Stroke Rehabilitation
Role of the Rehab Physician

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Acknowledgement

• Dr Caitlin Anderson
  – for emailing a number of references, abstracts and PDFs of relevant articles to me while I was still overseas
Role of the Rehab Physician

Wide ranging role from the initial consultation to community follow-up after discharge:

• Consultation
  – prognosis for recovery of function

• Management in rehab ward
  – rehabilitation of various stroke related issues
  – medical Management including secondary prevention
  – management of comorbidities and complications

• Rehabilitation after discharge
  _ referral to community resources
  _ spasticity management
  _ return to work
  _ return to driving
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Consultation by rehab physician

• early after stroke
  – Ideally attend acute stroke unit case conference
• generally the aim of consultation is to:
  – give an opinion on prognosis for recovery of function and
  – suitability for rehabilitation
• consultation time is often quite brief but many factors need consideration:
  – a review of history & diagnosis
  – neuro exam – motor, sensory, cognition, speech
  – course of recovery and current function
  – level of function prior to stroke
  – functional implications of co-morbidities
  – medical stability
  – social supports and likely discharge options
  – ability to participate in a rehabilitation program
Consultation by rehab physician

Know the literature to help you determine a patient’s prognosis and to make a decision on patient selection when you do a consultation
Patient selection:
The evidence on outcome and time course of recovery

• rehabilitation unit data
  – tends to have a ‘selection bias’ as stroke rehab services do not accept all stroke patients

• population based unit data
  – include all stroke patients regardless of severity

• publications from these two sources are often conflicting

Therefore, when patients are assessed for rehab very early after stroke, data from unselected populations is more relevant
the Copenhagen Stroke Study describes
  - the course and outcome of unselected stroke patients
  - from the acute admission to the completion of rehabilitation or death

88% of all strokes in a defined area in Copenhagen (population 238,886) are admitted to this hospital

acute treatment and rehab in neurology unit

patients were not discharged until further in-hospital improvement was considered unlikely by the team

1,197 consecutively admitted stroke patients

many publications in 1990s on various aspects
Copenhagen Stroke Study
Stroke: Neurologic and Functional Recovery

- **Neurologic impairment:**
  - Scandinavian Stroke Score (SSS):
    - on admission
    - the day after admission

- **Functional disability:**
  - Barthel Index (BI):
    - during the first week of admission

- SSS and Barthel were recorded
  - each week until death or end of rehabilitation
  - 6-month post stroke
Copenhagen Stroke Study
Outcome and Time Course of Recovery in Stroke: Part I

**Discharge Placement, %**

- Home – dark columns
- N/H – hatched
- Clear - died

**SSS**

- Very severe: 0-14
- Severe: 15-29
- Moderate: 30-44
- Mild: 45-58

**p<0.00001**
Copenhagen Stroke Study
Outcome and Time Course of Recovery in Stroke: Part I

**Functional Disability at Discharge, %**

Columns show disability at discharge on BI
none, mild, moderate, severe, very severe

<table>
<thead>
<tr>
<th>Initial Stroke Severity</th>
<th>0-14</th>
<th>15-29</th>
<th>30-44</th>
<th>45-58</th>
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<tbody>
<tr>
<td>Mild</td>
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<tr>
<td>Very severe</td>
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Scandinavian Stroke Scale

On admission
• 20% of the survivors with initially very severe strokes had no disability or only mild functional disability at the end of rehabilitation
Time course for recovery of neurologic impairment
Copenhagen Stroke Study
Outcome and Time Course of Recovery in Stroke: Part II

Time to neurological recovery (best SSS)

- 80% of cases had reached their best SSS in 4.5 weeks &
- 95% in 11 weeks
Time course for recovery of function
Copenhagen Stroke Study Experience

Time to best functional level on Barthel

- **Mild Stroke** (SSS 45 - 58)
  - 80% in 3 weeks
  - 95% in 8.5 weeks

- **Moderate Stroke** (SSS 30 - 44)
  - 80% in 7 weeks
  - 95% in 13 weeks

- **Severe Stroke** (SSS 15 - 29)
  - 80% in 11.5 weeks
  - 95% in 17 weeks

- **Very Severe Stroke** (SSS 0 - 14)
  - 80% in 11.5 weeks
  - 95% in 19.5 weeks

- Best functional level on Barthel achieved in 80% of all patients in 6 weeks & 95% in 13 weeks
The prognosis of patients with mild or moderate stroke is generally excellent.

Patients with severe stroke have a very variable recovery. Although their prognosis is generally poor, 1/3 of survivors achieve no or mild disability and can be discharged home.

Only 9 out of 1,197 patients showed late recovery after 5 months.

The most important factor for recovery is the initial severity of stroke.
Copenhagen Stroke Study  
Ischemic vs Hemorrhagic Stroke  

- 1000 acute stroke
- ICH - in 88 (8.8%), CI - in 912 (91.2%)
- patients with ICH generally had a more severe stroke  
  - admission SSS 25 vs 39

Stroke type had no influence on
  - time course of neurological or functional outcome

Functional outcome was similar in patients with ICH and those with CI when the difference in initial stroke severity was taken into consideration
Ischemic vs Hemorrhagic Stroke

Kelly PJ et al (Spaulding Rehab)
Arch Phys Med Rehabil 2003;84:968-72

• n=1064. Infarct 871, ICH 193
• at admission ICH subgroup was significantly more functionally impaired than the cerebral infarction subgroup (FIM 51 vs 59)
• ICH subgroup had larger increases in total FIM scores (28 vs 23) than cerebral infarction group at discharge
• However, at discharge no significant differences in total FIM (79 vs 82), FIM motor, or FIM cognitive scores

ICH patients had greater functional gain during rehab than infarcts
Do Stroke Patients With Intracerebral Hemorrhage Have a Better Functional Outcome Than Patients With Cerebral Infarction? Pesi H. Katrak, MD, FAFRM, Deborah Black, MStat, PhD, Victoria Peeva, MD

PM&R Vol. 1, Iss. 5, 2009

Admission to discharge FIM gain

(n = 718)

ICH patients had a greater FIM gain than CI
Do Stroke Patients With Intracerebral Hemorrhage Have a Better Functional Outcome Than Patients With Cerebral Infarction? Pesi H. Katrak, MD, FAFRM, Deborah Black, MStat, PhD, Victoria Peeva, MD
PM&R Vol. 1, Iss. 5, 2009

Conclusions:
Patients with ICH achieved significantly greater gains in function than patients with CI after rehabilitation

Bias in selection of ICH patients occurs at several levels:
1. increased mortality in ICH
2. selection by the acute unit of ICH patients with seemingly poor prognosis by not referring these patients to rehab
3. selection by rehab units of patients with a reasonable expectation of being able to achieve improvement in function
Copenhagen Stroke Study
Factors for Good Recovery in Most Severe Strokes

• 1,197 unselected stroke patients
• 223 patients with the most severe strokes:
  – <15 points on SSS at admission
  – 139 (62%) died in hospital
  – 84 who survived included in this report
• These 84 patients were stratified into 2 groups:
  – 26 who eventually had a good functional outcome, ie, a discharge Barthel Index (BI) score of ≥ 50
  – 58 who had a poor functional outcome, ie, a BI score <50 points after completed rehabilitation
Copenhagen Stroke Study
What determines good recovery in the most severe strokes

- 84 survivors from 1197 unselected stroke patients with SSS <15

**Barthel at discharge ≥ 50 v < 50**

- ICH (%)  24 v 25
- SSS @ adm  7.6 v 8
- SSS @ 1 week  27 v 13
- disc Barthel  79 v 10
- discharge to home (%)  92 v 9
- disc to Nursing home (%)  8 v 91

Degree of neurological impairment 1 week after stroke onset added substantial information regarding the functional outcome
Copenhagen Stroke Study
Neglect: incidence & prognosis

- n=602
- **Hemineglect** present in 23% of patients on admission
  - 42% in right hemisphere lesions - 8% in left hemisphere lesions
- **Anosognosia** present in
  - 73% of patients with hemineglect and in 6% of those without hemineglect
- **Hemineglect had no independent influence on**
  - functional outcome
    - length of rehabilitation or
    - mortality
- **Anosognosia had an independent influence on:**
  - discharge BI score
  - mortality and
  - rate of discharge to independent living

The overall outcome of patients with anosognosia was, thus, much worse than that of patients with hemineglect.
Neglect assessed at 5 weeks and outcome

Paolucci et al

Arch PM&R 2001; 82:743

- 89 neglect vs 89 without neglect matched for age and onset to rehab interval
- neglect assessment at 38 days
- neglect group had more severe deficits on adm neurologic and functional scores
- despite cognitive training neglect patients had worse ADL, mobility, LOS and incontinence (21% vs 5%) at discharge

- The contrast with Scandinavian Stroke Study is probably because that study evaluated neglect in the acute phase – thus including cases with spontaneous improvement of neglect
- If neglect persists beyond the acute phase its influence on outcome is more relevant
Definition: Hemispatial neglect is a deficit in attention to and awareness of one side of space that cannot be attributable to a primary sensory (eg, visual) or motor deficit

• Although neglect improves over time, neglect symptoms continue to interfere with daily functioning long after stroke. Karnath HO et al. Brain. 2011;134(pt 3):903–912

Treatment:

• limited evidence to date that these interventions increase daily life functioning, even when performance on neglect tests has improved. Yang Nyet al. Fron Hum Neurosci. 2013;7:187

  – half-field eye patching, visual scanning training, prism adaptation, limb activation, optokinetic stimulation, mental imagery and brain stimulation with repetitive transcranial magnetic stimulation, theta burst transcranial magnetic stimulation, or tDCS
The Measure of Balance in Sitting in Stroke Rehabilitation Prognosis

• 24 patients, age 70.7 yrs, LOS 17.7 days
• Sitting balance weekly till discharge
  1: unable to maintain sitting without support
  2: can sit unsupported but requires assistance if pushed to either side
  3: can sit unsupported but requires assistance if pushed to hemi side
  4: normal balance
• Barthel Index 4 weeks post stroke

<table>
<thead>
<tr>
<th>Initial sitting</th>
<th>Change</th>
<th>BI at 4 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 or 4</td>
<td></td>
<td>85</td>
</tr>
<tr>
<td>1 or 2</td>
<td>3 or 4</td>
<td>69</td>
</tr>
<tr>
<td>1 or 2</td>
<td>1 or 2</td>
<td>48</td>
</tr>
</tbody>
</table>

Sitting balance can be helpful in anticipating functional outcome at discharge
Copenhagen Stroke Study

Jorgensen et al, 1994 & 95

Walking Function

• 804 patients, age 74.5 yrs
• assessed within 1 week and every week to discharge
  − LE score of Scandinavian Stroke Score
  − Barthel score for walking

• best walking function was reached within:
  − 4 weeks for patients with mild paresis
  − 6 weeks for those with moderate paresis
  − 11 weeks for severe paralysis

Recovery of walking was related to the initial severity of LE weakness
The return of motor power is not synonymous with recovery of function.

Function may be hampered by:

- apraxia
- sensory deficit – neglect, anosognosia
- communication disorder
- cognitive impairment
- incoordination
The restoration of motor function following hemiplegia in man
Twitchell T
Brain. 1951 Dec;74(4):443-80

• 25 patients
• Followed from admission to stable condition
• Stages of motor recovery:
  ▪ return of tendon reflexes
  ▪ flexion synergy
  ▪ extension synergy
  ▪ isolated motor control
Shoulder shrug – a prognostic sign for recovery of hand movement after stroke.
Katrak, PH. Med J Aust 1990; 152:297-301

• 32 stroke patients
• shoulder shrug at 35 days post stroke

Hand Movements Scale

1= no active movements in fingers
2= synergistic finger flexion only
3= synergistic finger flexion+extension
4= able to extend index in isolation
5= thumb opposition to index only
6= thumb opp. to each fingertip
Shoulder shrug – a prognostic sign for recovery of hand movement after stroke.

*Katrak, PH. Med J Aust 1990; 152:297-301*

Patients with initial hand movements of 3 or less

- 18 patients with absent shrug:
  - 2 pts recovered good hand movements

- 11 patients with weak or good shrug:
  - 8 recovered good hand movements

Patients with initial hand movements of 2 or less

- 5 patients with absent shrug:
  - 1 recovered good hand movements

- 7 patients with weak or good shrug:
  - 5 recovered good hand movements
Predicting Upper Limb Recovery After Stroke: The Place of Early Shoulder and Hand Movement
Pesi Katrak, Greg Bowring, Phillip Conroy, Marylin Chilvers, Roslyn Poulos, Don McNeil
Arch Phys Med Rehabil 1998;79:758-61

• n = 71 stroke patients

Presence of shoulder shrug at 11 days (mean) post-stroke predicted
  – good hand movement (odds ratios 7.3, 7.0, 6.0) and
  – hand function (odds ratios 13.8, 5.3, 11.3)
  – at 1, 2, and 3 months, respectively
EPOS Cohort Study: Early Prediction of Functional Outcome After Stroke

- n = 188

- finger extension and shoulder abduction (FE+SA) within 72 hours of stroke and at days 5 and 9

- Action research arm test (ARAT) at 6 months

  - upper limb function on ARAT at 6 months
    - patients with some FE+SA on day 2 after stroke onset had a 98% probability of achieving some dexterity at 6 months
    - 60% of patients with some finger extension within 72 hours had full recovery on ARAT

- Retesting the model on days 5 and 9
  - 98% probability of regaining dexterity remained for those with some FE+SA
  - gradual decline in probability of regaining dexterity from 25% to 14% for those without this voluntary control.
The PREP algorithm predicts potential for upper limb recovery after stroke


- sparing of CST (cortico-spinal tract) is related to better recovery of upper limb function after stroke
- n = 40 ischaemic stroke
- Serial assessments of
  1. SAFE score (Shoulder Abduction + Finger Extension on MRC, range 0–10) within 3 days of onset. If <8 proceed to TMS
  2. TMS for MEP in ext digitorum. If absent proceed to MRI
  3. MRI-DWI to assess the structural integrity of the posterior limbs of the internal capsules; fractional anisotropy asymmetry index – not within 5 days of stroke
The PREP algorithm predicts potential for upper limb recovery after stroke

*Stinear CM et al. Brain. 2012 Aug;135(Pt 8):2527-35*

- upper limb recovery at 12 weeks, measured with the ARAT (Action Research Arm Test)
- 39/40 recovered as well or better than predicted
- PREP algorithm can accurately predict recovery of upper limb as ‘complete, notable (or moderate), limited or none’ with a
  - positive predictive power of 88%
  - negative predictive power of 83%
  - specificity of 88% and
  - sensitivity of 73%.
Cognition and Memory
AHA/ASA Stroke Rehab Guidelines 2016

• Cognitive impairment is found in more than one third of stroke survivors at 3 and 12 months after
  – Impairments in attention, processing speed, executive function, verbal and visual memory, language, and perception


• The usefulness of donepezil, rivastigmine and Fluoxetine in the treatment of poststroke cognitive deficits is not well established
Limb apraxia

AHA/ASA Stroke Rehab Guidelines 2016

Definition:
Limb apraxia is “a decrease or difficulty in performing purposeful, skilled movements” that cannot be attributed to hemiplegia or lack of effort

- There is evidence that apraxia is associated with reduced independence in daily life activities. Blijlevens H et al. Disabil Rehabil. 2009;31:466–475
- There is a paucity of research on therapeutic interventions for limb apraxia
Aphasia
AHA/ASA Stroke Rehab Guidelines 2016


A systematic review of RCTs of aphasia treatment stated that no conclusions can be made about the effectiveness of one treatment over another. Brady MC et al. Cochrane Database Syst Rev. 2012;5:CD000425
Balance and Ataxia
AHA/ASA Stroke Rehab Guidelines 2016

- Balance depends on sensory inputs from the visual, vestibular, and somatosensory systems
- Balance impairment is common after stroke because stroke can affect one or more of the sensory and motor networks
- Although balance training programs have been shown to be beneficial after stroke, no specific approach or program has been demonstrated to be superior, nor is the optimal timing clear
- Training typically includes balance-specific activities, (eg, practice responding to challenges in standing) and more general activities (eg, strengthening exercises, gait activities). Lubetzky-Vilnai A et al. J Neurol Phys Ther. 2010;34:127–137
- Ataxia without concurrent hemiparesis has a better prognosis for functional recovery
Mobility
*AHA/ASA Stroke Rehab Guidelines 2016*

- restoration of gait is often one of the primary goals of rehab
- A number of systematic reviews have demonstrated enhanced outcomes of gait, gait-related activities after intensive, repetitive task training. *French B et al. Cochrane Database Syst Rev. 2007:CD006073*

- Key training parameters for improving mobility after stroke are activity-specific and functional task practice that is:
  - progressively more difficult and challenging
  - of sufficient intensity, frequency, and duration

- it is not yet known whether treadmill training is superior to overground walking training. *Polese JC et al. J Physiother. 2013;59:73–80*

Comparison of Clinical Characteristics and Functional Outcomes of Ischemic Stroke in Different Vascular Territories
Ng YS et al. Stroke. 2007;38:2309-2314

• n = 2213. ACA (120), MCA (1123), PCA (160), Brain Stem (252), Cerebellar (84), Small Vessel (284), >1 Territory (196)

• Hemispheric strokes have much lower cognitive FIM scores compared with the brainstem, cerebellar, and small-vessel strokes

• attention, memory, and executive functions, agitation, abulia, and depression are a feature of ACA strokes

• most to least severe disability on admission to rehabilitation:
  – strokes in MVT, MCA, ACA, PCA, brain stem, cerebellar and small-vessel

• most to least severe disability on discharge:
  – strokes in MVT, MCA, ACA, PCA, brain stem, small-vessel and cerebellar

all groups made approximately equal functional gains on completion of inpatient rehabilitation

the admission motor and cognitive function were the most important predictors of the discharge functional status
• Deep Venous Thrombosis
  – Elastic compression stockings are NOT useful\textsuperscript{85,86}

• Bowel and Bladder Incontinence
  – 40\% to 60\% have urinary incontinence in acute phase falling to 25\% by hospital discharge.
  – At 1 year, 15\% will remain incontinent of urine\textsuperscript{90}

• Skin Breakdown and Contractures – 60\% in 1\textsuperscript{st} year \textsuperscript{65,66}

• Hemiplegic Shoulder Pain – multifactorial
  – Suprascapular nerve blocks may be effective\textsuperscript{145}

• Central post-stroke pain - incidence 7\% to 8\%
  – Pharmacotherapy + therapeutic exercise + psychosocial support\textsuperscript{152,156}

• Falls - Up to 70\% fall during the first 6 months after discharge\textsuperscript{174}
• Depression and anxiety
  – up to 33% of survivors
  – Associated with increased mortality & poor functional outcomes$^{207-214}$
  – early effective treatment may have a positive effect on outcome

• Seizure - more common with ICH$^{189}$

• Osteoporosis - increased risk for osteoporosis and fracture

• Family Caregiver Support
  – 12% to 55% of caregivers suffer from some emotional distress, most commonly depression$^{238}$

• Community Rehabilitation

• Referral to Community Resources
  – day service program, support groups, leisure and exercise programs, respite care, Meals on Wheels
  – provision of information to patients and their caregivers
  – improves patient satisfaction and reduce patient depression scores$^{871}$

• Return to work

• Return to driving
Summary of prognosis/patient selection factors

the initial grade of paresis is the most important predictor,

accuracy of the initial motor assessment may be invalid because of apraxia, neglect, or aphasia.

prediction rapidly improves during the first few days after stroke
Poor Functional Outcome

- severe initial neurological impairment
- severe initial functional deficits
- neglect or anosognosia
- poor sitting balance
- persistent urinary incontinence
- bowel incontinence
- older age
- cognitive impairment
- delay to rehab

Side of stroke and gender have no correlation to outcome
Other factors related to local circumstances that may affect patient selection

- Nursing
  - trache, IV
  - heavy patients
  - staffing level

- Medical
  - On-site overnight cover
  - heparin, APTT
  - Level of alertness
  - Significant medical issues

- Allied health
  - staffing

- Waiting list

- Geographical boundary
SECONDARY STROKE PREVENTION

REVIEW OF SOME IMPORTANT TRIALS
• n = 669 patients with non-valvular AF and a recent TIA or minor ischaemic stroke
  1. adjusted-dose warfarin (target INR, 3.0)
  2. 300 mg of aspirin daily
  3. placebo

Main outcome - combined vascular death, MI, stroke, or systemic embolism
  - substantially reduced by warfarin compared with placebo, HR, 0.53
  - annual risk of stroke was reduced from 12% to 4%, HR, 0.34

NOACs – a number of recent trials
  - non-inferior to warfarin
  - lower incidence of ICH
ESPS-2
European Stroke Prevention Study
*Journal of the Neurological Sciences. 143(1-2):1-13, 1996*

- n = 6602 patients with prior ischemic stroke or TIA
  1. 25 mg aspirin bd;
  2. 200 mg ER-Dipyridamole bd;
  3. 25 mg aspirin plus 200 mg ER-DP bd;
  4. Placebo

**RRR of recurrent stroke:**
- Aspirin vs placebo - 18%
- Dipyridamole vs placebo - 16%
- Aspirin plus 200 mg ER-DP vs placebo – 37%
A randomised, blinded, trial of clopidogrel versus aspirin in patients at risk of ischaemic events (CAPRIE)


- **n=19,185** patients with recent ischaemic stroke, myocardial infarction, or symptomatic peripheral arterial disease
  1. clopidogrel 75mg/day
  2. aspirin 325mg/day

mean follow-up 1.91 years

- clopidogrel is more effective than aspirin in reducing the combined risk of ischaemic stroke, myocardial infarction, or vascular death (RRR 8.7%)
- on a sub group analysis of patients with prior stroke, the risk reduction was smaller and non significant
PRoFESS
Prevention Regimen for Effectively Avoiding Second Strokes

- n = 20,332 patients with ischaemic stroke
  1. Aspirin + Dipyridamole
  2. Clopidogrel

- recurrent stroke over 2.5 years follow-up:
  - aspirin+dipyridamole – 9%
  - clopidogrel – 8.8%

- The net risk of recurrent stroke or major hemorrhagic event was similar in the two groups
MATCH
Management of Atherothrombosis With Clopidogrel in High-Risk Patients With Recent Transient Ischemic Attacks or Ischemic Stroke
*Lancet. 2004;364:331–337*

- n = 7599 high-risk patients with recent ischaemic stroke or TIA
  1. clopidogrel 75 mg
  2. clopidogrel 75 mg + aspirin 75 mg

composite of ischaemic stroke, myocardial infarction, vascular death, or rehospitalisation for acute ischaemia over 3.5 yrs follow-up:
  - no significant benefit of combination therapy compared with clopidogrel alone
  - risk of major hemorrhage was significantly increased in the combination group
CHARISMA
Clopidogrel and aspirin versus aspirin alone for the prevention of atherothrombotic events

- n = 15,603 patients with either clinically evident cardiovascular disease or multiple risk factors
  1. clopidogrel 75mg + aspirin (75-162 mg)
  2. placebo + aspirin
- composite of myocardial infarction, stroke, or death from cardiovascular causes
- 28 months follow-up:
  - no statistically significant benefit of combination therapy compared with aspirin alone

Similar results in SPS3
Effects of clopidogrel added to aspirin in patients with recent lacunar stroke
Which antiplatelet agent?

- studies comparing clopidogrel to other antiplatelet agents have not clearly established that it is superior to any one of them
- No studies have compared clopidogrel to placebo
- The combination of aspirin and dipyridamole may be more effective than aspirin alone

Patient characteristics, safety & cost may affect choice of agent:

- intolerance of specific agents
  - clopidogrel for patients intolerant to aspirin and
  - for patients who do not tolerate dipyridamole because of headache
- comorbidity
  - aspirin + clopidogrel for patients with acute coronary syndromes or recent vascular stenting
PROGRESS
Perindopril Protection Against Recurrent Stroke Study
*Lancet. 2002;359:2120*

- n = 6105 with previous stroke or TIA
  1. perindopril
  2. perindopril + indapamide
  3. placebo

After 4 years:
- Active therapy reduced the primary end point of fatal or nonfatal stroke by 28%
- treatment effect was similar in people with and without baseline hypertension
- a direct relationship between lower achieved pressure and lower stroke rate

A meta-analysis of randomized trials confirmed that antihypertensive medications reduced the risk of recurrent stroke after stroke or TIA. *Hypertens Res. 2009;32:1032–1040*
SPARCL
Stroke Prevention by Aggressive Reduction in Cholesterol Levels

- n = 4731 patients with stroke or TIA and no known CHD
  1. atorvastatin 80mg
  2. placebo

4.9 years follow-up
- 11.2% of those who received atorvastatin experienced a stroke vs
- 13.1% who received placebo (absolute reduction in risk, 2.2%)

**Atorvastatin reduced the overall incidence of strokes and of cardiovascular events, despite a small increase in the incidence of hemorrhagic stroke.**

Several trials have confirmed that statin drugs reduce the risk of stroke even in patients without elevated LDL or low HDL.
Fluoxetine for motor recovery after acute ischaemic stroke (FLAME): a randomised placebo-controlled trial

- n = 118 ischaemic stroke, NIHSS < 20
- randomized within 5-10 days of onset
  - fluoxetine 20 mg once per day, orally or placebo for 90 days
- primary outcome was the mean change in FMMS (Fugl Meyer motor scale) score between inclusion (day 0) and day 90
  - The motor domain ranges from 0 to 100, with 66 points for the upper limb and 34 points for the lower limb
- mean progression in FMMS total score from baseline to day 90 was significantly higher in the fluoxetine group than in the placebo group
- mRS scores 0, 1, or 2 was significantly higher in the FLU group
- depression during the 3 months was significantly lower in the fluoxetine group

early prescription of fluoxetine with physiotherapy enhanced motor recovery after 3 months
The Effects of Pretreatment versus De Novo Treatment with Selective Serotonin Reuptake Inhibitors on Short-term Outcome after Acute Ischemic Stroke
Siepmann T et al. (Dresden, Germany) J Stroke cerebrovasc dis. 2015;1886–1892

• exploratory analysis comparing stroke patients
  1. already receiving fluoxetine, citalopram, or escitalopram
  2. with those who started treatment de novo

• n = 239 , NIHSS 7
  – 51 started treatment with SSRI before stroke
  – 188 were prescribed newly SSRIs during hospitalization

• functional outcome at discharge defined as a modified Rankin Scale score of 2 or less
  – SSRI pre-treatment was associated with favourable functional outcome OR 4.00

• data suggest that SSRI pre-treatment may
  – improve clinical outcomes in the early stages of acute ischemic stroke

supporting the hypothesis that prolonged SSRI treatment started pre-stroke
is superior to post-stroke SSRI
AHA/ASA Guidelines for Secondary Prevention of Stroke & TIA.
*Stroke*. 2014;45:2160-2236

- anti-thrombotic and anti-coagulant therapy
- hypertension
- dyslipidaemia

- diabetes
  - all patients should probably be screened for DM. HbA\textsubscript{1c} – a more accurate screening tests in the immediate post-stroke period

- overweight and obesity
  - the usefulness of weight loss is uncertain

- exercise
  - moderate-intensity exercise - an average of 40 minutes, 3-4 times/week

- sleep apnoea
  - a sleep study might be considered for patients with an ischemic stroke or TIA on the basis of the very high prevalence of sleep apnea

- smoking
  - strongly advise every patient with stroke or TIA who has smoked in the past year to quit (Class I; Level of Evidence C)

- alcohol
  - heavy drinkers should eliminate or reduce their consumption of alcohol *(Class I; Level of Evidence C)*
Role of the Rehab Physician

Wide ranging role from the initial consultation to community follow-up after discharge:

• Consultation
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• Management in rehab ward
  – rehabilitation of various stroke related issues
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• Rehabilitation after discharge
  _ referral to community resources
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  _ return to driving
NEUROPLASTICITY PRINCIPLES - I

- Rehabilitative interventions may modulate plasticity both positively and detrimentally
- Differentiate between recovery through ‘true’ plastic mechanisms – ‘restoration’ and behavioural ‘compensation’
- Enriching stimulation leads to plastic processes including morphological change [49, 50] augmented dendritic branching [62] and synaptogenesis [63]
- Specific training leads to specific adaptation [51, 52]
- Simple repetitive motion alone hardly result in profound plastic change [54]. Skill learning must be present to promote cortical plasticity [55]
NEUROPLASTICITY PRINCIPLES -II

- Without use of the paretic extremity, representational areas undergo further deterioration. If the paretic extremity is used excessively early, - intense rehabilitation - a dramatic increase in the size of the lesion is found [19]

- The longer one waits, the smaller the chance to therapeutically influence outcome. Training initiated after day one is more effective than training started a week after experimentally induced ischemia [80]

Conclusions:
- therapy must be intense and specific
- it must be started early after stroke