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## Blood Pressure Management in Acute Care for Patients with Stroke

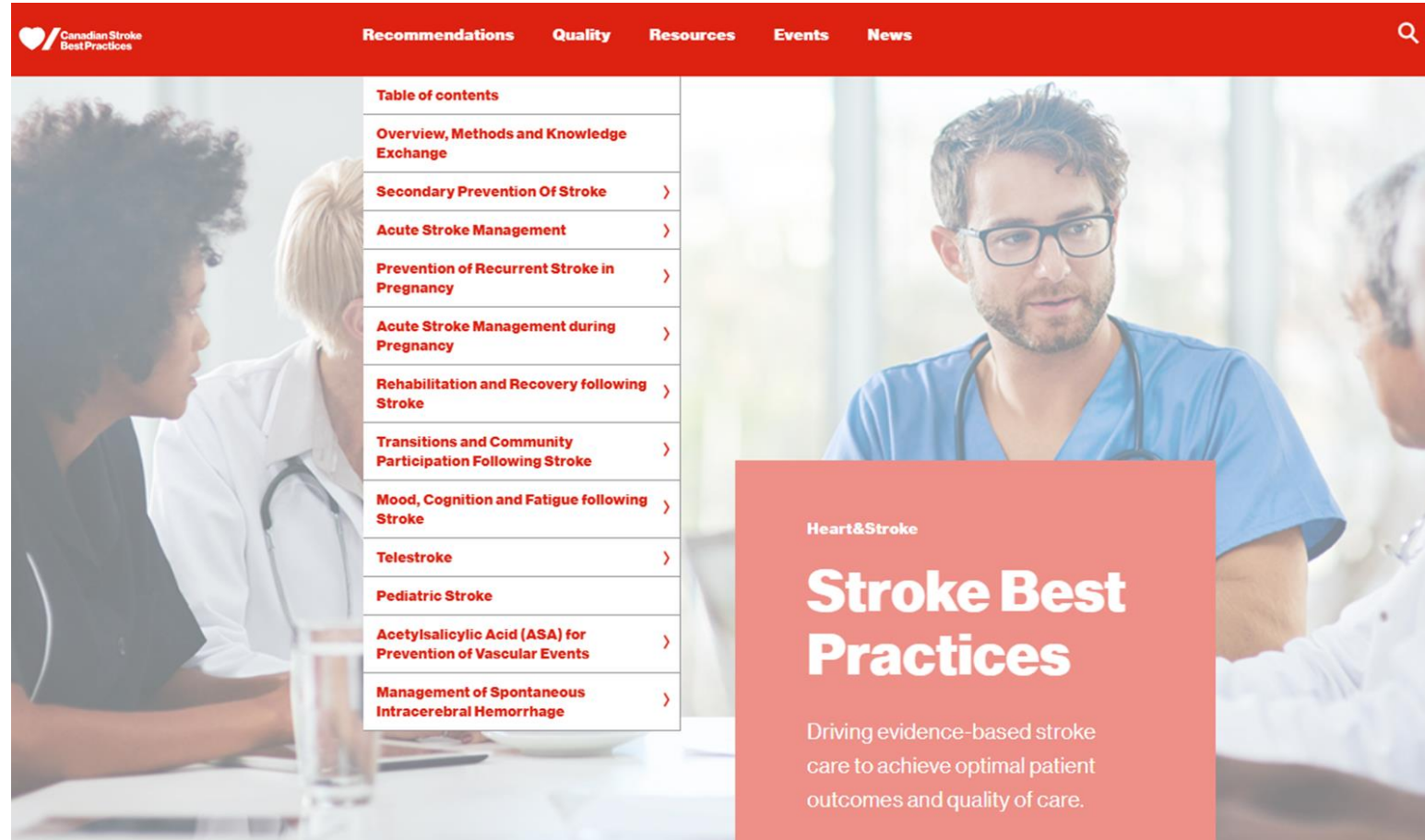
August 2023

# Objectives

- Discuss why blood pressure (BP) matters in acute stroke
- Provide refresher on BP monitoring & management for patients with ischemic stroke, intracerebral hemorrhage (ICH) and aneurysmal subarachnoid hemorrhage (aSAH) in ED, Critical Care, & Acute Care
- Highlight what's new in BP management for acute stroke
- Discuss importance of our role in BP management



# [www.strokebestpractices.ca](http://www.strokebestpractices.ca)



Canadian Stroke Best Practices

Recommendations Quality Resources Events News

Table of contents

- Overview, Methods and Knowledge Exchange
- Secondary Prevention Of Stroke >
- Acute Stroke Management >
- Prevention of Recurrent Stroke in Pregnancy >
- Acute Stroke Management during Pregnancy >
- Rehabilitation and Recovery following Stroke >
- Transitions and Community Participation Following Stroke >
- Mood, Cognition and Fatigue following Stroke >
- Telestroke >
- Pediatric Stroke
- Acetylsalicylic Acid (ASA) for Prevention of Vascular Events >
- Management of Spontaneous Intracerebral Hemorrhage >

Heart&Stroke

## Stroke Best Practices

Driving evidence-based stroke care to achieve optimal patient outcomes and quality of care.







# Hypertension

The Most Modifiable Risk  
Factor For Stroke



# Why Blood Pressure Matters!

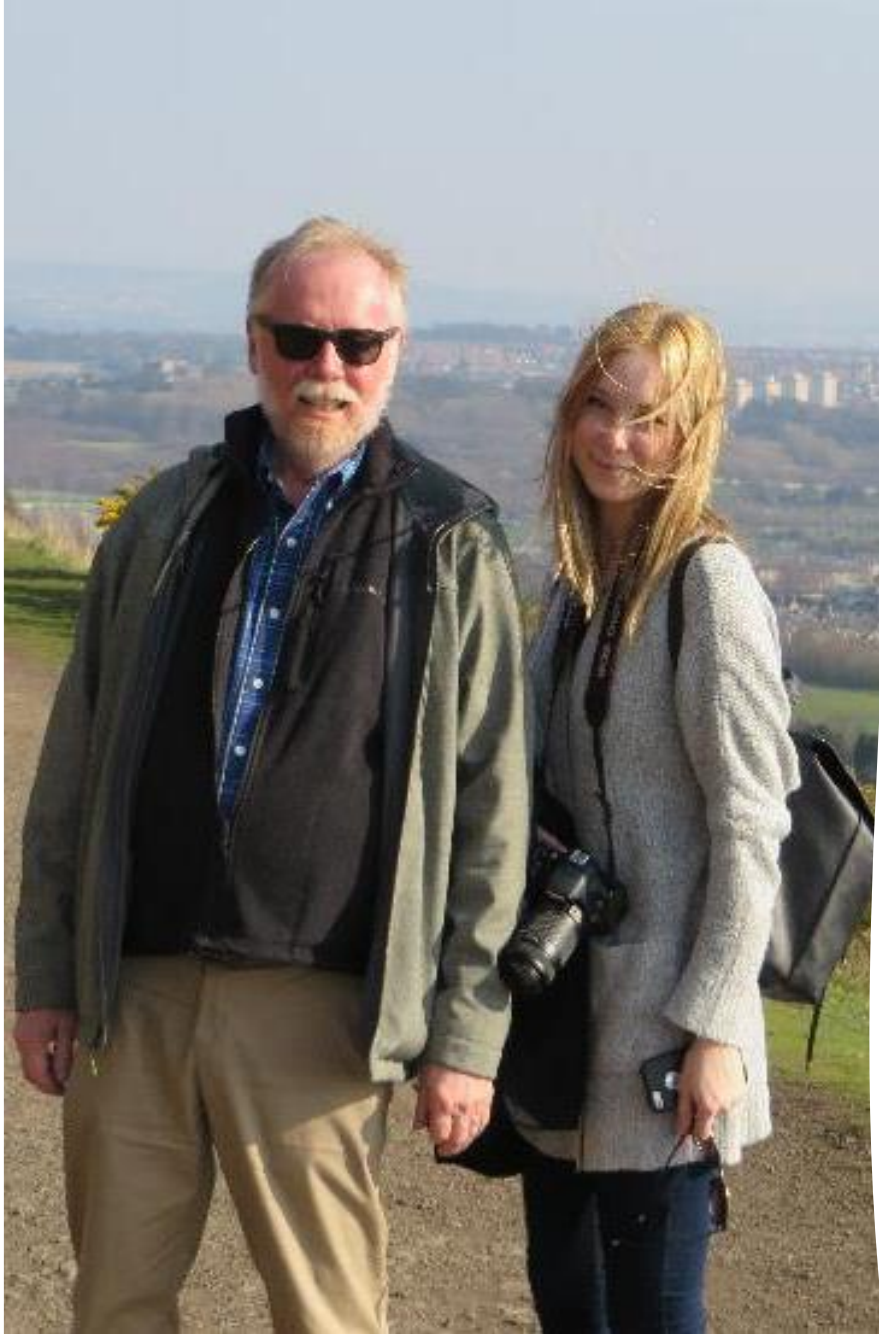


- Patients often present with hx of hypertension & other comorbidities
- Elevated BP and fluctuation are common immediately after stroke
  
- High and low blood pressure are associated with poor patient outcomes
- Hypotension
  - Avoid rapid or excessive lowering of BP
  - Hydration
  - Maintaining perfusion prevents infarct expansion
  
- Hypertension: Risk of hyperperfusion → endothelial damage, cerebral edema, intracranial hemorrhage, death
- Challenging to achieve BP targets but important tool to reduce odds of death

*Doubles the Odds of Poor Functional Outcome*



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# Case Study

- **Tom**, 68-year-old, lives in Belleville, was discovered by daughter on his deck slumped over on right side, speaking incomprehensively and right facial droop
- Daughter called **9-1-1** immediately at 11:00h
- Paramedics assessed Tom was LSW at 09:00h and activated Acute Stroke Protocol. +ve Large Vessel Occlusion (LVO) screen communicated & transported to Belleville General ED
- In ED, symptoms ongoing + BP elevated

## HISTORY:

- MI 15 years ago with stents
- Hypertension x 25 years
- 40 pack year smoker (vapes)

## MEDICATIONS:

- Metoprolol 50 mg BID
- ASA 81 mg OD
- HCTZ 12.5 mg OD



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# Tom is a Candidate for TNK and EVT

- Reviewed inclusion/exclusion criteria
- Tom's initial BP > 185/110 mmHg
  - BP management protocol: Labetalol 10mg IV over 2 mins, repeat 10-20 mg IV every 10-20 mins PRN until target reached
  - Avoid dramatic changes in BP
    - ✓ Tom's BP ↓ed to 175/92 with 2 doses of IV labetalol

01/09/2022

**Acute Stroke Protocol of Southeastern Ontario  
KGH Emergency Guide for Thrombolytic Therapy (IV Thrombolysis) and/or  
Endovascular Thrombectomy (EVT)**

Inclusion Criteria for TNK or rt-PA	Exclusion Criteria for TNK or rt-PA
<ol style="list-style-type: none"> <li>1. Patient suspected of having ischemic stroke</li> <li>2. Deficit should be of a severity that would lead to significant compromise in patient's quality of life</li> <li>3. Deficit should be relatively stable during period of observation</li> <li>4. Clear and credible time of stroke onset can be established, and patient can receive IV thrombolysis within 4.5 hours. Time of onset is time patient was last seen well</li> <li>5. Pregnancy is <b>NOT</b> a contraindication</li> <li>6. Age &lt;18 years is <b>NOT</b> a contraindication if a child presents with stroke symptoms, Neurology-Stroke Service + Paediatric Intensive Care Service to jointly decide on next steps (e.g., consider contacting The Hospital for Sick Children in Toronto)</li> </ol>	<ol style="list-style-type: none"> <li>1. Major surgery during previous 2 weeks</li> <li>2. Major cerebral infarct or head/spinal injury in past 3 months</li> <li>3. A known source of recent bleeding</li> <li>4. Puncture of non-compressible artery or biopsy site within 7 days, including lumbar puncture</li> <li>5. Blood pressure remains at systolic &gt; 185 and/or diastolic &gt; 110 despite treatment</li> <li>6. Serious co-morbidity (e.g., advanced cancer, renal failure, hepatic failure) that would increase bleeding risk or limit effectiveness of treatment</li> <li>7. Coma during current event</li> <li>8. -INR &gt; 1.7; -Increased PTT; -Platelet Count &lt; 100,000; or -Direct Oral Anticoagulants taken within 24 hours *Caution if Warfarin taken within 48 hours</li> <li>9. Blood glucose &lt;2.7 or &gt;22.2 mmol/L</li> <li>10. Rapidly resolving neurologic signs</li> </ol>
Inclusion Criteria for EVT	Exclusion Criteria for EVT
<ol style="list-style-type: none"> <li>1. Presenting &lt; 6 hours from stroke onset                             <ul style="list-style-type: none"> <li>• Highly selected patients presenting between 6-24 hours based on clinical &amp; imaging criteria</li> </ul> </li> <li>2. NIH Stroke Scale (NIHSS) greater than 5</li> <li>3. Pre-stroke functioning independently in activities of daily living in their community</li> <li>4. Age 18 yrs or greater (if &lt; 18 yrs see #6 above)</li> </ol>	<ol style="list-style-type: none"> <li>1. Complete resolution of neurological signs (TIA)</li> <li>2. Serious co-morbidity with limited lifespan (e.g., advanced cancer, advanced dementia)</li> <li>3. Recent Intracranial bleed</li> <li>4. Severe contrast allergy or absolute contraindication to Iodinated Contrast</li> <li>5. Difficult femoral, radial or brachial artery access</li> <li>6. Fibromuscular Dysplasia (relative contraindication)</li> </ol>

**Thrombolytic Therapy and/or EVT Checklist** (See Inside Acute Stroke Protocol Package for more Details)

- Draw bloodwork: CBC, PT, PTT, INR, electrolytes, BUN, Creatinine, Glucose, Troponin, Type and Hold 2 units, and  $\beta$ HCG (pregnancy test) if indicated
- Establish 2 IVs. Secondary IV should be started with 18-gauge needle in right antecubital fossa unless contraindicated
- Establish continuous ECG and O2 saturation monitoring
- Transport to CT Suite for non-contrast head CT + CT Angiography (CTA) + RAPID CT Perfusion (CTP); Take stretcher, monitor, transport kit, TNK or rt-PA, & stroke medication kit to CT. If directed to take rt-PA, bring IV pump
- Neurologist obtains consent from patient, or where necessary an appropriate family member
- Consider urinary foley catheter **only** if known that patient is candidate for EVT after CTA/CTP is done
- Determine patient's weight for TNK or rt-PA
- Treat Blood Pressure systolic > 185 and/or diastolic > 110 with IV Labetalol or IV Hydralazine as per Appendix A of Guidelines for the Use of IV Thrombolysis /EVT in Acute Stroke Protocol package
- See inside Acute Stroke Protocol package for IV TNK or rt-PA administration guideline
- Monitor CNS and blood pressure q 15min during & post IV thrombolysis /EVT for 2 hours
- Monitor for Angioedema and treat as per Appendix C of Guidelines for the Use of IV thrombolysis/EVT
- Keep patient NPO





**TNK**



# Acute Stroke Treatment with Thrombolysis



## 4.3 Acute Blood Pressure Management

i. Patients with ischemic stroke eligible for thrombolytic therapy:

BP should be lowered and sustained below 185/110 mmHg while initiating + during IV thrombolysis therapy, and for next 24 hrs (NEW)

**See inside your Acute Stroke Protocol/Code Stroke Packages**

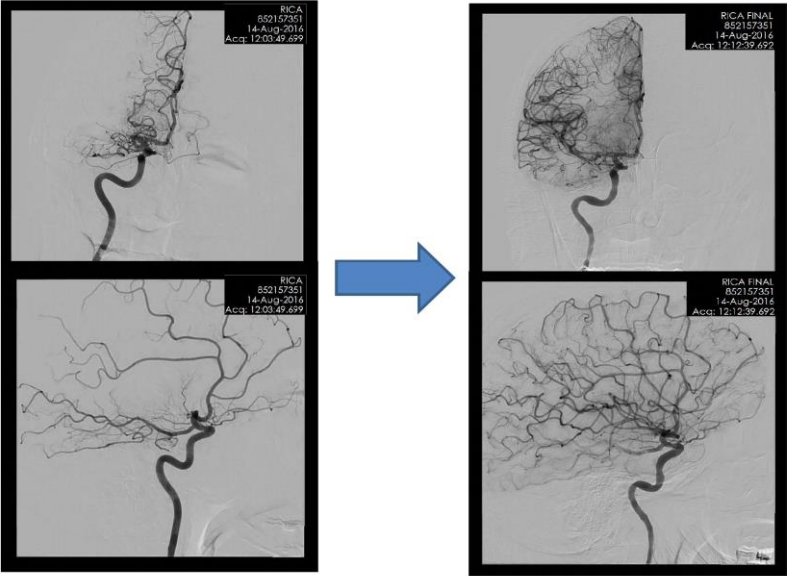
## 5.2 Clinical Considerations (NEW)

6. BP should be lowered for symptomatic ICH who are hypertensive (>185/110 mm HG) specific target and duration of antihypertensive are unknown



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# Endovascular Thrombectomy



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# 5. Acute Stroke Treatment with EVT



## General Management BEFORE & DURING EVT (BOX 5D)

6. Maintain **BP according to target for IV thrombolysis**; avoid aggressive BP lowering

## General Management After EVT (BOX 5D.2)

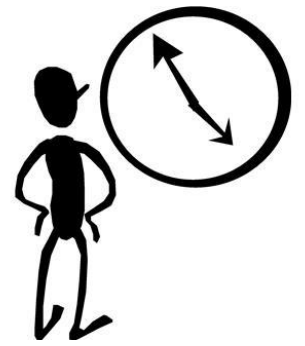
15. Ideal target after EVT is unknown. BP targets should be individualized based on clinical factors, e.g., degree of recanalization achieved, if intra-procedural complication, IV thrombolysis, & baseline BP



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# Clinical Picture 1<sup>st</sup> 24 hours

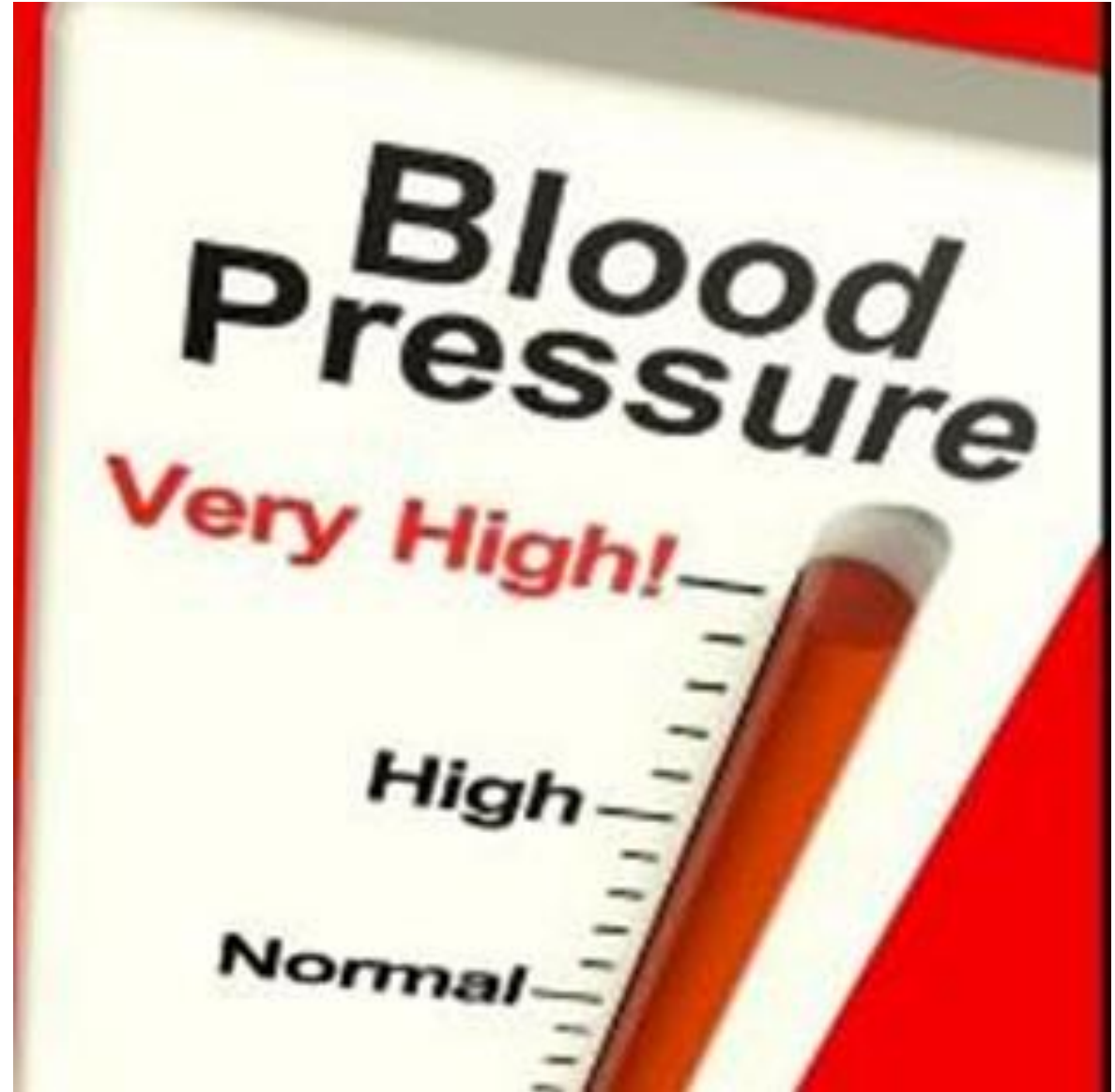


- Tom → D4ICU; Motor & speech deficits improved –not at baseline
- Blood work-
  - Glucose: 8.0 mmol/L; Other bloodwork normal
- ECG: Sinus Rhythm w frequent PACs including couplets
- SpO<sub>2</sub> 92- 94% on R/A, chest clear
- **B/P elevated at 190-170/85-110 (IV antihypertensives prn)**
- T: 37.3-37.8<sup>0</sup>C; (Acetaminophen PR, prn target < 37.5)
- Tom NPO (8-24 hours); anti-thrombotics held until f/u CT
- No signs of angioedema
- No signs of bleeding (intracranial or systemic)



What if Tom  
has an  
arterial line?

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What if Tom  
was not  
Eligible for  
Hyperacute  
Treatments?

- Recommend lowering BP for **Ischemic Stroke** when BP > 220/120 mmHg unless co-existing comorbidities
- If ↓ing BP, ↓ by approximately 15% and not > 25% over first 24hrs with gradual reduction thereafter-permissive hypertension



# Transferred to Stroke Unit

- Follow up CT –negative for hemorrhagic transformation
- STAND (swallowing screen) negative, Tom can have PO meds
- Tom started on Dual Antiplatelet Therapy (DAPT)
- Tom transferred to Stroke Unit
- Watch out for hypotension & hypertension



# Clinical Picture in Stroke Unit

- BP remained elevated. ACE Inhibitor added. Antihypertensive PO prn
- No signs of hemorrhagic transformation
- Temperature < 37.5 °C
  - Orders: if T > 37.5, ↑monitoring; administer Acetaminophen; investigate possible source of infection; & treat source of infection
- Glucose level 7-14 mmol/L throughout stay
  - Blood glucose level greater than 10mmol/L: Report and repeat with fasting blood glucose and HbA1C
  - Treat hyperglycemia as per diabetes patient care orders with bolus insulin SC (Tube feeding/NPO/Eating)
- Low Molecular Weight Heparin (LMWH) sc for VTE prophylaxis



# Clinical Picture before Transfer to Rehab

- BP decreased slightly 140-160/82-90
- Converted to Atrial fibrillation on Day 3
- Glucose level remained  $\uparrow$ 8-11 mmol/L
- LDL-C elevated on admission (3.5 mmol/L)
- Tom transferred to IP Rehab on day 5
- **DC medications:**
  - ACEI and continue thiazide
  - DAPT (asked IP Rehab to start DOAC on Day 7 & stop DAPT and LMWH)
  - Bolus Insulin sc
  - Statin
  - $\beta$ -Blocker (not changed)
  - NRT

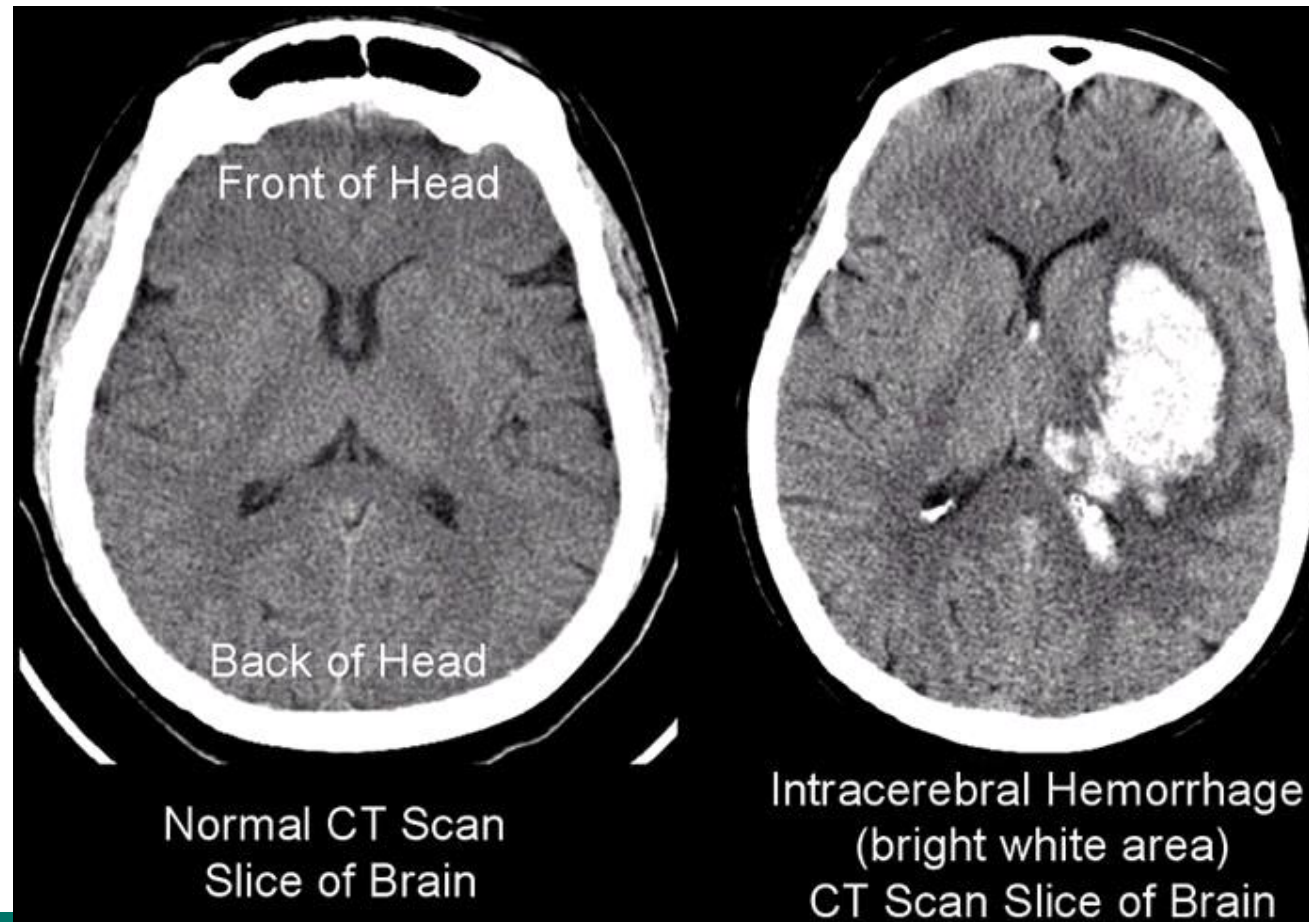
Stroke team provided education including [Stroke Information Package](#)



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# What If Tom Presents With Hemorrhagic Stroke?



# Intracerebral Hemorrhagic (ICH) Stroke: Blood Pressure Management



- Assess BP every 15 mins until target achieved and maintained for 1st 24 hours
- SBP lowering to target of < 140 mmHg systolic does not worsen neurological outcomes (relative to a target of 180 mmHg systolic)
- Subsequent SBP monitoring should be individualized as per stability of V/S & ICP

## Clinical Considerations

- SBP of < 140-160 mm Hg for 1st 24-48 hours may be reasonable
  - Factors that may favour this lower target may include: presentation within 6 hours of symptom onset; presenting SBP no greater than 220 mmHg; anticoagulation therapy; presence of neuroimaging markers of expansion and/or normal renal function
- Labetalol, hydralazine, nicardapine and/or enalapril (oral or IV) may be considered for acute BP reduction



# Subarachnoid Hemorrhage: Blood Pressure Management



- CSBP (2015) indicated that for **Unsecured Aneurysm**:
  - BP should be closely monitored and maintained as normotensive
  - Tx for high BP should be initiated to reduce risk of hypertension-induced rebleeding while maintaining CPP
- **Unsecured Aneurysm**: Normotensive usually SBP 110-140mmHg. **Secured Aneurysm**: SBP < 160 mmHg
- Between the time of SAH onset and aneurysm obliteration, BP should be controlled with a titratable med to balance the risk of stroke, HTN related rebleeding, and maintenance of CPP
- For the prevention of rebleeding
  - Maintenance of MAP > 90 mmHg to maintain CPP



# SAH-Vasospasm

- Administer prophylaxis Nimodipine po/NG
  - Calcium channel blocker
  - 60mg q4h x 21 days
- Maintain Euvolemia
  - Avoid hypovolemia & hypervolemia
  - Fluid boluses prn
- In the case of symptomatic cerebral vasospasm and delayed cerebral ischemia after SAH
  - Induced HTN is recommended
- May start vasopressors to ↑BP to resolve symptoms
- Milrinone IV
  - If no resolution of symptoms despite increase in SBP
  - Limited data on efficacy for refractory vasospasms from SAH



# What to do in the Subacute Phase?

Previously untreated patients with SBP $\geq$ 140 mm Hg or DBP  $\geq$ 90 mm Hg

- Initiate BP therapy

Patients with SBP <140 mm Hg and DBP <90 mm Hg

- Initiation of BP therapy is of uncertain benefit

Previously treated patients with known hypertension

- Resume BP therapy

# Blood Pressure Management Secondary Stroke Prevention



- Assess /manage BP in everyone with stroke or TIA
- Target BP < 140/90 mm Hg for ischemic stroke or TIA
- Target SBP < 130 mmHg for **small subcortical stroke** (i.e., lacunar stroke)
- Target SBP < 130/80 for patients with ICH or diabetes



## NEW

- Tx with **ACE inhibitor + thiazide/thiazide-like diuretic** is recommended. Long-acting diuretic may be considered over short-acting. Use of ACE + ARB not recommended
- Refer to [Hypertension Canada guidelines](#)

*Tom continued on ACEI & received nutrition counselling with RD in acute and rehab including ↓ Sodium. Tom had f/u appt in Stroke Prevention Clinic*



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# Reminders-We all have role to play

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- In all healthcare settings across continuum- prevention
- Provide individualized info and education about medication and other strategies to manage BP & other vascular risk factors
- Discuss & document **adherence** to secondary prevention tx plan(s) (pharmacotherapy & lifestyle changes)
- Explore & address non-adherence/ barriers & engage in joint goal setting to encourage adherence



# Medication Adherence

- Many patients are non-adherent e.g., not everyone fills Rx
- Patients experience more than 1 barrier
- Use multi-interventional approach tailored to patient
- Learn more about adherence management
- Link with pharmacist team

*Rehab pharmacist sees Tom and links with other team members. Tom links with his community pharmacist & primary care team for ongoing support*



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# Home BP Management Tips

- Encourage the use of approved home monitors and teach proper technique and BP tracking
  - Advise patients to monitor BP at home to encourage self-care and adherence.
  - Home BP target is <135/85



JOURNAL DE TENSION ARTÉRIELLE						
Jour de la semaine						
Lundi / Mardi / Mercredi / Jeudi / Vendredi / Samedi / Dimanche						
Date	Heure	Tension artérielle	Freq. card.	Médc.	Médic.	
		140 / 90	72	x		
9 Feb	2:45	154 / 81	81			
9 Feb	8:40	141 / 75	82			
10 Feb	8:40	153 / 74	80			
10 Feb	11:15	138 / 75	87			
10 Feb	3:50	135 / 72	87			
10 Feb	8:25	154 / 87	95			
11 Feb	7:45	127 / 73	82			
11 Feb	11:55	160 / 83	73			
11 Feb	6:30	149 / 76	80			
11 Feb	8:25	159 / 73	83			
12 Feb	8:25	122 / 73	78			
12 Feb	11:30	117 / 81	84			
12 Feb	3:15	146 / 76	77			
12 Feb	7:45	135 / 77	82			
13 Feb	7:45	146 / 79	80			
13 Feb	3:00	147 / 77	80			
13 Feb	7:55	145 / 78	84			
14 Feb	7:00	149 / 77	77			
14 Feb	11:30	149 / 77	83			
14 Feb	3:55	162 / 71	90			
14 Feb	8:10	154 / 78	81			

**Which of the Following is the Correct Position?**

White COAT hypertension



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# Resources

- <https://www.strokenetworkseo.ca/>
- <https://www.strokebestpractices.ca/>
- <https://hypertension.ca/>



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## Let's Stay connected



Website

[www.strokenetworkseo.ca](http://www.strokenetworkseo.ca)



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# Main References

- Heran, M., Lindsay, P., Gubitz, G., Yu, A., Ganesh, A., Lund, R., . . . Shamy, M. (2022). Canadian Stroke Best Practice Recommendations: Acute Stroke Management, 7th Edition Practice Guidelines Update, 2022. Canadian Journal of Neurological Sciences / Journal Canadien Des Sciences Neurologiques, 1-94. doi:10.1017/cjn.2022.344. Available [here](#)
- Shoamanesh (Co-chair), A., Patrice Lindsay, M., Castellucci, L. A., Cayley, A., Crowther, M., de Wit, K., English, S. W., Hoosein, S., Huynh, T., Kelly, M., O’Kelly, C. J., Teitelbaum, J., Yip, S., Dowlathshahi, D., Smith, E. E., Foley, N., Pikula, A., Mountain, A., Gubitz, G., & Gioia, L. C. (2020). Canadian stroke best practice recommendations: Management of Spontaneous Intracerebral Hemorrhage, 7th Edition Update 2020. International Journal of Stroke. <https://doi.org/10.1177/1747493020968424>. Available [here](#)





# Main References

- Gladstone, D., Lindsay, M., Douketis, J., Smith, E., Dowlathshahi, D., Wein, T., . . . Poppe, A. (2021). Canadian Stroke Best Practice Recommendations: Secondary Prevention of Stroke Update 2020. *Canadian Journal of Neurological Sciences / Journal Canadien Des Sciences Neurologiques*, 1-69. doi:10.1017/cjn.2021.127. Available [here](#)
- Casaubon, L. K., Boulanger, J.M., Blacquiere, D., Boucher, S., Brown, K., Goddard.,... Lindsay, P. (2015). Canadian Stroke Best Practice Recommendations: Hyperacute Stroke Care Guidelines, Update 2015. *World Stroke Organization*, 10, 924-940. doi: 10.1111/ijs.12551.
- Hypertension Canada: Treatment of hypertension in association with stroke. Available [here](#)



- Britton, M., Carlsson, A., & de Faire, U. (1986). Blood pressure course in patients with acute stroke and matched controls. *Stroke*, 17(5), 861–864.
- Buletko AB, Thacker T, Cho SM, Mathew J, Thompson NR, Organek N, et al. Cerebral ischemia and deterioration with lower blood pressure target in intracerebral hemorrhage. *Neurology* 2018;91:e1058-66.
- Chang, J. Y., et al. (2019). Postreperfusion Blood pressure variability after endovascular thrombectomy affects outcomes in Acute ischemic stroke patients with poor collateral circulation. *Frontiers In Neurology*, 10, 346
- De Georgia, M., Bowen, T., Duncan, K. R., & Chebl, A.B. (2023). Blood pressure management in ischemic stroke patients undergoing mechanical thrombectomy. *Neurological Research and Practice*, <https://doi.org/10.1186/s42466-023-00238-8>
- Delgado-Mederos R, Ribo M, Rovira A, et al. Prognostic significance of blood pressure variability after thrombolysis in acute stroke. *Neurology* 2008;71:552–558.



- Divani AA, Liu X, Di Napoli M, Lattanzi S, Ziai W, James ML, et al. Blood pressure variability predicts poor in-hospital outcome in spontaneous intracerebral hemorrhage. *Stroke* 2019; 50:2023-9
- Gorelick, P. B., Whelton, P, K., Sorond, F., & Carey, R.M. (2020). Blood pressure management in stroke. *Hypertension*, 76, 1688-1695. doi: 10.1161/HYPERTENSIONAHA.120.14653.
- He J, Zhang Y, Xu T, Zhao Q, Wang D, Chen CS, Tong W, Liu C, Xu T, Ju Z, et al; CATIS Investigators. Effects of immediate blood pressure reduction on death and major disability in patients with acute ischemic stroke: the CATIS randomized clinical trial. *JAMA*. 2014;311:479–489. doi: 10.1001/jama.2013.282543



- He J, Zhang Y, Xu T, et al. Effects of immediate blood pressure reduction on death and major disability in patients with acute ischemic stroke: the CATIS randomized clinical trial. *JAMA* 2014; 311:479–489. 23.
- Hemphill JC 3rd, Greenberg SM, Anderson CS, Becker K, Bendok BR, Cushman M, Fung GL, Goldstein JN, Macdonald RL, Mitchell PH, et al; American Heart Association Stroke Council; Council on Cardiovascular and Stroke Nursing; Council on Clinical Cardiology. Guidelines for the management of spontaneous intracerebral hemorrhage: a guideline for healthcare professionals from the American Heart Association/ American Stroke Association. *Stroke*. 2015;46:2032–2060. doi: 10.1161/STR.0000000000000069
- Hemphill JC 3rd, Greenberg SM, Anderson CS, Becker K, Bendok BR, Cushman M, et al. Guidelines for the management of spontaneous intracerebral hemorrhage: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke* 2015;46:2032-60



- Guo, QH. Liu, CH., & Wang, JG. (2022). Blood pressure goals in acute stroke. *American Journal of Hypertension*, 35(6). <https://doi.org/10.1093/ajh/hpac039>.
- Ho, B.L., Ko, N.U., Amin-Hanjani, S., Chou, S. HY., Flores, SC., et al. (2023). Guideline for the management of patients with aneurysmal subarachnoid hemorrhage: A guideline from the American Heart Association/American Stroke Association. *Stroke*, 54, e314-e370. doi. 10.1161/STR.00000000000000436.
- Jauch EC, Saver JL, Adams HP, et al. Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke* 2013;44:870–947.
- Kim, S.M., Woo, H. G., Kim, Y. J., & Kim, B.J (2020). Blood pressure management in stroke patients. *Journal of Neurocritical Care*, 13(2), 69-79. <https://doi.org/10.18700/jnc.2000028>
- Lehman, L. W., et al. (2013). Methods of blood pressure measurement in the ICU. *Critical Care Medicine*, 41(1), 34–40.
- Lin QS, Ping-Chen, Lin YX, Lin ZY, Yu LH, Dai LS, et al. Systolic blood pressure variability is a novel risk factor for rebleeding in acute subarachnoid hemorrhage: a case-control study. *Medicine (Baltimore)* 2016;95:e3028.





- Liu, D., et al. (2021). Adverse outcomes Associated with Higher Mean Blood pressure and Greater Blood pressure variability immediately after successful embolectomy in those with Acute ischemic stroke, and the influence of pretreatment collateral circulation status. *J Am Heart Assoc*, 10(5), e019350
- Manning, L. S., et al. (2015). Prognostic significance of short-term blood pressure variability in Acute Stroke: Systematic review. *Stroke*, 46(9), 2482–2490.
- Mattle, H. P., et al. (2005). Blood pressure and vessel recanalization in the first hours after ischemic stroke. *Stroke*, 36(2), 264–268.
- Minhas, J.S., Moullaali, T.J., Rinkel, G.J.E., & Anderson, C. S. (2022). Blood pressure management ater intracerebral and subarachnoid hemorrhage: The knowns and known unknowns; *Stroke*, 53, 1066-1073. doi: 10.1161/STROKEAHA.121.036139.
- Moullaali TJ, Wang X, Martin RH, Shipes VB, Robinson TG, Chalmers J, Suarez JJ, Qureshi AI, Palesch YY, Anderson CS. Blood pressure control and clinical outcomes in acute intracerebral haemorrhage: a preplanned pooled analysis of individual participant data. *Lancet Neurology*. 2019;18:857-864. doi: 10.1016/S1474-4422(19)30196-6



- Nam HS. Effect of intensive vs conventional blood pressure lowering after successful intra-arterial thrombectomy in acute ischemic stroke: the OPTIMAL-BP randomized clinical trial. Presented at: ESOC 2023. May 26, 2023. Munich, Germany.
- Pasquier, M., et al. (2021). Vital signs in Accidental Hypothermia. *High Altitude Medicine & Biology*, 22(2), 142–147.
- Patel VN, Gupta R, Horn CM, Thomas TT, Nogueira RG. The neuro-critical care management of the endovascular stroke patient. *Curr Treat Options Neurol* 2013;15:113–124.
- Powers WJ, Rabinstein AA, Ackerson T, Adeoye OM, Bambakidis NC, Becker K, Biller J, Brown M, Demaerschalk BM, Hoh B, et al. Guidelines for the early management of patients with acute ischemic stroke: 2019 update to the 2018 guidelines for the early management of acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*. 2019;50:e344–e418. doi: 10.1161/STR.0000000000000211
- Powers, W. J., et al. (2019). Guidelines for the early management of patients with Acute ischemic stroke: 2019 update to the 2018 guidelines for the early management of Acute ischemic stroke: A Guideline for Healthcare Professionals from the American Heart Association/American Stroke Association. *Stroke*, 50(12), e344–e418.



- Qureshi, A. I., et al. (2007). Prevalence of elevated blood pressure in 563,704 adult patients with stroke presenting to the ED in the United States. *American Journal Of Emergency Medicine*, 25(1), 32–38. 14
- Qureshi AI, Palesch YY, Barsan WG, Hanley DF, Hsu CY, Martin RL, et al. Intensive blood-pressure lowering in patients with acute cerebral hemorrhage. *N Engl J Med* 2016;375:1033-43.
- Saini, M., & Shuaib. A. (2010). Blood pressure lowering and stroke. *Expert Review of Neurotherapeutics*, 10(2), 225-241.
- Sandset, EC, Bath PM, Boysen G, et al. The angiotensin-receptor blocker candesartan for treatment of acute stroke (SCAST): a randomised, placebo-controlled, double-blind trial. *Lancet* 2011;377:741–750. 22.
- Shi L, Xu S, Zheng J, Xu J, Zhang J. Blood pressure management for acute intracerebral hemorrhage: a meta-analysis. *Sci Rep*. 2017;7:14345. doi: 10.1038/s41598-017-13111-x
- Tarlov N, Nien YL, Zaidat OO, Nguyen TN. Periprocedural management of acute ischemic stroke intervention. *Neurology* 2012;79(suppl 1):S182–S191.



- Treggiari, M. M., Rabinstein, A. A., Busl, K. M., Caylor, M. M., Citerio, G, Deem, S., et al. (2023). Guidelines for the neurocritical care management of aneurysmal subarachnoid hemorrhage. *Neurocritical Care*, <https://doi.org/10.1007/s12028-023-01713-5>
- Williams B, Mancia G, Spiering W, Agabiti Rosei E, Azizi M, Burnier M, Clement DL, Coca A, de Simone G, Dominiczak A, Kahan T, Mahfoud F, Redon J, Ruilope L, Zanchetti A, Kerins M, Kjeldsen SE, Kreutz R, Laurent S, Lip GYH, McManus R, Narkiewicz K, Ruschitzka F, Schmieder RE, Shlyakhto E, Tsioufis C, Aboyans V, Desormais I; Authors/Task Force Members. 2018 ESC/ESH Guidelines for the management of arterial hypertension: The Task Force for the management of arterial hypertension of the European Society of Cardiology and the European Society of Hypertension. *J Hypertens* 2018; 36:1953–2041
- Woodhouse, L., Manning, L., Potter, J.F., Berge, E., Sprigg, N., Wardlaw et al. for the Blood Pressure in Acute Stroke Collaboration. (2017). Continuing or temporarily stopping prestroke antihypertensive medication in acute stroke: An individual patient data meta-analysis. *Hypertension*, 69, 933-941. doi: 10.1161/HYPERTENSIONAHA.116.07982
- Verschoof, M. A., et al. (2020). Association between low blood pressure and clinical outcomes in patients with Acute ischemic stroke. *Stroke*, 51(1), 338–341.



- Yan, S., et al. (2015). Sudden Drop” in blood pressure is Associated with Recanalization after Thrombolysis. *Medicine (Baltimore)*, 94(30), e1132.
- Yang M, Pan X, Liang Z, Huang X, Duan M, Cai H, et al. Association between blood pressure variability and the short-term outcome in patients with acute spontaneous subarachnoid hemorrhage. *Hypertens Res* 2019;42:1701-7.
- Zonneveld, T. P., Richard, E., Vergouwen, M. D. I., Nederkoorn, P. J., de Hann, R. J., roos, B. W. E. M., & kruyt, N. D. (2018). Blood pressure-lowering treatment after subacute stroke to prevent recurrent stroke, major vascular events, and dementia. *Stroke*, 49, e309-e310. doi: 10.1161/STROKEAHA.118.023087.
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