

## Symptomatic Therapies

Symptom	Drug	Typical Dose	Mechanism of Action	Pros/Cons
<p><b>Fatigue</b></p> <p>is the most common complaint among patients with MS. Treatment of fatigue commonly includes pharmacological and non-pharmacological agents, such as energy conservation techniques in conjunction with medications.</p>	<ul style="list-style-type: none"> <li>Amantadine</li> </ul>	100mg, 2x/day	N-methyl D-aspartate (NMDA) receptor antagonist	Few side effects, relatively inexpensive
	<ul style="list-style-type: none"> <li>Modafinil</li> </ul>	100-200mg/day	Dopaminergic stimulant approved for treatment in narcolepsy	Moderately expensive, many third-party payers will not cover cost for off-label use
	<ul style="list-style-type: none"> <li>Pemoline</li> </ul>	36.5-75mg/day	Stimulant	Anorexia and severe liver toxicity are potential side effects
	<ul style="list-style-type: none"> <li>Pharmacologic treatment of depressive symptoms commonly relieves symptoms presenting as fatigue</li> </ul>			
<p><b>Spasticity</b></p> <p>is common in up to</p>	<ul style="list-style-type: none"> <li>Baclofen</li> </ul>	Starting dose 5mg 2-3x/day, and	Stimulates $\gamma$ -aminobutyric acid receptors	Sedation is common side effect,

<p>75% of patients with MS. May cause significant disability in patients. Commonly treated pharmacologically as well as with nonpharmacological treatments, such as physical therapy. Goal of therapy is not to eliminate spasticity but, rather, to improve function. A common disease-modifying drug used in patients with MS, beta-interferons, may aggravate spasticity.</p>		work up to normal effective dose of 30-90x/day	to act centrally as skeletal muscle relaxant	withdrawal symptoms can occur if discontinued abruptly such as seizures and psychosis
	<ul style="list-style-type: none"> <li>• Tizanidine</li> </ul>	Starting dose 1-2 mg every 3-4 days, and work up to normal effective dose of 2-36 mg/day	$\alpha_2$ -adrenergic receptor agonist increasing presynaptic inhibition by spinal neurons	Does not usually cause as much weakness as baclofen, can cause hepatic problems
	<ul style="list-style-type: none"> <li>• Dantrolene</li> </ul>	25-100mg/day	Directly acts on skeletal muscle	Often causes increased weakness, including bulbar and respiratory muscles and causes sedation
	<ul style="list-style-type: none"> <li>• Others: Benzodiazepine drugs (diazepam and clonazepam), anti-epileptic drugs (gabapentin), botulinum toxin,</li> </ul>			

	intrathecal baclofen, and cannabis and its derivatives			
<b>Weakness</b> commonly accompanies reduction in spasticity	<ul style="list-style-type: none"> <li>4-anubioyridine</li> </ul>		Proposed increase in conduction across demyelinated nerves	Seizures are risk when taken in high doses
<b>Bladder Dysfunction</b> presents itself in many different forms in patients with MS, as emptying the bladder is controlled by sympathetic and parasympathetic systems that must work in coordination with one another. Pharmacological treatments are therefore based on specific bladder dysfunction symptoms, and are often used in conjunction with catheterization techniques.	<ul style="list-style-type: none"> <li>Oxybutynin and Tolterodine (for detrusor overactivity)</li> </ul>	Orally 2.5mg/day up to 20mg/day over several doses. Or patch available at 3.9 mg delivered 2x/week	Anti-cholinergics	Side effects include dry mouth, constipation, urinary retention
	<p>Others, if not responding well to anticholinergics:</p> <ul style="list-style-type: none"> <li>Imipramine, amitriptyline, and nortriptyline</li> <li>Desmopressin (for nocturia and daytime frequency)</li> </ul>		Tri-cyclic anti-depressants  Anti-diuretic	

	<ul style="list-style-type: none"> <li>• Capsaicin (for intractable detrusor overactivity)</li> <li>• Botulinum toxin and cannabinoids (being studied in relaxation of bladder wall and urethral sphincter)</li> </ul>		hormone	
<p align="center"><b>Bowel Dysfunction</b></p> <p>commonly present as constipation and fecal incontinence in patients with MS. Patients may use pharmacological therapies in conjunction with suppository and enema treatments and bowel programs.</p>	<ul style="list-style-type: none"> <li>• Methylcellulose, polycarbophil, and psyllium</li> </ul>		Adds fecal mass to peristalsis	
	<ul style="list-style-type: none"> <li>• Docusate sodium</li> </ul>		Stool softener	
	<ul style="list-style-type: none"> <li>• Senna and bisacodyl</li> </ul>		Stimulant laxatives	
	<ul style="list-style-type: none"> <li>• Lactulose and polyethylene glycol</li> </ul>		Osmotic laxatives	
	<ul style="list-style-type: none"> <li>• Loperamide (when stools are too loose and watery)</li> </ul>		Antimotility drug	
<p align="center"><b>Sexual Dysfunction</b></p> <p>is reported in up to 75% of all patients with MS. May be a result of several</p>	<ul style="list-style-type: none"> <li>• Sildenafil, vardenafil, tadalafil (for erectile dysfunction)</li> </ul>	50-100 mg taken just before intercourse	Phosphodiesterase-5 inhibitors which increase penile corporeal smooth muscle	Contraindicated in patients taking nitrates for CAD

<p>factors including depression, complications with spasticity, medication side-effects, or disease itself. Nonpharmacological treatments include penile devices, lubricants, and stimulating vibrators.</p>			relaxation and augment erection	
	<ul style="list-style-type: none"> <li>• Yohimbine (to increase sexual sensation and ejaculation)</li> </ul>		$\alpha$ -2 agonist	Does not enhance penile erections, can cause anxiety, nausea, palpitations, and tremor
	<ul style="list-style-type: none"> <li>• Estrogen replacement therapy (to increase vaginal lubrication, decrease vaginal burning, and reduce dyspareunia) sometimes used in conjunction with methyltestosterone</li> </ul>			Methyltestosterone adverse effects: clitoral enlargement, weight gain, and increased facial hair
<p><b>Depression</b></p> <p>leads to increase rate of suicide in patients with MS. May be related to pharmacological disease-modifying agents, as well as challenges in living</p>	<ul style="list-style-type: none"> <li>• Selective serotonin reuptake inhibitors (SSRI's) and Tricyclic antidepressants (TCA's)</li> </ul>	Medications and dosing should be tailored specifically for individual patients		
	<ul style="list-style-type: none"> <li>• Bupropion and venlafaxine</li> </ul>		Norepinephrine reuptake	

with the disease.			and dopamine reuptake inhibitors	
<p><b>Cognitive problems</b></p> <p>commonly include problems with short-term memory, attention, concentration, and processing information.</p>	<ul style="list-style-type: none"> <li>Beta-interferons and glatiramer (used in slowing progression of cognitive decline)</li> </ul>			
	<ul style="list-style-type: none"> <li>Donepezil, rivastigmine, and galantamine (used in treating Alzheimer’s and may benefit patients with MS cognitive problems)</li> </ul>		Cholinesterase inhibitors	
<p><b>Vertigo</b></p> <p>causes nausea and vomiting and may be addressed with nonpharmacological treatments such as canalith repositioning for BPPV</p>	<ul style="list-style-type: none"> <li>Dimenhydrinate, prochlorperazine, or benzodiazepine</li> </ul>		Anti-emetic drugs	
	<ul style="list-style-type: none"> <li>Ondansetron (Zofran)</li> </ul>	4-8mg/day		Expensive, administered intravenously
<p><b>Nystagmus</b></p> <p>can cause diplopia when there is brainstem or cerebellar involvement in patients with MS.</p>	<ul style="list-style-type: none"> <li>Botulinum toxin, gabapentin, baclofen, and isoniazide</li> </ul>			
<p><b>Pain</b></p>	<ul style="list-style-type: none"> <li>Carbamazepine /</li> </ul>			

<p>may be caused by associated symptoms, such as spasticity, or other neurologic changes. Often can be treated with antidepressants, anti-epileptic drugs, or simple analgesics.</p>	<p>oxycarbazepine, baclofen, gabapentin, lamotrigine, and topiramate (used in treatment of trigeminal neuralgia)</p>			
	<ul style="list-style-type: none"> <li>• Carbamazepine (used in treatment of Lhermitte's phenomenon)</li> </ul>			