Complications Associated with Vertebroplasty and Kyphoplasty

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Since percutaneous vertebroplasty (PV) was introduced in Europe in 1984, it has become an increasingly popular technique. It was introduced in the United States in the early 1990s, and since 1998 it has been the standard of care for painful compression fractures (1). Although less commonly used than PV, kyphoplasty (KP), or “balloon-assisted vertebroplasty,” introduced in the late 1990s, has also become popular for treating the pain associated with vertebral compression fractures (VCFs). Both procedures are structurally similar and use percutaneously introduced bone cement to augment a fractured or destroyed vertebral body. This chapter evaluates the types of complications that have occurred with both procedures and indicates ways to avoid these complications.

Initially, training for both procedures was achieved through short (usually 1-day) cadaver courses given by experienced physicians worldwide. This ideally was followed by several proctored cases to get the “physician in training” off to a safe start. No formal training was offered in universities for residents until more recently. The first physicians doing the procedures progressed through their learning curves carefully as the procedure was cautiously applied. Few complications were initially experienced and reported. Severe or permanent complications were rare. However, since the procedures were first devised, complication reports have been collected and have identified definite risks of the procedures. Although complications cannot be eliminated completely, they can be minimized through good image guidance (high-quality fluoroscopic equipment or computed tomography), a thorough knowledge of the spinal anatomy involved in both PV and KP, and a complete understanding of the criteria for performing these procedures safely. This means appropriate patient selection, adherence to safe procedure technique, proper material selection, and good judgement that minimizes the patient risk while affording a high probability of successful outcome. It should be remembered that preventing complications is the key to a safe procedure.
Incidents and Complications

Incidents

An incident is an asymptomatic event that is unexpected or undesirable but that produces no measurable ill effect to the patient.

Cement Leakage

Cement leaks are not uncommon with either PV or KP. They are typically small and pose no risk to the patient. Leaks may occur through the vertebral wall due to a fracture fissure, destruction created by malignancy, or even a blow-out fracture through the vertebral wall created by the Kyphon balloon (Figure 13.1A). Leaks can also occur through connecting vascular structures because injecting into the intra trabecular space is effectively injecting into the intravascular, venous space. Small amounts of cement in the venous structures, paraspinal tissue, or the disc space are almost never associated with clinical symptoms. To minimize these leaks and keep them asymptomatic, they must be realized very early and while still small. This allows the operating physician to stop the cement injection. Cement should be viscous or thick before injection to ensure that it does not flow out of the vertebra except with the continued pressure of injection. Cement that is very liquid or cement that has a very long working time at room temperature (e.g., Cranioplastic, Vertebroplastic, or Secore) can remain liquid even after injection and present a risk for leak from the needle stick site and along the needle track (Figure 13.1B). Recognizing the leak and immediately stopping the injection will protect against a large and potentially symptomatic leak. Figure 13.1C shows a small leak through the posterior venous plexus into the epidural space on a computed tomographic (CT) scan obtained after the PV was completed. The fluoroscopic images obtained during the procedure (Figure 13.1D) show that cement appears to approach the posterior wall, but there is no initial evidence of leak. This highlights an important aspect of the vertebral anatomy: The vertebra is not a box with square borders, but rather has a concave posterior margin and a convex anterior margin. If cement extends to what appears to be the posterior margin on fluoroscopy, then it has likely already leaked beyond the true concave portion of the posterior wall. Cement therefore should be stopped when it reaches the posterior quarter of the vertebra.

The convex anterior margin is important also, as a laterally placed needle can breach the anterolateral wall before the tip of the needle appears to reach the anteriormost portion of the vertebra in the lateral projection (Figure 13.1E). The needle should be positioned beyond the midline at the junction of the middle and anterior thirds of the vertebra (in the lateral projection), but not all the way to the apparent anterior margin. At least mild angulation away from the lateral margin is optimal to avoid the lateral wall.

Asymptomatic Pulmonary Emboli

Essentially all PV and KP procedures will displace blood products and marrow fat during either balloon inflation or cement injection (2). Both