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QUESTION 4: How can postoperative infections be distinguished from normal postoperative changes on magnetic resonance imaging (MRI)?

RECOMMENDATION: The presence of an abscess in the back muscles or posterior site, confirmed by gadolinium enhancement, is the most frequently-reported change on MRI of patients with surgical site infection (SSI). The presence of a collection of fluid outside the head of the pedicle screws is another sign of SSI.

LEVEL OF EVIDENCE: Limited

DELEGATE VOTE: Agree: 71%, Disagree: 8%, Abstain: 21% (Super Majority, Strong Consensus)

RATIONALE

A search was conducted using the MeSH terms "spine AND MRI AND surgical site infection." The initial search yielded 149 references, and after screening, 13 abstracts remained. However, only three studies assessed the use of MRI for postoperative spine infections and were found eligible.

Kanayama et al. retrospectively used MRI in 20 patients with surgical site infections after instrumented spinal surgery [1]. In their series they considered two markers for diagnosing SSI: (1) the presence or absence of osteomyelitis at the instrumented vertebra and (2) the presence or absence of intervertebral abscess. All 20 patients had a confirmed SSI, but in 7 MRIs it was considered negative. The study mainly aimed to assess the utility of MRI to confirm the severity of the infection. Using the above-mentioned criteria, they tried to predict the need for implant removal. However, MRI was not evaluated as a diagnostic tool for assessing the presence or absence of infection.

Kim et al. reviewed 43 patients with MRI after SSI [2]. First, they divided their infections on an anatomical basis, assessing if it affected only the posterior region (31 cases), only the anterior area or both posterior and anterior regions [2]. In addition, they looked for abscess in different spinal locations (posterior epidural space, laminectomy site, back muscles, subcutaneous fat layer, paravertebral space, psoas muscle and anterior epidural space). They also evaluated the presence of osteomyelitis of the vertebral body and discitis. The most frequent findings were abscesses in the back muscles in 40 patients (93%), abscesses in the laminectomy site in 29 (67.4%) and in the subcutaneous fat layer in 27 (62.8%). All abscesses were identified by the presence of peripheral rim or diffused enhancement of adjacent soft tissue after administration of intravenous gadolinium.

They did not compare their findings with those of patients without confirmed SSI. The authors concluded that for diagnosing infection, the posterior surgical field was more important than the vertebral body or the disc area. This conclusion supports the findings of the previous study by Kanayama, in which seven patients with SSIs did not show involvement of the vertebral body or the disc area.

Finally, Kimura et al. published a comparative study on postoperative MRI including 17 patients with a deep SSI and 64 non-SSI controls who had an MRI examination within 4 weeks after surgery [3]. Their investigation focused on the "pedicle screw fluid sign" (PS fluid sign) and did not search for other signs of infection. The PS fluid sign refers to the collection of fluid outside the head of a pedicle screw, suggesting the presence of an abscess on axial MRI scans. The authors observed that fluid collections medial to the pedicle screw head are not infrequent. They considered that when the collection expands outside the head of the screw into the paravertebral

muscles, it is likely to be an abscess. In their view, artifacts have little effect on the area outside the screw head, compared with the inside. In their study, this sign was positive in 15 of 17 deep SSI infections and only in 7 of 64 patients without infection. Sensitivity was 88.2%, specificity 89.1%, positive predictive value 68.1% and negative predictive value 96.6%.

In conclusion, abscesses in the back muscles, laminectomy site and subcutaneous fat layer, after administration of gadolinium were the most common findings related with surgical site infection. In addition, the PS fluid sign had a sensitivity of 88.2% and specificity of 89.1%.

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