assays, it has been determined that an additional 20% of early pregnancies in otherwise healthy women terminate spontaneously, many without notice. In most individual instances, the mechanisms leading to early loss of pregnancy are unknown. However, multiple fetal and maternal causes of spontaneous abortion have been identified. Among the most important are the following:

- *Fetal chromosomal anomalies*, such as aneuploidy, polyploidy, and translocations, are present in approximately 50% of early abortuses. More subtle genetic defects, for which routine genetic testing is not readily available, account for an additional fraction of abortions.
- *Maternal endocrine factors*, including luteal-phase defect, poorly controlled diabetes, and other uncorrected endocrine disorders
- *Physical defects of the uterus*, such as submucosal leiomyomas, uterine polyps, or uterine malformations, may prevent or disrupt implantation
- *Systemic disorders affecting the maternal vasculature*, such as antiphospholipid antibody syndrome, coagulopathies, and hypertension
- *Infections* with protozoa (Toxoplasma), bacteria (Mycoplasma, Listeria), or a number of viruses. Ascending infection is particularly common in second-trimester losses.

Ectopic Pregnancy

Ectopic pregnancy refers to implantation of the fetus in a site other than the normal intrauterine location; the most common site is the extrauterine fallopian tube (approximately 90% of cases). Other sites include the ovary, the abdominal cavity, and the intrauterine portion of the fallopian tube (cornual pregnancy). Ectopic pregnancies account for 2% of confirmed pregnancies. The most important predisposing condition, present in 35% to 50% of patients, is prior *pelvic inflammatory disease* resulting in intralumenal fallopian tube scarring (chronic salpingitis). The risk of ectopic pregnancy is also increased with peritubal scarring and adhesions, which may be caused by appendicitis, endometriosis, and previous surgery. In some cases, however, the fallopian tubes are apparently normal. Use of an intrauterine contraceptive device is associated with twofold increase of ectopic pregnancy.

Ovarian pregnancy results from the fertilization and trapping of the ovum within the follicle just at the time of its rupture. Abdominal pregnancies occur when the fertilized ovum fails to enter or drops out of the fimbriated end of the tube. In each abnormal location, the fertilized ovum develops as usual, forming placental tissue, amniotic sac, and fetus. The host implantation site may also develop decidual changes.

MORPHOLOGY

Tubal pregnancy is the most common cause of hematosalpinx (blood-filled fallopian tube) and should always be suspected when a tubal hematoma is present. Initially the embryonal sac, surrounded by immature chorionic villi, implants within the lumen of the fallopian tube. Trophoblastic cells and chorionic villi then invade the wall of the fallopian tube as they would do in the uterus during normal pregnancy. **With time the growth of the gestational sac distends the fallopian tube, causing thinning of the wall and rupture. The rupture frequently results in massive intraperitoneal hemorrhage, which sometimes is fatal.** Less commonly the tubal pregnancy may undergo spontaneous regression and resorption, or be extruded through the fimbriated end of the tube into the abdominal cavity (tubal abortion).

Clinical Features. **Rupture of a tubal pregnancy is a medical emergency**. The clinical course of ectopic tubal pregnancy is characterized by the onset of moderate to severe abdominal pain and vaginal bleeding 6 to 8 weeks after last menstrual period, correlating with distention and then rupture of the fallopian tube. In such cases the patient may rapidly develop *hemorrhagic shock* with signs of an acute abdomen, and therefore early diagnosis is critical. Diagnosis is based on determination of chorionic gonadotropin titers, pelvic sonography, endometrial biopsy (which shows decidua without chorionic villi or implantation site) and/or laparoscopy. Despite advances in early diagnosis, ectopic pregnancy still accounts for 4% to 10% of pregnancy-related deaths.

Disorders of Late Pregnancy

Disorders that occur in the third trimester of pregnancy are related to the complex anatomy of the maturing placenta. Complete interruption of blood flow through the umbilical cord from any cause (e.g., constricting knots or compression) can be lethal to the fetus. Ascending infections involving the chorioamnionic membranes may lead to premature rupture of amniotic membranes and delivery. Retroplacental hemorrhage at the interface of placenta and myometrium (*abruptio placentae*) threatens both mother and fetus. Disruption of the fetal vessels in terminal villi may produce a significant loss of fetal blood with resultant fetal injury or death. Uteroplacental malperfusion can be precipitated by abnormal placental implantation or development, or maternal vascular disease; the effects may range from mild intrauterine growth retardation to severe uteroplacental ischemia, and maternal preeclampsia.

Twin Placentas

Twin pregnancies arise from fertilization of two ova (dizygotic) or from division of one fertilized ovum (monozygotic). There are three basic types of twin placentas (Fig. 22-48): diamnionic dichorionic (which may be fused), diamnionic monochorionic, and monoamnionic monochorionic. Monochorionic placentas imply monozygotic (identical) twins, and the time at which splitting of the developing embryo occurs determines whether one or two amnions are present. Dichorionic placentation may occur with either monozygotic or dizygotic twins and is not specific.

One complication of monochorionic twin pregnancy is *twin-twin transfusion syndrome*. Monochorionic twin placentas have vascular anastomoses that connect the