- Escherich, T. (1885). *Fortschr. Med.*, **3**, 515. (Cited Cushing and Livingood, 1900.)
- Garrod, L. P. (1939). *St. Bart's Hosp. Rep.*, **72**, 145.
- Gillespie, A. L. (1893). *J. Path. Bact.*, **1**, 279.
- Goodsir, J. (1842). *Edinb. med. surg. J.*, **67**, 430.
- Haden, R. L., and Bohan, P. T. (1925). *J. Amer. med. Ass.*, **84**, 409.
- Hewetson, J. T. (1904). *British Medical Journal*, **2**, 1457.
- Knott, F. A. (1923). *Guy's Hosp. Rep.*, **73**, 429.
- (1927). *Ibid.*, **77**, 1.
- and Venables, J. F. (1924). *Ibid.*, **74**, 245.
- Koser, S. A., and Baird, G. R. (1944). *J. infect. Dis.*, **75**, 250.
- Lettulle, M. (1888). *Bull. Mém. Soc. méd. Hôp. Paris*, 3s., **5**, 380. (Cited Bolton, 1913.)
- Levin (1899). *Ann. Inst. Pasteur*, **13**, 558.
- Löhr, W. (1924). *Dtsch. Z. Chir.*, **187**, 289.
- Najjar, V. A., and Holt, L. E. (1943). *J. Amer. med. Ass.*, **123**, 683.
- , Johns, G. C., Medairy, G. C., Fleischmann, G., and Holt, L. E. (1944). *Ibid.*, **126**, 357.
- Nakamura, T. (1924). *Ann. Surg.*, **79**, 29.
- Nickel, A. C., and Hufford, A. R. (1928). *Arch. intern. Med.*, **41**, 210.
- Nuttall, G. H. F., and Thierfelder, H. (1895). *Z. physiol. Chem.*, **21**, 109. (Cited Cushing and Livingood, 1900.)
- Priestley, J. T., Thompson, L., and Sealey, W. B. (1944). *Proc. Mayo Clin.*, **19**, 1.
- Rosenow, E. C. (1916). *J. infect. Dis.*, **19**, 333.
- (1923). *Ibid.*, **33**, 248.
- and Sanford, A. H. (1915). *Ibid.*, **17**, 219.
- Sanborn, A. G. (1931a). *Ibid.*, **48**, 541.
- (1931b). *Ibid.*, **49**, 37.
- Sealey, G. P., and Colp, R. (1941). *Surgery*, **10**, 369.
- Spallanzani, L. (1783). *Expériences sur la Digestion de l'Homme et de différentes Espèces d'Animaux*, Geneva.
- Young, R. M. (1942). *J. Bact.*, **43**, 643.
- and James, L. H. (1942). *Ibid.*, **44**, 75.
- and Rettger, L. F. (1943). *Ibid.*, **46**, 351.

TREATMENT OF BRANCHIAL CLEFT CYSTS BY ASPIRATION AND INJECTION OF PURE CARBOLIC ACID

BY

T. FRANCIS JARMAN, M.D.

Deputy Tuberculosis Physician, Welsh National Memorial Association;
Deputy Medical Superintendent, Cymla Tuberculosis Hospital, Neath

The occurrence of branchial cysts is relatively rare. The most common mistake in diagnosis is to confuse the condition with an abscess resulting from breaking-down tuberculous glands. In a study of 42 branchial cysts and 9 branchial fistulae, in which incorrect diagnosis was made in 42% of cases, Shedden (1931) reports that 12% were diagnosed as tuberculous glands in the neck. Hamilton Bailey (1928) reports 11 cases of branchial cyst in which this mistake was made, and one very interesting case in which tubercle bacilli were found both in the wall of a branchial cyst and in its fluid contents.

Diagnosis

According to Shedden (1931) branchial cysts occupy a constant anatomical position. They lie in relationship to the deep surface of the upper half of the sterno-mastoid, and nearly always protrude around the anterior border of this muscle. Most commonly the centre of the cyst is opposite the greater cornu of the hyoid bone. In the six cases reported here the swellings were hard and tense, giving an impression of induration rather than of being cystic and fluctuant. Bailey (1923) remarks that all branchial cysts which give rise to symptoms are lined with squamous epithelial cells, and that so-called "mucous branchial cysts" lined with columnar epithelium are in reality cystic hygromas. He states, further, that the presence of cholesterol crystals in aspirated fluid is diagnostic of a branchial cyst. Two other factors, noticed when aspiration is performed, appear to me to indicate a branchial cyst rather than a tuberculous abscess: (a) that the fluid content is very thin, and (b) that the cyst can almost always be completely emptied at the first aspiration.

The cases here reported were diagnosed as tuberculous cervical adenitis, and were referred to me for treatment of that condition. The diagnosis of branchial cyst was subsequently made in each case on the finding of squamous epithelial cells during examination of aspirated fluid at the Central Tuberculosis Laboratory, Cardiff.

Treatment

The treatment generally recognized as being the only satisfactory one is complete excision (Shedden, 1931; Bailey, 1923, 1928; Baumgartner, 1933). Cutler and Zollinger (1933) report several cases of cervical fistulae and pilonidal cysts treated by a modified Carnoy's solution containing absolute alcohol 6 ml.,

chloroform 3 ml., glacial acetic acid 1 ml., and ferric chloride 1 g. Robitshek (1933) records a case of branchial fistula successfully treated in this way. Five of the six cases reported below were treated by aspiration followed by the injection of from 0.5 to 1 ml. of pure carbolic acid. In one case the cyst disappeared after a single aspiration without the injection of any sclerosing fluid, but recurred 8 months after this aspiration. Aspiration was made with a moderately fine needle, which was held carefully in place to receive the Record syringe containing the carbolic acid. After aspiration, which in every case caused complete flattening of the cystic swelling, the acid was injected with maximum rapidity in order to obtain a spraying effect with the carbolic on the lining of the cyst wall. Firm pressure was then maintained on the site of the emptied cyst for five or ten minutes.

Case Reports

Case 1.—A man aged 31 was admitted with a very large hard mass in the left side of the neck deep to the upper third of the sterno-mastoid; on Feb. 13, 1943, 25 ml. of rather thin yellowish fluid was aspirated and the swelling completely flattened. On Feb. 27 the swelling reappeared, and 5 ml. of fluid was aspirated. The laboratory report (Dr. Ruth Milne) on the aspirated fluid stated: "No acid-fast bacilli found. The presence of many epithelial cells suggests that the pus may be from a simple branchial cyst. The character of the fluid is also suggestive but not absolutely typical of this." March 20: Swelling very large and hard again; 20 ml. of fluid aspirated, and swelling completely flattened again; 0.5 ml. of pure carbolic acid injected. March 27: Swelling now very small. April 10: Swelling hardly palpable. May 1: Swelling completely gone. Seen in January, 1945, and March, 1946, the patient stated that there had been no recurrence.

Case 2.—A woman aged 41 was admitted on April 2, 1943, with a hard tense swelling in the right side of the neck; 10 ml. of brownish fluid aspirated from the cyst and swelling completely flattened. Laboratory report (Dr. Milne): "No tubercle bacilli. Squamous epithelial cells present in large numbers. Findings typical of a branchial cyst." This case was kept as a control and no carbolic acid was injected. The cyst showed no signs of filling up until Dec. 6. The swelling recurred, and by Jan. 10, 1944, had reached the same size as when originally seen. It was aspirated and 12 ml. of brownish fluid withdrawn. This fluid was again reported on as being characteristic of a branchial cyst. This time, however, 1 ml. of pure carbolic acid was injected after aspiration. Three months later only a small firm swelling was present near the anterior border of the sterno-mastoid. Jan. 29, 1945: No palpable swelling present. March 1, 1946: No recurrence.

Case 3.—A man aged 26 was admitted on Aug. 18, 1943, with a large hard tense mass in the upper half of the right side of the neck, deep to the sterno-mastoid: 12 ml. of thin greenish-yellow fluid aspirated from the swelling. Laboratory report on the fluid (Dr. Milne): "No tubercle bacilli present. Large numbers of squamous epithelial cells. Findings typical of branchial cyst." Sept. 4: Swelling up again; 6 ml. of fluid aspirated; 0.5 ml. of pure carbolic injected. Sept. 18: Swelling much smaller, but up again; 4 ml. of fluid aspirated; 1 ml. of pure carbolic acid injected. Dec. 13: Now has a small firm swelling near the anterior border of the sterno-mastoid. Jan. 10, 1944: A tiny hard nodule only is palpable. Jan. 29, 1945: No mass or nodule palpable. April 20, 1945, and March 1, 1946: No recurrence.

Case 4.—A young woman aged 22 was admitted on March 3, 1944, with a tensely fluctuant swelling in the upper half of the left side of the neck; 16 ml. of brownish thin fluid aspirated. Laboratory report on fluid (Dr. Milne): "No tubercle bacilli present. Large numbers of squamous epithelial cells observed. Findings typical of branchial cyst." April 28: Swelling up again; 18 ml. of fluid aspirated and swelling completely flattened; 1 ml. of pure carbolic injected. May 12, 1944: Small hard mass palpable. July 21: Swelling completely gone; nothing to palpate. Jan. 22, 1945: No palpable swelling. April 23, 1945, and March 1, 1946: Follow-up; no recurrence.

Case 5.—A young woman aged 23 was admitted on March 3, 1944, with a large tensely fluctuant swelling in the left side of the neck; 15 ml. of thin yellowish fluid aspirated from the swelling. Laboratory report on the fluid (Dr. Milne): "No tubercle bacilli; large numbers of squamous epithelial cells. Findings typical of a branchial cyst." March 10: 5 ml. of fluid aspirated; 1 ml. of pure carbolic injected. April 28: Swelling completely gone. May 26: Swelling still absent; nothing at all abnormal to palpate. Jan. 29, 1945: Swelling reappeared a week ago. A very hard swelling the size of a walnut present. Aspiration attempted but no fluid obtained. Diagnosis doubtful. Feb. 10: Swelling has disappeared; may have been a lymphadenitis. April 30: No palpable swelling. March 3, 1946: No recurrence.

Case 6.—A girl aged 12 was admitted on Dec. 22, 1944, with a fairly tense cystic swelling in the left side of the neck, deep to the

upper half of the sterno-mastoid; 25 ml. of buff-coloured fluid aspirated and swelling completely flattened. Laboratory report: "Fluid contains large numbers of squamous epithelial cells and is typical of a branchial cyst." Jan. 5, 1945: Swelling has recurred, but is not so large as when first seen; 12 ml. of fluid aspirated and swelling again completely flattened; 1 ml. of pure carbolic acid injected. Jan. 19, 1945: Swelling again present, but now very small and indurated. Feb. 9: A small firm mass, the size of a hazel nut, is palpable deep to the upper third of the sterno-mastoid. March 22: Swelling completely gone. April 30, 1945, and March 1, 1946: No recurrence.

Discussion

No untoward reactions of any kind have been encountered after this treatment. Shedden (1931) reports that iodine, alcohol, caustic potash, trichloroacetic acid, and mercuric nitrate have all been injected into branchial fistulas in attempts to close them, sometimes with fatal results after passage of these substances along the fistula into the mouth. I cannot find any reference, however, in the literature to the use of sclerosing solutions in the treatment of branchial cysts. Trail, in a personal communication in 1944, reported the disappearance of a branchial cyst following its aspiration and the injection into it of lipiodol for purposes of radiological study. It would seem that branchial cysts have no fistulous connexion with the mouth (Bailey, 1923). Baumgartner (1933), however, describes a form of "incomplete internal" fistula with an internal but no external opening which could presumably become cystic and in which the injection of pure carbolic acid might carry some risk. This is, I believe, far more of a theoretical than an actual practical risk, and one which could be overcome by careful scrutiny of the mouth after the injection of methylene-blue solution into the cyst.

The follow-up in these cases is too short to be certain that recurrence will not take place but is long enough to make such a conclusion reasonable.

Summary

Six cases of branchial cyst are reported. They were treated by aspiration followed by the injection of from 0.5 to 1 ml. of pure carbolic acid. In every case the swellings disappeared and have not, so far, recurred. One of the cases was first treated by aspiration alone, but the cyst recurred after 8 months. It was subsequently treated as above, and has not recurred since.

REFERENCES

- Bailey, Hamilton (1923). *Brit. J. Surg.*, **10**, 565.
— (1928). *British Medical Journal*, **1**, 940.
Baumgartner, C. J. (1933). *Surg. Gynec. Obstet.*, **56**, 948.
Cutler, E. C., and Zollinger, R. (1933). *Amer. J. Surg.*, **19**, 411.
Robitsek, E. C. (1933). *Minnesota Med.*, **16**, 760.
Shedden, W. M. (1931). *New Engl. J. Med.*, **205**, 800.

Medical Memoranda

Post-operative Mania treated by Continuous Intravenous Pentothal

Little has been written about the action and effects of sodium pentothal, even as a short-acting anaesthetic. By the following case it is hoped to illustrate the possibilities of prolonged narcosis produced and sustained by this drug. It would seem that modifications of the method as shown below may be used in the treatment of other disorders of a nervous nature.

CASE HISTORY

The patient, an ex-officer in the Merchant Navy aged 24, gave a history of peptic ulceration dating back to 1939. From September, 1943, to July, 1945, he had had four operations—two for perforations and one each for gastro-jejunostomy and laparotomy. After the last operation he was violent and confused, and had to be restrained, but this lasted for only 24 hours. He was left with no obvious mental trauma. After two months' hospital treatment a partial gastrectomy was performed in September, 1945.

Some facts involving the patient's psychological state are of interest. He underwent many hardships on the Murmansk convoys, and on one of these his ship was torpedoed. As a result he was very nearly drowned and lost the thumb and three fingers of his left hand. His wife had a baby four weeks before his present operation, and about the same time he lost the job which he had held since his discharge from the Service a year ago. He smokes 15 to 20 cigarettes daily, but takes no alcohol.

The patient is a well-built, healthy-looking man, introspective and rather "highly strung." He requires a lot of attention and is obviously "spoilt." His general physical condition is good. The handicap of his left hand does not worry him unduly, and he has

overcome it to a great extent. Examination of his C.N.S. revealed no abnormality. The day before his operation he was very well, and looking forward to the benefit which he was to receive from it. That night he slept well without sedation.

Sept. 7, 1945.—8.30 a.m.: Premedication—omnipon 1/3 gr. (22 mg.) and hyoscine 1/150 gr. (0.44 mg.). 10.10–11.30 a.m.: At operation the gastro-enterostomy was undone and a partial gastrectomy carried out. Anaesthesia was induced with intravenous pentothal 0.5 g., and thereafter he was given nitrous oxide, oxygen, and ether. Induction and anaesthesia were smooth and uneventful, and at no time was he cyanosed. 2.15 p.m.: Coming out of the anaesthetic; restless; omnipon 1/3 gr. 4 p.m.: Continuing restless; 4 dr. (14 ml.) rectal paraldehyde given without effect. 6 p.m.–2 a.m.: 1½ gr. (0.1 g.) of morphine in 1/4-gr. (16-mg.) doses. Patient now very violent and having hallucinations of torpedoes and sensations of fear of drowning. A restraining sheet failed to control him.

Sept. 8.—3.15 a.m.: Omnipon 2/3 gr. (45 mg.) and hyoscine 1/75 gr. (0.87 mg.). Very little effect. Pulse rate rising, but colour remains good. 10.20 a.m.: As the patient's condition in some ways resembled delirium tremens 3 ampoules of vitamin B₁ were given intravenously. An hour later he was more violent than before. He was out of bed on several occasions, being almost uncontrollable. 12.40 p.m.: Slept for one hour after 3½ gr. (2.2 g.) sodium amylal intravenously. 2.50 p.m.: Slept for a further hour after 6 dr. (21 ml.) rectal paraldehyde, some of which was returned. 4.30 p.m.: Began to retch violently, then vomited some clotted blood. Was not obstreperous but quite uncooperative. Pulse and colour remained good. 6 p.m.: At this point it was agreed that he would have to be put to sleep or he would die from exhaustion. Since hypnotics were apparently useless, it was decided that sodium pentothal intravenously was the most effective and suitable narcotic. Consequently sleep was induced by the injection of 0.5 g. as for induction of anaesthesia. A glucose-saline drip was then set up, containing 1 g. of pentothal to 1 pint (568 ml.) of glucose-saline. The rate of drip was determined by the depth of the narcosis, 40 drops a minute being required on an average to keep him narcotized. 8.10 p.m.: A second pint, again containing 1 g. of pentothal, was begun. 10.45 p.m.: A third pint, containing 0.5 g. of pentothal, was begun.

Sept. 9.—1.30 a.m.: Drip discontinued; a total of 3 g. of pentothal had been given. He slept on for 3½ hours after the drip was stopped, remaining reasonably quiet until 8 a.m., when he again became violent; later he fell asleep for one and a half hours. 12.30 p.m.: The patient got out of bed, brushed all restraint aside, and ran into the corridor, where he collapsed exhausted. Sleep was again induced with 0.5 g. of pentothal, and the glucose-saline-pentothal drip reinstituted (1 g. to the pint as before). 3.20 p.m.: He was now kept under with 0.5 g. per pint, but this involved a faster rate of flow, and by 8 p.m., after having had 3 pints (1.7 litres) of fluid containing 2 g. of pentothal, signs associated with increased bronchial secretion became evident. Atropine 1/100 gr. (0.65 mg.) was administered. The concentration of the drip was then increased to 1.5 g. per pint, and a dripping-rate of 5 drops a minute sufficed to keep the patient narcotized.

Sept. 10.—By this time he had had 21 hours' continuous sleep (excluding the first occasion), with 4 g. of pentothal in 4 pints (2.3 litres) of glucose-saline. The drip was then discontinued. 12.15 p.m.: Beginning to waken. To prevent his regaining consciousness too quickly 6 dr. (21 ml.) of rectal paraldehyde was administered. 2.15 p.m.: Respirations becoming shallow and colour poor. Carbon dioxide and oxygen given in addition to strychnine 1/30 gr. (2 mg.). T. 103° F. (39.4° C.), P. 138, R. 32. 6–10 p.m.: Still unconscious. General condition very poor. One ampoule of nikethamide given hourly. T. 104.8° F. (40.45° C.), P. 150, R. 32. The patient was now beginning to be restless, but no effort at restraint was made.

Sept. 11.—4 a.m.: He was obviously beginning to regain consciousness. Those present in the room were his wife, a nurse, and the house-surgeon. He remained quiet and soon recognized these persons by their voices. He was apparently blind, but after three hours recovered sufficiently to recognize objects in the room. From this time he was very co-operative and began to take fluids by mouth. During the period of narcosis he was catheterized repeatedly, and he found some difficulty in passing urine during the next 12 hours. 10 a.m.: Complaining of severe abdominal pain. Morphine 1/2 gr. (32 mg.) and atropine 1/100 gr. were administered without effect. 12.15 p.m.: Pain continuing. Nephenthe 10 m. (0.6 ml.) and tincture of belladonna 10 m. given by mouth. Some nausea but no vomiting. 2 p.m.: Tincture of belladonna 10 m.; pain easier. This was repeated at 5 p.m. 11 p.m.: Patient unable to sleep; abdominal pain very severe. Morphine 1/2 gr. given; repeated at 1 a.m.

Sept. 12.—3 a.m.: Again very violent and "light-headed." Sleep was induced as before with 0.5 g. of pentothal; he slept for 3½ hours after this. On waking the patient felt much better. The pain had subsided and his eyesight had recovered. He was very weak, and fell into a deep sleep. From then onwards he continued to improve rapidly. There was no internal or external haemorrhage, and the abdominal wound held firm except for two skin sutures.

It is interesting to note that he remembers nothing from the time when he went into theatre on Sept. 7 until he regained consciousness on Sept. 11. He does remember vaguely the vomiting of blood on the afternoon of the 8th.

COMMENT

With a history of previous post-operative violence, and in view of the recent psychological history, it was feared that the patient might behave as he had done before. The much greater degree of mental disturbance on this occasion may be due either to the greater weight of worry and misfortune or to the longer time he was under the anaesthetic. The exact