Contents

I. Introduction 1
II. Physical Principles of Ultrasonic Diagnosis 3
III. Technical Equipment for Ultrasonic Diagnostic Scanning 12
   A. Echo Reflection of Pulsed Ultrasonic Waves 12
      1. A Mode 13
2. M Mode 14
3. B Mode, B Scan 14
B. Formation of the Scan 14
C. Real-Time Scanner 17
D. Changing the Setting and Calibration of the Equipment 18
IV. Effects and Hazards of Ultrasound. 22
A. Physical and Chemical Effects of Ultrasound 22
   1. Mechanical Effects 22
   2. Thermal Effects 23
   3. Chemical Effects. 23
B. Biologic Effects of Ultrasound. 24
   1. Effects on Cells, Tissues and Organs in Animal Experiments 25
   2. Effects on Cell Cultures 26
   3. Effects on Chromosomes 27
   4. Effects on Live Spermatozoa 31
   5. Effects on Animal Behavior 32
   6. Effects in Clinical Obstetrics 33
V. Diagnostic Procedure 36
VI. Diagnostic Application 39
A. The Uterus. 41
   1. The Nonpregnant Uterus 44
   2. The Uterus in Normal Pregnancy. 46
   3. The Uterus in Complicated or Disturbed Pregnancy 48
B. Gestational Sac. 49
   1. The Gestational Sac before the 12th Week of Gestation 51
      a) Ultrasound Pattern and Shape of the Gestational Sac 51
      b) Diameters of the Gestational Sac 51
      c) Areas of the Gestational Sac 56
      d) Estimated Volume of the Gestational Sac 59
      e) Implantation of the Gestational Sac 62
      f) Signs of Anomaly 64
      g) Double Sac 65
   2. The Gestational Sac until the End of Early Pregnancy 65
      a) Diameters of the Gestational Sac 66
      b) Estimated Volume of the Gestational Sac 72

Contents VI

C. The Placenta. 74
   1. Ultrasound Pattern of the Placenta 75
   2. Placental Location and Shape 75
   3. Changes in Placental Location 78
D. Hydatidiform Moles. 79
1. Ultrasound Pattern of Hydatidiform Moles 79
2. Partial Mole, Mole with a Coexistent Fetus 80
3. Differential Diagnosis by Ultrasound. 81
E. The Fetus 82
1. Demonstration of a Fetus 82
2. Signs of Fetal Life 83
3. Crown-Rump Length 84
4. Biparietal Diameter 87
5. Fetal Malformation and Intrauterine Fetal Death 93
F. Multiple Pregnancies 95
1. Diagnosis by Number of Gestational Sacs 97
2. Diagnosis by Fetal Echoes 98
G. Ectopic Pregnancy 99
1. Ultrasound Patterns 99
2. Differential Diagnosis by Ultrasound 100
VII. Fetal Movements and Fetal Behavior 102
A. Earlier Incidental Observations 103
B. Systematic Observations and Planned Experiments in vitro 105
C. Fundamentals of the Development of Nervous System Function 108
D. Observations of Intrauterine Fetal Movements 111
1. Basic Observations of Fetal Movements 111
2. Space for Movements (Fetal Volume vs. Gestational Sac Volume) 113
E. Differentiation of Fetal Movements 116
1. Strong and Brisk Movements 117
2. Slow and Sluggish Spontaneous Movements 119
3. Absence of Spontaneous Movements 119
4. Passive Fetal Movements 120
F. Some Implications of Different Motor Activities 120
1. Correlation with Clinical Findings 121
2. Correlation with Outcome of Pregnancy 123
3. Correlation with Hormonal Parameters 124
4. Motor Provocation Test 126
VIII. Summary and Perspectives 128
IX. Acknowledgements 130
X. References 131