



Piriform Sinus Fistula: An Underlying Abnormality Common in Patients with Acute Suppurative Thyroiditis

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We have previously reported that an internal fistula (piriform sinus fistula) was the apparent route of infection in 15 patients with acute suppurative thyroiditis (AST). Here, we describe 43 patients with AST, most of whom had a demonstrable fistula.

The characteristic clinical features included: onset in infancy or childhood in 74% of cases, a left-sided predominance of involvement (40:3), and frequent recurrence. Twenty-nine patients had had several previous episodes of AST. The fistula was demonstrable in 38 of 42 patients examined by barium meal. Twenty-seven patients underwent fistulectomy. Six of 16 patients who declined fistulectomy had recurrences and 2 of them underwent surgery thereafter. None of 29 patients who had fistulectomy developed recurrences, except for 2 patients in whom the fistula could not be removed completely. The fistula ended medial or lateral to the thyroid lobe, attached to or entered the lobe in 6, 3, 6, and 12 cases, respectively. The thyroid specimens showed several features of inflammatory change.

Thus, we concluded that the piriform sinus fistula is the most common underlying abnormality in patients with AST. Recurrence of inflammation can be prevented by complete fistulectomy.

The thyroid gland is an endocrine organ which has no external connections and is remarkably resistant to bacterial infection due to its high iodine content. This generally prevents the gland from developing infection unless there is some underlying abnormality. Hazard [1] raised several possible routes of infection in acute suppurative thyroiditis (AST); however, the route was not clarified except in a few cases resulting from septicemia [2] or infection via a persistent thyroglossal duct [3]. Moreover, in most cases, the diagnosis was not based on pathological evidence of thyroiditis.

In 1978, we [4] found an internal fistula (a piriform sinus fistula) in 7 patients with AST, and reported in both English and Japanese papers in 1979 [5, 6] that the fistula was the route of infection. The fistula ends in or adjacent to the thyroid and allows bacterial infection to develop in or around the gland [7].

Here, we describe the clinical features, diagnosis, treatment,

and outcome as well as the operative and pathological findings in 43 patients with AST.

Patients

The patients were treated at Kuma Hospital, Osaka University Medical School Hospital, and Kagawa Medical School Hospital from 1976 to 1988. There were 24 females and 19 males. The age at diagnosis ranged from 11 months to 57 years with a mean of 18.0 years.

Clinical Features

Most patients complained of the abrupt onset of a painful swelling in the thyroid region accompanied by fever. The pain was increased on swallowing. Some of the adult patients presented with a vague firm mass in the thyroid region with slight pain and no fever, suggestive of an unusual malignant tumor. With the progression of inflammation, the overlying skin became edematous and erythematous, and an abscess developed. The condition was usually treated easily by administration of antibiotics with or without incision and drainage, and rarely caused an external fistula. The left side was predominantly involved, with the left-to-right ratio being 40:3.

Recurrence of symptoms was quite common. Twenty-nine patients had had a number of previous episodes (up to 12 episodes; mean, 2.8), while 14 patients were seen with their first episode. The age at the first episode ranged from 11 months to 56 years with a mean of 11.7 years, and was less than 12 years in 74% of the patients (Fig. 1). The interval between episodes varied from 1 month to 37 years, and the patients were asymptomatic in the interval.

AST occasionally followed upper respiratory tract infections and occurred frequently in the Fall and Winter (Fig. 2). In 1 patient, it followed blunt trauma to the thyroid region. In another patient, it occurred shortly after subtotal thyroidectomy for Graves' disease, suggesting injury to the fistula during the operation.

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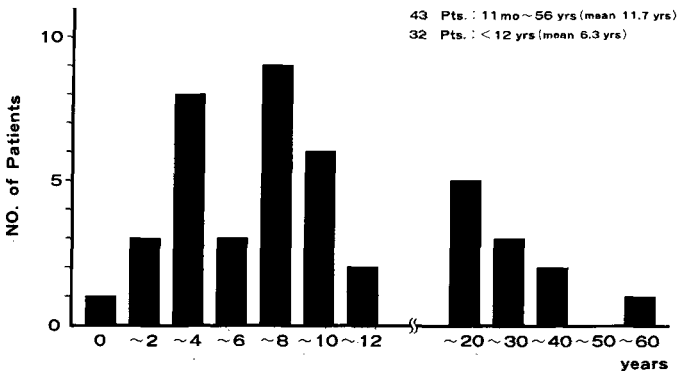


Fig. 1. Age at onset of acute attack in patients with piriform sinus fistula.

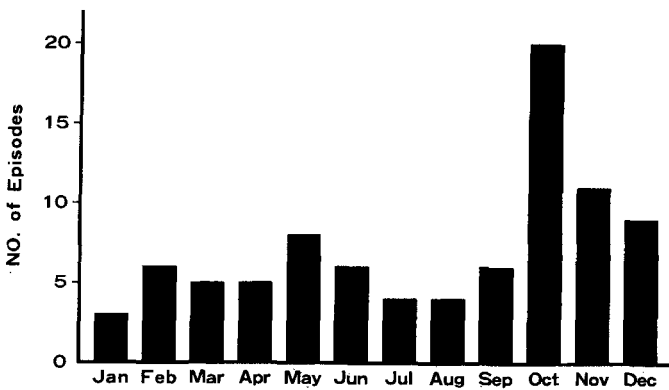


Fig. 2. Timing of episodes of acute inflammation in patients with piriform sinus fistula.

Laboratory and Radiological Findings

Laboratory investigations showed leukocytosis, an increased erythrocyte sedimentation rate, and a positive C reactive protein reflecting acute inflammation. Serum levels of thyroid hormones, thyrotropin, and thyroglobulin were normal in most patients while some patients had transient mild elevations of serum thyroxine and thyroglobulin. Culture of the pus yielded a wide spectrum of bacteria and, sometimes, multiple organisms. Culture was negative, suggesting anaerobic bacteria in some cases.

Thyroid scintigraphy with radioactive iodine or sodium pertechnetate ^{99m}Tc demonstrated a decreased uptake in the affected lobe in 24 of 30 patients examined. Most patients with a normal thyroid scintigram were examined in the convalescent stage of AST.

Plain roentgenograms of the neck showed the trachea shifted laterally by a soft tissue swelling which occasionally contained a gas shadow. Ultrasonography and CT scan performed in selected patients demonstrated an abscess formed in or around the affected thyroid lobe (Figs. 3, 4).

The most important diagnostic findings were obtained by barium swallow examination. A careful search of the hypopharynx disclosed an internal fistula originating from the apex of the piriform sinus on the affected side in 38 of 42 patients examined (Fig. 5). One infant patient was not tested. The fistula was very

thin and could, sometimes, not be demonstrated in the acute phase of AST. Barium swallow also showed one or more small diverticula in the cervical esophagus in 4 patients (Fig. 5).

Treatment and Outcome

AST was treated with antibiotics and 32 patients also required incision and drainage. After the acute inflammation had settled, 27 patients underwent fistulectomy (Table 1). In 2 of them, the fistula could not be identified at surgery, and these 2 patients developed recurrence of the inflammation after surgery. Twenty-five patients in whom the fistula was removed completely had no recurrence after surgery. Sixteen patients declined fistulectomy and 6 of them developed recurrences. Two of these subsequently underwent fistulectomy. Vocal cord paralysis occurred in 2 patients after surgery, and recovered completely in one.

Operative Findings

At surgery, the affected lobe of the thyroid gland was generally covered with fibrous or granulation tissue. The fistulas penetrated the cricopharynx or cricothyroid muscles at the lower edge of the thyroid cartilage, and ran anteroinferiorly to reach the scar tissue. Fistulas ended medial or lateral to the thyroid lobe, or attached to or entered the lobe in 6, 3, 6, and 12 cases, respectively. The superior parathyroid gland was found in its normal position without any relation to the fistula in 11 of 13 patients in whom this was checked. In 2 patients, the gland could not be found due to dense fibrosis around the thyroid gland.

Surgical Procedures

A collar skin incision standard for thyroid surgery was made, and the scar tissue around the thyroid was dissected free to identify the fistula in a retrograde fashion in our earlier series. At the entrance of the fistula to the pharynx, the cricopharynx or cricothyroid muscles were divided to expose the root of the fistula, which was ligated and cut. The divided muscle was then sutured to cover the cut end. In cases with a fistula attached to a thyroid lobe, part of the lobe was removed together with the fistula.

We later found that the fistula could be more easily identified at the point of the entrance, and that this procedure was less likely to injure the recurrent laryngeal nerve. In our recent series, we initially made a small horizontal incision at the level of the cricoid cartilage. The superior thyroid vessels were then ligated and cut, taking care not to injure the external branch of the superior laryngeal nerve. The upper pole of the thyroid lobe was next retracted anterolaterally to show the surfaces of cricothyroid and cricopharynx and the fistula was identified at the lower border of the thyroid cartilage. The inflammatory changes were usually less severe at this point. In the new procedure we removed only the fistula (and part of the thyroid lobe in the cases where it attached to the lobe), and abandoned removing fibrous tissue around the thyroid to avoid injury to the recurrent laryngeal nerve.

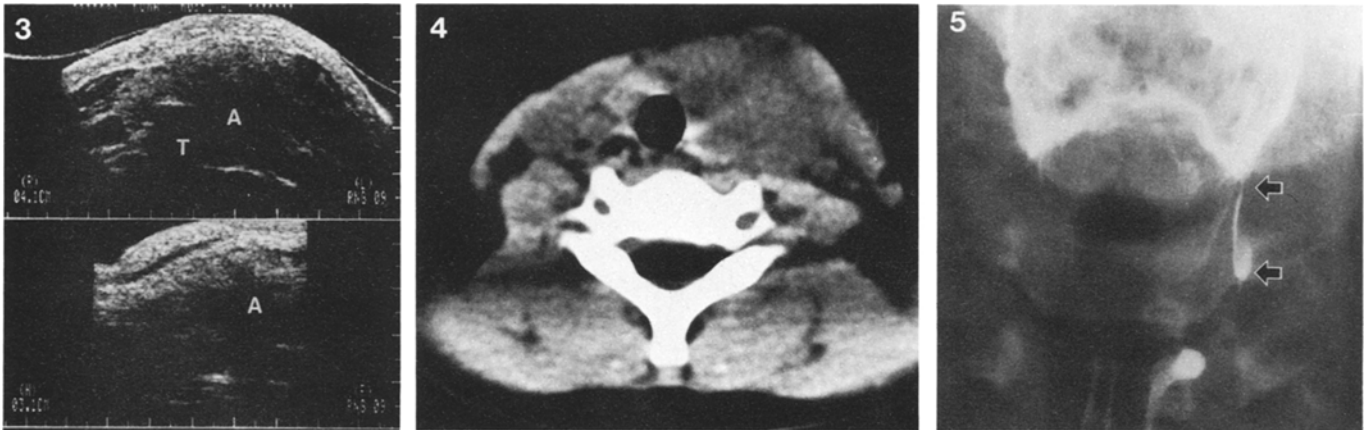


Fig. 3. Ultrasonography demonstrates an abscess in and around the left thyroid lobe in a patient with acute suppurative thyroiditis. Upper: Horizontal scan. Lower: Sagittal scan. A: Indicates abscess, T: Trachea.

Fig. 4. Computed tomography showing an intrathyroid abscess in the same patient as in Fig. 3.

Fig. 5. Barium meal shows a piriform sinus fistula (arrows) and a small esophageal diverticulum.

Table 1. Treatment and outcome in patients with acute suppurative thyroiditis.

Treatment	No. of patients	Recurrence	n
Fistulectomy ^a	27	No	25
		Yes	2 ^b
Antibiotics ± drainage	16	No	10
		Yes	6 ^c

^aFistulectomy was performed after acute inflammation had settled.

^bIn both patients, the fistula was not removed completely.

^cTwo patients underwent later fistulectomy and have had no further recurrence.

Pathological Findings

The fistula was usually a fine, tubular structure composed of a thin fibrous wall and a lining epithelium (Fig. 6). The lining epithelium was found in 22 cases. Stratified squamous, columnar, and ciliated epithelium were seen in 18, 7, and 10 cases, respectively. The fistula occasionally formed small branches in the thyroid gland (Fig. 7). In 5 cases, the fistula contained granulation or fibrous tissue only. The walls of the fistula were frequently infiltrated with lymphocytes. Concerning accessory tissues, mucous glands and thyroid follicles were seen in the wall of the fistula in 6 and 5 cases, respectively (Fig. 6). Thymic tissue and parathyroid tissue were also found in the fibrous tissue along the fistula in 3 and 2 cases, respectively. Twenty of the thyroid specimens from 26 patients showed fibrosis, granulation tissue, or evidence of the regeneration of damaged thyroid follicles such as uneven-sized follicles or solid clusters of follicular cells without colloid (Fig. 8). These findings indicated previous inflammation of the thyroid gland. Other thyroid pathology included papillary carcinoma, Graves' disease, and Hashimoto's chronic thyroiditis in 2, 1, and 4 cases, respectively.

Discussion

There have been occasional case reports on AST in the past, but it had been a mysterious disease for a long time. Since the

thyroid gland is very resistant to bacterial infection and is not in contact with the outside, acute suppurative inflammation is unlikely to occur unless there is some underlying abnormality.

We previously [4–6] found a piriform sinus fistula in patients with AST and reported that the fistula was the route of infection. The fistula originates from the apex of the piriform sinus, penetrates the cricopharynx or cricothyroid muscles, runs anteroinferiorly, and then ends next to or enters a lobe of the thyroid [7]. Bacteria from the fistula seem to spread along the perithyroidal space around the thyroid and invade the thyroid gland secondarily [5, 6]. In cases with a fistula entering a lobe of the thyroid, inflammation may occur in the thyroid primarily [7]. The present report further clarified the close relation of the fistula to the thyroid lobes. Taylor and associates [8] have reported the computed tomography scan appearance of a case in which an abscess was formed in the thyroid. Miller and colleagues [9] and Hirata and coworkers [10] have reported cases of an intrathyroid cyst with fistulous communication to the piriform sinus. The abscess seems to be formed mainly in the perithyroidal space in most cases; however, since infection via the piriform sinus fistula presents the clinical features of AST, and since the thyroid gland is actually involved whether primarily or secondarily, the piriform sinus fistula should be recognized as the most common underlying abnormality in AST.

At the initial episode, the clinical features are typical of AST in most cases while in the cases with multiple attacks, the inflammation tends to localize, probably due to adhesions in the perithyroidal space, and shows the features of an abscess.

Patients with an adult onset may present with a vague, firm mass in the thyroid region without the typical features of acute inflammation. This may lead to the suspicion that the lesion is an unusual malignant tumor. Kodama and associates [11] have also reported such a case.

Infants with a large cystic fistula may develop acute respiratory distress due to tracheal compression following feeding or crying, and this risk increases markedly with inflammation [12].

Patients with this congenital fistula are asymptomatic until

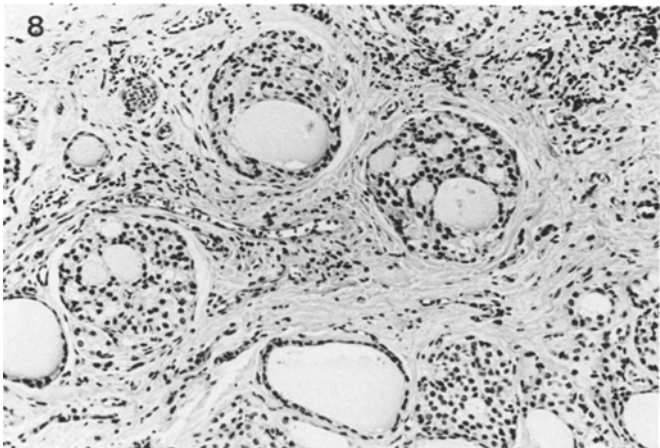
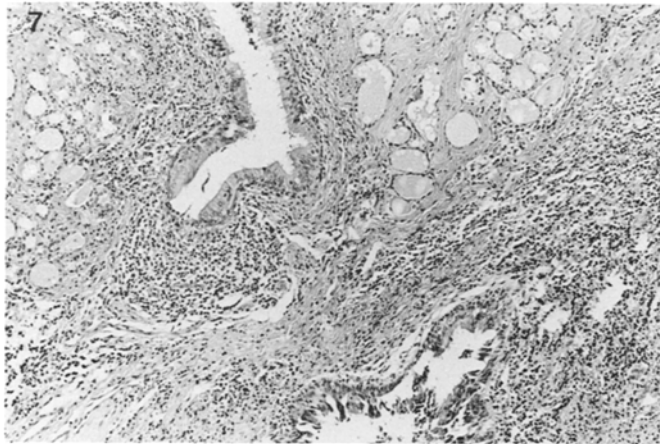


Fig. 6. Histological specimen of a piriform sinus fistula demonstrating the lining epithelium and accessory tissues (thyroid follicles and mucous glands). Hematoxylin and eosin.

Fig. 7. Specimen of thyroid gland showing a branching fistula. Hematoxylin and eosin.

Fig. 8. Thyroid specimen shows clusters of uneven-sized follicles and solid clusters lacking colloid divided by interstitial fibrosis. Evidence of previous inflammation of the thyroid. Hematoxylin and eosin.

the onset of inflammation except for such infants with a large cystic fistula. The factors that may induce inflammation are: upper respiratory tract infection, injury or obstruction of the

fistula by food or foreign bodies, rupture of the fistula by excess pharyngeal pressure, and direct trauma to the fistula. AST is preceded by upper respiratory tract infection in many cases, and is frequent in the Fall and Winter. In rare instances, direct injury to the fistula by accidental trauma or by an operative procedure have caused inflammation, as reported in the present article. Taylor and colleagues [8] have also reported one of the former type of cases.

In the previous papers [5–7], we emphasized that complete removal of the fistula was essential for a permanent cure because recurrence of AST is very common. In the present series, 67% of patients had had previous episodes, and 38% of patients who refused fistulectomy developed recurrence during the follow-up period. None of the patients who had a complete fistulectomy developed a recurrence, confirming the effectiveness of surgery; however, the resected fistula had no lining epithelium and was completely filled with fibrous or granulation tissue in 5 cases. Also, 62% of patients who declined fistulectomy have not had a recurrence so far. These facts suggest that a spontaneous cure may be possible in some patients, especially those with a very fine fistula. A follow-up policy without fistulectomy in patients with a very fine fistula and no previous episodes may be acceptable because AST due to a piriform sinus fistula does not cause severe sequelae if adequately treated.

The fistula is fine and it is very difficult to detect it, especially in scar tissue. We recommend to search directly for the fistula on the surface of the cricopharynx or cricothyroid muscles. We abandoned dissection and removal of the scar tissue around the thyroid gland in order to avoid injury to the recurrent laryngeal nerve, which occurred in 2 early cases. Kaneko and coworkers [13] have reported that injection of dye from the pharyngeal orifice of the fistula was helpful in its identification. Hirata and associates [10] use insertion of a Fogarty catheter from the pharyngeal orifice for the same purpose.

The embryological origin of the piriform sinus fistula is controversial, but it appears to be a remnant of one of the pharyngeal pouches. The piriform sinus is formed by the third and fourth pharyngeal pouches so, persistent ducts of either of these pharyngeal pouches would drain into it [14]. According to Burge and Middleton [12], the third pouch fistula drains anterior to the fold made by the internal laryngeal nerve, and the fourth drains posterior to this fold. This anatomy was not investigated in our series. The fistula runs inferior to the superior laryngeal nerve (the nerve of the fourth pharyngeal arch) and superior to the recurrent laryngeal nerve (the nerve of the sixth pharyngeal arch). This anatomic relationship suggests a fourth pouch origin for the fistula. The ventral portion of the fourth pharyngeal pouch develops into the ultimobranchial body, which fuses with the thyroid gland and subsequently disseminates to give rise to the C cells [15]. This may explain the close relationship of the fistula to the thyroid gland; however, the fact that the superior parathyroid gland, the major derivative of the fourth pharyngeal pouch, had no relation to the fistula argues against this theory and the origin still remains to be explained. The left fourth branchial arch artery forms part of the aortic arch, while the right one becomes the right subclavian artery. The embryological asymmetry in the normal development of the lower neck region may favor left side predominance of the fistula.

Following our papers in 1979 [5, 6] and 1981 [7], reports of

this entity have increased in number. While most of the reports come from Japan, there are also reports from a number of other countries [16–20]. These reports support our initial speculation [7] that many cases have not been reported in the past because definite evidence of thyroid involvement was lacking. Since the acute inflammation is easily controlled by treatment, and since the patients are asymptomatic between the episodes, there is little chance to find evidence of involvement of the thyroid or of the existence of the underlying abnormality.

The spectrum of this entity has been widened to include infants with a large cystic fistula and patients with an adult onset who present unique clinical features different from those seen in children. This entity is not as rare as was initially suspected; therefore, surgeons, pediatricians, periatric surgeons, and otolaryngologists should be aware of the possibility of AST due to a piriform sinus fistula.

Résumé

Nous avons déjà postulé que la voie apparente d'infection chez 15 patients ayant une thyroïdite aiguë suppurée (TAS) était une fistule interne (fistule sinusale piriforme). Nous décrivons ici 43 patients ayant une TAS, la plupart avec une fistule évidente.

Les caractéristiques cliniques étaient: début dans l'enfance pour 74% des cas, prédominance gauche (40:3), et récurrences fréquentes. Vingt-neuf patients ont déjà eu plusieurs épisodes de TAS. La fistule était visible par un transit baryté chez 38 des 42 patients ayant eu cet examen. Vingt-sept patients ont eu une fistulectomie. Six des 16 patients qui ont refusé la fistulectomie ont récidivé et 2 d'entre eux ont eu par la suite besoin d'une chirurgie. Aucun des 29 patients qui ont eu une fistulectomie n'a récidivé, sauf 2 patients chez qui on n'a pu enlever complètement la fistule. La localisation de la terminaison de la fistule était variable: sur la ligne médiane dans 6 cas, sur un bord latéral du lobe thyroïdien dans 3 cas, attaché au lobe dans 6 cas, et entrant dans le lobe dans 12 cas. Les pièces d'exérèse thyroïdienne étaient inflammatoires.

Nous concluons donc que la fistule sinusale piriforme est l'anomalie principale de la TAS. La récurrence de l'inflammation peut être évitée par une fistulectomie complète.

Resumen

Hemos reportado previamente que una fístula interna (fístula del seno piriforme) fue la causa aparente de infección en 15 pacientes con tiroiditis supurativa aguda (TSA). Sin embargo, en el presente artículo informamos 43 pacientes con TSA, la mayoría de los cuales tenía una fístula demostrable.

Las características clínicas incluyen: comienzo en la infancia o en la niñez en el 74% de los casos, mayor prevalencia de la lesión sobre el lado izquierdo (40:3), y recurrencia frecuente. Veintinueve pacientes habían padecido varios episodios de TSA; la fístula fue demostrable en 38 de 42 pacientes examinados con bario administrado por vía oral. Veintisiete pacientes fueron sometidos a fistulectomía. Seis de 16 pacientes que rehusaron fistulectomía presentaron recurrencias y 2 de ellos fueron operados más tarde. Ninguno de 29 pacientes sometidos a fistulectomía desarrolló recurrencias, excepto 2 pacientes en quienes la fístula no pudo ser totalmente resecada. La fístula terminaba en la región medial al lóbulo tiroideo en 6 casos, en

la región lateral en 3, aparecía ligada al lóbulo en 6 o entraba al lóbulo en 12. Los especímenes de glándula tiroidea demostraron características de cambios inflamatorios.

Nuestra conclusión es que las fistulas del seno piriforme son la anomalía etiológica más frecuente en pacientes con TSA. La recurrencia del proceso inflamatorio puede ser prevenida mediante la fistulectomía total.

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Invited Commentary

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We are indebted to the authors for their articles informing us that most patients with acute suppurative thyroiditis have a fistula between the piriform sinus, extending through the cricopharyngeus or cricothyroid muscle, and the thyroid gland. Such a fistula was documented by barium swallow in 38 of their 42 patients. Twenty-five (93%) of the 27 patients were successfully treated by fistulectomy and had no further episodes of thyroiditis, whereas 6 (37.5%) of 16 of the patients who refused fistulectomy developed recurrent acute suppurative thyroiditis. The 2 patients who recurred after fistulectomy did not have the entire fistula excised.

Acute suppurative thyroiditis is a rare condition and about 50% of these patients have an antecedent history of infection of the teeth, throat, or upper respiratory tract or injury to the neck. It occurs most often in children (74% of the authors' patients) on the left side [40 (93%) of 43 patients] and 29 of 43 of the authors' patients had a history of several preceding episodes of thyroiditis.

Most patients present with the acute onset of neck pain (that may radiate to the ear) and discomfort with swallowing and dysphagia. Physical examination reveals a tender thyroid gland that may be fixed to the adjacent structures and the overlying skin is often indurated or erythematous. The patients are febrile and tend to keep the head flexed and fixed on the chest. The differential diagnosis includes subacute thyroiditis, pseudothyroiditis due to infiltrating tumor or other process in the thyroid gland, or an invasive malignant thyroid tumor.

The pertinent laboratory tests reveal leukocytosis, increased sedimentation rate, and a positive C reactive protein. Most patients with acute suppurative thyroiditis are euthyroid, al-

though some have transient mild elevations of serum thyroxine and thyroglobulin as is also found in patients with subacute thyroiditis. The best method of confirming the diagnosis is by percutaneous aspiration biopsy with smear, cytology, and culture for aerobic and anaerobic microorganisms as well as for fungus and acid fast bacillus. As expected, radioactive iodine and sodium pertechnetate ^{99m}Tc scans revealed decreased uptake in 24 of 30 of the authors' patients, but I do not feel that this investigation provides enough information to be indicated, especially in children. An ultrasound is also unnecessary if percutaneous aspiration biopsy is used, but would be preferable to radionuclide scanning and would certainly identify an abscess cavity. As mentioned by the authors, the most important diagnostic test is a barium swallow with careful evaluation of the hypopharynx. This examination revealed an internal fistula in 38 (90%) of 42 patients reported by the authors and 4 patients also had a coexistent esophageal diverticula.

Initial treatment should include treatment with antibiotics (usually penicillin or selected by the smear obtained by percutaneous biopsy). Thirty-two of the authors' patients were successfully treated with antibiotics and incision and drainage. Twenty-seven of these patients were subsequently treated by excision of the fistula which penetrates the cricopharyngeus or cricothyroid muscle at the lower edge of the thyroid cartilage before entering the thyroid gland. A small portion of the thyroid gland should be removed where it is attached to the fistula. Both of the authors' patients whose fistula tract could not be identified during thyroid exploration developed recurrent inflammation.

In conclusion, patients who present with acute pain and swelling of the thyroid gland, especially if recurrent or on the left side, may have acute suppurative thyroiditis. The diagnosis should be made by percutaneous biopsy with smear, culture, and sensitivity as well as cytological examination and barium swallow which are essential for confirming the fistulous tract from the piriform sinus preoperatively. Initial treatment should be antibiotics, and incision and drainage. Subsequent treatment requires excision of the fistulous tract and attached thyroid tissue. With this treatment, recurrence is unlikely.