

TABLE OF CONTENTS

Doppler Echocardiography for the Small Animal Practitioner

Preface

1 The Basics: What You Need to Know 1

Doppler Principles as They Apply to Accuracy and Quality of the Exam 1

Doppler shift 1

Types of Doppler 2

Advantages and disadvantages of each type of Doppler 4

The spectral display 4

The color display 6

Nyquist limit and aliasing 8

Accuracy of spectral flow information 12

Optimizing Doppler Displays 14

Color flow 14

Spectral Doppler 19

Laminar and Turbulent Flow 21

Normal laminar flow 21

Turbulent flow 21

Causes of spectral broadening 22

2 The Doppler Examination 23

Spectral Doppler 23

Normal spectral flows in the heart 23

Mitral valve 23

Aorta and LVOT 26

Pulmonary artery and RVOT 27

Left ventricular isovolumic relaxation time (IVRT) 31

Pulmonary venous flow 32

Left auricular flow 32

Color Flow Doppler 37

Normal color flow in the heart 37

Mitral valve 37

Aorta 38

Pulmonary artery 43

Tricuspid valve 47

3 Applications 55

Pressure Gradients (PGs) 55

PG meaning 55

Normal pressures in the heart and vessels 55

Bernoulli equation 55

Modified equation 55

How can blood flow when pressures in the ventricles and great vessels are the same? 57

Factors Affecting Flow Velocities 57

Volume 57

Narrowed pathway 57

Pressure 57

Limitations of the simplified Bernoulli equation 59

Common Applications of PG in Acquired Heart Disease 59

Using mitral regurgitation 59

Hypertrophic cardiomyopathy 62

Pulmonary hypertension 63

Diastolic Function and Doppler 66

Definitions 66

Classes of diastolic dysfunction 66

Overview of diastolic function 72

4 Doppler Features in Common Acquired Cardiac Diseases 77

Chronic Valve Disease 77

2D and M-mode features 77

Color flow evaluation 77

Spectral Doppler 80

Dilated Cardiomyopathy 82

2D and M-mode features 82

Color flow evaluation 84

Spectral Doppler 84

Hypertrophic Obstructive Cardiomyopathy 84

2D and M-mode features 84

Color flow evaluation 85

Spectral Doppler 87

Diastolic function 88

Dynamic Right Ventricular Outflow Tract Obstruction (DRVOTO) 88

2D and M-mode features 88

Color flow evaluation 90

Spectral Doppler 90

Nonspecific Cardiomyopathy 90

2D and M-mode features 90

These result in diminishing systolic function 90

Color flow evaluation 90

Spectral Doppler 91

Pulmonary Hypertension 92

2D and M-mode features 92

Color flow evaluation 93

Spectral Doppler 93

Appendix 1 Spectral Doppler Reference Ranges for the Dog and Cat 99

Appendix 2 Abbreviations 103

Recommended Reading 105

Index 107.