Maternal Physiologic Changes

LEARNING OBJECTIVES

• Describe the anatomic and physiologic changes that occur during the postpartum period.
• Identify characteristics of uterine involution and lochial flow and describe ways to measure them.
• List expected values for vital signs, deviations from normal findings, and probable causes of the deviations.

KEY TERMS AND DEFINITIONS

afterbirth pains (afterpains) Painful uterine cramps that occur intermittently for approximately 2 or 3 days after birth and that result from contractile efforts of the uterus to return to its normal involuted condition.

autolysis The self-destruction of excess hypertrophied tissue

diatasis recti abdominis Separation of the two rectus muscles along the median line of the abdominal wall

involution Reduction in size of the uterus after birth, and its return to its nonpregnant condition

lochia Vaginal discharge during the puerperium consisting of blood, tissue, and mucus

lochia alba Thin, yellowish to white, vaginal discharge that follows lochia serosa on approximately the tenth day after birth and that may last from 2 to 6 weeks postpartum.

lochia rubra Red, distinctly blood-tinged vaginal flow that follows birth and lasts 2 to 4 days.

lochia serosa Serous, pinkish brown, watery vaginal discharge that follows lochia rubra until approximately the tenth day after birth.

pelvic relaxation Lengthening and weakening of the fascial supports of pelvic structures

puerperium Period after the third stage of labor and lasting until involution of the uterus takes place, usually approximately 3 to 6 weeks; fourth trimester of pregnancy

subinvolution Failure of the uterus to reduce to its normal size and condition after pregnancy

ELECTRONIC RESOURCES

Additional information related to the content in Chapter 15 can be found on the companion website at evolve.elsevier.com/lowdermilk/maternity/

• NCLEX Review Questions
• WebLinks

or on the interactive companion CD

• NCLEX Review Questions
The postpartum period is the interval between the birth of the newborn and the return of the maternal reproductive organs to their normal nonpregnant state. This period is sometimes referred to as the puerperium, or fourth trimester of pregnancy. Although the puerperium has traditionally been considered as lasting 6 weeks, this time frame varies among women. The distinct physiologic changes that occur during the reversal of the processes of pregnancy are normal. To provide care during the recovery period that is beneficial to the mother, her infant, and her family, the nurse must synthesize knowledge of maternal anatomy and physiology of the recovery period, the newborn's physical and behavioral characteristics, infant care activities, and family response to the birth of the infant. This chapter focuses on anatomic and physiologic changes that occur in the mother during the postpartum period.

**REPRODUCTIVE SYSTEM AND ASSOCIATED STRUCTURES**

**Uterus**

**Involution process**

The return of the uterus to a nonpregnant state after birth is known as involution. This process begins immediately after expulsion of the placenta with contraction of the uterine smooth muscle.

At the end of the third stage of labor the uterus is in the midline, approximately 2 cm below the level of the umbilicus, with the fundus resting on the sacral promontory. At this time the uterus weighs approximately 1000 g. Within 12 hours the fundus may rise to approximately 1 cm above the umbilicus (Fig. 15-1). By 24 hours postpartum the uterus is about the same size it was at 20 weeks of gestation (Resnik, 2004). Involution progresses rapidly during the next few days. The fundus descends about 1 to 2 cm every 24 hours. By the sixth postpartum day the fundus is normally located halfway between the umbilicus and the symphysis pubis. The uterus should not be palpable abdominally after 2 weeks (Resnik, 2004). The uterus, which at full term weighs approximately 11 cm above the umbilicus (Fig. 15-1). By 24 hours postpartum the uterus weighs 50 to 60 g (see Fig. 15-1).

Increased estrogen and progesterone levels are responsible for stimulating the massive growth of the uterus during pregnancy. Prenatal uterine growth results from both hyperplasia, an increase in the number of muscle cells, and from hypertrophy, an enlargement of the existing cells. Postpartally, the decrease in these hormones causes autolysis, the self-destruction of excess hypertrophied tissue. The additional cells laid down during pregnancy remain and account for the slight increase in uterine size after each pregnancy.

**Subinvolution** is the failure of the uterus to return to a nonpregnant state. The most common causes of subinvolution are retained placental fragments and infection.

**Contractions**

Postpartum hemostasis is achieved primarily by compression of intramyometrial blood vessels as the uterine muscle contracts rather than by platelet aggregation and clot formation. The hormone oxytocin, released from the pituitary gland, strengthens and coordinates these uterine contractions, which compress blood vessels and promote hemostasis. During the first 1 to 2 postpartum hours, uterine contractions may decrease in intensity and become uncoordinated because it is vital that the uterus remain firm and well contracted, exogenous oxytocin (Pitocin) is usually administered intravenously or intramuscularly immediately after expulsion of the placenta. Mothers who plan to breastfeed may also be encouraged to put the baby to breast immediately after birth because suckling stimulates oxytocin release from the posterior pituitary gland.

**Afterpains**

In first-time mothers, uterine tone is good, the fundus generally remains firm, and the mother does not perceive uterine cramping. Periodic relaxation and vigorous contraction are more common in subsequent pregnancies and may cause uncomfortable cramping called afterbirth pains (afterpains), which persist throughout the early puerperium. Afterpains are more noticeable after births in which the uterus was overdistended (e.g., large baby, multifetal gestation, polyhydramnios). Breastfeeding and exogenous oxytocin medication usually intensify these afterpains because both stimulate uterine contractions.

**Placental site**

Immediately after the placenta and membranes are expelled, vascular constriction and thromboses reduce the placental site to an irregular nodular and elevated area. Upward growth of the endometrium causes sloughing of necrotic tissue and prevents the scar formation that is characteristic of normal wound healing. This unique healing process enables the endometrium to resume its usual cycle of changes and to permit implantation and placentation in future pregnancies. Endometrial regeneration is completed by postpartum day 16, except at the placental site (Resnik, 2004). Regeneration at the placental site usually is not complete until 6 weeks after birth.

**Lochia**

Postchildbirth uterine discharge, commonly called lochia, initially is bright red (lochia rubra) and may contain small clots. For the first 2 hours after birth the amount of uterine discharge should be approximately that of a heavy menstrual period. After that time the lochial flow should steadily decrease. Lochia rubra consists mainly of blood and decidual and trophoblastic debris. The flow pales, becoming pink or brown (lochia serosa) after 3 to 4 days. Lochia serosa consists of old blood, serum, leukocytes, and tissue debris. The median duration for lochia serosa discharge is 22 to 27 days (Bowes &
In most women, about 10 days after childbirth the drainage becomes yellow to white (lochia alba). Lochia alba consists of leukocytes, decidua, epithelial cells, mucus, serum, and bacteria. Lochia alba usually continues for 10 to 14 days but may normally last longer (Simpson & Creehan, 2001).

If the woman receives an oxytocic medication, the flow of lochia is often scant until the effects of the medication wear off. The amount of lochia is typically smaller after cesarean births. Flow of lochia usually increases with ambulation and breastfeeding. Lochia tends to pool in the vagina when the woman is lying in bed; upon standing, the woman may experience a gush of blood. This gush should not be confused with hemorrhage.

Persistence of lochia rubra early in the postpartum period suggests continued bleeding as a result of retained fragments of the placenta or membranes. Recurrence of bleeding approximately 7 to 14 days after birth is from the healing placental site. About 10% to 15% of women will still be experiencing normal lochia serosa discharge at the 6-week postpartum examination (Bowes & Katz, 2002). In the majority of women, however, a continued flow of lochia serosa or lochia alba by 3 to 4 weeks after birth may indicate endometritis, particularly if fever, pain, or abdominal tenderness is associated with the discharge. Lochia should smell like normal menstrual flow; an offensive odor usually indicates infection.

Not all postpartal vaginal bleeding is lochia; vaginal bleeding after birth may be a result of unrepaired vaginal or cervical lacerations. Table 15-1 distinguishes between lochial and nonlochial bleeding.

Cervix

The cervix is soft immediately after birth. Within 2 to 3 days postpartum it has shortened, become firm, and regained its form (Resnik, 2004). The cervix up to the lower uterine segment remains edematous, thin, and fragile for several days after birth. The ectocervix (portion of the cervix that protrudes into the vagina) appears bruised and has some small lacerations—optimal conditions for the development of
the woman is pushing during birth. Women often experience
Fig. 8-9 on p. 218). Internal hemorrhoids may evert while
may occur. Healing should occur within 2 to 3 weeks.
of approximation (separation of the edges of the incision)
tion (pain, redness, warmth, swelling, or discharge) or loss
iotomy is the same as any surgical incision. Signs of infec-
for visualization of some episiotomies. Healing of an epis-
in the lithotomy position. A good light source is essential
woman observes good hygiene during the first 2 weeks af-
repaired, hematomas are prevented or treated early, and the
is usually barely distinguishable from that of a nulliparous
Most rugae are permanently flattened. The mucosa remains
atrophic in the lactating woman, at least until menstruation
resumes. The use of a water-soluble lubricant during sexual in-
and the amount soon lessens to a trickle of bright red
Lochial and Nonlochial Bleeding

<table>
<thead>
<tr>
<th>LOCHIAL BLEEDING</th>
<th>NONLOCHIAL BLEEDING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lochia usually trickles from the vaginal opening. The</td>
<td>If the bloody discharge spurts from the vagina, there may</td>
</tr>
<tr>
<td>steady flow is greater as the uterus contracts. A gush</td>
<td>be cervical or vaginal tears in addition to the normal</td>
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<tr>
<td>of lochia may result as the uterus is massaged. If it</td>
<td>lochia.</td>
</tr>
<tr>
<td>is dark in color, it has been pooled in the relaxed vagina,</td>
<td>If the amount of bleeding continues to be excessive and</td>
</tr>
<tr>
<td>and the amount soon lessens to a trickle of bright red</td>
<td>bright red bleeding with defecation. Hemorrhoids usually</td>
</tr>
<tr>
<td>lochia (in the early puerperium).</td>
<td>decrease in size within 6 weeks of childbirth.</td>
</tr>
</tbody>
</table>

Pelvic muscular support
The supporting structure of the uterus and vagina may be
injured during childbirth and may contribute to later gynec-
ologic problems. Supportive tissues of the pelvic floor that
are torn or stretched during childbirth may require up to
6 months to regain tone. Kegel exercises, which help to
strengthen perineal muscles and encourage healing, are rec-
commended after childbirth (see Teaching Guidelines, Chap-
ter 4). Later in life, women can experience pelvic relaxation,
the lengthening and weakening of the fascial supports of
pelvic structures. These structures include the uterus, upper
posterior vaginal wall, urethra, bladder, and rectum. Although
pelvic relaxation can occur in any woman, it is usually a di-
rect but delayed complication of childbirth (see Chapter 25).

ENDOCRINE SYSTEM

Placental Hormones
Significant hormonal changes occur during the postpartal pe-
niod. Expulsion of the placenta results in dramatic decreases
of the hormones produced by that organ. Decreases in hu-
man chorionic somatomammotropin, estrogens, cortisol,
and the placental enzyme insulinase reverse the diabetogenic
effects of pregnancy, resulting in significantly lower blood
sugar levels in the immediate puerperium. Mothers with type
1 diabetes will be likely to require much less insulin for sev-
eral days after birth. Because these normal hormonal changes
make the puerperium a transitional period for carbohydrate
metabolism, it is more difficult to interpret glucose tolerance
tests during this time.

Estrogen and progesterone levels drop markedly after ex-
pulsion of the placenta and reach their lowest levels 1 week
postpartum. Decreased estrogen levels are associated with
breast engorgement and with the diuresis of excess extra-
cellular fluid accumulated during pregnancy. In nonlactat-
ing women, estrogen levels begin to rise by 2 weeks after
birth and by postpartum day 17 are higher than in women
who breastfeed (Bowes & Katz, 2002).

β-Human chorionic gonadotropin (β-hCG) disappears
from maternal circulation in 14 days (Resnik, 2004).
Pituitary Hormones and Ovarian Function

Lactating and nonlactating women differ considerably in the time when the first ovulation occurs and when menstruation resumes. The persistence of elevated serum prolactin levels in breastfeeding women appears to be responsible for suppressing ovulation. Because levels of follicle-stimulating hormone (FSH) have been shown to be identical in lactating and nonlactating women, it is thought that ovulation is suppressed in lactating women because the ovary does not respond to FSH stimulation when increased prolactin levels are present (Resnik, 2004).

Prolactin levels in blood rise progressively throughout pregnancy. In women who breastfeed, prolactin levels remain elevated into the sixth week after birth (Lawrence & Lawrence, 2004). Serum prolactin levels are influenced by the frequency of breastfeeding, the duration of each feeding, and the degree to which supplementary feedings are used. Individual differences in the strength of an infant’s sucking stimulus probably also affect prolactin levels. In nonlactating women, prolactin levels decline after birth and reach the prepregnancy range by the third postpartum week (Bowes & Katz, 2002).

Ovulation occurs as early as 27 days after birth in nonlactating women, with a mean time of about 70 to 75 days (Bowes & Katz, 2002). Approximately 70% of nonbreastfeeding women resume menstruating by 3 months after birth (Lawrence & Lawrence, 2004). In women who breastfeed, the mean length of time to initial ovulation is 6 months (Bowes & Katz, 2002). In lactating women, both resumption of ovulation and return of menses are determined in large part by breastfeeding patterns (Resnik, 2004). Many women ovulate before their first postpartum menstrual period occurs; therefore there is need to discuss contraceptive options early in the puerperium (Lawrence & Lawrence, 2004).

The first menstrual flow after childbirth is usually heavy (Cunningham et al., 2005). With adequate emptying of the bladder, bladder tone is usually restored 5 to 7 days after birth (Cunningham et al., 2005). Because of birth-induced trauma, increased bladder capacity following childbirth, and the effects of conduction anesthesia combined to cause a decreased urge to void. In addition, pelvic soreness caused by the forces of labor, vaginal lacerations, or an episiotomy reduces or alters the voiding reflex. Decreased voiding combined with postpartum diuresis may result in bladder distention. Immediately after birth, excessive bleeding can occur if the bladder becomes distended because it pushes the uterus up and to the side and prevents the uterus from contracting firmly. Later in the puerperium overdistention can make the bladder more susceptible to infection and impede the resumption of normal voiding (Cunningham et al., 2005). With adequate emptying of the bladder, bladder tone is usually restored 5 to 7 days after childbirth.

URINARY SYSTEM

The hormonal changes of pregnancy (i.e., high steroid levels) contribute to an increase in renal function; diminishing steroid levels after childbirth may partly explain the reduced renal function that occurs during the puerperium. Kidney function returns to normal within 1 month after birth. From 2 to 8 weeks are required for the pregnancy-induced hypotonia and dilation of the ureters and renal pelves to return to the nonpregnant state (Cunningham et al., 2005). In a small percentage of women, dilation of the urinary tract may persist for 3 months, which increases the chance of developing a urinary tract infection.

Urine Components

The renal glycosuria induced by pregnancy disappears, but lactosuria may occur in lactating women. The blood urea nitrogen increases during the puerperium as autolysis of the involuting uterus occurs. This breakdown of excess protein in the uterine muscle cells also results in a mild (+1) proteinuria for 1 to 2 days after childbirth in 40% to 50% of women (Simpson & Creehan, 2001). Ketonuria may occur in women with an uncomplicated birth or after a prolonged labor with dehydration.

Postpartal Diuresis

Within 12 hours of birth, women begin to lose excess tissue fluid accumulated during pregnancy. Profuse diaphoresis often occurs, especially at night, for the first 2 or 3 days after childbirth. Postpartal diuresis, caused by decreased estrogen levels, removal of increased venous pressure in the lower extremities, and loss of the remaining pregnancy-induced increase in blood volume, also aids the body in ridding itself of excess fluid. Fluid loss through perspiration and increased urinary output accounts for a weight loss of approximately 2.25 kg during the puerperium.
Timing of Fluids and Food after Cesarean Birth

BACKGROUND
• Health care is full of assumptions and traditions that do not necessarily stem from evidence. It has long been customary to withhold fluids and food after major abdominal surgery until bowel function returns, evidenced by bowel sounds and passing of flatus and stool. The concern is the occurrence of paralytic ileus, a loss of peristalsis, characterized by abdominal tenderness and distention, nausea and vomiting, and lack of bowel sounds. Some health care providers have a policy of limiting food and fluids to women after cesarean birth, even if no handling of the bowel has occurred. Depending on the institution, fluids and food can be withheld up to 24 hours, followed by a transition day from clear to full liquids, and solids by the third day. This is in addition to the time that the woman has already been without food and fluids while in labor.
• Critics of this policy find this starvation unnecessary because simple cesarean birth is not associated with bowel manipulation. Indeed, there is some evidence that bowel function continues even after major manipulation, but with altered bowel sounds. Paralytic ileus is thought to be multifactorial, caused by neural and hormonal factors involving the sympathetic and parasympathetic nervous systems, use of narcotics, and type of anesthesia. Some researchers have found that fluids are well tolerated after cesarean birth and should be provided unless the operation involved extensive bowel manipulation or sepsis. Some institutions even offer fluids within 90 minutes after birth, and, if well tolerated, a regular diet soon thereafter.

OBJECTIVES
• Reviewers sought to clarify these different treatment alternatives and question the basis for delaying fluids and foods after cesarean birth. They sought to review trials that compared early and delayed reintroduction of fluids and food after cesarean birth. Outcome measures included occurrence of nausea, vomiting, crampy abdominal pain, bloating, and abdominal distention; presence of bowel action on the third postoperative day; delayed return to bowel sounds and action; ketosis; blood sugar values; duration of intravenous fluids; breastfeeding success; women’s satisfaction; hunger, fatigue, and breastfeeding.

METHODS
Search Strategy
• The reviewers searched the Cochrane Database, MEDLINE, and the journals summarized by Zetoc, the British Library Electronic Table of Contents. Search words were oral feed, oral fluid, oral hydration, oral intake, eat, drink, food, cesar, Caesarean, and cesarean section. Reviewers included six randomized, controlled trials, published from 1993 to 2001. Information about total number of women and number of women per trial was not noted. Countries of origin also were not included in the review.

Statistical Analyses
• Statistical analyses of outcomes with early reintroduction of oral fluids and solids (usually within 6 to 8 hours postoperatively) were compared with delayed administration of fluids and solids, as defined by the trial authors. The authors accepted differences between groups that exceeded the 95% confidence interval as significant.

FINDINGS
• Early administration of oral fluids was associated with decreased time to first solids, decreased time to bowel sounds, and decreased length of hospitalization in the subgroup that had regional analgesia. Early fluids also led to a trend toward decreased abdominal distention, but this was not significant.
• There were no significant differences between early and delayed fluid administration in the following outcomes: nausea, vomiting, time to bowel action, time to passing flatus, paralytic ileus, and number of doses of analgesia taken postoperatively. No adverse outcomes were found with early postcesarean intake of fluids and food.

LIMITATIONS
• Protocols for times for offering fluids varied. Some trials may have offered clear liquids, some slush, and some fluid and food. Timing of intake varied. Because neither the number of the study participants nor the total number of studies reviewed was reported, it is not possible to assess whether small sample size led to bias.
• No data were available on intravenous hydration, biochemical changes, patient satisfaction, hunger, fatigue, and breastfeeding.

CONCLUSIONS
• There is no evidence from randomized trials to justify a policy of delaying fluids or food after uncomplicated cesarean birth.

IMPLICATIONS FOR PRACTICE
• Nurses in settings where food and fluid are withheld after cesarean birth should work to change the practice.

IMPLICATIONS FOR FURTHER RESEARCH
• The reviewers call for larger, well-designed trials. Further information is needed regarding the intake of fluids and food after complicated cesarean birth. It is unknown whether there are any differences in postoperative gastrointestinal recovery between planned and unplanned cesarean births.
Evidence—Is there sufficient evidence to draw conclusions about normal physiologic breast changes in lactating women and the reliability of breastfeeding as a contraceptive method?

1. Evidence:—Is there sufficient evidence to draw conclusions about normal physiologic breast changes in lactating women and the reliability of breastfeeding as a contraceptive method?

2. Assumptions:—What assumptions can be made about the following issues:
   a. Differences in the breasts of lactating and nonlactating women.
   b. Interest in resuming sexual intimacy after childbirth.
   c. Safe and reliable contraceptive choices for the breastfeeding woman.

3. What implications and priorities for nursing care can be drawn at this time?

4. Does the evidence objectively support your conclusion?

5. Are there alternative perspectives to your conclusion?

Nonbreastfeeding Mothers

The breasts generally feel nodular in contrast to the granular feel of breasts in nonpregnant women. The nodularity is bilateral and diffuse. Prolactin levels drop rapidly. Colostrum is present for the first few days after childbirth. Palpation of the breast on the second or third day, as milk production begins, may reveal tissue tenderness in some women. On the third or fourth postpartum day, engorgement may occur. The breasts are distended (swollen), firm, tender, and warm to the touch (because of vasodilation). Breast distention is caused primarily by the temporary congestion of veins and lymphatics rather than by an accumulation of milk. Milk is present but should not be expressed. Axillary breast tissue (the tail of Spence) and any accessory breast or nipple tissue along the milk line may be involved. Engorgement resolves spontaneously, and discomfort decreases usually within 24 to 36 hours. A breast binder or tight bra, ice packs, fresh cabbage leaves, or mild analgesics may be used to relieve discomfort. Nipple stimulation is avoided. If suckling is never begun (or is discontinued), lactation ceases within a few days to a week.

GASTROINTESTINAL SYSTEM

Appetite

The mother usually is hungry shortly after the birth and can tolerate a light diet. Most new mothers are very hungry after full recovery from anaesthesia, anesthia, and fatigue. Requests for double portions of food and frequent snacks are not uncommon.

Bowel Evacuation

A spontaneous bowel evacuation may not occur for 2 to 3 days after childbirth. This delay can be explained by decreased muscle tone in the intestines during labor and the immediate puerperium, prelabor diarrhea, lack of food, or dehydration. The mother often anticipates discomfort during the bowel movement because of perineal tenderness as a result of episiotomy, lacerations, or hemorrhoids and resists the urge to defecate. Regular bowel habits should be reestablished when bowel tone returns.

Operative vaginal birth (forceps or vacuum use) and anal sphincter lacerations are associated with an increased risk of postpartum anal incontinence. If it occurs, anal incontinence is often temporary and may resolve within 6 months (Bowes & Katz, 2002). Women should be taught during pregnancy about episiotomy and its possible sequelae. Pelvic floor (Kegel) exercises should be encouraged.

Breasts

Promptly after birth, there is a decrease in the concentrations of hormones (i.e., estrogen, progesterone, hCG, prolactin, cortisol, and insulin) that stimulated breast development during pregnancy. The time it takes for these hormones to return to prepregnancy levels is determined in part by whether the mother breastfeeds her infant.

Breastfeeding Mothers

During the first 24 hours after birth, there is little, if any, change in the breast tissue. Colostrum, a clear yellow fluid, may be expressed from the breasts. The breasts gradually become fuller and heavier as the colostrum transitions to milk by about 72 to 96 hours after birth; this is often referred to as the “milk coming in.” The breasts may feel warm, firm, and somewhat tender. Bluish-white milk with a skim-milk appearance (true milk) can be expressed from the nipples. As milk glands and milk ducts fill with milk, breast tissue may feel somewhat nodular or lumpy. Unlike the lumps associated with fibrocystic breast disease or cancer (which may be consistently palpated in the same location), the nodularity associated with milk production tends to shift in position. Some women experience engorgement, but with frequent breastfeeding and proper care, this is a temporary condition that typically lasts only 24 to 48 hours (See Chapter 20).

The nipples are examined for erectility and signs of irritation such as cracks, blisters, or reddening. Sore, damaged nipples are most often the result of incorrect latch (see Chapter 20).

Nonbreastfeeding Mothers

The breasts generally feel nodular in contrast to the granular feel of breasts in nonpregnant women. The nodularity is bilateral and diffuse. Prolactin levels drop rapidly. Colostrum is present for the first few days after childbirth. Palpation of the breast on the second or third day, as milk production begins, may reveal tissue tenderness in some women. On the third or fourth postpartum day, engorgement may occur. The breasts are distended (swollen), firm, tender, and warm to the touch (because of vasodilation). Breast distention is caused primarily by the temporary congestion of veins and lymphatics rather than by an accumulation of milk. Milk is present but should not be expressed. Axillary breast tissue (the tail of Spence) and any accessory breast or nipple tissue along the milk line may be involved. Engorgement resolves spontaneously, and discomfort decreases usually within 24 to 36 hours. A breast binder or tight bra, ice packs, fresh cabbage leaves, or mild analgesics may be used to relieve discomfort. Nipple stimulation is avoided. If suckling is never begun (or is discontinued), lactation ceases within a few days to a week.

Critical Thinking Exercise

Concerns of a Breastfeeding Mother

You receive a phone call on the Warm Line from Karen, who is entering her sixth week postpartum and is exclusively breastfeeding her new baby boy. She has concerns regarding the way that her breasts feel now that she has had a baby. She also states that her husband wants to resume sexual intimacy. She is willing to do so; however, she is concerned about the possibility of becoming pregnant and asks if she can rely on breastfeeding for contraception.

1. Evidence:—Is there sufficient evidence to draw conclusions about normal physiologic breast changes in lactating women and the reliability of breastfeeding as a contraceptive method?

2. Assumptions:—What assumptions can be made about the following issues:
   a. Differences in the breasts of lactating and nonlactating women.
   b. Interest in resuming sexual intimacy after childbirth.
   c. Safe and reliable contraceptive choices for the breastfeeding woman.

3. What implications and priorities for nursing care can be drawn at this time?

4. Does the evidence objectively support your conclusion?

5. Are there alternative perspectives to your conclusion?
decrease in total blood volume. Thereafter, most of the blood volume increase during pregnancy (1000 to 1500 ml) is eliminated within the first 2 weeks after birth (Simpson & Creehan, 2001).

Pregnancy-induced hypervolemia (an increase in blood volume of at least 35% more than prepregnancy values near term) allows most women to tolerate considerable blood loss during childbirth (Bowes & Katz, 2002). Many women lose approximately 500 ml of blood during vaginal birth of a single fetus and approximately twice this much during cesarean birth (Resnik, 2004).

Readjustments in the maternal vasculature after childbirth are dramatic and rapid. The woman’s response to blood loss during the early puerperium differs from that in a non-pregnant woman. Three postpartal physiologic changes protect the woman by increasing the circulating blood volume: (1) elimination of uteroplacental circulation reduces the size of the maternal vascular bed by 10% to 15%, (2) loss of placental endocrine function removes the stimulus for vasodilation, and (3) mobilization of extravascular water stored during pregnancy occurs. Therefore hypovolemic shock usually does not occur in women who experience a normal blood loss.

Cardiac Output
Pulse rate, stroke volume, and cardiac output increase throughout pregnancy. Cardiac output remains increased for at least the first 48 hours postpartum because of an increase in stroke volume. This increased stroke volume is caused by the return of blood to the maternal systemic venous circulation, a result of rapid decrease in uterine blood flow and mobilization of extravascular fluid (Resnik, 2004). Cardiac output generally returns to normal by 6 weeks postpartum, but the rate of return appears to be variable (Resnik, 2004). Recent data suggest that stroke volume, cardiac output, and systemic vascular resistance remain elevated over nonpregnant values at least 12 weeks after delivery (Resnik, 2004).

Vital Signs
Few alterations in vital signs are seen under normal circumstances. Heart rate and blood pressure return to non-pregnant levels within a few days (Resnik, 2004) (Table 15-2). Respiratory function returns to nonpregnant levels by 6 to 8 weeks after birth. After the uterus is emptied, the diaphragm descends, the normal cardiac axis is restored, and the point of maximal impulse (PMI) and the electrocardiogram (ECG) are normalized.

<table>
<thead>
<tr>
<th>TABLE 15-2</th>
<th>Vital Signs after Childbirth</th>
</tr>
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<tbody>
<tr>
<td><strong>NORMAL FINDINGS</strong></td>
<td><strong>DEViations FROM NORMAL FINDINGS AND PROBABLE CAUSES</strong></td>
</tr>
<tr>
<td>TEMPERATURE</td>
<td>Temperature during first 24 hours may rise to 38°C C as a result of dehydrating effects of labor. After 24 hours the woman should be afebrile. A diagnosis of puerperal sepsis is suggested if a rise in maternal temperature to 38°C C is noted after the first 24 hours after childbirth and recurs or persists for 2 days. Other possibilities are mastitis, endometritis, urinary tract infection, and other systemic infections.</td>
</tr>
<tr>
<td>PULSE</td>
<td>Pulse returns to nonpregnant levels within a few days postpartum, although the rate of return varies among individual women. A rapid pulse rate or one that is increasing may indicate hypovolemia as a result of hemorrhage.</td>
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<tr>
<td>RESPIRATIONS</td>
<td>Respiration should decrease to within the woman’s normal prepregnancy range by 6 to 8 weeks after birth. Hypoventilation may follow an unusually high subarachnoid (spinal) block or epidural narcotic after a cesarean birth.</td>
</tr>
<tr>
<td>BLOOD PRESSURE</td>
<td>Blood pressure is altered slightly if at all. Orthostatic hypotension, as indicated by feelings of faintness or dizziness immediately after standing up, can develop in the first 48 hours as a result of the splanchnic engorgement that may occur after birth. A low or decreasing blood pressure may reflect hypovolemia secondary to hemorrhage. However, it is a late sign, and other symptoms of hemorrhage usually alert the staff. An increased reading may result from excessive use of vasopressor or oxytocic medications. Because gestational hypertension can persist into or occur first in the postpartum period, routine evaluation of blood pressure is needed. If a woman complains of headache, hypertension must be ruled out as a cause before analgesics are administered.</td>
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</table>
Blood Components

**Hematocrit and hemoglobin**

During the first 72 hours after childbirth, there is a greater reduction of plasma volume than in the number of blood cells. This results in a rise in hematocrit and hemoglobin levels by the seventh day after the birth. There is no increased red blood cell (RBC) destruction during the puerperium, but any excess will disappear gradually in accordance with the life span of the RBC. The exact time at which RBC volume returns to prepregnancy values is not known, but it is within normal limits when measured 8 weeks after childbirth (Bowes & Katz, 2002).

**White blood cell count**

Normal leukocytosis of pregnancy averages approximately 12,000/mm³. During the first 10 to 12 days after childbirth, values between 20,000 and 25,000/mm³ are common. Neutrophils are the most numerous white blood cells. Leukocytosis coupled with the normal increase in erythrocyte sedimentation rate may obscure the diagnosis of acute infection at this time.

**Coagulation factors**

Clotting factors and fibrinogen are normally increased during pregnancy and remain elevated in the immediate puerperium. When combined with vessel damage and immobility, this hypercoagulable state causes an increased risk of thromboembolism, especially after a cesarean birth. Fibrinolytic activity also increases during the first few days after childbirth (Bowes & Katz, 2002). Factors I, II, VIII, IX, and X decrease within a few days to nonpregnant levels. Fibrin split products, probably released from the placental site, can also be found in maternal blood.

**Varicosities**

Varicosities (varices) of the legs and around the anus (hemorrhoids) are common during pregnancy. Varices, even the less common vulvar varices, regress (empty) rapidly immediately after childbirth. Surgical repair of varicosities is not considered during pregnancy. Total or nearly total regression of varicosities is expected after childbirth.

### MUSCULOSKELETAL SYSTEM

Adaptations of the mother’s musculoskeletal system that occur during pregnancy are reversed in the puerperium. These adaptations include the relaxation and subsequent hypermobility of the joints and the change in the mother’s center of gravity in response to the enlarging uterus. The joints are completely stabilized by 6 to 8 weeks after birth. Although all other joints return to their normal pre-pregnancy state, those in the parous woman’s feet do not. The new mother may notice a permanent increase in her shoe size.

**Critical Thinking Exercise**

**Complications of Immobility after Cesarean Birth**

Your patient assignment today on the Mother-Baby Unit includes a patient who gave birth yesterday by cesarean. This patient has not yet gotten out of bed. She also refuses to turn herself in bed or perform deep breathing exercises because “both those things make me hurt.” Based on your knowledge of postpartum physiology, you are concerned that she is at risk to develop a thromboembolism.

1. **Evidence**—Is there sufficient evidence to draw conclusions about risk factors for the development of a thromboembolism during the postpartum period in women who give birth by cesarean?
2. **Assumptions**—What assumptions can be made about the following issues:
   a. Differences in activity level between women who give birth vaginally and by cesarean during the immediate postpartum period
   b. The relationship between postoperative pain and the woman's activity level
   c. Cultural variations in reactions to pain and expression of pain
   d. Influence of supportive care by the nurse
3. **What implications and priorities for nursing care can be drawn at this time?**
4. **Does the evidence objectively support your conclusion?**
5. **Are there alternative perspectives to your conclusion?**
Chloasma of pregnancy (mask of pregnancy) usually disappears at the end of pregnancy. Hyperpigmentation of the areolae and linea nigra may not regress completely after childbirth. Some women will have permanent darker pigmentation of those areas. Striae gravidarum (stretch marks) on the breasts, abdomen, and thighs may fade but usually do not disappear.

Vascular abnormalities such as spider angomas (nevii), palmar erythema, and epulis generally regress in response to the rapid decline in estrogens after the end of pregnancy. For some woman, spider nevi persist indefinitely.

Hair growth slows during the postpartum period. Some women actually experience hair loss, because the amount of hair lost is temporarily more than the amount regrown. The abundance of fine hair seen during pregnancy usually disappears after giving birth; however, any coarse or bristly hair that appears during pregnancy usually remains. Nails return to their prepregnancy consistency and strength.

Profuse diaphoresis that occurs in the immediate postpartum period is the most noticeable change in the integumentary system.

INTEGUMENTARY SYSTEM

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IMMUNE SYSTEM

No significant changes in the maternal immune system occur during the postpartum period. The mother’s need for a rubella vaccination or for prevention of Rh isoimmunization is determined.

Key Points

- The uterus involutes rapidly after birth and returns to the true pelvis within 2 weeks.
- The rapid drop in estrogen and progesterone levels after expulsion of the placenta is responsible for triggering many of the anatomic and physiologic changes in the puerperium.
- The return of ovulation and menses is determined in part by whether a woman breastfeeds her baby.
- Assessment of lochia and fundal height is essential to monitor the progress of normal involution and to identify potential problems.

- Few alterations in vital signs are seen after birth under normal circumstances.
- Activation of blood clotting factors, immobility, and sepsis predispose the woman to thromboembolism.
- Marked diuresis, decreased bladder sensitivity, and overdistention of the bladder can lead to problems with urinary elimination.
- Pregnancy-induced hypervolemia and postpartum physiologic changes allow the woman to tolerate considerable blood loss at birth.

Answer Guidelines to Critical Thinking Exercises

Concerns of a Breastfeeding Mother

1. Yes, there is sufficient evidence to draw conclusions about normal physiologic breast changes in lactating women and the reliability of breastfeeding as a contraceptive method. During lactation the breast may feel nodular or “lumpy” as a result of filled milk glands and milk ducts. The lumps often shift in position from day to day. At about six weeks after birth the breasts of a breastfeeding woman change in size to about what they were during or before pregnancy. Many women worry about their milk supply at this time because the change in breast tissue may coincide with an infant growth spurt. Although lumps may also be palpable in women with fibrocystic breast disease or breast cancer, the position of these lumps tends to remain constant over time. Although most lactating women will not resume ovulation for several months after giving birth, breastfeeding cannot be considered a reliable contraceptive method. The return of ovulation is determined in large part by individual breastfeeding patterns and is influenced by such factors as the frequency and duration of breastfeeding sessions, the degree to which supplemental feeding is used, and the strength of each infant’s sucking stimulus.

2. a. Breasts of lactating and nonlactating women will not feel the same when palpated.
   b. Men and women may vary with regard to their interest in resuming sexual relations. Some couples resume sexual activity by 3 to 4 weeks after birth. By 6 weeks postpartum, episiotomy and/or lacerations should be healed well enough for sexual intercourse, although dyspareunia and vaginal dryness may be experienced. The woman may wish to delay intercourse because of fear of pain or because of fatigue resulting from the demands of caring for a newborn. The woman’s partner may strongly desire to resume sexual activity and therefore may pressure her to participate even if she does not want to.

COMMUNITY ACTIVITY

Interview an office nurse or a nurse who acts in the role of a childbirth educator regarding what she or he teaches expectant parents and patients about postpartum physiologic changes. Does the nurse consider in-depth discussion of physiology to be necessary? Does the nurse have patient education materials related to postpartum physiology in languages other than English? Does the nurse discuss risk factors that the patient may have that would predispose her to postpartum complications? What actions are taken once it has been determined that the patient is at risk for developing postpartum complications?
feel ready. Various positions may reduce pressure on tender tissues; the partner can insert a lubricated finger in the vagina to test for tender spots.

b. The woman’s preference regarding a contraceptive method should be honored if at all possible. Regardless of safety and effectiveness, women are not likely to consistently use a contraceptive method that they do not like. Some hormonal methods of contraception, such as those containing estrogen, should not be used while nursing because they adversely affect milk production. Although not as effective at pregnancy prevention as some other contraceptive options, foam and condoms may be acceptable choices because they provide some lubrication and thus may help to increase the woman’s satisfaction with intercourse. The lactational amenorrhea method of birth control may be an option for Karen and her husband. They should receive information about a variety of contraceptive options so that they might make an informed decision.

c. The priorities for nursing care at this time are to educate Karen about the normal breast changes associated with lactation and contraceptive options for the nursing woman. Karen should also be encouraged to discuss her contraceptive options with her health care provider before resuming sexual activity.

d. The patient experiencing pain is not eager to move or do anything else that might cause the pain to increase. The postcesarean woman may be hesitant to move about in bed or to ambulate due to fear of disrupting or damaging the surgical incision site. She may fear that the wound will break open with activity. The culturally sensitive nurse will take into consideration the woman’s culture when assessing and treating pain.

e. A supportive nurse who provides explanations and rationale for suggested interventions (such as the importance of ambulation) and provides nonpharmacologic and pharmacologic pain relief measures will likely be able to influence her patients to ambulate as necessary. Taking time and providing encouragement are supportive interventions that will be appreciated.

Complications of Immobility after Cesarean Births

1. There is sufficient evidence to draw conclusions about risk factors for developing a thromboembolism during the postpartum period, especially in postcesarean patients. The vessel damage that normally occurs during surgery and postoperative immobility are two contributing factors. Another contributing factor is the woman’s hypocoagulable state. Clotting factors and fibrinogen are normally increased during pregnancy and remain elevated during the immediate postpartum period. Especially when blood pools in the lower extremities, clots are likely to form.

2. a. Women who give birth by cesarean are less likely than those who give birth vaginally to be active during the first day or so postpartum. Pain is an obvious reason for decreased activity. Other contributing factors to immobility include the presence of an indwelling urinary catheter and an intravenous line. Both of these are present in most postcesarean patients for at least 24 hours after surgery.

b. Like other postoperative patients, postcesarean patients are less likely to be active when they are in pain. It is important to stay “on top of” a patient’s pain by providing medication as soon as she begins to hurt rather than waiting until her pain is severe. Newer analgesic techniques, such as the use of epidural morphine, provide excellent postsurgical pain relief while minimizing the common complications, such as respiratory depression and constipation, experienced by patients receiving opioid medications. Patient controlled analgesia (PCA) can also be very effective in providing pain control.

c. The physiology of pain response is the same for all. However, there are cultural variations in response to, and expression of, pain. Some cultures view verbal expression of pain negatively; others provide more support for the person who expresses pain. The culturally sensitive nurse will take into consideration the woman’s culture when assessing and treating pain.

d. The priorities for nursing care at this time are to educate this patient about the potential serious consequences of immobility and to encourage her to move as much as possible. Interventions to encourage activity would include providing assistance with changing positions (lying to sitting, sitting to standing, standing to walking) and ambulating, as well as administering analgesic medications before activity, to minimize pain. The patient might also be taught range-of-motion exercises for her legs and feet to be done as bed. This would improve lower extremity circulation and thus make thromboembolism formation less likely. She could also be assisted to sit on the side of the bed and dangle her legs.

3. There is a significant amount of information available concerning breast changes during lactation and contraceptive options for the nursing woman. Nursing women should be encouraged to discuss their contraceptive options with her health care provider before resuming sexual activity.

4. The priorities for nursing care at this time are to educate this patient about the potential serious consequences of immobility and to encourage her to move as much as possible. Interventions to encourage activity would include providing assistance with changing positions (lying to sitting, sitting to standing, standing to walking) and ambulating, as well as administering analgesic medications before activity, to minimize pain. The patient might also be taught range-of-motion exercises for her legs and feet to be done as bed. This would improve lower extremity circulation and thus make thromboembolism formation less likely. She could also be assisted to sit on the side of the bed and dangle her legs.

5. A patient experiencing pain is not eager to move or do anything else that might cause the pain to increase. The postcesarean woman may be hesitant to move about in bed or to ambulate due to fear of disrupting or damaging the surgical incision site. She may fear that the wound will break open with activity. The nurse can offer simple explanations regarding the safety of ambulation in relation to the surgical incision, and can reassure the patient that she/he will be there to assist whenever the patient is ready to get out of bed.
Maternal Physiologic Changes


