7. Post-Stroke Depression and Community Reintegration

Robert Teasell MD, Norhayati Hussein MBBS MRehabMed

7.1 Depression Post Stroke

7.1.1 Overview of Post-Stroke Depression

Depression is a common complication of stroke. Prevalence of depression (major and minor) has been reported to affect 23-40% of stroke patients. White (2002) reported that major depression was present in 9-37% of stroke survivors in the first in the 6 months, 5-16% next year and 19-21% thereafter in 1725 patients studied. Most cases of PSD is evident within the first two years and episodes last on average months or more with some persisting for years. Depression is often observed in severe physical illnesses. In post stroke depression there is less emphasis on feelings of low self-esteem, guilt and self-blame and more emphasis on hypochondriac concerns, lethargy and behavioural disturbances; on eoe the challenges is that diminished energy, weight loss, insomnia, poor concentration and psychomotor alterations all of which can be associated with the stroke itself. Patients may be unable to communicate their feelings due to aphasia which makes diagnosis more challenging.

DSM V. Criteria for Depression

**DEPRESSIVE DISORDER DUE TO ANOTHER MEDICAL CONDITION (DSM V: page 180-183)**

**Diagnostic Criteria**

1. A prominent and persistent period of depressed mood or markedly diminished interest of pleasure in all or almost all, activities that predominates in the clinical picture.
2. There is evidence from history, physical examination, or laboratory findings that the disturbance is the direct pathophysiological consequence of another medical condition.
3. The disturbance is not better explained by another mental disorder (e.g., adjustment disorder, with depressed mood, in which the stressor is a serious medical condition).
4. The disturbance does not occur exclusively during the course of a delirium.
5. The disturbance causes clinically significant distress of impairment in social, occupational, or other important areas of functioning.

**Risk Factors for Depression**

The most commonly identified risk factors for post stroke depression include:

- Female sex (especially those with severe depression)
- Previous history of depression
- Stroke severity, functional limitations or need for assistance with activities of daily living
- Cognitive impairment
- Social factors (living alone, divorced or living in a nursing home)
Possible Reasons for the High Incidence of Depression Post Stroke

1. Stroke risk factors coincide with high depression risk.
2. Disability causes a reactive depression.
3. Stroke induces neurotransmitter changes which lead to depression.
4. In acute onset depression there is increased risk associated with left frontal strokes and least risk with right frontal lesions.
5. In sub-acute or delayed stroke (2-6 months post stroke) there is no association with frontal regions and weak association with laterality of lesion location with greater risk in right hemispheric lesions.

7.1.2 Stroke Location and Depression

Robinson et al. (1984) found left frontal strokes appeared to be at higher risk of depression and questioned whether this was not associated with specific neurotransmitter changes in the brain with disruption of certain neural pathways. Other investigators not been able to consistently duplicate findings. More recent meta-analyses failed to establish a definitive relationship between site of stroke and depression. At present not known if stroke location influences developing depression.

Our own meta-analysis of research data (Bhogal et al. 2004) (see below) shows:

Figure 1. Odds Ratio of Post-Stroke Depression After Left Hemisphere Stroke, n=20*

1. Left hemispheric strokes are more likely to be depressed in hospital (earlier on).
2. Right hemispheric strokes are more likely to be depressed in the community (later on).
Despite a wealth of research, it has not been established whether stroke location influences likelihood of depression.

7.1.3 Impact of Depression Post Stroke

Functional Impairment and Depression
Depression has a powerful negative impact post-stroke. It has been estimated that the impact of depression on physical and functional outcomes accounts for 5-48% of the variance which is a potentially huge impact. Depressed patients post stroke are more likely to suffer deterioration in their physical functioning on discharge from rehab. Function and depression seem to interact - decreased function leads to depression while depression leads to decreased function. Depression post stroke has a powerful negative impact on physical and functional recovery.

Depression and Social Activities Post Stroke
Stroke impacts on how patients perceive themselves (self-image). This is in turn associated with depression and social withdrawal which in turn worsens depression. Social withdrawal is common post stroke and it is recommended that social withdrawal be dealt with early to limit its negative impact. Depression impacts upon social activity and vice-versa post-stroke.

**Cognitive Impairment and Depression Post Stroke**
It is well known that depression is associated with cognitive impairment although its impact on cognitive function has not been well studied in stroke patients.

**Mortality and Depression Post Stroke**
Depression has been linked to higher mortality among elderly patients with physical illness. Three studies have demonstrated a link between depression and increased mortality (refs). Depression post stroke is associated with greater mortality.

**Why is Depression Post Stroke Important?**
Depression post stroke is important because it is associated with:
- Increased physical impairment and decreased physical recovery.
- Increased cognitive impairment.
- Decrease social participation and quality of life.
- Increased risk for mortality.
- Increased risk of depression for informal caregivers.
- Increase healthcare utilization for both.

**7.1.4 Management of Depression Post Stroke**

**Canadian Best Practice Recommendations (2015)**
1. All patients with stroke should be screened for depressive symptoms, given the high prevalence of depression post-stroke, the need for screening to detect depression, and the stroke evidence for treating symptomatic depression post-stroke.
2. Screening should be undertaken using a validated tool to maximize detection for depression.
3. Stroke patient assessments should include evaluation of risk factors for depression, particularly a history of depression.
4. For patients who experience some degree of communication challenge or deficits following stroke, appropriate strategies for screening of possible PSD should be implemented to ensure adequate assessment and access to appropriate treatment.

**Screening and Assessment of Depression**

**Why Screen for Depression?** (Mitchell 2010, 2011; Mitchell & Kakkadasam 2010)
Screening for depression is important to ensure an accurate diagnosis post stroke. It has been shown that the accuracy of informal identification and diagnosis of depression is poor, reported to be approximately 33-48% (doctors) and 43% (nurses in an inpatient setting). There is a tendency toward false positives (exceed true positives by 3:1). Accuracy is particularly reduced in cases of: 1) Late life depression; 2) Minor vs. Major depression; 3) Populations with known risk of depression. Lowe et al. (2004) compared the sensitivity of formal screening with clinical observation by a physician (versus formal diagnosis); it was 40% with the physician but increased to 88% with HADS and 98% with PHQ-9.
Which Screening Tools are Typically Used?

- Geriatric Depression Scale (GDS)
- Hospital Anxiety and Depression Scale (HADS)
- Patient Health Questionnaire (PHQ-9)
- Stroke Aphasic Depression Questionnaire (SAD-Q)
- Aphasic Depression Rating Scale (ADRS)

Summary of Screening Tools for Depression

<table>
<thead>
<tr>
<th>Tool</th>
<th># of Items</th>
<th>Response Format</th>
<th>Total Score</th>
<th>Identification of Depression</th>
<th>Time to Administer</th>
<th>Training Req’d</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDS</td>
<td>30</td>
<td>Yes/No</td>
<td>0-30</td>
<td>Normal = 0-10; ≥11 indicate presence of depression; 11-20 = mild depression; 21-30 = moderate to severe depression.</td>
<td>6-10 mins</td>
<td>No</td>
</tr>
<tr>
<td>HADS</td>
<td>14(7)</td>
<td>Multiple choice response options 4 point scale</td>
<td>0-42 (21)</td>
<td>Scale authors recommended either 8/9 (high sensitivity) or 10/11 (high specificity) be used to identify the presence of depression using the depression subscale of the HADS. A recent report suggested scores of ≥ 8 represent the presence of minor PSD.</td>
<td>2-6 mins</td>
<td>No</td>
</tr>
<tr>
<td>PHQ-9</td>
<td>9</td>
<td>Multiple choice response options 4 point scale</td>
<td>0-27</td>
<td>Scores &gt; 10 (sensitivity = 80%; specificity = 73%) for identification of PSD 6-8 weeks post stroke.</td>
<td>2-5 mins</td>
<td>No</td>
</tr>
<tr>
<td>SAD-Q</td>
<td>10</td>
<td>Observer rating of observed behavior 4 point scale</td>
<td>0-30</td>
<td>Scores &gt; 15 represent the presence of depression.</td>
<td>3-4 mins</td>
<td>No</td>
</tr>
<tr>
<td>ADRS</td>
<td>9</td>
<td>Observer rating based on interview and observation Rating scale varies per item</td>
<td>0-32</td>
<td>Scores of &gt; 9 are used to indicate the presence of depression.</td>
<td>N/A</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Post Screening Assessment

Patients identified as at risk (screening) should be referred to a psychiatrist or psychologist or an appropriate clinician with an interest in depression management for further assessment and diagnosis.

Treatment of Depression Post Stroke
Drug Therapy for Post-Stroke Depression

Drug therapy is based on imbalance or underactivity of brain noradrenergic or serotonergic systems and involves three classes of drugs:

- Heterocyclic antidepressants (Nortriptyline)
- Selective Serotonin Reuptake Inhibitor (SSRI) antidepressants (citalopram, paroxetine)
- Amphetamines (methylphenidate)

Prevention and Prophylactic Use of Antidepressants

There are a number of trials suggesting routine use of antidepressants can prevent development of depression. Early initiation of antidepressant therapy, in non-depressed stroke patients, may reduce the odds of development of a stroke. Only 10% of stroke patients treated with sertraline or mirtazapine developed depression compared to 30-40% in placebo group (Rasmussen et al. 2003; Niedermaier et al. 2004). The impact of prophylactic antidepressants has been questionable in systematic reviews (Hackett et al. 2005). Optimum timing and duration of treatment and identification of the most appropriate recipients for a program of indicated prevention requires additional research.

Salter et al. (2013) did a pooled analysis of 8 RCTs which demonstrated reduced odds for the development of PSD associated with: 1) Pharmacological treatment (OR 0.34; 95% CI 0.20-0.53; P<.001); 2) Treatment duration of 1 year (OR 0.31; 95% CI 0.18-0.56; P<.001); 3) Use of a selective serotonin reuptake inhibitor (OR 0.37; 95% CI 0.22-0.61; P<.001).

<table>
<thead>
<tr>
<th>Study name</th>
<th>Odds ratio</th>
<th>Lower limit</th>
<th>Upper limit</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palomaki et al. (1999)</td>
<td>0.957</td>
<td>0.259</td>
<td>3.333</td>
<td>0.947</td>
</tr>
<tr>
<td>Narushima et al. (2002)</td>
<td>0.314</td>
<td>0.071</td>
<td>1.392</td>
<td>0.127</td>
</tr>
<tr>
<td>Rasmussen et al. (2003)</td>
<td>0.325</td>
<td>0.118</td>
<td>0.897</td>
<td>0.030</td>
</tr>
<tr>
<td>Niedermaier et al. (2004)</td>
<td>0.091</td>
<td>0.019</td>
<td>0.441</td>
<td>0.003</td>
</tr>
<tr>
<td>Almeida et al. (2006)</td>
<td>0.727</td>
<td>0.265</td>
<td>1.918</td>
<td>0.537</td>
</tr>
<tr>
<td>Robinson et al. (2008)</td>
<td>0.321</td>
<td>0.106</td>
<td>0.967</td>
<td>0.044</td>
</tr>
<tr>
<td>Chollet et al. (2011)</td>
<td>0.173</td>
<td>0.054</td>
<td>0.555</td>
<td>0.003</td>
</tr>
<tr>
<td>Tsai et al. (2011)</td>
<td>0.124</td>
<td>0.015</td>
<td>1.051</td>
<td>0.056</td>
</tr>
<tr>
<td></td>
<td>0.338</td>
<td>0.218</td>
<td>0.525</td>
<td>0.000</td>
</tr>
</tbody>
</table>

*active treatment conditions (Narushima et al. 2002) combined for purposes of overall analysis
HIGHLIGHTED STUDY

Methods: 118 patients free from clinical depression and not taking any antidepressant medication with Fugl-Meyer (FM) scores of <55 were randomly assigned to receive either 20 mg/day fluoxetine or matching placebo within 5-10 days of stroke onset for 90 days. All patients received usual rehabilitation care delivered by organised stroke teams.

Results: Frequency of depression was significantly greater in the placebo group when compared to the treatment group (29% vs. 7%, p=0.002). There was a significant between group difference reported in mean change in symptoms of depression over 90 days (p=0.032). Mean FM total and lower limb subscores were significantly higher in the fluoxetine group compared with control (54 vs 35, p<0.01 and 24 vs. 19, p=0.001); change in FM scores was also higher in the fluoxetine group.

Treatment of Established Depression

Heterocyclic Antidepressants
Heterocyclic antidepressants block reuptake of serotonin and norepinephrine within the brain, increasing levels within the brain. RCTs (nortriptyline and imipramine) were beneficial, reducing PSD. Side effects, especially in elderly patients, were quite high. There is strong evidence that heterocyclic anti-depressants improve post-stroke depression.

Summary of Heterocyclic Antidepressants in Post Stroke Depression

<table>
<thead>
<tr>
<th>Authors/Year</th>
<th>PEDro Score</th>
<th>N</th>
<th>Drug</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robinson et al 2000</td>
<td>8</td>
<td>104</td>
<td>Nortriptyline</td>
<td>+</td>
</tr>
<tr>
<td>Lauritzen et al 1994</td>
<td>8</td>
<td>58</td>
<td>Imipramine and Mianserin</td>
<td>+</td>
</tr>
<tr>
<td>Lipsey et al 1984</td>
<td>8</td>
<td>39</td>
<td>Nortriptyline</td>
<td>+</td>
</tr>
</tbody>
</table>

Odds Ratio and 95% Confidence Interval of Response to Treatment in Placebo Controlled Studies
Selective Serotonin Reuptake Inhibitors (SSRIs)

SSRIs selectively block serotonin reuptake thereby increasing levels of serotonin in the brain. Six RCTs (Fluoxetine, Citalopram, Sertraline) of which 3 were positive, two were negative and one while negative regarding depression management showed positive impact on QoL. Meta-analysis (Mead et al. 2013) of 52 using SSRIs for any indication in the first year post stroke. Patients who received SSRIs were less likely to be dependent (MRS > 3), disabled or neurologically impaired and less likely to be anxious and depressed. Interestingly, a subgroup analysis of patients who were not depressed at study onset also showed a benefit from SSRI treatment. There is strong evidence that SSRI antidepressants are effective in the treatment of post-stroke depression.

Summary of SSRI Antidepressants in PSD

<table>
<thead>
<tr>
<th>Authors/Year</th>
<th>PEDro Score</th>
<th>N</th>
<th>Drug</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anderson et al 1994</td>
<td>8</td>
<td>66</td>
<td>Citalopram</td>
<td>+</td>
</tr>
<tr>
<td>Robinson et al 2000</td>
<td>8</td>
<td>104</td>
<td>Fluoxetine</td>
<td>-</td>
</tr>
<tr>
<td>Wiart et al 2000</td>
<td>8</td>
<td>31</td>
<td>Fluoxetine</td>
<td>+</td>
</tr>
<tr>
<td>Fruehwald et al 2003</td>
<td>9</td>
<td>54</td>
<td>Fluoxetine</td>
<td>+</td>
</tr>
<tr>
<td>Murray et al 2005</td>
<td>9</td>
<td>123</td>
<td>Sertraline</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+ (QoL)</td>
</tr>
<tr>
<td>Choi-Kwon et al 2006</td>
<td>9</td>
<td>51</td>
<td>Fluoxetine</td>
<td>-</td>
</tr>
</tbody>
</table>

Weighted Mean Difference and 95% Confidence Interval on Effect of Antidepressant Therapy on Mean Change Scores
Odds Ratio and 95% Confidence Interval of Patients Lost Due to Side Effects in Placebo Controlled Studies*

*Drop-outs due to side effects calculated by dividing the number of patients who dropped out because of side effects over the total number of drop outs of that treatment group.

<table>
<thead>
<tr>
<th>Study or sub-category</th>
<th>Treatment n</th>
<th>Control n</th>
<th>OR (fixed) 95% CI</th>
<th>OR (fixed) 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 Selective Serotonin Re-Uptake Inhibitors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anderson</td>
<td>3/7</td>
<td>1/2</td>
<td>0.75 [0.52, 1.05]</td>
<td>Not estimable</td>
</tr>
<tr>
<td>Wart</td>
<td>0/2</td>
<td>0/1</td>
<td>Not estimable</td>
<td>Not estimable</td>
</tr>
<tr>
<td>Narusis</td>
<td>1/5</td>
<td>1/3</td>
<td>0.50 [0.32, 0.80]</td>
<td>Not estimable</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>24</td>
<td>12</td>
<td>0.69 [0.38, 0.98]</td>
<td></td>
</tr>
<tr>
<td>Total events: 20 (Treatment) 7 (Control)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for heterogeneity: $I^2 = 0.02$, df = 1 ($P = 0.87$), $P = 9.00$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect: $Z = 2.37$ ($P = 0.02$)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Psychostimulants (Amphetamines)
Methylphenidate (Ritalin) stimulates the noradrenergic system, blocks reuptake of serotonin/noradrenaline and has dopaminergic activity. Methylphenidate has an early onset of treatment effect (2-10 days) vs. 2-4 weeks for other antidepressants. Only one RCT (n=21) has shown
methylphenidate is more effective than placebo in improving depression and functional recovery (Grade et al. 1998).

Methylphenidate (a psychostimulant) may be effective in treating depression post-stroke and has an earlier onset of action than traditional antidepressants.

Summary of Effectiveness of Anti-Depressants
There is strong evidence that heterocyclic antidepressants and SSRIs improve PSD. Methylphenidate (a psychostimulant) may be effective in treating PSD with earlier onset of action.

<table>
<thead>
<tr>
<th>Drug Class</th>
<th>Example</th>
<th>Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heterocyclic Antidepressants</td>
<td>Nortriptyline</td>
<td>Yes – High side effect profile</td>
</tr>
<tr>
<td>Selective Serotonin Reuptake Inhibitors (SSRIs)</td>
<td>Sertraline, Fluoxetine, Celexa</td>
<td>Yes – May also improve neurorecovery (Chollet et al)</td>
</tr>
<tr>
<td>Selective Noradrenaline Reuptake Inhibitors (NARIs)</td>
<td>Reboxetine</td>
<td></td>
</tr>
<tr>
<td>Serotonin and Noradrenaline Reuptake Inhibitors (SNRIs)</td>
<td>Venlafaxine</td>
<td></td>
</tr>
<tr>
<td>Amphetamines</td>
<td>Methylphenidate</td>
<td></td>
</tr>
</tbody>
</table>

Functional Recovery Associated with Treatment of PSD
PSD has a negative impact on function and cognitive recovery. Treatment of PSD should improve these outcomes. 6 RCTs examined the role of antidepressants on improvement of functional outcomes, ADLs, cognitive and neurological recovery. Four of the RCTs were positive and 2 had no effect. This is conflicting evidence with a trend towards the positive. Dam et al. 1996 (n=52) found fluoxetine associated with greater ADL performance, and significant impact on gait performance. Pariente et al. 2001 (n=8) found fluoxetine use associated with fMRI activation of the ipsilesional cortex and improved function after single dose. Zittel et al. 2008 (n=8), Acler et al. 2009 (n=30) found Citalopram associated with improved hand function. All these studies report functional impact independent of effect on depression since there was no significant difference between groups regarding depression diagnosis.
Adverse events may include nausea, diarrhea, hepatic enzyme disorders, and bleeding (due to the role serotonin plays in platelet activation).

**Antidepressants to Improve Neurological Recovery**

The one unusual study was the FLAME trial (Chollet et al. 2011) which showed that early treatment with fluoxetine actually improved motor recovery as measured by the Fugl-Meyer scores. Budhdeo and DeLuca (2012) noted that fluoxetine administration upregulated BDNF (brain-derived neurotrophic factor) a neurotrophin which has been shown to promote neurogenesis and synaptic plasticity, thereby improving recovery from ischemic stroke (Binder and Scharfman 2004; Ploughman et al. 2009). Currently there are several larger trials of SSRIs on post-stroke recovery including the *Fluoxetine or Control Under Supervision* (FOCUS) trial, the *Australasian Assessment of Fluoxetine in Stroke Recovery* (AFFINITY) trial and the *Effectiveness of Fluoxetine – a Randomized Controlled Trial in Stroke* (EFFETS) trial.

**Summary of Stroke Recovery after Treatment with Antidepressant Medications**

<table>
<thead>
<tr>
<th>Study</th>
<th>Drug</th>
<th>Recovery</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narushima et al. 2003</td>
<td>Nortriptyline or fluoxetine</td>
<td>Physical function</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Early treatment vs. later treatment</td>
</tr>
<tr>
<td>Chemerinski et al. 2001</td>
<td>Nortriptyline</td>
<td>ADL</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>When depression remitted</td>
</tr>
<tr>
<td>Robinson et al. 2000</td>
<td>Fluoxetine or Nortriptyline</td>
<td>ADL</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Nortriptyline</td>
</tr>
<tr>
<td>Wiart et al. 2000</td>
<td>Fluoxetine</td>
<td>ADL</td>
<td>-</td>
</tr>
<tr>
<td>Miyai &amp; Reding 1998</td>
<td>Desipramine, Fluoxetine, or Trazadone</td>
<td>Functional</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Trazadone &amp; Fluoxetine)</td>
</tr>
<tr>
<td>Dam et al. 1996</td>
<td>Maprotiline or Fluoxetine</td>
<td>ADL and neurological</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fluoxetine</td>
</tr>
<tr>
<td>Raffoole et al. 1996</td>
<td>Trazadone HCl</td>
<td>ADL</td>
<td>-</td>
</tr>
<tr>
<td>Gonzalez-Torrecillas et al. 1995</td>
<td>Nortriptyline or Fluoxetine</td>
<td>Functional</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Nortriptyline &amp; Fluoxetine)</td>
</tr>
<tr>
<td>Reding et al. 1986</td>
<td>Trazadone</td>
<td>Functional</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pts with +ve dexamethasone suppression</td>
</tr>
<tr>
<td>Lipsey et al. 1984</td>
<td>Nortriptyline</td>
<td>Functional</td>
<td>-</td>
</tr>
</tbody>
</table>

**Non-Pharmacological Treatments of PSD**

**Exercise for Depressive Symptoms Post Stroke**

Eng and Reime (2014) conducted a review of 13 RCTs (n=1022) included in a meta-analysis. Exercise resulted in less depressive symptoms immediately after the exercise program ended (p=0.03) but the effects were not retained with longer term followup. Exercise had a positive effect on depressive symptoms across both the subacute (≤ 6 months post stroke) and chronic stage of recovery (> 6 months). There was a significant effect of exercise on depressive symptoms when higher intensity studies were pooled, but not for lower intensity exercise protocols. Antidepressant medication use was
not documented in the majority of studies and its potential confounding influence could not be assessed.

**Electroconvulsive Therapy (ECT) for Post-Stroke Depression**
ECT is an older treatment for major depression. Retrospective studies suggest it is a relatively safe treatment. There are no prospective studies examining its efficacy. Electroconvulsive therapy may be a safe and effective treatment for post-stroke depression but remains unstudied.

**Repetitive Transcranial Magnetic Stimulation**
Systematic review evaluating the effectiveness of rTMS improving vascular depression (VD) and post stroke depression. Seven studies met inclusion criteria of which 4 were RCTs. Overall there appears to be a benefit of rTMS in treating post stroke depression.

**Cognitive-Behavioural Therapy (CBT) Post-Stroke**
CBT is an active, directive, structured intervention based on emotion and behaviour as determined by experience. CBT concentrates on altering patient’s interaction with environment and their interpretation of experiences. There is only one small study, not a RCT, suggests it may be helpful for some in PSD. Cognitive-behavioural therapy may prove to be an effective treatment for post-stroke depression but more research is needed.

**Music Therapy in Depression**
Music therapy provides a form of stimulation, motivation and enhancement of social interactions which improves rehabilitation. One small study (n=18), not a RCT, suggested it improved post-stroke depression. Music therapy may improve post-stroke depression but requires more research.

### 7.2 Community Reintegration Post Stroke

Community reintegration is one of the most important and underrated areas of stroke care. Failure to mobilize adequate community supports can negate the best efforts of stroke rehabilitation. Community supports have a profound impact on quality of life.

#### 7.2.1 Stroke as a Psychological Transition

Glass and Maddox (1992) note the stroke experience:

1. Takes place in a short period of time.
2. Alters capacity for social role function.
3. Risk of loss of functional independence requires adjustment to new self with limitations of multiple and vital roles. The stroke experience requires both coping with loss and adaptation to change. The goal of social support is to help the patient deal with the loss and move to that acceptance of their new self.
7.2.2 Social Support

Social support defined as “the experience or information that one is loved and cared for, valued and esteemed, and able to count on others should the need arise”.

Social Support Domains

1. **Homefront** – composition of persons in the home and $ means.
2. **Social Situation** – availability of care and quality of social network.
3. **Residence** – adaptability to the needs of the individual.

Social Support Post Stroke

Glass et al. (1993) conducted a prospective study (n=46). Patients with severe stroke and greatest social support attained an average Barthel Index score 65% greater than those with low levels of support. Higher levels of support associated with faster and more extensive recovery of functional status. Knapp and Hewison (1998) observed the availability of a close confiding relationship and social network relationships (emotional support) had a protective function against later depression and in turn resulted in improved functional outcomes. Meijer et al. (2004) in a review of 6 cohort studies found that the factors most predictive of discharge home were marital status and large social networks. Large social network and perceived social support associated with better physical function. There is limited but extensive evidence that social support systems provided through family and social networks associated with better outcomes (discharge home, better physical and functional outcomes).

Social Support and Quality of Life

Quality of life is a complex multidimensional concept. Bays (2001) conducted review of 39 articles focusing on Quality of Life.

- **Positive influence on Quality of Life**: independence in ADLs, functional ability, social support and healthcare resources.
- **Negative influence on Quality of Life**: depression, cognitive impairment, stroke severity and aphasia.

The presence and size of social support networks as well as perceived effectiveness of social support networks have a positive influence on physical recovery and Quality of Life post stroke. Higher levels of social support are associated with greater functional gains, less depression and improved mood and social interaction.

7.2.3 Family and Stroke

Caregiver Burden

This term is used to describe the “load” carried by informal caregivers as a result of adopting this role. The reported prevalence of “significant burden” ranges from 25-54% (Rigby et al. 2009). **Objective Burden** is the physical assistance provided in the form of caregiving tasks. **Subjective Burden** is the psychological, social and emotional impact on caregivers as a consequence of objective burden (Montgomery et al. 1985).
Who Does the Caregiving?
The brunt of long-term care of stroke survivor falls onto family caregivers. There is no family caregiving system, rather one family member occupies role of primary caregiver. There tends to be an order in North American society as to who does the caregiving. Usually it is the spouse and if not the spouse than a daughter, often the youngest daughter, followed by a son if there is no daughter available and if no children the role falls to other relatives and if no family available, friends. The key point is that care tends to fall onto one person with limited shared responsibilities. Although friends and family provide assistance with care shortly after discharge home, little help is forthcoming at one year. If new care demands develop, it is the family (primary caregiver) who must meet those demands. Caregivers generally cope better with physical limitations than cognitive or emotional changes.

Negative Impacts of Caregiving
Family members caring for stroke survivors often face their own adjustment difficulties. Caregivers must sacrifice their own personal needs to provide the needs of stroke survivors. Often times they find themselves having to provide skilled nursing care which they must learn by ‘trial and error’.

Most commonly identified effects of caregiving:
- Increased caregiver stress/strain/burden.
- Decreased social contact and activity.
- Declines in psychological health (including increased risk for depression).
- Reduced quality of life.
- Individuals experiencing caregiver burden are at higher risk for depression and depression is also associated with deterioration of physical health (Schulz et al 1997).
- Physical health may be compromised when the demands of caregiving are perceived to be great (Shaw et al 1997).

Which Caregivers are at Risk?
Certain kinds of tasks are perceived as more stressful:
- Mood disturbances, bowel incontinence, memory impairments (Haley et al. 2009).
- Managing behavioural problems, providing emotional support (Bakas et al. 2004).
- “Most consistent patient and caregiver characteristics associated with burden are those relating to mental health” (Rigby et al. (2009).
- “The consensus appears to be that whilst increasing primary demands (task assistance and time spent caring) do not consistently increase carer distress or burden, emotional or behavioural problems do” (Morrison et al. 1999).

Behavioural Problems
Caregiver adjustment is influenced by behavioral problems post-stroke. Personality changes noted by the caregiver post stroke is seen in 67% at 3-8 months:
- better in 5%
- worse in 82%
- not clear in 13%

Negative Behavioral Changes
- Irritability
- Loss of self control
- Lower frustration tolerance
- Emotional lability
Factors which Contribute to Caregiver Stress and Breakdown Post Stroke
Caring for a stroke survivor with severe disabilities can be a formidable task. Caregivers cope better with physical limitations than cognitive or emotional disorders. Lack of rest or time to fulfill obligations, the need for constant vigilance/supervision as well as lack of respite can have a negative impact on caregivers. Caregivers are often required to sacrifice their own personal needs. The chief reasons for reports of less enjoyment of life on the part of caregivers include loss of companionship, increased domestic responsibility and interference with leisure and social activities.

The Impact of Caring for a Stroke Survivor Changes Over Time
Immediately following a stroke caregiver burden is influenced more by stroke severity. Caregivers are more preoccupied initially with physical limitations, medications and finances. Later (after 6-12 months), in part influenced by some continuing improvement, caregivers are more influenced by cognitive and emotional issues and may spend more time assisting with travel and leisure activities. Outpatient rehab and support has no influence on caregiver depression at 3 months post stroke but does at 12 months. Over the longer term (after 2 years), burden of care tends to decrease as does social support, while depression and quality of life remain stable.

Summary of the Effects of Caregiving Post Stroke
Commonly identified effects of caregiving on the caregiver include decreased health (both physical and mental), decreased social contact and activity, increased risk for depression, increased carer stress, strain or burden and an overall decrease in quality of life. Decreased social contact and activity in itself may contribute to increased carer strain, increased risk of depression and decreased life satisfaction. Age, severity of stroke, stroke-related impairments, and functional and cognitive status have been reported as influencing caregiver outcomes.

Caregiver Depression
Stroke caregivers are more susceptible to depression. Caregivers of stroke survivors have high rates of depression (39-52%) when compared to normal population (12-16.5%); studies are on opportunistic samples with a self-selection bias. Chief causes were loss of companionship, increased domestic responsibility and interference with leisure and social activities. Factors which predict post-stroke depression include the stroke survivor’s level of dependence, the amount of tangible support received, opportunities for socialization and a negative orientation towards problem solving.

Caregivers at highest risk of depression:
- Spouses of younger, more severely impaired strokes.
- Lower household incomes.
- Smaller social networks with whom they visit regularly.
- Lower levels of optimism and expectations.

Coughlan and Humphreys (1982) noted that 3-8 yrs post-stroke 32% of spouses reported “much less enjoyment of life”. Chief causes of reduced enjoyment were loss of companionship, increased domestic responsibility and interference with leisure and social activities. Webster and Newhoff (1981) noted that the wives of stroke patients had to assume duties formerly assigned to a spouse, had lack of people to confide in or talk to and lack of personal time alone.
Patient and Family Support
Patient and family support can be divided into two types of support:
1. Social Support (mixture of various support types)
   • Social work interventions
   • Spec. social networking
   • Day services
   • Home-based support and care management
2. Education (primarily informational support)
   • Information packages
   • Education sessions
   • Skills training

Social Support Interventions
There are 7 RCTs of some mode of formal social support intervention post stroke discharge. The main interventions were nurse or social worker coming to home and providing ongoing advice, encouragement and problem solving. There is strong evidence social support interventions delivered by social worker or outreach nursing home visits are not associated with increased well-being, QoL and perceived social support. There is moderate evidence social support interventions result in improved quality and quantity of professional and community-based informal relationships as well as increased knowledge about stroke and reduced feelings of social isolation. There is conflicting evidence that social support interventions are associated with a reduction in caregiver burden or strain.

Caregiver Support
Support given by caregiving peers may have a positive effect on the caregiver. It is important to include both the caregiver and stroke patient in social support interventions.

Psychological Disorders in Caregivers Less Likely to Get Support
Physical disabilities are more likely to receive assistance from formal sources than the harder to quantify behavioural and emotional disorders (Smith et al. 2004). Although behavioural and emotional problems may present the greatest difficulty, healthcare professionals may choose to ignore them. Simon et al. (2008) reported that caregivers with perceived poorer physical health received significantly more formal services following discharge. Psychological distress did not have a similar impact on service provision. 37% of carers were identified with significant psychological distress at discharge.

Family Function and Stroke
Evans et al. (1987) noted that poor family functioning contributes to poor treatment compliance and deterioration in function. Poor family functioning is directly related to re-hospitalization (accounts for 28% of variance).

Good families:
• Communicate and exchange info clearly and directly.
• Effective problem solvers.
• Report strong emotional interest in one another.
• Caregivers and patients have different viewpoints of the patient’s functioning which can create conflict.
• Patients generally rate their quality of life higher than the caregivers do.

Summary of Family Function Post-Stroke
Perceived family dysfunction is common post-stroke. Family function affects treatment adherence, performance of ADLs and social activity. Stroke patients do better with well-functioning families. Effective communication, good problem solving or adaptive coping and strong emotional interest in each other characterizes well-functioning families.

**Family Education Intervention**
There are 11 RCTs looking at family education interventions. There is strong evidence of a positive effect of family education when an active education-counselling/problem-solving approach is taken. There is strong evidence of no benefit for an information package or workbook approach to family education. Family education has a positive impact when an active educational-counselling approach is used but not when an information package and workbook approach is taken.

**Caregiver Skills Training**
There is strong evidence that skills training is associated with a reduction in depression. There is moderate evidence that training in basic nursing skills improves outcomes of depression, anxiety and quality of life for both the caregiver and the stroke patient.

### STUDY
Kalra et al. 2004
- RCT of 300 patients and caregivers
- Formal training of caregivers during patient’s rehabilitation associated with:
  - Less caregiving burden
  - Better psychological outcomes in patients and caregivers
  - Higher quality of life in patients and caregivers
  - Reduced overall costs of health and social care

**What social support interventions have been shown to help caregivers?**
Support provided by caregiving peers may have a positive effect on the caregiver. It is important to include both the caregiver and stroke patient in social support interventions. There is moderate evidence that participation in an online program providing information and support through contact with both a nurse and other caregivers is not associated with improvements in perceived emotional support, physical help or caregiver health. Participation in a structured psychoeducational program (e.g. Powerful Tools for Caregiving) may improve well-being and reduce behaviours that could lead to problems with physical health.

**Conclusions on Community Supports**
Higher levels of social support are associated with greater functional gains, less depression, improved mood and social interaction as well as improved quality of life. Social support is predictive of discharge destination. Interventions to help access community support services is associated with increased social activity. It is important to include the caregiver as well in social support interventions.

### 7.3 Leisure/Socialization

**Leisure Activities Post Stroke**
A reduction in social and leisure activities has been reported following stroke. Neimi et al. (1988) noted that stroke patients in a survey reported an 80% reduction in leisure domains. Belanger et al. (1988) reported 6 months after returning home, < 50% participated in regular physical activities and < 50% in leisure activities outside of home; more time spent watching TV in home. Labi et al. (1980) noted women and those with higher education were most often affected in terms of leisure activities. This was attributed to greater value placed on body image and social status in social activities. Davidson and Young (1985) noted younger patients were more likely to be affected.

Lawrence and Christy (1979) observed physical disability in itself was less important to stroke patient than others response to disability. Patients with a caregiver that lived with them were less inclined to socialize even though they are generally unoccupied throughout the day. Even after return of physical abilities, patients do not return to premorbid social activities. Often times, lack of socialization is avoided because of fear of managing outside of the home. For instance, toileting in strange and sometimes difficult facilities is often enough to keep the stroke patient isolated at home. Stroke leads to social isolation, loneliness and depression.

**Conclusions Regarding Leisure Activities Post-Stroke**

Deterioration in social and leisure activities is common post-stroke and is greatest in women, the young and those who are better educated. Perceptions about how others view their disabilities and perceptions about how they will be able to cope post-stroke may influence the degree of social isolation experienced.

**Leisure Interventions and Socialization**

Three RCTs examining the effect of leisure therapy (always occupational therapist) found mixed results with only one RCT able to demonstrate beneficial and lasting effects of leisure therapy. All were outpatient interventions; difficulty distinguishing between ADL and leisure activities, and limited number of interventions, often with small numbers. A recent meta-analysis pooling data from 3 RCTs found modest improvement in leisure activity with leisure therapy.

### 7.4 Sexuality, Aging, and Disability

In a study of individuals 50-92 years old, Gott et al. (2003) reported sex remained an important part of a close emotional relationship. However, sex may be assigned a lower priority, not due to aging per se, but rather due to increasing disability and health problems that are barriers to sexual activity.

#### 7.4.1 Sexuality Post-Stroke

Decreased sexual activity or abstinence is common post-stroke despite normal sexual libido. 70% of hemiplegic males and 44% of females report a decrease in frequency of sexual activity. This issue is often not well addressed in rehabilitation. Kerstan et al. (2002) interviewed 315 stroke survivors (18-65 years old) responded to questions regarding to changes in sex life post-stroke: 64% reported difficulties. Fugl-Meyer et al. studied 85 stroke victims who were sexually active pre-stroke. Post-stroke sexual activity was unchanged in 36%, decreased in 33% and discontinued altogether in 31%. Dysfunction was more significant in aphasia patients.
Decreased sexual activity post-stroke attributed to:

- Inability to discuss sexuality with spouse
- Unwillingness to participate in sexual activity
- Reduced body image and self-esteem
- Positioning problems due to disability

Most stroke patients agree resumption of sexual activity is important to them.

### 7.4.2 Treatment of Sexual Dysfunction Post-Stroke

There are no RCTs on treatment of sexual dysfunction post-stroke. Open discussion of the issue is critical. Personal care provision by the spouse reduces sexual intimacy. Both patient and partner need to recognize the need to adapt to physical disabilities. Patients and spouses need to be reassured that sexual activity will not result in another stroke. Importance of communication, sharing of concerns and development of adaptive approaches have been suggested.

<table>
<thead>
<tr>
<th>Recommendations Re Sexuality (Dutch Clinical Guidelines – van Heughten et al. 2006)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recommendation #1:</strong> Patients and spouses are often not satisfied with their sexual functioning after stroke; sexuality and intimacy should, therefore, be discussed with married couples.</td>
</tr>
<tr>
<td><strong>Recommendation #2:</strong> Changes in sexual function should be discussed with patients and spouses at different moments during the rehabilitation process, such as at discharge and at follow-up. Professional support should be offered when necessary.</td>
</tr>
<tr>
<td><strong>Recommendation #3:</strong> Sexuality and intimacy should be discussed during carer support groups. Information should be given about the nature and causes of these changes.</td>
</tr>
</tbody>
</table>

### Conclusions Regarding Sexuality Post-Stroke

A decrease in sexual activity is very common post-stroke and is likely related to a changed body image, reduced self-esteem and lack of communication with one’s partner. There is consensus opinion that sexual issues need to be addressed as an important part of community reintegration.

### 7.5 Driving Post-Stroke

**How might a stroke compromise driving ability?**

- Visual field deficit.
- Inattention, particularly left neglect.
- Cognitive deficits (problem solving).
- Hemiplegia or hemiparesis.
- Apraxias.
- Language difficulties (receptive aphasia).

**How important is driving to stroke survivors?**

Driving represents the final step towards independence and reintegration into the community. Failure to resume driving negatively impacts social activities and overall wellbeing. The literature reveals very
limited information about driving. Vision and attention are necessary elements for safe driving. These are often impaired post-stroke. Korner-Bitensky et al. (2000) have noted (motor free visual perceptual test) MVPT partially predicts driving ability. The ability of off-road tests to predict on-road results is questionable.

**Are stroke survivors accurate judges of their own ability to drive?**

- Most driving adults believe that they are better drivers than they are.
- Stroke survivors often are unaware of mistakes that they make in formal testing scenarios.
- Stroke survivors tend to rate their driving ability as “above average” and better than their spouses.

**What assessment tools are available to assess a stroke survivor’s fitness to drive?**

There are no specific assessment tools which are able to accurately predict who is able to drive and who cannot. Determination of ability to drive should not rely on neuropsychological testing or an on-road test evaluation. Cognitive tests such as the Trail Making Tests (A and B) and Rey-Osterreith Complex figure design have been consistently predictive of driving assessment outcomes. Other tests which have been identified as potentially useful include the Motor Free Visual Perceptions Test, the Useful Field of View test as well as tests of road knowledge (road sign and hazard recognition tests) and reaction time. Few studies have reported the development of cut-off points with appropriate sensitivity and specificity suitable for use within a stroke population.

In Ontario must report to Ministry of Transport if patient has valid driver’s license and concerned re driving; not all jurisdictions require reporting. Patient assessed by OT – MVPT >30/36 and brake reaction test within norms – go ahead for testing. Visual field testing needs to be done. On the road testing by professional driving instructor required for high-risk stroke survivors.

**CMA Determining Fitness to Drive (2012)**

- “Patients who have experienced either a single or recurrent transient ischemic attack should not drive a motor vehicle until a medical assessment is completed.”
- Detailed history and thorough physical examination, including assessment of cognition, insight and judgment are important.
- Assessment by an occupational therapist is ideal.
- Road test may help assess functional capacity to drive with concerns that such testing cannot always be relied on to reveal the true extent of the disability.
- “Patients who have had a stroke should not drive for at least one month.”
- “Where there is residual loss of motor power, a driving evaluation ... can make recommendations for ... vehicle modification strategies, such as use of a steering wheel ‘spinner knob’ or left-foot accelerator.”
- Patients with right hemispheric strokes are of particular concern because of visual perceptual disorders.
- Patients with a visual field deficit should have a visual field assessment conducted by an ophthalmologist or optometrist.

**When a Stroke Patient Returns to Driving what Should they Avoid?**

- Driving in an unfamiliar area.
- Driving at night.
- Driving when tired (includes long distances).
- Parallel parking.
• Driving in rush hour, particularly in a large city.
• Driving on busy multilane high speed expressways.

Treatment Interventions in Patients Not Able to Drive
There is moderate evidence that a visual attention retraining program is no more effective than traditional visuo-perception retraining in improving the driving performance of patients with stroke. There is moderate evidence that a simulator training program involving the use of appropriate adaptations and driving through complex scenarios similar to real life is associated with improvement in driving fitness and successful on road evaluation. Driving fitness may be improved through the use of a stimulator training program.

HIGHLIGHTED STUDY

Methods: 97 patients with stroke < 6 months and license to drive prior to stroke. Randomized to visual information-processing training or to control visuo-perceptual training on computer x 20 sessions.
Results: No significant differences on any outcomes. However, almost 2-fold increase (52.4% vs 28.6%) in rate of success for on-the-road testing of treatment group.

HIGHLIGHTED STUDY

Methods: 83 patients < 3 months stroke with license and active driver pre-stroke. Randomized to simulator-based training (n=42) or control (driving-related cognitive tasks) (n=41) for 15 x 1 hr sessions over 5 weeks.
Results: Both groups demonstrated significant improvements (p<.05) from pre to post training assessments. While the simulator group showed more improvement than control group did not reach significance (p=0.08). 73% of treatment group passed their on-the-road assessment vs. 42% of controls (p=0.03).

Conclusions on Driving Post-Stroke
Despite a lack of research, patients for whom there is a concern about their ability to drive post-stroke by law in Ontario need to be reported and properly assessed. There is moderate evidence (1 RCT) a visual attention-retraining program is no more effective than traditional visuo-perceptual retraining in improving driving performance of stroke survivors. There is moderate evidence (1 RCT) a driving simulator training program involving use of appropriate adaptations and driving through complex scenarios similar to real life is associated with improvement in driving fitness and successful on-the-road evaluation.

7.5 Returning to Work Post-Stroke
Wozniak and Kittner (2002) review noted considerable variation in the definition of “return to work”. Neurological and functional disability are major determinants of work resumption post stroke. Successful return to work often requires reduction in work hours, change in employment or
restructuring of work environment to facilitate RTW. Return to work is associated with improved subjective wellbeing and life satisfaction.

**Vocational Issues**

Observational studies suggest that many stroke patients could return back to work but most do not (less than half). The two major factors influencing RTW are the degree and nature of the stroke related impairment and the level of education/type of work. Despite a lack of research, there is consensus opinion that stroke survivors, if they were employed prior to the stroke, should be evaluated for their potential to return to work. A substantial proportion of stroke survivors who were employed prior to the stroke event do not return to work. Factors influencing return to work include the degree of physical and cognitive impairment, age, educational level and type of pre-stroke employment. There is consensus opinion that stroke survivors who worked prior to their stroke should, if their condition permits, be encouraged to be evaluated for their potential to return to work. Vocational rehabilitation strategies to assist the return to work of stroke survivors need to be developed and evaluated.
References


Determining Fitness to Drive, 8th edition, *Canadian Medical Association, 2012.*


