Professional Certificate in Medication Management (United Kingdom)

Drug Interactions

Absorption Interaction – Concept: Alteration of drug uptake from the gastrointestinal tract. Related terms: bioavailability, first-pass metabolism. Explanation: When a second agent modifies gastric pH, motility, or chelation, the amount of active drug entering systemic circulation changes. Example: Antacids decrease absorption of ketoconazole by raising gastric pH. Practical application: Assess timing of administration and advise separation of doses. Challenges: Variable patient diet and over-the-counter supplement use complicate prediction.

ACE Inhibitor Interaction – Concept: Potentiation of hypotensive effects when combined with other agents that lower blood pressure. Related terms: angiotensin-II receptor blockers, potassium-sparing diuretics. Explanation: Concurrent use of ACE inhibitors with NSAIDs can blunt antihypertensive efficacy, while combination with potassium-rich drugs raises hyperkalaemia risk. Example: Lisinopril plus spironolactone. Practical application: Monitor blood pressure and serum potassium after initiating therapy. Challenges: Renal dysfunction may amplify adverse outcomes.

Alcohol-Drug Interaction – Concept: Synergistic central nervous system (CNS) depression or metabolic competition. Related terms: Cytochrome P450, first-pass effect. Explanation: Ethanol induces CYP2E1, increasing clearance of certain drugs, and competes for metabolic pathways, leading to accumulation of others. Example: Disulfiram-alcohol reaction; benzodiazepines with alcohol causing profound sedation. Practical application: Counsel patients on abstinence or limited intake when prescribing CNS depressants. Challenges: Patient self-reporting of alcohol consumption is often unreliable.

Antacids Interaction – Concept: Reduction of drug dissolution and absorption through pH alteration or chelation. Related terms: hydrotalcite, magnesium hydroxide. Explanation: Antacids containing aluminium or magnesium bind to tetracyclines, fluoroquinolones, and iron salts, forming insoluble complexes. Example: Ciprofloxacin taken with calcium carbonate yields decreased plasma levels. Practical application: Separate dosing by at least two hours. Challenges: Patients may use antacids intermittently, making adherence monitoring difficult.

Anticholinergic Interaction – Concept: Additive blockade of muscarinic receptors leading to enhanced anticholinergic toxicity. Related terms: dry mouth, urinary retention. Explanation: Co-administration of drugs with anticholinergic properties (e.G., Antihistamines, tricyclic antidepressants) can precipitate confusion, delirium, or cardiac arrhythmias, especially in the elderly. Example: Diphenhydramine plus amitriptyline. Practical application: Use anticholinergic burden scales to guide prescribing. Challenges: Many over-the-counter products contribute to cumulative load.

Anticoagulant Interaction – Concept: Alteration of coagulation cascade leading to increased bleeding or thrombosis risk. Related terms: warfarin, direct oral anticoagulants. Explanation: Drugs that induce or inhibit CYP2C9, CYP3A4, or affect vitamin K metabolism modify warfarin plasma levels. Example: Fluconazole inhibits CYP2C9, raising INR; rifampicin induces metabolism, lowering INR. Practical application: Schedule

more frequent INR checks when new interacting agents are introduced. Challenges: Genetic polymorphisms of CYP enzymes cause inter-patient variability.

Antifungal Interaction – Concept: Potent inhibition or induction of CYP enzymes altering concomitant drug concentrations. Related terms: azole class, enzyme induction. Explanation: Azoles (ketoconazole, itraconazole) are strong CYP3A4 inhibitors, raising levels of statins, calcium channel blockers, and certain immunosuppressants. Conversely, terbinafine induces CYP2D6, reducing beta-blocker efficacy. Example: Itraconazole plus simvastatin leading to rhabdomyolysis. Practical application: Consider alternative antifungal agents or dose adjustments. Challenges: Limited therapeutic alternatives for resistant fungal infections.

Antihypertensive Interaction – Concept: Synergistic or antagonistic blood pressure effects when multiple agents are combined. Related terms: beta-blockers, diuretics. Explanation: Additive hypotension can cause orthostatic falls; antagonism may arise when NSAIDs blunt diuretic response. Example: Furosemide with ibuprofen reduces natriuresis. Practical application: Monitor orthostatic vitals after regimen changes. Challenges: Comorbid pain conditions often necessitate NSAID use, creating a therapeutic dilemma.

Antiplatelet Interaction – Concept: Enhanced bleeding risk when antiplatelet agents are combined with anticoagulants or NSAIDs. Related terms: aspirin, clopidogrel. Explanation: Dual antiplatelet therapy (DAPT) plus a direct oral anticoagulant significantly raises gastrointestinal bleeding incidence. Example: Aspirin plus rivaroxaban. Practical application: Employ gastro-protective strategies (PPI) and assess necessity of each agent. Challenges: Balancing thrombosis prevention against hemorrhagic complications.

Antipsychotic Interaction – Concept: Pharmacokinetic or pharmacodynamic changes leading to extrapyramidal symptoms or QT prolongation. Related terms: CYP2D6, serotonin syndrome. Explanation: CYP2D6 inhibitors (paroxetine) increase plasma levels of risperidone, heightening side-effects; co-administration with other QT-prolonging drugs (macrolides) augments arrhythmia risk. Example: Haloperidol plus fluoxetine. Practical application: Review medication list for CYP inhibitors before initiating antipsychotics. Challenges: Polypharmacy in psychiatric populations makes interactions common.

Antiretroviral Interaction – Concept: Complex modulation of viral protease, reverse transcriptase, and integrase inhibitors via CYP pathways. Related terms: HAART, pharmacogenomics. Explanation: Protease inhibitors are strong CYP3A4 inhibitors, raising levels of statins and certain antihypertensives; non-nucleoside reverse transcriptase inhibitors can induce CYP enzymes, lowering co-administered drug concentrations. Example: Ritonavir plus simvastatin causing myopathy. Practical application: Use statins less dependent on CYP3A4 (e.G., Pravastatin). Challenges: Resistance patterns may limit choice of antiretroviral regimen, forcing high-risk combinations.

Antitussive Interaction – Concept: Central nervous system depression when combined with opioids or alcohol. Related terms: dextromethorphan, serotonin syndrome. Explanation: Dextromethorphan is a weak NMDA antagonist and a serotonin reuptake inhibitor; concurrent use with SSRIs can precipitate serotonin syndrome. Example: Dextromethorphan plus sertraline. Practical application: Advise patients to avoid OTC cough syrups while on serotonergic antidepressants. Challenges: Patients often self-medicate for cough without informing clinicians.

Aspirin Interaction – Concept: Increased bleeding risk and pharmacodynamic antagonism with anticoagulants, NSAIDs, and certain antihypertensives. Related terms: platelet inhibition, GI protection. Explanation: Low-dose aspirin irreversibly inhibits COX-1; adding clopidogrel or a DOAC compounds hemorrhagic potential. NSAIDs may compete for gastric mucosal protection, worsening ulcer risk. Example: Aspirin plus naproxen. Practical application: Prescribe proton-pump inhibitors when dual therapy is unavoidable. Challenges: Balancing cardiovascular prophylaxis against gastrointestinal safety.

Beta-Blocker Interaction – Concept: Additive negative chronotropic and inotropic effects when combined with calcium channel blockers or digoxin. Related terms: verapamil, bradycardia. Explanation: Non-dihydropyridine calcium channel blockers (verapamil, diltiazem) inhibit CYP2D6, raising beta-blocker concentrations; together they may cause severe bradyarrhythmias. Example: Metoprolol plus verapamil. Practical application: Monitor heart rate and consider dose reduction of one agent. Challenges: Many patients with angina require both drug classes, necessitating careful titration.

Calcium Channel Blocker Interaction – Concept: Metabolic inhibition leading to elevated levels of co-administered drugs, and additive vasodilatory effects. Related terms: nimodipine, CYP3A4. Explanation: Diltiazem and verapamil inhibit CYP3A4, raising concentrations of statins, benzodiazepines, and certain immunosuppressants. Example: Diltiazem plus atorvastatin causing myopathy. Practical application: Select statins less reliant on CYP3A4 (e.G., Rosuvastatin) or adjust doses. Challenges: Dose adjustments may affect therapeutic efficacy of the primary antihypertensive.

Carbamazepine Interaction – Concept: Strong enzyme inducer affecting a broad spectrum of drugs. Related terms: auto-induction, hepatic metabolism. Explanation: Carbamazepine induces CYP3A4, CYP1A2, and CYP2C9, lowering plasma concentrations of oral contraceptives, warfarin, and certain antiretrovirals. Example: Reduced effectiveness of ethinyl estradiol leading to breakthrough bleeding. Practical application: Advise alternative contraceptive methods and monitor INR when starting carbamazepine. Challenges: Therapeutic drug monitoring for carbamazepine itself can be confounded by its own induction.

Catecholamine Interaction – Concept: Potentiation or antagonism of sympathomimetic agents. Related terms: epinephrine, alpha-agonists. Explanation: MAO inhibitors block degradation of catecholamines, intensifying the pressor response to tyramine-rich foods and sympathomimetic drugs, risking hypertensive crisis. Example: Phenylephrine nasal spray taken while on phenelzine. Practical application: Restrict use of over-the-counter decongestants in patients on MAOIs. Challenges: Patient awareness of dietary restrictions is variable.

Cephalosporin Interaction – Concept: Displacement of bilirubin from albumin and alteration of gut flora. Related terms: hyperbilirubinemia, Clostridioides difficile. Explanation: High-dose ceftriaxone can displace bilirubin, precipitating kernicterus in neonates; broad-spectrum cephalosporins disrupt microbiota, increasing risk of C. Difficile infection, especially when combined with proton-pump inhibitors. Example: Ceftriaxone in a newborn leading to elevated bilirubin. Practical application: Avoid ceftriaxone in neonates and monitor bilirubin; implement antimicrobial stewardship. Challenges: Balancing infection control with stewardship mandates.

Cholesterol-Lowering Interaction – Concept: Statin metabolism affected by CYP inhibitors or inducers

leading to myopathy or therapeutic failure. Related terms: HMG-CoA reductase inhibitors, lovastatin. Explanation: Strong CYP3A4 inhibitors (e.G., Clarithromycin) raise simvastatin levels, increasing rhabdomyolysis risk; inducers (e.G., Carbamazepine) lower statin concentrations, reducing lipid-lowering effect. Example: Simvastatin plus erythromycin causing muscle pain. Practical application: Select statins with minimal CYP interaction (e.G., Pravastatin) or adjust dosage. Challenges: Patient adherence to statin therapy can be compromised by side-effects.

Cimetidine Interaction – Concept: Broad-spectrum inhibition of multiple CYP enzymes and renal tubular secretion. Related terms: histamine H2-receptor antagonist, drug-clearance. Explanation: Cimetidine elevates plasma concentrations of warfarin, phenytoin, theophylline, and certain benzodiazepines, heightening toxicity. Example: Increased theophylline levels leading to seizures. Practical application: Prefer famotidine, which has a more selective profile, when polypharmacy is present. Challenges: Many patients self-medicate with OTC antacids, unaware of interaction potential.

Clarithromycin Interaction – Concept: Potent inhibition of CYP3A4 and P-glycoprotein affecting many cardiovascular and CNS agents. Related terms: macrolide antibiotic, QT prolongation. Explanation: Clarithromycin raises concentrations of statins, calcium channel blockers, and certain anti-arrhythmics, increasing risk of myopathy or arrhythmia. Example: Clarithromycin plus amlodipine leading to hypotension. Practical application: Evaluate need for macrolide versus alternative antibiotic; adjust doses accordingly. Challenges: Resistance patterns may limit alternative choices.

Clopidogrel Interaction – Concept: Reduced antiplatelet effect when CYP2C19 is inhibited, and increased bleeding risk when combined with anticoagulants. Related terms: prodrug activation, PPIs. Explanation: Proton-pump inhibitors such as omeprazole inhibit CYP2C19, decreasing conversion of clopidogrel to its active metabolite, potentially leading to stent thrombosis. Example: Clopidogrel plus omeprazole reduces platelet inhibition. Practical application: Use pantoprazole or H2 antagonists instead. Challenges: Balancing gastro-protection with antiplatelet efficacy.

COX-2 Inhibitor Interaction – Concept: Additive cardiovascular risk when combined with antihypertensives that raise blood pressure. Related terms: celecoxib, fluid retention. Explanation: Selective COX-2 inhibitors can cause sodium and water retention, diminishing the effect of ACE inhibitors or diuretics, potentially worsening hypertension. Example: Celecoxib plus lisinopril leading to uncontrolled BP. Practical application: Monitor blood pressure after initiating COX-2 inhibitors; consider alternative analgesics. Challenges: Patient preference for NSAIDs may conflict with cardiovascular safety.

Cyclosporine Interaction – Concept: Narrow therapeutic index; metabolism heavily influenced by CYP3A4 and P-glycoprotein. Related terms: immunosuppressant, nephrotoxicity. Explanation: CYP3A4 inhibitors (ketoconazole) dramatically raise cyclosporine levels, increasing nephrotoxicity; inducers (rifampicin) lower levels, risking graft rejection. Example: Cyclosporine plus fluconazole requiring dose reduction. Practical application: Perform therapeutic drug monitoring after any change in concomitant medications. Challenges: Frequent dose adjustments can be burdensome for transplant patients.

Digoxin Interaction – Concept: Alterations in absorption, distribution, or renal clearance leading to toxicity or loss of efficacy. Related terms: cardiac glycoside, p-glycoprotein. Explanation: Quinidine and verapamil

inhibit P-glycoprotein, raising digoxin concentrations; diuretics causing hypokalemia increase digoxin's arrhythmogenic potential. Example: Digoxin plus furosemide causing digitalis toxicity. Practical application: Monitor serum digoxin levels and electrolytes when initiating interacting drugs. Challenges: Narrow therapeutic window makes dose titration critical.

Diuretic Interaction – Concept: Electrolyte disturbances that influence the activity of other cardiovascular agents. Related terms: hypokalemia, hyperuricemia. Explanation: Thiazide diuretics can cause hypokalemia, potentiating the effect of digitalis and increasing the risk of arrhythmias; they also raise serum uric acid, potentially precipitating gout when combined with low-dose aspirin. Example: Hydrochlorothiazide plus digoxin. Practical application: Supplement potassium or switch to potassium-sparing diuretics when appropriate. Challenges: Patient adherence to electrolyte monitoring is often poor.

Dopamine Agonist Interaction – Concept: Synergistic hypotension or nausea when combined with other dopamine-modulating agents. Related terms: pramipexole, orthostatic hypotension. Explanation: Concomitant use of MAO-B inhibitors (selegiline) and dopamine agonists may amplify dopaminergic side-effects, such as nausea or severe hypotension. Example: Pramipexole plus rasagiline causing dizziness. Practical application: Start at low doses and titrate slowly; monitor blood pressure. Challenges: Parkinson's disease patients often require polypharmacy, increasing interaction risk.

Enzyme Induction Interaction – Concept: Increased metabolism of substrate drugs leading to reduced efficacy. Related terms: phenobarbital, phenytoin. Explanation: Strong inducers accelerate clearance of oral contraceptives, anticoagulants, and certain antiretrovirals, potentially resulting in therapeutic failure. Example: Phenobarbital decreasing plasma levels of warfarin, requiring higher INR targets. Practical application: Anticipate dose escalation or alternative therapy when initiating an inducer. Challenges: Induction may take weeks to manifest, complicating early detection.

Enzyme Inhibition Interaction – Concept: Decreased metabolism causing drug accumulation and toxicity. Related terms: ketoconazole, fluoxetine. Explanation: Inhibitors of CYP3A4 or CYP2D6 raise concentrations of substrates, heightening adverse effect risk. Example: Fluoxetine plus venlafaxine leading to serotonin syndrome. Practical application: Review patient medication list for known inhibitors before prescribing high-risk drugs. Challenges: Many inhibitors have dose-dependent effects, requiring nuanced management.

Epinephrine Interaction – Concept: Potentiation of vasoconstriction and tachycardia when combined with sympathomimetic agents. Related terms: alpha-agonist, beta-agonist. Explanation: Concomitant use of non-selective β-agonists (albuterol) and epinephrine can cause severe tachyarrhythmias, especially in patients with coronary artery disease. Example: Inhaled albuterol during anaphylaxis treatment with epinephrine. Practical application: Limit β-agonist doses and monitor cardiac rhythm. Challenges: Emergency settings often prioritize rapid treatment over interaction considerations.

Erythromycin Interaction – Concept: Strong CYP3A4 inhibition affecting cardiovascular and CNS drugs. Explanation: Erythromycin raises levels of statins, calcium channel blockers, and certain anti-arrhythmics, increasing risk of myopathy and torsades de pointes. Example: Erythromycin plus simvastatin causing muscle breakdown. Practical application: Consider azithromycin, which has less CYP involvement, when interactions are a concern. Challenges: Resistance patterns may dictate erythromycin use despite interaction

risk.

Estrogen-Containing Oral Contraceptive Interaction – Concept: Reduced efficacy when hepatic enzyme inducers increase steroid metabolism. Related terms: ethinyl estradiol, progestin. Explanation: CYP3A4 inducers such as rifampicin, carbamazepine, and St. John's wort accelerate estrogen clearance, causing breakthrough bleeding and possible unintended pregnancy. Example: A woman on carbamazepine experiencing contraceptive failure. Practical application: Recommend barrier methods or non-hormonal contraception while on inducers. Challenges: Patient may be unaware of the need for additional protection.

Fibrate Interaction – Concept: Additive risk of myopathy when combined with statins, especially those metabolised by CYP3A4. Related terms: gemfibrozil, muscle toxicity. Explanation: Gemfibrozil inhibits glucuronidation of statins, markedly increasing plasma concentrations and myopathic risk. Example: Gemfibrozil plus atorvastatin leading to rhabdomyolysis. Practical application: Avoid concurrent use; if combination is essential, select a statin with minimal interaction (e.G., Pravastatin) and monitor CK levels. Challenges: Dyslipidaemia often requires multi-agent therapy.

Fluconazole Interaction – Concept: Potent CYP2C9 and CYP3A4 inhibition affecting warfarin, benzodiazepines, and certain antiretrovirals. Related terms: azole antifungal, drug-clearance. Explanation: Fluconazole raises warfarin INR, increasing bleeding risk; it also elevates levels of midazolam, causing prolonged sedation. Example: Fluconazole plus warfarin requiring dose reduction. Practical application: Check INR more frequently after initiating fluconazole and adjust anticoagulant dosing. Challenges: Fungal infections may necessitate prolonged azole therapy, requiring ongoing monitoring.

Fluoxetine Interaction – Concept: Strong inhibition of CYP2D6 and moderate inhibition of CYP2C19, influencing antidepressants and analgesics. Related terms: SSRI, serotonin syndrome. Explanation: Fluoxetine increases plasma concentrations of tricyclic antidepressants, beta-blockers, and codeine (by reducing conversion to morphine). Example: Fluoxetine plus codeine resulting in inadequate analgesia. Practical application: Consider alternative analgesics or adjust doses. Challenges: Long half-life of fluoxetine means interaction potential persists after discontinuation.

Furosemide Interaction – Concept: Electrolyte depletion that can potentiate the cardiac toxicity of other drugs. Related terms: loop diuretic, hypokalemia. Explanation: Furosemide-induced hypokalemia enhances digoxin toxicity and may increase the arrhythmic potential of certain anti-arrhythmics. Example: Patient on digoxin developing bradyarrhythmia after high-dose furosemide. Practical application: Monitor electrolytes and consider potassium supplementation. Challenges: Adherence to regular blood tests is often suboptimal.

GABAergic Interaction – Concept: Additive CNS depression when multiple GABA-modulating agents are combined. Related terms: benzodiazepine, barbiturate. Explanation: Co-administration of benzodiazepines with alcohol, opioids, or gabapentinoids can cause profound sedation, respiratory depression, and increased fall risk. Example: Lorazepam plus gabapentin leading to excessive drowsiness. Practical application: Limit concurrent use, start with lowest possible doses, and educate patients about sedation. Challenges: Many patients with chronic pain or anxiety receive multiple GABAergic prescriptions.

Glucocorticoid Interaction – Concept: Metabolic induction of hepatic enzymes and antagonism of certain

antihypertensives. Related terms: prednisone, cushingoid effect. Explanation: Systemic steroids induce CYP3A4, lowering concentrations of oral contraceptives and some antiretrovirals; they also cause fluid retention, counteracting the antihypertensive effect of diuretics. Example: Prednisone reducing efficacy of ethinyl estradiol. Practical application: Consider alternative contraceptive methods and monitor blood pressure. Challenges: Steroids are often prescribed for short courses, yet interaction risk may be overlooked.

Glyburide Interaction – Concept: Hypoglycaemia risk when combined with CYP2C9 inhibitors or drugs that displace protein binding. Related terms: sulfonylurea, renal clearance. Explanation: Fluconazole inhibits CYP2C9, raising glyburide levels and causing severe hypoglycaemia; NSAIDs may compete for albumin binding, further increasing free drug. Example: Patient on glyburide developing low blood glucose after starting fluconazole. Practical application: Monitor glucose closely and adjust sulfonylurea dose as needed. Challenges: Elderly patients may have diminished renal function, amplifying risk.

Griseofulvin Interaction – Concept: Enzyme induction leading to reduced plasma concentrations of many drugs. Related terms: antifungal, CYP induction. Explanation: Griseofulvir induces CYP2C9, CYP2C19, and CYP3A4, decreasing effectiveness of warfarin, oral contraceptives, and certain antihistamines. Example: Reduced INR in a patient on warfarin after starting griseofulvin. Practical application: Increase warfarin dose or switch antifungal. Challenges: Griseofulvin is less commonly used now, but still prescribed for dermatophyte infections.

Heparin Interaction – Concept: Altered anticoagulant effect when combined with antiplatelet agents or drugs that affect platelet function. Related terms: LMWH, bleeding risk. Explanation: Concomitant aspirin or clopidogrel increases risk of gastrointestinal bleeding; certain antibiotics (e.G., Ceftriaxone) may potentiate heparin's effect via unknown mechanisms. Example: Patient on heparin and aspirin developing melena. Practical application: Assess need for dual therapy and provide gastro-protective agents. Challenges: Balancing thrombosis prevention with bleeding concerns is often complex.

Hydrochlorothiazide Interaction – Concept: Electrolyte disturbances influencing other cardiac drugs. Related terms: thiazide diuretic, hyperuricemia. Explanation: Thiazide-induced hypokalemia heightens the risk of digoxin toxicity; increased uric acid levels can precipitate gout when combined with low-dose aspirin. Example: Patient on HCTZ developing gout flare after starting aspirin. Practical application: Monitor serum potassium and uric acid, consider potassium-sparing diuretics if needed. Challenges: Thiazides are first-line antihypertensives, making avoidance difficult.

Hydroxyzine Interaction – Concept: Additive CNS depression and anticholinergic burden when combined with other sedatives. Related terms: first-generation antihistamine, sedation. Explanation: Hydroxyzine plus opioids or benzodiazepines can cause profound respiratory depression, especially in the elderly. Example: Elderly patient on morphine developing severe drowsiness after hydroxyzine addition. Practical application: Limit dose, avoid concurrent use where possible, and educate about sedation. Challenges: Hydroxyzine is often used for pruritus, and patients may not disclose OTC antihistamine use.

Ibuprofen Interaction – Concept: NSAID-induced reduction of renal prostaglandins affecting antihypertensive efficacy and renal function. Related terms: COX-non-selective NSAID, AKI. Explanation: Ibuprofen can blunt the effect of ACE inhibitors and diuretics, leading to fluid retention and uncontrolled

hypertension; it may also precipitate acute kidney injury in volume-depleted patients. Example: Patient on lisinopril experiencing rising BP after ibuprofen use. Practical application: Advise patients to use the lowest effective NSAID dose or select COX-2-selective agents with caution. Challenges: OTC availability leads to unmonitored use.

Imipramine Interaction – Concept: CYP2D6 inhibition leading to increased levels of other substrates and additive anticholinergic effects. Related terms: tricyclic antidepressant, serotonin syndrome. Explanation: Imipramine raises plasma concentrations of metoprolol, increasing bradycardia risk; combined with SSRIs, it may precipitate serotonin syndrome. Example: Imipramine plus sertraline causing agitation and hyperreflexia. Practical application: Monitor cardiac parameters and avoid serotonergic combinations. Challenges: Depression treatment often requires multiple agents, raising interaction potential.

Indinavir Interaction – Concept: Protease inhibitor metabolism heavily reliant on CYP3A4, prone to both inhibition and induction. Related terms: HIV therapy, hyperbilirubinemia. Explanation: Concomitant use of strong CYP3A4 inhibitors (ketoconazole) raises indinavir levels, increasing nephrotoxicity; inducers (rifampicin) lower levels, risking virologic failure. Example: Indinavir dose adjustment required when starting rifampicin for tuberculosis. Practical application: Therapeutic drug monitoring and alternative antiretroviral selection. Challenges: Co-infection with TB is common, limiting regimen options.

Insulin Interaction – Concept: Hypoglycaemia risk when combined with agents that increase insulin sensitivity or decrease glucose production. Related terms: beta-blockers, corticosteroids. Explanation: Beta-blockers mask hypoglycaemic symptoms, while corticosteroids raise glucose, potentially requiring insulin dose adjustments. Example: Patient on insulin experiencing unrecognised hypoglycaemia after starting propranolol. Practical application: Educate patients on symptom recognition and adjust insulin dosing when new drugs are added. Challenges: Variable patient response to insulin makes dosing complex.

Isotretinoin Interaction – Concept: Hepatic enzyme induction affecting steroid metabolism and increased teratogenic risk with hormonal contraceptives. Related terms: retinoid, CYP induction. Explanation: Isotretinoin induces CYP3A4, potentially reducing effectiveness of oral contraceptives, while also being highly teratogenic itself. Example: Isotretinoin therapy requiring dual contraception methods. Practical application: Prescribe non-hormonal contraception in addition to hormonal methods. Challenges: Patient adherence to strict contraception protocols is essential but often difficult.

Lamotrigine Interaction – Concept: Metabolism via glucuronidation; affected by enzyme inducers and inhibitors. Related terms: antiepileptic, Stevens-Johnson syndrome. Explanation: Carbamazepine induces glucuronidation, decreasing lamotrigine levels and risking seizure breakthrough; valproic acid inhibits metabolism, raising lamotrigine levels and increasing rash risk. Example: Lamotrigine dose reduction when started on carbamazepine. Practical application: Monitor seizure frequency and skin reactions after any change. Challenges: Balancing seizure control with adverse effect risk.

Levofloxacin Interaction – Concept: QT-prolonging potential when combined with other torsadogenic agents and CNS stimulants. Related terms: fluoroquinolone, arrhythmia. Explanation: Levofloxacin plus methadone or anti-psychotics can precipitate torsades de pointes, especially in patients with electrolyte abnormalities. Example: Patient on levofloxacin developing syncope due to ventricular tachycardia. Practical

application: Correct electrolytes before therapy and avoid concurrent QT-prolonging drugs. Challenges: Fluoroquinolones are often first-line for respiratory infections, limiting alternatives.

Lithium Interaction – Concept: Narrow therapeutic index; affected by drugs that alter renal clearance or sodium balance. Related terms: mood stabiliser, nephrogenic diabetes insipidus. Explanation: NSAIDs reduce renal prostaglandins, decreasing lithium clearance and causing toxicity; thiazide diuretics increase reabsorption, also raising lithium levels. Example: Patient on lithium developing tremor after initiating ibuprofen. Practical application: Monitor serum lithium after any change in diuretic or NSAID therapy. Challenges: Psychiatric stability may depend on lithium, making dose adjustments delicate.

Macrolide Interaction – Concept: Broad CYP3A4 inhibition leading to elevated levels of many cardiovascular, CNS, and metabolic drugs. Related terms: azithromycin, clarithromycin. Explanation: Clarithromycin raises concentrations of statins, calcium channel blockers, and certain anti-arrhythmics, increasing risk of myopathy and arrhythmia. Azithromycin has minimal CYP effect and may be preferred. Example: Clarithromycin plus atorvastatin causing muscle pain. Practical application: Select azithromycin when possible; otherwise, adjust statin dose. Challenges: Resistance patterns may limit use of azithromycin.

Metformin Interaction – Concept: Risk of lactic acidosis when combined with drugs that impair renal function or increase contrast exposure. Related terms: biguanide, contrast media. Explanation: Iodinated contrast agents can precipitate acute kidney injury, reducing metformin clearance and raising lactic acidosis risk. Example: Patient receiving CT scan with contrast while on metformin developing metabolic acidosis. Practical application: Discontinue metformin 48 hours before contrast administration and resume after renal function confirmation. Challenges: Many patients undergo imaging without informing prescribers of metformin use.

Methadone Interaction – Concept: QT prolongation and respiratory depression when combined with other CNS depressants or QT-prolonging drugs. Related terms: opioid substitution, serotonin syndrome. Explanation: Concomitant use of methadone with fluconazole (CYP3A4 inhibitor) raises methadone levels, increasing sedation; combining with anti-psychotics can prolong QT interval. Example: Methadone plus haloperidol causing torsades. Practical application: ECG monitoring and dose adjustments when initiating interacting agents. Challenges: Opioid dependence treatment often requires multiple concurrent medications.

Metoprolol Interaction – Concept: Metabolism via CYP2D6; inhibitors increase plasma levels, leading to bradycardia and hypotension. Related terms: beta-blocker, phenytoin. Explanation: Fluoxetine (CYP2D6 inhibitor) raises metoprolol concentrations, potentially causing severe bradycardia; inducers like carbamazepine reduce its effect. Example: Patient on metoprolol experiencing dizziness after starting fluoxetine. Practical application: Monitor heart rate and adjust beta-blocker dose accordingly. Challenges: Many antidepressants are CYP2D6 inhibitors, making co-prescribing frequent.

Methotrexate Interaction – Concept: Reduced renal clearance and increased toxicity when combined with NSAIDs, PPIs, or proton pump inhibitors. Related terms: antifolate, bone marrow suppression. Explanation: NSAIDs compete for renal tubular secretion, raising methotrexate serum levels and risk of mucositis and myelosuppression. Example: Patient on low-dose methotrexate for rheumatoid arthritis developing

pancytopenia after ibuprofen use. Practical application: Avoid NSAIDs, use alternative analgesics, and monitor blood counts. Challenges: Pain management in inflammatory conditions often relies on NSAIDs.

Minocycline Interaction – Concept: Inhibition of CYP2D6 leading to increased levels of certain antidepressants and antipsychotics. Related terms: tetracycline, hyperpigmentation. Explanation: Minocycline raises plasma concentrations of duloxetine, potentially causing serotonin syndrome. Example: Patient on duloxetine experiencing agitation after starting minocycline. Practical application: Consider alternative antibiotics or dose adjustments. Challenges: Minocycline is sometimes chosen for acne, where alternatives may be less effective.

Montelukast Interaction – Concept: Minimal CYP involvement; interactions primarily pharmacodynamic with other leukotriene modifiers. Related terms: leukotriene receptor antagonist, asthma. Explanation: Concurrent use with zileuton (5-lipoxygenase inhibitor) may increase risk of hepatotoxicity. Example: Patient on both agents developing elevated liver enzymes. Practical application: Monitor liver function tests when dual therapy is unavoidable.