

VOLUME 1

**Neonatal
and
Perinatal
Medicine**

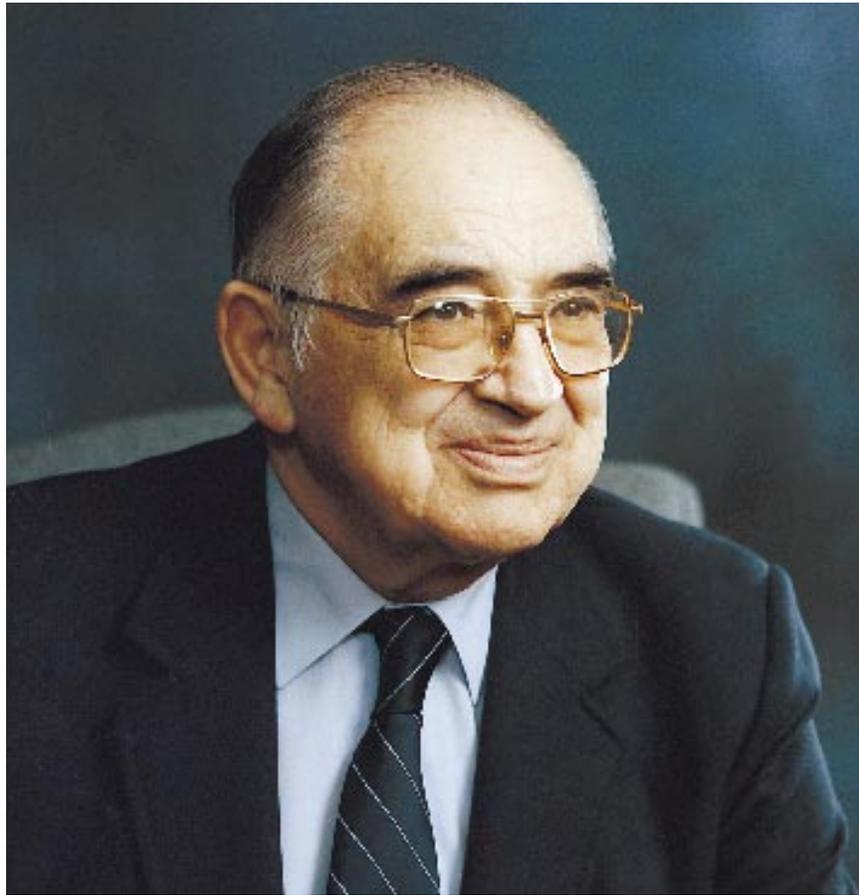
*Atlas of the
Newborn*

Rudolph

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Newborn*



Arnold J. Rudolph, M.D.
(Deceased)
Professor of Pediatrics
Baylor Medical College
Houston, Texas

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Newborn*

Arnold J. Rudolph, M.D.
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1997

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Foreword

Sir William Osler stated, "There is no more difficult task in medicine than the art of observation." The late Arnold Jack Rudolph was an internationally renowned neonatologist, a teacher's teacher, and, above all, one who constantly reminded us about how much could be learned by simply observing, in his case, the newborn infant.

This color atlas of neonatology represents a distillation of more than 50 years of observing normal and abnormal newborn infants. The *Atlas* begins with a section on the placenta, its membranes, and the umbilical cord. Jack Rudolph delighted in giving a lecture entitled "Don't Make Mirth of the Afterbirth," in which he captivated audiences by showing them how much you could learn about the newborn infant from simply observing the placenta, its membranes, and the umbilical cord.

In a few more than 60 photomicrographs, we learn to read the placenta and gain insight into such disorders as intrauterine growth retardation, omphalitis, cytomegalic inclusion disease, congenital syphilis, and congenital neuroblastoma. Congenital abnormalities of every organ system are depicted along with the appearance of newborn infants who have been subjected in utero to a variety of different drugs, toxins, or chemicals. We also learn to appreciate the manifestations of birth trauma and abnormalities caused by abnormal intrauterine positioning.

More than 250 photographs are used to illustrate the field of neonatal dermatology. The collection of photographs used in this section is superior to that which I have seen in any other textbook or atlas of neonatology or dermatology; this section alone makes this reference a required addition to the library of any clinician interested in the care of infants and children. Photographs of the Kasabach-Merritt syndrome (cavernous hemangioma with thrombocytopenia), Klippel-Trénaunay syndrome, Turner's syndrome, Waardenburg's syndrome, neurocutaneous melanosis, mastocytosis (urticaria pigmentosa), and incon-

tinencia pigmenti (Bloch-Sulzberger syndrome) are among the best that I have seen.

Cutaneous manifestations are associated with many perinatal infections. The varied manifestations of staphylococcal infection of the newborn are depicted vividly in photomicrographs of furunculosis, pyoderma, bullous impetigo, abscesses, parotitis, dacryocystitis, inastitis, cellulitis, omphalitis, and funisitis. Streptococcal cellulitis, *Haemophilus influenzae* cellulitis, and cutaneous manifestations of listeriosis all are depicted. There are numerous photomicrographs of congenital syphilis, showing the typical peripheral desquamative rash on the palms and soles, as well as other potential skin manifestations of congenital syphilis which may produce either vesicular, bullous, or ulcerative lesions. The various radiologic manifestations of congenital syphilis, including pneumonia alba, ascites, growth arrest lines, Wegner's sign, periostitis, and syphilitic osteochondritis, are depicted. Periostitis of the clavicle (Higouménaki's sign) is shown in a photograph that also depicts periostitis of the ribs. A beautiful photomicrograph of Wimberger's sign also has been included; this sign, which may appear in an infant with congenital syphilis, reveals radiolucency due to erosion of the medial aspect of the proximal tibial metaphysis.

The *Atlas* also includes a beautiful set of photographs which delineate the ophthalmologic examination of the newborn. Lesions which may result from trauma, infection, or congenital abnormalities are included. There are numerous photographs of the ocular manifestations of a variety of systemic diseases, such as Tay-Sachs disease, tuberous sclerosis, tyrosinase deficiency, and many more. Photographs of disturbances of each of the various organ systems, or disorders affecting such organ systems, also are included along with numerous photographs of different forms of dwarfism, nonchromosomal syndromes and associations, and chromosomal disorders. In short, this *Atlas* is the complete visual textbook of neonatology and will provide any

physician, nurse, or student with a distillation of 50 years of neonatal experience as viewed through the eyes of a master clinician.

Arnold Jack Rudolph was born in 1918, grew up in South Africa, and graduated from the Witwatersrand Medical School in 1940. Following residency training in pediatrics at the Transvaal Memorial Hospital for Children, he entered private pediatric practice in Johannesburg, South Africa. After almost a decade, he left South Africa and moved to Boston, where he served as a Senior Assistant Resident in Medicine at the Children's Medical Center in Boston, Massachusetts, and subsequently pursued fellowship training in neonatology at the same institution and at the Boston Lying-In Hospital, Children's Medical Center and Harvard Medical School under Dr. Clement A. Smith.

In 1961, Dr. Rudolph came to Baylor College of Medicine in Houston, Texas, the school at which he spent the remainder of his career. He was a master teacher, who received the outstanding teacher award from pediatric medical students on so many occasions that he was elected to the Outstanding Faculty Hall of Fame in 1982. Dr. Rudolph also received numerous awards over the years from the pediatric house staffs for his superb teaching skills.

He was the Director of the Newborn Section in the Department of Pediatrics at Baylor College of Medicine for many years, until he voluntarily relinquished that position in 1986 for reasons related to his health.

Nevertheless, Jack Rudolph continued to work extraordinarily long hours in the care of the newborn infant, and was at the bedside teaching both students and house staff, as well as his colleagues, on a daily basis until just a few months before his death in July 1995.

Although Dr. Rudolph was the author or co-author of more than 100 published papers that appeared in the peer-reviewed medical literature, his most lasting contribution to neonatology and to pediatrics is in the legacy of the numerous medical students, house staff, fellows, and other colleagues whom he taught incessantly about how much one could learn from simply observing the newborn infant. This *Atlas* is a tour de force; it is a spectacular teaching tool that has been developed, collated, and presented by one of the finest clinical neonatologists in the history of medicine. It is an intensely personal volume that, as Dr. Rudolph himself states, "is not intended to rival standard neonatology texts," but rather to supplement them. This statement reveals Dr. Rudolph's innate modesty, since with the exception of some discussion on pathogenesis and treatment, it surpasses most neonatology texts in the wealth of clinical information that one can derive from viewing and imbibing its contents. We owe Dr. Rudolph and those who aided him in this work a debt of gratitude for making available to the medical community an unparalleled visual reference on the normal and abnormal newborn infant.

Ralph D. Feigin, M.D.
June 13, 1996

Preface

I first became attracted to the idea of producing a color atlas of neonatology many years ago. However, the impetus to synthesize my experience and compile this current collection was inspired by the frequent requests from medical students, pediatric house staff, nurses and others to provide them with a color atlas of the clinical material provided in my “slide shows.” For the past few decades I have used the medium of color slides and radiographs as a teaching tool. In these weekly “slide shows” the normal and abnormal, as words never can, are illustrated.

“I cannot define an elephant but I know one when I see one.”¹

The collection of material used has been added to constantly with the support of the pediatric house staff who inform me to “bring your camera” whenever they see an unusual clinical finding or syndrome in the nurseries.

A thorough routine neonatal examination is the inalienable right of every infant. Most newborn babies are healthy and only a relatively small number may require special care. It is important to have the ability to distinguish normal variations and minor findings from the subtle early signs of problems. The theme that recurs most often is that careful clinical assessment, in the traditional sense, is the prerequisite and the essential foundation for understanding the disorders of the newborn. It requires familiarity with the wide range of normal, as well as dermatologic, cardiac, pulmonary, gastrointestinal, genitourinary, neurologic, and musculoskeletal disorders, genetics and syndromes. A background in general pediatrics and a working knowledge of obstetrics are essential. The general layout of the atlas is based on the above. Diseases are assigned to each section on the basis of the most frequent and obvious presenting sign. It seems probable that the findings depicted will change significantly in the decades to come. In this way duplication has

been kept to a minimum. Additional space has been devoted to those areas of neonatal pathology (e.g., examination of the placenta, multiple births and iatrogenesis) which pose particular problems or cause clinical concern.

Obviously, because of limitations of space, it is impossible to be comprehensive and include every rare disorder or syndrome. I have tried to select both typical findings and variations in normal infants and those found in uncommon conditions. Some relevant conditions where individual variations need to be demonstrated are shown in more than one case.

As the present volume is essentially one of my personal experience, it is not intended to rival standard neonatology texts, but is presented as a supplement to them. It seems logical that references should be to standard texts or reviews where discussion on pathogenesis, treatment, and references to original works may be found.

Helen Mintz Hittner, M.D., has been kind enough to contribute the outstanding section on neonatal ophthalmology.

I have done my best to make the necessary acknowledgements to the various sources for the clinical material. If I have inadvertently omitted any of those, I apologize. My most sincere appreciation and thanks to Donna Hamburg, M.D., Kru Ferry, M.D., Michael Gomez, M.D., Virginia Schneider, PA, and Jeff Murray, M.D., who have spent innumerable hours in organizing and culling the material from my large collection. We wish to thank Abraham M. Rudolph, M.D., for his assistance in reviewing the material. We also wish to thank the following people for their photo contributions to this work: Cirilo Sotelo-Avila, Stan Connor, Avory Fanaroff, Milton Finegold, Brian Kershan, Tom Klima, Susan Landers, Gerardo Cabera-Meza, Ken Moise, Don Singer, Edward Singleton.

It is hoped that this atlas will provide neonatologists, pediatricians, family physicians, medical students and nurses with a basis for recognizing a broad spectrum of normal variations and clinical problems as well as provide them with an overall perspective of neonatology, a field in which there continues to be a rapid acceleration of knowledge

and technology. One must bear in mind the caveat that pictures cannot supplant clinical experience in mastering the skill of visual recall.

1. Senile dementia of Alzheimer's type — normal aging or disease? (Editorial) *Lancet* 1989; i:476-477.

Arnold J. Rudolph, M.D.

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Introduction

Although several texts provide extensive written descriptions of disorders of the newborn infant, the senses of touch, hearing and, especially, sight create the most lasting impressions. Over a period of almost five decades, my brother Jack Rudolph diligently recorded in pictorial form his vast experiences in physical examination of the newborn. The *Atlas of the Newborn* reflects a selection from the thousands of color slides in his collection, and truly represents "the art of medicine" as applied to neonatology. A number of unusual or rare conditions are included in this atlas. I consider this fully justified because, if one has not seen or heard of a condition, one cannot diagnose it.

In this, the first in a five-volume series, three main topics are covered. Although it is common practice to discard the afterbirth, or placenta and its membranes, careful examination of this fetal organ often provides insight into conditions affecting the newborn. Thus, it may reveal evidence of intrauterine infection, which may be transmitted to the neonate; of hemorrhage, which may cause asphyxia; or of vascular or developmental anomalies, which may result in intrauterine growth retardation. Many of these placental abnormalities are illustrated in this volume.

Physical forces acting during fetal development, during delivery, or after birth may be responsible for a variety of anomalies in the newborn. The influences of uterine constraint, of fetal position, and of amniotic bands are demonstrated magnificently, with resulting anomalies being related to specific fetal postures. Conditions associated with birth trauma, including fractures, nerve disruptions and other disturbances, are clearly depicted. Many examples of complications resulting from treatment of the newborn, or iatrogenic problems such as vascular complications of umbilical arterial catheterization, are shown graphically.

A major section demonstrates many of the physical anomalies resulting from fetal exposure to various chemicals, such as occurs through maternal drug abuse or administration of pharmacologic agents to the mother during embryonic or fetal development.

This volume will be enormously valuable to obstetricians and neonatologists, as well as to midwives and nurses involved in the delivery and care of the newborn.

Abraham M. Rudolph, M.D.

Chapter 1

The Placenta, Its Membranes, and the Umbilical Cord

The human placenta is a highly sophisticated organ of interface between mother and fetus, often referred to as the “gate-keeper to the fetus.” Careful examination of the placenta, its membranes, and the umbilical cord can prove to be a valuable aid in the diagnosis and treatment of the neonate. Gross examination of the placenta takes five minutes, and more sophisticated examination should be considered when there is poor pregnancy outcome, recognizable malformations or abnormalities, multiple gestation, extremes of amniotic fluid volume, severe intrauterine growth retardation, short umbilical cord (< 32 cm), and profound acidemia. The maternal surface of the placenta (decidual plate) is soft, spongy and dark red; and the fetal surface (chorionic plate) is shiny and steel blue to gray. The placenta, membranes, and umbilical cord weigh approximately 400 to 600 g at birth. The ratio of fetal to placental size increases with gestation, being less than or equal to 1:1 at prior to three months, 4:1 at four to six months, and 6:1 at term. Abnormalities in structure can result in an inefficient transport of oxygen and nutrients to the developing baby. Despite this importance, it is one of the least understood and investigated human organs.

1.1



Figure 1.1. A succenturiate (accessory) lobe is common and has no effect on the fetus. This occurs in about 3 to 5% of deliveries. Its importance arises from the fact that it may be retained within the uterus and cause postpartum bleeding. (Sotelo-Avila, C.)

1.2

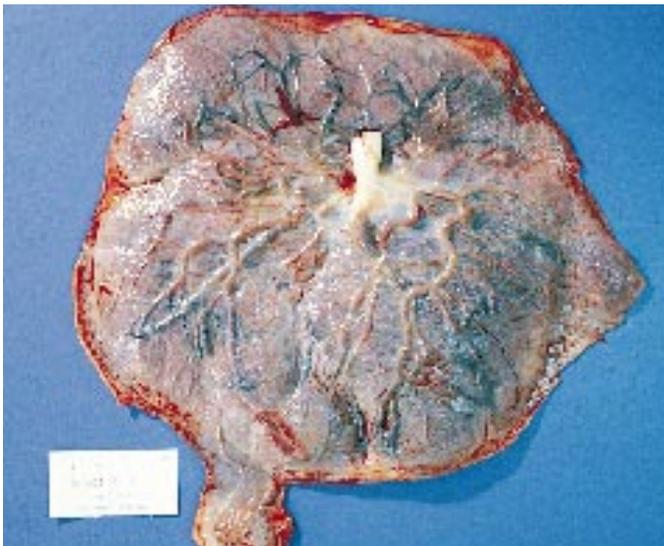
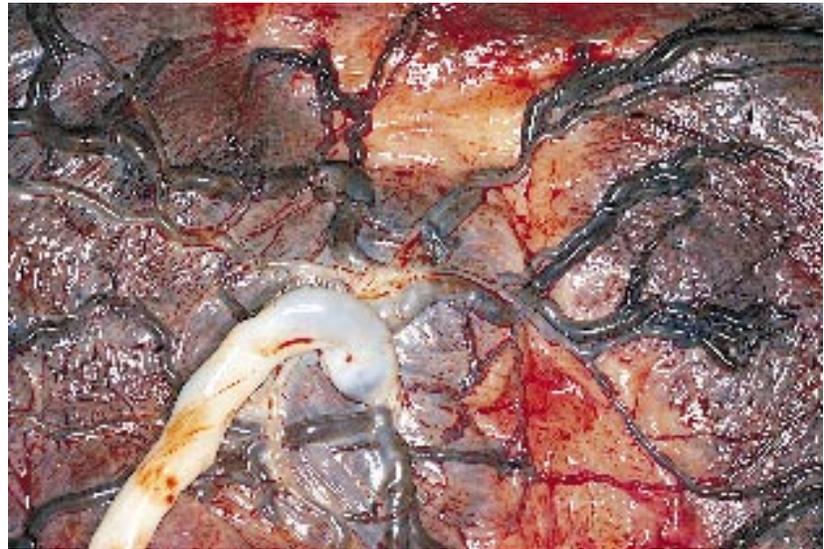


Figure 1.2. Another example of a succenturiate lobe. Note that this is very small and the diagnosis can easily be missed if the placenta is not examined carefully. (Singer, D.)

1.3

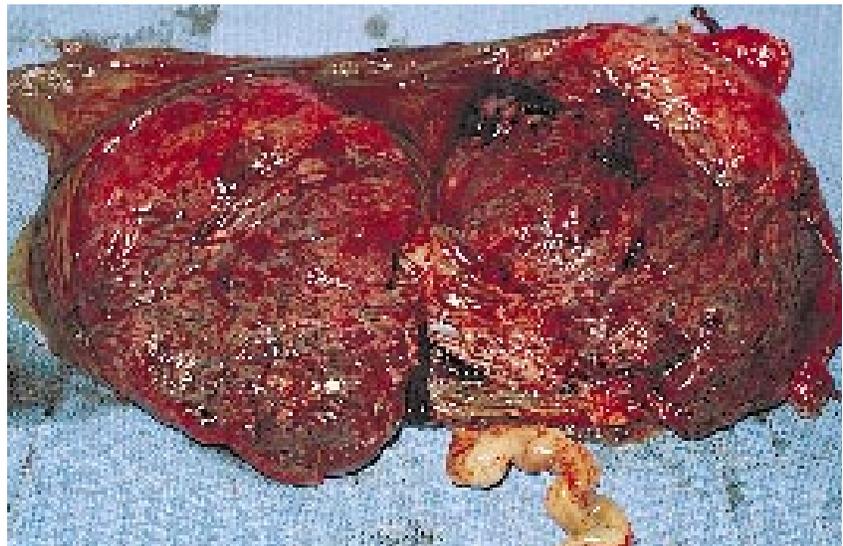


Figure 1.3. Fetal surface of a bipartite or bilobed placenta (placenta duplex). The two parts of the placenta are of nearly equal size and this occurs in about 1% of deliveries. Note that the lobes are separated by membranes. The umbilical cord may insert into one or other lobe, or may insert between the two.



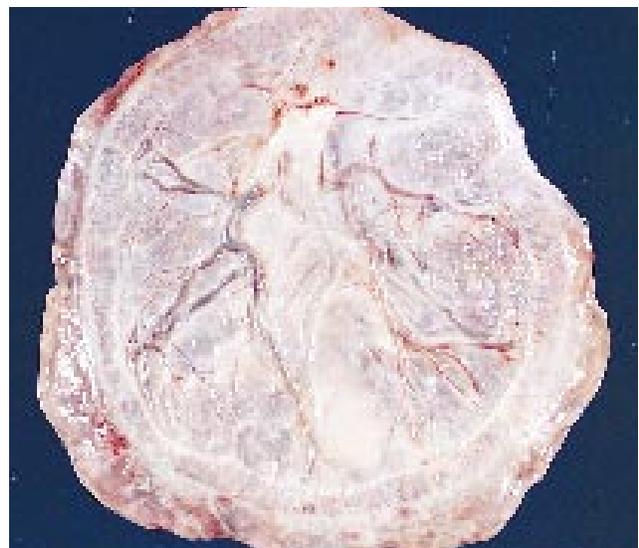
1.4

Figure 1.4. A close-up of the same placenta. The risk to the infant is that the vessels crossing the membranes may rupture, resulting in massive blood loss. It is suggested that this condition arises as a result of superficial implantation of the ovum.



1.5

Figure 1.5. Another example of a placenta duplex showing the maternal surface.



1.6

Figure 1.6. In a circumvallate (circummarginate) placenta the fetal surface may be reduced if decidual tissue has made its way between the amnion and chorion. This appears as a yellow, peripheral, hyalinized fold circumscribing the edge of the chorionic plate. This type of placenta has been reported to be a cause of antepartum bleeding and premature labor.

1.7

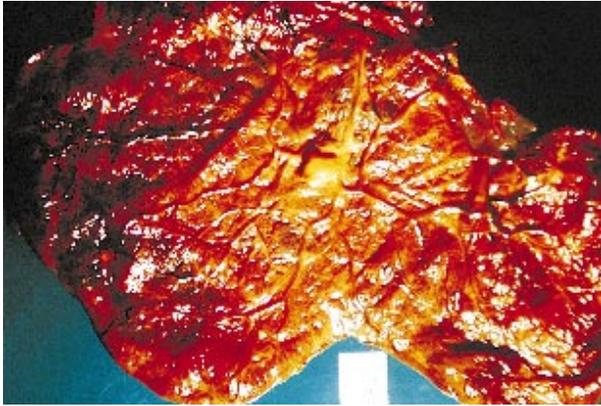


Figure 1.7. This is an example of placenta membranacea (placenta diffusa). These placentas are rare. The ovum implants too deeply, the villae of the chorion fail to regress, and the placental tissue develops over the entire surface of the chorion. The placenta is very thin and is associated with poor fetal growth and antepartum hemorrhage. There may be previa type bleeding.

1.8

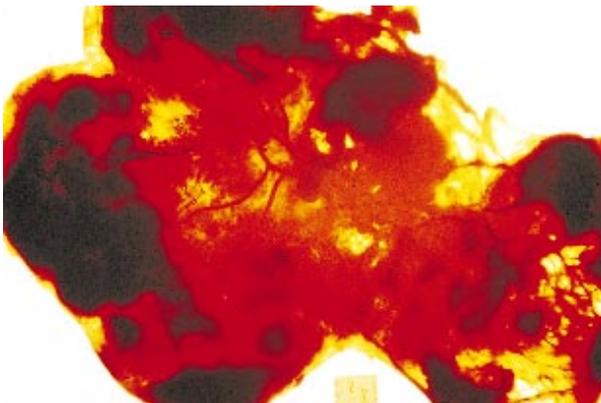


Figure 1.8. Transillumination of the same placenta shows the thinness of this type of placenta and that islets of placental tissue are present throughout the membranes. Pregnancy rarely goes to term and fetal death is common. If pregnancy continues to term, placenta accreta may occur. In this condition, there is failure of separation of the placenta during the third stage of labor and there may be severe postpartum hemorrhage.

1.9



Figure 1.9. An annular (“girdle” or ring-shaped) is a rare form of placenta which resembles a segment of a hollow cylinder. Sometimes a complex ring of placental tissue is seen. More commonly a portion of the ring undergoes atrophy resulting in a placenta which is approximately horseshoe-shaped. This type of placenta is probably a variant of placenta membranacea. Its clinical significance is uncertain but it appears to be associated with a high incidence of both ante- and postpartum bleeding. The fetus is often small for gestational age. (Connor, S.)

1.10

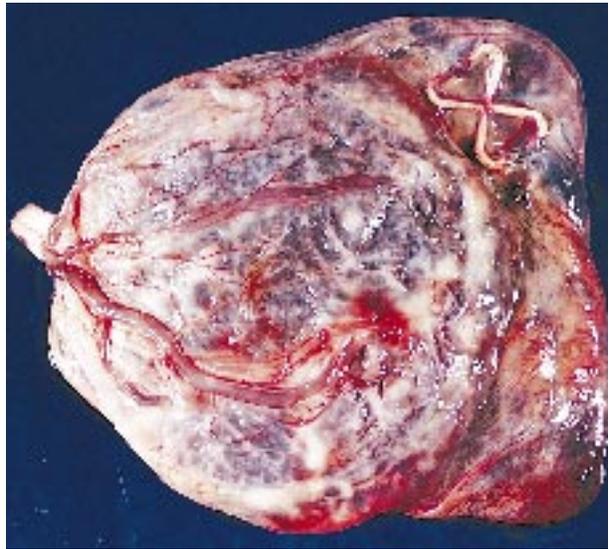


Figure 1.10. This otherwise normal placenta shows the presence of an intrauterine contraceptive device, indicating that it did not prevent pregnancy.

1.11



Figure 1.11. In premature separation of the placenta (abruptio placentae) there may be massive bleeding of maternal origin. Note the massive blood loss on the left of the maternal surface of the placenta. In these cases, there may be severe fetal asphyxia or death. The infant in this case had blood in stool (melena neonatorum) at birth. This was shown to be ingested maternal blood by the Apt test.

1.12

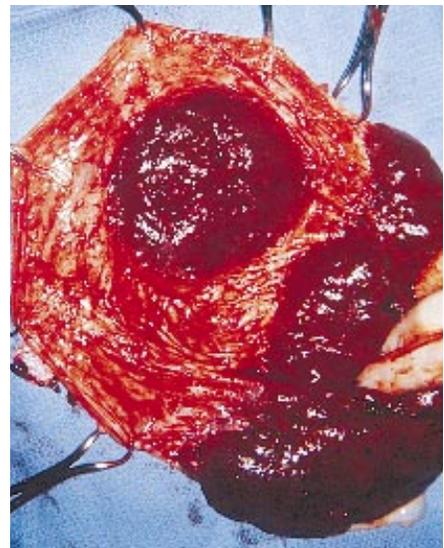


Figure 1.12. Another example of abruptio placentae. A large abruptio placentae may result in poor growth of the infant and fetal blood loss.

1.13

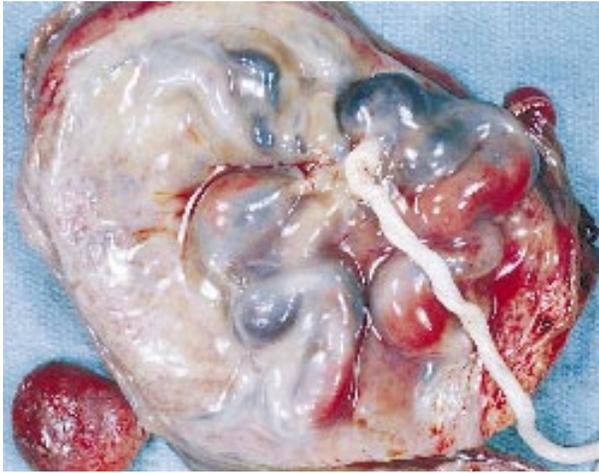


Figure 1.13. Fetal surface of a placenta with a large chorangioma (hemangioma of the placenta). These infants may present with severe nonimmune hydrops fetalis. The majority of cases of hydrops fetalis are now due to nonimmune causes.

1.14



Figure 1.14. Maternal surface of the same placenta. Note the placental enlargement due to the chorangioma and edema. If the placenta is not examined, this cause of nonimmune hydrops fetalis may be missed.

1.15

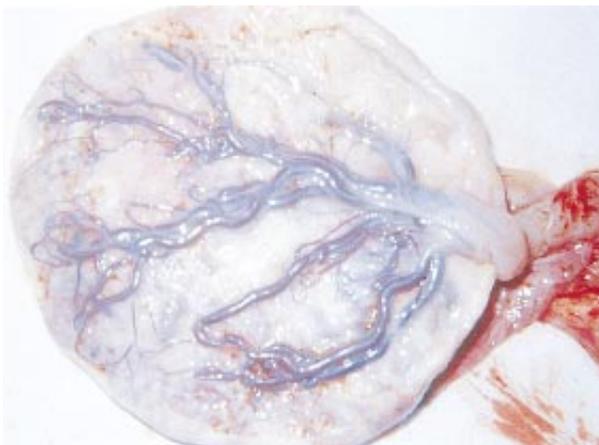


Figure 1.15. A calcified, small placenta. This infant had severe intrauterine growth retardation at term as a result of poor fetal nutrition.

1.16



Figure 1.16. In velamentous insertion of the cord the umbilical vessels traverse the fetal membranes unsupported by either the umbilical cord or by placental tissue. If tearing of these unsupported vessels occurs before or during delivery, it can result in massive fetal blood loss.

1.17



Figure 1.17. Another example of velamentous insertion of the cord. Note the vessels traversing the membranes before inserting into the fetal surface of the placenta. The vessels, lying in loose unsupported tissue, may easily stretch and tear, especially if they cross the cervical os and result in vasa previa with massive blood loss. (Sotelo-Avila, C.)

1.18



Figure 1.18. An example of velamentous insertion of the cord. Note the large vessels exposed in the membranes before they insert into the placental tissue, a section of which is shown at the top. Velamentous insertion of the cord occurs in 0.5 to 1% of singleton births, in 7% of twin births, and in 30 to 40% of triplet births. (Sotelo-Avila, C.)

1.19

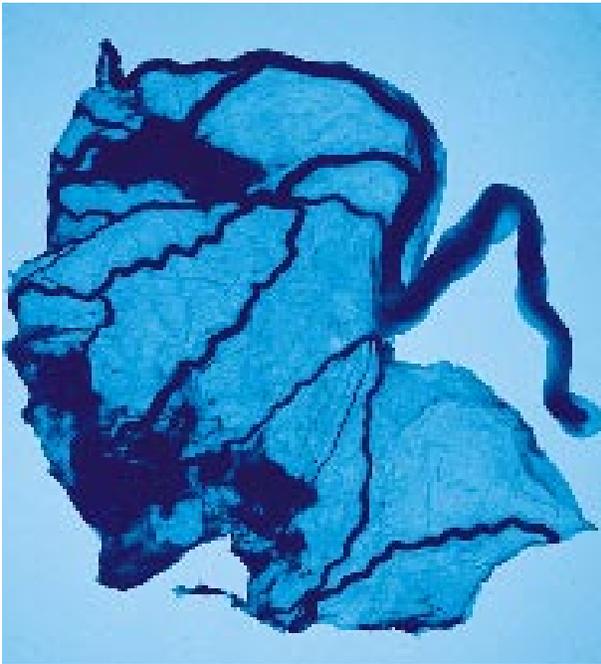


Figure 1.19. Transillumination of the placenta shown in Figure 1.18. (Sotelo-Avila, C.)

1.20



Figure 1.20. Fetus born in a caul. Note that the membranes completely surround the fetus and that the umbilical cord (nuchal cord) encircles the neck twice. A cord around the neck once occurs in about 20%, and twice in about 2% of pregnancies. Whether the cord causes any problems depends on its tightness around the neck. (Klima, T.)

1.21



Figure 1.21. Note the petechiae of the face and head and the subconjunctival hemorrhages in this infant who had a long cord around the neck. The normal umbilical cord is 40 to 60 cm long. Long cords (>70 cm) are more apt to be looped around the neck or an extremity of the fetus or to have true knots. Extremely short cords (<30 cm) may lead to abruptio placentae, inversion of the uterus, and intrafunicular hemorrhage (bleeding within the umbilical cord).