Psychopharmacology Tables

By: Insaf Alammouri, Hani Shihadeh, Ahmad Riyad

Psychopharmacology side effects			
	Symptoms/definition	**Drugs causing this side effect**	**Management**
1. HAM side effects	a. Anti**H**istamines → sedation, wt gain b. anti**A**drenergic → hypotension c. anti**M**uscarinic → dry mouth, blurred vision, urinary retention, constipation, exacerbation of neurocognitive disorders (dementia) d. Increased risk of falls & delirium in elderly	TCAs, low potency antipsychotics	
2. Serotonin syndrome	Psychiatric emergency (Confusion, flushing, diaphoresis, tremor, myoclonic jerks, hyperthermia, hypertonicity, rhabdomyolysis, renal failure, death)	When SSRIs & MAOIs are combined or pt is prescribed multiple medications with serotonergic activity	Stop medications, supportive care, Cyproheptadine ECT (electroconvulsive therapy)
3. Hypertensive crisis	Buildup of stored catecholamines (NE) Htn, headache, sweating, nausea, vomiting, photophobia, autonomic instability, arrhythmia, death	Combination of MAOIs +tyramine rich foods (red wine, cheese, chicken, liver, cured meat) or with sympathomimetics	IV phentolamine sublingual nifedipine
4. Extrapyramidal side effects (EPS)	a. Parkinsonism → mask like face, cogwheel chair rigidity, bradykinesia, pill rolling tremor b. Akathisia → restlessness, agitation c. Dystonia → painful muscle contraction (neck, tongue, eyes, diaphragm (asphyxiation)	Antipsychotics (more in typical 1st gen high potency antipsychotics) Occurs hrs-days after starting meds	Benztropine (Cogentin) B blocker propranolol (1st line for akathisia)
5. hyperprolactinemia	Decreased libido, galactorrhea, gynecomastia, impotence, amenorrhea	more in typical 1st gen high potency antipsychotics and risperidone	
6. Tardive dyskinesia (TD)	Choreoathetoid (involuntary irregular M movements) in mouth and tongue, may affect extremities More in old age, women, pts w/ affective disorders	more in typical 1st gen high potency antipsychotic Occurs after years of use	Irreversible (mostly) Discontinue and replace medication
7. Neuroleptic malignant syndrome	Medical emergency **FALTERED** (**f**ever, **a**utonomic (tachy, htn), **l**eukocytosis, **t**remor, **e**levated CPK, **r**igidity (lead-pipe), **e**xcessive sweating (diaphoresis), **d**elirium (mental status changes)) + hyporeflexia More in young males	Any antipsychotics, short or long time (increased in high potency, typical antipsychotics)	Discontinue, hydration, cooling Sodium dantroline, bromocriptine, amantadine, ECT in emergencies
8. Drug interactions	Cytochrome P450 enzymes of liver metabolize drugs: CYP450 inducers → ↓drug level →need higher dose CYP450 inhibitors ↑drug level →need lower dose	Inducers: tobacco, carbamazepine, barbiturates, St. John's wort Inhibitors: fluvoxamine, fluoxetine, paroxetine, sertraline, duloxetine	
9. Metabolic syndrome	Wt gain, hyperlipidemia, hyperglycemia & sometimes DKA, htn, CVS morbidity & mortality	Antipsychotics (more in 2nd gen antipsychotics: clozapine, olanzapine, quetiapine)	Continuous monitoring Metformin may be considered

SSRIs

- need 4-6 weeks of administration to start showing an effect
- inhibit presynaptic serotonin reuptake pumps, leading to increased availability of serotonin in synaptic clefts
- Cause downstream effects increasing brain plasticity (thought to delay onset of effect)
- Advantages: ↓ & temporary side effects, no food restrictions, safer overdose
- To treat sexual dysfxn (a side effect of SSRIs) → change to non SSRI, augmenting with bupropion, or in men add sildenafil
- SSRIs increase levels of warfarin and decrease platelet aggregation → bleeding & bruising
- Fewer side effects than TCAs & MAOIs due to serotonin selectivity
- Side effects resolve few weeks after discontinuation (nausea, diarrhea, insomnia, vivid dreams, headache, wt changes)
- Less common side effects: restlessness (akathisia), serotonin syndrome (if given with other med like triptans in migraine), hyponatremia (rare), seizures

	Advantages / uses	**Side effects**	**Notes**
Fluoxetine (Prozac)	Longest half life with active metabolites, no need to taper Safe in pregnancy, children, adolescent	Insomnia, anxiety, sexual dysfxn	Has weekly dosing form
Sertaline (Zoloft)	Wt neutral Very few drug interactions	Higher risk of GI disturbances Insomnia, anxiety, sexual dysfxn	
Paroxetine (Paxil)		Anticholenergic (sedation, constipation, wt gain), sexual dysfxn	Several drug interactions Short half life → uncomfortable withdrawal
Fluvoxamine (Luvox)	Wt neutral Used only in OCD (high doses)	Nausea, vomiting	Multiple drug interactions due to CYP inhibition
Citalopram (Celexa)		Dose dependent QT prolongation	Fewest drug interactions
Escitalopram (Lexapro)		Dose dependent QT prolongation	Levo-enantiomer of citalopram, similar efficacy, fewer side effects

SNRIs			
	Uses	**Side effects**	**Notes**
Venlafaxine (Effexor)	• depressive disorders • anxiety disorders (GAD) • neuropathic pain	• Similar to SSRIs except for ↑ BP • Short half life → discontinuation syndrome	• Low drug interaction • Extended release allows for once daily dosing • New form: desvenlafaxine (Pristiq), active metabolite of venlafaxine, no extra benifit
Duloxetine (Cymbalta)	• Depression • neuropathic pain • fibromyalgia	• Similar to SSRI except for more constipation (NE effect) • Hepatotoxicity in pts w/ liver disease or alcohol abuse	

Miscellanous antidepressants				
	MOA	**Uses**	**Side effects**	**Notes**
Bupropion (Wellbutrin)	NE- dopamine reuptake inhibitor	• ADHD • smoking cessation	• Increased anxiety • Increased seizures (lower seizure threshold)	• No sexual side effects • Wt neutral • Contraindicated in pts with epilepsy, active eating disorder, currently on MAOIs
Trazodone (Desyrel) & Nefazodone (Serzone)	Serotonin receptor antagonists and agonists	• Major depression (+/- anxiety) • Insomnia (sedative effect)	• Nausea, dizziness, orthostatic hypotension, arrhythmia, sedation, • Priapism (esp. trazodone) • Black box warning (rere but serious liver failure by nefazodone)	• No sexual side effects • Don’t affect REM sleep • Given w/ SSRIs to improve insomnia
Mirtazapine (Remeron)	α 2 receptor antag. → increased serotonin and NE release	• Major depression (esp. with wt loss, insomnia, elderly)	• Sedation & wt gain (act on histamine receptors causing sedation and increased appetite) • Dizziness, tremor, dry mouth, constipation, rarely agranulocytosis	• Fewer side effects and drug interactions than SSRIs

Tricyclic Antidepressants (TCA)					
	Mechanism of action	**Drugs**	**Other Therapeutic uses**	**Notes**	**Side effects**
Tertiary Amines (highly anticholinergic/antihistaminergic [more sedating]/ antiadrenergic [more orthostasis] with a greater lethality in overdose)	Mainly they inhibit presynaptic reuptake of the biogenic amines serotonin and noradrenaline	Amitriptyline (Elavil)	chronic pain Migraines Insomnia		■ **Antihistaminic**: Sedation and weight gain. ■ **Antiadrenergic [most common side effects]:** Orthostatic hypotension, dizziness, reflex tachycardia, arrhythmias (block cardiac sodium channel), and electrocardiographic (ECG) changes (widening QRS, QT, and PR intervals). **Avoid in patients with preexisting conduction abnormalities or recent MI, or with increased fall risk**. ■ **Antimuscarinic**: Dry mouth, constipation, urinary retention, blurred vision, tachycardia, and exacerbation of narrow-angle glaucoma. This can lead to delirium in the elderly population. ■ **Lethal in overdose [treated with** IV sodium bicarbonate.]—Must carefully assess the suicide risk when prescribing. **Symptoms of overdose** include agitation, tremors, ataxia, arrhythmias, delirium, hypoventilation from central nervous system (CNS) depression, myoclonus, hyperreflexia, seizures, and coma. ■ Seizures: The risk of seizure is directly related to the dose and serum level (i.e., higher risk of seizures at high doses and overdoses). ■ Serotonergic effects: Erectile/ejaculatory dysfunction in males, anorgasmia in females. **A 1-week supply of TCAs (as little as 1–2 g) can be lethal in overdose.** **Major complications of TCAs—3Cs: Cardiotoxicity / Convulsions /Coma**
		Imipramine (Tofranil)	Enuresis Panic disorder	Has intramuscular form	
		Clomipramine (Anafranil)	OCD	Most serotonin-specific	
		Doxepin (Sinequan)	Chronic pain Sleep aid in low doses.	Least likely to cause orthostatic hypotension. Useful therapeutic blood levels. Can be safely used in the geriatric population	
Secondary Amines Metabolites of tertiary amines (less anticholinergic/ antihistaminic/antiadrenergic)		Nortriptyline (Pamelor, Aventyl)	Chronic pain		
		Desipramine (Norpramin)		More activating/least sedating. Least anticholinergic.	
Tetracyclic Antidepressants					
	Mainly inhibits presynaptic reuptake of the biogenic amines serotonin and noradrenaline	Amoxapine (Asendin)		Metabolite of antipsychotic loxapine	May cause EPS and has a similar side-effect profile to typical antipsychotics

Monoamine oxidase inhibitors (MOAIs)				
MOA	**Notes**	**Therapeutic uses**	**Drugs**	**Side effects**
▪ prevent the inactivation of biogenic amines such as norepinephrine, serotonin, dopamine, and tyramine (an intermediate in the conversion of tyrosine to norepinephrine) ▪ By irreversibly inhibiting the enzymes MAO-A and B, MAOIs increase the number of neurotransmitters available in synapses.	▪ MAO-A preferentially deactivates serotonin and norepinephrine. ▪ MAO-B preferentially deactivates phenethylamine ▪ Both types also act on dopamine and tyramine.	MAOIs are **not used** as first-line agents because of the increased safety and tolerability of newer agents, notably SSRIs/SNRIs. However, MAOIs are rarely used for certain types of refractory depression and refractory anxiety disorders	Phenelzine (Nardil). Tranylcypromine (Parnate) Isocarboxazid (Marplan) Selegiline (Emsam transdermal patch): selective MAO-B; used also in Parkinson's disease	■ Serotonin syndrome ■ Hypertensive crisis ■ Orthostatic hypotension (most common). ■ Drowsiness. ■ Weight gain. ■ Sexual dysfunction. ■ Dry mouth. ■ Sleep dysfunction. ■ Patients with pyridoxine deficiency can have numbness or paresthesias, so they should supplement with B6. ■ Liver toxicity, seizures, and edema (rare). ■ "Start low and go slow" (low doses that are increased slowly).

Anti-psychotics

- Used to treat psychotic & bipolar disorders, and psychotic symptoms with other illnesses
- Both typical & atypical antipsychotics have similar efficacies in treating positive psychotic symptoms (hallucinations, delusions) but atypical antipsychotics are more effective in treating negative symptoms (flattened affect, social withdrawal), Both are used as first line treatment

	MOA	Drugs	Notes	Side effects
Typical 1st gen antipsychotics (neuroleptics)	Block dopamine D2 receptors	**Low potency 1st gen** • Chlorpromazine (thorazine) • Thioridazine (mellaril)	Low affinity to D2 receptors → higher dose needed • Chlorpromazine is also used to treat nausea, vomiting, intractable hiccups • Chlorpromazine oral or IM (good with lorazepam for agitation or psychosis in emergencies)	• Higher incidence of antisdrenergic , anticholinergic, antihistaminic side effects • Lower incidence of EPS & neuroleptic malignant syndrome • QT prolongation, heart block, v. tach (more lethal in overdose) • Higher seizure risk • Agranulocytosis (rare) • Chlorpromazine → orthostat. Hypotension, blue-gray skin discoloration, **corneal & lens** deposits, photosensitivity • Thioridazine → **retinitis** pigmentosa
		Mid potency 1st gen • Loxapine (loxitane) • Thiothixene(navane) • Molindone (moban) • Perphenazine (trilafon)	Loxapine metabolite is an antidepressant	• Loxapine → higher risk of seizures • Thiothixene → ocular pigmentation
		High potency 1st gen • Haloperidol (halodol) • Fluphenazine (prolixin) • Trifluoperazine (stelazine) • Pimozide (orap)	High affinity to D2 receptors → lower dose needed • Trifluoperazine → good for non psychotic anxiety • Haloperidol & Fluphenazine are available in decanote (long acting) form, IM (good for poorly compliant pts) • Haloperidol is also available IV	• Less sedation, orthostatic hypotension, anticholinergic effects • Greater risk of extrapyramidal symptoms & TD (tadive dyskinesia) • Pimozide → QT prolongation, v tach

1st gen side effects:

- Antidopaminergic effects (EPS, hyperprolactinemia), Anti HAM effects, Tardative dyskinesia, Neuroleptic malignant syndrome (details mentioned in the first page)
- Elevated liver enzymes, jaundice
- Ophthalmologic (retinal pigmentation, cornea & lens deposits)
- Dermatologic (rashes, photosensitivity, blue- gray discoloration
- Seizures (lower seizure threshold)

Anti-psychotics				
	MOA	**Drugs**	**Uses/ notes**	**Side effects**
Atypical 2nd gen antipsychotics	Block dopamine D2 and serotonin (5HT-2A) receptors	Clozapine (clorzaril)	• More effeciatious than others • Treat refractory schizophrenia • Only antipsychotic that decreases risk of suicide	• More anticholinergic side effects than others (tachy, constipation, hypersalivation) • Agranulocytosis (needs continuous monitoring) • Seizures • Myocarditis (small risk)
		Risperidone (Risperdal)	Long acting injectable (LAI) named consta	• Hyperprolactinemia • Orthostatic hypotension & reflex tachy
		Quetiapine (Seroquel)		• Sedation, oorthostatic hypotension, wt gain
		Olanzapine (Zyprexa)	Oral, IM, LAI forms	• Significant wt gain, sedation, dyslipidemia
		Ziprasidone (Geodon)	• Must be taken w/ food to promote absorption • Oral &IM forms	• QT prolongation
		Aripiprazole (abilify)	Partial D2 agonist, Oral, IM, LAI forms	• More activating (akathisia), less sedation
		Paliperidone (invega)	• Metabolite of risperidone • LAIs: sustenna, trinza • Newer more expensive	
		Asenapine (saphris)	• Sublingual • Newer more expensive	
		Iloperidone (fanapt)	• Newer more expensive	
		Lurasidone (latuda)	• Used for bipolar depression • Taken with food • Newer more expensive	

- Less side effects but higher dose
- Treat behavioral. symptoms of neurocognitive diorders (dementia) and delirium
- Effective in treating negative symptoms of schizophrenia, acute mania, bipolar, & as adjunctive med in unipolar depression
- Also used to treat borderline personality disorder, PTSD, some psychiatric disorders in childhood like tic disorders
- Side effects: Metabolic syndrome, Motality and stroke in elderly (FDA black box), some anti HAM effects, elevated liver fxn test (LFTs), QT prolongation
- Less likely to cause EPS, TD, neuroleptic malignant syndrome

Mood stabilizers					
Drug Category	**Drug Name**	**MOA**	**Side Effects**	**Therapeutic uses**	**notes**
Mood Stabilizers	Lithium		GI upset, tremor, nephrogenic DI, renal failure, hypothyroidism, leukocytosis, weight gain Ebstein's anomaly ECG changes.	drug of choice in acute mania and as prophylaxis for both manic and depressive episodes in bipolar and schizoaffective disorders.	• Onset of action takes 5–7 days. • Therapeutic range: 0.6–1.2. Toxic: >1.5. Potentially lethal: >2.0 • Lithium is metabolized by the kidney (dosing adjustments)
Anticonvulsant/ Mood Stabilizer	Valproic Acid (Depakote)	Increases GABA, blocks sodium channels	GI distress, weight gain, liver toxicity, tremor, sedation, pancreatitis, teratogenic effects (neural tube defects).	Useful in treating acute mania and rapid cycling	
	Carbamazepine (Tegretol)	Blocks sodium channels, inhibits action potentials	GI distress, CNS effects, skin rash (Stevens–Johnson syndrome), hyponatremia, aplastic anemia, teratogenic effects (neural tube defects, hepatitis	useful in treating mania and rapid-cycling bipolar disorder rather than depressed phase	• Onset of action is 5–7 days. • Therapeutic dose : (8–12) • induces its own metabolism. Patients may therefore need a dose increase
	Lamotrigine (Lamictal)	Modulates sodium channels, influences glutamate and aspartate	Dizziness, sedation, headaches, ataxia, Stevens-Johnson syndrome (SJS)	Efficacy for bipolar depression, though little efficacy for acute mania or prevention of mania.	
	Oxcarbazepine (Trileptal)		Monitor sodium levels for hyponatremia.	mood disorders	Less risk of rash and hepatic toxicity
	Gabapentin			used adjunctively to help with anxiety, sleep, neuropathic pain	Little efficacy in bipolar disorder.
	Pregabalin (Lyrica)			Used in GAD (second-line) and fibromyalgia.	Little efficacy in bipolar disorder
	Topiramate (Topamax)		Beneficial side effect is weight loss. hypochloremic, metabolic acidosis as well as kidney stones. most limiting side effect is cognitive slowing and sleepiness	impulse control disorders.	

Anxiolytics/ hypnotics					
Drug Category	**Drug Name**	**Therapeutic uses**	**notes**	**MOA**	**Side Effects**
benzodiazepines Long acting	Diazepam (Valium)	detoxification from alcohol or sedative-hypnotic-anxiolytics, and for seizures. muscle spasm		potentiating the effects of gamma-aminobutyric acid (GABA).	• Drowsiness. • Impairment of intellectual function. • Reduced motor coordination (careful in elderly). • Anterograde amnesia. • Withdrawal can be life threatening and cause seizures. • Toxicity: Respiratory depression in overdose, especially when combined with alcohol
	Clonazepam (Klonopin):	anxiety, including panic attacks	Avoid with renal dysfunction		
benzodiazepines Intermediate acting	Alprazolam (Xanax):	anxiety, including panic attacks			
	Lorazepam (Ativan):	panic attacks, alcohol and sedative-hypnotic-anxiolytic detoxification, agitation.	Not metabolized by liver		
	Oxazepam (Serax):	Alcohol and sedative-hypnotic-anxiolytic detoxification.	Not metabolized by liver		
	Temazepam (Restoril):		Not metabolized by liver		
benzodiazepines Short acting	Midazolam (Versed):	used in medical and surgical settings	Very short half-life.		

Anxiolytics/ hypnotics					
Drug Category	**Drug Name**	**Therapeutic uses**	**notes**	**MOA**	**Side Effects**
Non-BDZ hypnotics	• Zolpidem (Ambien) • Zaleplon (Sonata) • Eszopiclone (Lunesta)	short-term treatment of insomnia	Zaleplon has a shorter half-life than zolpidem, which has a shorter half-life than eszopiclone	selective receptor binding to the omega-1 receptor on the GABA-A receptor	anterograde amnesia, hallucinations, parasomnias (e.g., sleepwalking, sleepeating), increased fall risk, and GI side effects may limit their tolerability.
	Diphenhydramine (Benadryl)			antihistamine with moderate anticholinergic effects	sedation, dry mouth, constipation, urinary retention, and blurry vision
	Ramelteon (Rozerem)		No tolerance or dependence, making it an effective and safe sleep aid.	elective melatonin MT1 and MT2 agonist	
Non-BDZ anxiolytics	Buspirone (BuSpar)		takes several weeks for effect Does not potentiate the CNS depression of alcohol (useful in alcoholics)	Partial agonist at 5HT-1A receptor, thereby decreasing serotonergic activity	
	Hydroxyzine (Atarax)		Useful for patients who want quick-acting, short-term medication, but who cannot take BDZs for various reasons	An antihistamine.	sedation, dry mouth, constipation, urinary retention, and blurry vision.
	Barbiturates butalbitol, phenobarbital, amobarbitol, pentobarbital)				Rarely used because of the lethality of overdose, significant withdrawal, potential for abuse, and side-effect profile.
	Propranolol	Treats autonomic effects of panic attacks or social phobia used to treat akathisia		Beta-blocker.	

Psychostimulants			
Drug Name	**Therapeutic uses**	**notes**	**Side Effects**
Dextroamphetamine & amphetamines (Dexedrine, Adderall)	ADHD & refractory depression treatment	Dextroamphetamine is D-isomer of amphetamine	• Abuse/ diversion (schedule II) • Htn, wt loss, insomnia, exacerbation of tics, seizures
Methylphenidate (Ritalin, concerta)		CNS stimulant (similar to amphetamines) Schedule II	• Leukopenia, anemia • Htn, wt loss, insomnia, exacerbation of tics, seizures
Atomoxetine (Strattera)		• Inhibits presynaptic NE reuptake → ↑ synaptic NE & dopamine • Not classified as a controlled substance • Less effective	• Rare liver toxicity, possible increase in suicidal ideation in children & adolescents • Less appetite suppression, insomnia, abuse potential
Modafinil (Provigil)	Narcolepsy (not ADHD)		

cognitive enhancers				
Drug category	**Drug Name**	**Therapeutic uses**	**notes**	**Side Effects**
ACH esterase inhibitors	Donepezil (aricept)	Mild to moderate neurocognitive disorders (dementias)	Once daily dosing	Some GI side effects
	Galantamine (razadyne)		Twice daily dosing	Some GI side effects
	Rivastigmine (Exelon)		Twice daily dosing, has daily patch form with fewer side effects	
NMDA (glutamate) receptor antagonist	Memantine (Namenda)	Moderate to severe neurocognitive disorders (dementia)	Could be used in conjunction with ACH esterase inhibitors	Fewer side effects than cholineesterase inhibitors

Reference List of Medications That May Cause Psychiatric Symptoms

1. PSYCHOSIS

Sympathomimetics, analgesics, antibiotics (e.g., isoniazid, antimalarials), anticholinergics, anticonvulsants, antihistamines, corticosteroids, antiparkinsonian agents.

2. AGITATION/CONFUSION/DELIRIUM

Antipsychotics, **anticholinergics**, **antihistamines**, antidepressants, antiarrhythmics, antineoplastics, corticosteroids, NSAIDs, antiasthmatics, antibiotics, antihypertensives, antiparkinsonian agents, thyroid hormones.

3. DEPRESSION

Antihypertensives, antiparkinsonian agents, **corticosteroids**, calcium channel blockers, NSAIDs, antibiotics, peptic ulcer drugs.

4. ANXIETY

Sympathomimetics, antiasthmatics, antiparkinsonian agents, hypoglycemic agents, NSAIDs, thyroid hormones.

5. SEDATION/POOR CONCENTRATION

Antianxiety agents/hypnotics, anticholinergics, mood stabilizers, antibiotics, antihistamines, antipsychotics (e.g., clozapine, quetiapine, olanzapine).

SELECTED MEDICATIONS

- **Procainamide, quinidine:** Confusion, delirium.
- **Albuterol:** Anxiety, confusion.
- **Isoniazid:** Psychosis.
- **Tetracycline:** Depression.
- **Nifedipine, verapamil:** Depression.
- **Cimetidine:** Depression, confusion, psychosis.
- **Steroids:** Aggressiveness/agitation, mania, depression, anxiety, psychosis.

Other Treatments

ELECTROCONVULSIVE THERAPY (ECT)

- Pts premedicated with atropine → given general anesthesia and muscle relaxants (e.g., succinylcholine) →induce generalized tonic-clonic seizure using unilateral or bilateral electrodes placed on the head.
- The mechanism of action of ECT is not fully known, (likely anticonvulsant effects, as well as brain perfusion and connectivity changes).
- ECT is **the most effective** treatment for **major depressive disorder, especially with psychotic features, as well as for acute mania and catatonia**. It is often used in patients who cannot tolerate medications or who have failed other treatments.
- ECT is discontinued after symptomatic improvement, typically a course of 8–12 sessions given three times weekly. Monthly *maintenance ECT* is often used to prevent relapse of symptoms, and the addition of nortriptyline or venlafaxine may prolong remission even further.
- **The most common side effects** are muscle soreness, headaches, amnesia, and confusion. Bilateral electrode placement is more efficacious, but increases memory impairment and confusion. Evidence shows that the memory loss is almost always temporary and returns to baseline at 6 months.

DEEP BRAIN STIMULATION (DBS)

- DBS is a surgical treatment involving the implantation of a medical device that sends electrical impulses to specific parts of the brain.
- DBS in select brain regions has provided benefits for **Parkinson disease and disabling dystonia, as well as for chronic pain and tremors.**
- Its underlying principles and mechanisms are still not clear. DBS directly changes brain activity in a controlled manner and its effects are reversible (unlike those of lesioning techniques). DBS has been used to treat various affective disorders, including major depression. While DBS has proven helpful for some patients, there is potential for serious complications and side effects.

REPETITIVE TRANSCRANIAL MAGNETIC STIMULATION (rTMS)

rTMS is a noninvasive method to excite neurons in the brain. Weak electric currents are induced in the tissue by rapidly changing magnetic fields, a process called electromagnetic induction. In this way, brain activity can be triggered with minimal discomfort. rTMS can produce longer-lasting changes than nonrepetitive stimulation. Numerous small-scale studies have demonstrated efficacy in the treatment of major depression; however, studies show less efficacy than for ECT, and the price of treatment is high. Side effects include seizures (rare), as well as headache and scalp pain.

LIGHT THERAPY

Light therapy, or phototherapy, consists of exposure to daylight or to specific wavelengths of light using lasers, light-emitting diodes, fluorescent lamps, dichroic lamps or very bright, full-spectrum light, for a prescribed amount of time and, insome cases, at a specific time of day. The recommendation is for using a 10,000 lux bright white light for 30 minutes per day in the early morning. Light therapy is used to treat major depression with a seasonal pattern (**seasonal affective disorder**), with some support for its use with nonseasonal psychiatric disorders.

KETAMINE INFUSION

- Ketamine is an NMDA receptor antagonist that is most commonly used as an anesthetic agent.
- Ketamine can be given as an IV infusion for the treatment of **unipolar major depression**. It's effect is rapid (with response within 40–120 minutes), but the effect dissipates by day 10–14.
- Ketamine side effects: a risk of dissociation/ psychosis, bladder toxicity, and neurotoxicity.
- Currently, use of IV ketamine for depression is still mostly limited to research settings, but increasingly through specialized ketamine clinics. Esketamine, the intranasal formulation of ketamine, was recently FDA approved for treatment-resistant depression.

Most Common Psychiatric Medications for Wards

Typical Antipsychotics (D2 antagonism)

Drug name (Brand)	Dosing	Side Effects	Monitoring	Other
chlorpromazine (Thorazine)	200–800 mg	Hypotension, sedation, orthostasis	EKG, BMI, QTc	Least potent PO, IM
fluphenazine (Prolixin)	6–20 mg	EPS, sedation		PO, IM, LAI
haloperidol (Haldol)	2–20 mg	EPS, sedation		PO, IM, LAI
perphenazine (Triaflon)	8–32 mg	EPS, sedation		PO, IM

Watch for NMS (fever, **lead pipe rigidity**).

EPS tx: **Akathisia** (propranolol 10 mg TID), **Parkinsonism/Dystonia** (benztropine 1–2 mg daily)

Atypical Antipsychotics (D2 and 5HT2a antagonism)

Drug name (Brand)	Dosing	Side Effects	Monitoring	Other
clozapine (Clozaril)	300–900 mg	Anticholinergic, orthostatis, agranulocytosis, drooling	Weekly ANC	Most efficacious Lower suicide risk
aripiprazole (Abilify)	5–30 mg	Akathisia	**For all: A1C, fasting glucose, lipid profile, BMI, LFTs, renal function**	PO and LAI
lurasidone (Latuda)	40–120 mg	Akathisia		Give with food
olanzapine (Zyprexa)	10–30 mg	Metabolic syndrome, orthostasis, sedating		PO, IM, LAI
paliperidone (Invega)	3–12 mg	Hyperprolactinemia, EPS, sedation, metabolic syndrome		PO and LAI
quetiapine (Seroquel)	50–800 mg	Metabolic syndrome, orthostasis, sedating		PO, check QTc
risperidone (Risperdal)	2–6 mg	Hyperprolactinemia, EPS, sedation, metabolic syndrome		PO and LAI

Mood Stabilizers

Drug name Brand)	Dosing	Side Effects	Monitoring	Other
Lithium	900–1800 mg	GI upset, tremor, nephrogenic DI, renal failure	Thyroid, renal, serum drug level (0.8–1.2)	Ebstein's anomaly Lower suicide risk
lamotrigine (Lamictal)	100–200 mg	GI upset, SJS rash	Monitor for rash	Dose slowly
valproic acid (Depakote)	500–2000 mg	GI upset, weight gain, liver toxicity	Liver, ammonia, serum drug level (80–120)	Contraindicated in pregnancy: neural tube defect
carbamazepine (Tegretol)	800–1600 mg	Hyponatremia, agranulocytosis	Liver, renal, serum drug level (8–10)	Contraindicated in pregnancy: neural tube defect PacMan inducer

Antidepressants

Drug name (Brand)	Dosing	Side Effects/Monitor	Other
fluoxetine (Prozac)	20–80 mg	SSRI's: GI upset, sexual dysfunction, bleeding, discontinuation syndrome	Long half-life
sertraline (Zoloft)	50–200 mg		Safe in pregnancy
escitalopram (Lexapro)	10–20 mg		Few med interactions
venlafaxine (Effexor)	75–225 mg	Tremor, HTN, akathisia	Short half-life
duloxetine (Cymbalta)	40–120 mg	Monitor LFTs	Treats pain, fibromyalgia
mirtazapine (Remeron)	15–45 mg	Sedation, weight gain	Activating at higher doses
buproprion (Wellbutrin)	150–450 mg	Activating, insomnia	Increased seizure risk

Watch for 5HT syndrome (Fever, **hyperreflexia**, **myoclonus**, GI disturbance)

By: Insaf Iyad, Hani Shihadeh, Ahmad Riyad