

# THE LNC NEWSLETTER

PRESENTED BY:  
**Medical-Legal Interface**

## The Crossover from Fetal Breathing to Infant Breathing

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### Introduction

The mother delivers oxygen to the placenta via her blood. Oxygen and nutrients are then delivered to the fetal circulation by way of the umbilical cord and more specifically the umbilical vein. We know that stimulation to the umbilical vessels muscular walls can decrease or increase the fetal heart rate by dilatation or constriction of the vessels. The umbilical arteries are responsible for taking unoxygenated blood and wastes from the fetus to the placenta, and the umbilical vein transports the fresh oxygenated blood back to the fetus. It is only in fetus circulation where the vein brings the oxygenated blood to the fetus. It is a bit of a roll reversal because after delivery the arteries carry the oxygenated blood and the veins carry the deoxygenated blood.

The umbilical cord is composed of three vessels: two arteries and one vein. The umbilical vessels have thick muscular walls. These umbilical vessels respond to various stimuli, i.e. temperature, trauma,

oxygen content in the blood and tension or pressure in the vessels.

### From fluid filled to airfilled lungs

The fetal airways are not collapsed but filled with fluid until delivery and the initiation of ventilation. The fetal lung fluid is essential for normal lung development. In a term fetus the lung fluid production decreases in the days just prior to labor and the fetal lung fluid volume decrease to about 65% of the maximal volumes present during fetal life. During active labor and delivery another 30% of the fluid is cleared from the airways and alveoli, leaving only about 35% of the fetal lung fluid to be absorbed and cleared from the lungs. The entire process of turning the lung with fluid to air filled takes place in less than five minutes following birth in the term infant but would take much longer in a premature infant. During delivery of the term the infant's chest is subjected to elevated pressures (~ + 100 CM H2O) and returns immediately to

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## The Neurological Examination

Jeannine Lurie RN, BSN, CLNC

"The neurological examination is one of the most unique exercises in all of clinical medicine. Whereas the history is the most important element in defining the clinical problem, the neurological examination localizes a lesion within the central (CNS) or the peripheral nervous system (PNS). The statement has been made, History tells you what it is, and the examination tells you where it is." (Kalarickal J Oommen, MD). The history and examination allow the physician to arrive at the etiology and pathology of the condition, which are essential for treatment planning. The neurological assessment must be accurately documented and should be repeated regularly to recognize neurological deterioration.

It is important to emphasize that the neurologic exam tests function. Therefore, for each part of the exam, the patient's level of functioning must be titrated using several tests ranging from easy to difficult. What this means is if the patient has deficits, the physician must use those deficits as a guide to the nerves and nerve root involvement.

The importance of accurate documentation and assessment of the neurological exam lies in determining the patient's level of functioning in testing for any deficits. Without this assessment and documentation there is nothing to compare any future deficit findings. The literature states, "The tests the patient can and cannot perform on a given day should be recorded for comparison with follow-up examinations so that changes in the patient's status can be determined accurately."

The neurologic exam is an essential diagnostic tool, which consists of several sub divisions (i.e. mental status, cranial nerves, motor exam, sensory exam, reflexes, and coordination and gait).

### Motor Exam

The motor strength exam varies depending on whether or not the probably pathology is in the spinal cord, peripheral nerve or brain. Motor system assessment includes strength, movement, tone (normal, hypotonia, hypertonia) involuntary movements, and muscle mass. Motor strength is tested by asking the patient to make a movement against resistance and is reported on a scale of 1-5. Sides are reported.

The corresponding nerve root involvement for each area tested in the motor exam is as follows:

- Hip flexion is innervated by the L2 and L3 nerve roots via the femoral nerve.
  - Adduction of the hip is mediated by the L2, L3 and L4 nerve roots.
  - Abduction of the hip is mediated by the L4, L5 and S1 nerve roots.
  - Hip extension is innervated by the L4 and L5 nerve roots via the gluteal nerve.
  - Knee extension by the quadriceps muscle is innervated by the L3 and L4 nerve roots via the femoral nerve. This tests the quadriceps muscle.
  - The hamstrings are innervated by the L5 and S1 nerve roots via the sciatic nerve.
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## The Crossover from Fetal Breathing to Infant Breathing

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zero, following birth. As the infant passes through the birth canal, the increased thoracic pressure helps to clear the infant's large airways of fluid. Decreasing the chest wall pressure prepares the infant for beginning the process of initiating his first breath.

The inspiratory pressures exceeding - 70 CM H<sub>2</sub>O must be reached for the infant to initiate the first breath. Expelling the fetal fluid and creating an increased negative thoracic pressure both play an important role in providing a patent airway and establishing appropriate gas exchange. At this same time there is a lack of continued oxygen supply to the infant which also triggers the respiratory centers of the brain to incite the first breath. So not only must there be a negative pressure in the thoracic cavity for that first breath, there must also be enough pressure to inflate the lungs and open up the small air sacs called alveoli. This is the actual site of oxygen transfer to the blood. When an infant is born by cesarean section the parents, many times are told the infant's lungs are a bit wet. What they are really saying is the infant has not passed through the "wringer" known as the vaginal vault which squeezes most of the remaining fluid out of the lungs.

### Surfactant

During the last trimester the fetus begins secreting a fluid called surfactant into the alveoli. Surfactant is a fatty substance that lowers the surface tension in the alveoli and makes it easier for the infant to inflate the lungs. Inadequate amounts of surfactant is one reason why premature infants often have a much harder time breathing. Infants who are born prematurely and do not produce enough surfactant are diagnosed with a condition called respiratory distress syndrome (RDS). In these cases the alveoli sacs either fail to expand, or expand then collapse on expiration resulting in labored breathing for an already stressed immature infant. Fujiwara and associates in 1980 were the first to report clinical responses in infants with RDS treated with a bovine lung source surfactant. Surfactant treatment improved oxygenation in all infants with severe RDS. Surfactant for RDS became generally available in 1990 after extensive clinical trials. At the present, we have two

surfactant preparations currently in use in the United States.

### The Lungs

Until just recently, lung immaturity in the preterm newborn spelled certain death for the premature infant. The complex process of lung maturation involves considerations of anatomy, physiology, and cell biology. And with new research we are now saving many of these infants. The right lung along with the left lung is divided into lobes. Each lung lobe is further divided into segments. The 10 segments of the right lung and eight of the left are virtually self contained units. Gaseous exchange relies on simple diffusion. In order to provide sufficient oxygen and to rid the body of sufficient carbon dioxide there must be a large surface area for gaseous exchange. The blood in the alveolar capillaries are separated from alveolar air in many places by one thousandth of a mm. Diffusion gradients are maintained by breathing which renews alveolar air, maintaining oxygen concentration near that of atmospheric air and preventing the accumulation of carbon dioxide. The flow of blood in alveolar capillaries is continually exchanging blood with low oxygen concentration and high carbon dioxide concentration. The hemoglobin in blood dissolved the oxygen in a continuous manner from the blood and binds with it carrying oxygen to all parts of the body.

### Cardiac Defects

During fetal circulation, the pulmonary blood flow is minimal (3.5 %) as compared to the rest of the circulatory volume. This decrease in pulmonary blood flow is due to the increased pulmonary vascular resistance immediately following the first breath, the higher levels of oxygen help in decreasing the pulmonary vascular resistance and promotes elevation of the pulmonary perfusion. The decrease in pulmonary vascular resistance continues well into the first week to ten days following birth. Rapid decreases in the pulmonary vascular resistance, is a physiologic response that is important in the basic understanding of congenital heart disease. Those infants may have a normal delivery with Apgars of 8 and 9, be discharged from the hospital with no observed complications. The critical period is as the pulmonary vascular resistance falls is when heart failure may develop with specific cardiac defects. Understanding these effects of alterations in pulmonary vascular resistance is important when assessing a newborn under the age of two weeks.

This is where I am going to leave you because next month in the February issue, The LNC Newsletter will feature a heart theme as a way of celebrating Valentines Day. In that article I will be discussing cardiac defects in the newborn.

## ...Is In the Details

Robert Morrison, RN BSN

Last time we were looking at how my grandmother may have been preparing me for my future career when she bombarded me with her life sayings. At least one of these proved to be prophetic. That the devil is in the details I have no doubt, a fact often proved in our work.

Mary was taken to the ER after falling at school, landing on a hard floor and injuring her neck. When conservative treatment failed she was referred to a neurosurgeon, who established a herniation of the C6-7 disk. This was confirmed by MRI and discography. Prior treatments included medications and therapy, none of which relieved the pain. After discussing the available options, the surgeon and Mary decided on a discectomy and fusion.

The surgery was done without complications, except that it was the C5-6 disc that was fused. The right idea, the wrong location.

As before, the client requested an outline to prepare for deposition of the defendant surgeon. Also as before, virtually all the data for the deposition was drawn directly from the extensive medical record generated by the defendant himself. He was clearly hedging on the side of conservatism all along. He declined surgery at the start. He repeatedly assessed symptoms that confirmed the C6-7 nerve distribution as the cause of her pain. Discography was ordered to establish once again that there were no other pain generators. Cont on p 3

## The Neurological Examination

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- This tests the hamstrings.
- Ankle dorsiflexion is innervated by the L4 and L5 nerve roots via the peroneal nerve.
- Ankle plantar flexion is innervated by the S1 and S2 nerve roots via the tibial nerve.
- The extensor hallucis longus muscle is almost completely innervated by the L5 nerve root.

### Sensory exam:

The sensory examination evaluates light touch, pain, temperature, position, dermatomes, nerves and proprioception (vibratory, deep pressure, bone and joint sense).

The corresponding nerve root for each area tested is indicated in parenthesis:

- upper part of the upper leg (L2)
- lower-medial part of the upper leg (L3)
- medial lower leg (L4)
- lateral lower leg (L5)
- sole of foot (S1)

### Reflex Exam

Observing a patient's reflexes is the most objective part of the neurological exam, since the reflexes are not under voluntary control and testing them does not depend on the patient's cooperation, attitude, or intelligence. According to Haerer, A.F., 1992, *The Neurological Exam*, J.B. Lippincott Co., Philadelphia, "Incomplete or inaccurate exams can lead to incorrect diagnoses. Alterations in a person's reflexes are often the first sign of neurological dysfunction."

The examination of reflexes gives information about the pathways to and from the extremities from and to the spinal cord. Deep tendon reflexes (DTR), also known as muscle stretch reflexes, are reflexes elicited in response to stimuli to tendons. When the correct area of the muscle tendon is tapped with a soft rubber hammer, the muscle fibers contract. By noting whether the response to the tapping is normal or not, the

physician can assess whether there might be any injuries to the nervous system pathways that produce the deep tendon reflex. Deep tendon reflexes may be diminished by abnormalities in muscles, sensory neurons, lower motor neurons, and the neuromuscular junction. For example, the Patellar (knee) tests the L2, L3, L4 spinal nerve roots and the Achilles tendon (ankle) tests the L5 and S1 spinal nerve root. Deep tendon reflexes are rated on a scale. 1+ means trace, or seen only with reinforcement. 2+ is normal.

### Bibliography

1. Haerer, A.F., 1992, *The Neurological Exam*, J.B. Lippincott Co., Philadelphia,
2. Kalarickal J Oommen, MD, *Medical Director of Epilepsy Program, Associate Professor, Department of Neurology, University of Oklahoma, eMedicine Journal*.
3. *Lumbar disk disease: pathophysiology, management and prevention. Academy of Family Physicians. April 1993*

## ...Is In the Details

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The Worker's Compensation carrier reviewed the information and authorized the C6-7 fusion. When the carrier was changed, the new TPA again confirmed the authorization for surgery. Orders were written for consent forms to be signed. The patient was being interviewed by multiple staff and providers. And somewhere along the way the surgeon got his wires crossed about the level to be fused. Again the entire staff missed the forest for the trees. Everyone was so intent in their specific tasks they never noticed that the herniated disc had magically moved itself. And 3 months of assessment and diagnostic data went out the window.

These cases illustrate the potential for damage to the patient when the treatment team does not pay enough attention to the information they can clearly see. Both physicians had all the assessment data they needed, and both had gathered much of the data themselves. It would have taken nothing more than a basic overview of the file to reveal what the doctors

somehow failed to see. Jane would pay for the mistake with her life. Mary eventually had to be fused at three levels due to problems caused by the initial surgery. Her mobility has been permanently decreased and she looks forward to early losses of independence. Her occupation as a teacher has become difficult and painful.

They also illustrate the usefulness of the LNC. In both cases we were able to document all of the available data, establish their clinical implications, and draft extensive deposition outlines and questions. This assistance greatly reduced the attorneys' reliance on their testifying physicians, and helped make it smoother for the plaintiffs and families. The LNC can help the families understand what happened and prepare them for future activities. Interviews with the families confirmed much of the data used for the defendant's deposition, and even highlighted some deficiencies that added to the deposition. It certainly made it easier for the families to withstand the rigors of deposition and trial.

So my grandmother may indeed have known more than I gave her credit for. At least she did in this instance. Whenever I have been tempted to forgo that one final proofreading, or leave a situation as it is, I remember this saying and the lessons I have learned from its application to our work. Whenever we get a new malpractice file for review, we start with this simple premise and get a grip on the details.

Next month's  
newsletter will be  
devoted to issues of  
the heart.  
(Anatomical one, that is.)

# Patient Safety: Falls Risk Assessment and Intervention

Maggie Driscoll RN, BSN, CCRN, CLNC

## Introduction

Patient falls account for 32-84% of reported inpatient adverse events in acute care hospitals. Fifty percent of long term-care residents aged 65 and older fall each year. A fall is defined as unintentionally coming to rest on the ground, floor, or other lower level, but not as a result of syncope or overwhelming external force. While falls may be a frequent occurrence in hospitalized patients, only a small percentage results in serious injury. Serious injuries include fractures of the hip, ribs, arms, wrist and foot; spinal injuries; and subdural hematomas.

Fall-related injuries may occur in any age group, but the most serious and debilitating injuries occur in the elderly population. Falls are the leading cause of injury deaths and the second leading cause of spinal cord and brain injury among those 65 years and older. Approximately 2% of all falls result in hip fractures. Among the elderly who suffer a hip fracture, 50% die within the first year of recovery.

The United States Census Bureau estimates that by 2030, baby boomers will comprise 20% of the population age 65 and over. Increasing life expectancy and a growing percentage of elderly will likely increase the number of fall risk candidates in the years to come. Finan, a contributing author of the Harvard Risk Management Forum, theorizes that when today's consumer-wise baby boomers become tomorrow's senior citizens, they will have a greater propensity to file suit than the seniors of today.

## Impact of the Nursing Shortage

The average age of the working registered nurse in the United States is approximately 43 years old. An aging work force, a decline in nursing enrollment and an expanding elderly population will ultimately contribute to the growing nursing shortage. A recent study published in the *Journal of the American Medical Association* estimates that by 2020 the number of nurses required to adequately care for patients will fall to nearly 20 percent

below the anticipated needs of the healthcare industry. According to the Agency for Healthcare Research and Quality, there is a link between inadequate nurse staffing ratios and adverse outcomes within hospitals. Falls prevention will continue to be a major focus of risk management in acute care facilities as the population ages and the nursing shortage grows.

## Falls Risk

Falls are generally attributed to one or more of the following factors; patient risk factors, environmental hazards and system gaps in care management.

## Patient Risk Factors

Identifying patients at risk for falls is the first step in falls injury prevention. Guided by Joint Commission Accreditation of Healthcare Organizations (JCAHO) standards and hospital policy, a falls risk assessment should be completed by the Registered Nurse within 24 hours of patient admission to the facility. Subsequent re-assessment of falls risk is generally determined by hospital policy and patient condition change. Whether the hospital facility utilizes an industry-designed falls risk assessment tool or creates a unique assessment tool, the following patient risk factor identification information should be collected and analyzed;

- Advanced age (over 65)
- History of Previous Falls
- Mentation (Confusion/Disorientation/Agitation)
- Gait and Balance Disturbances
- Medications Causing Drowsiness, Sedation (such as narcotic pain medication)
- Elimination Patterns

A history of previous falls has been identified as one the strongest predictors of future falls. According to a study by Tinetti et al, the risk of falling increases from 19% when one risk factor was present to 78% in the presence of 4 or more risk factors. While this study focused on community-dwellers, it deserves attention among the hospitalized population as well.

## Environmental Risk Factors

More than 50% of falls are related to

environmental factors. A review of fall related claims by the Harvard Risk Management Foundation discovered that fall-related injuries occurred most often in the patient's room, halls and lobbies, the patient's bathroom, radiology and emergency treatment areas.

## System/Staff Factors

One study published in the *Journal of Healthcare Risk Management* demonstrated that admission falls risks assessments are a good predictor of falls incidence. In this study, 83% of patients who fell during their stay were identified as a falls risk based upon the initial assessment. Use of less experienced nursing staff and poor communication between departments are associated with increased patient falls. When reviewing patient falls claims, it is important to research the facility's staff education programs designed to reduce patient falls. Additionally, many facilities have executed falls risk identification programs designed to allow staff throughout the facility to identify those patients at risk for falls.

## Falls Prevention Interventions

Identifying patients at risk for falls is just the first step in preventing falls related injuries. The next step is to identify and implement effective interventions to reduce falls. These interventions should be individualized based on patient assessment and communicated on the plan of nursing care. While the effectiveness of falls risk assessments and interventions to reduce injury within healthcare facilities are still being studied, there are a group of commonly used interventions in practice that continue to define the standard of care:

- Falls identification programs
- Treatment of underlying medical conditions
- Bed Alarms
- Patient and family education and involvement in care
- Minimizing patient sedation
- Involvement of Geriatric Nurse Practitioner when available
- Improving functional mobility and strength through physical therapy
- Increasing staff surveillance and proximity

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## Degenerative Disc Disease

Pattie Patterson RN, LNCC, LCP

Degenerative disc disease (DDD) is part of the natural process of growing older. Unfortunately, as we age, our intervertebral discs lose their flexibility, elasticity, and shock absorbing characteristics. The ligaments that surround the disc called the annulus fibrosus, become brittle and they are more easily torn. At the same time, the soft gel-like center of the disc, called the nucleus pulposus, starts to dry out and shrink. The combination of damage to the intervertebral discs, the development of bone spurs, and a gradual thickening of the ligaments that support the spine can all contribute to degenerative arthritis of the lumbar spine.

To a certain degree degenerative disc disease happens to everyone. However, not everyone who has degenerative changes in their lumbar spine has pain. Many people who have "normal" backs have MRIs that show disc herniations, degenerative changes, and narrowed spinal canals. Every patient is

### Patient Safety: Falls Risk Assessment and Intervention

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Nursing documentation and agency policies should reflect the following interventions to prevent environmental-related falls:

- Use of floor-level night lights
- Beds kept in low and locked position
- Floors kept free of obstacles
- Availability of grab bars in bathrooms
- Avoiding use of full length side rails
- Blocking off wet floors
- Leaving dry areas around wet floors
- Using skid-proof showers, tubs and bathroom floors
- Regular maintenance checks performed on canes, walkers, wheelchairs and lifts
- Quick response time for cleaning spills

This month's focus on falls risks assessment and prevention will be continued by a discussion on the use of restraints as a deterrent to falls and restraint guidelines in March.

is different, and it is important to realize that not everyone develops symptoms as a result of degenerative disc disease.

When degenerative disc disease becomes painful or symptomatic, it can cause several different symptoms, including back pain, leg pain, and weakness that are due to compression of the nerve roots. These symptoms are caused by the fact that worn out discs are a source of pain because they do not function as well as they once did, and as they shrink, the space available for the nerve roots also shrinks. As the discs between the intervertebral bodies start to wear out, the entire lumbar spine becomes less flexible. As a result, people complain of back pain and stiffness, especially towards the end of the day.

#### Symptoms

The most common symptom of degenerative disc disease is back pain. When DDD causes compression of the nerve roots, the pain often radiates down the legs or into the feet, and may be associated with numbness and tingling. In severe cases of lumbar DDD, where there is evidence of nerve root compression, individuals may experience symptoms of sciatica and back pain, and sometimes even lower extremity weakness.

#### Diagnosis

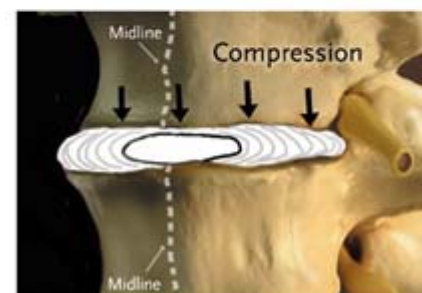
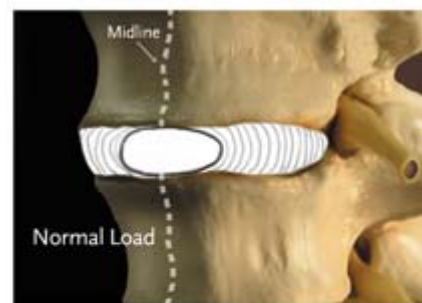
The diagnosis of degenerative disc disease begins with a complete physical examination of the body, with special attention paid to the back and lower extremities. Your doctor will examine your back for flexibility, range of motion, and the presence of certain signs that suggest that the nerve roots are being affected by degenerative changes in your spinal column. The doctors will check to be sure your muscle strength and reflexes are normal. They also look for symptoms such as numbness and tingling. Often times they will order x-ray which show a narrowing of the spaces between the vertebral bodies, which indicates that the disc has become very thin or has collapsed. Bone spurs begin to form around the edges of the vertebral bodies and also around the edges of the facet joints in the spine. These bone spurs can be seen on an x-ray, where they are called osteophytes. As the disc collapses and bone spurs form, the space available for the nerve roots

starts to shrink. The nerve roots exit the spinal canal through a bony tunnel called the neuroforamen, and it is at this point that the nerve roots are especially vulnerable to compression.

#### Treatment

In many situations, doctors will order a MRI or a CT scan (CAT scan) in order to evaluate the degenerative changes in the lumbar spine more completely. A MRI scan is very useful for determining where disc herniations have occurred and where the nerve roots are being compressed. A CT scan is often used to evaluate the bony anatomy in the spine, which can show how much space is available for the nerve roots and within the neuroforamen and spinal canal.

Your doctor will be able to discuss with you what your diagnosis means in terms of treatment options. For most people who do not have evidence of nerve root compression with muscle weakness, the first line of therapy includes non-steroidal anti-inflammatory drugs and physical therapy. A soft lumbar corset is often prescribed in order to allow the back to have a chance to rest. Surgery is offered only after physical therapy, rest, and medications have failed to adequately relieve the symptoms of pain, numbness and weakness over a significant period of time.



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