Chapter 3

Macroscopic Evaluation of the Second- and Third-Trimester Placenta

Selection of Placentas for Pathologic Examination

In general, tissue removed or spontaneously passed from the body must be sent for pathologic examination. Placentas are the notable exception in that they are the only specimens for which routine examination is not required. The Joint Commission on the Accreditation of Hospitals states that "normal placentas" from "normal deliveries" are not required to be examined or submitted to pathology. However, a definition of what is normal is not forthcoming. Although there are a number of options for placental selection, this task is frequently left to obstetricians or other health care workers involved in the delivery, and thus selection is seldom based on specific criteria. This is the least desirable of the possible options discussed below.

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Examination of All Placentas

Most placentas are normal, as are most babies; therefore, examination of all placentas may not be warranted, and from a practical standpoint, may not be possible due to time constraints and other practical and financial considerations, particularly in hospitals with large numbers of deliveries. Nonetheless, a case can be made for this option. First, sporadic examination does not allow the general surgical pathologist or pathology resident *to obtain sufficient background knowledge as to what constitutes a truly normal placenta*. Gross and microscopic examination of many placentas is necessary to have a good base of knowledge of what is and what is not normal. Another reason examination of all placentas may be desirable is today's litigious climate, which makes *the study of placentas highly valuable, particularly in the defense of obstetricians* (see Chap. 26).

Selection Based on Consensus Indications

Another option is selection of placentas based on *relevant indications for submission*, which is a reasonable compromise. The College of American Pathologists coordinated a multidisciplinary working group on placental pathology, which developed indications for submission of placentas for pathologic examination that included **placental, fetal, and maternal indications**. An adapted version is shown in Table 3.1. When delivery personnel are responsible for the selection of placentas, it is recommended that these indications be provided to them and adopted for routine use. If these indications are followed, the likelihood that a placenta with any significant pathology will not be examined is very small.

Initial Selection with Storage of Remaining Placentas

In this approach, *placentas are initially selected for examination* by consensus criteria as above and the remaining placentas are stored in a refrigerator at 4°C. This method is particularly desirable as *a number of neonatal problems are not apparent until several days of life*. Furthermore, it provides a way to "catch" those placentas that should have been submitted but for some reason or another, were not. One week is usually sufficient time for storage, and placentas are almost perfectly preserved for meaningful examination when stored for this time period. If this approach is to be implemented, a refrigerator with seven shelves labeled with the days of the week is recommended. The placentas are placed on the shelf corresponding to the day of delivery, and each day the placentas not selected from 1 week prior are discarded. During that week of storage, neonatologists, obstetricians, or other personnel may request placental examination based on development of neonatal or postpartum problems. This is method used in our institution.

Gross Examination of All Placentas with Microscopic Examination on Selected Placentas

In this scheme, *all placentas are initially examined macroscopically*. Based on gross examination and clinical information, a *portion of them is submitted for microscopic examination*. Those with no significant gross abnormalities

and normal pregnancy and delivery history would only be examined macroscopically. The success of this approach is partially dependent on the skill and experience of the examiner as well as the availability of clinical history. A variation of this technique is macroscopic examination along with *submission of tissue for processing into blocks on all placentas*. Histologic sections are then cut only on selected cases based on gross examination and history as above. If problems occur in the future, the blocks may then be cut. This approach has not commonly been used, and at some institutions regulations may prohibit such a system from being implemented. However, in recent years some malpractice insurance companies have shown interest in this approach as a type of "insurance" against future litigation.

Storage

Placentas should ideally be examined *in the fresh state or at least prior to fixation*. Placentas should **never be frozen** prior to examination, as it makes macroscopic examination difficult and obliterates the most useful histologic characteristics. Specimens that have been *previously frozen will show reddish discoloration of the fetal surface, cord, and membranes due to hemolysis*. Formalin fixation prior to examination is not optimal, as it obscures many macroscopic features, makes examination more difficult, and causes difficulties in the submission of specimens for tissue culture, cytogenetics, and bacteriologic examination. Although some lesions are better visualized after fixation, examination of unfixed placentas affords the opportunity to view lesions in both fresh and fixed states. If storage is needed, placentas should be stored in tightly sealed containers at 4°C.

During storage, the placenta loses some weight to a small extent by evaporation but predominantly by leakage of blood and serum. The freshly examined placenta is thus softer, bloodier, and thicker than one that has been stored. Weight loss is most significant in hydropic or edematous placentas. *After formalin fixation, the placenta will gain approximately 5% in weight*.

Macroscopic Examination

As with examination of any specimen, it is wise to *follow a routine protocol*. This will not only enhance subsequent interpretation, but also provide a systematic approach so that nothing will be omitted. The following is an example of such a procedure for placental examination. Readers are encouraged to tailor this to their personal style and needs. Specific gross lesions are listed by location in tables at the end of the chapter (Tables 3.2–3.6), and Fig. 3.1 gives an example of a gross reporting form useful for macroscopic evaluation.

Instruments

The instruments needed are basic, and consist of a *ruler or tape measure; a long, sharp knife; forceps with teeth; scissors; and a scale*. Mounting the ruler directly over and perpendicular to the cutting board is advantageous, as the cord length, placental diameter, and other measurements can be easily made. The knife should be long, relatively thin, and very sharp. Often

SYNOPTIC REPORT OF MACROSCOPIC PLACENTAL EXAMINATION

Name :_____ Path. #_____ Medical Record #_____

History:_____

_____

_____

GENERAL:

Weight (disk only)_____g

☐ Formalin-fixed

☐ Unfixed

Size_____ x_____ x_____ cm

CORD:

Insertion: ☐ Central
☐ Eccentric
☐ Marginal
☐ Furcate
☐ Interpositional
☐ Velamentous
_____cm from margin

Velamentous vessels:
☐ Intact
☐ Disrupted
☐ Thrombosis

MEMBRANES:

Insertion: ☐ Marginal
☐ Circumvallate
☐ Circummarginate

Color: ☐ Green
☐ Opaque
☐ Brown
☐ Normal
☐ Other_____

Point of rupture from margin: _____cm

☐ Amnion nodosum

☐ Squamous metaplasia

Other_____

SURFACE VESSELS ABNORMALITIES:_____

TWINS: ☐ Yes
☐ No

HIGHER MULTIPLES:_____

Fused: ☐ Yes
☐ No
☐ DiDi
☐ DiMo
☐ MoMo

Anastomoses_____

Cord Vessels: ☐ 3
☐ 2
☐ 4

Thrombosis: ☐ Yes
☐ No

Knots: ☐ Yes
☐ No

Length: _____ cm Diameter_____ cm

Coiling: ☐ Left
☐ Right
☐ None or minimal
☐ Marked

Discoloration: ☐ Green
☐ Yellow
☐ Brown
☐ Other_____

Other lesions_____

MATERNAL SURFACE:

Intact: ☐ Yes
☐ No

Color: ☐ Normal
☐ Pale
☐ Congested

Retroplacental hematoma: Size _____cm,
_____% of surface
☐ Old
☐ Recent

CUT SURFACE/VILLOUS TISSUE:

Infarct(s): ☐ Yes
☐ No

Multiple (no.)_____

Largest size(cm)_____

% of total placenta_____

☐ Old

☐ Recent

Intervillous thrombi_____

Increased Fibrin_____

Other Lesions:_____

Pictures taken?

☐ Yes

☐ No

Special Studies _____

Figure 3.1. Suggested macroscopic worksheet.

the best knife for this use is obtained from a butcher supply house or cutlery store rather than conventional sources. The forceps, scissors, and scale are all standard items and easily obtained. In addition, an adjacent sink is optimal, as this facilitates rinsing of the placenta for easy, gentle removal of blood and other fluids. This will assist in accurate identification of lesions and discolorations of the membranes, cord, or surfaces of the placenta and makes for a cleaner work area. The placenta should never be wiped off, as this will damage the surfaces.

Procedure for Examination

After removing the placenta from the container and rinsing briefly in water, perform the following steps:

- **General characteristics:**
  - **Check for odors** – may indicate bacterial growth.
  - **Ascertain shape** – irregular, discoid, etc. Immersion of the placenta in water will return the placenta to its shape in utero and thus demonstrate the shape of the uterine cavity. This is particularly useful with abnormally shaped placentas (see Chap. 13) and in cases of uterine anomalies.
- **Membranes (Table 3.2):**
  - **Check for completeness** – sufficient membranes should be present to enclose the fetus.
  - **Measure membrane rupture site** – this is the distance from the placental edge to the nearest rupture site (Fig. 3.2). If it is greater than zero in a vaginally delivered specimen, a placenta previa is ruled out.

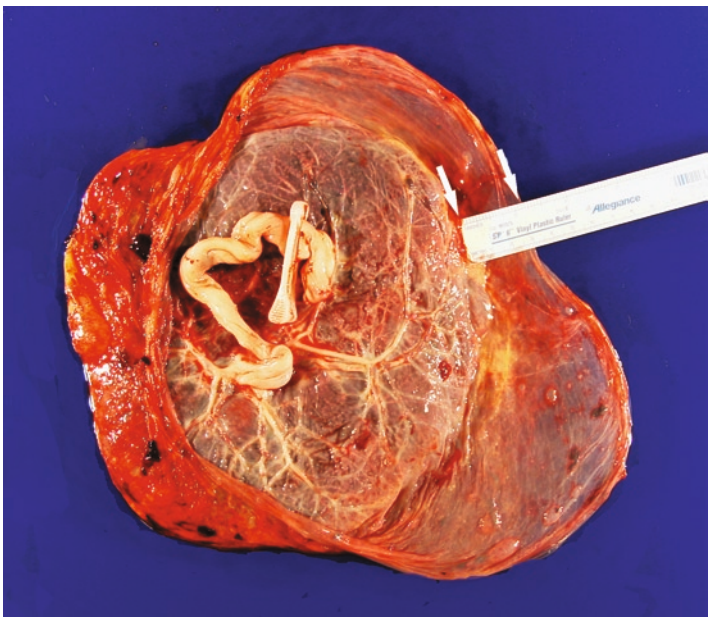

Figure 3.2. Demonstration of the measurement of the shortest distance between the membrane rupture site and the margin of the placenta. The two *arrows* along the *ruler* indicate this measurement.

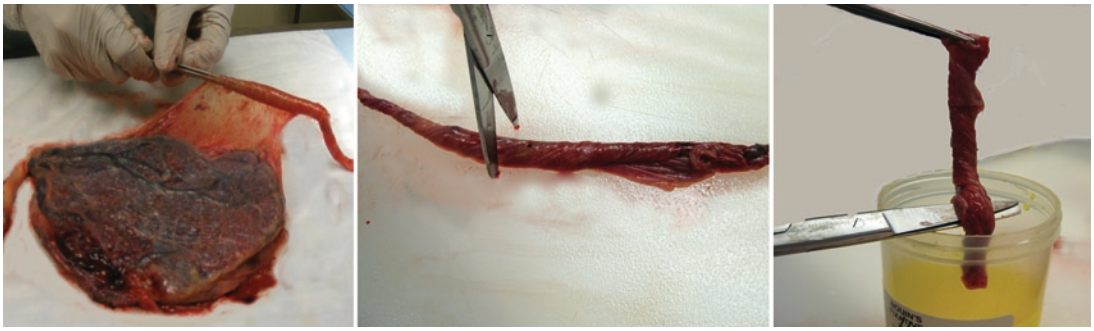

Figure 3.3. Rolling of membranes for fixation and later sectioning. It is best to use a standardized protocol, rolling the membranes with the amnion inside, starting at the site of rupture and proceeding toward the edge of the placenta as shown at *left*. A segment is taken from the rolled portion (*center*) and fixed (*right*) before sectioning.

- **Evaluate color and appearance** – the membranes are normally translucent and shiny, but may be opaque or discolored yellow, green, brown or red-brown.
- **Identify membrane insertion** – the normal insertion is at the margin; insertion other than at the edge indicates circumvallation or circummargination (Figs. 13.4–13.6 in Chap. 13).
- **Remove fetal membranes** – use sharp scissors and keep the orientation to rupture site.
- **Make a "membrane roll"** – take a strip approximately 10 cm wide, and with forceps grasp the portion representing the rupture site (furthest from the placental margin). Roll the membranes with the rupture site in the center and with the amnion inward (Fig. 3.3).

- **Fetal surface (Table 3.3):**
  - **Evaluate color and appearance** – the fetal surface is normally purple-blue and translucent (Fig. 3.4). As with the membranes, note opacity and discoloration.
  - **Examine surface and subchorionic region** – identify nodules, plaques, amnionic bands, hemorrhage, cysts, fibrin, masses and, so on.
  - **Inspect the fetal surface vessels** – look for vascular thrombosis, hemorrhage or disruption; *arteries cross over veins* (Fig. 3.5).
- **Umbilical cord (Table 3.4):**
  - **Measure length and diameter.**
  - **Identify spiraling of the umbilical cord** – right or left twist (Fig. 3.6); excessive or minimal twisting or constriction.
  - **Identify insertion of the umbilical cord** – marginal, eccentric, central, paracentral, or velamentous (see Fig. 15.17); if velamentous, measure the distance from the insertion to the placental edge, and note hemorrhage, disruption, or thrombosis of vessels.

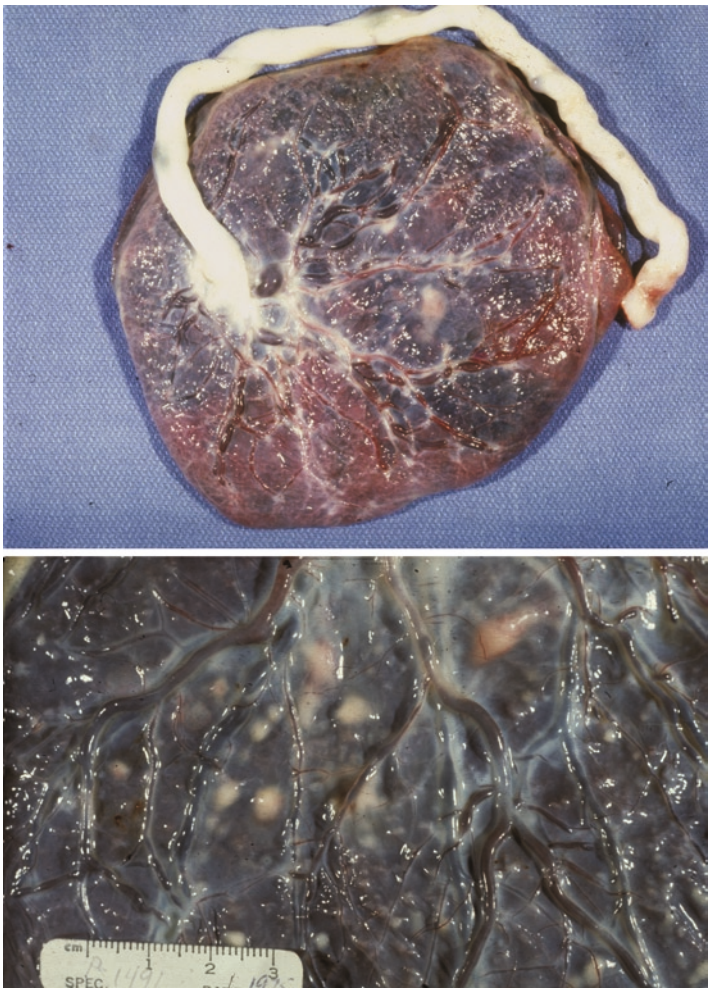

Figure 3.4. Normal fetal surface of the placenta. The surface is blue to purple and translucent with a pearly white, eccentrically inserted umbilical cord (*top*). Normally, subchorionic fibrin/fibrinoid deposits are present which appear as irregular white patches on the fetal surface (*bottom*).

- **Knots** – identify true knots; note whether tight or loose and if congestion is present.
- **Umbilical vessels** – normally three, but two or four vessels may occur.
- **Other** – discoloration, thrombosis, hemorrhage, cysts, surface nodules, masses, etc.
- **Remove the cord from the placenta at the insertion site**.

- **Placental disk (Tables 3.5–3.7):**
  - **Measure the placenta in three dimensions.**
  - **Weigh the placenta** – without cord or membranes.
  - **Evaluate shape of placental disk** – discoid, irregular, bilobed, succenturiate, etc. Evaluate membranous vessels if present.

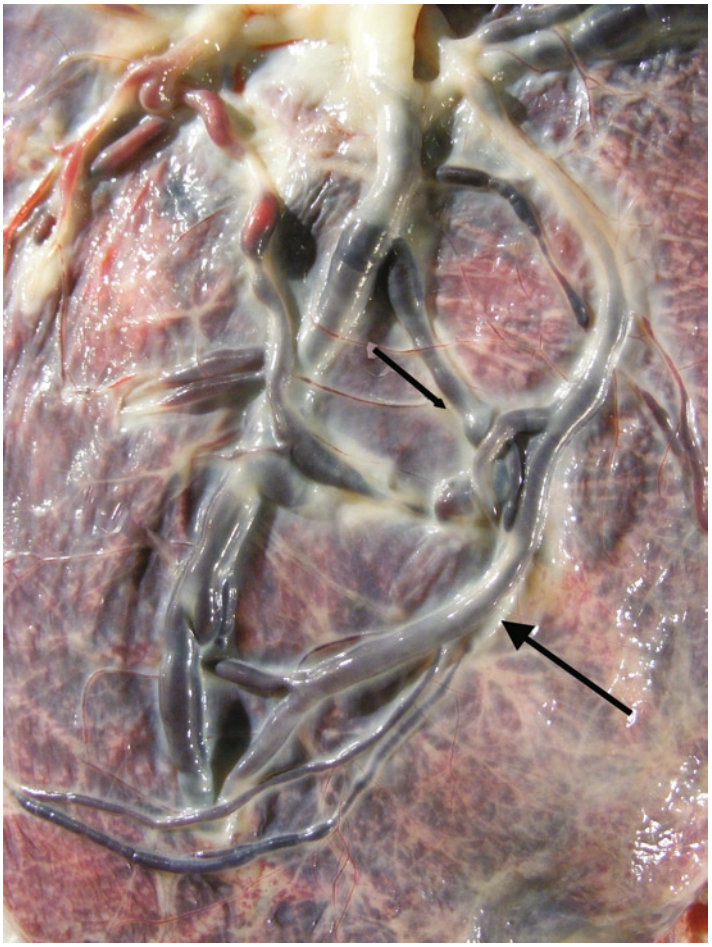

Figure 3.5. Entrance of the vessels on the chorionic plate into the cotyledon. One artery (*large arrow*) brings in the fetal blood and the vein (*small arrow*) returns it to the fetus. Note that the arteries cross over the veins.

  - **Maternal surface** – check for completeness, cotyledonary development, blood clots, calcifications (Fig. 3.7).
  - **Retroplacental hematoma (abruptio placentae)** – look for adherent blood clot, compression of villous tissue, underlying infarct (Fig. 3.8).
- **Serially section the placental tissue at 5-mm intervals.**
- **Evaluate the color of villous tissue – pale, congested or normal.**
- **Identify and describe villous lesions – measure, note location (fetal versus maternal surface; peripheral versus central), single or multiple and percentage of placenta involved (Fig. 3.8).**

Normal Macroscopic Appearance

In 90% of the cases, the placenta is disk-like, flat, and round to oval. Abnormalities of shape occur in about 10% of cases and include **bilobed placenta, succenturiate lobes**, and **placenta membranacea**

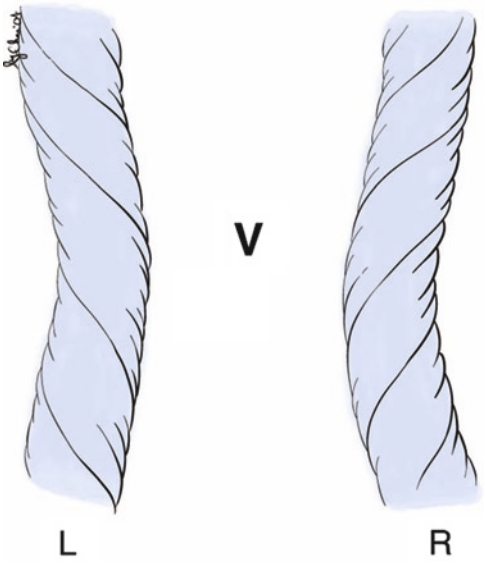

Figure 3.6. Diagram of cord twisting. When cord is placed vertically, the direction of the spiral is compared to the arms of the letter "V." If the spiral is in the direction of the left arm, the cord is left twisted, and if it is in the direction of the right arm, it is a right twist. This method ensures the same results no matter which way the cord is oriented.

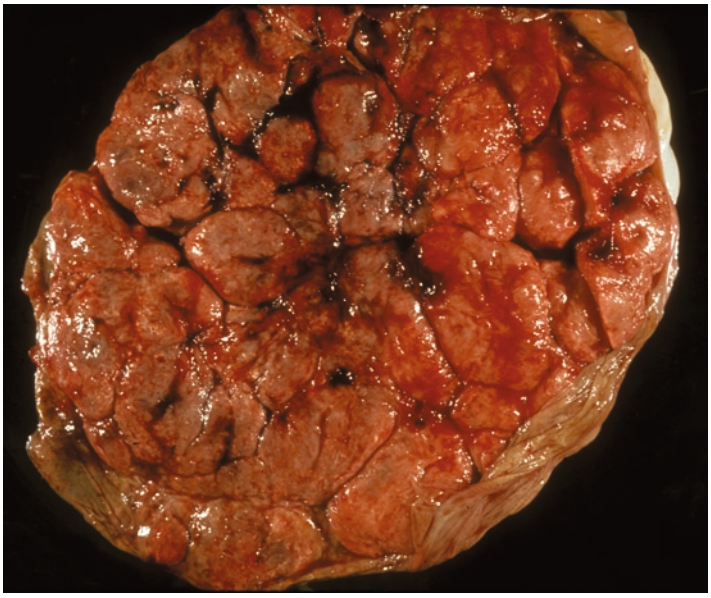

Figure 3.7. Normal maternal surface of the term placenta. Note the divisions into lobules or cotyledons and the small white speckled areas representing calcifications.

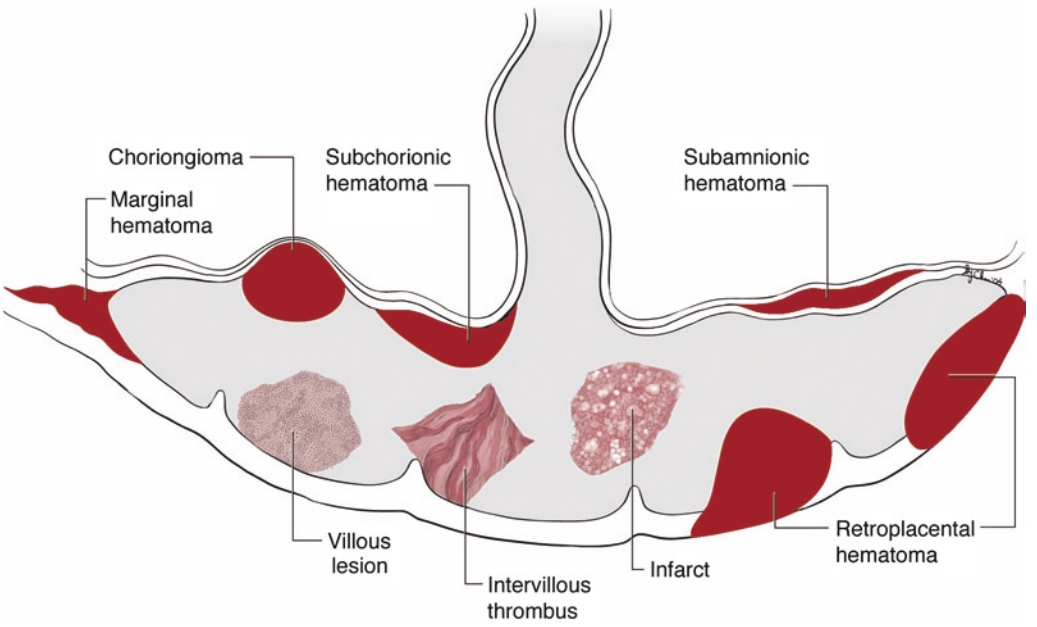

Figure 3.8. Diagram of selected, grossly visible lesions of the placenta. Miscellaneous lesions include acute or chronic villitis, fibrinoid deposition, intervillous abscesses and various tumors.

(see Chap. 13). At term, the average diameter is 22 cm, thickness is 2.5 cm, and weight is 470 g (Table 3.7). The umbilical cord is normally pearly white and measures an average of 55 cm in length and 1.0–1.5 cm in diameter at term (Table 3.4). It most commonly inserts **eccentrically** and usually contains three vessels, two arteries, and one vein. It may have a **marginal, velamentous**, or **furcate insertion**. Occasionally a single artery or a persistent second vein occurs (see Chap. 15). Care must be taken when evaluating the cord for the presence of a single umbilical artery, as the arteries commonly anastomose close to their insertion on the placental surface. The cord is left twisted in about 70% of cases (Fig. 3.6). The coiling index is sometimes used to evaluate the amount of twisting, although this may vary throughout the length of the cord. A normal coiling index is 0.2 ± 0.1 coils/cm, i.e., one coil for every 5 cm.

The **fetal membranes** are generally translucent and shiny but in pathologic conditions may be **opaque** or **discolored** (Table 3.2). The **fetal surface**, facing the amnionic cavity, is usually blue to purple with a **glossy** or **shiny** appearance. Pathologic conditions may lead to discoloration or opacity (see Chap. 14). The **chorionic vessels** run underneath the amnion and branch is a star-like pattern, centrifugally from the cord insertion (Fig. 3.4). *Arteries cross over veins* (Fig. 3.5, Table 3.3). Around the larger vessels, the **chorionic plate** is more opaque due to increased numbers of collagen fibers. White plaques or nodules are due to **subchorionic fibrinoid** and in moderate amounts are not significant**.** Occasionally, the remnant of the **yolk sac** can be identified

underneath the amnion, consisting of a chalky white, flattened ovoid of tissue (see Fig. 14.7a).

After delivery of the placenta, some **decidua basalis** is left in utero and some remains as part of the **basal** plate. The plate is composed of a heterogeneous population of trophoblastic and decidual elements embedded in **extracellular debris, fibrinoid,** and **blood clot.** An incomplete system of "grooves" subdivides the basal surface into 10–40 lobes or **cotyledons** (Fig. 3.7), which correspond to the **septa** seen histologically.

On cut section, the villous tissue is **red** to **red-brown**, and **spongy** on cut section. Its color is almost wholly determined by its content of *fetal blood and thus the fetal hemoglobin/hematocrit* (Tables 3.5 and 3.6). If the fetal hemoglobin is high, the villous tissue is dark and congested; if the hemoglobin is low, the villous tissue is pale. In the center of many delivered placentas are holes or so-called lakes, which were filled with blood in utero, they are of no consequence. At the periphery of many term placentas, the villous tissue may show areas of tan-white and firmer tissue and thus may appear "infarcted." These are not true infarcts but rather villous atrophy due to poor circulation at the periphery.

Suggested Gross Description

The following is a suggested gross description with options in parentheses. It can be used as a template for dictation and transcription.

Received **(fresh/unfixed/in formalin)**, labeled with the patient's name and ID, is a **(discoid/bilobed/irregularly shaped)** placenta measuring _____×_____×_____cm in greatest dimensions with a trimmed weight of _____ g. The **(three/two)** vessel umbilical cord has a **(right/left/minimal/marked)** twist. It measures _____cm in diameter by _____cm in length and has **(an eccentric/a marginal/a velamentous/a central)** insertion. There **(is/is no)** evidence of hemorrhage, thrombosis, discoloration or true knots. The membranes are **(complete/incomplete)** and are ruptured _____cm from the placental margin. The fetal surface is **(purple, translucent/discolored yellow/opaque, etc)**. The maternal surface is **(intact/disrupted/incomplete)** with **(no/a recent/an old)** retroplacental hematomas. Cut section reveals spongy, **(pale/congested/friable/unremarkable)** soft spongy tissue with **(no/a single/numerous)** infarct **(s)**. **(The infarcts comprise _____% of the placental tissue.)** No other gross lesions are identified. Representative sections are submitted. Summary of sections: A1 – umbilical cord (×2) and membrane roll (×2), A2–A4 – villous tissue, A4 – lesion, A6 – maternal surface.

Submission of Microscopic Sections

Routine sections that should be taken on every placenta are listed below. Additional sections should be taken when abnormalities are present, and the reader is directed to Tables 3.2–3.6 for descriptions of specific lesions. The routine sections should include:

- **Two sections of membrane roll, one from the rupture site and one from the placental margin**
- **Two sections of umbilical cord from each of two areas**

- **Two full-thickness sections of villous tissue including fetal and maternal surfaces**
- **Sections of the maternal surface**

Several small sections of the maternal surface in one cassette may enhance one's examination of decidual vessels. The sections of the villous tissue should be *taken away from the margin of the placenta*, as the perfusion is not consistent throughout the placenta and abnormalities exist in peripheral areas of poor perfusion that *may not be reflective of the remainder of the specimen*. Sections of the **fetal surface with chorionic vessels** should be included in those sections of villous tissue. This requires taking at least one section near the insertion of the umbilical cord to obtain vessels of sufficient caliber.

Fixation

Pathologists commonly fix tissue for histological study in **10% buffered formalin** solution (a 1:10 dilution of the commercial 40% formaldehyde). However, brief fixation in formalin is usually insufficient for placental tissue, which tends to be quite bloody. Inadequate fixation makes trimming of the tissue and sectioning on the microtome more difficult, giving poor results in final sections. This is particularly true of the sections of the membrane roll. One option is to *fix the initial sections of placental tissue for a longer period*, at least overnight before trimming and processing. Another option is to *briefly fix the tissue in* Bouin's solution prior to trimming and processing. Bouin's solution makes tissue considerably harder and allows one to trim the tissue more readily before embedding. Bouin's solution is made by preparing a saturated solution (1.2%) of picric acid in water and adding 40% formaldehyde solution and glacial acetic acid in proportions of 15:5:1. After 1–3 h fixation, the tissue is ready to be trimmed. Ideally, the Bouin's-fixed sections are immersed in a *saturated lithium carbonate solution* before embedding. This step is not required, but it helps to remove extraneous pigments. Moreover, some intervillous blood is lysed, and pigments derived from blood ("formalin pigment," acid hematin) are more frequently present when lithium carbonate is omitted. This is also important when one wishes to do immunohistochemistry.

Special Procedures

The placenta is a good source of tissue for **chromosome analysis**, particularly when the fetus is macerated, as tissue from that source will often not grow in culture. The procedure is to disinfect the amnion with alcohol and then strip the amnion off a portion of placental surface. With sterile instruments, a piece of chorion is taken, placed in culture medium, and then transferred to the cytogenetics laboratory. Multiple areas of the placenta may need to be sampled if one needs to rule out confined placental mosaicism

(see Chap. 11). **For bacterial culture**, tissue swabs or tissue samples from the undersurface of the amnion should be taken as contamination of the amnion is likely.

Photography should be an integral part of any gross examination. The old adage that "a picture is worth a thousand words" is most applicable in this instance, and particularly true when the placenta is the subject of future litigation. Any unusual or clinically significant lesion should be photographed, as dissection will usually destroy the macroscopic lesion. Photography is particularly important when the macroscopic appearance, and not the microscopic appearance, demonstrates the lesion best.

Table 3.1. Indications for placental examination.

Maternal indications
History of reproductive failure – ≥1 spontaneous abortions (Abs), stillbirths, neonatal deaths, or premature births
Maternal diseases
Coagulopathy
Hypertension (preeclampsia, pregnancy induced or chronic)
Diabetes mellitus
Prematurity (<2 weeks)
Postmaturity (>42 weeks)
Oligohydramnios
Polyhydramnios
Fever or infection
Repetitive bleeding
Abruptio placentae
Fetal and neonatal indications
Stillbirth or perinatal death
Fetal growth restriction (intrauterine growth retardation, IUGR)
Hydrops
Severe neonatal central nervous system (CNS) restriction or neurologic problems such as seizures
Apgar score of 3 or less at 5 min
Suspected infection
Congenital anomalies
Thick meconium
Placental indications
Any gross abnormality of the placenta, membranes or umbilical cord, such as masses, thrombi, excessively long, short or twisted umbilical cord, etc.
Optional recommendations
Prematurity between 32 and 36 weeks
Low 1-min Apgar score
Fetal distress or non-reassuring fetal status
Multiple birth

Adapted from the College of American Pathologists (Altshuler and Deppisch 1991).

Table 3.2. Macroscopic lesions of the fetal membranes (see Chap. 14).

Type of lesion	Diagnosis		Comment	Figure number
Discoloration				
Green, green-yellow	Meconium		Check for staining of umbilical cord (see Table 3.4)	14.15a
Opaque, white to yellow	Acute inflammation (chorioamnionitis)		Check for odor Consider culture	16.2
Brown to yellow	Hemosiderin		Old bleeding – retromembranous or retroplacental hematoma	14.19a
Red-brown, red-pink	Hemolysis		Most often due to fetal demise or freezing	–
Focal lesions	***Description***	***Diagnosis***		
Plaques	Red to brown, shaggy	Retro-membranous hematoma	May be secondary to ruptured membranes, decidual bleeding or iatrogenic due to amniocentesis	14.12
	Yellow to white, ragged	Decidual necrosis	May be due to decidual vascular lesions but most commonly nonspecific	–
	Tan, roundish, plaque-like	Fetus papyraceous	Ascertain placentation if possible	10.1–10.3
	Pasty, hydrophobic material	Vernix caseosa	Usually secondary to membrane rupture and is of little consequence	14.8
Strings or bands of membrane	Usually tethered to base of umbilical cord	Amnionic bands	Chorionic plate will be devoid of amnion May be associated with isolated amputations, various fetal anomalies or cord entanglement Take photograph	14.24–14.29

Table 3.3. Macroscopic lesions of the fetal surface and chorionic plate (see Chaps. 14, 21, and 22).

Description	Diagnosis	Comment	Figure number
Plaques or nodules			
White, hydrophobic plaques	Squamous metaplasia	Adherent to surface DDx: amnion nodosum	14.21a
Translucent, white or yellow nodules	Amnion nodosum	Can be scraped off Due to oligohydramnios DDx: squamous metaplasia	14.22
Oval, chalky disk, under amnion	Yolk sac remnant	Normal embryonic remnant	14.7a
Firm, white subchorionic nodules or plaques	Subchorionic fibrin/fibrinoid	Usually of no consequence	3.4, 3.8
Well-circumscribed, hemorrhagic, fibrous or myxoid nodule	Chorangioma	Note size, consistency Villous tissue may be pale due to associated hemorrhage	3.8 22.1–22.4
Cyst	Subchorionic cyst	Usually of no consequence	14.4, 14.5

(continued)

Table 3.3. (continued)

Description	Diagnosis	Comment	Figure number
Plaques or nodules			
Hemorrhage or hematoma	Amnionic cyst	Usually of no consequence	14.2
	Subchorionic hematoma	Note size and % surface If large, may be associated with demise	3.8, 14.13 14.14
	Subamnionic hematoma	Usually iatrogenic Look for source of bleeding – disrupted fetal vessels in chorionic plate (rare)	3.8, 14.11
Chorionic vessels			
White streak or firmness in vessel	Thrombosis	Extra sections of fetal surface vessels May be associated umbilical cord problems	21.1–21.3
Dilated and tortuous vessels	Acute cord compression	May be associated with cord problems, e.g., hypercoiling, long cords, knots, entanglements, etc.	–
	Mesenchymal dysplasia	May be associated with cystically dilated villi	19.18a

DDx differential diagnosis.

Table 3.4. Macroscopic lesions of the umbilical cord (see Chap. 15).

Description	Diagnosis	Gross examination	Figure number
Insertion			
Insertion at placental margin	Marginal	Usually of no consequence unless there are associated velamentous vessels (velamentous insertion)	15.17
Insertion into/ within membranes	Velamentous	Measure from insertion to placental margin Note disruption, hemorrhage or thrombosis of vessels Submit separate membrane roll of velamentous vessels	15.17, 15.18, 15.21, 15.22
Cord divides before insertion	Furcate	Check that all vessels are intact	15.17, 15.19
Cord inserts and runs in membranes without branching	Interpositional	Usually of no consequence	15.17, 15.20
***Length*: Normal 55 cm**			
<40 cm	Short cord	Difficult to diagnose without measurement of total cord length at delivery	–
>70–80 cm	Long cord	Check for associated chorionic plate vascular thrombosis	15.9
***Diameter*: Normal 1–1.5 cm**			
Increased	Thick cord	If focal, may represent a cyst May be associated with diabetes, macrosomia or hydrops	15.10

(continued)

Table 3.4. (continued)

Description	Diagnosis	Gross examination	Figure number
***Diameter*: Normal 1-1.5cm**			
Decreased	Thin cord	May be associated with growth restriction	15.8
Focal constriction	Stricture	Measure diameter and take sections through stricture Check for associated chorionic plate vascular thrombosis	15.8
Knot	True knot	Document Loose or tight Congestion on one side of the knot If, after untying, cord stays coiled Take sections through untied knot	15.12, 15.13, 15.16
	False knot	Redundant vessels of no consequence	15.15
Twisting or coiling			
Excessive twist		Check for associated thrombosis or stricture May be associated with adverse outcome	15.6, 15.7
Minimal or no twist		May be associated with adverse outcome	15.6
***Vessels*: Normally three**			
Two vessels	Single umbilical artery	Avoid sections near insertion site due to arterial anastomosis	15.23
Four vessels	Persistent vein	Avoid sections with false knots	–
Thrombosis	Thrombosis	Ensure it is not in an area of cord clamping or due to false knots Serially section and submit Take photograph	15.24
***Discoloration*: Normal – white**			
Pink, red, or red-brown	Hemolysis	Usually due to fetal demise or freezing of the placenta	–
Brown, yellow-brown	Hemosiderin	Due to old bleeding	14.19a
Green or yellow-green	Meconium	Note if focal or diffuse Take extra sections of stained cord	14.15a
Yellow	Bile	Note in report May be due to maternal hyperbilirubinemia	14.18
Chalky deposits	Calcification	Usually due to infection – necrotizing funisitis	16.21
Mass			
Cyst	Embryonic remnants	Measure and take extra sections	15.2
White, tan, or yellow surface nodules	*Candida* infection	Take additional sections of lesions	16.16
Hemorrhage	Hemorrhage, hematoma, or hemangioma	Ensure it is not in an area of cord clamping	15.26, 15.27
Miscellaneous			
Edema	Edema	If localized, may represent a cyst May be associated with macrosomia or hydrops	15.10
Rupture	Rupture	Look for associated lesions that could explain rupture, such as hematoma, meconium, masses, etc.	15.26

Table 3.5. Macroscopic lesions of the maternal surface (see Chaps. 16, 18, and 19).

Description	Diagnosis	Comment	Figure number
White, chalky, stippled, gritty lesions	Calcifications	Normal finding	3.7
Shaggy, tan loosely adherent plaques	Decidual necrosis	Usually a nonspecific finding but may be associated with decidual vascular disease	–
Adherent blood clot	Retroplacental hematoma (abruptio placentae)	Note size and % of maternal surface involved Note compression of villous tissue Note if old or recent Note if there is an underlying infarct	3.8, 18.13, 18.14, 19.5, 19.6
	Marginal hematoma	Often due to ascending infection (acute chorioamnionitis) Note size and % of maternal surface involved Note compression of villous tissue	3.8 16.3
Yellow discoloration; firm, corrugated surface	Maternal floor infarction (massive perivillous fibrinoid)	Note % involvement of placental parenchyma Note if diffuse or multifocal	19.13 19.14
Firm, white or reddish lesions	Infarct, intervillous thrombus or fibrin deposition	Note size and % involvement Take extra sections of lesions	3.8, 18.7–18.9, 19.6

Table 3.6. Abnormalities of placental shape and macroscopic lesions of the villous tissue (see Chaps. 13, 18–23).

Description	Diagnosis	Comment	Figure number
Shape alterations			
Two equal lobes	Bilobed	Check membranous vessels to ensure they are intact and without thrombosis	13.1, 13.2
Two or more unequal lobes	Succenturiate lobe	Check membranous vessels to ensure they are intact and without thrombosis	13.1, 13.3
Extremely large, thin placenta	Membranacea	May be associated with bleeding and/or placenta accreta	13.1, 13.12
Membranes do not insert into placental margin	Circumvallate or circummarginate	Note if partial or complete Measure distance from insertion to placental margin	13.4–13.6, 13.8
	Extrachorial or extramembranous pregnancy	Measure distance from insertion to placental margin	13.9, 13.10
Full thickness defect in placenta	Fenestra	Usually of no consequence	13.1, 13.13
Ring shaped placenta	Zonary placenta	Usually of no consequence	13.1, 13.14

(continued)

Table 3.6. (continued)

Description	Diagnosis	Comment	Figure number
Diffuse lesions of villous tissue			
Firm, net-like, white deposits throughout villous tissue	Maternal floor infarction/massive perivillous fibrin deposition	Note extent – % of villous tissue involved Note if multifocal or diffuse Note involvement of maternal floor	19.15–19.17
Mottling of villous tissue	Chronic villitis	Usually very subtle Note the extent – % of villous tissue involved	3.8, 16.29
Focal lesions			
Well-circumscribed, round lesion with granular surface	Recent infarct (pink to red discoloration)	Note if single or multiple Note % of placenta involved	3.8, 18.8
	Old infarct (white discoloration)	Note if single or multiple Note % of placenta involved	3.8, 18.7–18.9, 19.6
Well-circumscribed, angular lesion with shiny surface	Intervillous thrombus	Usually of no consequence If large or multiple may be associated with fetomaternal hemorrhage	3.8 19.1 19.2
Well-circumscribed nodular lesion with consistency of blood clot, myxoid or "fibrous" tissue	Chorangioma	Benign hemangioma Usually of no consequence unless large	3.8, 22.1–22.4
Poorly demarcated white, granular lesion	Intervillous abscess	Associated with bacterial infection, most commonly *Listeria*	16.12
Cystically dilated villi	Mesenchymal dysplasia	Dilated, tortuous vessels on fetal surface may also be present	19.18a
	Hydatidiform moles	Additional sections should be taken Consider cytogenetics, flow cytometry, etc.	23.2, 23.3, 23.6
Nodular lesion with consistency of blood clot, myxoid or "fibrous" tissue	Chorangioma	Benign hemangioma	3.8, 22.1–22.4
	Chorangiomatosis	Multiple lesions – various clinical associations	19.10
Color of villous tissue **– reflective of fetal hematocrit**			
Pale	Fetal anemia	May be associated intervillous thrombi May be associated with fetomaternal hemorrhage or hydrops	20.1
	Twin-to-twin transfusion	Note type and size of vascular anastomoses	9.7, 10.13
Congestion	Villous congestion	May be associated with maternal diabetes or obstruction of venous return (possible umbilical cord problems)	17.3

Table 3.7. Normative values.

Pregnancy week postmenstrual	Crown–rump length (mm)	Foot length (cm)	Embryonic/fetal weight (g)	Placental weight (g)	Fetal/placental weight ratio	Placental thickness (cm)	Placental diameter (cm)	Umbilical cord length (cm)
3								
4								0.2
5	2.5							0.4
6	5							0.7
7	9							1.2
8	14		1.1	6	0.18			2.0
9	20		2	8	0.25			3.3
10	26		5	13	0.38			5.5
11	33		11	19	0.58			9.2
12	40		17	26	0.65			12.6
13	48	1.2	23	32	0.72		5.0	15.8
14	56	1.7	30	41	0.73	1.0	5.6	18.8
15	65	1.9	40	50	0.80	1.1	6.2	21.5
16	75	2.2	60	60	1.00	1.2	6.9	24.0
17	88	2.5	90	70	1.29	1.2	7.5	26.4
18	99	2.8	130	80	1.63	1.3	8.1	28.7
19	112	2.9	180	101	1.78	1.4	8.7	30.9
20	125	3.3	250	112	2.23	1.5	9.4	33.0
21	137	3.6	320	126	2.54	1.5	10.0	35.0
22	150	3.9	400	144	2.78	1.6	10.6	36.9
23	163	4.2	480	162	2.96	1.7	11.2	38.7
24	176	4.5	560	180	3.11	1.8	11.9	40.4
25	188	4.7	650	198	3.28	1.8	12.5	42.0
26	200	5.0	750	216	3.47	1.9	13.1	43.5
27	213	5.3	870	234	3.72	1.9	13.7	45.0
28	226	5.5	1,000	252	3.97	2.0	14.4	46.4
29	236	5.8	1,130	270	4.19	2.0	15.0	47.7
30	250	6.0	1,260	288	4.38	2.1	15.6	49.0
31	263	6.2	1,400	306	4.58	2.1	16.2	50.2
32	276	6.5	1,550	324	4.78	2.2	16.9	52.0
33	289	6.7	1,700	342	4.97	2.2	17.5	53.0
34	302	6.9	1,900	360	5.28	2.3	18.1	54.0
35	315	7.1	2,100	378	5.56	2.3	18.7	54.9
36	328	7.4	2,300	396	5.81	2.4	19.4	55.7
37	341	7.6	2,500	414	6.04	2.4	20.0	56.5
38	354	7.8	2,750	432	6.37	2.4	20.6	57.2
39	367	8.0	3,000	451	6.65	2.5	21.3	57.9
40	380	8.1	3,400	470	7.23	2.5	22.0	58.5

Portions of this table were modified from Kalousek et al. (1992)

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