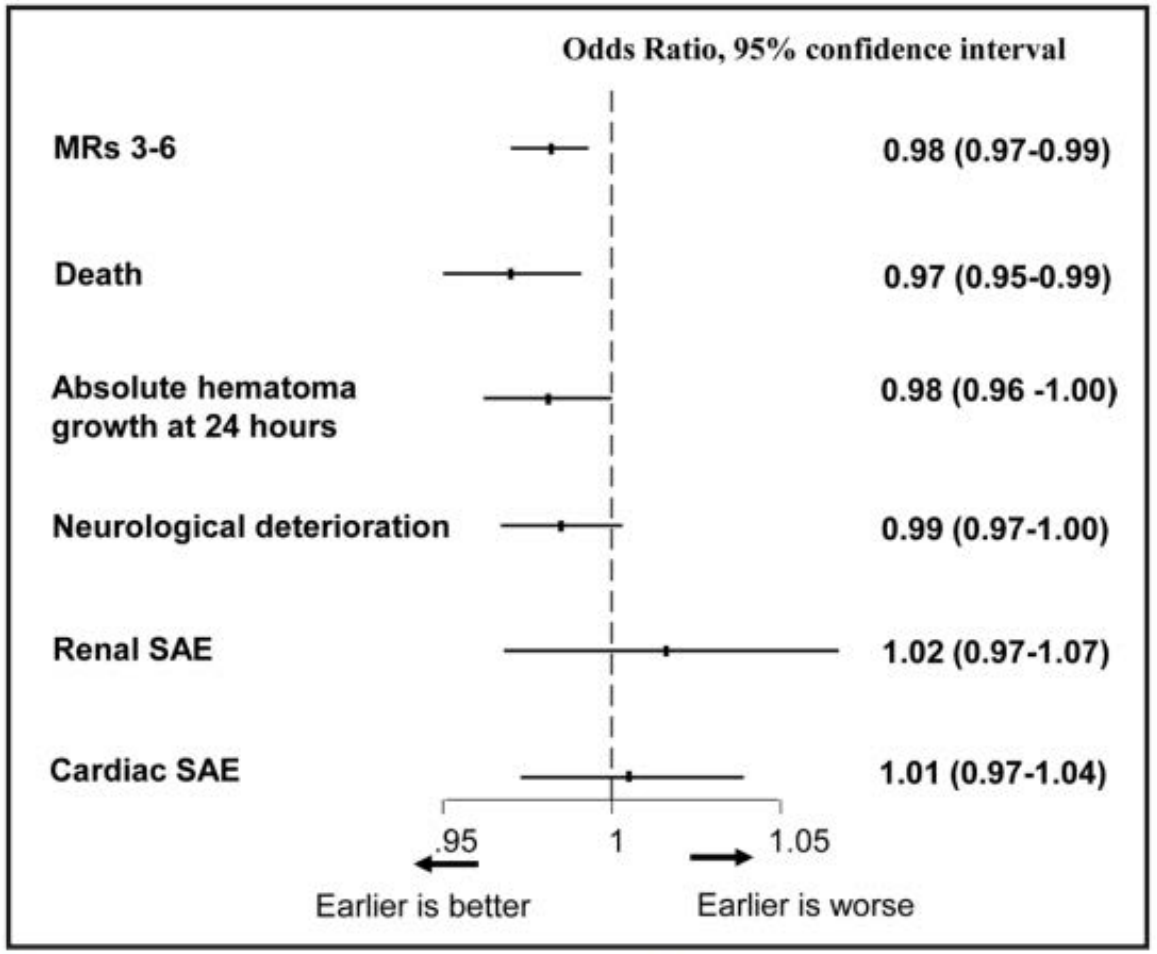


Figure 1. Association of time to achieve systolic blood pressure (SBP) of 120 to 140 mm Hg and maintained until 24 h, and the primary and secondary clinical, and safety and radiological outcomes.

mRS indicates modified Rankin Scale; and SAE, serious adverse event.

Intravenous agents

- Limited evidence to guide choice of agent
- α and β adrenoceptor blockers (Labetalol & Metoprolol) probably better for intensive BP lowering. Block the autonomic response that occurs in acute stroke
- Hydralazine and Nicardipine can be useful
- GTN patches in RIGHT-2 trial of **pre hospital (i.e. very early)** ambulance treatment were associated with greater haematoma growth and poorer outcomes than placebo. GTN may promote vasodilatation or disrupt haemostatic mechanisms in ICH

Duration of intensive blood pressure control

- Essentially unknown
- Given most haematoma expansion occurs in the first 3-6 hours Reasonable to treat for up to 72 hours, but instituting oral / NG agents after 24 hours

When to restart usual antihypertensives

- 2 RCT's compared continuing v stopping antihypertensives after acute stroke
  - Randomization was within 48 hours of stroke onset
  - No difference in outcome

- A Meta-analysis of these studies a subgroup analysis of patients randomized to continue within 12 hours of stroke onset did worse

- Pragmatic approach would be to consider restarting pre-stroke antihypertensive medications once safe swallow or NG is insitu

BP Management in Secondary Prevention

- Blood pressure lowering reduces risk by about 25%, irrespective of baseline BP
- Higher adherence to treatment if commenced prior to hospital discharge
- Target blood pressure in general is <140/90mmHg
  - Particularly if there is significant stenosis of major intracranial artery
  - A lower target of <130mmHg may have more benefit, particularly in small vessel disease or ICH strokes.
  - Start low and go slow appropriate for older frailer patients
- Appropriate Drug classes to consider are;
  - ACE Inhibitors
  - Angiotensin II receptor antagonists
  - Calcium Channel blockers
  - Thiazides
  - NB> B-Blockers are not first line unless associated IHD

BP Management in Secondary Prevention

- How to measure blood pressure out of hospital to reliably guide BP management
  - Clinic BP are potentially unreliable;
    - Infrequent
    - White coat syndrome = over estimating BP (common)
    - Masked Hypertension = under estimating BP (10-15%)
  - Alternatives – superior to clinic recordings
    - Home BP monitoring. Can be imprecise
    - ABPM (ambulatory BP monitors) = 24 hours, can be useful to clarify White coat or Masked syndromes

Key Messages

- Ischaemic stroke
  - Acute lowering of BP is harmful
  - In secondary prevention, hypertension should be managed gradually, initiated in hospital and continued in the community

- Intracranial Haemorrhage
  - **Time is brain**, most haematoma expansion occurs within the first 3-6 hours
  - Hypertension should be managed ASAP post stroke onset
  - Acute blood pressure target is around 140mmHg

What can you do

- Patients and families
  - Educate on BP goals
    - Reassure about hypertension in acute ischaemic stroke

- Educate your colleagues (Doctors included)
  - In ICH Time is Brain
    - Encourage **early** antihypertensive treatment