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HETEROTOPIC OSSIFICATION IN POSTGASTRECTOMY SCARS

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胃切除術創に認められる異所性骨形成

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我々の経験では、胃切除術創にみられる異所性骨形成現象は、従来考えられていた程にまれなものではないことが示唆された。本症は、側方向および斜位のレントゲン写真で容易に証明できる。術創部に悪性腫瘍の再発を疑わせるような臨床所

見のある症例では、不必要な試験開腹術を避けるため、腹部腫瘤の原因としての骨形成現象を鑑別すべきである。5例の症例報告、関係文献の検討および鑑別診断についての考察を行つた。

Introduction

Heterotopic ossification in laparotomy scars, though known for years, has been considered rare²¹⁾. Its clinical significance lies in its diagnostic differentiation from recurrent gastric and other neoplasms since it may mimic the latter on palpation. Few cases have been reported in America and only 12 so

far in Japan, all in surgical publications¹⁶⁾. Only Katz and LeVine's report¹⁰⁾ exists in the American radiological literature. Its frequency has rarely been documented.

Retrospective review of all roentgenograms of 135 postgastrectomy cases yielded 5 with this abnormality. The results and a review of the literature are presented here.

Background

The Atomic Bomb Casualty Commission-Japanese National Institute of Health Adult Health Study²⁾, jointly sponsored by the U.S.A. National Academy of Sciences-National Research Council and the Japanese National Institute of Health of the Ministry of Health and Welfare, is a large scale long-term clinical investigation for the detection of late effects of the atomic bombs, among a sample originally numbering 20,000 in Hiroshima and Nagasaki. Adult Health Study subjects have biennial clinical examinations including 14 × 17 inch posteroanterior and left lateral chest roentgenograms, and when clinically indicated, additional radiological and other examinations. The superior portion of the abdomen can be observed sufficiently well on lateral chest roentgenograms to demonstrate heterotopic ossification in gastrectomy scars.

Material and Method

Of the Adult Health Study subjects examined from 1960 to 1972, 135 cases with metallic clips in the upper midline or left upper quadrant of the abdomen on chest roentgenography, with serial roentgenograms, were reviewed. Since lateral chest roentgenograms are most useful to tangentially visualize heterotopic ossification¹⁰⁾, they were used to screen our subjects. Following this all of the screened patients' films were reviewed. Only cases with both pre- and postgastrectomy roentgenograms were included in this review. Those whose postgastrectomy roentgenograms showed ossification, but who had no satisfactory pre-gastrectomy films were excluded.

Results

Five patients, 4 males and 1 female, had bone or linear calcification in their scars. Age at surgery ranged from 40 to 68 and averaged 57 years. Two of 3 cases with histologic confirmation had gastric cancer; 1, gastric ulcer. The other 2, diagnosed as gastric ulcer, were not histologically confirmed. The period from operation to roentgenologic demonstration of the calcification ranged from 4 to 52 months. In 2 of the 5 cases, masses were palpated in the laparotomy scars on physical examination, but they did not enlarge. These were due to the ossifications.

Report of Cases

Case I (M.F. # 277799): This male was 50 years of age at surgery. In 1963, fluoroscopy revealed a gastric ulcer. During his May 1965 examination, he complained of occasional epigastralgia, and two of his stool examinations were positive for occult blood. No abnormal density was seen in the anterior abdominal wall on the lateral chest roentgenograms (Fig. 1, A). An upper gastrointestinal series at that time revealed an indentation with an apparent niche along the greater curvature of the stomach near the pylorus, and early stage¹⁵⁾ gastric cancer was suspected. This was confirmed after gastrectomy on July 1, 1965, without metastasis to the regional lymph nodes. Physical examination in June 1967 was normal, but lateral chest roentgenograms showed a calcified density with evidence of bone trabeculae in the scar region (Fig. 1, B). Two years later palpation revealed a superficial firm non-movable 4 × 5 cm tumor in the laparotomy scar region. There were no subjective symptoms. In July 1971 and July 1973, results of the physical and roentgenological examinations were unchanged (Fig. 1, C). An upper gas-

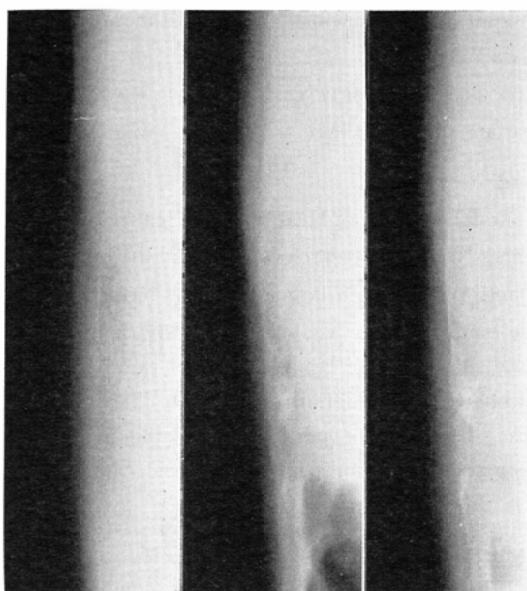


Fig. 1. Case I. (A) Normal preoperative lateral roentgenogram of May 1965. (B) Calcified density with bony trabeculae in scar on lateral roentgenogram of June 1967. (C) No interval change on lateral roentgenogram 6 years later in July 1973.

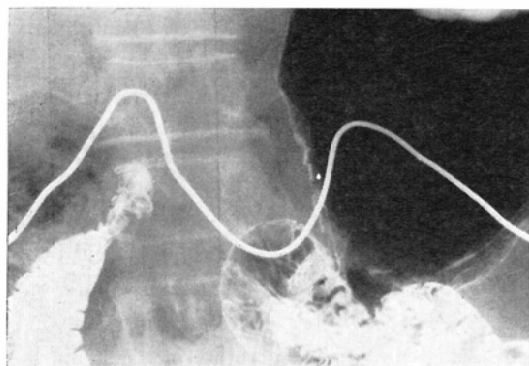


Fig. 2. Case I. Mass in region of abdominal scar outlined during an upper gastrointestinal series of July 1973. The inferior costal margins are outlined laterally; the mass centrally between them.



Fig. 3. Case I. Heterotopic bone in abdominal scar, in a slightly oblique roentgenogram of July 1973.

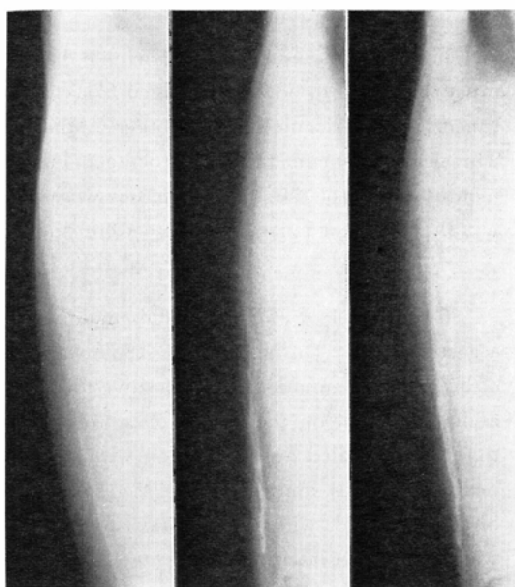


Fig. 4. Case II. (A) Normal preoperative lateral roentgenogram of September 1963. (B) Linear calcified density in scar on lateral roentgenogram of August 1965. (C) No interval change on lateral roentgenogram 8 years later in September 1973.

trointestinal series in July 1973 revealed a mass (Fig. 2). This had no relation to the stomach and did not suggest cancer recurrence. A film in a slight oblique projection showed the density anteriorly (Fig. 3).

Case II (M.F. # 282589): This male was 60 years of age at surgery. In December 1961, he had epigastralgia when hungry. In September 1963 an upper gastrointestinal series revealed a benign gastric ulcer, and a lateral chest roentgenogram showed no calcification in the anterior abdominal wall. He had a subtotal gastrectomy late in 1963. Physical examination in August 1965 revealed no mass in the scar, but chest roentgenography showed a linear calcified density there, which remained unchanged through September 1973 (Fig. 4, A-C). A 1971 upper gastrointestinal series spot film in a slight right anterior oblique projection also demonstrated the density (Fig. 5).



Fig. 5. Case II. Calcified density in abdominal scar, in a slightly oblique roentgenogram of November 1971.

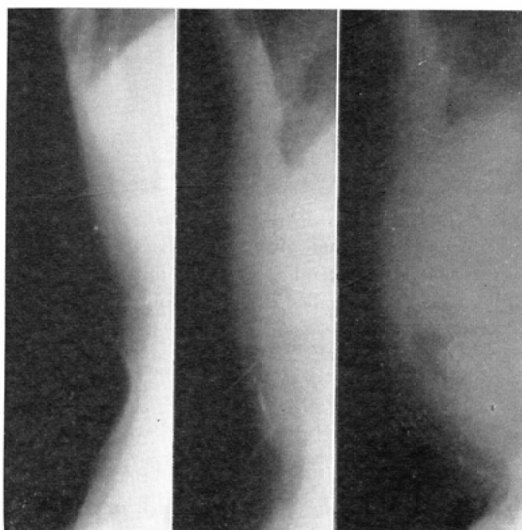


Fig. 6. Case III. (A) Normal preoperative lateral roentgenogram of June 1964. (B) Calcified density in abdominal scar on lateral roentgenogram of June 1966. (C) No interval change on lateral roentgenogram 6 years later in June 1972.

Case III (M.F. # 263880): This male was 67 years old at surgery. On June 14, 1965, with a clinical preoperative diagnosis of gastric cancer, he underwent a subtotal gastrectomy, but a benign gastric ulcer was found. No abdominal calcification was seen on chest roentgenograms of June 1964 (Fig. 6, A). In June 1966, physical examination revealed a firm 1×1 cm tumor palpable in the laparotomy scar, and chest roentgenography revealed linear calcified density in the scar (Fig. 6, B). Roentgenological examinations in 1968, 1970 and 1972 (Fig. 6, C) showed no interval change.

Case IV (M.F. # 242135): This female was 68 years of age at surgery. No abnormality was noted in the anterior abdominal wall on the chest roentgenogram of June 1967 (Fig. 7, A). With a diagnosis of gastric cancer, on May 16, 1969 she underwent gastrectomy, and histologically, the lesion was papillotubular adenocarcinoma of the stomach. Physical examination and chest roentgenography on October 13, 1969 were normal (Fig. 7, B), but chest roentgenography of November 1, 1971 demonstrated new calcified density in the scar (Fig. 7, C). She died on February 25, 1972 with roentgenologic evidence

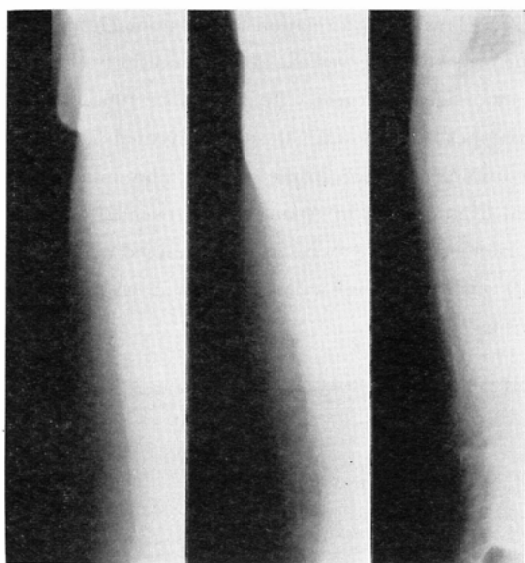


Fig. 7. Case IV. (A) Normal preoperative lateral roentgenogram of June 1967. (B) Normal postoperative lateral roentgenogram of October 1969. (C) Calcified density in abdominal scar on lateral roentgenogram 2 years later in November 1971.

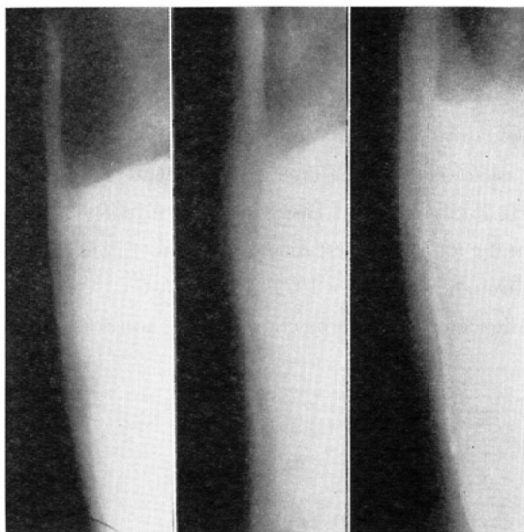


Fig. 8. Case V. (A) Portion of a normal preoperative lateral chest roentgenogram of June 1964. (B) Lateral chest roentgenogram in May 1966, 4 months postoperatively, showed linear calcified density in a scar. (C) Lateral chest roentgenogram of 1972 showed no interval change since May 1966.

of lung metastasis, but no autopsy was performed.

Case V (M.F. (# 016329): This male was 40 years of age at surgery. No abnormalities were noted in his anterior abdominal wall on a lateral chest roentgenogram of June 1964 (Fig. 8, A). He had a partial gastrectomy for a gastric ulcer in January 1966. A chest roentgenogram 4 months after surgery demonstrated a new linear calcified density in the scar (Fig. 8, B). Roentgenological examinations in 1968, 1970 and 1972 (Fig. 8, C) showed no change in the density. No mass nor tumor was palpated on physical examination.

Discussion

Clinical Findings:

Abdominal wall heterotopic ossification does not usually cause symptoms, is therefore easily overlooked, and consequently considered rare. Our discovery of 5 cases among only 135 postgastrectomies contradicts this impression. During 30 years of surgical practice, Sanders²⁰⁾ encountered only 1 case; with subsequent concentrated effort, he discovered 6 more in 7 years, 3 of them in the last year. Mebius¹⁴⁾ discovered various degrees of callus formation in 3 of 31 operative scars of autopsied subjects grossly and histologically.

Heterotopic ossification is more frequent among males, not only in Western countries but Japan¹³⁾¹⁶⁾, where a total of 12 cases were reported; 8 males and 3 females, the sex and age of one not indicated. Affected Japanese are most frequently in their sixth decade, averaging 50 years of age, and our cases have similar sex and age distributions. This is probably due to the fact that gastrectomies

were performed more frequently in aging males.

Such ossification is subsequent not only to gastrectomy, but to other operative procedures and its frequency is greater with upper midline abdominal incisions¹³⁾¹⁶⁾¹⁷⁾, and all of our cases had this type. However, the first Japanese case reported was that of a young female with postappendectomy ossification in the right lower quadrant¹²⁾. The time from operation to diagnosis of the ossification ranges from within 14 days¹³⁾ to several years, but most frequently within 2 years¹⁷⁾. In our cases this range was from 4 to 52 months.

The lesion, usually discovered by chance, as a firm palpable abdominal wall mass, may or may not be painful. Pain increases on forward flexion, subsiding on return to the erect position⁴⁾⁹⁾¹⁰⁾. Additional upper abdominal discomfort may accompany this. There may be sounds of friction or fractures on moving the body. Some feel discomfort from wearing a belt⁴⁾. Flexion of the body may be restricted, and Classen et al.⁴⁾ reported a case in which such restriction disappeared on fracture of a portion of the ossified tissue. No abnormal laboratory tests are found, including those of calcium metabolism. The patient's course usually remains unchanged once the condition is established. As a rule, no treatment is required if the patient is asymptomatic. However, with severe symptoms or if a malignant tumor cannot be excluded, surgical removal of the lesion is indicated. Only 1 case of recurrence of ossification has been recorded⁹⁾. All of our patients were asymptomatic, but 2 of them had palpable masses in their scars.

The etiology is not clear and many hypotheses have been advanced in the literature. The latter may be roughly divided into two groups: 1) particles of periosteum or perichondrium are torn loose and implanted in adjacent muscle or fascia, thus initiating osseous growth, or 2) under certain environmental conditions, undifferentiated connective tissue may form osteoblasts by a process of metaplasia.

Sakuma et al.¹⁹⁾ reported a case of heterotopic ossification continuous with the xiphoid process, supporting the first theory. Similar findings were also reported by others⁵⁾²⁰⁾²³⁾. Watkins²³⁾ described 3 cases of bone formation in the abdominal scars of 15 laparotomies with xiphoidectomy, but none in 244 without xiphoidectomy. Only 1 case with recurrence also received partial xiphoidectomy at the time of excision of the first ossified mass⁵⁾.

The second theory is supported by many experimental studies, including injection of alcoholic extracts, intramuscular calcium implants, epithelial transplants to the lower urinary passages and transplant of gastric mucosa imbedded in the muscle. A case report of ossification surrounding suture material also supports the metaplasia theory¹⁾.

Concerning familial frequency, there was only 1 case report in brothers²²⁾.

Roentgenographic Findings and Differential Diagnosis:

Ossification degree varies widely by subject. The roentgenographic diagnosis is relatively easy when longitudinal bone or calcification is visible as in our cases. The lateral roentgenogram can confirm its presence. It is usually linear, part of a bony plaque, with or without segmentation. Gilmer and Anderson⁶⁾ defined traumatic myositis ossificans as the total of all soft somatic tissue reactions following trauma and which may progress to the formation of bone or cartilage. Roth et al.¹⁸⁾ stated that the ossification usually arose in the region of amorphous calcification, and that chronic inflammation and foreign body reaction were sometimes present. It is therefore reasonable to include roentgenologically

demonstrable linear calcified densities with heterotopic ossification.

Terms in the medical literature to describe its roentgenologic features include: "linear density," "density similar to gallbladder," "semilunar density," "Y forms," "ring shadows," "bony structures articulating with the xiphoid," and "ossification with multiple segments."

In the differential diagnosis, cancer recurrence is most important. Though rare, 1 case report described coexistence of bone and recurrent cancer at the same site in a scar³⁾. Two other cases had simultaneous cancer and ossification at different sites⁷⁾¹⁰⁾. In another case¹⁶⁾ ascites was already present when a tumor was palpable in a operative scar, and an ossified mass was palliatively enucleated. Heterotopic ossification has been associated with an inflammatory omental mass¹¹⁾, and in keloid scars⁹⁾²⁰⁾. It is roentgenologically distinguishable from a tumor. Rapid calcification is readily demonstrable by preoperative and postoperative films. Costal cartilage calcification is easily differentiated by its inferolateral bifurcation on oblique roentgenograms¹⁰⁾.

Calcified hematomata in abdominal musculature usually have histories of sudden severe pain anywhere in the abdominal wall⁹⁾.

Oblique—especially left anterior oblique—roentgenography can differentiate gallbladder and biliary duct lesions, including limy bile in the common duct¹⁰⁾. Spinal disease, foreign bodies, other calcification in soft tissue posteriorly, and barium on the patient's gown are also to be excluded.

Our experience indicates that heterotopic ossification in postlaparotomy scars is not as rare as previously reported. It is essential that lateral and oblique abdominal roentgenograms be obtained in suspected cases, especially in those of possible recurrent cancer. Identification of this lesion can help prevent needless exploratory laparotomies.

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