

Handbook of Treatment Algorithms for Medical and Pharmacy Students

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DEDICATION

This textbook is dedicated to

The pharmacy/medical students of today and tomorrow, whose passion for learning and commitment to patient care will shape the future of our profession. The educators who inspire and mentor the next generation of pharmacists/doctors, imparting not only knowledge but also the values and critical thinking skills essential to pharmaceutical care.

The practicing pharmacists/doctors who daily represent the vital role in healthcare through their clinical expertise, compassionate patient interactions, and tireless advocacy for optimal medication therapy.

The patients whose needs remain at the center of our professional purpose, reminding us that behind every prescription is a person deserving of our best care.

And to all who strive to advance the science and practice of pharmacy in service of human health and wellbeing.

"May this book serve as a trusted companion in your professional journey"

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Special recognition is due to the pharmacy/medical organizations and institutions that provided access to resources, clinical practice guidelines, and case studies that enrich this work. Their commitment to advancing pharmacy education aligns with our vision for this textbook.

We acknowledge the editorial and production staff whose attention to detail, design expertise, and tireless efforts have transformed manuscript pages into a polished, accessible educational tool.

Finally, we express our gratitude to our families, colleagues, and mentors who supported us throughout this project with their patience, encouragement, and understanding. Their unwavering support made this collaborative endeavor possible.

While we have strived hard for accuracy and comprehensiveness, we welcome feedback from readers as we continuously seek to improve future editions of this work.

CHAPTER 1

TREATMENT ALGORITHMS FOR CARDIOVASCULAR DISORDERS

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Abstract

Treatment algorithms for cardiovascular disorders rely on evidence-based, stepwise clinical pathways. The management of hypertension begins with accurate diagnosis and ASCVD risk stratification, followed by foundational lifestyle modifications. Pharmacological therapy is then initiated, guided by blood pressure targets and compelling indications, often requiring stepwise addition of first-line agents like diuretics, CCBs, or RAS-blockers. Coronary artery disease management is bifurcated: stable ischemic heart disease is managed with guideline-directed medical therapy (GDMT) for event prevention and symptom control, whereas acute coronary syndromes (ACS) demand time-sensitive reperfusion for STEMI or risk-based invasive strategies for NSTEMI. Heart failure algorithms are stratified by ejection fraction. HFrEF management is built on four concurrent pillar therapies—ARNI/ACEi/ARB, beta-blockers, MRAs, and SGLT2 inhibitors. HFpEF management centers on SGLT2 inhibitors and rigorous comorbidity control. The approach to atrial fibrillation rests on three pillars: anticoagulation based on stroke risk, rate control, and rhythm control strategies. Algorithms for ventricular arrhythmias are dictated by hemodynamic stability, prioritizing defibrillation for unstable patients and ICDs for long-term prevention. Valvular heart disease interventions, whether surgical or transcatheter, are primarily triggered by the onset of symptoms or objective evidence of ventricular dysfunction.

Keywords: *Cardiovascular Algorithms, Guideline-Directed Medical Therapy (GDMT), Hypertension, Acute Coronary Syndrome, Heart Failure*

Learning Objectives

After completion of the chapter, the learners should be able to:

- Identify first-line pharmacological classes for Stage 1 hypertension based on current ACC/AHA guidelines.
- Explain the pathophysiologic differences in the treatment algorithms for Heart Failure with Reduced Ejection Fraction (HFrEF) versus Preserved Ejection Fraction (HFpEF).
- Select the appropriate anticoagulation and rate/rhythm control algorithm for a new patient presenting with atrial fibrillation.
- Differentiate the immediate treatment algorithms for a patient with ST-Elevation Myocardial Infarction (STEMI) versus Non-ST-Elevation Myocardial Infarction (NSTEMI).
- Justify the choice of therapy (e.g., medical management vs. revascularization) for a patient with stable coronary artery disease based on symptoms and risk.

HYPERTENSION

Hypertension, or high blood pressure, is a critical modifiable risk factor for cardiovascular disease, stroke, and chronic kidney disease. Its management algorithm is foundational to preventive cardiology and requires meticulous assessment and long-term stewardship.

Pathophysiology

Essential hypertension is a complex polygenic disorder resulting from a persistent elevation of systemic blood pressure. Its pathophysiology is multifactorial, involving a dysregulation of cardiovascular control systems. Two primary mechanisms are the Sympathetic Nervous System (SNS) and the Renin-Angiotensin-Aldosterone System (RAAS). Overactivity of the SNS leads to increased heart rate, cardiac contractility, and peripheral vasoconstriction. It also stimulates renin release from the kidneys, activating the RAAS. The cascade culminates in Angiotensin II, a potent vasoconstrictor that also stimulates the adrenal cortex to release aldosterone. Aldosterone, in turn, promotes sodium and water reabsorption in the distal nephron, expanding plasma volume. Over time, this sustained pressure

load causes endothelial dysfunction and vascular remodeling, leading to arterial stiffness and a "reset" of baroreceptors, which perpetuates the hypertensive state

Diagnosis and Initial Assessment

The therapeutic algorithm begins with accurate diagnosis. This is established from an average of two or more readings taken on two or more separate occasions, ideally using automated oscillometric devices or out-of-office measurements (ambulatory or home blood pressure monitoring) to confirm the diagnosis and rule out white-coat hypertension. Initial assessment involves quantifying the blood pressure stage (e.g., ACC/AHA Stage 1, Stage 2) and performing a comprehensive 10-year atherosclerotic cardiovascular disease (ASCVD) risk calculation. Concurrently, the clinician must evaluate for target-organ damage (e.g., left ventricular hypertrophy, retinopathy, albuminuria) and screen for potential secondary causes, especially in cases of new-onset, resistant, or very high blood pressure.

Differential Diagnosis

While over 90% of hypertension is primary (essential), a crucial early step is to consider secondary causes, particularly in atypical presentations. The differential includes renal parenchymal disease, renovascular disease (renal artery stenosis), primary aldosteronism (which is increasingly recognized as common), obstructive sleep apnea, and substance-induced hypertension (e.g., NSAIDs, decongestants, illicit substances). Less common causes include pheochromocytoma, Cushing's syndrome, and thyroid or parathyroid abnormalities.

Non-pharmacological Interventions

Lifestyle modification is a universal component of all hypertension treatment algorithms and is the primary intervention for elevated blood pressure or Stage 1 hypertension with low ASCVD risk. This includes adherence to a reduced-sodium diet (<1500 mg/day ideally) such as the DASH (Dietary Approaches to Stop Hypertension) eating plan, a diet rich in fruits, vegetables, and low-fat dairy. Regular aerobic exercise (e.g., 90-150 minutes/week), moderation of alcohol

consumption, and smoking cessation are equally critical. Weight loss in overweight or obese individuals can have a profound impact.

Treatment Algorithm

The management of hypertension (HTN) is a stepwise process based on accurate blood pressure (BP) measurement, cardiovascular risk stratification, and selection of patient-specific pharmacotherapy.

Step 1: Diagnosis and Risk Stratification

The therapeutic pathway begins with accurate diagnosis, which is confirmed with an average of two or more readings on two or more separate occasions. A reading of BP $\geq 130/80$ mmHg is classified as ACC/AHA Stage 1, while $\geq 140/90$ mmHg is Stage 2. Ambulatory BP monitoring (ABPM) is considered the gold standard to exclude white-coat hypertension.

Following diagnosis, risk stratification is critical. The decision-making process diverges based on the 10-year atherosclerotic cardiovascular disease (ASCVD) risk, often calculated using the Pooled Cohort Equations. For Elevated BP (120-129/<80), the recommendation is non-pharmacological therapy only. For Stage 1 HTN (130-139/80-89), the approach depends on risk: if ASCVD risk is below 10% and the patient has no clinical ASCVD, diabetes (DM), or chronic kidney disease (CKD), non-pharmacological therapy is the sole initial intervention, with reassessment in 3-6 months. However, if the risk is 10% or higher, or these comorbidities are present, both non-pharmacological therapy and a first-line pharmacological agent are initiated. For Stage 2 HTN ($\geq 140/90$), the standard of care is to initiate non-pharmacological therapy along with two first-line pharmacological agents from different classes.

Step 2: Non-Pharmacological Interventions (Universal)

Lifestyle modification is a foundational, non-negotiable step in all hypertension management plans. This includes weight loss to aim for a BMI between 18.5-24.9 kg/m², adherence to the DASH (Dietary Approaches to Stop Hypertension) diet, and significant sodium restriction to less than 1500 mg/day. Regular aerobic exercise for 90-150 minutes per week, moderation of

alcohol (to ≤ 2 drinks/day for men or ≤ 1 for women), and smoking cessation are also critical components.

Table 1.1: First-Line Antihypertensive Therapy

Compelling Indication	Preferred First-Line Agent(s)
Heart Failure (HFrEF)	ARNI/ACEi/ARB, Beta-Blocker, MRA, SGLT2i
Post-Myocardial Infarction	Beta-Blocker, ACEi/ARB
Stable Ischemic Heart Disease	Beta-Blocker, ACEi/ARB
Chronic Kidney Disease (CKD)	ACEi or ARB (esp. with albuminuria)
Diabetes Mellitus	ACEi or ARB (esp. with albuminuria)
Stroke (Secondary Prevention)	Thiazide Diuretic, ACEi/ARB
African Ancestry (no CKD/HF)	Thiazide Diuretic or CCB

Step 3: Initial Pharmacological Selection

The first-line classes of medications include thiazide diuretics, Calcium Channel Blockers (CCBs), ACE Inhibitors (ACEi), or Angiotensin II Receptor Blockers (ARBs). The selection process is heavily influenced by patient comorbidities, or "compelling indications."

In patients with no comorbidities, any first-line agent is acceptable, though thiazides or CCBs may demonstrate more effectiveness as initial monotherapy in Black adults. For patients with Chronic Kidney Disease (Stage 3+ or with albuminuria), the therapeutic pathway strongly prefers an ACEi or ARB to slow CKD progression. Similarly, individuals with Diabetes Mellitus and albuminuria should be preferentially started on an ACEi or ARB. In cases of Heart Failure with Reduced Ejection Fraction (HFrEF), the medication choices are dictated by HFrEF's own guidelines, which include ACEi/ARB/ARNI and beta-blockers, but not CCBs as a first-line option. For Stable Ischemic Heart Disease, beta-blockers and an ACEi or ARB are preferred. When

END OF PREVIEW

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