Pelvic Radioiodine Uptake in a Rectal Wall Teratoma After Thyroidectomy for Papillary Carcinoma

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A 30-yr-old woman with previously resected papillary thyroid carcinoma was found to have a pelvic lesion which concentrated radioiodine. By performing simultaneous ^{131}I whole-body and ^{99m}Tc-methylene diphosphonate bone scans, we found the lesion to be in soft tissue between the sacrum and bladder. Radioiodine therapy was postponed so that the lesion, a benign teratoma of the rectal wall, could be surgically removed. Prior to laparotomy, the patient received a second tracer dose of ^{131}I so that the lesion could be located at surgery with a hand-held gamma detector. A postoperative whole-body ^{131}I scan confirmed that the lesion had been removed, thus reducing the absorbed radiation that would have been received by the ovaries during radioiodine therapy. Although the lesion contained both thyroid and gastric epithelium, accumulated ^{131}I was limited to the area with thyroid follicles.

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This report describes a patient with papillary thyroid cancer whose initial ^{131}I scan after thyroid surgery showed a focus of activity in the pelvis. Combined ^{131}I and ^{99m}Tc-methylene diphosphonate (MDP) scanning, and intra-operative use of a hand-held gamma detector aided in locating the lesion in the rectal wall. The lesion concentrated 0.105% of the administered radioiodine and proved to be a benign teratoma. Its resection before ^{131}I therapy prevented excess radiation to the ovaries.

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CLINICAL PRESENTATION

A 30-yr-old woman developed a sore throat, a painful thyroid nodule and slight hoarseness. A [^{99m}Tc]pertechnetate scan showed decreased activity in the lower pole of the right lobe of the thyroid that corresponded to the 2-cm nodule. A fine needle aspirate showed papillary carcinoma. Also palpable were a 5-mm nodule in the left lobe and a 1-cm movable lymph node in the left posterior cervical chain.

At total thyroidectomy, the right lobe contained a calcified mass with a proliferation of follicles lined by cuboidal cells with characteristic clear nuclei and occasional papillary formation. Elsewhere, the gland contained multiple small tumor foci of similar histology. The diagnosis was multi-focal papillary thyroid carcinoma, follicular variant. The nodule in the left lobe was a follicular adenoma.

A whole-body scan (1.5 mCi ^{131}I), 6 wk after surgery and 2 wk after discontinuing triiodothyronine, showed left thyroid bed activity and another focus in the pelvis just to the right of midline (Fig 1A). Because images 48 hr later and following a cathartic showed the pelvic focus again, combined ^{99m}Tc-MDP and ^{131}I scans were obtained which showed that the ^{131}I focus was in soft tissue, anterior to the sacrum and cephalad to the bladder (Fig 1B). Diagnostic considerations included a lymph node metastasis of thyroid carcinoma, Meckel's diverticulum (*1*), an ovarian teratoma (*2–4*) and an ovarian cystadenoma (*5*). She had no urinary, gynecologic or gastrointestinal symptoms. Pelvic and barium enema examinations were normal. Ultrasound showed a prominent right ovary with small cystic areas. There was fluid in the pelvis.

A repeat whole-body scan 2 mo later again showed the pelvic focus. T_3 replacement was restarted and the next day a laparotomy was performed. A 3-cm cystic mass adherent to the wall of the proximal rectum was identified. A hand-held gamma detector showed that the mass was intensely radioactive and when it was resected the pelvic counts dropped to background.

The cyst, containing thick creamy fluid and a central mass of firm tan tissue, measured 3.2 × 1.4 × 1.3 cm and weighed 2.8 g. Squamous, transitional and respiratory epithelium lined the cyst wall (Fig. 2). The solid nodule contained gastric and colonic epithelium, skin appendages, smooth muscle, lymphoid aggregates, fibrovascular connective tissue and cartilage. Glandular structures resembling follicular thyroid epithelium were adjacent

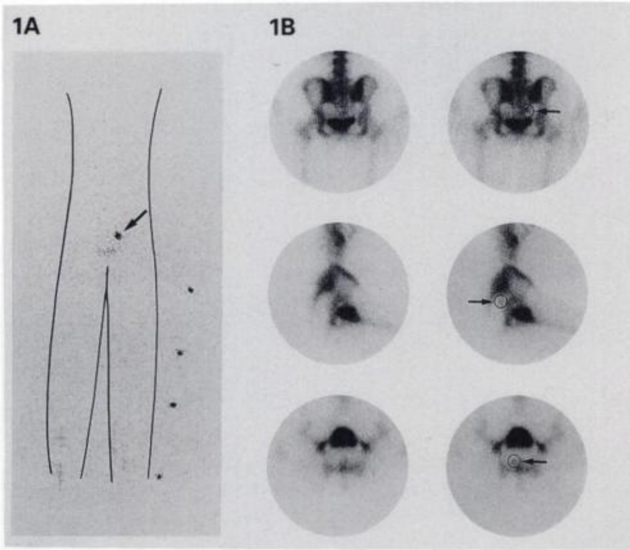

FIGURE 1. (A) Posterior whole-body ^{131}I scan after thyroidectomy. Besides physiological uptake in the bladder, radioiodine concentration was present just to the right of the midline in the pelvis (arrow). Iodine-131 was also present in the left thyroid bed (not shown). The foci along the right leg are ^{133}Ba reference standards. (B) Images of the posterior pelvis (upper panels), right lateral pelvis (middle panels), and with the patient sitting above the camera (lower panels). On the left are the ^{99m}Tc-MDP bone scans; on the right are overlays of the bone and ^{131}I scans. The arrows point to the lesion accumulating ^{131}I.

to mucus secreting glands and respiratory epithelium. The diagnosis was benign cystic teratoma of the colon.

After the laparotomy, gamma camera images of the pelvis showed that the focus of radioiodine had disappeared. Later, a 30 mCi ^{131}I treatment was given to ablate the thyroid remnant; at 96 hr gamma camera images again showed the thyroid bed activity, but pelvic activity was normal.

Iodine-131 Assay and Quantitative Autoradiography

Radioactivity was measured in a gamma well counter and its distribution determined by quantitative autoradiography (*6*). Dried frozen sections, 20 μm thick, were used to expose x-ray film that was later analyzed with a scanning microdensitometer. Adjacent sections were stained with hematoxylin and eosin.

The lesion contained 0.105% of the administered ^{131}I with 0.01% of this in the cyst fluid and wall. Corrected for decay, solid tissue contained 1.5 μCi or 3.73 μCi/g. A comparison of H & E and autoradiographic sections showed that the most radioactive

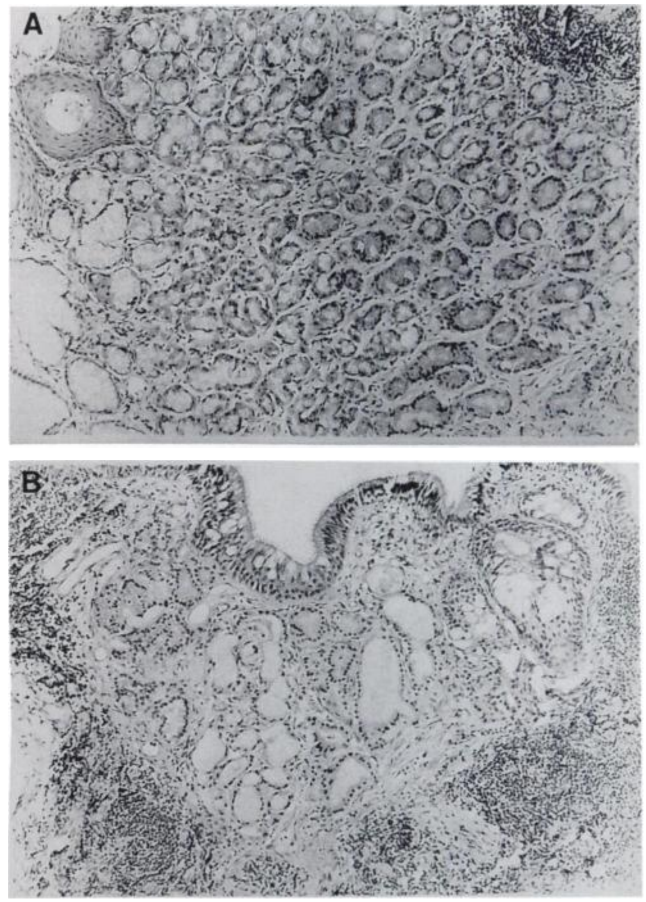

FIGURE 2. (A) High power view of the pelvic lesion, demonstrating mature tissue from the germ layers including gastric type epithelium (H&E, 200×). (B) High power view of the pelvic lesion showing glandular structures resembling thyroid follicles and the cyst wall lined by mature respiratory epithelium (H&E, 200×).

areas contained eosinophilic epithelium (Fig. 3). Although the 20-μm autoradiographic sections were too thick for precise identification of cell type, the areas containing radioactivity coincided with anti-thyroglobulin antibody-stained small thyroid follicles and not with adjacent gastric-like epithelium.

DISCUSSION

In adults, the ovary is the most common location of teratomas, although retroperitoneal organs are also com-

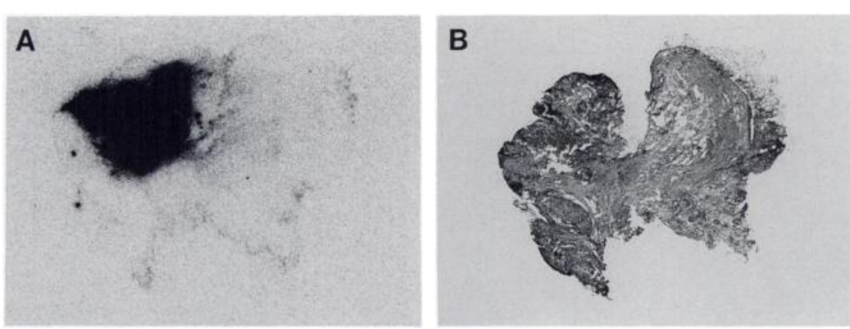

FIGURE 3. Autoradiograph (A) of a 20-μm section (B) of the pelvic lesion demonstrating the presence of ^{131}I in a limited area. This coincides with the region that contained thyroid follicles and not with other regions that were rich in gastric epithelium.

mon sites (*7–9*). These tumors may arise in the rectum or colon (*10–15*) or secondarily involve lower bowel that is adjacent to a primary tumor in the ovary (*16–19*) or the fallopian tube (*20*). Almost all are benign. About 10% of benign cystic teratomas of the ovary contain mature thyroid tissue (*21,22*). The frequency of thyroid tissue occurring in colonic teratomas is unknown.

In the present case, a benign cystic teratoma of the rectosigmoid colon was detected by ^{131}I whole-body scanning. First, a solitary pelvic bone metastasis was excluded by simultaneous ^{131}I whole-body and ^{99m}Tc-MDP bone scans. From the results of these studies, the most likely lesion was a Meckel's diverticulum or an ovarian teratoma, a pelvic lymph node metastasis being less likely. Rather than immediate ^{131}I therapy, exploratory surgery was undertaken to remove a potentially malignant teratoma or a lesion that could lead to gastrointestinal bleeding. Second, it was recognized that if the lesion were located in an ovary the radiation to that organ during ^{131}I therapy could be large.

Assuming that the ^{131}I in the tumor was uniformly distributed in one ovary with an effective half-life of 6 days, the absorbed radiation dose to the ovary from 30 mCi of ^{131}I would have been 685 rad.* However, the activity was concentrated in 0.41 g, making local absorbed radiation 6900 rad. A centrally located tumor could cause substantial radiation of adjacent ovarian tissue. The absorbed gamma radiation from ^{131}I in a 4-g sphere (equivalent to one ovary) would be about 5% of the total absorbed radiation (*25*). If the source is centrally located, this value is increased by 4/3 (*25*). Thus, if the tumor was in the center of the ovary, the ovary would receive about 45 rad of gamma radiation.

In a patient with a thyroid uptake of 5% and no focus in the pelvis, 30 mCi of ^{131}I therapy would give 12 rad of absorbed radiation to the ovary (*26*). The risk of having a child with a harmful trait caused by autosomal dominant or x-linked recessive mutation is 0.8%, and it has been estimated that the risk of these mutations is increased by 0.0016% for each rad of gonadal radiation (*27*). Thus, if the ovary received 685 rad, the additional risk would be 1.1%.

At surgery, the peritoneum contained fluid, and the bowel wall adjacent to the teratoma was friable. Thus, removal of the lesion may have prevented a rectal perforation that could have been precipitated by ^{131}I therapy.

*$30{,}000\ \mu Ci \times 0.00105 \times 1/4.134 \times 90 = 685$ rad, where 4.134 is the weight (g) of one ovary (*23*), and 90 is rad/μCi/g (*24*).

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