
The Effect of Previous Thoracic Surgery on Gallium Uptake in the Chest

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To determine the frequency, average duration, and characteristic patterns of persistent gallium uptake caused by thoracotomy, serial postsurgical scans of 51 patients were reviewed. In each of these cases a thoracotomy had been performed for resection of lung cancer, and there had been no evidence of recurrent tumor for at least 2 yr following surgery. Postoperative gallium activity due to non-neoplastic postoperative changes occurred in 15 patients. Five of six patients scanned within 3 mo of surgery and six of 21 scanned 3 to 6 mo following surgery showed persistent uptake at the operative site. All 13 patients who had subsequent scans demonstrated eventual clearing. Activity persisted more than 18 mo postoperatively in only one patient. Patterns of gallium accumulation included both focal chest wall uptake at the incision site and diffuse pleural activity.

J Nucl Med 28:1831-1834, 1987

Gallium-67 (^{67}Ga) imaging has been used widely for detection and localization of tumor (1,2) including recurrent lung cancer. However, its utility has been impaired by uncertainty regarding the possible effects of operative trauma on gallium uptake. This study was performed to determine the frequency, duration, and characteristic patterns of post-thoracotomy gallium uptake in patients who had lung cancers successfully resected. The gallium scans of 51 patients who were determined clinically and radiologically to be free of recurrent disease for at least 2 yr and who had had gallium studies at intervals of 3 to 12 mo postoperatively were reviewed.

MATERIALS AND METHODS

The study included 51 consecutive patients who underwent successful resection of lung cancer at The University of Chicago Medical Center. The criteria for inclusion in the study were (a) successful performance of a lobectomy or pneumonectomy for lung cancer, (b) absence of recurrent tumor by clinical, radiologic and scintigraphic criteria for at least 2 yr postoperatively, (3) availability of one or more postoperative gallium scans, and (4) absence of an obvious inflammatory cause of gallium accumulation.

Gallium scans were performed using a PhoCon tomographic scanner[†] at 72 hr after i.v. injection of 10 mCi of

[^{67}Ga]citrate. The first postoperative scan was obtained 3 to 6 mo following surgery and subsequent scans were performed at 6-mo to 1-yr intervals. Patients were followed postoperatively with a minimum of interview, physical examination, and chest radiography at 3-mo intervals.

Review of the clinical charts and chest radiographs confirmed that all patients were disease-free for at least 2 yr postoperatively. Because of the long disease free interval, gallium accumulation at the surgical site first noted in the postoperative period was presumed to be caused by surgical trauma and postoperative inflammatory changes rather than recurrent tumor. Retrospective review of all postoperative gallium scans and chest radiographs was performed to determine the frequency, duration, intensity, and characteristic patterns of postsurgical activity in the chest. Intensity of uptake was recorded using a scale of 0 to 3+ with 0 indicating no uptake, 1+ indicating minimal uptake, 2+ indicating moderate uptake, and 3+ indicating activity equal to or greater than the liver. Activity was localized in an antero-posterior plane by means of the tomographic images.

RESULTS

Of the 51 tumor-free patients studied, a total of 15 demonstrated postoperative gallium activity in the ipsilateral hemithorax. Thirteen of these had subsequent scans that showed clearing of the abnormal activity. The two remaining patients had a single postoperative scan. Patterns of uptake included both focal chest wall accumulation (Fig. 1) as well as activity around the periphery of the thoracic cavity, possibly within the pleura (Fig. 2).

Received Dec. 22, 1986; revision accepted May 28, 1987.

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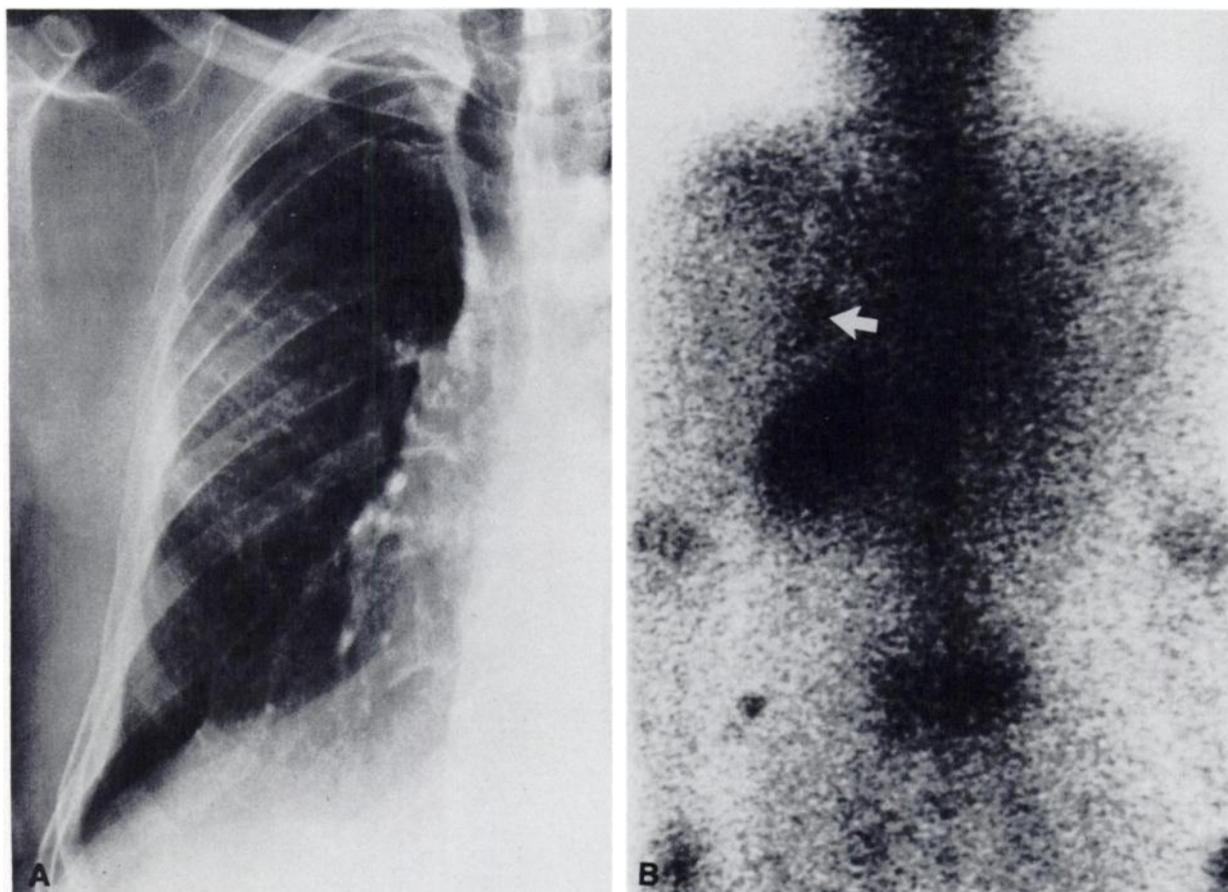


FIGURE 1

A: A chest radiograph of a 63-yr-old man (Patient "K" in Fig. 3) 4 mo after right upper lobectomy for bronchogenic carcinoma shows mild pleural scarring and no active lung disease. B: A posterior tomographic section from a gallium scan demonstrates focal tracer concentration (2+ intensity) at the surgical incision site (arrow), typical of benign postoperative activity.

Six patients had scans within 3 mo of thoracotomy (Fig. 3). In five of these, chest wall accumulation was seen with intensities of 2+ or 3+. Abnormal activity cleared on subsequent scans in three patients with the duration of abnormal activity extending to 7 mo postoperatively. Two patients did not receive a second postoperative scan. Of 21 patients who had their first postoperative scan performed between 3 and 6 mo postoperatively, six showed activity ascribed to surgical traumatic/inflammatory changes with intensity ranging from 1+ to 3+. Of the remaining 24 patients who had their first postoperative scan 7 mo or more following surgery, four had persistent uptake with intensities of 1+ or 2+. Activity persisted more than 18 mo postoperatively in only one patient. This patient had persistent activity on seven follow-up scans over a 5-yr period, that eventually cleared 83 mo after surgery. It should be noted that the precise duration of abnormal activity is uncertain in some cases due to the long intervals between scans.

Correlation with postoperative chest radiographs demonstrated gallium activity to be in the postero-

lateral chest wall at the incision site in eight of the 15 patients. This activity did not correlate consistently with the presence of surgical rib fractures or correspond to the site(s) of the fracture(s) in all cases. Four patients had focal activity at the rib fracture site. Of the remaining three patients with postoperative activity, two had apparent pleural activity at the ipsilateral lung base while one patient had pleural uptake along the lateral chest wall. The patterns of activity occurred independently of the type of resection performed (lobectomy versus pneumonectomy) and the presence of residual pleural thickening or pulmonary scarring as seen on chest radiographs.

DISCUSSION

It is apparent that surgical trauma and postsurgical inflammation can result in persistently abnormal gallium scans in a number of cases. Presumably, some degree of abnormal activity would be present in all cases in the immediate postoperative period, and for this reason we usually postpone the "baseline" scan

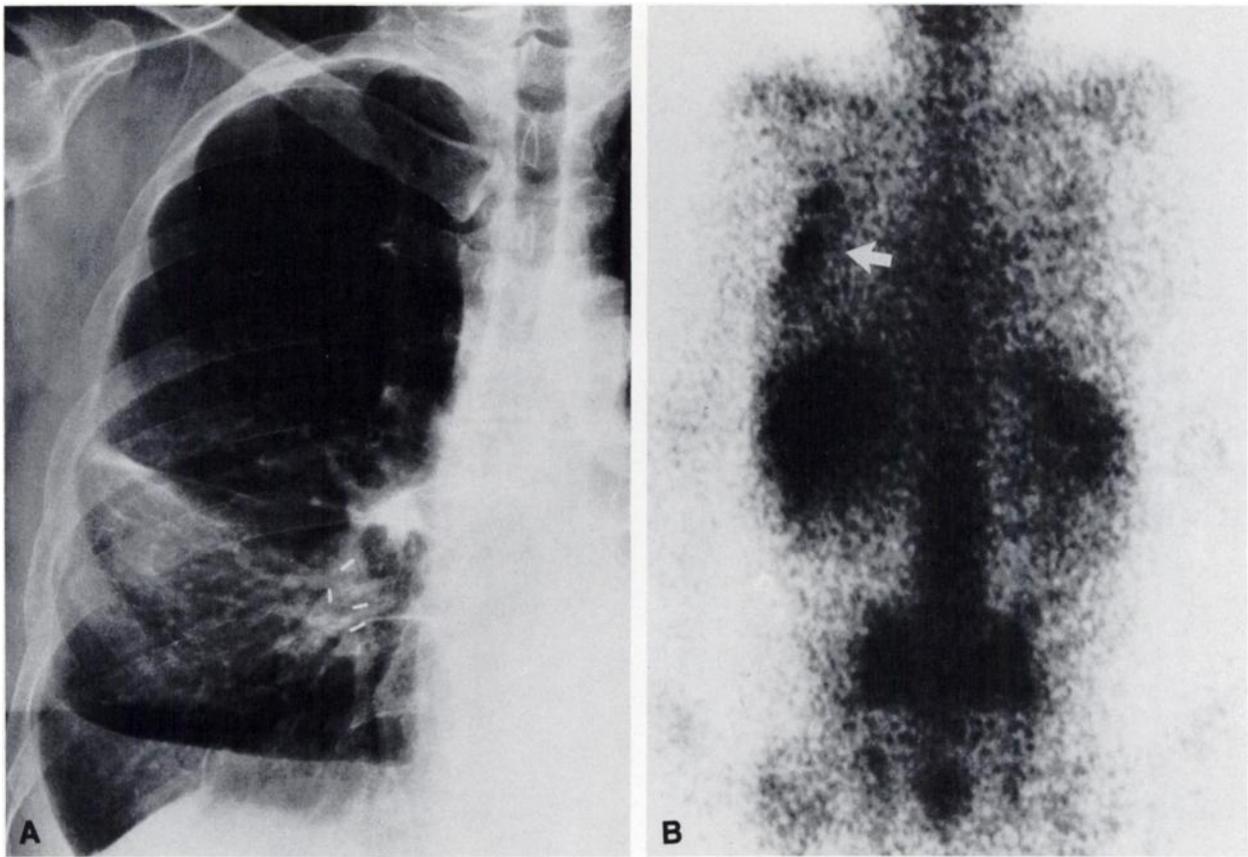


FIGURE 2
 A: A chest radiograph of a 69-yr-old man (Patient "O" in Fig. 3) 1 mo after right lower lobectomy for lung cancer shows mild pleural thickening and no active lung disease. B: A mid-posterior section from a gallium scan shows diffuse peripheral activity (3+ intensity) in the region of the pleura (arrow). This pattern of benign postsurgical activity was seen in several cases.

until at least 3 mo after surgery. At 6 mo to 1 yr after resection, persistent activity occurs in nearly one-third of these cases. In the majority, uptake returns to normal within 12 mo. In no instance did gallium activity at the surgical site increase in intensity over time. Although

the pattern of uptake is variable in these patients, the majority show one of two characteristic patterns: (a) focal uptake at the surgical incision site, or (b) a more diffuse pattern of peripheral accumulation, probably localized in the pleura.

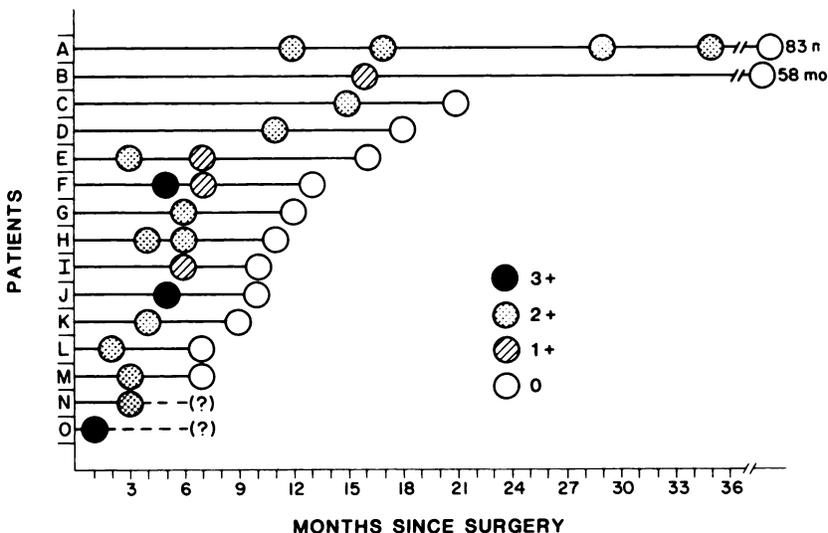


FIGURE 3
 Duration and intensity of benign postoperative gallium uptake in 15 patients.

These findings are similar in some respects to those reported for persistent uptake of bone scanning agents at fracture sites. Matin reported that the minimum time for a bone scan to return to normal after rib fractures was 5 mo (3). Twenty-one percent were still abnormal at 1 yr, 7% at 2 yr, and none at 3 yr. A characteristic pattern of postoperative gallium uptake has also been described following median sternotomy, though the length of time that such activity persists has not been defined (4,5). Interestingly, in the cases described here, the abnormal uptake was not usually localized to the site of the surgical rib fracture but rather further laterally, in the region of the chest wall incision. Gallium uptake has been shown to be useful in the diagnosis of postoperative sternal osteomyelitis (4,5).

Thus, gallium uptake persists for at least 3 mo in approximately one-third of all patients after thoracotomy and the pattern of uptake is frequently characteristic. While the rate of clearing is variable, uptake is unusual after 18 mo. Increasing activity was not observed in this series and should be regarded as suspicious for recurrent tumor.

NOTE

* (Siemens Radiographic) Searle-Siemens Medical Systems, Inc., Iselin, NJ.

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