Acute Stroke Care

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For Many Strokes, There’s an Effective Treatment. Why Aren’t Some Doctors Offering It?

By GINA KOLATA   MARCH 26, 2018

Outline

• Time is Brain!
• The importance of system & organization
• How are we doing?
• Deconstructing the Acute Stroke Protocol
• Treating more patients faster
1. Every minute counts!
2. Parallel processing essential
3. Keep the family close
4. Fast, focused clinical assessment
5. TPA (or not) ASAP after CT scan
6. Page Neurology if possible EVT candidate
Disclosures - 1

I have given CME lectures and served on advisory boards for

- AstraZeneca
- Boehringer Ingelheim
- Bristol-Myers Squibb
- Hoffmann-LaRoche
- Merck Frosst
- Pfizer
- sanofi-aventis
- Servier

The QEII Acute Stroke Program has received support from

GlaxoWellcome, Hoffmann-La Roche, Merck Frosst, sanofi-aventis, Servier, Bayer
Disclosures - 2

- I was Canadian coordinator for the third International Stroke Trial of t-PA
- I was on the International Advisory Committee for the ENOS trial of transdermal GTN for acute stroke
- I am on the International Advisory Board for the RIGHT-2 trial of transdermal GTN for ultra-acute stroke
• I was inaugural co-chair of the Best Practices & Standards Advisory Committee of the Canadian Stroke Strategy
first released December 2006 • continuously updated since
Accompanying each recommendation:

Rationale
System implications
Performance measures
Resources for implementation
Evidence summary
ATLANTIC EXPERTISE IN WORKING GROUPS

Pierre Craig
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Stroke Neurologist, St. John’s, Newfoundland

Dr. Brian Moses
Internist, Yarmouth, Nova Scotia

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Medical Director, EHS, Nova Scotia
Want to contribute?

Volunteers welcome!
plindsay@hsf.ca

Patrice Lindsay, RN, PhD
Director, Stroke
Heart and Stroke Foundation
Disclosures - 4

- I was inaugural co-chair of the Best Practices & Standards Advisory Committee of the Canadian Stroke Strategy
- I am a Clinical Advisor for Cardiovascular Health Nova Scotia
Nova Scotia Health Authority Management Zones

7 Stroke Programs
1 Stroke System
Nova Scotia Stroke System

• Stroke unit care
• Ambulance bypass protocols
• Enhanced rehabilitation staff
• Quality improvement focus on TPA therapy
• 2º prevention & rapid access TIA clinics
TIA & Non-Disabling Stroke

The risk of recurrent stroke after a TIA is 10-20% within 90 days, half of the strokes occur in the first two days after symptom onset.

The goal of outpatient management of TIA is rapid assessment and management to reduce the risk of a recurrent, possibly more serious, event.

Has the patient had a TIA?

Carotid Territory TIA
- Transient monocular blindness (amateur's fugue)
- Persistent visual symptoms (strabismus)
- Speech and/or language disturbance

Vertebrobasilar Territory TIA
- Bilateral simultaneous sensorimotor symptoms
- Hemiplegia, visual field defect
- Diplopia with other symptoms on this list
- Vertigo with other symptoms on this list
- Dysarthria with other symptoms on this list

What is the RISK category?

LOW RISK
ONSET more than 2 weeks prior
- and/or patients with isolated sensory symptoms (such as tingling)

REQUIRES all tests/evaluations* WITHIN 1 MONTH.
Patient should be seen by TIA/Stroke Secondary Prevention Services WITHIN 1 MONTH.

MEDIUM RISK
ONSET between 48 hours and 2 weeks
- WITHOUT persistent or fluctuating motor symptoms
- WITHOUT persistent or fluctuating sensory symptoms
- WITHOUT other clinically localizable symptoms

REQUIRES all tests/evaluations* WITHIN 24 HOURS.
If patient cannot be adequately investigated WITHIN 24 HOURS they should be sent to nearest regional hospital.

HIGH RISK
ONSET within last 48 hours
- Persistent or fluctuating motor symptoms
- Persistent fluctuating sensory symptoms
- Other clinically localizable symptoms

Send IMMEDIATELY to the nearest regional hospital.

Best Practice Medications
Patients with atrial fibrillation: bridge with anticoagulation or to CT scan and hemorrhage.
Other patients: Begin or start anticoagulation immediately (as per guidelines).
All risk factors for cardiovascular disease are managed.

Tests/Evaluations
- Bloodwork: hematology (CBC), electrolyte, coagulation (PT/INR), renal function (creatinine, glomerular filtration rate), HBG, rapid anticoagulation screen, testing for paraneoplastic syndrome, testing for carotid imaging.
- Non-Contrast Head CT:
  - Consider: positive/compatible CT, negative CT, and neuroimaging tests.
  - Admit to STROKE UNIT.
- 12 lead ECG:
  - If patient has TIA and ECG shows ST elevation or right bundle branch block, consult with vascular surgeon/CT.
  - Report to ICP and consult accordingly.
- Carotid Imaging:
  - Carotid imaging online clears cerebrovascular TIA patient for discharge and candidates for imaging if TIA is confirmed.

Additional Information:
- www.strokebestpractices.ca/
- Cardiovascular Health Nova Scotia
- Revised 2014
EMERGENCY DEPARTMENT MANAGEMENT
TIA & Non-Disabling Stroke

The risk of recurrent stroke after a TIA is 10-20% within 90 days; half of the strokes occur in the first two days after symptom onset.

The goal of outpatient management of TIA is rapid assessment and management to reduce the risk of a recurrent, possibly more serious, event.

1. Has the patient had a TIA?

   LIKELY Carotid Territory TIA
   • Transient monocular blindness (amaurosis fugax)
   • Hemianesthesia
   • Speech and/or language disturbances

   LIKELY Vertebrobasilar Territory TIA
   • Bilateral simultaneous sensorimotor symptoms
   • Bilateral visual field loss
   • Bilateral with other symptoms on this list
   • Vertigo with other symptoms on this list
   • Dysarthria with other symptoms on this list

   NOT LIKELY TIA
   • Transient symptoms lasting only seconds
   • Transient loss of consciousness only
   • Transient partial amnesia
   • Non-emergent diagnosis
   • Vague weakness without loss of power
   • AND no other neurological findings

What is the risk category?

LOW RISK
Symptoms
• onset more than 2 weeks prior
• should only occur with transient sensory symptoms (such as tingling)
• requires all tests/evaluations
• within 1 month

MEDIUM RISK
Symptoms
• onset between 48 hours and 2 weeks
• WITHOUT persistent or fluctuating sensory symptoms
• WITHOUT persistent or fluctuating speech symptoms
• WITHOUT other clinically localizable symptoms
• requires all tests/evaluations
• within 24 hours

HIGH RISK
Symptoms
• onset within the last 48 hours
• persistent or fluctuating sensory symptoms
• persistent or fluctuating speech symptoms
• other clinically localizable symptoms
• requires all tests/evaluations
• immediately

Does the following apply to patient?
• TIA in preceding 30 days
• Comorbidities requiring hospitalization
• Travel to hospital for follow-up difficult

Refer to TIA/Stroke Secondary Prevention Services

2. Tests/Evaluations

   Bloodwork
   • hematocrit (HC)
   • electrolytes
   • creatinine (Cr, lab)
   • renal function (creatinine, glomerular filtration rate)
   • FBC
   • type II diabetes (Insulin)
   • fasting blood glucose

   Non-Contrast Head CT
   • Consider if suspect neurovascular disease
   • May provide additional information

   12 lead ECG
   • Consider if suspect neurovascular disease
   • May provide additional information

   Carotid Imaging
   • Carotid imaging assesses Stroke Unit
   • Carotid duplex, TIA
   • Consider if suspect neurovascular disease
   • May provide additional information

   Best Practice Medications

   Patients with a history of hypertension
   • Regular antihypertensive as such as
   • Other patients: Begin short-term antithrombotic therapy regardless of CT scan result, even if normal.
   • All risk factors for cardiovascular disease:
   • Approach through aggressive medical and/or pharmacological means to optimize control.

   www.novascotiastroke.ca/index.php/presentations/324-
   May 2019

3. Refer to TIA/Stroke Secondary Prevention Services
Nova Scotia Stroke System

• Stroke unit care
• Ambulance bypass protocols
• Enhanced rehabilitation staff
• Quality improvement focus on TPA therapy
• 2º prevention & rapid access TIA clinics
• Dedicated coordinators & MD leadership
Your Stroke Program Clinical Leaders

Michelle MacGrath – Program Coordinator
Dr. Mohammad Fahim
Dr. Mary Gorman
Dr. Graham Miles
Nova Scotia Stroke System

Multifaceted approach to quality improvement & knowledge translation
Nova Scotia Stroke System

Multifaceted approach to quality improvement & knowledge translation

Development via support, implementation tools, education, monitoring, evaluation & feedback
Disclosures - 5

• I was inaugural co-chair of the Best Practices & Standards Advisory Committee of the Canadian Stroke Strategy

• I am a Clinical Advisor for Cardiovascular Health Nova Scotia

• I am a long-time volunteer for the Heart and Stroke Foundation
FACE is it drooping?
ARMS can you raise both?
SPEECH is it slurred or jumbled?
TIME to call 9-1-1 right away.

ACT FAST BECAUSE THE QUICKER YOU ACT, THE MORE OF THE PERSON YOU SAVE.
APPRENEZ LES SIGNES DE L’AVC

VISEAGE Est-il affaissé?
INCAPACITÉ Pouvez-vous lever les deux bras normalement?
TROUBLE DE LA PAROLE Trouble de prononciation?
EXTRÊME URGENCE Composez le 9-1-1.

APPRENEZ À RECONNAÎTRE LES SIGNES. PLUS VITE VOUS RÉAGISSEZ,
PLUS VITE VOUS SAUVEZ LA PERSONNE.
Stroke & TIA are time-sensitive emergencies

- Stroke: act within minutes to hours
- TIA: act within hours to days
Risk of stroke after TIA or minor stroke in the Oxford Vascular Study 2002-2003

Coull et al. *BMJ* 26 Jan 2004
EXPRESS Study: prompt treatment reduced risk of stroke after TIA by 80%

Stroke risk %

Days from TIA

p=0.0001

Act *FAST* because…

Loss *per minute* in a typical MCA territory stroke:
- 2 million neurons
- 14 billion synapses
- 12 km of myelinated fibres

Saver, J. *Time is brain – quantified.* *Stroke* 2006; 37: 263-266
...the quicker you act, the better

Effect of timing of IV t-PA on good outcome (mRS 0-1)

Thrombolysis in Acute MI

Loss of benefit per hour of delay to randomisation: 1.6 SD 0.6 per 1000 patients

Time: the most important factor in acute stroke therapy

100/1000 good outcomes
50/1000 good outcomes
20/1000 good outcomes

Interaction: $\chi^2 = 5.80 (p = 0.016)$
Time is Brain

Even a “short” delay attenuates benefit

Emerson STTC Lancet 2014
Meretoja Neurology 2012;79:306-13; Stroke 2014
TPA time-window considerations

Data related:

- Continuous decline in treatment effect
- No additional hazard by delay within 6 h

Clinical:

- Time measurement imprecise
- How much benefit is worthwhile?
Symptomatic intracranial hemorrhage in systematic review of stroke t-PA trials

Treated within 3 h

- All 5 trials before IST-3
- IST-3
- All 6 trials (n=1779)

Treated between 3 to 6 h

- All 6 trials before IST-3
- IST-3
- All 7 trials (n=4965)

OR 4.6 (2.9-7.1)

OR 3.7 (2.9-4.9)

*Lancet* 2012; 379: 2364-72
Why aren’t some doctors offering thrombolytic therapy?

- Don’t believe the evidence
- Guidelines advise against it
- Consent issues
- Clinical opinion
2015 Position Statement

• Treat within 3 hours
• Neuroradiology and Neurology input
Consent issues

• US guidelines recommend obtaining informed consent when feasible
• Consent not addressed in Canadian Best Practice Recommendations
• Obtaining consent delays treatment
“In cases of medical emergency when the patient (or substitute decision maker) is unable to consent, a physician has the duty to do what is immediately necessary without consent.”
“... a contemporaneous record (at the time) should be made explaining the circumstances which forced the physician's hand.”
And

If you don’t treat, document why

and

explain to the patient’s family
ED physicians more often sued for not giving tPA for stroke

“tPA doesn’t help much... it’s not like treating MI”
### Treatment and outcome

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Benefit N / 1000 treated</th>
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<tbody>
<tr>
<td>IV tPA within 6 h of stroke*</td>
<td>42</td>
</tr>
<tr>
<td>- alive &amp; independent months later</td>
<td></td>
</tr>
<tr>
<td>IV thrombolysis within 6 h of AMI#</td>
<td>?</td>
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<td>30</td>
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<tr>
<td>- alive 35 days later</td>
<td></td>
</tr>
<tr>
<td>IV tPA within 3 h of stroke*</td>
<td>90</td>
</tr>
<tr>
<td>- alive &amp; independent months later</td>
<td></td>
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Stroke Thrombolysis in Helsinki 1998-2011

4.2.ii. All eligible patients should receive IV tPA ASAP after hospital arrival [Evidence Level A], with a target door-to-needle (DTN) time of less than 60 min in 90% of treated patients, and a median DTN time of 30 min [Evidence Level B].
Expediting Stroke Diagnosis & Treatment in the ED
Emergency Department Management of the Patient with Suspected Acute Stroke

1. Alert duty physician
2. STAT CBC, INR, glucose, electrolytes, creatinine, ECG
3. Establish IV access

Focused clinical assessment confirming sudden-onset persisting neurological deficit? → NO → Consider differential diagnosis

CT head & CT angiogram head & neck ± CT brain perfusion

Other → YES → Intracranial hemorrhage or non-stroke lesion?

NO → Symptom recognition < 5 hours?

YES → Follow t-PA protocol

NO → Eligible for t-PA?

NO → Admit to Stroke Unit

YES → Eligible for endovascular thrombectomy (EVT)?

NO → Alert EVT Team or phone Stroke Centre

YES → Eligible for endovascular thrombectomy (EVT)?

https://www.e-therapeutics.ca/
Patient arrives in ED. Stays on EHS stretcher in “breezeway”.

**POD 2 RN or ED MEDIC**
- Ensures patient has at least 18 G IV line (right antecubital preferred)
- Obtains venipuncture for stat labs
- Delivers blood to Porter for transport to the Lab
- Performs point-of-care INR test
- Locates NOK/SDM and makes them available

**CHARGE MD/NEUROLOGIST**
- Receives summary from EHS Paramedic
- Reviews stability of patient
- Performs brief neuro exam
- Calls ASP if not done
- Sends CT request

**CHARGE RN ± DPC**
- Registers patient
- Prepares patient chart
- Reserves bed in POD 2 for patient

**CHARGE RN** contacts Bed Manager to expedite transfer(s) from ED

**EHS PARAMEDIC**
- Takes patient to CT on EHS stretcher

Version 04Dec2015
Emergency Department Management of the Patient with Suspected Acute Stroke

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YES → Alert EVT Team or phone Stroke Centre

NO → NO
Focused clinical assessment confirming sudden-onset persisting neurological deficit? 

Consider differential diagnosis
Physician’s Role

• Is it a stroke?
• Syndrome?
• Localization?
• Severity?
• Contraindications to tPA?
• Potential for embolectomy?
Physician’s Role - 2

- Need for *focused* assessment
- Priority is to capture the information required to make treatment decisions ASAP
- Defer other aspects of the assessment until after tPA started
Stroke: Textbook Features

SUDDEN ONSET – ‘NEGATIVE’ SYMPTOMS

- Unilateral weakness face arm leg
- Speech disturbance
- Vision loss
- Unilateral sensory loss
- Posterior circulation symptoms – diplopia, dysarthria, dysphagia, dysequilibrium
The NIH Stroke Scale

• Helps focus on the relevant
• Part of the lexicon of acute stroke
• 11-item scale
• Score 0 (normal) to 42 (max. severity)
• Validated for evaluation of acute stroke patients and used in stroke trials
Domains of the NIH Stroke Scale

1. LOC
2. Gaze
3. Visual fields
4. Facial palsy
5. Motor – arms
6. Motor – legs
7. Limb ataxia
8. Sensation
9. Language
10. Dysarthria
11. Extinction and inattention

http://nihss-english.trainingcampus.net/
Also gives t-PA indications and contraindications
Focused clinical assessment confirming sudden-onset persisting neurological deficit? [YES/NO]

NO → Consider differential diagnosis

YES → [Further actions]
77 year-old woman

• Woke with left arm & leg weakness

• Exam findings:
  – alert
  – normal speech & language
  – full visual fields
  – left hemiplegia
  – left Babinski sign
  – no sensory signs

NIHSS 8
Diagnosis?
• Hemiparesis alone is lateralizing but not localizing
• Absence of cortical signs usually indicates subcortical localization
• Subcortical ischemic strokes are usually due to small-artery disease
51 year-old man
51 year-old man

- Alert
- Severe dysarthria
- Left homonymous hemianopia
- Right gaze deviation
- Left hemiplegia
- Left sensory loss & extinction

NIHSS 19
Diagnosis?
Non-contrast CT

45 min after symptom onset; 20 min after arrival in ED
Large-artery territory strokes are usually due to atherothromboembolism or cardiogenic embolism.
Lacunar strokes (LACS) are usually due to intracerebral small-vessel disease.
Focused clinical assessment confirming sudden-onset persisting neurological deficit?

- YES
- NO Consider differential diagnosis
If it’s a TIA...

• is there scope for carotid revascularization?
• is there atrial fibrillation and a need for oral anticoagulant therapy?
• is there diabetes that needs better therapy?
• ASA and clopidogrel for 21 days
• start/adjust BP lowering treatment
• start/adjust statin therapy
• smoking cessation & other life-style changes
Stroke Mimics and Chameleons

False-Positive Acute Stroke Protocol Activations at the Halifax Infirmary ED

> 25% not a stroke syndrome

- migraine
- seizure
- tumour
- conversion disorder
- transient global amnesia
- etc...
Median Times: ED Triage to ED Discharge in 2014

<table>
<thead>
<tr>
<th></th>
<th>ASP Activations</th>
<th>Other Neurology Consults</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=202</td>
<td>n=1135</td>
</tr>
<tr>
<td><strong>Median Time</strong></td>
<td><strong>4.7 h</strong></td>
<td><strong>7.6 h</strong></td>
</tr>
</tbody>
</table>
CT head & CT angiogram head & neck ± CT brain perfusion
CT/CTA Head & Neck
New Minimum Standard in Acute Stroke

• Accessibility
• Rapid acquisition
• Low risk
  – low radiation exposure
  – contrast–induced nephropathy 3%
  – allergic reaction 1/10,000
**CT/CTA Head & Neck**  
New Minimum Standard in Acute Stroke

<table>
<thead>
<tr>
<th>Stroke type</th>
<th>Information acquired</th>
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<tbody>
<tr>
<td>TIA</td>
<td>cervical carotid stenosis</td>
</tr>
<tr>
<td>AIS</td>
<td>intracranial occlusion detection</td>
</tr>
<tr>
<td></td>
<td>collateral assessment</td>
</tr>
<tr>
<td></td>
<td>patho-anatomy of aortic arch</td>
</tr>
<tr>
<td>ICH</td>
<td>aneurysm &amp; AVM detection</td>
</tr>
</tbody>
</table>
Other

**Intracranial hemorrhage or non-stroke lesion?**

- **YES**
- **NO**
Subarachnoid hemorrhage
Cerebellar hemorrhage
Lobar hemorrhage

Neurosurgical
Non-surgical
86 year-old man. Non-contrast CT
Symptom recognition < 5 hours?

Follow t-PA protocol

Eligible for t-PA?

Eligible for endovascular thrombectomy (EVT)?

Alert EVT Team or phone Stroke Centre

Admit to Stroke Unit
Thrombolytic Therapy

Treat as soon as possible without delay, and not later than 4.5 hours after symptom-onset or last seen normal
Thrombolytic Therapy

**Inclusion Criteria**

Age >18

<4.5 h since onset (or LSN)

**Absolute Exclusion Criteria**

Intracranial hemorrhage (ICH)

At ↑risk of major extracranial hemorrhage
Thrombolytic Therapy

Relative Exclusion Criteria

History of ICH

Stroke or head trauma in prior 3 months

Major surgery in prior 14 days

Arterial puncture in prior 7 days

Refractory hypertension >180/105
Thrombolytic Therapy

Relative Exclusion Criteria

Blood glucose <2.7 or >22.2

INR >1.7

↑PTT

PLT <100

ASPECTS <6
Examine all the images at the ganglionic and supra-ganglionic levels.

Take off 1 pt from 10 for every region affected.

- 8-10 Small core
- 6-7 Moderate core
- 0-5 Large core

aspectsinstroke.com
Thrombolytic Therapy

Treatment of Bleeding Complications

Insufficient evidence to support use of:

- fresh-frozen plasma
- prothrombin complex concentrate
- platelet transfusion
Thrombolytic Therapy

Treatment of tPA-induced Angioedema

Stop t-PA

Airway management

Hydrocortisone 100 mg IV

Diphenhydramine 50 mg IV

Ranitidine 50 mg IV

[risk of ↑BP and ICH with nebulized epinephrine]
Symptom *recognition* < 5 hours?

- **YES**: Eligible for t-PA?
  - **YES**: Eligible for endovascular thrombectomy (EVT)?
    - **YES**: Alert EVT Team or phone Stroke Centre
    - **NO**: Admit to Stroke Unit
  - **NO**: Follow t-PA protocol
- **NO**: Admit to Stroke Unit
Eligibility criteria for EVT

- disabling stroke due to MCA territory deficits +
- small-to-moderate ischemic core on NCCT +
- intracranial proximal artery occlusion in anterior circulation on CT angiography (CTA) +
- moderate-to-good pial collateral filling on CTA, or evidence of CT perfusion mismatch +
- treatment can be started within 6 hours of symptom recognition

Update 2015
1. Every minute counts!
2. Parallel processing essential
3. Keep the family close
4. Fast, focused clinical assessment
5. TPA (or not) ASAP after CT scan
6. Page Neurology if possible EVT candidate
Atlantic Canada Stroke Conference
November 2\textsuperscript{nd} & 3\textsuperscript{rd}, 2018
Lord Nelson, Halifax