

CASE STUDY 1:

Newborn

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GENDER

M

AGE

Neonate

SETTING

- Hospital

ETHNICITY

- Black American

COEXISTING CONDITIONS

- Myelomeningocele

PSYCHOSOCIAL

- Parental anxiety

THE NERVOUS SYSTEM

Overview: This case requires knowledge of hydrocephalus, spina bifida, growth and development, as well as an understanding of the client's background, personal situation, and parent-child attachment relationship.

Client Profile

Jerod is the name Joanna and Jim chose for their first child. Jim accompanied Joanna to all of her prenatal visits. When the routine ultrasound was performed at 32 weeks' gestation, Jerod was diagnosed with hydrocephalus and a myelomeningocele. His parents were initially devastated, but remained very excited about their son's birth. Joanna was scheduled for a caesarean section at 38 weeks' gestation and the couple were anxious about Jerod's condition and his treatment following birth.

Case Study

Jerod is delivered by caesarean section and transferred to the pediatric intensive care unit (PICU). On admission to the nursery he weighs 3.4 kg (7.5 lb) and is 8 cm (20 in.) in length. His vital signs are:

Temperature: 37° C (98.6° F)

Pulse: 144 beats/minute

Respirations: 40 breaths/minute

He has bulging fontanels and a high-pitched cry. His head circumference is 40 cm (15.8 in.) and his chest circumference is 34 cm (13.4 in.). In the lumbar region of his spine, the nurse notes a sac-like projection. When Joanna and Jim visit the nursery, they stroke Jerod and caress his fingers and toes. Joanna begins to cry and comments to the nurse, "I so wanted to breastfeed Jerod, but now I guess I can't."

Questions

1. Discuss the reason for Jerod being delivered by caesarean section.
2. Discuss the significance of Jerod's clinical manifestations.
3. What is hydrocephalus?
4. What is a myelomeningocele and how is it related to hydrocephalus?
5. Discuss the incidence and etiology of hydrocephalus and myelomeningocele.
6. Discuss the complications associated with Jerod's myelomeningocele.
7. What are the priorities of care for Jerod on admission?
8. Discuss Jerod's parents' actions when visiting Jerod in the nursery and how the nurse should respond to Joanna's concern about breastfeeding.
9. Discuss the priority nursing interventions when caring for Jerod's myelomeningocele prior to surgery.
10. Jerod's myelomeningocele is surgically repaired and a shunt is placed for his

hydrocephalus. Discuss the two types of shunts used to treat hydrocephalus and which is most common.

11. Discuss the complications that may occur in a child with a ventriculoperi-

toneal (VP) shunt and an atrioventricular (AV) shunt.

12. Discuss the teaching priorities for Jerod's parents prior to his discharge from the hospital to home.

Questions and Suggested Answers

1. Discuss the reason for Jerod being delivered by caesarean section. The decision to deliver Jerod by caesarean section was made to protect the integrity of the myelomeningocele from the stress of labor and a vaginal delivery. If he was delivered vaginally, the passage through the tight birth canal would compromise the integrity of the myelomeningocele, resulting in potential exposure of the sac contents to the vaginal canal and the air. This would increase the risk of infection and further compromise the contents of the sac, leading to additional neurological deficits for Jerod.

2. Discuss the significance of Jerod's clinical manifestations. Classic manifestations of hydrocephalus include bulging fontanel, a high-pitched cry, and an enlarged head circumference compared to the chest circumference (see Fig. 1-1). A neonate's fontanel should be flat; bulging indicates increased pressure within the brain. A high-pitched cry also is a sign of increased intracranial pressure. The head circumference of a normal neonate is within 2.5 cm (1 in.) of the chest circumference; Jerod's is 6 cm (2.4 in.) larger than his chest. This further indicates increased intracranial pressure. The sac-like projection in his lumbar region is consistent with spina bifida (see Fig. 1-2). Transillumination is a noninvasive procedure of shining a flashlight beam on the lateral aspect of the sac to determine whether the sac is filled with just fluid (meningocele) or if the sac contains solid contents (nerve roots, spinal cord, meninges, and fluid) which indicates a myelomeningocele. (Light beams can pass through fluid but not through solid tissue.) An ultrasound provides definitive differentiation, however. Jerod's vital signs are within normal limits for a neonate. Unlike in adults, vital sign indicators of increased intracranial pressure are not present in neonates until the pressure exceeds the accommodation of the flexible cranial sutures and the fontanel.

3. What is hydrocephalus? According to the National Institute of Neurological Disorders and Stroke (NINDS), "The term hydrocephalus is derived from the Greek words *hydro* meaning water and *cephalus* meaning head. As its name implies, it is a condition in which the primary characteristic is excessive accumulation of fluid in the brain. Although hydrocephalus was once known as "water on the brain," the "water" is actually cerebrospinal

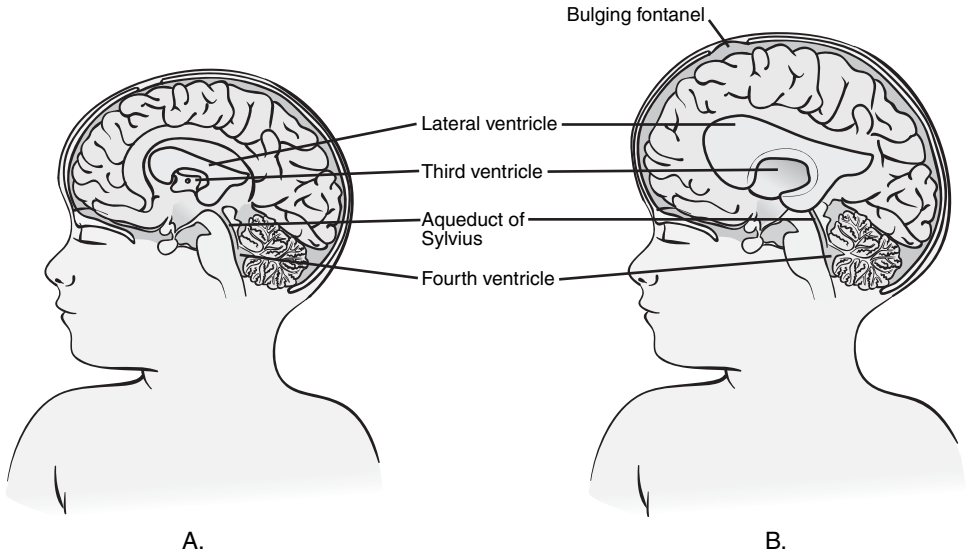


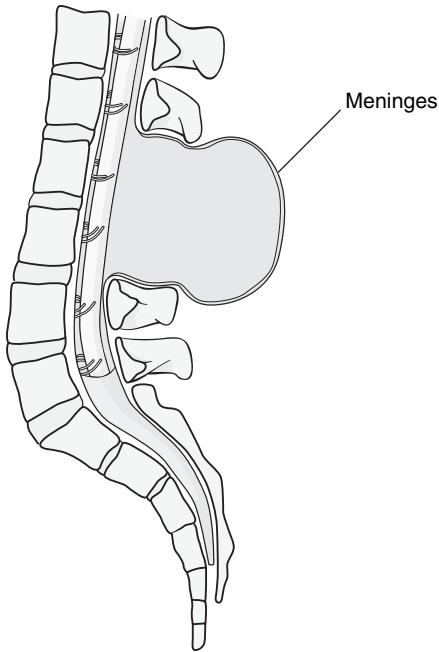
Figure 1-1 Comparison of *A. Normal size ventricles* and *B. Enlarged ventricles associated with hydrocephalus.*

fluid (CSF)—a clear fluid surrounding the brain and spinal cord. The excessive accumulation of CSF results in an abnormal dilation of the spaces in the brain called ventricles. This dilation causes potentially harmful pressure on the tissues of the brain.” Hydrocephalus is usually congenital and is associated with the following anomalies of the central nervous system:

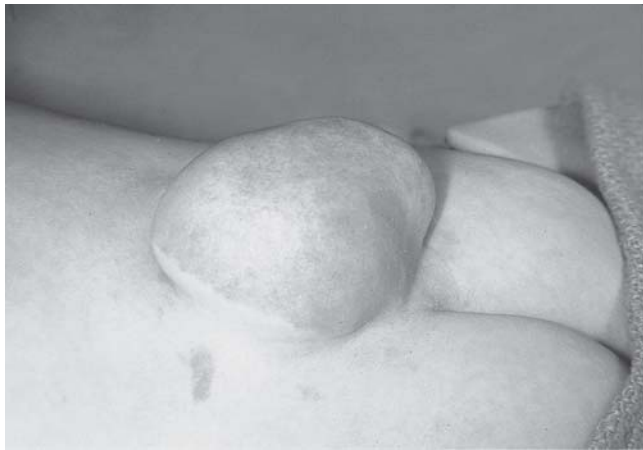
- a. Arnold–Chiari malformation
- b. Congenital arachnoid cysts
- c. Congenital tumors
- d. Aqueduct stenosis
- e. Spina bifida (meningocele and myelomeningocele)

It also may result from conditions associated with preterm birth, neonatal meningitis, subarachnoid hemorrhage, intrauterine infection, and perinatal hemorrhage. It occurs when there is either impaired absorption of the CSF within the subarachnoid space (communicating hydrocephalus) or an obstruction of CSF flow within the ventricles, preventing CSF from entering the subarachnoid space (noncommunicating hydrocephalus).

4. What is a myelomeningocele and how is it related to hydrocephalus? A myelomeningocele is a congenital neural tube defect resulting from incomplete closure of the spinal column during the first 28 days of gestation. It leads to neurological deficits similar to a spinal cord injury including neurogenic bladder and bowel and weakness of the lower extremities when located in the lumbar region. Defects located higher result in more



A.



B.

Figure 1-2 A. Illustration of meningocele; B. Meningocele.

severe neurological damage including those in the thoracic level and above and may cause preterm or neonatal death. Because the central nervous system develops early, including all of its components, hydrocephalus most commonly occurs in conjunction with neural tube defects.

5. Discuss the incidence and etiology of hydrocephalus and myelomeningocele. Hydrocephalus affects approximately 1 in every 500 children, the majority occurring prenatally. The cause of hydrocephalus is not completely understood, but has been associated with genetic inheritance, complications of preterm birth, prenatal maternal infection, perinatal infection or injury, childhood tumors, or subarachnoid hemorrhage. According to the National Information Center for Children and Youth with Disabilities, “Approximately 40% of all Americans may have spina bifida occulta, but because they experience little or no symptoms, very few of them ever know that they have it.” The other two types of spina bifida, meningocele and myelomeningocele, are known collectively as “spina bifida manifesta,” and occur in approximately one out of every 1,000 births. Of these infants born with “spina bifida manifesta,” about 4% have the meningocele form, while about 96% have myelomeningocele form. The exact cause of myelomeningocele is not known; however, evidence indicates that genetic predisposition, maternal folic acid deficiency during pregnancy, and viral infections are strongly associated with the development of spina bifida.

6. Discuss the complications associated with Jerod’s myelomeningocele. Myelomeningoceles can cause life-threatening infections in the neonate if the sac loses its integrity prior to surgical closure. In addition, myelomeningocele leads to neurological deficits similar to a spinal cord injury including neurogenic bladder and bowel, weakness of the lower extremities, and paralysis when located in the lumbar region. Defects located higher result in more severe neurological damage including those in the thoracic level and above and may cause preterm or neonatal death. Because the central nervous system develops early including all of its components, hydrocephalus most commonly occurs in conjunction with neural tube defects. Latex allergies are common in these children as a result of the need for daily intermittent urinary catheterization.

7. What are the priorities of care for Jerod on admission?

- a. Ineffective cerebral tissue perfusion related to increased intracranial pressure
- b. Risk for impaired skin integrity related to fragility of myelomeningocele sac
- c. Risk for injury, neurological alterations, related to spinal cord injury
- d. Risk for infection related to potential lack of integrity of myelomeningocele sac, invasive lines, and surgical placement of shunt
- e. Risk for impaired parent/infant attachment related to Jerod’s being in critical care environment
- f. Impaired urinary and bowel elimination related to interference of nerve stimulation

- g. Deficient knowledge related to Jerod's condition, treatment, and home care and breastfeeding

8. How should the nurse therapeutically respond to Jerod's mother?

Jerod can be breastfed. Prior to surgery, the nurse can assist Joanna in positioning Jerod on his side facing her breast, taking care not to apply any pressure to Jerod's back in the vicinity of the myelomeningocele. This position can be used postoperatively following Jerod's surgical repair and closure of the myelomeningocele. Joanna should be taught to use a breast pump to express the breast milk that can be stored in the refrigerator and administered to Jerod until the surgeon clears him for continuation of breastfeeding. The nurse should encourage Joanna about breastfeeding and her options until normal breastfeeding can continue.

9. Discuss the priority nursing interventions when caring for Jerod's myelomeningocele prior to surgery.

The priority goal for the nurse is to maintain the integrity of the sac until surgery. This is accomplished by placing Jerod in a side-lying position and providing care to the sac according to the health care provider's prescription. Sac care may involve leaving the sac open to the air, applying a sterile gauze dressing, a transparent dressing, or wet-to-dry dressing using sterile normal saline. Iodine substances and alcohol are very drying and should not be used on the sac. Monitoring urinary and bowel output is necessary and intermittent urinary catheterization may be prescribed to prevent bladder infections due to urinary stasis and to prevent bladder injury related to bladder distention.

10. Jerod's myelomeningocele is surgically repaired and a shunt is placed for his hydrocephalus. Discuss the two types of shunts used to treat hydrocephalus and which is most common.

Ventriculoperitoneal shunts (VP shunts) are the most common type of drainage shunt used in children with hydrocephalus. This shunt functions by draining the ventricles of excess CSF and causing it to be absorbed through the peritoneal wall into systemic circulation and excreted by the kidneys. The shunt is a flexible tube beginning in the ventricle and ending in the peritoneal cavity. The atrioventricular shunts (AV shunts) are much less common and are usually inserted in response to complications of the VP shunt. The AV shunt drains the ventricle(s) of the brain into the atrium of the heart to be absorbed into the blood and pumped into systemic circulation by the left cardiac ventricle. The excess fluid is then circulated systemically and excreted through the kidneys.

11. Discuss the complications that may occur in a child with a VP shunt and an AV shunt.

The most common complications associated with a VP shunt are malfunction of the shunt and infection. Malfunction or obstruction of the shunt will lead to increased intracranial pressure. Infection in the

shunt can lead to central nervous system infections that can lead to death. An AV shunt can produce the same complications as a VP shunt, but with the additional life-threatening complication of cardiac dysrhythmias associated with the cardiac end of the shunt coming in contact with the myocardium and stimulating dysfunctional contractions.

12. Discuss the teaching priorities for Jerod's parents prior to his discharge from the hospital to home.

- a. Assess the understanding Joanna and Jim have about Jerod's condition and surgical treatment.
- b. Demonstrate infant care including intermittent catheterization for Jerod and allow sufficient opportunities for them to return the demonstration, evaluating their ability and providing encouragement.
- c. Demonstrate range-of-motion exercises for Jerod, as prescribed, allowing for return demonstration.
- d. Discuss signs and symptoms of increased intracranial pressure, stressing the importance of reporting these immediately to Jerod's pediatrician.
- e. Discuss skin care as prescribed.
- f. Following collaboration with health care provider, discuss referral information including home health, National Hydrocephalus Foundation, and Social Services and contact phone numbers.
- g. Discuss signs and symptoms of infection, ensuring parents know how to take Jerod's temperature (axillary) and importance of reporting temperature elevation to the health care provider.
- h. Discuss specific discharge information prescribed by the health care provider including the importance of follow-up care.
- i. Allow sufficient time for Joanna and Jim to ask questions, ensuring these are addressed by the appropriate health care professionals.
- j. Document teaching and Joanna and Jim's responses including evaluation of their abilities to provide care demonstrated.

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