

# Gallium Scintigraphy in the Evaluation of Disk-Space Infections: Concise Communication

Dean A. Bruschwein, Manuel L. Brown, and Richard A. McLeod

*Mayo Clinic and Mayo Foundation, Rochester, Minnesota*

**Disk-space infections may present a difficult diagnostic problem. To evaluate the usefulness and accuracy of gallium-67 scanning for disk-space infections, a retrospective review was made of the records of 100 consecutive patients in whom gallium scans were obtained and disk-space infection suspected. Of the 100 patients, 19 had disk-space infections, with positive gallium scans in 17. In three of these, the gallium scan was positive, whereas the results on radiographs and other tests were normal. In this study, gallium scanning was a useful adjunct in the evaluation of patients with suspected disk-space infections; the sensitivity was 89%, specificity 85%, and accuracy 86%.**

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Disk-space infections are uncommon but not rare and, in the differential diagnosis of low-back pain, may represent a difficult problem. In the past, the diagnosis was made on the basis of clinical suspicion and radiographic changes, with confirmation by disk-space aspiration or open biopsy (1). However, with the nonspecific nature of the clinical symptoms and with a latent period of 2 to 8 wk for radiographic changes to appear, disk-space infection may go unrecognized for a considerable time before being diagnosed and treated. Other diseases, such as degenerative disk disease and ankylosing spondylitis with pseudarthrosis, may mimic disk-space infection radiographically (2,3). For these reasons, gallium scanning has been used at our institution as a noninvasive means to help establish the diagnosis of disk-space infection.

Gallium scanning has been shown to be useful in the workup of various inflammatory lesions (4-6). Recently, several instances of the use of gallium in detecting disk-space infection have been reported (7,8). We wished to determine the sensitivity of gallium scanning for the diagnosis of this condition.

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For reprints contact: Manuel L. Brown, MD, Diagnostic Nuclear Medicine, Mayo Clinic, Rochester, MN 55901.

## METHODS, MATERIALS, AND RESULTS

The gallium scans of 100 consecutive patients with suspected disk-space infection, who were seen between October 1973 and November 1978, were retrospectively reviewed. The ages ranged from 18 mo to 82 yr. The earlier scans were performed on a rectilinear scanner,\* with the later ones done on a tomoscanner† or a LFOV gamma camera.† Most scans were performed 24 and 48 hr after the intravenous administration of 3-5 mCi of gallium-67 citrate.

The diagnosis or exclusion of disk-space infection was established on the basis of the clinical course, including erythrocyte sedimentation rate, leukocyte count, and blood cultures, sequential radiographic findings, and cultures of disk-space aspirates or open biopsy, when performed. The gallium scans were reviewed and interpreted as either positive or negative, and these results were correlated with the diagnosis.

In this study there were no controls as such. All patients were considered to have a disk-space infection at the time of their study. All had a complete clinical workup, including laboratory tests, radiographs, and follow-up, and those who were considered to have true-negative findings served as controls.

Of the 100 patients, nine were excluded because of

**TABLE 1. 100 GALLIUM-67 SCANS REVIEWED FOR DISK-SPACE INFECTION\***

| Finding  | Patients |      |
|--|----------|------|
|  | Nos.     | %    |
| Disk-space infection                                       | 19       | 21   |
| true positive  | (17)     | (19) |
| false negative   | (2)      | (2)  |
| Without disk-space infection                               | 72       | 79   |
| false positive†  | (11)     | (12) |
| true negative  | (61)     | (67) |
| Sensitivity $\left( \frac{TP}{TP + FN} \times 100 \right)$ |          | 89%  |
| Specificity $\left( \frac{TN}{TN + FP} \times 100 \right)$ |          | 85%  |
| Accuracy $\left( \frac{TP + TN}{Total} \times 100 \right)$ |          | 86%  |

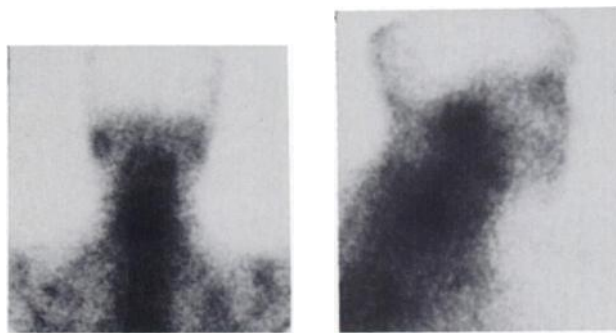
\* Nine scans were excluded because cases had insufficient workup.

† Seven patients with other diseases; four without disease.

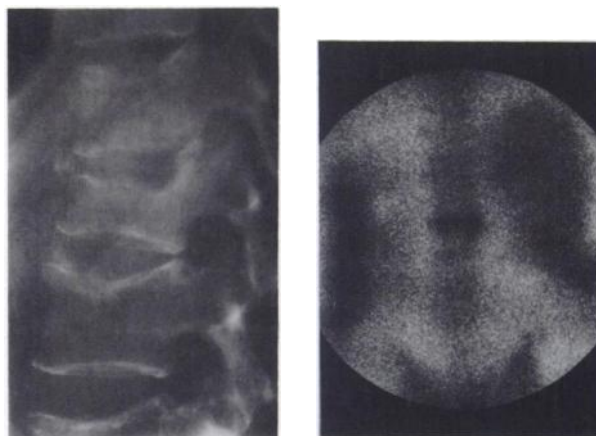
insufficient workup at our institution (Table 1). Of the remaining 91 patients, 19 had disk-space infections, of which two had false-negative gallium scans. There were 11 patients with scans false-positive for disk-space infection; of these, seven had other disease in the vertebral or paravertebral region, and four had false-positive scans without disease. The remaining 61 patients had true-negative scans, with an average follow up of 9 mo. Thus, the sensitivity was 89%, the specificity 85%, and the accuracy 86%. The predictive value for disk-space infection of a positive test is 61% in this population, and that of a negative test is 97%.

#### DISCUSSION

Of the 19 disk-space infections, 12 were confirmed by



**FIG. 1.** Posterior and lateral views of cervical spinal column. Positive Ga-67 scan of disk-space infection at C-7 was proved by open biopsy. This 62-year-old woman presented with malaise, loss of weight, and severe neck pain. Clinically, myeloma was considered, but radiographically there was suspicion of infection.



**FIG. 2.** A 57-year-old woman with systemic lupus erythematosus, who had severe back pain while receiving steroid therapy. Radiograph of lumbar spine. Changes were considered secondary to hypercortisolemia. Posterior Ga-67 scan of lumbar spine with positive uptake in T-12 interspace. This finding directed clinicians to staphylococcal infection of disk space.

positive disk-space aspiration or open biopsy. In three of the 17 patients with positive gallium scans, the findings on the initial radiographs and the test results were normal, but the positive gallium scan directed the clinicians to the site of active infection (Figs. 1 and 2). In four others, the gallium scan was instrumental in establishing the diagnosis, even though other evidence supported disk-space infection. Of the two patients with false-negative gallium scans, one (who had been receiving antibiotics intermittently for several years) had chronic osteomyelitis in an anterior cervical fusion site, and the other had diabetes with a disk-space infection involving the lumbosacral interspace.

Eleven patients had false-positive scans; seven of the 11 had disease. Three of the seven had sites of infection close to the spinal column, causing increased uptake that appeared to be of vertebral origin. One patient had pneumonia with empyema, another had a peripancreatic abscess, and a third had an epidural abscess. The other



**FIG. 3.** Posterior Ga-67 scan of thoracolumbar spinal column in 79-year-old woman with recent onset of back pain. Scintigram is positive at T-7, consistent with disk-space infection. Biopsy revealed lymphoma at this site.

four patients had malignancies: one a cancer in the head of the pancreas, two had metastatic disease, and one had lymphoma with bony invasion (Fig. 3).

An attempt was made at differentiating the patients with disk-space infection from those with abnormalities in surrounding bone or soft tissue. Disk-space infections had usually spread and involved the full width of the disk space, at least they did in this series. In noninfected disease, the uptake also appeared to involve the entire width of the disk space. With the use of tomography, such as with the tomoscanner,<sup>†</sup> we might have been able to determine more accurately whether an abnormality was in surrounding bone or soft tissue or in the disk space.

Four patients had false-positive scans but had no known pathologic process as the cause for the increased uptake. One patient had increased uptake in an area of spondylolisthesis of the lumbar spinal column and one in an area of recent vertebral compression fractures. Two patients had false-positive scans in which the radiographic findings also were suggestive of disk-space infection, but disk-space aspirate with culture was negative—the final clinical diagnosis being degenerative disk disease. However, it has been reported that disk-space aspiration and culture is positive in only 50% of the patients with proved disk-space infection (9).

#### CONCLUSION

Gallium-67 scanning has proved to be an accurate and sensitive test for the diagnosis of disk-space infection, especially in those cases of acute onset before radiographic changes have occurred.

#### FOOTNOTES

- \* GE dual-probe
- † Searle & Co, Chicago, IL.

#### ACKNOWLEDGMENT

This paper was presented at the 26th Annual Meeting of the Society of Nuclear Medicine, June 25–28, Atlanta, GA.

Since the completion of this study, seven additional patients with disk-space infections have had positive gallium scans.

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