Book to Bedside: Develop an Acute Stroke Management Service

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OBJECTIVES
1. Identify core elements of the Acute Stroke Management System
2. Identify methods to assure rapid and reliable thrombolytic treatment of stroke
3. Identify appropriate means to manage co-morbid illness
4. Describe mechanisms to reduce the risk of complications following stroke
5. Institute evidence based secondary prevention therapies.

What do you call a group of whales?
A “Pod”

What do you call a group of crows?

A “Murder”
What do you call a group of hyenas?

A ‘Cackle’

A 63 y/o woman with obesity, hypertension, diabetes, and a pack-a-day smoking habit who takes a daily baby aspirin develops acute right sided weakness and sensory loss.

- How do you develop a program to have the best chance of reversing the deficits from this stroke?
- How can we reduce the chance of complications which would risk survival and promote disability through system design?
- How do we optimize care systems?
Ischemic Stroke

- 700,000 ischemic strokes yearly
  - Approximately one stroke every 45 seconds
- 200,000 are recurrent events
- Leading cause of disability in the US
  - Lifetime cost of ischemic stroke $90,000

Stroke Care

- Optimally a seamless transition of events
- Recognition
- Prehospital
- ED
- Hospital Care
- Rehabilitation
- Home

THE STROKE CENTER

Mimics the progression of Trauma Centers

The Financials...

Quality Stroke Care Attractive

- DRG for CVA with IPA $6000 more
- Cost-Reimbursement ratio 0.82

- Strokes in Colorado 2008:
  - 40% private insurance
  - 48% Medicare
  - 6% Medicaid
  - 6% Self-Pay

References:
- Stroke 2007;38:1309-1312
- Colorado Stroke Alliance Data 2008
- Presented by Dr. Don Smith at Rocky Mountain Stroke Summit Dec 2008
STEP 1

- Assemble the Stroke Council- (minimum)
  - Neurology/Neurosurgery
  - Stroke Program Coordinator (NP, PA, Nurse)
  - Hospitalist
  - Emergency Department
  - Administration

- Ensure top administration support

- Budget

Stroke Center

- Rapid + reliable delivery of thrombolysis
- Effective prevention of complications
- Efficient, cost effective stroke care
- Prevention of second ischemic events
- Interdisciplinary approach
- Coordination between sites of care
  - EMS – ED
  - ICU – WARD
  - Rehab – Home
- ED and Stroke Team CME
- Process/outcome tracking

Rapid and Reliable Thrombolysis

- Time to tPA is highly associated with outcome.
- National rates for tPA use are only 3-8%
- Increased from 23.5 to 40.8% for patients presenting within 2 hours of symptoms in hospitals participating in GWTG

This is a high stakes and time critical decision
Hyper-Acute Care Team

- Rapid transport to hospital
- Early triage
- Focused history
- NIH stroke scale
- Coordinate imaging
- Labs and assessment of lytic contraindications
- tPA risk/benefit discussion

Multiple elements must occur

When time is critical, team performs tasks in parallel rather than in sequence

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Elements Necessary For Success

- ED Personnel Training + Coordination with EMS
  - Stroke alerts called from field
  - ED stroke care pathway
- Acute Stroke Team- At bedside in 15 minutes
  - Neurologist/Neurosurgeon
  - Stroke NP/PA
  - Hospitalist
  - ED Physician
- 24/7 Neuroimaging- To scan in 25 min
  - CT versus MRI depends on consistent availability
- 24/7 Stat labs- Complete in 45 min
- Goal door to needle time of 60 minutes
- Registry of all strokes to track performance

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What do you call a group of otters?
A “Romp”

Effective Prevention of Complications

The Stroke Unit

- Management of Co-morbidities
  - Hyperlipidemia
  - Hyperglycemia
  - Blood Pressure

- Prevention of Complications
  - Urinary Tract Infection
  - Aspiration Pneumonia
  - Venous Thromboembolism

- Stroke units demonstrated to reduce mortality 17%
  - Excellent post-stroke care provides benefit comparable to that of tPA

SPARCL trial 16% RRR with statin over 5 yrs following CVA

- No change in mortality

- Cholesterol lowering therapy recommended for LDL>100
Management of Co-morbidities

Lipid Management

How are we doing?

- 2006 study from 11 California hospitals:
  - Lipids measured and treated in only half of pts
  - 40% of pts not discharged on treatment

- GWTG hospitals were able to increase appropriate treatment rates
  - 59% to 77%

Lipid panel and statin therapy in admit order set

Management of Co-morbidities

Glycemic Control

- Hyperglycemia present in 1/3 of strokes
- Correlates with worsened outcomes
- Control to <200
  - goal of 80-140
- How to achieve this goal and whether intensive insulin drip therapy will end up proving beneficial is not clear

PEARLS
- Rarely a need for dextrose in IVF in the first 24 hours
- Metformin problematic-contrast/lactic acidosis
- Sulfonylurea medications associated with hypoglycemia when oral intake interrupted

Consult or Co-management Hospitalist + Neurologist

Management of Co-morbidities

Hypertension

Ischemic Penumbra

- Zone of at risk tissue susceptible to reduction below the threshold of viability in response to relatively small drops in MAP.
Objective of Blood Pressure Control

- Intervention is designed to maximize perfusion to the ischemic penumbra while minimizing the hypertensive risk of hemorrhagic transformation.

Management of Co-morbidities

Acute Blood Pressure Control

- 80% of stroke admissions have elevated BP.
- Even without intervention, the pressure tends to fall 10-15% in the first 24 hours.
- By day 10 BP will fall 13-20%

Ischemic Stroke Pre-tPA

BP must be <185/110 for tPA

- Exclusion criteria if relatively non-aggressive measures have failed to bring down to BP <185/110.

Recommended Steps:

- Labetalol 10-20mg IV (may repeat x1) or
- Nitropaste 1-2 inches
Ischemic Stroke
Post-tPA
Goal BP<180/105
- Monitor BP closely.
- BP q15min x 2 hrs then
- q30min x 6 hrs then
- qhr x 16 hrs

Choice of agent?
- Nitroprusside
- Labetolol
- Nicardipine
- Fenoldopan
- Nitroglycerin

*Avoid placing an arterial line after tPA. Avoid sublingual nifedipine and clonidine.

About 1/3 of patients who receive tPA require antihypertensive therapy in the first day.

Ischemic Stroke Without tPA

Withhold treatment until BP >220/120

“Permissive Hypertension”

- Titratable
- Avoid overcorrection
- If BP lowered it is generally safe as long as not exceeding 10-15%

Order set should suggest therapy with room for individualized therapy.

What do you call a group of Porcupines?
A “Prickle”

Complications
- 64% of stroke patients in a modern stroke unit have a complication in the first week
  - Fever 24%
  - UTI 16%
  - Pneumonia 11%
  - Myocardial injury 16%
  - PE 0.6%

URINARY TRACT INFECTION
- 80% of nosocomial UTIs are associated with catheters
- Infection is directly related to duration of use
- Physicians unaware of catheter
  - 28% of cases
- Remove ASAP/use alternatives if possible
  - (condom cath)

Stop Orders
Alternatives
**Prevention of Complications**

**Deep Venous Thrombosis**

- Without prophylaxis, up to 75% of patients with hemiplegic stroke will have evidence of DVT
- Effective prophylaxis can reduce the VTE rate by 50-70%
- With prophylaxis- 1% symptomatic VTE rate

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**Prevention of Complications**

**Deep Venous Thrombosis**

- Early mobilization!!
- Stockings and SCDs offer a non-significant reduction in DVT rates
- Anti-platelet therapy alone is NOT sufficient prophylaxis against venous thrombus
- Lower potency heparin prophylaxis (heparin 5000 U bid) less effective than higher potency
- Higher efficacy prophylaxis does not appear to confer increased risk for ICH
  - Studies have mixed results on this issue

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**Prevention of Complications**

**Electrolyte Disturbances**

- Hyponatremia common after intracranial events
- Hypo-osmolar state may worsen cerebral edema
- Avoid hypotonic fluids in the early period post CVA

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Prevention of Complications
Aspiration Pneumonia
- 2/3 of stroke patients have dysphagia
- 1/3 of pts with aspiration will develop pneumonia
- 50% reduction in risk with formal program:
  - Swallow screen prior to diet/meds
  - Aspiration precautions
  - Oral care
  - Pneumonia/Influenza vaccine

The Stroke Unit
Elements Necessary For Success
- Interdisciplinary Team Care
- Admission Stroke Order Sets
  - Guides management through appropriate defaults
  - Minimizes unwarranted practice variation
  - Assures documentation
    - PT/OT consult
    - PT/OT consult not indicated due to resolution of sx
- Ongoing Education

What do you call a group of peacocks?
An “Ostentation”

Secondary Prevention
Anti-thrombotics-101

- JCAHO requires anti-thrombotics to be started within 48 hours
- Warfarin for atrial fibrillation
- Antiplatelet therapy if non-cardioembolic
  - Clopidogrel
  - ASA/Dipyridamole ER
  - ASA

Secondary Prevention
Anti-thrombotics-201

- Acute use of heparin has never been proven to improve outcomes.
  - Early second ischemic stroke equally balanced by early hemorrhagic strokes
- Higher doses of aspirin do not provide greater benefit than low doses – UK TIA trial
- For arterial strokes - warfarin is not superior to aspirin – WARSS Trial
- Combination of clopidogrel and aspirin does not provide benefit over monotherapy – MATCH Trial
Patient Education

- Patients must receive documented education on:
  - Personal risk factors
  - Warning signs
  - Activation of EMS
  - Follow-up
  - Medications provided after discharge
- Stroke Center has an obligation to provide
  - Post stroke support
  - Community Outreach

Develop customizable discharge education kits

10 JCAHO Quality Measures

- DVT prophylaxis
- Discharged on anti-thrombotic therapy
- Patients with A-fib receiving anticoagulation
- Thrombolytic therapy administered
- Anti-thrombotic therapy by hospital day 2
- Discharged on cholesterol-reducing medication
- Dysphagia screening
- Stroke education
- Smoking cessation/advice/counseling
- Assessed for rehabilitation

JCAHO Quality Measures

- If there are 10 independent JCAHO measures and your hospital has a 95% success rate for each one.
- What is the chance that a patient will receive all of the mandated quality measures

Only 60%
Individual Brilliance Is Inadequate In the Absence of Systematic Organization

NEXT STEPS
Once all the parts are in place:
- Leadership Team
- Admin support
- Acute Stroke Team
- Budget
- ED/EMS Training
- ED Stroke Care Pathway
- 24/7 Imaging and Labs
- Tracking Log
- Stroke Unit
- Stroke Team CME
- Standardized Order Sets
- Outcomes monitoring
- Pt Education
- Post-stroke Support
- Community Outreach

Where Do You Go From Here?

Ensure Continuous Improvements

Strokes Occurring During Hospitalization

- 7-15% of all hospitalized stroke cases
- Mostly occur on Medicine, Cardiology, CT surgery
- Frequently associated with procedures
- 1% of all MI patients will have a stroke during hospitalization
43 y/o in hospital for observation after a minor GI procedure.

- Day #2 after his procedure he has sudden acute onset of severe vertigo, nausea, and diplopia.
- Nurse calls the physician listed on post-procedure orders. No answer after three attempts. Nursing eventually determines the correct physician to call. Verbal order for promethazine.
- Patient continues to complain of severe vertigo. Nursing calls back physician who evaluates and orders non-contrast head CT

Head CT read as negative for bleed. Based on continued symptoms neurology called for consultation.

- Neurologist answers page but explains that she is covering multiple hospitals and can not physically see the patient. Recommends MRI with diffusion.
- Hospitalist called for consultation
- MRI/MRA ordered

Case Study

- Radiology indicates MRI no longer available as technician has gone home.
- Order changed to CT/CTA
- CT/CTA read as cerebellar infarct – Likely vertebral dissection
QUESTIONS

- Did this represent exceptional care, standard care, or sub-standard care.
- Would this patient have been better off if he had his stroke outside the hospital?
- Could this happen at your hospital?

Inpatient Stroke Alert Program

- Single alert number
- Mobilization of staff (rapid response team/acute stroke team)
- Priority path for transport and imaging
- Education of all staff on stroke symptoms

Inpatient Strokes

Response time to inpatient strokes significantly slower than response time to strokes via the ED (p<0.001)

Stroke Alert Program reduces time to CT scan for in-hospital strokes (271 minutes versus 74 minutes, p<0.02)
Continuous Process Improvement

- Process Map
  - Identification of slow and unreliable steps
    - Transport
    - Labs
    - IV access
    - Notification of CT tech
- Solutions found to Barriers
  - Stroke Team/Nurse now transports pt to scanner
  - CT techs now have stroke pager
- Optimal process Codified
  - In-hospital stroke pathway cards distributed
  - Outlines exactly what needs to occur and by whom in chronological sequence

Results

- In-hospital stroke alert response time cut in half
- In-hospital stroke alerts scanned within 25 minutes increased from 17% to 24%

What do you call a group of people who take care of stroke patients?
If you guessed “Pace”…. That’s uncharitable

What do you call a group of people who take care of stroke patients?

- Paramedics
- ED physicians
- Hospitalists
- Intensivists
- Neurologists
- Neurosurgeons
- PMNR physicians

- Nurses
- Pharmacists
- Physical Therapists
- Occupational Therapists
- Speech Therapists
- Interventional radiologists

The Stroke Team