Morphology in postdiscectomy problems

Importance of magnetic resonance imaging

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Despite the high preoperative diagnostic accuracy for disc prolapse, some patients still do not do well following surgery. Careful evaluation prior to further treatment is essential. Immediate failure occasionally occurs when the operation is performed at the wrong level, particularly in the presence of a transitional vertebra. Another cause, however, is the failure to remove a sequestrated fragment. Careful preoperative evaluation, either by computed tomography (CT) with sagittal reconstructions or magnetic resonance (MR), should identify the full extent of the prolapse, enabling its complete removal. Evaluation of the spine in the immediate postoperative period should be undertaken with care. CT in asymptomatic patients in the immediate postoperative period showed a clearly delineated uniform shadow of 60–85 Hounsfield units protruding into the canal in nearly half of them, which was clearly delineated from the dural sac and extradural shadow (Montaldi et al. 1988). In 84 percent of cases, there is new heterogenous material of lower attenuation than disc and with blurred margins within the canal. This was suggested to represent bleeding, which evolved into scar tissue and was commonly followed by late slight attraction of the dural sac to the operated side. The attenuation of the nucleus pulposus in the disc that was operated on was low. There is little change in the appearances between 1 and 6 weeks. These features may vary with technique.

The immediate postoperative MR image is of heterogenous material with intermediate intensity on T1 and high intensity on T2, with a loss of definition of the dural sac outline. The soft tissue mass blends with the disc outline.

Back pain may also be a feature soon after surgery, and if severe, a postoperative discitis may be present. This is best demonstrated with MR which shows a loss of outline of the vertebral end plate, a low signal in the adjacent vertebra and disc on T1 weighted images, and an increased signal on T2. An increased uptake of Technetium 99 MDP may be present but studies suggest that MR is more sensitive and shows changes at an earlier stage (Szypryt et al. 1988).

Further sciatica after a period of relief may be due to a recurrent disc prolapse. Both CT and MR are valuable for diagnosis. If the anatomy has returned substantially to normal, the nerve root will be seen surrounded by low attentuation fat on CT and by high signal intensity fat on T1 weighted MR. The outline of a recurrent disc prolapse will be easily diagnosed. The ease of diagnosis depends, however, on the degree of epidural scarring, which has occurred following surgery. On CT, scarring appears as diffuse areas of tissue of lower attenuation than the disc, which obliterate the epidural fat and distort the dural sac. The nerve root may not be visualised although the attenuation of epidural fibrosis is lower than disc but overlap may occur.

The use of intravenous contrast enhancement may assist in differentiation as fibrous tissue enhances as either a unified mass or circumscribing the dural sac, whereas disc material does not usually enhance or may do so only on the circumference (Dixon and Bannon 1982, Firooznia et al. 1987).

Although some contrast patients with scarring do not show enhancement, the use of intravenous injections has been found to be valuable in situations where this diagnosis is equivocal. The appearances of scar on magnetic resonance are hypo- or isointense on T1 weighted spin echo, and hyperintense on T2 relative to the annulus (Bundschuh et al. 1988). Epidural scar formation also enhances on T1 weighted images after the injection of gadolinium DTPA (Heuftle et al. 1988) while disc material remains unchanged, appearing either hypo or isointense, with annulus on T1 and T2 sequences. Rim enhancement may occur around disc material, and the degree of differentiation by enhancement becomes less clear as the time of imaging after injection increases, due to diffusion of the paramagnetic contrast agent. MR correlation with surgery is 96 percent accurate (Ross et al. 1990), and comparison with CT suggests that MR is more accurate (Focrain et al. 1989). It is important to make the differentiation, as comparison between symptomatic and asymptomatic post-operative patients shows no difference in the

presence and extent of epidural fibrosis (Cervellini et al. 1988, Montaldi et al. 1988).

The limited significance of fibrosis is also highlighted by a study by Kuslich (1991), who stimulated various tissues at surgery performed under local anesthesia and found that when perineural fibrosis was probed there was no symptom reproduction but that the underlying nerve root was frequently sensitive and being fixed might be susceptible to tension or compression.

While fibrosis around the dural sac is relatively common, inflammation or adhesions within the dural sac following surgery is unusual. This may also be secondary to irritation by the disc herniation, but the most common cause is the preoperative investigation by oil based or watersoluble myelographic contrast media. There is a fibrinous exudate which progresses to fibroblastic activity and collagen deposition which enmeshes the nerve roots which become atrophic. The demonstration of the nerve roots on CT requires low dose intrathecal contrast, and in normal circumstances the nerve roots are clearly defined individually. In arachnoiditis they are matted together, thickened and with loss of definition. In more severe cases a rat tail effect may be present on water soluble myelography and in some cases shows a complete block. MR will demonstrate the normal nerve roots independently within the dural sac in the lower lumbar spine, while in the upper lumbar spine they are seen lying in the dependent part of the dural sac on both T1 and T2 weighted images. In arachnoiditis the nerve roots appear clumped together or may be adherent to the wall of the dura, giving an empty-sac appearance (Johnson and Sze 1990). Enhancement of the nerve roots may occasionally occur after intravenous injection of gadolinium DTPA but was never intense and did not assist in diagnosis (Johnson and Sze 1990).

Occasionally surgery may be performed without resolving the symptoms, and in such cases the presence of a tumor should be considered. MR is the investigation of choice as it will demonstrate both intra and extrathecal tumours and in particular lesions at the cauda equina, which can mimic the clinical features of a disc prolapse. The area of the field of view should not be too limited on the axial views around the sacrum as posterior intrapelvic tumours may also give features of nerve root irritation.

Finally, patients may continue with chronic back and nondermatomal leg pain following surgery. MR will provide an assessment of the status of the disc and may demonstrate extensive degeneration. These changes are common in both symptomatic and asymptomatic subjects, and in these circumstances, examination by discography, paying particular attention to the area and type of pain provocation, may be of value (Colhoun et al. 1988). Local anesthetic injections into the facets may also prove helpful in assessing the pain source (Fairbank et al. 1981).

In conclusion, the recent advances in MR imaging make this technique the initial examination of choice to define the morphology in patients with post discectomy problems. Enhancement with intravenous gadolinium DTPA is essential for the full assessment of the patient. In the more chronic cases, invasive tests designed to assess pain localisation may be required.

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