Southeastern Ontario Contingency Plans for Acute Stroke Care

November 18, 2020

Preamble

Following evidence-based stroke guidelines should continue to be the goal during COVID-19 or other future pandemic crises. All efforts should be devoted to the preservation of high priority stroke best practices/standards.

This regional stroke contingency plan is focused on preserving essential best practices related to:

1) **Hyper-acute care** including the emergency Regional Acute Stroke Protocol, continued timely access to imaging, thrombolysis and Endovascular Thrombectomy (EVT) through preservation of Acute Stroke Protocol/Code Stroke processes; and
2) **Acute stroke unit care** in designated stroke units [Acute Stroke Unit (ASU) or Integrated Stroke Unit (ISU)].

CorHealth Ontario's memorandum of *"Recommendations for Designated Stroke Hospitals When Developing Regional Contingency Plans for Acute Stroke Care"* (Click here for the Memo) includes a framework which was used to help guide this high-level regional contingency plan along with the following recommended guiding principles:

1. **Patient-centred**: Ensure that contingency plans incorporate the needs and experiences of patients and caregivers.
2. **Last Resort**: Ensure that contingency plans clearly articulate the circumstances under which implementation is warranted (i.e. after all other options have been explored).
3. **Equitable**: Ensure that contingency plans preserve equitable access to stroke best practices.
4. **Simple**: Ensure that contingency plans can be easily implemented in a timely manner.
5. **Future-oriented**: Ensure that contingency plans, although developed to respond to current circumstances, are applicable to other circumstances.
6. **Collaborative**: Ensure that contingency plans leverage the partnerships and systems already in place.
7. **Temporary**: Ensure that contingency plans are short-term and not intended to be used on an ongoing basis.

The following are Levels 1, 2, & 3 plans for the Regional Stroke Centre [Kingston Health Sciences Centre (KHSC)] & the District Stroke Centre [Quinte Health Care (QHC)] located in Southeastern Ontario.

Level 1: Recommendations for Local Designated Stroke Centres

Designated Stroke Centres should continually assess and identify local risks that may compromise their ability to deliver hyper-acute and/or acute stroke services. The following are contingency strategies to mitigate risks that may compromise ability to fully deliver hyper-acute and/or acute stroke care services at local Designated Stroke Centres (KHSC Regional Stroke Centre and QHC District Stroke Centre).

Southeastern Ontario Contingency Plans for Acute Stroke Care

November 18, 2020

Hyper-Acute

Reduced Access to Stroke Specialists

- **Improve Access to Local Stroke Physician Specialists**

  KHSC:

  - Prepare in-person stroke service **back-up call schedules** and update these regularly.
  - Use **tele-neurology- virtual local telestroke workstation as needed** to enable stroke neurologist to provide hyper-acute stroke consultation (see Appendix A). The telestroke workstation is a unit on wheels with zoom and microphone features to enable a virtual neuro exam for use in ED to assist with decision-making. If 2 stroke neurologists were to become unavailable due to COVID risk, the neurology stroke service would make use of this local telestroke workstation to conserve the ability to deliver stroke expertise while protecting patients and providers. There would be no change in Acute Stroke Protocol processes at KHSC except that local telestroke would be incorporated as needed.

  QHC:

  - Continue to make use of the **Provincial Telestroke Program**.
  - Since January 2020, **ICU has two physicians** working 0800-1800. The **second physician covers** the ICU satellite unit, Critical Care Response Team, and codes - including **code stroke**.

- **Improve Access to Local Stroke Team (e.g., Allied Health, Nursing)**

  KHSC:

  - **Refer to hospital surge plan** and consider support for coverage from other areas. The assumption in level 1 is that there will be continued access to nursing and allied health stroke expertise given the pool of human resources.

  QHC:

  - For other disciplines, refer to hospital surge plan.

- **Minimize Personal Contact**

  KHSC & QHC:

  - **Follow Protected Acute Stroke Protocol or Code Stroke** to preserve workers and PPE both in ED and for In-hospital Stroke Codes (Click here for samples and see Appendix B for KHSC Protected Acute Stroke Protocol sample.).
    - Practice Protected Stroke Protocols if time has passed since previous use.
  - **Send fewer people to the Acute Stroke Protocol or Code Stroke** in order to preserve workers & PPE and maintain physical distancing given space is at a premium.

Availability of Neuroimaging

KHSC & QHC:

- **Perform CTA/CT Perfusion with RAPID with CT** for all patients presenting with stroke to minimize return to imaging departments and to expedite treatments.
- Perform CTA with CT for patients with TIA.

Southeastern Ontario Contingency Plans for Acute Stroke Care

November 18, 2020

Availability of Critical Care Beds

- **Continue best practice critical care monitoring post thrombolysis, EVT, or for other patients requiring critical care** (e.g., unstable hemorrhagic stroke patients).
  - If access to critical care beds becomes limited**, consider alternate place for continued critical care monitoring** and aim for geographical cohorting of these patients.
  - **Efficient repatriation** to local stroke units at sending/bypassed hospitals as soon as possible. Local telestroke can be used to facilitate consultation & care for patients in their local stroke units, closer to home.

  KHSC:
  - If no critical care bed available, close observation on Kidd 7 (K7) may be best if ED is unable to care for patients for 24 hours (See Appendix C).

  QHC:
  - New OTN drop installed in Diagnostic Imaging to support availability of code stroke.
  - ICU satellite unit has opened to increase ICU capacity.

Acute Stroke Unit Care

High Census Limiting Capacity

- **Strive to NOT Decrease Access to Stroke Unit Care given the strong evidence that length of stay & mortality increase if patients are not cared for in a Stroke Unit.**

  KHSC:
  - Preserve 6-bed Stroke Acute Stroke Unit (ASU) on K7 for stroke patients.
  - Continue to improve flow into and out of ASU. Stable stroke patients requiring less observation to be moved out to clustered area on K7. Transfer to next destination as efficiently and safely as possible (repatriate to local stroke units, timely referrals to PCH, Perth rehab, home; see more regarding flow below).
  - Transfer off-service non-stroke patients and some neurosurgical patients (e.g., laminectomies) off the K7 unit when surge demands. Refer *ALC to LTC* patients to IMUH.
  - If K7 becomes a quarantined unit, create a "green zone" in ASU and ward beds of K737, K738 & K739 and a "red zone" for quarantined COVID patients in other K7 beds. Contain nursing staff to either the red quarantined zone or the green zone. Limit movement between these areas. For the Acute Stroke Team including allied health, "batch" seeing the patients, e.g., see all the green zone patients first then red zone patients at the end of the day.

  QHC
  - Acute stroke patients will continue to be admitted to the Integrated Stroke Unit (ISU) with potential for non-stroke admissions to Sills beds to support bed flow given the extra capacity within the unit. No change to beds available for stroke patients.

Lack of Ability for Regular Rounding -Regular rounding helps avoid patient complications, critical care admission and longer length of stay.

KHSC

- **Use tele-rounding** with the local telestroke unit, as needed (See Appendix A)
- **Use MS Teams** to promote communication within the stroke services as needed

Challenges re Flow –Home, Repatriation and Transfers

KHSC & QHC:

- Continue to **start the discharge process at beginning of the admission** process.
- **Efficient repatriation** to local sending/bypassed hospital, as soon as possible. **Use local telestroke** to facilitate consultation & care for patients in their local stroke units, closer to home.
- Emphasize sustaining **efficient flow processes to rehabilitation and community** by ensuring very tight transfer and discharge processes. Refer to Rapid Response Nurses (QHC & KHSC) and telephone follow-up processes (KHSC) to assess clinical status.
- At KHSC, sustain Fast Track Rehab Admission process with Providence Care Hospital.
- **Investigations to be done in a timely manner** and consideration for less urgent testing to be done as outpatients. Consider what investigations and consults are essential and what can be safely postponed.
- **Avoid TIA admissions** unless medically unstable. High risk TIA patients to be seen in the Stroke Prevention Clinic (SPC) as soon as possible to avoid hospital admissions. At KHSC for example, avoid admitting TIA for MRI; instead, communicate directly with radiology to plan timely outpatient imaging. QHC SPC is set up for virtual visits (telephone and Zoom) & KHSC SPC is set up for hybrid model including virtual care.

Level 2: Recommendations for Designated Stroke Centres and Regional Network

The following are contingency strategies when Designated Stroke Centres become very limited in their ability to deliver essential priority hyperacute (tPA & EVT) and acute stroke care.

"One Stroke Team" across the region is needed, more than ever.

- More collaboration and interprofessional team support is needed (e.g., EMS, ED, Acute Care, Rehab and Community providers) when Designated Stroke Centres become limited in their ability to deliver essential hyper-acute and acute stroke best practices.
- Every effort should be focused on **preserving capacity at the Regional Stroke Centre given its role as the tertiary care centre** for Southeastern Ontario.

KHSC & QHC: Maximize all Level 1 Contingency strategies.

Limited Access to Local Stroke Expertise

- **KHSC-Use local telestroke unit consistently** and transition temporarily to a more consultative/decision-making role at KHSC with use of house staff.
- **KHSC**- **Use Provincial Telestroke Program as back-up only when necessary** to access stroke neurologist for hyperacute stroke care **when there is very limited access to KHSC neurologists**.
    - In the event that there are no stroke neurologists available, ED and Internal Medicine specialists could work with provincial telestroke support for Acute Stroke protocols and for stroke consultation. This would require communication with the provincial telestroke and CritiCall system.
- **QHC – continue to use Provincial Telestroke Program.**
- **KHSC & QHC-**For other disciplines, **consider coverage from other areas of the hospital, referring to surge plans.**
- Consider Redirection of Staff Resources
    - In consultation with Ontario Health East, **regional consideration would be given to moving staff resources** across the region in order to leverage the expertise, space, and equipment capacity in place at the Designated Stroke Centres.

Level 3: Recommendations for Designated Stroke Centres and Regional Network

The following are contingency strategies when Designated Stroke Centres are <u>unavailable</u> for thrombolysis or EVT. These recommendations are for worst case scenario, are to be last-resort and should be temporary. In this situation we would **defer to and follow Corporate and Ontario Health's guidance**. **KHSC would not send patients out unless EVT was down.** If redirection needed to be considered, Ontario Health East would be engaged in planning, discussions and decision-making given the loss of essential services would be likely to be beyond stroke.

Inform all Impacted Parties. Impacted parties would include EMS, Non-designated & Designated Stroke Centres, Ontario Telestroke Program, and CorHeath Ontario before enacting regional contingency plans.

No Stroke Neurologists at KHSC

- **KHSC would keep their patients and would defer to Provincial Telestroke Program for hyperacute care if there were no neurologists available at KHSC.**
    - ED and Internal Medicine specialists would work with provincial telestroke support for Acute Stroke Protocols and for stroke consultation.

Very Limited Bed or Human Resource Capacity

- **Re-direct <u>non-stroke</u> patients to field hospital(s)** near KHSC as per Corporate's guidance from Incident Command to maintain flow and sustain the Regional Stroke Centre mandate.
- **Follow Ontario Health's Clinical Triage Protocol for Major Surge in COVID Pandemic** as an absolute last resort under Ontario Health's direction.

- In consultation with Ontario Health East, **redirect staffing resources** across the region in order to leverage the expertise, space and equipment capacity in place at Designated Stroke Centres.

Lack of access to thrombolysis at QHC

- **Redirect QHC Patients to KHSC**
    - If both staffing and space/equipment is NOT available at QHC Telestroke site, consideration should be given to redirection of patients to KHSC for delivery of thrombolysis and assessment for EVT. This would be done in collaboration with KHSC Incident Command and the Regional Stroke Team.
    - Ensure CTA/RAPID (if available) is done prior to transferring patients from QHC to KHSC.
    - Efficient repatriation processes to be in place. Transfer patients back from KGH ED or ICU to QHC ED or ICU/ISU < 24 hours, as soon as possible.

EVT is Unavailable-No Interventionalists or No Space at KHSC to Perform EVT

- **KHSC would not send patients out unless EVT was down.**
- **Refer to EVT Provincial Contingency Mapping**. This would involve local assessment, collaborative identification of EVT candidates, and use of CritiCall Ontario to facilitate referral and transfer.
    - KHSC would refer EVT cases to The Ottawa Hospital (TOH) as the primary site (R1). If R1-TOH should experience service interruption then refer to R2 - Toronto.
    - QHC will continue to do *RAPID* imaging and consult Provincial Telestroke Program and KHSC neurologists for appropriate action.

Southeastern Ontario Contingency Plans for Acute Stroke Care

November 18, 2020

Appendix A

KHSC Local Telestroke Protocol- Draft 4 April 8 2020

For use when Neurologists capable of covering Stroke are not available to attend Acute Stroke Protocol in person due to requirements for self-isolation, quarantine or sickness.

The Regional Stroke Program will engage the following stakeholders in the development/review of this process and in any related communication:

- Regional Stroke Medical Director or delegate
    a. Local Telestroke Neurologists
    b. Residents on stroke service call.
    c. ED Physician lead, Dr. Terry O'Brien
    d. Head of Radiology, Dr. Omar Islam
- Regional Stroke Director or delegate
    e. ED Manager, Jackie Kehoe-Donaldson who will engage charge/others as needed
    f. CLS covering ED, Laura McDonough
    g. DI Manager Kelly Hubbard and Senior CT technologist Barb Delaney

Scenario involves Telestroke with Stroke Neurologist and Resident on-call representing Neurology; used when only 2 stroke neurologists remain available. Off service/call residents would be expected to go through this document at the beginning of their rotation and be familiar with the protocol including Appendix A.

The attending physician on stroke service is responsible for ensuring that all off service residents rotating through the stroke service BE OBSERVED performing the modified NIHSS within 48 hours of start on the Stroke Service.

Telestroke: main telestroke workflow change is tPA is administered in ED vs CT

Scenario A: Telestroke with Resident on-call

1. EMS Pre-notification provided to Resident on call AND Stroke neurologist on call.
2. ED Nurse or delegate turns on the telestroke workstation and places it in position in area A
3. On patient arrival, ED nurse follows usual protocol while resident gets the brief story from EMS, assesses the patient and takes the patient to CT Scan with the nurse and EMS.
4. The resident and neurologist discuss the case over the phone during the CT scan. Option for the neurologist to talk to EMS if needed to clarify history.
5. Neurologist calls ER to ensure Telestroke system is on/ready
6. The neurologist reviews the image live during this process using RAPID app
7. The resident is present with the patient at bedside all along and upon return from CT, signs into REACTs telemedicine platform.
8. The neurologist comes live on Telestroke when the patient is back from the CT.
9. All information regarding the CT Scan, Treatment decision, options available will be discussed with the patient by the resident and telestroke neurologist.
10. If decision made to deliver tPA → resident administers

11. If EVT proceeds AND no Neurologist capable of covering stroke available in person → Telestroke neurologist discusses imaging/case with IVR and resident; patient taken to IVR; resident supports IVR in ongoing neuro assessment as required

Appendix 1- Simplified Stroke Examination

1. Impaired level of consciousness? Yes or No.
2. Gaze towards one side? Yes or No.
3. Sees hand waving on both the left and right side? Yes or No.
4. Able to raise arm to 45 degrees for 10 seconds without drift? Yes or No.
5. Able to straight leg raise with heel 6 to 12 inches off bed? Yes or No.
6. Speech impaired? Yes or No.
7. Feels tap on left shoulder? Yes or No.

Southeastern Ontario Contingency Plans for Acute Stroke Care

November 18, 2020

Appendix B

Acute Stroke Protocol for Patients with Suspected or Confirmed COVID-19

April 1, 2020

Suspected/Query COVID-19 Includes Acute Stroke Protocol Patients Who Were NOT Able to be Screened for COVID-19 by Paramedics or Hospital Providers (e.g., due to aphasia or cognitive issues).

- **Number of Protected Acute Stroke Protocol (ASP) Team = 1 physician (Attending Neurologist or Resident) and 1 ED RN**

A. Transfer to a Stroke Centre

1. Paramedics initiate pre-notification to ED ASAP & inform KGH ED of COVID-19 status. If hospital transfer, hospital to call KGH ED at 7003 and inform them of COVID-19.

B. ED

1. ED contacts Switchboard re Protected Acute Stroke Protocol (suspected or confirmed COVID-19)
2. Switchboard contacts ASP list with added communication of "Protected" Acute Stroke Protocol.
3. ED Charge RN assigns 1 RN. Neurologist to decide if Resident will perform assessment.
4. Upon arrival, patient is registered including COVID-19 flag; notify CT of patient arrival in ED, include if COVID-19 precautions and/or unstable.
5. Patient brought to usual desk area in Section A by paramedics for brief assessment.
6. Protected ASP team dons PPE as per IPAC policy before assessing or placing IVs/+/- bloodwork: Mask, Face Shield, Gown & Gloves. If PPE not located in nearby cart, ask Charge RN or ED RN.
    a. If patient requires intubation or is unstable, patient is placed in Isolated Room in Section A. If intubation is needed, Critical Care/ED dons N95, bouffant, face shield with drape, gown, & gloves; Neurology will not be involved with intubation of cases.
    b. If patient is intubated, Kidd 2 ICU intensivist and Charge RN are notified. If after hours and patient is unstable, notify ACO.
7. Rapid handover from paramedics to Protected ASP team (if Walk-In report given by triage RN).
8. Protected ASP physician conducts rapid assessment using NIHSS or Simplified Stroke Exam as described in Appendix 1. Protected ASP ED nurse establishes 2 IVs unless previously started +/- bloodwork.
9. Place yellow procedure mask & clean sheet on patient before transport to CT. Mask kept on.
10. Protected ASP ED nurse to remove gown & gloves and obtain tPA from Omnicell and equipment including stretcher, pump, monitor, & ASP package and will go ahead opening doors. Protected ASP physician + paramedic to keep PPE on & follow with patient. If there is a "clean runner" present (e.g., Resident), they can open doors.
11. Important to have someone call CT before leaving to ensure they are ready.

C. Imaging

1. CT console room should be kept clear as possible of extra staff.

2. 1 CT tech dons PPE. Protected ASP physician, paramedic & CT tech place patient on CT table. Paramedic/physician change monitor leads. CT Tech hooks up injector for contrast.
3. CT Tech, physician & paramedic remove gown & gloves in CT ante-room laundry basket (back into closed door to open door). Paramedic gives report to "clean" nurse.
4. Non -Contrast CT and +/- CT Perfusion using RAPID.
5. If tPA to be given, Protected ASP ED nurse or ASP physician prepares bolus. Protected ASP physician or Resident dons gown and gloves & administers bolus. Nurse prepares infusion then dons gown & gloves and starts infusion. Patient is transferred to stretcher by Protected ASP physician or resident & nurse and moved into hallway. Physician removes gown & gloves and reviews rest of CT images either in CT console room or via cell phone.

D. Transfer from Imaging

- Notify Infection Prevention & Control (IPAC) & receiving location prior to transfer.
- Patient to be transferred by Protected ASP ED nurse who keeps PPE on. Protected ASP physician or Resident remains "clean" and opens doors.
  - **If IV tPA only:** patient will be transferred back to ED Section A to await D4ICU bed unless bed is ready. If intubated, aim to transfer patient to K2ICU ASAP with RT, Critical Care RN & Porter.
  - **If NO EVT or tPA:** patient will be transferred back to ED to Section A or C (if stable) to await bed assignment by the Bed Allocation Team 7.
  - **If EVT,** patient transfers to IVR when IVR ready (at times may need to go to ED Section A if IVR not ready-after hours).

E. EVT Procedure in IVR

1. IVR Team assisting with IVR procedure dons PPE. Protected ASP ED nurse assists with transferring patient to IVR procedure bed & provides report. ASP ED nurse can then leave removing gown & gloves. Protected ASP physician or resident dons lead apron, gown and gloves to assist if necessary.
2. Patient is prepped-needs clean gown. Insert Foley Catheter if needed.
3. EVT procedure completed (If patient becomes unstable requiring intubation, do hand hygiene, don clean gloves, then place N95 on before bagging patient while waiting for RACE (also applies in DI)).
4. IVR team transfers patient to D4ICU or K2ICU stretcher/bed.
5. Critical care RN & ASP physician or porter transferring patient to Critical Care don PPE. Designate 1 clean staff to carry patient chart, open doors, & to touch elevator button-Kidd/Davies Elevator 3 or 4.

F. Post EVT Management

1. Patient requires care in D4ICU or K2ICU (ventilated cases) as soon as possible post EVT +/-tPA.
2. After intensive monitoring is no longer needed, patients are transferred to the COVID-19 Isolation Unit if COVID-19 positive as per the Bed Allocation Team.

Southeastern Ontario Contingency Plans for Acute Stroke Care

November 18, 2020

Appendix C

Contingency Plan for Non-COVID Stroke Patients Requiring Critical Care during a Pandemic at KHSC (draft 3, July 10, 2020)

Preamble: Some patients with stroke require intensive monitoring and critical care. During a pandemic, there is more likelihood of reduced access to critical care beds and resources for non-COVID patients as per the experience from other hospitals around the world.

Stroke patients requiring critical care typically have a large intracerebral hemorrhage, subarachnoid hemorrhage, or a large ischemic stroke at risk for herniation. Ischemic stroke patients receiving IV thrombolysis or EVT also require critical care monitoring for a period of time.
IV Thrombolysis (tPA) will continue to be administered in CT suite or ED. EVT will continue to be delivered in IVR. If IVR is down, collaborate with others to consider alternative space at KHSC for EVT and coiling procedures (e.g., CVL, OR)

Main Guiding Principles:

1. Remaining vigilant in minimizing medical complications with stable stroke patients on K7 will help decrease avoidable transfers to critical care.
2. Some stroke patients may require critical care outside of typical D4ICU/K2ICU settings due to lack of access to these beds. The Acute Stroke Unit (ASU) would be the best alternative setting providing that critical care supports are available. Management on a general K7 ward without critical care supports is not recommended.
3. Stable stroke patients in ASU may need to be transferred out to K7 depending on the volume of critical care stroke patients in ASU.
4. Best practices must be maintained to the best of the team's abilities for patients admitted with stroke requiring critical care.
5. Stroke care will continue to require a multi-disciplinary team approach. Enhancement of the acute stroke team model with critical care providers may be required to optimize critical care best practices in alternative settings.
6. Providers will need to be supported when working in an unfamiliar setting. K7 team will need to be supported in learning some essential critical care practices. There is also cross learning opportunity for critical care providers about essential stroke best practices from the ASU team. Use of "in the moment" teaching and "buddy" mentorship will be required to support learning.
7. For critical care patients admitted to ASU, sufficient staff must be provided to adequately monitor for deterioration and provide critical care interventions. An Intensivist consultant, critical care nurse and/or critical care allied health provider may be designated for added support if patients require critical care monitoring outside of K2/D4ICU and if outside the scope of practice for K7 team.

8. Local telemedicine unit may be used to increase access to specialist assessment and care.
9. Continue early transition planning and consider more rapid discharge home, if appropriate and maintain Fast Track service for inpatient rehabilitation at PCH.

4 Scenarios for Contingency Planning

1. **Minor Surge with Increased Demand on K2/D4ICU beds (by 25%):**
   Transfer stable patients post tPA or EVT to ASU between 12-24 hours providing these patients require less intensive critical care and could transfer back to D4ICU if needed.
   Stroke patients post tPA and EVT are usually monitored in a critical care bed for 24 hours. There are many best practice guidelines supporting this practice but there is no strong evidence to support this practice. Recent literature indicates that not all ischemic stroke patients post tPA/EVT require 24 hours of monitoring in a critical care bed (Faigle et al., 2020; Chang et al., 2018). Clinical factors such as elevated NIHSS and blood pressure are predictors of critical care needs (Faigle et al., 2016). Patients with NIHSS ≥10 had a 7.7 times higher risk of requiring ICU resources (Faigle et al., 2014). Brain hemorrhage is a potential complication post thrombolysis. Some literature supports shorter ICU stays x 12 hours for ischemic stroke patients post EVT/tPA as the majority of symptomatic hemorrhage occurs within 12 hours (Chang et al., 2018).

2. **Moderate Surge with decreased access to K2/D4ICU beds (by 50%):**
   Transfer stable stroke patients 1hour post tPA infusion or EVT to ASU providing there is critical care monitoring capacity in ASU. Certain patients who have received IV tPA/EVT may be admitted directly to ASU providing there is close monitoring capability & trained staff (Alexandrov, et al., 2016; Coleman et al., 2018; Middleton et al., 2015).
   - Patients would recover for 1hour post tPA in ED or 1hour post EVT in IVR recovery.
   - Depending on ASU bed capacity, some stable stroke patients in ASU may need to transfer to K7 to accommodate patients requiring critical care support.

3. **Major Surge with limited access to K2/D4ICU beds (by 75%):**
   All stroke patients requiring level 2 critical care unit will be cared for in ASU providing there are critical care supports.
   - Stroke patients requiring level 3 critical care unit such as those needing ventilator support and/or management of hemodynamic instability requiring invasive monitoring and vasopressor/inotrope medications would continue to be cared for in K2ICU.
   - Depending on ASU bed capacity, stable stroke patients in ASU may need to be transferred to K7 to accommodate patients requiring critical care support. Stable neurology patients may need to be transferred to another medical ward off K7.

4. **Major Crisis Surge with NO access to K2/D4ICU beds for stroke patients (by 100%):**
   All non-ventilated critical care stroke patients including those requiring invasive critical care monitoring will be cared for in ASU providing there are advanced critical care supports. All

ventilated stroke patients will be cared for in an alternate designated unit where other ventilated patients are being cared for (e.g., PACU, CSU). Many hospitals have had to transform alternate areas into ICUs (Peters, Chawla, & Turnbull, 2020; Toner & Waldhorn, 2020; Yager, Whalen, Cummings, 2020; Daugherty & Rubinson, 2011). This type of surge may require use of the *Ontario Health's Clinical Triage Protocol for Major Surge in COVID Pandemic (Ontario Health, 2020)*–many patients would still qualify for critical care and those who do not, still need to be cared for appropriately. A minor-moderate surge can be accommodated but a crisis surge may exceed capacity; crisis surge may require regional contingency planning and provincial support. (Maves et al, 2020).

Scenario 1: Minor Surge

Stable patients post tPA and/or EVT may be transferred to ASU between 12-24 hours providing these patients do NOT require intensive monitoring.

EXCEPTIONS:

- Severe stroke. NIHSS remains ≥ 10 post tPA or EVT
- EVT + tPA combination
- Persistent high blood pressure requiring ongoing IV medication or persistent hypotension requiring fluids + vasopressor/inotrope support
    - SBP >185 mmHg and DBP> 110mmHg
    - SBP <90mmHg
- Neurological deterioration
- Arrhythmia or myocardial infarction requiring continuous cardiac monitoring
- Hyperglycemia requiring IV Insulin
- Internal Stroke Protocol (depends on admission dx and comorbidities)
- Other reasons for ongoing critical care in an ICU as per Attending physician

Care guidelines between 12-24 hours post IV thrombolysis/EVT:

- Continue to follow usual post tPA/EVT order set and collaborative care plan EXCEPT:
    - CNS and vital sign monitoring q 2 hours x 12 hours (if EVT, check groin site and pedal pulses q shift)
    - STAND screen providing patient is alert and can sit upright for assessment
    - Mobilize to chair if able/as per physiotherapist review
    - Telemetry x 12 hours then reassess for discontinuation

Staffing & Education:

- No change in staffing, providing volumes remain reasonable
- No extra training needed however cardiac arrhythmia education refresher is required due to apparent use of telemetry on K7 for diagnostic purposes only
- No ICU expert support required

Scenario 2: Moderate Surge

Stable stroke patients may be transferred to ASU 1 hour post IV thrombolysis or EVT.

EXCEPTIONS:

- Severe stroke. NIHSS remains ≥ 10 post tPA or EVT
- EVT + tPA combination
- Persistent high blood pressure requiring ongoing IV medication or persistent hypotension requiring fluids + vasopressor/Inotrope support
    - SBP >185 mmHg and DBP> 110
    - SBP <90mmHg
- Neurological deterioration
- Arrhythmia requiring continuous cardiac monitoring
- Anaphylaxis or angioedema post tPA/tNK
- Ongoing hyperglycemia requiring IV insulin
- Internal Stroke Protocol (depends on admission dx and comorbidities)
- Other reasons for ongoing critical care in an ICU as per Attending physician

Care guidelines 1 hour post IV thrombolysis/EVT:

- Continue to follow usual post tPA/EVT order set and collaborative care plan EXCEPT:
    - CNS and vital sign monitoring q 1hour for 10 hours then q 2 hours for 12 hours (if EVT, check groin site Q 30 min x 3 hours and then q shift)
    - STAND screen at 12 hours providing patient is alert and can sit upright for screening. If EVT only, may consider STAND at 6-12 hours providing patient is alert and can sit upright for screening
    - Mobilize at 12 hours (dangle or chair) if able/as per physiotherapy review. May dangle at 6 hours post EVT only
    - Telemetry x 24 hours then +/- discontinue

Staffing & Education:

- Nursing 1:3 critical care patient ratio for first 24 hours. May flex up or down as per acuity
- Physician: No change
- Allied Health: No change unless increase in volumes
- No extra training support required; however cardiac arrhythmia education refresher is required due to apparent use of telemetry on K7 for diagnostic purposes only
- No ICU consultant/resource required

Scenario 3 Major Surge with limited access to K2/D4ICU beds

All Level 2 critical care stroke patients may transfer to ASU regardless of stability providing there are critical care supports/resources in place.

EXCEPTIONS:

- Level 3 unit monitoring and care is needed
    - Requiring airway and mechanical ventilator support
- Requiring close invasive hemodynamic monitoring and management of hemodynamic instability with vasopressor/inotrope medications
- Other reasons for critical care in ICU as per Attending physician

Care guidelines:

- If stable post tPA and/or EVT as described in Scenario B, follow Scenario B Care guidelines.
- **Follow usual stroke order sets and collaborative care plans including the following Level 2 critical care practices:**
    - Continuous cardiac monitoring x 24 hours then assess for discontinuation
    - Continuous $Sp0_2$ monitoring x 24 hours then assess for discontinuation
    - Close Blood Pressure monitoring and treatment (follow stroke orders)
    - Angioedema monitoring (follow stroke orders)
    - Seizure management
    - If neurological deterioration, increase monitoring and consult for transfer to Level 3 unit
    - Post neurosurgical monitoring & care
    - Post subarachnoid aneurysm coiling monitoring & care
    - Respiratory support (e.g., BiPaP ventilation)
    - Hyperglycemia with IV insulin
    - Close invasive intracranial pressure monitoring & management (e.g., IV osmotic diuretic- IV Mannitol
    - ICP monitoring -Ventriculostomy

Staffing & Education:

- Nursing 1:2-1:3 critical care patient ratio; may flex up or down as per acuity level.
- D4ICU EVT nurse +/- Level 2 critical care unit resource nursing to be added to ASU team to circulate and provide support for K7 nurses as needed such as for cardiac monitoring interpretation, overseeing of IV medication titration, ventriculostomy care management and monitoring of ICP. Critical care resource RN would not have a patient assignment. Resource nurse would flex up as needed.
- Physician: Increase Neurology Residents. May require use of local Telemedicine Unit located in ASU to connect to stroke neurologist to support Residents, as needed. May consider 1 added stroke neurologist.
- Allied Health: Increase in SLP and PT as stroke volumes increase. Allied Health may need training support as per their request. Consider added RT as needed

- Critical care training support is required for K7 nurses including training in continuous cardiac monitoring, respiratory support, IV medications and titration, angioedema management, monitoring ICP, etc.

Additional Supplies/Equipment:

- Cardiac Monitors-consider using portable monitors from other units, hospitals
- Assess for another Crash Cart
- Respiratory equipment/supplies (e.g., sleep oximetry)
- ICP monitoring equipment
- IV medications (e.g., blood pressure, diuretics, insulin, anticonvulsants, vasospasm); work with pharmacy for added critical care omnicell

Scenario 4: Major Crisis Surge with No access to K2/D4ICU beds

All stroke patients requiring critical care support to be transferred to ASU.

EXCEPTION:

- Requiring airway and mechanical ventilator support.

Care guidelines:

- If stable post tPA and EVT as described in Scenario B, follow Scenario B care guidelines
- **Follow usual stroke order sets and CCPs including the following usual Level 2 unit practices:**
  - Continuous cardiac monitoring x 24 hours then assess for discontinuation
  - Continuous $Sp0_2$ monitoring x 24 hours then assess for discontinuation
  - Close Blood Pressure monitoring and treatment (follow stroke orders)
  - Angioedema monitoring (follow stroke orders)
  - Seizure management
  - If neurological deterioration, increase monitoring and consult for transfer to Level 3 unit
  - Post neurosurgical monitoring & care
  - Post subarachnoid aneurysm coiling monitoring & care
  - Respiratory support (e.g., BiPaP ventilation)
  - Hyperglycemia with IV insulin
  - Close invasive ICP monitoring & management (e.g., IV osmotic diuretic- IV Mannitol)
  - ICP monitoring -Ventriculostomy

  Follow orders for higher level of critical care monitoring and interventions:

  - Close invasive hemodynamic monitoring with IV vasopressor/inotrope medication titration

Staffing & Education:

- Nursing 1:1 -1:2 critical care patient ratio; may flex up or down as per acuity level.

- D4ICU EVT nurse +/- Level 2 critical care unit resource nursing to be added to ASU team to circulate and provide support for K7 nurses as needed such as for cardiac monitoring interpretation, overseeing of IV medication titration, ventriculostomy care management and monitoring of ICP. Critical care resource RN would not have a patient assignment. Resource nurse would flex up as needed.
- Critical care nurses to be added to care for stroke patients with higher level of critical care acuity.
- Physician: Increase Neurology Residents. Add 1 Attending stroke neurologist. 1 Critical Care Resident and Intensivist consultative support may be required for higher critical care acuity. May use local Telemedicine Unit to enhance access to specialists.
- Allied Health: Increase in SLP and PT coverage as needed. Allied Health may need training support as per their request. Add RT coverage.
- Critical care training support required for K7 nurses including continuous cardiac monitoring, respiratory support, IV meds & titration, angioedema management, monitoring ICP, etc.

Additional Supplies/Equipment:

- Cardiac Monitors-consider using portable monitors from other units, hospitals
- Assess for another Crash Cart
- Respiratory equipment/supplies
- ICP monitoring supplies
- Hemodynamic monitoring supplies
- IV medications (e.g., blood pressure, diuretics, insulin, anticonvulsants, vasospasm); work with pharmacy for added critical care omnicell

Learning Resources

Provide Access to Kidd 7 to D4ICU Shared Drive for Critical Care resource learning modules.

Quick ICU Training Resources from U of T and Toronto Academic Health Sciences Network (Pocket Card, Procedural Videos, Short Lectures Additional Resources) for Non-ICU Health Care workers:
https://www.quickicutraining.com/topics/

Osler Resources for nurses and physicians:
ICU Nursing Upskilling for Non-ICU nurses: https://osler.force.com/covid/s/nurses-to-icu
ICU Intensivist skills for the Non-Intensivist physician: https://osler.force.com/covid/s/ward-to-icu
Cardiac Monitoring: https://learning.oslertechnology.com/modules/ecg_mon18/story.html

References

Alexandrov, A. W., Coleman, K. C., Palazzo, P., Shahripour, R. Z., & Alexandrov, A. V. (2016). Direct stroke unit admission of intravenous tissue plasminogen activator: Safety, clinical outcome, and hospital savings. *Therapeutic Advances in Neurological Disorders, 9* (4), 304-309. doi: 10.1177/1756285616648061.

Chang, A., Llinas, E. J., Chen, K., Llinas, R. H., & March, E. B. (2018). Shorter intensive care unit stays? The majority of post-intravenous tPA (Tissue-Type Plasminogen Activator) symptomatic hemorrhages occur within 12 hours of treatment. *Stroke, 49,* 1521-1524. doi: 10.1161/STROKEAHA.118.021398.

Coleman, K. C. et al. (2013). Abstract 5: Management of intravenous tPA in non-ICU environments: Safety, clinical outcome, and cost savings- International Stroke Conference Oral Abstracts. *Stroke, 44,* A5. doi: 10.1161/str.44duppl_1.A5.

Daugherty, E. L., & Rubinson, L. (2011). Preparing your intensive care unit to respond in crisis: Considerations for critical care clinicians. *Critical Care Medicine, 39,* 2534-2539.

Faigle, R., Butler, J., Carhuapoma, J. R., Johnson, B., Zink, E. K., Saheed, M., & Urrutia, V. C. (2020). Safety trial of low-intensity monitoring after thrombolysis: Optimal post tPA –IV monitoring in ischemic stroke (OPTIMIST). *The Neurohospitalist, 10*(1), 11-15. doi: 10.1177/1941874419845229.

Faigle, R., Marsh, E. B., Llinas, R. H., Urrutia, V. C., & Gottesman, R. F. (2016). ICAT: A simple score predicting critical care needs after thrombolysis in stroke patients. *Critical Care, 20:26.* doi: 10.1186/s13054-016-1195-7.

Faigle, R., Sharrief, A., Marsh, E. B., Llinas, R. H., & Urrutia, V. C. (2014). Predictors of critical care needs after IV thrombolysis for acute ischemic stroke. *PLoS ONE, 9* (2): e88652. doi: 10.1371/journal.pone.0088652.

Maves, R.C., Downar, J., Dichter, J.R., Hick, J.L., Devereaux, A., Geiling, J.A., Kissoon, N., Huper, N., et al. (2020). Triage of scarce critical care resources in COVID-19: An implementation guide for regional allocation. *Chest, 158* (1), 212-225. doi: https://doi.org/10.1016/j.chest.2020.03.063.

Middleton, S., Grimley, R., & Alexandrov, A. W. (2015). Triage, treatment, and transfer-Evidence-based clinical practice recommendations and models of nursing care for the first 72 hours of admission to hospital for acute stroke. *Stroke, 46,* e18-e25. doi: 10.1161/STROKEAHA.114.006139.

Ontario Health. (2020). *Clinical triage protocol for major surge in COVID pandemic.* Retrieved from *https://med.uottawa.ca/pathology/sites/med.uottawa.ca.pathology/files/clinical_triage_protocol_for_major_surge_in_covid_pandemic_-_march_28_20205.pdf*

Peters, A. W., Chawla, K.S., & Turnbull, Z. A. (2020). Correspondence COVID-19 Notes-Transforming ORs into ICUs. *The New England Journal of Medicine,* e52 (1)-e52 (2). doi: 10.1056/NEJMc2010853.
Toner, E., & Waldhorn, R. (2020). What US hospitals should do now to prepare for a COVID-19 pandemic. *Johns Hopkins Clinicians' Biosecurity News.* Retrieved from https://www.centerforhealthsecurity.org/cbn/2020/cbnreport-02272020.html

Yager, P. H., Whalen, K. A., & Cummings, B. M. (2020). Repurposing a pediatric ICU for adults. *The New England Journal of Medicine,* 382:e80. doi: 10.1056/NEJMc2014819.