<table>
<thead>
<tr>
<th>THERAPEUTICS</th>
</tr>
</thead>
</table>
| **Brands** | • Elavil  
*see index for additional brand names*
|**Generic?** | Yes |
| **Class** | • Neuroscience-based Nomenclature: serotonin, norepinephrine multi-modal (SN-MM)  
• Tricyclic antidepressant (TCA)  
• Serotonin and norepinephrine/noradrenaline reuptake inhibitor |
| **Commonly Prescribed for** | (bold for FDA approved)  
• Depression  
• Endogenous depression  
• Neuropathic pain/chronic pain  
• Fibromyalgia  
• Headache  
• Low back pain/neck pain  
• Anxiety  
• Insomnia  
• Treatment-resistant depression |
| **How the Drug Works** | • Boosts neurotransmitters serotonin and norepinephrine/noradrenaline  
• Blocks serotonin reuptake pump (serotonin transporter), presumably increasing serotonergic neurotransmission  
• Blocks norepinephrine reuptake pump (norepinephrine transporter), presumably increasing noradrenergic neurotransmission  
• Presumably desensitizes both serotonin 1A receptors and beta adrenergic receptors  
• Since dopamine is inactivated by norepinephrine reuptake in frontal cortex, which largely lacks dopamine transporters, amitriptyline can increase dopamine neurotransmission in this part of the brain |
| **How Long Until It Works** | • May have immediate effects in treating insomnia or anxiety  
• Onset of therapeutic actions usually not immediate, but often delayed 2–4 weeks  
• If it is not working within 6–8 weeks for depression, it may require a dosage increase or it may not work at all  
• May continue to work for many years to prevent relapse of symptoms |
| **If It Works** | • The goal of treatment of depression is complete remission of current symptoms as well as prevention of future relapses  
• The goal of treatment of chronic pain conditions such as neuropathic pain, fibromyalgia, headaches, low back pain, and neck pain is to reduce symptoms as much as possible, especially in combination with other treatments  
• Treatment of depression most often reduces or even eliminates symptoms, but not a cure since symptoms can recur after medicine stopped  
• Treatment of chronic pain conditions such as neuropathic pain, fibromyalgia, headache, low back pain, and neck pain may reduce symptoms, but rarely eliminates them completely, and is not a cure since symptoms can recur after medicine is stopped  
• Continue treatment of depression until all symptoms are gone (remission)  
• Once symptoms of depression are gone, continue treating for 1 year for the first episode of depression  
• For second and subsequent episodes of depression, treatment may need to be indefinite  
• Use in anxiety disorders and chronic pain conditions such as neuropathic pain, fibromyalgia, headache, low back pain, and neck pain may also need to be indefinite, but long-term treatment is not well studied in these conditions |
| **If It Doesn’t Work** | • Many depressed patients have only a partial response where some symptoms are improved but others persist (especially insomnia, fatigue, and problems concentrating)  
• Other depressed patients may be nonresponders, sometimes called treatment-resistant or treatment-refractory  
• Consider increasing dose, switching to another agent or adding an appropriate augmenting agent  
• Consider psychotherapy  
• Consider evaluation for another diagnosis or for a comorbid condition (e.g., medical illness, substance abuse, etc.) |
SIDE EFFECTS

How Drug Causes Side Effects
- Anticholinergic activity may explain sedative effects, dry mouth, constipation, and blurred vision
- Sedative effects and weight gain may be due to antihistamine properties
- Blockade of alpha adrenergic 1 receptors may explain dizziness, sedation, and hypotension
- Cardiac arrhythmias and seizures, especially in overdose, may be caused by blockade of ion channels

Notable Side Effects
- Blurred vision, constipation, urinary retention, increased appetite, dry mouth, nausea, diarrhea, heartburn, unusual taste in mouth, weight gain
- Fatigue, weakness, dizziness, sedation, headache, anxiety, nervousness, restlessness
- Sexual dysfunction (impotence, change in libido)
- Sweating, rash, itching

Life-Threatening or Dangerous Side Effects
- Paralytic ileus, hyperthermia (TCAs + anticholinergic agents)
- Lowered seizure threshold and rare seizures
- Orthostatic hypotension, sudden death, arrhythmias, tachycardia
- QTc prolongation
- Hepatic failure, extrapyramidal symptoms
- Increased intracocular pressure
- Rare induction of mania
- Rare activation of suicidal ideation and behavior (suicidality) (short-term studies did not show an increase in the risk of suicidality with antidepressants compared to placebo beyond age 24)

Weight Gain
- Many experience and/or can be significant in amount
- Can increase appetite and carbohydrate craving
**Overdose**
- Death may occur; CNS depression, convulsions, cardiac dysrhythmias, severe hypotension, EKG changes, coma

**Long-Term Use**
- Safe

**Habit Forming**
- No

**How to Stop**
- Taper to avoid withdrawal effects
- Even with gradual dose reduction, some withdrawal symptoms may appear within the first 2 weeks
- Many patients tolerate 50% dose reduction for 3 days, then another 50% reduction for 3 days, then discontinuation
- If withdrawal symptoms emerge during discontinuation, raise dose to stop symptoms and then restart withdrawal much more slowly

**Pharmacokinetics**
- Substrate for CYP450 2D6 and 1A2
- Plasma half-life 10–28 hours
- Metabolized to an active metabolite, nortriptyline, which is predominantly a norepinephrine reuptake inhibitor, by demethylation via CYP450 1A2
- Food does not affect absorption

**Drug Interactions**
- Tramadol increases the risk of seizures in patients taking TCAs
- Use of TCAs with anticholinergic drugs may result in paralytic ileus or hyperthermia
- Fluoxetine, paroxetine, bupropion, duloxetine, and other CYP450 2D6 inhibitors may increase TCA concentrations
- Fluvoxamine, a CYP450 1A2 inhibitor, can decrease the conversion of amitriptyline to nortriptyline and increase amitriptyline plasma concentrations
- Cimetidine may increase plasma concentrations of TCAs and cause anticholinergic symptoms
- Phenothiazines or haloperidol may raise TCA blood concentrations
- May alter effects of antihypertensive drugs; may inhibit hypotensive effects of clonidine
- Use of TCAs with sympathomimetic agents may increase sympathetic activity

**DOSING AND USE**

**Usual Dosage Range**
- 50–150 mg/day

**Dosage Forms**
- Capsule 25 mg, 50 mg, 100 mg

**How to Dose**
- Initial 25 mg/day at bedtime; increase by 25 mg every 3–7 days
- 75 mg/day in divided doses; increase to 150 mg/day; maximum 300 mg/day

**Dosing Tips**
- If given in a single dose, should generally be administered at bedtime because of its sedative properties
- If given in split doses, largest dose should generally be given at bedtime because of its sedative properties
- If patients experience nightmares, split dose and do not give large dose at bedtime
- Patients treated for chronic pain may only require lower doses
- If intolerable anxiety, insomnia, agitation, akathisia, or activation occur either upon dosing initiation or discontinuation, consider the possibility of activated bipolar disorder, and switch to a mood stabilizer or an atypical antipsychotic

**Sedation**
- Many experience and/or can be significant in amount
- Tolerance to sedative effects may develop with long-term use

**What to Do About Side Effects**
- Wait
- Wait
- Wait
- Lower the dose
- Switch to an SSRI or newer antidepressant

**Best Augmenting Agents for Side Effects**
- Many side effects cannot be improved with an augmenting agent
AMITRIPTYLINE (continued)

- Methylphenidate may inhibit metabolism of TCAs
- Activation and agitation, especially following switching or adding antidepressants, may represent the induction of a bipolar state, especially a mixed dysphoric bipolar II condition sometimes associated with suicidal ideation, and require the addition of lithium, a mood stabilizer or an atypical antipsychotic, and/or discontinuation of amitriptyline

**Other Warnings/Precautions**

- Add or initiate other antidepressants with caution for up to 2 weeks after discontinuing amitriptyline
- Generally, do not use with MAOIs, including 14 days after MAOIs are stopped; do not start an MAOI for at least 5 half-lives (5 to 7 days for most drugs) after discontinuing amitriptyline, but see Pearls
- Use with caution in patients with history of seizures, urinary retention, angle-closure glaucoma, hyperthyroidism
- TCAs can increase QTc interval, especially at toxic doses, which can be attained not only by overdose but also by combining with drugs that inhibit TCA metabolism via CYP450 2D6, potentially causing torsade de pointes-type arrhythmia or sudden death
- Because TCAs can prolong QTc interval, use with caution in patients who have bradycardia or who are taking drugs that can induce bradycardia (e.g., beta blockers, calcium channel blockers, clonidine, digitalis)
- Because TCAs can prolong QTc interval, use with caution in patients who have hypokalemia and/or hypomagnesemia, or who are taking drugs that can induce hypokalemia and/or magnesemia (e.g., diuretics, stimulant laxatives, intravenous amphotericin B, glucocorticoids, tetracosactide)
- When treating children, carefully weigh the risks and benefits of pharmacological treatment against the risks and benefits of nontreatment with antidepressants and make sure to document this in the patient’s chart
- Distribute the brochures provided by the FDA and the drug companies

- Warn patients and their caregivers about the possibility of activating side effects and advise them to report such symptoms immediately
- Monitor patients for activation of suicidal ideation, especially children and adolescents

**Do Not Use**

- If patient is recovering from myocardial infarction
- If patient is taking agents capable of significantly prolonging QTc interval (e.g., pimozide, thioridazine, selected antiarrhythmics, moxifloxacin, sparfl oxacin)
- If there is a history of QTc prolongation or cardiac arrhythmia, recent acute myocardial infarction, uncompensated heart failure
- If patient is taking drugs that inhibit TCA metabolism, including CYP450 2D6 inhibitors, except by an expert
- If there is reduced CYP450 2D6 function, such as patients who are poor 2D6 metabolizers, except by an expert and at low doses
- If there is a proven allergy to amitriptyline or nortriptyline

**SPECIAL POPULATIONS**

**Renal Impairment**

- Use with caution; may need to lower dose

**Hepatic Impairment**

- Use with caution; may need to lower dose

**Cardiac Impairment**

- Baseline ECG is recommended
- TCAs have been reported to cause arrhythmias, prolongation of conduction time, orthostatic hypotension, sinus tachycardia, and heart failure, especially in the diseased heart
- Myocardial infarction and stroke have been reported with TCAs
- TCAs produce QTc prolongation, which may be enhanced by the existence of bradycardia, hypokalemia, congenital or acquired long QTc interval, which should be evaluated prior to administering amitriptyline
- Use with caution if treating concomitantly with a medication likely to produce prolonged bradycardia, hypokalemia,
May be used to treat enuresis or hyperactive/impulsive behaviors
• Some cases of sudden death have occurred in children taking TCAs
• Adolescents: initial dose 50 mg/day; increase gradually up to 100 mg/day

Pregnancy
• Effective June 30, 2015, the US FDA requires changes to the content and format of pregnancy and lactation information in prescription drug labels, including the elimination of the pregnancy letter categories; the Pregnancy and Lactation Labeling Rule (PLLR or final rule) applies only to prescription drugs and will be phased in gradually for drugs approved on or after June 30, 2001
• Controlled studies have not been conducted in pregnant women
• Crosses the placenta
• Adverse effects have been reported in infants whose mothers took a TCA (lethargy, withdrawal symptoms, fetal malformations)
• Must weigh the risk of treatment (first trimester fetal development, third trimester newborn delivery) to the child against the risk of no treatment (recurrence of depression, maternal health, infant bonding) to the mother and child
• For many patients this may mean continuing treatment during pregnancy

Breast Feeding
• Some drug is found in mother’s breast milk
• Recommended either to discontinue drug or bottle feed
• Immediate postpartum period is a high-risk time for depression, especially in women who have had prior depressive episodes, so drug may need to be reinstituted late in the third trimester or shortly after childbirth to prevent a recurrence during the postpartum period
• Must weigh benefits of breast feeding with risks and benefits of antidepressant treatment versus nontreatment to both the infant and the mother
• For many patients this may mean continuing treatment during breast feeding

slowing of intracardiac conduction, or prolongation of the QTc interval
• Avoid TCAs in patients with a known history of QTc prolongation, recent acute myocardial infarction, and uncompensated heart failure
• TCAs may cause a sustained increase in heart rate in patients with ischemic heart disease and may worsen (decrease) heart rate variability, an independent risk of mortality in cardiac populations
• Since SSRIs may improve (increase) heart rate variability in patients following a myocardial infarct and may improve survival as well as mood in patients with acute angina or following a myocardial infarction, these are more appropriate agents for cardiac population than tricyclic/tetracyclic antidepressants
* Risk/benefit ratio may not justify use of TCAs in cardiac impairment

Elderly
• Baseline ECG is recommended for patients over age 50
• May be more sensitive to anticholinergic, cardiovascular, hypotensive, and sedative effects
• Initial dose 50 mg/day; increase gradually up to 100 mg/day
• Reduction in the risk of suicidality with antidepressants compared to placebo in adults age 65 and older

Children and Adolescents
• Carefully weigh the risks and benefits of pharmacological treatment against the risks and benefits of nontreatment with antidepressants and make sure to document this in the patient’s chart
• Use with caution, observing for activation of known or unknown bipolar disorder and/or suicidal ideation, and inform parents or guardians of this risk so they can help observe child or adolescent patients
• Monitor patients face-to-face regularly, particularly during the first several weeks of treatment
• Not generally recommended for use under age 12
• Several studies show lack of efficacy of TCAs for depression
**THE ART OF PSYCHOPHARMACOLOGY**

**Potential Advantages**
- Patients with insomnia
- Severe or treatment-resistant depression
- Patients with a wide variety of chronic pain syndromes

**Potential Disadvantages**
- Pediatric and geriatric patients
- Patients concerned with weight gain
- Cardiac patients

**Primary Target Symptoms**
- Depressed mood
- Symptoms of anxiety
- Somatic symptoms
- Chronic pain
- Insomnia

**Pearls**
- Was once one of the most widely prescribed agents for depression
- Remains one of the most favored TCAs for treating headache and a wide variety of chronic pain syndromes, including neuropathic pain, fibromyalgia, migraine, neck pain, and low back pain
- Preference of some prescribers for amitriptyline over other tricyclic/tetracyclic antidepressants for the treatment of chronic pain syndromes is based more upon art and anecdote rather than controlled clinical trials, since many TCAs/tetracyclics may be effective for chronic pain syndromes
- TCAs are no longer generally considered a first-line treatment option for depression because of their side effect profile
- Amitriptyline has been shown to be effective in primary insomnia
- TCAs may aggravate psychotic symptoms
- Alcohol should be avoided because of additive CNS effects
- Underweight patients may be more susceptible to adverse cardiovascular effects
- Children, patients with inadequate hydration, and patients with cardiac disease may be more susceptible to TCA-induced cardiotoxicity than healthy adults
- For the expert only: although generally prohibited, a heroic but potentially dangerous treatment for severely treatment-resistant patients is to give a tricyclic/tetracyclic antidepressant other than clomipramine simultaneously with an MAOI for patients who fail to respond to numerous other antidepressants
- If this option is elected, start the MAOI with the tricyclic/tetracyclic antidepressant simultaneously at low doses after appropriate drug washout, then alternately increase doses of these agents every few days to a week as tolerated
- Although very strict dietary and concomitant drug restrictions must be observed to prevent hypertensive crises and serotonin syndrome, the most common side effects of MAOI/tricyclic or tetracyclic combinations may be weight gain and orthostatic hypotension
- Patients on TCAs should be aware that they may experience symptoms such as photosensitivity or blue-green urine
- SSRIs may be more effective than TCAs in women, and TCAs may be more effective than SSRIs in men
- Since tricyclic/tetracyclic antidepressants are substrates for CYP450 2D6, and 7% of the population (especially Caucasians) may have a genetic variant leading to reduced activity of 2D6, such patients may not safely tolerate normal doses of tricyclic/tetracyclic antidepressants and may require dose reduction
- Phenotypic testing may be necessary to detect this genetic variant prior to dosing with a tricyclic/tetracyclic antidepressant, especially in vulnerable populations such as children, elderly, cardiac populations, and those on concomitant medications
- Patients who seem to have extraordinarily severe side effects at normal or low doses may have this phenotypic CYP450 2D6 variant and require low doses or switching to another antidepressant not metabolized by 2D6
Suggested Reading

