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# Pediatric Case Study

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R.B. is a 22-month-old female with the admitting diagnosis of viral croup and fever. She weighs 10.5 kilograms and is 78.6 centimeters long, with a BMI of 16.9. She is allergic to amoxicillin and her mother states that she breaks out in a red rash all over her face and body when given the medication. The patient has no history of any significant diseases or disorders; however, she was delivered by caesarean at 38 weeks of gestational age due to her mother's diagnosis of oligohydramnios (low amniotic fluid volume). She lives with her mother, her father, and her 4-year-old sister in a single-family house in a small rural community. Her father is self-employed and her mother is a respiratory therapist, and the family has highly adequate health insurance through the hospital the mother works for (which is also the hospital where the child is being treated). Both parents are non-smokers. The patient was chosen for this case study based on the time the researcher was able to spend with the patient, the information the patient's mother was able to reveal about the child's history, and the commonality of croup in the pediatric population.

## Child Development and Nutrition

On first impression R.B. seems to be a happy, if quiet child. The researcher had the chance to interact with the child throughout the day, and came to the conclusion that R.B. was slightly verbally delayed for her age, but had no other significant barriers to normal child development. R.B. did exhibit plenty of other signs of social development such as smiling, person-to-person interaction, and clear preferences for toys and specific cartoons. Development of fine motor skills was also observed in the child; she had no difficulty picking up small pieces of cereal and doing other tasks with

her hands that required some type of dexterity. R.B. was also very steady on her feet and displayed no physical developmental delays.

R.B.'s mother stated that the little girl is a very busy child at home, which is concurrent with the behavior of other children of her age. She acknowledged that the child is talking some at home, but that often the little girl's older 4-year-old sister "talks for her". This could be the reason the child seems verbally delayed, combined with the fact that children often regress and become quieter than normal when in a hospitalized state. The mother also pointed out that R.B. often plays with dolls and pretends they are talking to one another, which is concurrent with the researchers observance of other signs of social development.

According to Erickson, the R.B. is in the stage of Autonomy Versus Shame and Doubt (children aged 1 to 3 years). This stage is marked by the toddler's development of independence. The child in this stage may start showing control over his or her own body excretions, may start saying "no" when asked to do something, and directing motor activity (Ball et. al, 2010). If children in this stage are continually criticized for showing signs of autonomy or lack of control (such as when toilet training), they could develop a sense of shame about themselves and may begin to doubt their own abilities (Ball et. al, 2010).

Weighing 10.5 kilograms, R.B. is in approximately the $12^{th}$ percentile on the growth chart for her age, and being 78.7 centimeters she is in the $10^{th}$ percentile for height. No data was available for head circumference. Her weight-to-length ratio is on the $75^{th}$ percentile of the growth chart. This illustrates that although R.B. is small for her

age, she is well proportioned. R.B. has a body-mass index (BMI) of 16.9, which is also on the 75th percentile curve of the growth charts for her age.

According to R.B.'s mother, the little girl has a very inconsistent appetite, which is consistent, however, with children of her age. Toddlers often exhibit eating patterns consisting of days when they seem to not want to eat at all, and days that they seem to not be able to get enough to eat. This is a normal part of the growth of the child, and should not be too much of a concern for parents unless growth delay becomes evident. R.B. likes to eat fruit such as apples and bananas, she likes to snack on crackers and cereal, and she loves "finger foods". She will eat chicken nuggets or cut-up chicken pieces and also likes sandwiches. R.B.'s mother worries that the child does not get enough vegetables because the child refuses to eat many of them. The researcher suggested mixed fruit and vegetable juices to incorporate servings of vegetables into the child's diet.

## Admission Symptoms and Ordered Medications

The patient was admitted to the unit on November 3rd, 2009, with a barking, seal-like cough, thick yellow sputum, and stridor (high-pitched squeal-type sound) present on inspiration. She had an axillary temperature of 37.6 degrees Celsius at 2000 hours that evening, and she also had a large emesis. Respiratory therapy was ordered for the patient q6h (every six hours).

The patient was ordered a number of medications to treat her diagnosis. Respiratory therapy administered budesonide, an inhaled medication used to relax the airway, at a dosage of 0.5 milligrams q6h. The safe pediatric dosage of this medication is 0.5 milligrams once daily or 0.25 milligrams bid (twice daily). The medication should

not exceed one milligram per day (Carpenito, 2008). Budesonide is a corticosteroid. The reason the patient was prescribed more than the normal safe dose of 1 milligram per day is that her diagnosis is an acute pathology, and not a chronic disease such as asthma (another pathology the medication is used to treat). Receiving the medication at a dose of 0.5 milligrams q6h puts the patient at a total of 2 milligrams per day, but this will not harm the patient significantly.

The patient was also prescribed prednisolone at 21 milligrams po (by mouth) once every morning. Prednisolone is a corticosteroid that decreases the inflammation and edema of the airway that is associated with croup. As a steroid, this drug also suppresses the normal immune response, therefore hygiene and care around people with known pathologies are important when taking this medication. There is also a possibility of decreased renal function while using this drug, so monitoring the patient's intake and output is important. The safe pediatric dose of this medication is 0.1-2 milligrams/kilogram a day (Carpenito, 2008). The patient weighs 10.5 kilograms, therefore she received 2 milligrams of the medication per each kilogram of body weight each day, and therefore she is within the safe pediatric dosage guidelines.

Another medication the patient was ordered is racemic epinephrine, an adrenergic and bronchodilator, to be inhaled at a dosage of 0.0113mg in 0.5 milliliters of the drug q2h prn (as needed) for symptoms of respiratory distress. The safe pediatric dose for this medication is 0.25-0.5 milliliters. Therefore, if the patient did end up needing this medication, she would be receiving a safe pediatric dose.

Another prn medication ordered was a 3-milliliter solution of NaCl (sodium chloride) to be inhaln q2h if needed. This medication was not needed during the patient's

hospitalization, but would be used to help clear secretions blocking the patient's airway. The last medication R.B. was ordered was children's Motrin (ibuprofen) to be taken orally at a dosage of 100 milligrams q6h prn. This drug is a non-opioid analgesic and an antipyretic (fever-reducing agent). The medication was ordered for R.B. for fever. The safe pediatric dose of this medication is 5-10 milligrams/kilogram every 4-6 hours, but not to exceed 40 milligrams/kilogram per day. The patient was receiving a safe dose.

## 0800 Assessment

Upon arrival to the unit, the researcher conducted a head-to-toe assessment of the patient. The child's skin was pink, her skin turgor was < 2 seconds, and her capillary refill was < 2 seconds. She appeared well groomed and happy, despite being ill. She had no obstructions of the ears or nose, and her pupils were equal and reactive to light and accommodation. Her mucous membranes appeared pink and moist. The patient exhibited no signs of pain at this time.

Upon listening to the child's lungs, the researcher could hear fine crackles in both the upper and lower left lobes, diminished right lung sounds, and a miniscule end-expiratory wheeze. The patient's breathing pattern was slightly irregular, which was to be expected given the child's diagnosis. Bowel sounds were heard in all four quadrants of the abdomen, and the abdomen was round and soft. The child's mother stated that she had had a decreased appetite since becoming ill, but that she was passing flatus and having regular bowel movements. The patient's bladder was non-distended and her mother stated that she had been voiding with no difficulties. At this point the child had an oral intake of 240 milliliters and an output of 80 milliliters. Her pedal pulses were +

2(strong) and bilateral (equal on both sides), and here extremities showed no signs of cyanosis. The child was held by her mother during this first assessment and the researcher did not yet have an opportunity to observe her gait and movement.

The following table illustrates the patient's vital signs at 0800 and the normal vital signs for a child of her age.

| Vital Sign | Patient's Value | Normal Value for age |
|---|---|---|
| Apical Pulse Rate | 117 beats per minute | 80 – 120 beats per minute |
| Respirations | 36 breaths per minute | 25-40 breaths per minute |
| Blood Pressure | Unable to obtain; Patient was crying. | 85-109 mmHg/ 43-65 mmHg |
| Temperature | 36.5 degrees Celsius | 37 degrees Celsius |
| Blood Oxygen Saturation | 99 % @ Room Air | 95 – 100% at room air |

All of the values are normal for the child's age.

## 1130 Assessment

The second assessment of the day showed signs of improvement in the patient. The child was up and moving around the room, she was giggling and interacting with the researcher, and appeared to being feeling better overall. The focused assessment at this time was a respiratory assessment to determine the ability of the patient to breath, and integumentary, to determine if the patient's blood cells were getting enough oxygen to carry throughout the body.

The patient's lug sounds at this time were similar to those heard at the 0800 assessment. There were still fine crackles heard in the left lobes and the right-sided lung sounds were still slightly diminished. The end-expiratory wheeze was not evident at this time, however. The patient was not coughing during this assessment and she had no mucous being expectorated from the airway. The patient's extremities showed no signs of cyanosis and her skin turgor and capillary refill were < 2 seconds. The patient showed no signs of pain.

The following table represents the patient's vital signs at the 1130 assessment.

| Vital Sign | Patient's Value | Normal Values for age |
|---|---|---|
| Apical Pulse Rate | 118 beats per minute | 80-120 beats per minute |
| Respirations | 34 breaths per minute | 25-40 breaths per minute |
| Blood Pressure | 135 mmHg/86 mmHg | 85-109 mmHg/ 43-65 mm/Hg |
| Temperature | 36.6 degrees Celsius | 37 degrees Celsius |
| Blood Oxygen Saturation | 99 % at room air | 95-100% at room air |

All of the patient's vital signs were normal except for her blood pressure reading, which is very high for the child's age. The researcher contributes this discrepancy to the inaccuracy of the electronic Dynamap blood pressure cuff, as the patient exhibited no signs of hypertension or distress. A pediatric size manual cuff was not available for use.

# Etiology of Pediatric Croup

Croup can be viral or bacterial in pathology. Croup is most often diagnosed in children aged 6 months to 6 years. In an 11-year study, Denny, Murphy, Clyde, Collier, and Henderson (all medical doctors) it was found that "the attack rate for croup was highest in the second year of life" (1983). A more recent text by Ball, Bindler, and Cowen (2010) shows consistency with this finding in reporting that the peak age of croup is 2 to 3 years. The study by Denny et. al also found that the incidence of lower respiratory infections in general was highest during the first year of life.

Croup itself is a general term used to classify a broad array of airway illnesses resulting from an edematous epiglottis and larynx (Ball et al. 2010). Croup most often refers to laryngotracheobronchitis (LTB), a viral invasion of the upper airway extending throughout the larynx, trachea, and bronchi (Ball et al., 2010). A thorough description of the pathophysiology of croup is given by Ball et. al (2010) :

> The tracheal and laryngeal airway tissues respond to the invading virus with inflammation and edema. Copious, tenacious secretions further increase the child's respiratory distress. The laryngeal inflammation causes the airway diameter to narrow in the subglotic area, the site of the smallest upper airway diameter. Even small amounts of mucus or edema can quickly obstruct the airway. During inspiration, the walls of the inner airway are pulled together, further irritating the inflammation and respiratory distress. (p. 857)

The following excerpt explains the phenomenon of coughing as the main symptom of croup, as identified in 2008 by Pruikonen, Dunder, Reinko, Pokka, and Uhari:

> "…inflammation of the airway of the larynx, trachea and larger bronchi is a powerful stimulus for coughing, and the outer ear, the esophagus and the abdominal organs are other origins of coughing that are innervated by the vagus nerves. The rapidly adapting pulmonary stretch receptors (RAR) in the airway epithelium of the larynx and the tracheo-bronchial tree are the primary sensory pathways for cough. Pulmonary and bronchial C-fiber receptors mediate neurogenic inflammation and release tachykinins, which can activate RARs. RARs and C-fiber receptors are correlated with vagal afferent fibers, the central connections of the C-fiber receptors being known to inhibit coughing. (p. 158)

According to Pruikkonen et al. (2008), "any respiratory virus, including human metapneumovirus and occasionally herpes simplex virus, is able to cause croup." However, the most common cause of viral croup found by all sources is determined to be the para-influenza viruses. Pruikkonen et. al (2008) attribute more than two-thirds of cases of croup to para-influenza virus, Denny et. al. (1983) states that "the para-influenza viruses were the predominant agents at all ages with little difference between age groups," and Ball et. al (2010) reports that "the causative organism [of croup] is usually para-influenza virus type I, II, or III, which appears during late fall and winter months in clustered outbreaks".

Other common causes of croup are the respiratory syncytial virus (RSV), *Mycoplasma pneumoniae*, and influenza viruses A and B. The following table is taken from the study by Denny et al. (1983) and shows the distribution of causative organisms of croup in a total of 360 patients.

**Etiologic Agents Recovered from Children with Croup, Chapel Hill, NC, 1964-1975**

| Etiologic Agent | No. of Children | % of Total |
|---|---|---|
| Para-influenza virus type 1 | 173 | 48.1 |
| Para-influenza virus type III | 63 | 17.5 |
| Respiratory syncytial virus | 36 | 10.0 |
| Para-influenza virus type II | 31 | 8.6 |
| *Mycoplasma pneumoniae* | 13 | 3.6 |
| Influenza virus type A | 13 | 3.6 |
| Influenza virus type B | 12 | 3.3 |
| Miscellaneous viruses | 19 | 5.3 |
| Total | 360 | 100 |

## Risk Factors for Croup

The most significant risk factor for croup itself and recurrent croup, as identified by Pruikkonen et. al (2008), is a family history of croup. A history of croup among a child's siblings showed more significance than a history of parental croup, but the latter is still a risk factor for a child to be diagnosed with the disease. Parental smoking does appear to be a risk factor for respiratory infections in general, but not specifically for croup (Pruikkonen et. al, 2008). The study by Pruikkonen et al.(2008) also identified having a cat as a household pet as a risk factor of equal significance for both croup and other respiratory infections. A patient history of asthma and wheezy bronchitis and a history of snoring also increased the risk of the patient to acquire a croup infection. The following table is a condensed version of a table taken from the study

conducted by Pruikkonen et al. in 2008, which illustrates different risk factors of 182 pairs of children. One child of the pair was diagnosed with croup, while the other child was matched by age (+ or – 6 months) and gender. It is important to note that the number of pairs varies because of missing data in the questionnaires filled out by the subjects of the study.

| **Risk Factor** | **No. of Pairs of Children with Factor** |
|---|---|
| Parental History of Croup | 159 |
| Sibling History of Croup | 146 |
| Snoring | 167 |
| Parental Smoking | 178 |
| Number of Siblings | 166 |
| Attendance of Child at a Daycare Center | 148 |
| Breast feeding | 174 |
| Asthma | 176 |
| Hay Fever | 179 |
| Atopic Dermatitis | 177 |
| Animal Allergy | 179 |
| Pet Dog | 172 |
| Pet Cat | 172 |
| Pet Rodent | 172 |
| Patient in Neonatal Intensive Care Unit as Neonate | 172 |
| History of Otitis Media Episodes | 166 |
| History of Bronchitis Episodes | 95 |

According to Dr. Muntz & Dr. VanWoerkom (2008), children with recurrent croup may have underlying pathology making them more prone to these episodes. In a study of 80 children with recurrent croup, Muntz & VanWoerkom determined accompanying etiology they believed made the children prone to croup cases. The doctors determined that the most common factors associated with recurrent croup were laryngopharyngeal reflux and subglottic stenosis (a narrowing of the airway below the epiglottis). The following chart shows the number and percentage of the 80 children that had specific underlying etiologies associated with recurrent croup. It is important to acknowledge that many of the children had more than one risk factor.

| **Risk Factor** | **No. of Children with Factor** | **% of Children with Factor** |
|---|---|---|
| Laryngopharyngeal Reflux | 45 | 56 |
| Subglottic Stenosis | 26 | 33 |
| Allergies or Asthma | 31 | 39% |
| Tracheomalacia | 16 | 20 |
| Innominate Artery Compression | 7 | 9 |

## Croup Treatment and Diagnostic Testing

The main form of treatment for most children diagnosed with croup is a regimen of some type of bronchodilator medication. Alpha- and beta-adrenergic agonists such as racemic epinephrine may be administered through a facemask in order to decrease bronchial and tracheal secretions, as well as to decrease symptoms of respiratory distress (Ball et al., 2010).

Corticosteroids are also frequently prescribed. These medications can be given intramuscularly and orally, as well as inhaln. The purposes of these medications as used for croup are to produce an anti-inflammatory effect causing decreased edema of the airway (Ball et. al 2010). Children with a pulse oximeter reading of less than 92% at room air will also be ordered some form of oxygen, whether it be via nasal canula, face mask, blow-by, etc.

There are no lab values used to diagnose croup. However, pulse oximetry is used to detect hypoxemia (ball et al 2010). If the diagnosis of croup is not certain and the child's airway does not appear to be threatened, anterior, posterior, and lateral radiographs of the lungs and airway may be taken. In some children with croup, a tapered and symmetrical subglottic narrowing (called a "steeple sign") can be seen (Ball et al 2010). The radiographs can also rule out the presence of a foreign body that could be causing symptoms (Ball et al, 2010). Nowhere in R.B.'s chart was there any documentation of a radiograph or any other lab or diagnostic work.

## Nursing Care Management

The following chart shows the nursing care plan for a child with croup. Included are nursing diagnoses, short-term and long-term goals as well as interventions used to meet these goals. Specific implementation used to care for the child in this case study and evaluation of the hypothetical goals and interventions are also illustrated in the chart.

| **Nursing Diagnoses** | Ineffective breathing pattern r/t tracheobronchial obstruction, decreased energy, and fatigue (Ball et. al 2010 p.859) | Potential for imbalanced nutrition: Less than body requirements r/t dysphagia secondary to obstruction of airway. |
|---|---|---|
| **As Evidenced By…** | • Thick yellow sputum<br>• Inspiratory stridor<br>• Adventitious lung sounds | • Patient exhibits a decrease in appetite according to patient's mother<br>• Thick mucous present in airway<br>• Patient has edematous airway |
| **Short-term Goals** | Patient will demonstrate an effective respiratory rate and pulse oximeter | Patient will eat at least 50 % of all meals served during shift. |

| | | |
|---|---|---|
| | reading during shift. | |
| **Short-term Nursing Interventions** | • Bronchodilator medications will be administered to patient prn as ordered. Rationale: Bronchodilators decrease bronchial secretions and decrease symptoms of respiratory distress (Ball et al. 2010, p. 859)<br>• Monitor pulse oximetry and respiratory rate q2h during shift. Rationale: If the oxygen saturation falls below 92% the patient may need supplemental oxygen. Patient's respiratory rate will be increased if respiratory distress is imminent. (Ball et. al p.857)<br>• Monitor patient's lung sounds q4h, or more often if signs of respiratory distress are apparent. Rationale: Increasingly diminished breath sounds are a sign that the patient is becoming too exhausted to breath and is at risk for entering into respiratory distress. (Ball et. al, 2010, p. 858) | • Provide a pleasant and relaxed atmosphere for eating. Rationale: The patient will have a better appetite if he/she does not feel rushed. (Carpenito, 2008)<br>• Arrange to have the highest protein/ calorie nutrients served at the time the patient most feels like eating (i.e. NOT immediately following a painful procedure). Rationale: The patient will not want to eat when he/she is upset or in pain. (Carpenito, 2008)<br>• Provide corticosteroid medications prn as ordered. Rationale: These medications decrease swelling of the airway, making it easier to swallow. (Ball et. al 2010, p. 859) |
| **Long-term Goals** | Patient will show no signs of obstructed airway after 7 days of being discharged. | Patient will continue to ingest daily nutritional requirements in accordance with his/her activity level and metabolic needs after being discharged. |
| **Long-term Nursing Interventions** | • Patient will blow bubbles for 5 minutes twice each hour at home. Rationale: blowing bubbles is parallel to using an incentive spirometer and helps the patient work on deep breathing (and expectorating secretions) in a fun way. (J. Zaluski, personal communication, October 28, 2009)<br>• Patient will be encouraged to drink enough fluids to maintain adequate hydration (1025 mL of fluid q24h for | • Offer frequent small feedings throughout the day (six per day plus snacks). Rationale: this reduces the feeling of a distended stomach, which may add discomfort to patient's condition. (Carpenito, 2008)<br>• Encourage the patient's family to eat with the patient. Rationale: The patient will feel more like eating if it is a socialized setting and others are |

| | | |
|---|---|---|
| | R.B.) Rationale: Fluids promote liquefaction of secretions obstructing the airway and therefore decreases respiratory difficulties (Ball et. al 2010, p. 859 | eating as well (Carpenito, 2008). |
| **Implementation Specific To patient R.B.** | • Patient received nebulized budesonide from respiratory therapy.<br>• Patient was given prednisolone by researcher.<br>• Patient's pulse oximetry was checked q2h during shift.<br>• Patient's lung sounds were monitored q4h during shift. | • Patient was offered snacks during shift.<br>• Patient's eating habits were discussed with patient's mother.<br>• Prednisolone was administered to decrease swelling of airway and increase patient's ability to swallow.<br>• Patient's mother was encouraged to offer fluids continuously throughout the day. |
| **Evaluation** | Patient demonstrated an effective respiratory rate and pulse oximetry reading during shift. Patient showed no signs of obstructed airway within 7 days of being discharged. | Patient ate 50% of meals during shift. Patient continued to ingest adequate nutritive/caloric intake for personal activity level once discharged. |

## Conclusion

After reviewing this case study the researcher feels that readers will have a realistic insight into the diagnosis of croup in the pediatric setting. Treatment, etiology, and nursing care management of croup have been discussed. Medications and development specific to R.B., the child diagnosed with croup in this case study, were also illustrated. As technology continues to advance and the field of pharmacology expands, more treatments for croup may develop, and perhaps the diagnosis of croup will become less abundant in the pediatric population. Until then, the researcher has provided this case study as a guide to understanding and providing nursing care for croup.

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