Electrocardiography for Healthcare Professionals
Chapter 10
Pacemaker Rhythms and Bundle Branch Block

Learning Outcomes
10.1 Describe the various pacemaker rhythms
10.2 Identify pacemaker rhythms using the criteria for classification and explain how the rhythm may affect the patient including basic patient care and treatment.
10.3 Summarize pacemaker complications relative to the ECG tracing.
10.4 Identify bundle branch block using the criteria for classification and explain how the rhythm occurs and may affect the patient.

10.1 Introduction to Pacemaker Rhythms
- Also known as artificial pacemakers
- Deliver electrical impulse to myocardium, causing cells to depolarize
- Provides small amounts of electrical current in predetermined intervals

10.1 Introduction to Pacemaker Rhythms (Cont’d)
- Mimics the normal pacemaker of the heart
- Can pace the atria, ventricles, or both
- Usually implanted under the skin

10.1 Introduction to Pacemaker Rhythms (Cont’d)
- Performing ECG on patient with pacemaker may require additional training
- Each pacemaker is individually set for the desired heart rate and electrical current

10.1 Introduction to Pacemaker Rhythms (Cont’d)
- Atrial pacing is used alone when the AV node and ventricular conduction are performing correctly
- Performing ECG on patient with pacemaker may require additional training

10.1 Introduction to Pacemaker Rhythms (Cont’d)
- Each pacemaker is individually set for the desired heart rate and electrical current
- Atrial pacing is used alone when the AV node and ventricular conduction are performing correctly

10.1 Introduction to Pacemaker Rhythms (Cont’d)
- Atrioventricular sequential pacing
  - provides direct stimulation of the atria and ventricles in a sequence pattern
  - allows the atria to contract completely prior to the ventricles to allow an atrial kick

10.1 Introduction to Pacemaker Rhythms (Cont’d)
- Atrioventricular sequential pacing (Cont’d)
Atrial kick provides extra blood supply needed for normal cardiac output.

**10.1 Electronic Pacemaker Rhythms (Cont'd)**

**10.1 Pacemaker Safety**
- Electrical current from pacemaker cannot be transmitted to those who encounter the patient.
- The skin does not conduct electricity

**10.1 Apply Your Knowledge**
What is the advantage of atrioventricular pacing?

**Answer:** It mimics the normal cardiac conduction system and allows for the atria to contract completely prior to the ventricles to allow for an atrial kick.

**10.2 Evaluating Pacemaker Function**
- Based on ECG tracings
- Determine the presence of a pulse with each captured beat
  - Capture is the ability of the heart muscle to respond to electrical stimulation and depolarize the myocardial tissue

**10.2 Evaluating Pacemaker Function (Cont'd)**
- Pacing spike
  - Thin spike on ECG tracing indicating electrical current from pacemaker
  - After spike, either a P wave or wide QRS complex or both will appear, depending on which chamber is being paced

**10.2 Evaluating Pacemaker Function (Cont'd)**
- AV delay
  - Similar to PR interval on normal rhythm tracing
  - Measured from atrial spike to ventricular spike
  - Normally 0.12-0.20 second

**10.2 Seven Steps To Evaluating Pacemaker ECG Tracing**
- Step 1 - What are the rate and regularity of the paced rhythm?
- Step 2 - What are the rate and regularity of the intrinsic rhythm?
- Step 3 - Is the atrial lead sensing appropriate?
- Step 4 - Is atrial capture present?

**10.2 Seven Steps To Evaluating Pacemaker ECG Tracing (Cont'd)**
- Step 5 - Is AV delay appropriate?
- Step 6 - Is ventricular sensing appropriate?
- Step 7 - Is ventricular capture present?
  - Note: If patient does not have an AV sequential pacemaker, steps 3 through 5 can be eliminated.
10.2 Apply Your Knowledge
What term refers to the ability of the heart muscle to respond to electrical stimulation and depolarize the myocardial tissue?

Answer: Capture

10.3 Pacemaker Complications Relative to the ECG Tracing
■ Weak battery complications
  □ Slow firing rates
  □ Less effective sensing capabilities
  □ Less than predetermined electrical current
■ Program complication
  □ Sensing capability too low for pacemaker to see normal contractions

10.3 Pacemaker Complications Relative to the ECG Tracing (Cont’d)
■ Malfunctioning – failure to pace
■ Malsensing – failure to sense
■ Loss of capture – failure to depolarize
■ Oversensing – perceiving sources other than the heart

10.3 Pacemaker Complications Relative to the ECG Tracing (Cont’d)
■ Recognize normal pacemaker rhythms and possible complications
■ Be aware of differences in ECG waveforms
  - Presence of pacing spike
  - Chamber depolarization characteristics
  - Atrioventricular delay

10.3 Apply Your Knowledge
What is your responsibility in caring for patients with pacemakers?

10.4 Introduction to Bundle Branch Block Dysrhythmias
■ Bundle branch blocks occur:
  □ When one or both of the ventricular pathways are damaged or delayed due to cardiac disease, drugs, or other conditions
  □ Electrical current is not able to travel through the myocardial tissue in the normal manner

10.4 Bundle Branch Block Dysrhythmias
■ Right bundle branch block (RBBB)
  □ Septum is depolarized normally
  □ Left ventricle activated
Current travels to right ventricle

10.4 Bundle Branch Block
Dysrhythmias (Cont'd)
- Left Bundle Branch Block (LBBB)
  - Left conduction pathway is blocked
  - Conduction travels to right ventricle first, then moves to the left side

10.4 Branch Bundle Block Dysrhythmias Criteria
- Specific characteristics of left or right BBB identifiable in leads V1 to V6
- Rhythm
  - May be regular or irregular
  - Depends on underlying rhythm
- Rate – atria and ventricles depend on basic rhythm

10.4 Branch Bundle Block Dysrhythmias Criteria (Cont’d)
- P wave configuration – shape, configuration, deflection, and coordination with QRS complex depend on basic rhythm
- PR interval – normal, 0.12-0.20 second
- QRS duration – 0.12 second or greater, wider QRS complex

10.4 Bundle Branch Blocks
What You Should Know
- Patient exhibits normal effects of basic rhythm
- Widening of QRS complex must be reported to a licensed practitioner immediately
- Condition can deteriorate to complete heart block
- May require pacemaker or Code Blue

10.4 Apply Your Knowledge
Will the QRS complex be of normal duration or widened in a bundle branch block?

ANSWER: Widened; 0.12 second or greater

Chapter Summary
- Electronic or artificial pacemakers
  - deliver an electrical impulse to the myocardium causing cells to depolarize
  - can pace the atria, ventricles, or both
  - function can be evaluated based on ECG tracings

Chapter Summary (Cont’d)
- Pacemaker failure will be evident on the ECG tracings
  - recognize normal pacemaker rhythms
  - note differences in ECG waveforms:
    - presence of pacing spike, chamber depolarization,
and atrioventricular delay

**Chapter Summary (Cont’d)**

- **Bundle Branch Blocks**
  - one or both of the ventricular pathways are damaged or delayed
  - reflected in a wider QRS complex
  - monitor patient for deterioration and report rhythm to licensed practitioner