



SIGN, MARK & X-RAY

Prevention of Wrong-Site Spinal Surgery

Technical Document

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Checklist Use

Post checklist in the operating room in a highly visible area. If there are multiple procedures, the checklist should be applied for each procedure. Consider a second time out when there is a change of surgeons/proceduralists during the case or for localization during higher risk cases. Do not skip steps. If any of the activities to verify patient, site or procedure fails, do not proceed until confirmation or accurate identification is obtained.

Definition of Wrong-Site Spinal Surgery

Wrong-site surgery occurs when the wrong anatomical site is operated on. There are two types of wrong-site spinal surgery: either surgery done at an unintended level or on an unintended side. The most common error in spine surgery occurs when a procedure is done one level above the intended site. Surgical exposure of a spinal segment in proximity to the intended surgical level is common and should not be considered a wrong-site operation. Performing bony work for the purposes of identifying the spinal level is not wrong-site surgery, but should be recorded in the surgical note.

Source:

Palumbo MA, Bianco AJ, Esmende S, Daniels A. Wrong-site Spine Surgery. *J Am Acad Orthop Surg* 2013. 21:312-320.

Documentation

Documenting verification methods is recommended. This would include documentation of time outs and a dictated explanation of the methods used. Consider "saving" any images. See "Sign, Mark & X-ray Checklist for Safety."

Infection Risk Related to Marking

Marking pens can potentially be the source of cross-infection. Pens should be indelible and, optimally, used one time and discarded after each patient.

Source:

Driessche AM. Surgical site markers: potential source of infection. *Orthop Nurs*. 2012 Nov-Dec; 31(6):344-7.



Marker Placement and Localization

Appropriate Markers. Markers should be radiopaque markers/instruments. Exceptions may be made for x-rays where radiopaque instrumentation is found at an identifiable level. Exceptions may also be made where the level is readily identifiable due to fracture, etc. Localization x-rays should be taken with the radiopaque markers as close to the pathology as reasonably possible. Sutures are not an acceptable marking tool as they may fall off.

Localization. Accurate localization is crucial. Localization may be difficult in transitional levels and in the thoracic spine. Localization in the thoracic spine may be difficult in patients with an abnormal number of ribs, or where imaging may be unclear due to an abundance of soft tissue in the obese, in patients with decreased bone density, or where imaging is unclear due to scapular shadowing.

General Localization Guides. The following provide some general localization guides only. Special or complex cases, or patients with unusual anatomy, may require different localization approaches as deemed by the physician given the circumstances of individual patients.

- Upper Cervical Spine (Posterior)—C2 spinous process
- Lower Cervical Spine (Posterior)—T1 spinous process
- Lumbar Spine—Identify the lowest fully formed mobile lumbar segment and adjudicate the numbering. In addition, if the patient is having surgery in the lateral position, a preoperative anterior/posterior and lateral lumbar x-ray is helpful to determine the number of non-rib bearing lumbar vertebral bodies, because the number of non-rib bearing vertebral bodies does not always correlate with the total number of disc spaces.
- Thoracic Spine—Imaging views and counting techniques used to identify levels preoperatively should be compared with the intraoperative image (by x-ray or fluoroscopy) and an additional intraoperative count to confirm the levels using the same counting method and imaging views used preoperatively. If the localizing image is going to be based on counting from the sacrum, then the preoperative imaging studies must show the sacrum.
- If fluoroscopy does not provide an adequate image, consider using portable x-ray for localization.
- Preoperative imaging should typically include anterior/posterior and lateral x-rays extending from the skull to the affected area or from the pelvis to the affected area so these can be cross-referenced with any other imaging preoperatively and utilized intraoperatively to verify proper localization. This is particularly relevant when the preoperative imaging consists solely of MRI images.
- If the surgeon is unable to get convincing accuracy with localization, there should be a mechanism of escalation to get assistance from a hospital radiologist. If this is unavailable or the site is still indeterminate, the case should be cancelled and an image-guided radiopaque marker placed prior to the repeat surgery.
- In scoliosis/deformity surgery, final determination of the specific operated levels may be modified intraoperatively depending on the correction and balance.



Individual to Conduct Marking. Preoperative marking has to be conducted by a member of surgical/procedure team performing the procedure.

Source:

Balderston R, An H. Complications in Spinal Surgery. WB Saunders Co. Philadelphia, PA 1991. P. 62-63.

Hsu W, Kretzer RM, Dorsi MJ, Gokaslan ZL. Strategies to avoid wrong-site surgery during spinal procedures. Neurosurg Focus 2011. 31(4):E5, 2-3.

Ibrahim DA, Myung KA, Skaggs DL. Ten percent of patients with adolescent idiopathic scoliosis have variations in the number of thoracic or lumbar vertebrae. J Bone Joint Surg Am 2013. 95:832.

Jhawar BS, Mitsis D, Duggai N. Wrong-sided and wrong-level neurosurgery: a national survey. J Neurosurg: Spine Nov 2007. 7:469.

Mayer JE, Dang RP, Guillermo FDP, Cho SK, Qureshi SA, Hecht A. Analysis of the techniques for thoracic- and lumbar-level localization during posterior spine surgery and the occurrence of wrong-level surgery: results from a national surgery. 2013; The Spine Journal. Article in Press.

McCulloch J, Young P. Essentials of Spinal Microsurgery. Lippincott Raven. Philadelphia, PA 1998. p. 252-259, 509-512.

Palumbo MA, Bianco AJ, Esmende S, Daniels A. Wrong-site Spine Surgery. J Am Acad Orthop Surg 2013. 21:312-320.

Wong D, Transfeldt E. MacNab's Backache. 4th Ed. Lippincott & Wilkins. Philadelphia, PA 2007. p. 9-17.

Patients Who Refuse Marking

When patients refuse marking, the institution or facility should have a written, alternative process to ensure the correct site for surgery.

Source:

The Joint Commission. Speak Up. The Universal Protocol for Preventing Wrong Site, Wrong Procedure, and Wrong Person Surgery. Available at: http://www.jointcommission.org/assets/1/18/UP_Poster1.PDF. Accessed: December 3, 2013.

Physical Factors that May Affect Risks Related to Wrong-Site Spinal Surgery

Physical factors that may also contribute to wrong-site surgery include:

- Morbid obesity in which patient size may limit the quality of imaging
- Unusual anatomy (extra vertebra, transitional anatomy with lumbarized discs, extra ribs)

- Segmentation anomalies
- Arthritic changes
- Pre-existing implants

Source:

Mayer JE, Dang RP, Guillermo FDP, Cho SK, Qureshi SA, Hecht A. Analysis of the techniques for thoracic- and lumbar-level localization during posterior spine surgery and the occurrence of wrong-level surgery: results from a national surgery. 2013; The Spine Journal. Article in Press.

Use of the Intra-operative X-ray and Radiology Consultation

Use of the intra-operative x-ray and a radiology consultation may be dependent upon the resources available to a particular locality or institution. Examples may include institutions that are isolated or rural or where a radiologist is not immediately accessible. In these instances, it may not be possible to implement these steps in the checklist.

An x-ray of the pertinent spinal segment(s) with the cross sectional image to determine the appropriate procedure site may be considered.

Where a radiology consultation is used, review of films should take place with the direct and simultaneous involvement of a radiologist and surgeon/proceduralist.

Preoperative images should be available for comparison in surgery. Preoperative plain x-rays may be helpful especially when anatomical variances are present. Inclusion of the pelvis in preoperative x-rays should be considered for thoracic cases where counting up from the pelvis is planned.

Recommendations for Management Following the Discovery of Wrong-Site Surgery

General

If during the course of a surgical procedure, or after surgery or procedure has been completed, it is determined that the surgery or other invasive procedure is being or has been performed at the wrong site, the surgeon should always:

1. Act in accord with the patient's best interests and to promote the patient's well-being;
2. Record the events in the appropriate medical records.

General Anesthesia

If the procedure is being performed under general anesthesia, when it is determined that the surgery is being performed at the wrong site, the surgeon should:

1. Take appropriate steps to return the patient, as nearly as possible, to the patient's preprocedure condition;
2. Perform the desired procedure at the correct site, unless there are medical reasons not to proceed, e.g., if proceeding with the surgery at the correct



site would materially increase the risk associated with extended length of the surgical procedure or if the correct-site surgery would likely result in an additional and unacceptable disability;

3. Advise the patient, and the patient's family, if appropriate, as soon as reasonably possible, of what occurred and the likely consequences, if any, of the wrong-site surgery.

Local Anesthesia

If the procedure is being performed under a local anesthesia and/or conscious sedation and the patient is clearly able to comprehend what has occurred and competent to exercise judgment, the surgeon/proceduralist should:

1. Take appropriate steps to return the patient, as nearly as possible, to the patient's preprocedure condition;
2. Advise the patient of what has occurred, recommend to the patient what, in the surgeon's/proceduralist's best judgment, is the appropriate course for the patient to follow under the circumstances; and
3. Truthfully answer any relevant question posed by the patient and then proceed as directed by the patient.
4. In the event that a patient is not able to comprehend the situation and/or competent to exercise judgment, the patient's family should be informed and asked to make the decision, unless it is an emergency situation.

Discovery After Surgery

If, after the procedure has been completed, it is determined that it was performed at the wrong site, the physician should: as soon as reasonably possible, discuss the mistake with the patient and, if appropriate, with the patient's family and recommend an immediate plan to rectify the mistake unless there is a medical reason not to proceed.

Source:

American Academy of Orthopaedic Surgeons. Information Statement. Wrong-site surgery. Available at: <http://www.aaos.org/about/papers/advistmt/1015.asp/>. Accessed: December 3, 2013.

