laminoplasty, in general, a trough is drilled in one lamina, and a "door" is drilled through the opposite laminae. The posterior arch is distracted away—or the door is opened. This is completed at several cervical levels, for example, C3–C6. Graft material may be placed in the opening in the laminae, and a miniplate is placed for fixation. This procedure enlarges the spinal canal without removing bony structures. Length of stay is commonly 2–3 days.

D. Foraminotomy

Foraminotomy is a posterior surgical procedure used to treat patients with cervical disc herniation. This procedure is effective when one nerve root is compressed and an obvious radicular symptomology is present. With foraminotomy, the intravertebral foramen or canal is enlarged with the goal of removing tension or compression on the nerve root. Only the portions of the disc that are pressing on the nerve root are removed. A spinal fusion is not usually required. Length of stay is usually overnight.

E. Posterior Discectomy

A posterior discectomy is performed with a laminectomy. Once the lamina is removed, the neural structures are retracted (i.e., moved aside) and any portions of the intervertebral disc that has herniated are removed. The remaining annulus is left in place. The discectomy may be performed with or without a fusion. Length of stay is usually overnight.

F. Upper Cervical Fusion

Occipital cervical fusion is indicated if the patient has instability of the craniocervical junction—either pathologically or as a result of a surgical procedure. The fixation can be performed with a variety of wires, rods, and plates. Length of stay is variable, but commonly is 2–3 days.

Figure 23. Intraoperative cervical laminectomy and fusion with instrumentation

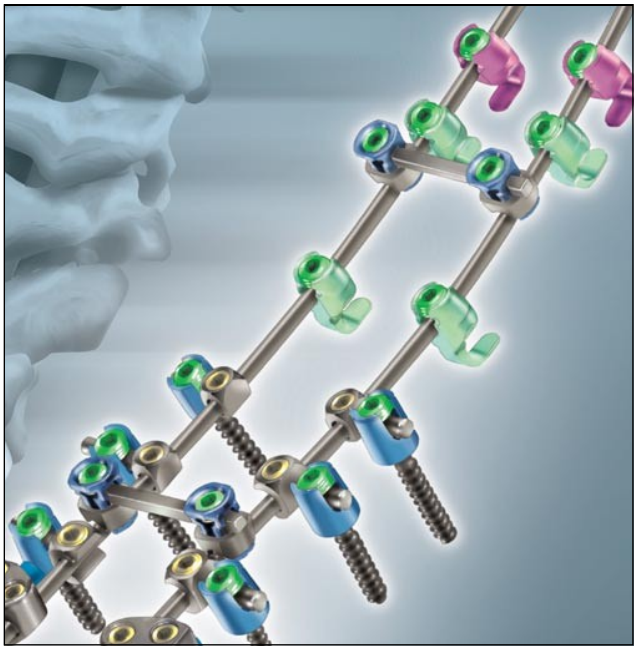
IV. Combined Anterior/Posterior Approach

A patient with extensive pathology involving both the anterior and posterior elements of the cervical spine, or a patient requiring a major procedure that leaves the cervical spine very unstable may require a combined anterior/posterior procedure (**Figures 25, 26**). Typically, the patient will undergo a multilevel ACDF or corpectomy followed by a posterior fusion with or without a laminectomy. Both procedures may be done at the same time or may be staged (i.e., performed at different times).

V. Minimally Invasive/Minimal Access Approach

Minimally invasive techniques in the cervical spine are reported to be endoscopic posterior cervical laminoforaminotomy and anterior cervical foraminotomy. These techniques are performed through very small incisions, utilizing muscle splitting. Proponents say that the posterior approach offers decreased postoperative pain and muscle

Figure 24. Posterior cervical instrumentation



Note. Photo (n.d.), retrieved January 26, 2007, from www.sofamordanek.com/patient-spinal-vertex.html. Copyright © by Medtronic Sofamor Danek. Reprinted with permission.

spasms while maintaining posterior muscle integrity. The anterior approach preserves the disc, maintaining the motion segment (Perez-Cruet, Fessler, & Perin, 2002). These techniques require specialized equipment and surgical training. Minimal access surgical procedures are designed to reduce perioperative discomfort and shorten surgical healing times. Minimal access surgeries are evolving and gaining popular support.

VI. The Basics of Bone Healing

A solid bony fusion (i.e., arthrodesis) must be achieved in order to provide permanent spinal stability. Spinal instrumentation provides only temporary, internal fixation. If a solid bony fusion is not achieved, fusion failure may result in the fatigue and failure of supporting instrumentation. The patient's symptoms may persist or worsen. Nurses caring for cervical fusion patients are in a pivotal position to explain and reinforce to the patient the importance of providing an ideal environment to promote bony healing (**Figure 27**).

A. Three Primary Bone Types

1. Woven bone: Woven bone occurs in embryonic development, during fracture healing, and in disease states such as hyperparathyroidism and Paget's disease.
2. Cortical bone: This type of bone is composed of osteons; it is compact and cylindrical. Haversian canals are the vascular channels at the center. These are connected to each other by horizontal Volkmann's canals. The cortical bones form internal and external tables of flat bones and external surfaces of long bones. Their mechanical strength depends on the tight packing of the osteons.
3. Cancellous bone: Also referred to as the trabecular bone, it lies between the cortical bone surfaces. Its network of honeycombed interstices contains hematopoietic stem cells and bony trabeculae. The cancellous bone is arrayed in a perpendicular orientation to provide structural support and is continually undergoing remodeling on the internal endosteal surfaces.

B. Cellular Components of Bone

1. Osteoblasts: Mature, metabolically active bone-forming cells
2. Osteocytes: Mature osteoblasts trapped in the bone matrix
3. Osteoclasts: Multinucleated bone-resorbing cells that are controlled by hormonal and cellular mechanisms
4. Bone metabolism: Under constant regulation by a host of hormonal and local factors

Figure 25. Anterior/posterior cervical spine decompression and fusion, A/P X ray

Figure 26. Anterior/posterior cervical spine decompression and fusion, lateral X ray