Lesson S16: PreAnesthetic Assessment of the Patient for Lumbar Spinal Surgery – Part 1

Authored by: Elizabeth A.M. Frost, M.D., Clinical Professor, Mount Sinai School of Medicine, New York, NY

Reviewed by: Ram Roth, MD, Assistant Professor of Anesthesia, Mount Sinai Medical Center, New York, NY

Read this article, reflect on the information presented, then go online and complete the lesson post-test and course evaluation before the termination date below. (CME credit is not valid past this date.) You must achieve a score of 80% or better to earn CME credit.

TIME TO COMPLETE ACTIVITY: 2 hours
RELEASE DATE: January 1, 2011
TERMINATION DATE: January 31, 2012

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Needs statement

Surgical interventions to alleviate back pain are the most common procedures performed by neurosurgeons and orthopedists. Patients frequently possess multiple comorbidities that impact anesthetic care. The use of regional anesthesia has been suggested as a means to improve outcome.

This is a two part activity. Part 1 addresses the surgical approach with a discussion of the performance of general patient history and physical examination including a detailed description of appropriate cardiac evaluation. Part 2 expands on co morbid conditions that are commonly seen in the older patent presenting for complex lumbar surgery and describes pulmonary evaluation, the problems of obstructive sleep apnea, obesity, renal insufficiency, diabetes, hematological considerations and drug interactions.
Learning Objectives

At the end of this activity, the participant should be able to:

1. Quote the incidence of lumbar disc disease.
2. Describe operations commonly performed to correct lumbar disc disease.
3. Appreciate the pathology of spondylolisthesis.
4. Describe cardiac evaluation for a hypertensive patient.
5. Identify the patient who typically presents for major lumbar surgery.
6. List typical co morbidities.
7. Understand the meaning of METS 1-8.
8. Indicate when an EKG might be limited in usefulness.
9. Understand different interpretations of “cardiac clearance”.

Case History

A 67 year old gentleman with a height of 68 inches and weight of 295lbs was scheduled for T8-L4 laminectomies and instrumentation for intractable back pain. He had undergone 2 lumbar surgeries within the past 12 years and had been attending a pain clinic for 9 months with little improvement in his symptoms. Other medical history includes hypertension, treated with beta and calcium channel blockers for 20 years, hypercholesterolemia and a smoking history, 1 pack per day for 50 years. Recently Captopril®, an angiotensin converting enzyme inhibitor, was added to his medication regimen. Physical examination reveals a BP 155/95, HR 53, Hb 14.6, serum glucose 174. He wears eye glasses.

Introduction

Low back pain (LBP) is the second most common medical condition in the United States\(^1\) affecting millions of people every year, and costing billions of dollars between health care expenditures and lost work days.\(^2\) The overall occurrence of LBP ranges from 13.8% to 31%, with a radicular component to the pain estimated at an incidence of 12% to 40%. In industrialized nations, the lifetime prevalence of LBP can be as high as 70%. Moreover, 84% of people experience some form of LBP during their lifetime.\(^3\)

Procedures on the lumbar spine vary in complexity from simple discectomy to multi level reconstruction and fusion with instrumentation. Similarly, anesthetic management can range from local anesthesia with some sedation to general anesthesia. Procedures may be planned for months or occur emergently as part of multiple trauma. Thus many factors determine appropriate preoperative anesthetic assessment and accommodation must be made for patients presenting for lumbar surgery with multiple comorbidities.
Surgical procedure

Spinal stenosis is the single most common diagnosis leading to any type of spine surgery with laminectomy as a basic part of the surgical treatment. The undamaged lamina of the vertebra is removed to widen the spinal canal and create more space for the spinal nerves and thecal sac. Laminectomy is the most effective remedy for severe spinal stenosis; however, most cases of spinal stenosis respond to bed rest, non-steroidal anti-inflammatory agents and steroids. When symptoms include numbness, loss of function and neurogenic claudicating, laminectomy is generally indicated. If the spinal column is unstable then fusion with instrumentation is required.

Spondylolisthesis describes the anterior displacement of a vertebra or the vertebral column in relation to the vertebrae below. This pathology occurs most commonly in the lumbar spine. A hangman's fracture is a type of spondylolisthesis associated with C1- C2.

Figure 1 is an X-ray showing spondylothesis where L5 has slipped over the sacral bone.

*Fig 1: Spondylolisthesis where L5 has slipped over the sacral bone*
Clinical Presentation

Patients presenting for major spinal surgery are more likely to be male with truncal obesity and frequently have multi-system disease. Some of the more typical findings are shown in Table 1.

### Table 1: Comorbidities commonly associated with the patient for major spine surgery

<table>
<thead>
<tr>
<th>FINDINGS and SYMPTOMS</th>
<th>ANESTHETIC IMPLICATIONS</th>
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<tbody>
<tr>
<td>Hypertension</td>
<td>Well controlled?</td>
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<tr>
<td></td>
<td>Medications</td>
</tr>
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<td></td>
<td>Effects of general anesthesia</td>
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<tr>
<td>Smoking</td>
<td>Respiratory function</td>
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<tr>
<td></td>
<td>Wound healing</td>
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<td></td>
<td>Postoperative care</td>
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<tr>
<td>Obesity</td>
<td>Obstructive sleep apnea</td>
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<tr>
<td></td>
<td>Airway difficulties</td>
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<td></td>
<td>Pulmonary hypertension</td>
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<tr>
<td>Diabetes mellitus</td>
<td>Perioperative glucose control</td>
</tr>
<tr>
<td>Multiple pain management</td>
<td>Drug interactions</td>
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<tr>
<td>Renal disease</td>
<td>Diuretic therapy</td>
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<tr>
<td></td>
<td>Coronary artery disease</td>
</tr>
<tr>
<td>Hematologic anomalies</td>
<td>Anemia</td>
</tr>
<tr>
<td></td>
<td>Polycythemia</td>
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</table>

Spinal fusion and instrumentation is major surgery that is generally planned many months in advance. Patients often undergo extensive evaluation before they present for a preanesthetic assessment. When preparing for consultation with such patients, information provided by all of the information available from perioperative and preoperative caregivers should be considered when creating an appropriate plan. Several studies that such information is not always available and thus this approach is not always taken. A multiple-choice survey regarding the purposes and utility of cardiology consultations was sent to randomly selected New York metropolitan area anesthesiologists, surgeons, and cardiologists. Most cardiologists and surgeons believed that it was important and useful to consult with a cardiologist prior to surgery regarding topics such as intraoperative monitoring, "clearing the patient for surgery," and advising as to the safest type of anesthesia to prevent hypoxia and hypotension. In contrast, this type of consultation was regarded as unimportant by anesthesiologists. A review of 146 medical consultations showed that the majority of cardiac consultations do not typically offer advice that will impact either perioperative management or outcome of surgery. In only 5 consultations (3.4%) did the consultant specifically identify a new significant finding; 62 consultations (42.5%) contained no pertinent recommendations. Therefore, careful history taking and physical evaluation by the anesthesiologist is essential as not only can situations change over a few weeks, but factors that are critical in anesthetic management may appear of less significance to the cardiologist.
History

The history should seek to identify cardiac conditions that impact perioperative morbidity and mortality such as unstable coronary syndromes, prior angina, recent or past myocardial infarction, decompensated heart failure, significant dysrhythmias, and severe valvular disease. A prior history of placement of a pacemaker or implantable cardioverter defibrillator (ICD) or a history of orthostatic intolerance is important. Modifiable risk factors for coronary heart disease (CHD) should be recorded, along with evidence of associated diseases, such as peripheral vascular disease, cerebrovascular disease, diabetes mellitus, renal impairment, and chronic pulmonary disease. In patients with established cardiac disease, any recent change in symptoms must be ascertained. Accurate recordings of current medications used, including herbal and other nutritional supplements, and dosages are essential. Alcohol and tobacco use and over-the-counter and illicit drugs ingestion should be documented. The history should also seek to determine the functional capacity. (See Table 2.)

<table>
<thead>
<tr>
<th>Level</th>
<th>Self Care</th>
<th>Housework</th>
<th>Recreation</th>
<th>Work</th>
</tr>
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<tbody>
<tr>
<td>METS 1-3</td>
<td>Bathe, dress, comb hair, put on shoes</td>
<td>Wash dishes, dust, set table</td>
<td>Walk 2mph, read, TV, play piano</td>
<td>Type, desk, occasional lifting up to 10lbs</td>
</tr>
<tr>
<td>METS 3-4</td>
<td>Shower, climb stairs, wash hair, driving</td>
<td>Laundry, weeding, vacuuming, make bed</td>
<td>Walk 3mph, bowl, golf with cart, fish from boat</td>
<td>Light repair work, painting small jobs, occasionally lift to 20lbs</td>
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<tr>
<td>METS 4-5</td>
<td>Sexual intercourse</td>
<td>Digging, wax floors, move furniture, wash car</td>
<td>Walk 3.5mph, golf and carry clubs, doubles tennis, bicycling</td>
<td>Mix cement, occasionally lift to 50lbs, painting exteriors</td>
</tr>
<tr>
<td>METS 5-7</td>
<td>Hanging clothes</td>
<td>Split wood, climb ladder, put up storm windows</td>
<td>Walk 4-5mph, singles tennis, softball, cross country skiing</td>
<td>Heavy farming, occasionally lift 50-100lbs, heavy industry</td>
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<tr>
<td>METS &gt; 8</td>
<td>Saw hardwood by hand, push and pull hard, move furniture</td>
<td>Jogging 5mph, football, downhill skiing, cross country running</td>
<td></td>
<td>Heavy construction, frequent lifting and carrying (&gt; 50lbs)</td>
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</table>
Assessment of a patient’s capacity to perform a spectrum of common daily tasks correlates well with maximum oxygen uptake by treadmill testing. A patient classified as high risk (because of age or known CAD) but who is asymptomatic and runs for 30 minutes daily may need no further evaluation. In contrast, a sedentary patient, such as one immobilized by severe back pain, without a history of cardiovascular disease but with clinical factors that suggest increased perioperative risk may benefit from a more extensive preoperative evaluation.

**Physical Examination**

Physical examination should include a review of general appearance. Cyanosis, pallor, dyspnea during conversation or with minimal activity, Cheyne-Stokes respiration, poor nutritional status, obesity, skeletal deformities, tremor, and anxiety are indicators of underlying disease and/or coronary artery disease. A long standing history of hypertension and hyperlipidemia is common, usually treated with several medications including diuretics, angiotensin converting enzyme (ACE) inhibitors, calcium channel and beta blockers and a statin. In assessing blood pressure, several measures should be taken from both arms. An elevated blood pressure may indicate “white coat” syndrome or failure to adhere to the prescribed regimen. Patients sometimes fail to take their medications because they misunderstand the pre-operative instruction of “nothing to eat or drink”. Hypertensive disease may be present despite pre-operative measurements of blood pressure in the normal range. A mean blood pressure of 60-70mmHg may be well tolerated by a young man with normal vasculature but may well be too low for someone who typically has a baseline mean pressure of 110 (140/90) with medication. Also, the long term ingestion of antihypertensive agents, especially ACE inhibitors, may cause a decrease in blood pressure intraoperatively, necessitating early administration of vasopressors. The patient should be examined for carotid pulse contour and bruits, jugular venous pressure and pulsations, auscultation of the lungs, precordial palpation and auscultation, abdominal palpation, and examination of the extremities for edema and vascular integrity. The finding of weak or absent arterial pulses confirms the diagnosis of underlying cardiovascular disease.

Although rales and chest X-ray evidence of pulmonary congestion correlate well with elevated pulmonary venous pressure in acute heart failure, in patients with chronic failure, these findings may be absent and an elevated jugular venous pressure or a positive hepatojugular reflux are more reliable signs. Peripheral edema is not a reliable indicator of chronic failure unless the jugular venous pressure is elevated or the hepatojugular test is positive. During cardiac auscultation, a third heart sound at the apical area suggests a failing left ventricle, but its absence is not a reliable indicator of good ventricular function. Presence of a cardiac murmur may or may not be significant. For example, aortic stenosis poses a higher risk for noncardiac surgery. Even if aortic regurgitation and mitral regurgitation are minimal, they predispose the patient to infective endocarditis should bacteremia occur.

Following a general history and physical examination, specific situations should be explored.

**Cardiac Evaluation**

*Electrocardiographic Evaluation*

The basic clinical evaluation obtained by history, physical examination, and review of the ECG usually provides sufficient data to estimate cardiac risk. The resting 12-lead ECG has been examined perioperatively to evaluate its prognostic value. Lee et al studied 4315 patients aged 50 years or older
undergoing major noncardiac surgery (with more than 2 days stay in the hospital). The presence of a pathological Q wave on the preoperative ECG was associated with an increased risk of major cardiac complications, defined as an infarction, pulmonary edema, ventricular fibrillation, primary cardiac arrest, or complete heart block. Pathological Q waves were found in 17% of the patient population. Based on these findings, the authors derived a “simple index” known as the Revised Cardiac Risk Index for the prediction of cardiac risk for stable patients undergoing nonurgent major noncardiac surgery. Independent predictors of complications were found to be:

1. History of ischemic heart disease (history of myocardial infarction, positive treadmill test, use of nitroglycerin, chest pain, or ECG with abnormal Q waves).
2. History of congestive heart failure (history of failure, pulmonary edema, paroxysmal nocturnal dyspnea, peripheral edema, bilateral rales, S3, X-ray with pulmonary vascular changes).
3. History of cerebral vascular disease (transient ischemic attack or stroke).
4. High-risk surgery (major vascular or orthopedic surgery).
5. Need for insulin treatment for diabetes mellitus.
6. Preoperative creatinine greater than 2 mg per dL.

In this report of the risk of major cardiac complications with major nonemergent noncardiac surgery, the presence of 2 of these factors correlated with patients with moderate (7%) and high (11%) complication rates. These findings are consistent with prior research and guidelines that have emphasized the value of clinical data in perioperative risk stratification. The Revised Cardiac Risk Index has become one of the most widely used risk indices.

Reported improvements in outcome may also reflect selection bias in surgery, advances in surgical technique, anesthesia, and perioperative management of coronary artery disease.

In contrast to these findings, Liu and colleagues studied the predictive value of a preoperative 12-lead ECG in 513 patients aged 70 years or older undergoing elective or urgent noncardiac surgery. In this cohort, 75% of the patients had a baseline ECG abnormality, and 3.7% of the patients died. Electrocardiographic abnormalities were not predictive of outcome. The optimal time interval between obtaining a 12-lead ECG and elective surgery is unknown, but general consensus suggests that an ECG within 30 days of surgery is adequate for those with stable disease.

Table 3: Cardiac conditions that require further evaluation

<table>
<thead>
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<th>Condition</th>
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<tr>
<td>Unstable coronary syndrome</td>
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<tr>
<td>Severe angina</td>
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<tr>
<td>Recent myocardial infarction</td>
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<td>High grade AV block</td>
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<tr>
<td>Mobitz 11 AV block</td>
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<tr>
<td>Decompensated cardiac failure</td>
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<tr>
<td>Worsening or new onset failure</td>
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<tr>
<td>Symptomatic dysrhythmias</td>
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<tr>
<td>Severe valvular disease</td>
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Further cardiac assessment

Cardiac conditions indicating the need for further evaluation prior to non-cardiac surgery are summarized in Table 3.
Two main techniques are used in preoperative evaluation of patients who cannot exercise:

1. Increasing myocardial oxygen demand (by pacing or intravenous dobutamine)
2. Inducing a hyperemic response by pharmacological vasodilators such as intravenous dipyridamole or adenosine.

The most common examples presently in use are dobutamine stress echocardiography and intravenous dipyridamole/adenosine myocardial perfusion. Results of these studies have shown that reversible perfusion defects, which reflect jeopardized viable myocardium, carry the greatest risk of perioperative cardiac death or magnetic imaging with both thallium-201 and technetium-99m.

Dobutamine stress echocardiography (DSE) is the method of choice for pharmacological stress testing with ultrasound imaging. Positive test results range from 5% to 50%. The predictive value of a positive test is 0% to 33% for events such as myocardial infarction or death. Negative predictive value range from 93% to 100%.\(^4\) The presence of a new wall-motion abnormality appears to be a powerful determinant of an increased risk for adverse perioperative events after multivariable adjustment for different clinical and echocardiographic variables. The value of DSE in prediction of perioperative events is further enhanced by integration with other risk factors such as angina or diabetes. An ischemic response at 60% or more of maximal predicted heart rate was associated with only a 4% event rate if no clinical risk factors were present versus a 22% event rate in patients with more than 2 risk factors.\(^10\) These findings have been shown to be predictors of long-term and short-term outcomes. Beattie et al conducted a meta-analysis (68 studies) comparing stress myocardial perfusion imaging versus stress echocardiography in 10,049 patients at risk for MI before elective noncardiac surgery and concluded that both myocardial perfusion imaging and stress echocardiography detected a moderate-to-large defect in 14% of patients that was predictive of myocardial infarction and/or death.\(^11\) Mondillo et al compared the predictive value and determined that the predictors were the severity and extent of ischemia (dipyridamole, p < 0.01; dobutamine, p <0.005).\(^12\) Only reversible perfusion defects at scintigraphy were significantly related to perioperative events. The strongest predictor of cardiac events was the presence of more than 3 reversible defects (p < 0.05). A meta-analysis of 58 studies indicated that perioperative cardiac risk appears to be directly proportional to the amount of myocardium at risk as reflected in the extent of reversible defects found on imaging.\(^13\) Because of the overall low positive predictive value of stress nuclear imaging, it is best used selectively in patients with a high clinical risk of perioperative cardiac event.

Dr. Elizabeth A.M. Frost, who is the editor of this continuing medical education series, is clinical professor of anesthesiology at The Mount Sinai School of Medicine in New York City. She is the author of Clinical Anesthesia in Neurosurgery (Butterworth-Heinemann, Boston) and numerous articles. Dr. Frost is past president of the Anesthesia History Association and former editor of the journal of the New York State Society of Anesthesiologists, Sphere. She is also editor of the book series based on this CME program, Preanesthetic Assessment, Volumes 1 through 3 (Birkhäuser, Boston) and 4 through 6 (McMahon Publishing, New York City).

Note: Part 2 of this activity will be available in March, 2011
REFERENCES


Post-test

1. **Regarding lower back pain:**
   a. It is the second most common medical condition in the United States
   b. The overall occurrence exceeds 90%
   c. Surgery is usually necessary
   d. Pathology is usually related to diseased laminae

2. **Spinal fusion:**
   a. Is indicated for stabilization of an unstable spine
   b. Is planned over many months
   c. Requires patients to undergo extensive pre-op evaluation
   d. All of the above

3. **A pre-surgical cardiology consultation:**
   a. Is required for all patients presenting for complex spine surgery
   b. Negates the need for preanesthetic assessment
   c. Is not always part of the preanesthetic assessment
   d. Always provides valuable information on proper anesthetic management

4. **The least likely presentation of a patient for complex spine surgery:**
   a. Smoker with BMI 43
   b. Diabetic with blood sugar typically about 180mg/dl
   c. Hypertensive patient controlled with 2-3 medications
   d. Female with BMI 27

5. **The most common diagnosis requiring spinal surgery is:**
   a. Spondylolisthesis
   b. Spinal stenosis
   c. Numbness with loss of bowel or bladder function
   d. Failure of steroid injection
6. The risk of myocardial infarction is significantly increased in pre-op patients who test positive for:
   a. Abnormal Q waves on ECG
   b. Hyperlipidemia
   c. Elevated serum glucose
   d. Sleep apnea

7. Hypertension during the preanesthetic interview may be caused by:
   a. “White coat syndrome”
   b. Failure to take morning medications
   c. Preexisting disease
   d. All of the above

8. Findings in chronic heart failure include:
   a. Elevated pulmonary venous pressure
   b. Negative hepatojugular reflex
   c. Pulmonary congestion on chest X-ray
   d. Elevated jugular venous pressure

9. The finding of a cardiac murmur:
   a. Is always significant
   b. Poses a higher risk for noncardiac surgery when associated with aortic stenosis
   c. Needs no more than antibiotic coverage
   d. None of the above

10. A simple indicator of cardiac risk for patients undergoing non cardiac surgery is least likely to include:
    a. History of transient ischemic attacks
    b. Need for insulin to control blood sugar levels
    c. Creatinine > 1.2mg/dl
    d. Bilateral rales