



# Prevention of Complications after Stroke

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# Objectives

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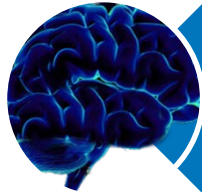
- Team member will identify potential complications during the Prehospital, Hyper acute care, Acute Care and Rehab phases of care after a stroke.
- Team member will identify multiple treatment options to prevent complications after a stroke.

# Stroke Facts:



- Stroke is the leading cause of serious long term disability in the United States and across the globe.
- Early action and treatment is crucial in preserving brain during a stroke to minimize neurological injury.
- The healthcare team plays an integral role in caring for the stroke patient with:
  - Effective communication with EMS
  - Rapid physical and neuro evaluation
  - Administer thrombolytic, when indicated
  - Stroke work-up for etiology
  - Assist with expediting treatments quickly
- With **timely** delivery, of stroke care we can significantly improve neurological outcomes.

# If left untreated, Stroke Kills



32,000

- brain cells per second



1.9 million

- brain cells per minute



120 million

- brain cells per hour

## Prehospital Care: Prevention of complications begins during the initial management of stroke in the field.

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- Assess/Manage ABC's
- Initiate cardiac monitoring
- Supplemental O2
- Establish IV
- Check Blood Glucose
- Determine LKW, and family contact.
- Triage and transport
- Notify hospital of pending stroke arrival
- Maintain NPO

# Hyper acute care phase:

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- “Stroke is a primary failure of focal tissue oxygenation and energy supply.” (Stroke, March 2013)
- Avoid systemic tissue hypoxia
- Avoid hypotension
- Avoid hypoglycemia
- Continuously re-assessing ABC’s and Neuro status.
- The stroke savvy nurse plays a key role in the hyper acute phase with timely delivery of skilled stroke care.

**Hypoxia**: In one small study of hemi paretic patients, 63% developed hypoxia within 48 hours of stroke.

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### **Common cause of Hypoxia post stroke**

- Partial airway obstruction
- Hypoventilation
- Aspiration
- Atelectasis
- Pneumonia
- Most are due to AMS
- Brain stem dysfunction

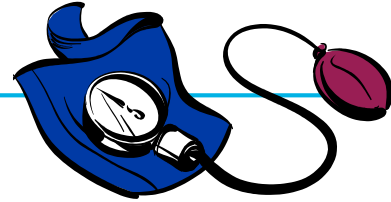
### **Prevention plan**

- Frequent observation of rate and pattern
- Cheyne-Stokes resp. common in stroke pts.
- O2 to maintain O2 sat >94% with least invasive method.
- Intubation and Mechanical Ventilation may be required



## Blood Pressure: Management of BP is one of the most important factors in caring for a stroke patient.

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- Blood pressure can rise during acute stroke as a compensatory mechanism, allowing increased cerebral perfusion and enhancing collateral circulation.
- If SBP rises too high, blood brain barrier may be disrupted >↑ risk of cerebral edema, hemorrhagic transformation or expansion of hemorrhagic stroke.
- Extreme increase in arterial BP can lead to encephalopathy, cardiac complications and renal insufficiency.
- BP is not usually treated until determination of stroke type, unless >220/120 mmHg.



# Blood Pressure - Acute Ischemic Stroke (AIS)

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- Alteplase (rtPA) eligible patients
- New rtPA label (Genentech 2015) has contraindication of – Current severe uncontrolled hypertension.
- Current AHA/ASA guidelines define HTN associated with rtPA eligibility as SBP > 185 mm Hg or DBP > 110 mm Hg.
- AHA/ASA guidelines also recommend during initiation and for 24 hours post treatment with rtPA – B/P < 180/105 mm Hg.

# AHA/ASA Guidelines

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## **Table 9. Potential Approaches to Arterial Hypertension in Acute Ischemic Stroke Patients Who Are Candidates for Acute Reperfusion Therapy**

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Patient otherwise eligible for acute reperfusion therapy except that BP is >185/110 mm Hg:

Labetalol 10–20 mg IV over 1–2 minutes, may repeat 1 time; or

Nicardipine 5 mg/h IV, titrate up by 2.5 mg/h every 5–15 minutes, maximum 15 mg/h; when desired BP reached, adjust to maintain proper BP limits; or

Other agents (hydralazine, enalaprilat, etc) may be considered when appropriate

If BP is not maintained at or below 185/110 mm Hg, do not administer rtPA

Management of BP during and after rtPA or other acute reperfusion therapy to maintain BP at or below 180/105 mm Hg:

Monitor BP every 15 minutes for 2 hours from the start of rtPA therapy, then every 30 minutes for 6 hours, and then every hour for 16 hours

If systolic BP >180–230 mm Hg or diastolic BP >105–120 mm Hg:

Labetalol 10 mg IV followed by continuous IV infusion 2–8 mg/min; or

Nicardipine 5 mg/h IV, titrate up to desired effect by 2.5 mg/h every 5–15 minutes, maximum 15 mg/h

If BP not controlled or diastolic BP >140 mm Hg, consider IV sodium nitroprusside

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BP indicates blood pressure; IV, intravenously; and rtPA, recombinant tissue-type plasminogen activator.

# Blood Pressure - Acute Ischemic Stroke (AIS)

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- For AIS NOT Eligible for rtPA
- SAVE THE PENUMBRA!!!
- Permissive hypertension for 48 hours  
– Hold BP meds and only treat if BP > 220/120 mm Hg.
- Facilitates increase in perfusion to the acutely infarcted brain tissue.
- If BP is reduce dramatically, perfusion pressure may be inadequate for the penumbra, leading to extension of infarct or loss of penumbra.

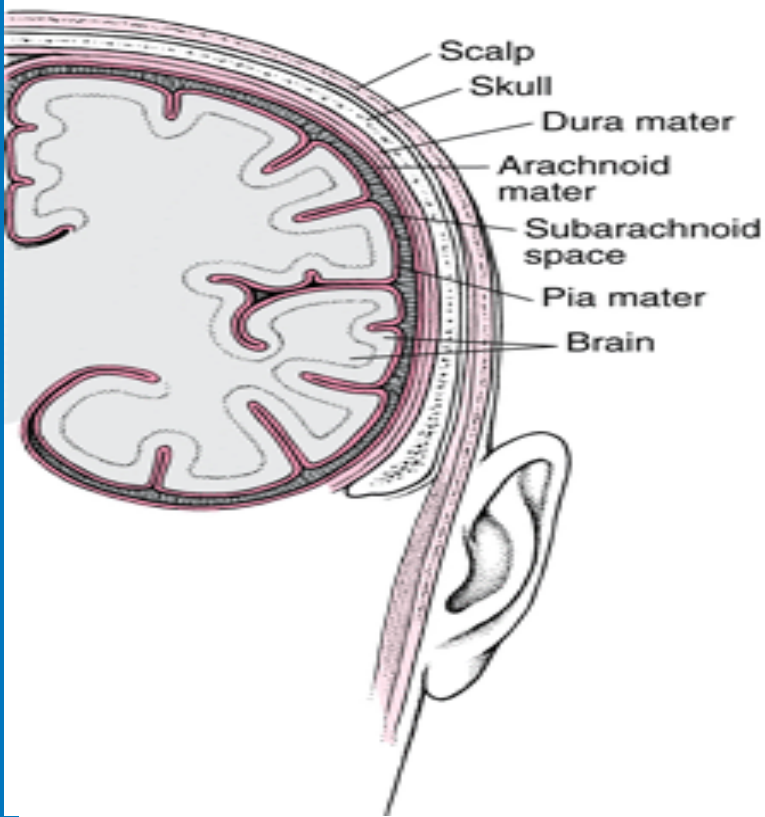
# Blood Pressure - Acute Ischemic Stroke (AIS) - Hypotension

- Hypotension is rare during AIS
- Impairs cerebral autoregulation
- Look for other causes, shock, aortic dissection or cardiac issues
- Associated with poor outcomes
- Treatment plan
- Prevent further infarct.
- Urgent evaluation, diagnosis and correction of the cause
- Vasopressor agents and/or fluids if needed to elevate BP



# Hemorrhagic Stroke

**Cross Section of the Brain**

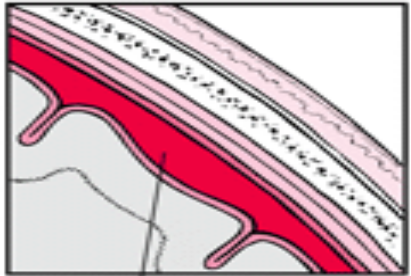


**Intracerebral Hemorrhage**



Bleeding inside the brain

**Subarachnoid Hemorrhage**



Bleeding in the subarachnoid space

# Blood Pressure Management Hemorrhagic Stroke

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- ICH –  
Intracranial Hemorrhage
- Acute reduction of SBP to 140-160 is thought to be reasonable and safe.
- SAH –  
Subarachnoid Hemorrhage
- After acute SAH, BP reduction to lower than 160/90 is reasonable.

(Connolly, et al.,2012)

# INTERACT 2 Trial

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- Largest clinical trial evaluating intensive blood pressure lowering in 2839 patients with SBP between 150 and 220 mm Hg within 6 hours of ICH.

# AHA/ASA B/P Recommendations based on INTERACT2 trial

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- For ICH patients presenting with SBP between 150 and 220 mm Hg and without contraindication to acute BP treatment, acute lowering of SBP to 140 mm Hg is safe (Class 1; Level A) and can be effective for improving functional outcome. (Class IIb; level C).
- For ICH patients presenting with SBP >220, it may be reasonable to consider aggressive reduction of BP with a continuous intravenous infusion and frequent BP monitoring (Class IIb; level C).
- <http://stroke.ahajournals.org/content/early/2015/05/28/STR.0000000000000069>



# Blood Pressure Management Hemorrhagic Stroke

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- NEJM Published June 8, 2016  
ATACH-2 trial – “Intensive Blood-Pressure Lowering in Patients with Acute Cerebral Hemorrhage.
- Randomly selected eligible patients (1000) with intracerebral hemorrhage.
- 500 were assigned intensive treatment SBP range – 110-139
- 500 were assigned standard treatment SBP range – 140-179.

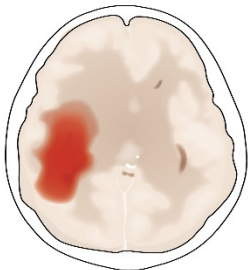
# ATACH-2 Conclusion

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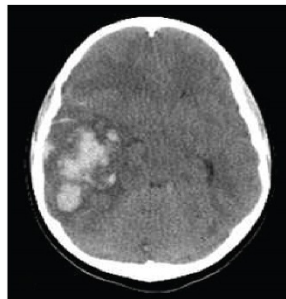
- The treatment of participants with ICH to achieve a target SBP of 110-139 mm Hg did not result in a lower rate of death or disability than standard reduction to a target of 140-179 mm Hg.

# Hemorrhagic Stroke - Care

- Blood Pressure management is crucial in preventing re-bleed or expansion.
- Hemostasis is critical to prevent continued bleeding.
- Prevention Plan
  - Assess for coagulopathy
  - Assess current med list
  - FFP, Cryo or Vit K
  - Prothrombin Complex Concentrate – KCENTRA/Feiba
  - Use reversal agents; Praxbind reversal for Pradaxa



(a)



(b)

# Aneurysmal SAH - Vasospasm



- At risk between day 6 and 21 post hemorrhage.
- Occurs when arteries narrow, leading to decreased blood flow causing ischemia
- SAH patients should be monitored in the ICU
- **Prevention Plan**
- Nimodipine 60 mg Q 4 hours for 21 days
- If patient has neurologic deterioration
  - Triple “H” Therapy
  - Hypervolemia
  - Hypertension
  - Hemodilution

# Management of elevated Intracranial Pressure (ICP)

- Increased ICP is most likely to occur in ICH or SAH and patients with large vessel ischemic strokes.
- For ICH/SAH, if ICP↑ titrate MAP to maintain CPP at least > 60.
- Prevention Plan
- Elevate HOB
- Keep neck aligned
- Reduce stimulation
- Osmotherapy; Mannitol or hypertonic saline
- CSF diversion; Ventriculostomy
- Maintain Temp <99.0F
- Mechanical ventilation
- Barbiturate coma
- Craniectomy



# Management of Blood Glucose - Hypoglycemia

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- Hypoglycemia is rare during AIS, and is usually related to antidiabetic medications.
- Can mimic stroke and cause seizures, but is easily and rapidly correctable.
- If severe and prolonged, can result in worsening of brain injury.
- Blood glucose should be measured pre-hospital, and treated urgently if low.

# Management of Blood Glucose - Hyperglycemia

- Elevated BS is very common during AIS, presenting in > 40% of cases.
- Increases anaerobic metabolism, lactic acidosis and free-radical production.
- Can lead to infarct expansion, hemorrhagic transformation and reduced recanalization.
- Increases length of stay and mortality.
- Prevention Plan
- Avoid Hypoglycemia with aggressive hyperglycemia correction
- Avoid IV solutions with glucose
- Sliding Scale Insulin orders
- Accu-checks and SQ insulin should be punctual to reduce peaks and valleys



# Management of Temperature Hyperthermia

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- Approx 1/3 of stroke pts develop hyperthermia ( $T > 37.6$  C) within first few hours.
- Inflammatory response may result from damage to the thermoregulatory center.
- Increases metabolic demand
- Accelerates the ischemic cascade leading to conversion of penumbra to infarct
- Independently contributes to death and disability at 30 days.
- Prevention plan
- Maintain normothermia
- Determine source of fever - UTI, sepsis pneumonia or may be due to stroke.
- Acetaminophen, aspirin, ibuprofen
- Surface cooling; avoid shivering
- Educate family to limit blankets
- Avoid warm room temperatures



# Acute Care of Stroke Patient

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- Multiple studies – indicate post stroke care in a designated stroke unit will lessen the rate of mortality and morbidity.
- 63% of patients have 1 or more complications after AIS when not cared for in a stroke unit.
- Severity of the stroke affects the development of complications, which usually occur in the first 4 days.

# Admission, Length of Stay and Interdisciplinary team

**Appendix 1. Structure and Organization of Stroke Rehabilitation Care in the United States**

Setting	Admission	Median Length of Stay	Specialist Involvement
Acute inpatient facility (hospital)	Near onset	4 d for ischemic stroke 7 d for hemorrhagic stroke	Major: MD, RN More limited: OT, PT, SLT, SW
IRF	5–7 d	15 d (range, 8–30 d)	Major: MD, RN, OT, PT, SLT More limited: SW
SNF	5–7 d	Highly variable (maximum, 100 d)	Major: LPN/LVN, NA, OT, PT, SLT More limited: MD, RN
Long-term care (nursing home)	Highly variable	Prolonged and highly variable	Major: LPN/LVN, NA More limited: RN, OT, PT, SLT, MD
Long-term care hospital	Variable	25-d average (required)	Major: RN, MD More limited: OT, PT, SLT
HHCA	Variable (typically 5–30 d)	Maximum 60-d episode	Major: NA, RN More limited: OT, PT, SLT, MD
Outpatient office	Variable (typically 5–30 d)	Variable	Major: OT, PT, SLT, MD

HHCA indicates home healthcare agency; IRF, inpatient rehabilitation facility; LPN/LVN, licensed practical or vocational nurse; MD, medical doctor; NA, nurse assistant; OT, occupational therapist; PT, physical therapist; RN, registered nurse (preferably with training in rehabilitation); SLT, speech-language therapist; SNF, skilled nursing facility; and SW, social worker. Modified from Miller et al.<sup>11</sup> Copyright © 2010, American Heart Association, Inc.

# Deep Vein Thrombosis (DVT) and Pulmonary Embolus(PE)

- Stroke patients are in bed 50% of the time for the first 2 weeks.
  - Immobility, limb paralysis common
  - PE account for 10% of deaths post stroke
  - DVT and PE were more likely to occur in first 3 months after stroke
  - PE usually occur for venous thrombi that develop in a paralyzed lower extremity or pelvis.
- Prevention Plan
  - Early Mobilization
  - Early involvement with PT/OT
  - Anti-thrombotics
  - SCD's especially for pts with ICH/SAH
  - Heparin SQ
  - Low-Molecular weight heparin - Lovenox



# Dysphagia – Impaired Swallowing

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*The Joint Commission Requires*

*“All patients exhibiting stroke symptoms are screened for dysphagia prior to receiving any oral intake of fluids, food, or medication.”*



# Dysphagia – Impaired Swallowing

- Affects 37% to 78% of patients with acute stroke.
- Associated with increased risk of aspiration, pneumonia, prolonged hospital stay, disability, and death.
- **Prevention Plan**
- Starts in ED – use a validated tool to assess swallow
- Assess for possible aspiration
- Strict NPO if fail
- Consult Speech therapist
- Feed only when awake and alert
- Elevate HOB upright
- Suction available
- Avoid rushed or forced feeding
- Provide thickened liquid or pureed diet when recommended by SLT.
- Provide frequent oral care.



No Food or Drink

# Seizure Post Stroke

- AIS is one of the highest causes of epilepsy in the elderly population.
- ICH patients are at high risk for seizures in first 24 hours
- Hematomas in the temporal lobe and cerebral cortex have higher risk for seizure

## Prevention Plan

- Prophylactic anticonvulsants should not be routinely given with ICH.
- Anticonvulsants are often prescribed in acute phase if having clinical S/S of seizures.
- Assess for other causes of seizures
- Protect airway, protect from harm
- Ativan during acute phase if can inject before spontaneous resolution
- Continuous EEG

# Maintenance of Nutrition/Hydration

- Hypovolemia may lead to hypoperfusion and exacerbate the ischemic brain tissue, cause renal impairment and lead to thrombosis.
- Hypervolemia may lead to cerebral edema and increase stress on heart.
- Dehydration and malnutrition may slow recovery
- Strict NPO due to dysphagia or AMS
- **Prevention plan**
- If NPO – IV fluids – bolus followed by maintenance fluids
- Isotonic solution
- NG or Duotube for meds and feedings
- PEG placement
- Bowel management
- Consult dietician
- Speech to continue to assess swallow function



# Infection – Pneumonia

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- Pneumonia is responsible for approximately 35% of acute stroke patient deaths.

## Common Causes of Pneumonia Post Stroke:

- Suppression of immune responses which predispose to infection.
- Dysphagia is associated with risk for pneumonia and increased risk of death.
- Immobility and atelectasis
- Mechanical Ventilation can also increase incidence.



# Infection - Pneumonia

- Patients at greatest risk for pneumonia due to dysphagia
  1. Brain stem infarcts
  2. Multiple strokes
  3. Major hemispheric lesions
  4. Severe AMS
  5. Impaired gag/cough
  6. High NIHSS
- Prevention Plan
- NPO if fail Swallow screen
- Early Mobilization
- Early PT/OT/Speech consults
- Turn patient Frequently
- Good pulmonary care; deep breaths
- Good frequent oral care.



# Infection – Urinary Tract Infection (UTI)

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- Occur in up to 60% of stroke patients and are associated with poor outcomes.
- Incidence highest in patients with indwelling cath.
- Loss of sphincter can increase risk
- Can lead to sepsis or bacteremia
- Prevention Plan
- Early mobilization
- Urinalysis if indicated
- Avoid indwelling catheters; Remove ASAP
- Intermittent Caths may reduce risk
- Antibiotics, if indicated

# Impaired Mobilization

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- Usually due to stroke causing mobility deficits; hemiparalysis.
- 66% of patients are immobile for a period of time post stroke
- 33% will continue to have mobility issues up to three months.
- Early mobilization will reduce risk for complications and improve functional outcomes.
- **Prevention Plan**
- Consult PT/OT/Speech early to develop plan for rehabilitation
- PROM early to prevent joint contractures and atrophy
- Teach families PROM to involve in care
- Monitor BP with position changes

# Falls – Post Stroke

- increased risk for fall due to motor, sensory, communication, visual, balance and cognitive deficits
- Additional risk include, nursing staffing levels, hx of falls, continence status, medications and procedures.
- Prevention Plan
- Assess for falls risk
- Frequent Nursing rounds
- Frequently orient patient to environment and stress not getting out of bed without assistance
- Call bell/bedside table within reach
- Offer toileting Q2 hours
- Bed or chair alarm on
- Bed in low position
- Assess for need of sitter

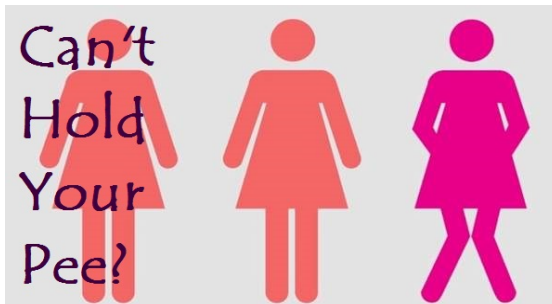
# Skin Breakdown Post Stroke

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- Occurs in 9% of all hospitalized pts.
- Stroke patients are high risk due to immobility, paresis, decreased sensation and cognition as well as diabetes
- Bony areas at more risk
- Moisture from incontinence also a risk
- **Prevention Plan**
- Assess for skin breakdown risk using a valid tool; Braden scale
- Turn frequently Q2
- Keep skin clean and dry
- Avoid friction and sheering
- Maximize nutrition
- Adequate padding and mattress

# Incontinence/Constipation

- **Constipation** common during first 2 weeks post stroke
- **Caused by:** decrease mobility, pain medications, dehydration, and depression
- **Urinary incontinence** occurs in as many as 60% of stroke patients early after stroke.
- **Caused by:** Neurogenic bladder, hyperreflexia, urge incontinence and AMS
- **Prevention Plan**
- Assess bowel and bladder function
- Avoid constipation and straining – will cause spikes in BP
- Bowel training – stool softeners, laxatives, enemas
- Avoid urinary catheters
- Retrain Bladder –offer frequent toileting, Q2 when awake and Q4 at night.
- Lessen fluid intake in the evening hours.



# Pain/Positioning Post Stroke

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- Stroke patients are at risk for contractures pain and joint damage due to a paretic limb.
- Shoulder pain occurs in up to 80% of pts with arm paresis due to: poor positioning and traction on arm during transfer
- Spasticity occurs in up to 65% of stroke patients
- **Prevention plan**
- Early PT/OT consults for splinting to prevent contractures
- Position paretic limb
- Progressive ROM
- Electrical stimulation
- Heat
- Anti-inflammatory agents or analgesics
- Proper handling of paretic extremity
- **Spasticity treatment-** stretching, splinting, and medications.
- Botox injections
- Oral Baclofen, benzodiazepines.

# Depression Post Stroke

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- Present in more than 1/3 of ischemic stroke patients
- Can negatively affect cognition and motor recovery
- Associated with increased mortality
- Can increase caregiver distress
- Caused by: loss of function/independence, biological impact of alteration of brain neurotransmitter function.

## Prevention Plan

- AHA/ASA recommends screening
- Should use a validated depression screening tool: PHQ2, PHQ9, HADS, DT
- Antidepressants improve outcomes
- Avoid alcohol
- May take up to 4-6 weeks to feel full effect of antidepressant



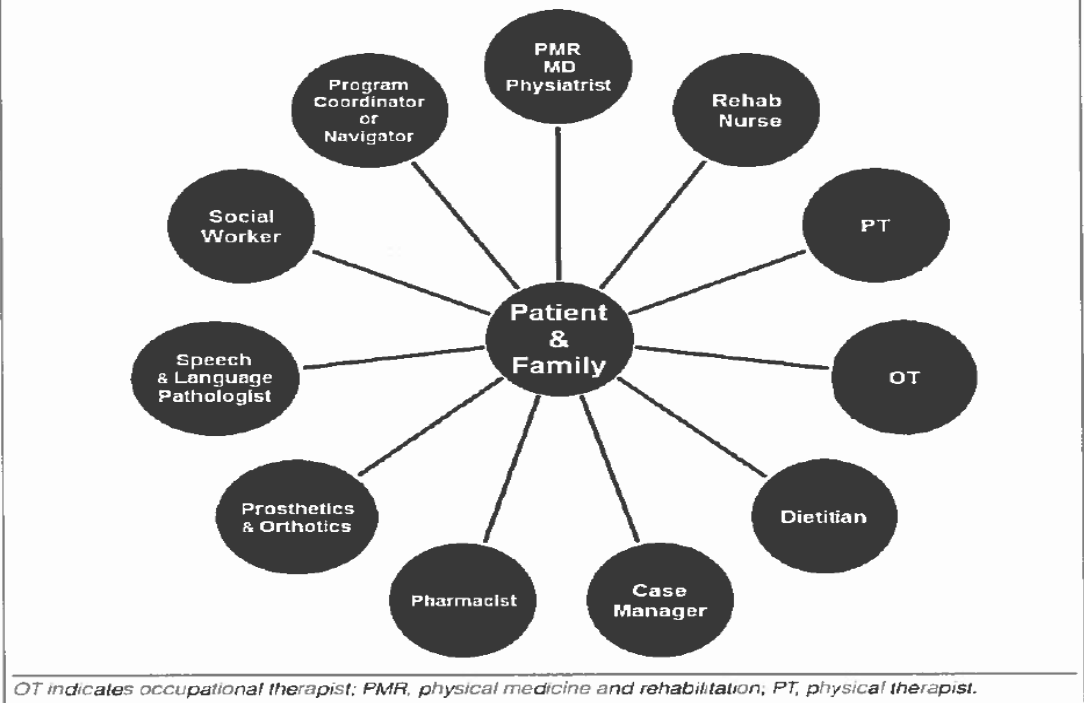
# Prevention of Future Stroke

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- EDUCATE, EDUCATE, EDUCATE!!!
- Of the 795,000 stroke that occur each year, approximately 25% are recurrent events.
- Provide individualized education for each patient and his/her family
- Should ALWAYS include the patient and family in facilitation of care goals and options.

# Successful Stroke Care and Rehabilitation is ALWAYS a TEAM approach.

Figure 7-1. Typical Rehabilitation Team Composition



*OT indicates occupational therapist; PMR, physical medicine and rehabilitation; PT, physical therapist.*

# Patient Prevention Plan – Education

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- Identify patient specific stroke risk factors
- List medications and treatment plan to control risk factors
- Explain cause of stroke if known
- Review medical, nursing and other therapeutic interventions to manage the stroke
- Review interventions to prevent another stroke; Ex; Quit smoking, routine exercise
- Stress importance of recognizing signs and symptoms of stroke and the importance of calling 911.

# References

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