“Underneath our Noses”: Inpatient Stroke

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Disclosure

- No Honoraria for current presentation.
- Have Received Honoraria from Bristol-Myers Sqibb, Sanofi Aventi, Allergan and Boehringer Ingelheim.
- No other financial interests to disclose.

Objectives

- Review the Epidemiology of Inpatient Stroke
- Case review demonstrating the variability of inpatient-stroke presentation.
- Cases chosen to demonstrate challenges in acute treatment of Stroke in the inpatient setting.
- Emphasis on Symptom Recognition.
- Extrapolation of management principles from the outpatient setting. the impact of strategies of secondary prevention of recurrent stroke And primary prevention of complications on outcome.
- To introduce QA strategies for improving outcomes, local efforts and provincial efforts such as the QuICR project in Stroke Outcomes.
- Review of Inpatient Stroke Algorithm as Interventional Tool.

Pre-test

- What Proportion of Total Strokes in Hospital occur in the in-patient setting?
- What are the Outcomes of Patients who experience a stroke in hospital?

- What are the chances of receiving and Acute intervention for Stroke in Patients who experience a stroke in hospital?
- What are the time windows of intervention for i.v. tPA and Endovascular Therapy?
- What are the high risk settings (if any) for inpatient stroke?
- How does inpatient stroke present?
- What is out site based algorithm for inpatient stroke?

Case 1:

- Patient is a 28 year old woman admitted for femoral embolectomy. History of Mitral Valve Replacement, On Heparin in peri-operative period.
- Patient noted in p.m. to have apparent weakness of left lower and upper extremity.
- Discussed with Stroke-team approx 12-14 hours later.
- Stroke in Rt Fronto-parietal area identified.
- Patient trasferred to Stroke Unit for Rehab en route to transfer to Glen Rose Hospital.

Case 2:

- Patient is a 70+ year old gentleman.
- POD 1, CEA.
- Presents with Acute Left Hemiplegia, Hemineglect.
- Symptoms identified at approximately 5 hours.
- Plan?
- Discussed with Interventional Radiology, Patient treated “conservatively”

Cases 1 and 2: Discussion

- Both patients underwent recent high risk procedures and had inherent pre-operative risk factors for stroke.
- Despite this, delay in time to symptoms first recognition.
- Both patients had contraindications to intravenous tPA.

Inpatient/Peri-Operative Stroke:

- Peri-operative Stroke
- Prevalance from Heterogenous (Non Cardiac Surgery)Estimates at approx. 0.5%.
- Certain High Risk Procedures have also been identified eg. Hip Replacement/Repair Surgery, Hemicolectomy, Pulmonary Surgery-4%.
- The presence of a previous history of stroke increases risk (15%)

Inpatient/Peri-operative Stroke

- Prognosis:
- Mortality: 26%
- Patient Characteristics: Typically have a history of Vascular/Cardiac Diagnostic or Therapeutic Intervention.
- 2/3 will occur within first 48 hours post high risk procedures, remaining presenting over a 30 day period
- Dilemma for subsequent management as tPA often contraindicated.

Post-Operative Stroke

- Mechanisms (Non Cardiac, Non-Vascular):
- Post-operative stress Responses
- Aminergic Effects
- Inflammatory Mediators

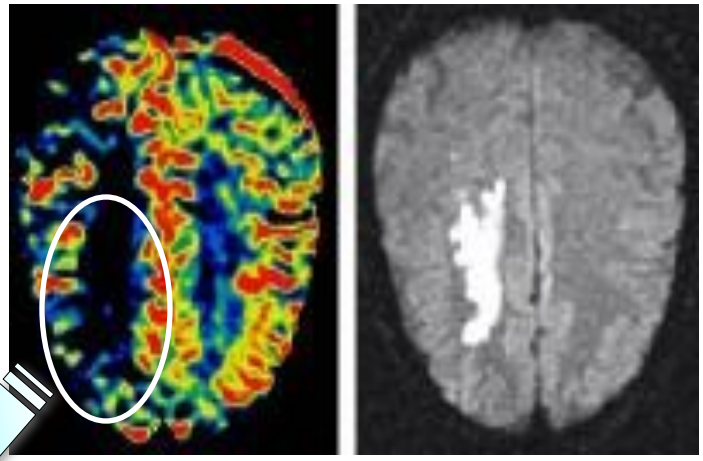
Post-Operative Stroke

- Preventive Strategies:
- Certain Vascular Protective Strategies have been proposed.
- Cardiac Surgery Literature has shown most experience.
- Extrapolation to Non-Cardiac Setting, and CEA setting of some identified factors has occurred.

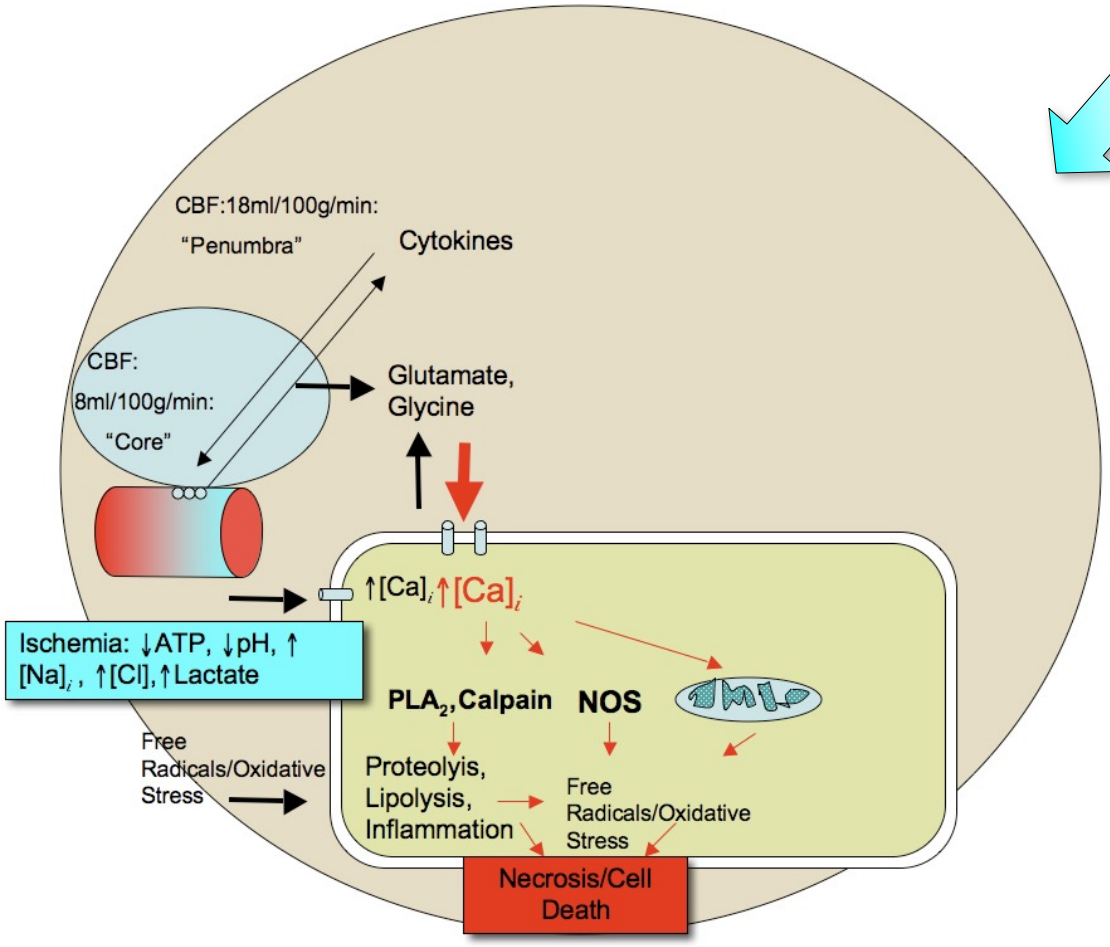
Table 1. Summary of pharmacotherapy strategies for patients undergoing carotid endarterectomy

Strategy	Key points
β-blockade	• Reduces myocardial injury rates following surgery in appropriately selected patients • Low-risk patients likely do not derive a benefit if not already on a β-blocker • May be associated with adverse events at higher doses or if used indiscriminately
ACE inhibitor/ ARB	• Associated with improved long-term survival in patients with peripheral vascular disease • Stabilizes carotid plaque and improve vessel wall biology • Appropriate long-term agent for patients without contraindications
Statin	• Reduces acute and long-term stroke risk, reduces cardiovascular event rate, associated with long-term survival • Multiple mechanisms of action including lipid profile and plaque stabilization • Reasonable agent for all patient undergoing vascular surgery
Antiplatelet	• Reduces acute and long-term stroke risk, reduction in cardiovascular event rate • Low-dose aspirin efficacious • No clear benefit to dual therapy or high-dose therapy in patients undergoing CEA

“The Ischemic Cascade”



“The Ischemic Penumbra”

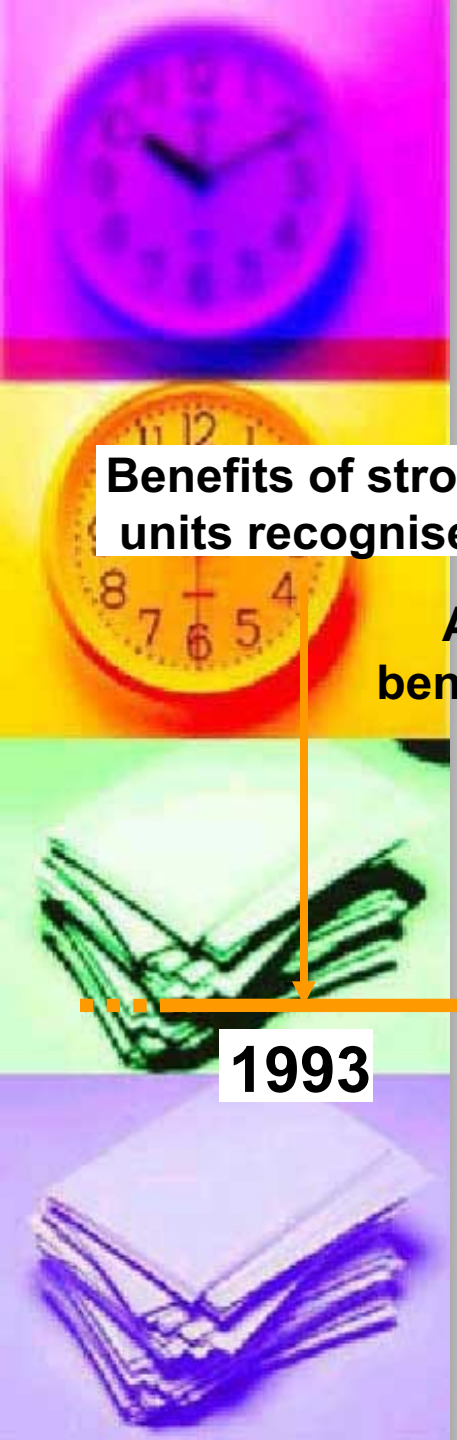


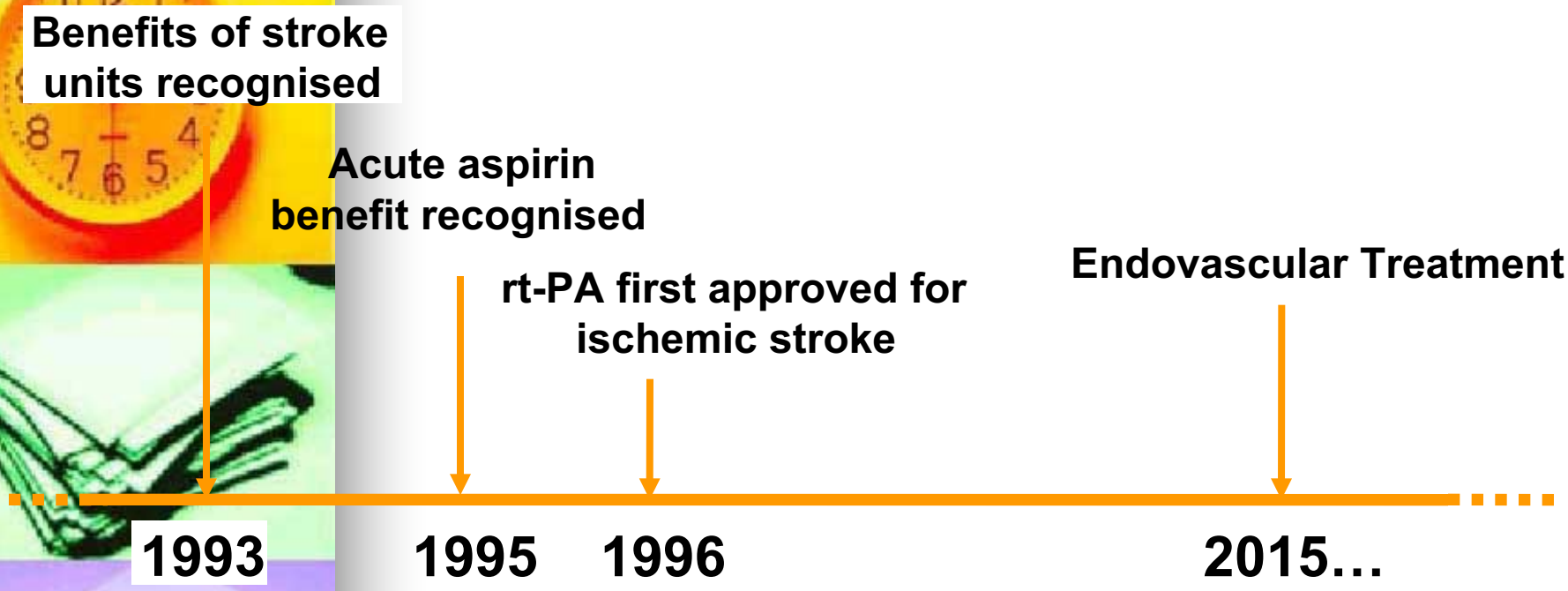
“In patients experiencing a typical large vessel acute ischemic stroke;… In each minute, 1.9 million neurons, 14 billion synapses, and 12 km (7.5 miles) of myelinated fibers are destroyed. “

-From: Saver, J; “Time is Brain: Quantified”,*Stroke*. 2006;37:263-266.

In the absence of Reperfusion; Collaterals Will Fail.

Advances in the Management of Stroke: A Timeline



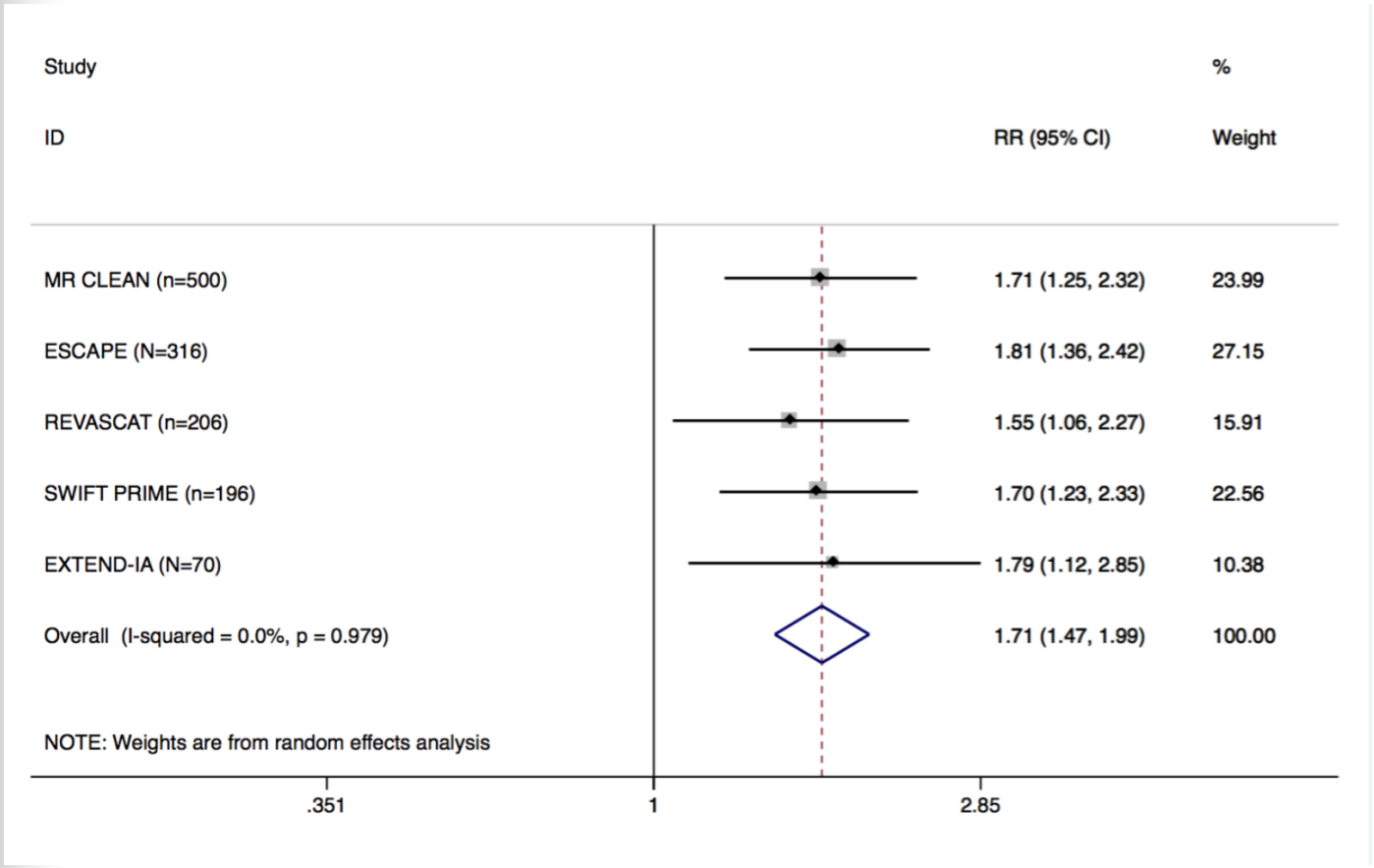


i.v. tPA: Inclusion/Exclusion

- Inclusion:
- Clinically: Acute Stroke
- Onset<3 hours
- (“Consider” <4.5h)
- No ICH by CT scan

- Exclusion:
- BP>185/110 (vs. non tPA parameters of 220/120)
- Recent Stroke
- Abnormal Coagulation Profile
- Recent Trauma or Surgery
- Recent “Hemorrhage”
- Blood glucose <3, >22

Endovascular Treatment in Stroke



Endovascular Therapy for Stroke

i. Endovascular therapy should be offered within a coordinated system of care including agreements with EMS; access to rapid neurovascular (brain and vascular) imaging; coordination between the ED, the stroke team and radiology; local expertise in neurointervention; and access to a stroke unit for ongoing management [Evidence Level A].

ii. Endovascular therapy is indicated in patients based upon imaging selection with noncontrast CT head and CTA (including extracranial and intracranial arteries) [Evidence Level A]. *See Appendix S4 for Inclusion Criteria for endovascular therapy.*

iii. Eligible patients who can be treated within six-hours (*i.e.* whose groin can be punctured within six-hours of symptom onset) should receive endovascular therapy [Evidence Level A]. *Refer to Appendix S4 for Inclusion Criteria for endovascular therapy.*

a. Select patients with disabling stroke presenting between 6 and 12 h of stroke symptom onset, including those with stroke symptoms upon awakening, who meet clinical and imaging criteria, may be considered for endovascular therapy [Evidence Level B], in accordance with local protocols.

b. Time from CT (first slice of the noncontrast CT) to groin puncture should be as fast as possible, ideally less than 60 min [Evidence Level C].

iv. Endovascular therapy is indicated in patients who have received intravenous tPA and those who are not eligible for intravenous tPA [Evidence Level A]. Patients eligible for intravenous tPA as well as endovascular therapy should also be treated with intravenous tPA, which can be initiated while simultaneously preparing the angiography suite for endovascular therapy [Evidence Level A].

v. Device selection: Retrievable stents are recommended as the first-choice endovascular device [Evidence Level A].

a. Other interventional devices (e.g. thrombus aspiration devices) may be used based on local protocols and expertise [Evidence Level C].

vi. Endovascular procedures should not be performed using elective general anesthesia and intubation in most patients. General anesthesia and intubation should only be used if medically indicated (e.g. for airway compromise, respiratory distress, depressed level of consciousness, severe agitation, or any other indication determined by the treating physician), and in such cases, excessive and prolonged hypotension should be avoided [Evidence Level B].

From Canadian Best Practice Guidelines Update: Hyperacute Stroke

- **Thus Endovascular Treatments May Allow for Treatment of Certain Post-operative Inpatient Populations Previously Excluded, From Acute Stroke Interventions.**

TIA vs. Hyperacute Stroke?

- How do we know that we are not treating a TIA with tPA?
- <2% of patient not treated will resolve <24 h vs. 12% with treatment (NINDS trial, NEJM 1995).
- <1 in 6 patients with symptoms at 1 h will resolve (Levy DE, Neurology 1988).
- 30% of acutely presenting patients with rapid improvement, will show clinical deterioration or death.
- Relapsing deficits an important presentation in the inpatient/ER setting.

Speed Matters!

ORIGINAL CONTRIBUTION

Time to Treatment With Intravenous Tissue Plasminogen Activator and Outcome From Acute Ischemic Stroke

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Importance Randomized clinical trials suggest the benefit of intravenous tissue-type plasminogen activator (tPA) in acute ischemic stroke is time dependent. However, modest sample sizes have limited characterization of the extent to which onset to treatment (OTT) time influences outcome; and the generalizability of findings to clinical practice is uncertain.

Objective To evaluate the degree to which OTT time is associated with outcome among patients with acute ischemic stroke treated with intravenous tPA.

Design, Setting, and Patients Data were analyzed from 58 353 patients with acute ischemic stroke treated with tPA within 4.5 hours of symptom onset in 1395 hospitals participating in the Get With The Guidelines-Stroke Program, April 2003 to March 2012.

Main Outcomes and Measures Relationship between OTT time and in-hospital mortality, symptomatic intracranial hemorrhage, ambulatory status at discharge, and discharge destination.

Results Among the 58 353 tPA-treated patients, median age was 72 years, 50.3% were women, median OTT time was 144 minutes (interquartile range, 110-170), 9.3% (5404) had OTT time of 0 to 90 minutes, 77.2% (45 029) had OTT time of 91 to 180 minutes, and 13.6% (7920) had OTT time of 181 to 270 minutes. Median pretreatment National Institutes of Health Stroke Scale documented in 87.7% of patients was 11 (interquartile range, 6-17). Patient factors most strongly associated with shorter OTT included greater stroke severity (odds ratio [OR], 2.8; 95% CI, 2.5-3.1 per 5-point increase), arrival by ambulance (OR, 5.9; 95% CI, 4.5-7.7), and arrival during regular hours (OR, 4.6; 95% CI, 3.8-5.4). Overall, there were 5142 (8.8%) in-hospital deaths, 2873 (4.9%) patients had intracranial hemorrhage, 19 491 (33.4%) patients achieved independent ambulation at hospital discharge, and 22 541 (38.6%) patients were discharged to home. Faster OTT, in 15-minute increments, was associated with reduced in-hospital mortality (OR, 0.96; 95% CI, 0.95-0.98; $P < .001$), reduced symptomatic

JAMA. 2013;309(23):2480-2488

O5.01 QuICR: Improving Door-to-Needle Times to a Median of 30 minutes throughout Alberta, Interim Results

Noreen Kamal[1], Thomas Jeerakathil[2], Muzaffar Siddiqui[3], Eric E. Smith[1], Shy Amiani[4], Darla Reynolds[3], Elaine Shand[5], Jennifer Bestard[5], Corinna Hartley[5], Kevin Reedyk[5], Darlene Peacock[7], Kara Rimmer[8], Magali Benard[8], Dana Norton[9], Chris Nichol[9], Rachel Peveril[10], Philo M. King[11], Shirley Garnier[12], Balraj Mann[13], Shelley Valaire[13], Andrew M. Demchuk[1] and Michael D. Hill[1]

International Journal of Stroke, 11(2S)

For 1000 treated patients, every 15-minutes of faster treatment resulted in:

- 18 more patients with improved ambulation at discharge
- 8 more with fully independent ambulation
- 7 more discharged home

- However, the population of patients who present with Acute Stroke while admitted in hospital have been largely excluded from analyses of efficacy as well as from educational strategies targeting outcome.
- The QuICR project now additionally focusing on IHS

Post-Operative Stroke

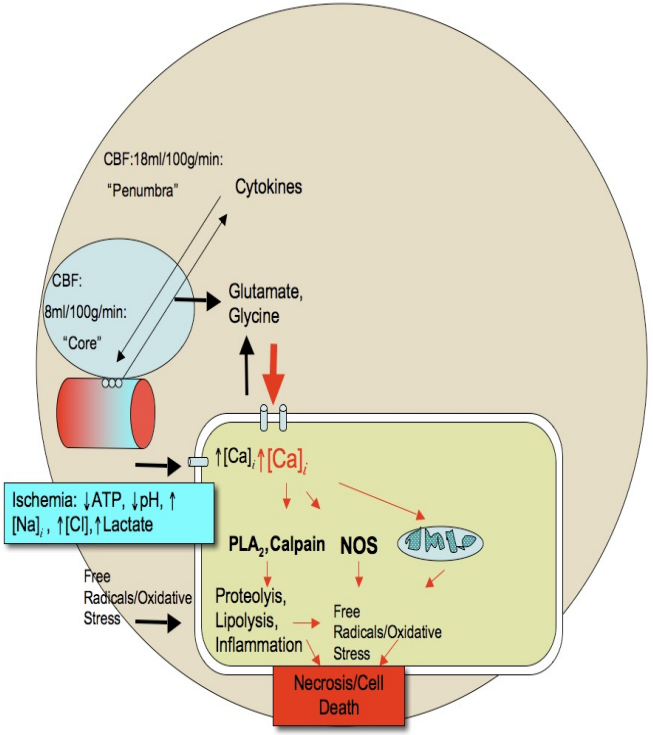
- Acute Treatment Strategies:
- iv tPA?
- EVT?

Discussion:

- Is there Evidence of Impact with Intervention in the Inpatient Stroke Setting?

“Acute Stroke Interventions”

- Inpatient stroke comprises approximately 10 (4-15%) of all strokes admitted to hospital.
- Increased mortality, length of stay, and more patients referred for inpatient rehabilitation in IHS patients than that seen in OHS patients.
- Fewer proportion of IHS patients receive acute stroke interventions (ASI) than OHS patients.
- The proportion of the total stroke patients undergoing acute stroke interventions that are IHS patients is approximately 10 %.
- IHS patients who receive treatment, better treatment times and comparably good functional outcomes of treatment.
- Awareness of Site Based Stroke Protocols and Early Symptoms Recognition Key areas of education to positively impact outcome.



Symptom Recognition:

- "Summary" Scales and "Slogans" useful for Public Education and Pre-Hospital assessments.
- Inpatient providers of care require greater familiarity
- Challenges to assessment in the peri-operative setting require high degree of vigilance and recognition of the diversity of presentation.

Stroke is a medical emergency.

LEARN THE SIGNS OF STROKE

FACE is it drooping?
ARMS can you raise both?
SPEECH is it slurred or jumbled?
TIME to call 9-1-1 right away.

Table 2. Knowledge of Stroke Warning Signs (n=875)

Correct Answers	No. of Responses (%)
Numbness or weakness	760 (86.9%)
Confusion, trouble speaking, or understanding	725 (82.9%)
Trouble walking, dizziness, or loss of balance or coordination	89 (10.2%)
Headache	159 (18.2%)
Trouble seeing	126 (14.4%)
≥1 warning signs correct	820 (93.7%)
≥2 warning signs correct	762 (87.1%)
3 warning signs correct	270 (30.9%)

Edelman, E. et. al. Stroke Awareness Among Inpatient Nursing Staff at an Academic Centre, Stroke 2014, 45: 271-73

Fig.2.

Covenant Health
Grey Nuns

GNCH Inpatient Suspected Stroke Algorithm for Ischemic Stroke Patients

Primary Path is always to Unit 52

Inpatient Suspected Stroke (Non ICU)

Inpatient develops stroke symptoms
- Asymmetric Weakness of Face, Arm or Leg
- Language Difficulty
- Acute Changes in Consciousness or orientation with language difficulties and asymmetric weakness (For sudden loss of consciousness Rapid Response Med Team to be alerted as per protocol)

Nursing staff alerts in house physician, on call physician or extender to assess patient for possible "Code Stroke", vital signs and GOC status. House Staff / Extender to urgently assess and inform staff attending.

Attending MD notifies Neurologist after having urgently verified the following
Key pieces of information:
- Clinical Presentation
- Time of Onset: last documented assessment where patient was seen to be normal
- Concomitant meds: Emphasis of presence of Oral or IV anticoagulants
- Admission Presenting Complaint: if post op, clarify procedure
- Relevant Co-morbidities: eg. CHF, Atrial Fibrillation, Cancer
- Relevant recent imaging findings

Attending to order STAT CT identifying the neurologist involved
Unit Clerk/Charge Nurse to
- Enter CT order into VAX as "STAT Stroke Protocol" and specify neurologist involved
- Phone CT to notify them of "STAT Stroke Protocol" CT (57230, direct call to CT tech, alt 57142 – Radiology)
- Phone Emergency Room Charge Nurse to notify them of potential inpatient Stroke
- Call Laboratory to notify them of "STAT Stroke Protocol" Labs that will need to be done in CT or ER
- Responsible Physician and RN to accompany patient to CT in bed, do not delay for arrival of porter or transport to stretcher
- ER Stroke Team Nurse to meet patient in CT

"Key Laboratory Testing Notes
1. All req's & tubes will be labeled with 'Acute stroke'.
2. Specimens are transported to lab
3. Lab assistant/RN notifies Core lab at 57088 that Acute Stroke blood work is on lift
4. Lab calls PT and INR results to nurse in charge (59967)

TPA Candidate
- No → Patient to return to unit
- Yes

1. tPA ordered Bolus administered in CT by ER Nurse if clinically safe and indicated
2. 60 minute tPA infusion completed in ED

Neurologist notifies Unit 52 Charge that pt will receive tPA

Bed Manager & Unit 52 Charge discuss bed availability plan

CTA
- Yes → Neurologist to call CT tech at 5-7230 (direct) or 5-7142 to confirm if additional acute CTA necessary if before 2300h. Between 2300 – 0800h Neurologists to call CT Tech for contact number of Neuro Radiologist on call for discussion.
- No → Clear endovascular case if NIH is greater than 13 **OR** Between 2300 – 0800h

Endovascular Candidate
- Yes → Neurologist to inform UAH Stroke Team via RAAPID; while ER arranging for urgent transport
- No → Remain in ED until ready for transfer → Patient is stable and ready for transfer

Staffed Available Bed on 52
- Yes → 52 Charge - implements ischemic stroke admission protocol
- No → Reason due to bed availability or staffing

Bed Manager notifies ED of location for transfer and assigns bed

Bed Manager determines where the patient is to go until admission to Unit 52 is possible. Emergency first venue or ICU as last resort

Transfer to 52

Pt is transferred by RN and porter to the location specified by the bed manager with a portable monitor (if within the 24 hour period post tPA)

Contingency for Bed Availability
In the unanticipated situation that Unit 52 monitored beds are both in use by post tPA patients the Bed Manager will facilitate alternate monitoring location (emergency or ICU) for the time required based on staffing and patient safety.
Staffing Contingency for Unit 52
Staffing office and Unit 52 Supervisor maintains an accurate list of staff names that have completed the required education for the care of a monitored patient on Unit 52.
Regional Bed Call
One monitored bed is blocked on Unit 52. The Bed Manager updates Unit 52 monitored bed use status

Inpatient Protocol: Impact

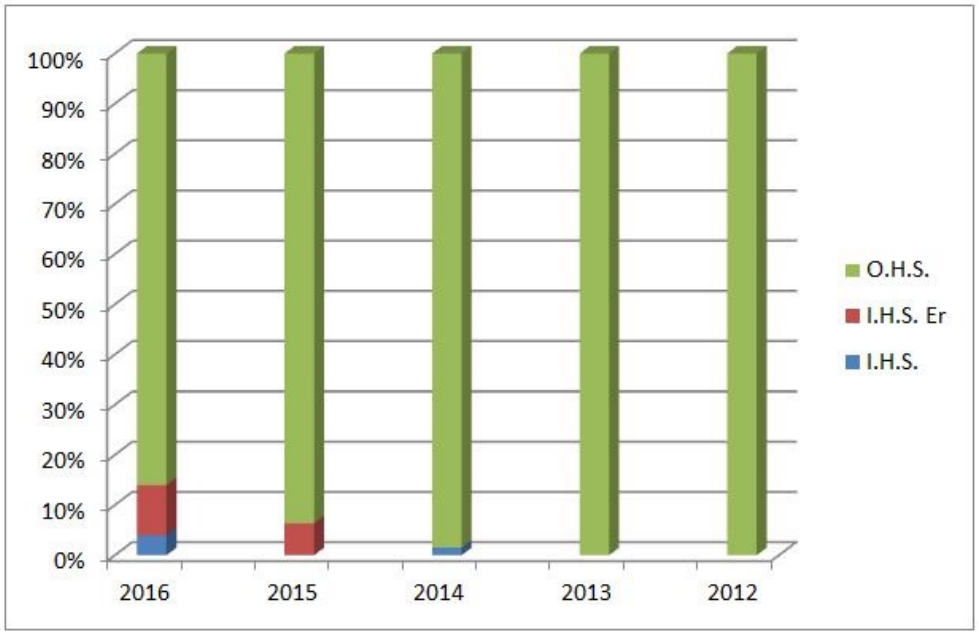


Fig. 1.Percentages of Patients Receiving Acute Stroke Interventions (i.v. tPA) by Disposition GNCH

Case 3:

- Patient 72 year old woman admitted for CHF exacerbation/pneumonia. Approximately 1 week into admission patient noted to be weak of right hand side and poorly communicative. Last seen well by nursing staff 2 1/2 hours ago.
- Patient discussed with Stroke Staff on-call.
- Charge Nurses on Stroke Unit and ER alerted. Urgent labs drawn verifying normal coagulation parameters and patient transferred to Stroke Unit from CT scan.
- ER nursing staff dispatched to Stroke Unit to facilitate mixing and administration of tPA.
- Patient received i.v. tPA at 3h 45 minutes from presumed onset.
- Following day, marked improvement of deficits.

Case 4:

- Patient 68 year old man admitted for bilateral femoral revacularization.
- Past medical history of Chronic Renal failure and Atrial Fibrillation with no previous history of stroke.
- Patient underwent serial bilateral endovascular percutaneous SFA angioplasties.
- Medications included ASA/Plavix, and Unfractionated Heparin for DVT prophylaxis.
- Last seen normal at 10:30 during nursing check and blood draw.
- Noted approximately 1 hour later to be non responsive and demonstrating left sided weakness.
- CT acquired and Neurology paged by house staff after discussing with MRP.

Case 4: Considerations

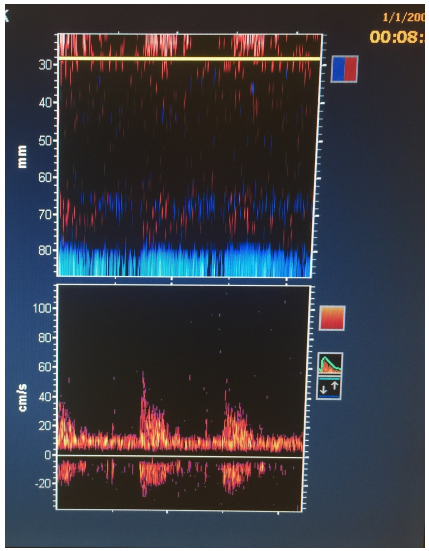
- Patient underwent serial arterial punctures.
- Patient showed signs of urethral trauma having pulled out Foley.
- Patient had chronic non healing ulcers in lower extremities.
- Decrease in level of consciousness raises possibility of proximal occlusion (Basilar Thrombosis) and need for transfer to UAH
- Will this patient be a candidate for tPA?

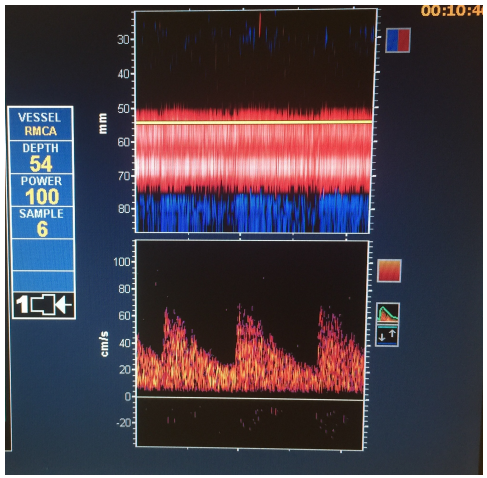
Case 4: Measures

- 3 way catheter for bladder irrigation inserted in ER while awaiting stat-drawn coags.
- Discussed with Vasc Surgery Staff and nursing staff of IMCU regarding compressive methods should it be necessary.
- Patient cross matched and typed.

Case 4: Treatment

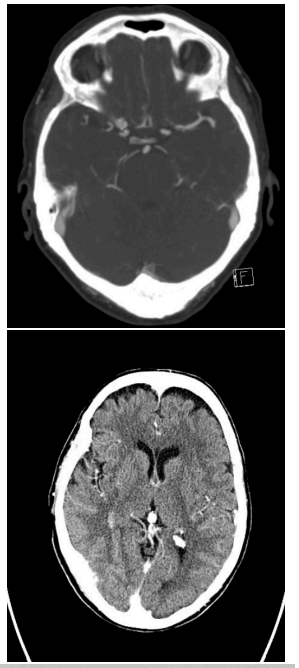
- Patient had shown interim improvement.
- Now alert
- Left sided hemifacial weakness and dysarthria
- Gaze preference to right.
- Mild Left sided hemiparesis
- Extinction to Double Simultaneous stimulation.
- NIH 5
- Exam suggestive of partial recanalization and distal migration of clot, suspicion that patient will not be EVT candidate.
- Coags performed which showed normal range.
- tPA given at 2:45 (wthin 4.5 hour time window).
- Intrainfusional TCD monitoring verified recanalization of proximal vessels, thus precluding the need for transfer.
- 24 h patient has returned to baseline with mild persisting hemifacial weakness.

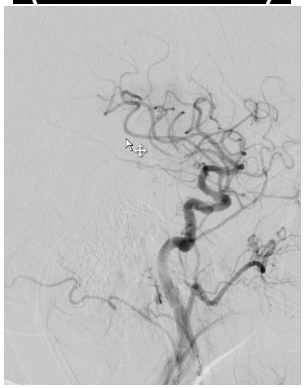




Case 5:

- Patient is a 72 year old woman POD right Knee Replacement.
- The patient was last seen normal effectively at 0100 hours on the early morning
- of April 7, 2017.
- At about 2 a.m. in the morning nursing personnel visited the patient and noted
- garbled speech. The clinical associate was contacted, and then Neurology on call contacted
- Clinical associate informed at 2:04 hours and discussed the case with the
- radiology resident at 2:13 a.m.
- imaging study (CT/CTA) was done at 2:47 a.m.
- Patient discussed with myself at 3:00 a.m.
- Patient transported to UAH (4:13am), Repeat routine head CT (4:32am) and transfer to Angio suite (4:46am).
- NIH 14, Dense Hemplegia and Hemineglect.
- 24 h post NIH of 6, Inpatient course of ongoing clinical improvement with patient transferred onward to the Glenrose for inpatient rehab.





In-patient and Post-Operative Stroke

- Practical applications:
- Inpatient Stroke as a Whole 10% of Strokes
- Vascular Procedures are High risk.
- Vigilant monitoring and Symptom Recognition are key, Both for Early mobilization of Acute tPA pathways and early treatment/prevention of potential sub-acute complications.
- Familiarity with Existing Site Based Protocols for Acute Stroke is Necessary for Prompt Assessment and Treatment.
- Site based protocols should take into logistic realities and involve all stakeholders, eg DI, ER, ICU and after hours support.
- Educational Strategies, including the implementation of Mock “Stroke Codes” necessary

Thank You!