

PREVENTING MATERNAL AND NEWBORN INFECTIONS

KEY CONCEPTS you will learn in this chapter include:

- What the special features of maternal and newborn infections are
- Why maternal and newborn infections are more common in developing countries
- How prevention can decrease the risk of many fetal and newborn infectious diseases
- How to decrease the risk of maternal and newborn infections following labor and delivery

BACKGROUND

In no other area of primary healthcare is the disparity between developed and developing country morbidity and mortality greater than for pregnant women and their newborns. For example, in some of the poorest countries, maternal mortality rates are a hundred times higher than those in Western Europe and the United States.

In developed countries, most pregnant women are healthy and well nourished. They deliver their babies in a hospital or birthing center, and only a few are subjected to the wide variety of invasive and diagnostic procedures experienced by most other hospitalized patients. Even for those having cesarean sections, the surgery is short (i.e., usually less than an hour) and usually uncomplicated. Urinary catheterization, if required, is brief (1–2 days) and rarely is assisted ventilation required postoperatively. Thus, the risk of nosocomial (hospital-acquired) infection, or infection with a multidrug-resistant organism following delivery, even after cesarean section, is low compared with other types of hospitalized patients. In fact, were it not for the nearly five-fold increase in cesarean section rates from 5.5% in 1978 to 30% during the early 1990s, maternal morbidity and mortality would be even lower.¹ Finally, because most women in developed countries start attending prenatal clinics early (i.e., first trimester) and are fully immunized, the risk of serious infection to the fetus and newborn is low as well.

The situation in countries with limited resources, however, is radically different in nearly every aspect. In these countries, anywhere from 50–80%

¹ Mortality from cesarean section still remains at least two to four times higher than that following vaginal delivery (Petitti et al 1982).

of pregnant women give birth at home—usually alone or with a family member—and most have received only limited antenatal care. They are poorly nourished and anemic. If a complication occurs in labor requiring cesarean section, they usually arrive at the hospital too late, when they are near death. Moreover, even if they survive the surgery the rate of postoperative infection is high (15–60%), and wound infections, the most serious complication, are very common. Added to this in recent years is the fact that in some countries up to 30% of pregnant women are seropositive for HIV. This, coupled with the resurgence of tuberculosis, especially drug-resistant strains, further complicates the situation. As a consequence, pregnant women in developing countries are at much higher risk for acquiring a nosocomial infection following delivery than their counterparts in developed countries.

Newborns do not fare well either! Other than maternal tetanus toxoid immunization during pregnancy, and treatment to prevent congenital syphilis, few other preventive measures to protect the fetus and newborn are routinely available. For example, with the exception of prenatal HIV testing and antiretroviral treatment in a few countries, screening and treatment for other infectious diseases (e.g., gonorrhea and chlamydia) are not available because of the cost and lack of laboratory capability. Moreover, in Africa and parts of Asia, malaria is a major problem that can adversely affect pregnancy outcome. Thus, in countries where healthcare resources are limited, little progress has been made over the past decade in preventing fetal and newborn diseases, and improving the quality and availability of newborn services in hospitals has been slow as well.

DEFINITIONS

- **Endometritis.** Acute postpartum infection of the lining (endometrium) of the uterus with extension into the smooth muscle wall (myometrium). Clinical features include fever, usually developing on the first or second postpartum day, uterine tenderness, lower abdominal pain, foul-smelling vaginal discharge (lochia) and signs of peritonitis in women who have had a cesarean section.
- **Episiotomy.** Surgical cut made in the perineum (usually at the 6 o'clock position) just prior to delivery. The purpose is to facilitate delivery of the presenting part and minimize the risk of injury to the perineal area. Episiotomies, however, are associated with increased bleeding, may lead to increased tearing (3rd or 4th degree perineal laceration), can become infected and, most importantly, usually are not necessary.
- **Intra-amniotic infection syndrome (IAIS), also referred to as amnionitis or chorioamnionitis.** Acute detectable infection in the uterus and its contents (fetus, placenta and amniotic fluid) during pregnancy. It occurs in a small percentage (<5%) of term pregnancies, but in up to 25% of women with preterm labor (before 37 weeks gestation). It is usually related to colonization of the uterine cavity

with organisms present in the cervix and vagina after prolonged ruptured membranes and labor. In cases of IAIS associated with serious, and often fatal, newborn infection and postpartum endometritis, the most common organisms isolated from amniotic fluid are group B streptococci and *E. coli*.

- **Invasive group B streptococcal sepsis.** Newborn infection characterized by bacteremia, pneumonia, meningitis and death in up to 25% of infants with the infection. It occurs most commonly following IAIS. Other sites of infection include newborn skin infections (cellulitis) and infections in bones (osteomyelitis).
- **Nosocomial infection in newborns.** Infection occurring after birth but excluding those infections known to have been transmitted across the placenta such as congenital syphilis, cytomegalovirus, rubella, varicella (chicken pox) and the protozoan parasite, *Toxoplasmosis gondii*.
- **Nosocomial infection in obstetrical patients.** Infection that is neither present nor incubating at the time the patient is admitted to the hospital. Most urinary tract infections and endometritis are nosocomial even though the causative organism may be endogenous (i.e., present in the maternal lower genital tract prior to delivery).
- **Septic pelvic thrombophlebitis.** Thrombosis (blockage) of the deep pelvic veins due to inflammation and blood clots. It is uncommon (approximately 1 in 2000 deliveries). Predisposing factors include cesarean section after long labor (>24 hours), premature rupture of membranes, difficult delivery (forceps or vacuum extraction), anemia and malnutrition.

EPIDEMIOLOGY

Maternal Infections

In developing countries, postpartum infection remains second only to postpartum hemorrhage as a cause of maternal deaths and is the leading cause of serious maternal complications of childbirth. This is still the case despite the fact that more than 150 years have elapsed since Semmelweis and Holmes independently determined not only that childbed fever, puerperal sepsis, was spread from woman to woman on the hands of physicians, but also that outbreaks of this deadly disease could be prevented by:

- rigorously enforcing handwashing with chlorinated lime before delivery, and
- boiling all instruments and utensils after use when treating an infected postpartum woman.

Employing these preventive efforts, Holmes reported a dramatic decrease in maternal mortality from 16% to 1% (Holmes 1843).

In many countries, acute endometritis (puerperal sepsis) is still the most common postpartum infection. Rates of infection range from a low of 1–3% following vaginal deliveries in hospitals with high quality services and excellent infection prevention practices, to as high as 85% following high-risk cesarean sections in poorly nourished, exhausted patients who have their operation in large teaching hospitals that have limited healthcare resources (Hemsell 1991).

Cesarean section is the most important factor contributing to both the frequency and severity of postpartum endometritis (Gibbs 1980). For example, patients who have cesarean sections are at least 10 times more likely to become infected than patients who deliver vaginally (Minkoff and Schwarz 1980). Moreover, patients undergoing their first (primary) cesarean section are at an even greater risk for an infection or other complications compared to patients having an elective, repeat section.

The distribution and type of nosocomial infections following cesarean section in the US are shown in **Table 25-1**. While organ/space surgical site infections such as endometritis account for over half, the most serious and costly are wound infections (nearly 20%). For example, patients with wound infections typically spend 7 days longer in the hospital than those without infection and 4 days longer than patients with endometritis. Wound infections are primarily the result of direct contamination of the incisional area with organisms in the endometrial cavity at the time of surgery. Predisposing factors for wound infection are women who:

- have bacterial vaginosis (*Gardnerella vaginalis*) isolated from the endometrium,
- have a cesarean section during the second stage of labor, or
- had infection of the fetal membranes (chorioamnionitis) diagnosed prior to delivery (Mead 1993).

Table 25-1. Distribution of Nosocomial Infections in Cesarean Section

Incisional Surgical Site Infection	Organ/Space Surgical Site Infection¹	Urinary Tract Infection	Pneumonia	Primary Bloodstream Infection	Other
19%	55%	12%	3%	2%	9%

¹ Primarily endometritis; may also include infections such as intra-abdominal abscess.

Adapted from: Horan et al 1993.

Other obstetrical infections are less frequent, ranging from less than 1% to 15%. In decreasing order of frequency these include:

- Nosocomial urinary tract infections (about 12% and largely in women who had a cesarean section)

- Episiotomy infections (<5%, usually simple and uncomplicated)
- Nosocomial pneumonia (3% and almost always in post cesarean section patients)
- Septicemia (2% and largely in post cesarean section patients)
- Breast infection (mastitis) in postpartum nursing women (<3%)

Maternal nosocomial infection rates in most developing countries, however, are considerably higher.

Fetal and Newborn Infections

Fetal and newborn infections are classified based on whether they were acquired *in utero* (transplacentally), during passage through the birth canal (vertical transmission) or in the neonatal period (i.e., during the first 28 days following birth).

In utero infections include those caused by:

- viruses—cytomegalovirus, rubella, varicella (chicken pox/zoster), HIV and parovirus;
- protozoa—*toxoplasmosis gondii*; and
- bacteria—congenital syphilis.

Intrapartum (mother to newborn) and immediate postpartum newborn infections include those caused by:

- viruses—hepatitis B, hepatitis C, HIV, herpes simplex virus (HSV), human papillomavirus (HPV) and parovirus; and
- bacteria—*E. coli*, group B streptococci, yeast (candida species); conjunctivitis due to chlamydia, gonorrhea or *Listeria monocytogenes*, and a number of infections due to gram-negative anaerobic bacilli.

In addition, a number of other organisms that can colonize and sometimes infect newborns during the first month of life include:

- viruses—cytomegalovirus, enterovirus, respiratory syncytial virus and rhinovirus;
- protozoa—malaria in many tropical countries; and
- bacteria—tuberculosis and tetanus.

Strictly speaking, only newborn infections acquired during passage through the birth canal or in the neonatal period are considered nosocomial. Determining whether an infection is nosocomial or was present or incubating prior to admission to the hospital is extremely difficult—and often not useful. For example, a common definition of nosocomial intra-amniotic infection syndrome (IAIS) is one that occurs

following either an invasive action (e.g., vaginal examination or intrauterine fetal monitoring) or an attempt to induce labor more than 24 hours previously. Using this definition, less than 1% of IAISs would be considered nosocomial in most hospitals (Mead 1993)!

MICROBIOLOGY

Causes of Maternal Infections

Most postpartum infections are caused by endogenous flora—microorganisms that are normally present in the genital tract but usually cause no disease until labor, delivery or postpartum. Nearly 30 bacteria have been identified as being present in the lower genital tract (vulva, vagina and cervix) at any time (Faro 1990). While some of these, including several fungi, are considered nonpathogenic under most circumstances at least 20, including *E. coli*, *S. aureus*, *Proteus mirabilis* and *Klebsiella pneumoniae*, are pathogenic.

The organisms most commonly isolated from women with endometritis are listed in **Table 25-2**. Because endometrial and urine cultures may be misleading due to the contaminating vaginal and cervical flora, not surprisingly postpartum women with clinical evidence of endometritis or urinary tract infections are cultured less frequently than patients with other types of infections (Mead 1993).

Table 25-2. Commonly Isolated Organisms in Women with Endometritis

AEROBES

- Gram-positive cocci
 - Group B streptococcus
 - Group A streptococcus
 - Enterococcus
 - Streptococcus sp. (other)
 - Staphylococcus sp.
- Gram-negative
 - Escherichia coli*
 - Klebsiella pneumoniae*
 - Proteus mirabilis*

ANAEROBES

- Gram-positive cocci
 - Peptococcus sp.
 - Peptostreptococcus sp.
- Gram-positive bacilli
 - Clostridium sp.
- Gram-negative bacilli
 - Prevotella bivia*
 - Bacteroides fragilis*
 - Bacteroides sp. (other)

Adapted from: Cox and Gilstrap 1989.

Colonization and Infection in Newborns

Most infants are delivered from a sterile environment inside the uterus. During and after birth, however, they are rapidly exposed to numerous microorganisms that colonize their skin, nasopharynx and gastrointestinal tract. Sick newborns, subjected to multiple invasive procedures (e.g., endotracheal tubes or umbilical artery catheters), may be colonized at multiple sites with numerous other organisms, particularly gram-negative bacteria.

The skin of the newborn is a major initial site of bacterial colonization, particularly for *Staphylococcus aureus*, which is most often acquired from within the nursery rather than from the mother. Any break or cut in the skin provides an opportunity for infection to develop with this pathogenic organism. In addition, at birth the newborn has at least one open surgical wound (the umbilicus) that is highly susceptible to infection. A circumcision, if performed, is another, and if a fetal scalp electrode was used during labor, then the newborn has a third site as well. Therefore, to minimize the risk of infection in the newborn period, all sites must be cared for using aseptic technique.

Although severe infection in a full term infant is uncommon, when it occurs it often is secondary to group B streptococci, *E. coli*, *L. monocytogenes*, *Citrobacter diversus*, salmonella, chlamydia, herpes simplex virus (HSV) or enteroviruses. All of these organisms can be transmitted to other infants in the nursery on the hands of hospital staff unless Standard Precautions are strictly followed, especially those for handwashing (or use of antiseptic handrub) and gloves.

PREVENTING FETAL AND NEWBORN INFECTIOUS DISEASES

Prevention has long been the only viable alternative in the fight against most of the devastating fetal and newborn infectious diseases such as congenital rubella, cytomegalovirus, varicella (chicken pox), syphilis, toxoplasmosis and tetanus. And, over the past 50 years, preventive efforts have successfully reduced the risk of serious fetal and newborn infections in developed countries. This success has been accomplished through:

- maternal immunization (tetanus, rubella, varicella and hepatitis B);
- antenatal treatment of maternal syphilis, gonorrhea and chlamydia;
- prophylactic use of postnatal eye drops to prevent chlamydial, gonorrheal and yeast (candida) eye infections (conjunctivitis);
- prophylactic treatment of pregnant women at risk of group B streptococcal disease; and most recently
- maternal (antenatal and intrapartum) and newborn (postnatal) treatment with antiretroviral (ARV) drugs to prevent HIV.

In countries with limited healthcare resources, however, little progress has been made in preventing these fetal and newborn infectious diseases with the exception of neonatal tetanus and syphilis.

In **Appendix K**, specific information regarding prevention of the most important fetal and newborn infectious diseases is presented. In addition, infection prevention guidelines are provided that are designed to minimize the risk of transmission to other newborns, postpartum mothers and susceptible health workers and other staff.

REDUCING THE RISK OF MATERNAL AND NEWBORN INFECTIONS

In this section, guidelines are provided for reducing the risk of maternal and newborn infections during and following either vaginal or cesarean delivery. Basic information also is included on managing outbreaks in newborn nurseries and neonatal intensive care units (NICUs). Simple, preventive practices that can be used in all settings and by all healthcare workers are described.

Because of the increasing risk of exposure to HIV and other bloodborne viruses during labor, delivery and resuscitation of the baby, if required, health workers also should be protected. The conscientious use of Standard Precautions, especially handwashing and use of gloves, face shields and plastic or rubber aprons, can minimize these risks; therefore, the appropriate use of personal protective equipment is emphasized throughout this chapter.

Minimizing the Risk of Infection during Labor and Vaginal Delivery

Babies are born in a variety of settings around the world, especially when the birth is a normal delivery. Although vaginal delivery does not require the aseptic conditions of an operating room, a few simple practices can make the procedure safer for the mother, the infant and the healthcare provider. For example, using the “three cleans” approach—keeping the hands, perineal area and umbilical area clean during and following childbirth—and having clean delivery kits help improve the safety of home births for both mother and newborn.

Vaginal deliveries are associated with a number of factors that increase a woman’s risk of endometritis or urinary tract infection. These include:

- prolonged ruptured membranes (>24 hours),
- trauma to the birth canal (vaginal or perineal lacerations and urethral tears),
- manual removal of the placenta due to retained placenta or placental fragments,
- episiotomy, and
- midforceps delivery (Hemsell 1991; Newton, Prihoda and Gibbs 1990).

Each of these provides a means for microorganisms to enter, or to be placed inside, the uterus (uterine cavity). While the first three factors can happen regardless of where the birth occurs (at home or in the hospital), the last two are related solely to deliveries occurring in hospital maternity units. Moreover, when babies are born in a hospital or healthcare facility, another factor that increases the risk of maternal infection is vaginal examinations, especially those performed by medical and midwifery students. For example, in one study it was found that the risk of endometritis was 27% if seven or fewer vaginal examinations were performed but rose to 71% when more than seven were performed (Iffy et al 1984).

To minimize this risk:

- Use a clean pair of examination gloves, or high-level disinfected surgical gloves that have been reprocessed, for each examination. (Sterile gloves are not necessary for vaginal examinations.)
- Avoid pushing the tip of the examining finger up against the opening to the cervix (cervical os) until active labor occurs or until the decision has been made to induce labor.
- Carefully limit cases for student training to those patients in active and progressive labor.

**Vaginal Delivery
(Maternity Unit of
Birthing Center)**

Steps that can be taken to decrease the risk of maternal infection **before** and **during** delivery include:

STEP 1: Make sure the following items are available:

- Two pairs of high-level disinfected or sterile surgical gloves
- Pair of high-level disinfected or sterile “fingerless” surgical gloves (**Chapter 7**)
- Pair of clean examination gloves for washing the perineum
- Basin of clean warm water, soap, a face cloth and clean dry towel²
- Plastic or rubber apron and face shield (or a mask and goggles)
- Waterless, alcohol-based antiseptic handrub or antiseptic solution (e.g., 2% chlorhexidine gluconate or 10% povidone-iodine)
- High-level disinfected or sterile blunt scissors (Mayo)
- High-level disinfected or sterile cord clamp or cloth to tie off the cord
- Injectable oxytocin (with or without methergine) or oral misoprostol

² If tap water is contaminated, use water that has been boiled for 10 minutes and filtered to remove particulate matter (if necessary), or use chlorinated water—water treated with dilute bleach solution (sodium hypochlorite) to make the final concentration 0.001% (see **Chapter 26**).

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- High-level disinfected or sterile urinary catheter (straight, rubber or metal) and clean basin to collect urine (optional)
- Package of gauze squares
- Clean basin for the placenta
- Clean drape or cloth for wrapping the baby
- Clean perineal pads
- Light source (a flashlight or lamp) if needed
- Puncture-resistant sharps container (within arm's reach if possible)
- Plastic bucket with a tight fitting lid, filled with 0.5% chlorine solution for decontamination
- Plastic bag or a leakproof, covered waste container for disposal of contaminated waste items

If episiotomy is required, the following will be needed as well:

- High-level disinfected or sterile needle holder
- High-level disinfected or sterile tissue forceps
- #0 chromic suture on, or with, a curved, minimally blunt (preferred) or cutting suture needle
- Local anesthetic (without epinephrine)

Prior to Delivery

STEP 2: Once the patient is positioned for delivery, put examination gloves on both hands and wash the perineal area (vulva, perineum, and anal region) with soap and clean water³:

- Use a downward and backward motion when washing the perineal area so that fecal organisms will not be introduced into the vagina.
- Clean the anal area last and place the washcloth or towel in a plastic container.

Shaving perineal (pubic) hair increases the risk of infection associated with delivery (Landry and Kilpatrick 1997).

STEP 3: Immerse both gloved hands in a 0.5% chlorine solution, remove gloves by inverting, and place them in the plastic bag or leakproof, covered waste container.

³ Use of antiseptic solutions for cleaning the perineal area has not been shown to decrease postpartum infections in mother or baby (AAP and ACOG 1997).

STEP 4: Thoroughly wash hands, especially between the fingers, and forearms up to the elbows with soap and clean water and dry with a clean, dry towel or air dry.

Note: If reprocessed high-level disinfected or sterile surgical gloves are used, double gloving is recommended to reduce the risk of exposure to blood or other body fluids.

STEP 5: Apply 5 mL (about 1 teaspoonful) of the antiseptic handrub to hand and forearms and rub until dry; repeat application and rubbing 2 more times for a total of at least 2 minutes, using a total of about 15 mL (3 teaspoonfuls) of the handrub. (If handrub is not available, apply an antiseptic solution to hands and forearms, rinse with clean water and dry hands.)

STEP 6: Put high-level disinfected or sterile surgical gloves on both hands.

Note: Shoe covers, unless they are resistant to fluids, are not helpful.

STEP 7: Wear protective equipment including a plastic or rubber apron and face shield (or a mask and goggles) because splashing of blood and blood-tinged amniotic fluid can be expected.

During Delivery

- If resuscitation of the infant is required, use mechanical suction if available. (If mouth suction of the airway cannot be avoided, place a trap in the line.)
- If manual removal of the placenta is required, fingerless surgical gloves should be used to avoid contaminating the forearm with blood. To use fingerless gloves:
 - First, remove the surgical glove from one or both hands using the technique described in **Chapter 4**.
 - Next, put on a fingerless high-level disinfected or sterile surgical glove(s) and pull up onto the forearm(s) using the technique described in **Chapter 7**.
 - Finally, put a new high-level disinfected or sterile surgical glove on one or both hands.

After Delivery

STEP 8: Before removing gloves, put the placenta in the clean basin and place all waste items (e.g., blood-stained gauze) in the plastic bag or leakproof, covered waste container.

STEP 9: If an episiotomy was done or there were vaginal or perineal tears requiring surgical repair:

- Place sharps (suture needles) in the puncture-resistant sharps container.
- If disposing of hypodermic needle and syringe, hold the needle under the surface of a 0.5% chlorine solution, fill the syringe and push out (flush) three times; then put in a puncture-resistant sharps container.

Alternatively, if reusing syringe (and needle), fill syringe with needle attached with 0.5% chlorine solution and soak for 10 minutes for decontamination.

STEP 10: Immerse both gloved hands in a 0.5% chlorine solution; remove gloves by inverting, and place in the plastic bag or leakproof, covered waste container if discarding them. If reusing them, place them in a 0.5 % chlorine solution for 10 minutes for decontamination.

STEP 11: Wash hands or use an antiseptic handrub.

Minimizing the Risk of Infection During Cesarean Section

Cesarean sections should be performed using the same standards as for any general surgical procedure as described in **Chapter 7**. Certain features that make this operation different are:

- The surgeon and assistant should wear a face shield (or mask and goggles) and a plastic or rubber apron over their scrub suits because splashing of blood and blood-tinged amniotic fluid can be expected.
- Double gloving is recommended, especially if reprocessed sterile or high-level surgical gloves are used.
- A first or second-generation cephalosporin should be given intravenously after the cord is clamped if the section is high risk (i.e., prolonged ruptured membranes or labor of any duration). (See **Table 23-2** for details.)⁴
- The health worker receiving the infant should wash her/his hands and put on clean examination gloves (or reprocessed high-level disinfected surgical gloves) before handling the baby.
- The baby should be placed on a clean towel after being passed off to the health worker caring for the infant.
- Change surgical gloves before manually removing the placenta. (If available, use elbow-length surgical gloves or a combination of fingerless gloves and a new pair of surgical gloves as described in **Chapter 7** and above.)
- With prolonged ruptured membranes or with documented intra-amniotic infection syndrome (chorioamnionitis):
 - Avoid spillage of amniotic fluid into the abdominal cavity.
 - Place folded, moistened sterile laparotomy pads or towels on either side of the uterus (paracolic gutters) to catch as much contaminated amniotic fluid as possible.
 - If large amounts of meconium or amniotic fluid spill into the abdominal cavity, remove the laparotomy pads or towels in the

⁴ Several well-designed studies have demonstrated that intravenous (IV) antibiotic prophylaxis reduces the risk of endometritis by about 50% after nonelective cesarean sections. (Cunningham et al 1983; Padilla, Spence and Beauchamp 1983). Antibiotic lavage of the abdominal cavity, however, offers no advantage over IV administration, is time-consuming and has been shown in one study to be less effective (Conover and Moore 1984).

gutters and lavage the cavity with sterile isotonic (0.9%) saline solution.

- Do not explore the peritoneal cavity unless absolutely necessary, and then only after closure of the uterine incision and surgical gloves have been changed.
- If the cervix is closed and membranes were not ruptured prior to the cesarean section:
 - Dilate the cervix from below (i.e., through the vagina) sufficiently to permit the outflow of blood and fluid (lochia) after delivering the baby and placenta.
 - Insert the gloved finger into the cervix only once to dilate it.
 - Do not go back and forth or remove the hand from the pelvis and then put the finger back into the cervix.
 - When dilation is completed, remove the gloves and put on a new pair of sterile or high-level disinfected surgical gloves (**Chapter 4**).
- To minimize postoperative wound infections:
 - Patients should not be shaved prior to surgery. (If it is necessary to remove pubic or abdominal hair, clip the hair with scissors just prior to surgery.)
 - Make the skin incision with a scalpel rather than with electrocautery.
 - After the fascia is closed, irrigate the wound with sterile isotonic (0.9%) saline and then blot it dry.
 - Whenever possible, do not place drains in the subcutaneous layer.
 - Close the skin edges using a subcuticular technique.
 - Apply a sterile dressing and care for the wound as described in **Chapter 23**.

Aseptic technique is broken whenever a nonsterile area is touched, such as when the gloved hand reaches down into the pelvis to extract the baby's head or buttocks. Whenever a sterile or high-level disinfected surgical glove (or gloves) becomes contaminated, it should be changed as soon as possible (see **Chapter 4** for how to change gloves).

Postpartum Care of the Mother

Minimizing the risk of nosocomial infection in mothers during the postpartum period includes the following:

- Wear examination or utility gloves when handling perineal pads, touching lochia (vaginal discharge) or touching the episiotomy.

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- In the immediate postpartum period, check to be sure she is voiding without difficulty.
- Teach her how to wash the perineal area with boiled water after changing a pad or having a bowel movement (defecation).
- If the patient is breastfeeding, teach her how to care for her breasts and nipples to avoid infection (mastitis).
- If delivery was by cesarean section, to avoid pulmonary problems during the immediate postoperative period and for the next few days:
 - use pain medication cautiously,
 - encourage her to move about in bed and take deep breaths frequently, and
 - get her out of bed and walking within the first 12 hours (**Chapter 27**).
- If delivery was by cesarean section and an indwelling catheter was inserted, to avoid urinary problems:
 - check to be sure urine is flowing and the urine collection system is intact,
 - follow the “Tips for Preventing Infections” in **Chapter 22**, and
 - remove the catheter as soon as possible (within 24–48 hours).

Postnatal Care of the Newborn

Minimizing the risk of nosocomial infection in the newborn involves the following:

- Wear gloves and plastic or rubber apron when handling the infant until blood, meconium or amniotic fluid has been removed from the infant’s skin.
- Careful removal of blood and other body fluids using a cotton cloth, not gauze, soaked in warm water followed by drying the skin may minimize the risk of infection.
- Wash hands before holding or caring for the infant. Alternatively, a waterless, alcohol-based antiseptic handrub can be used.
- Bathing or washing the newborn should be delayed until the baby’s temperature has stabilized (usually about 6 hours). The buttocks and perineal areas are the most important to keep clean. They should be washed after each diaper change using a cotton cloth soaked in warm soapy water, and then carefully dried.
- Cover gowns or masks are not required when handling infants.
- No single method of cord care has proved to be better in preventing infection. General suggestions are:
 - Wash hands, or use an antiseptic hand rub, before and after cord care.
 - Keep the cord stump clean and dry.

- Do not cover the cord stump with a dressing or bandage.
- Fold the diaper below the cord stump.
- If the cord stump gets soiled or dirty, gently wash it with boiled soapy water, and rinse with boiled water and dry with a clean cloth.
- Explain to the mother that if the cord stump becomes red or is draining pus or blood she should bring the baby to a clinic or hospital equipped to care for newborns as soon as possible.

Management of Outbreaks in the Nursery or NICU

A presumptive epidemic in a nursery or neonatal intensive care unit (NICU) is defined as finding two or more newborns with the same condition (e.g., skin infection or infectious diarrhea) at the same time. If an epidemic or outbreak of a particular disease such as diarrhea is suspected, the first step is to assess it promptly and carefully to:

- determine the need for laboratory or epidemiologic studies (if available);
- identify the source of the diarrhea (e.g., patients, staff or visitors) and the means of transmission (e.g., contamination via hands of staff, parents or visitors); and
- decide on the type of control measures required to prevent the spread of the infection. (See **Chapter 28** for details of how to conduct an outbreak investigation.)

Even if an intensive investigation is not required, the control measures (e.g., strict isolation or placing all infected newborns in a common area) should be monitored to be sure that they have been effective and the problem is resolving.

For additional information on management of outbreaks due to:

- infectious diarrhea and foodborne infections, see **Chapter 26**; and
- specific airborne, droplet or contact diseases, see **Chapter 21** and **Appendix I**.

In addition, management of infected newborns, based on their presumptive diagnosis (clinical findings), is described in **Appendix K**.

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