the seventh-day milk are due to differences in the speed of maturation, and that in more mature milk the variation in these constituents has practically disappeared. In this study there were no differences in the success of lactation which were associated with the protein content of the seventh-day milk, so that the speed of maturation is apparently of no particular importance in this connexion. That is, milk which is slow to "come in" does not necessarily portend unsuccessful breast-feeding.

The rapidity with which women with poor lactation stop breast-feeding emphasizes the importance of studying human milk composition as early as possible in lactation, if the full range of variation is to be appreciated. Any investigation of human milk secreted after the second or third month of lactation would be carried out on a highly selected population. Those women with poor lactation would, of necessity, have abandoned breast-feeding, and although a considerable variation in milk composition may remain among the rest there will be little or no really poor milk discovered. This may, in part, be the basis for the widely held belief that variations in milk composition are unimportant.

Summary

The success of lactation, judged by the duration of breast-feeding and the weight gain of the baby, is shown for 167 subjects whose milk was analysed on the seventh post-partum day. Both milk yield and fat content were related to the clinical data. The total fat output had a stronger relationship than either.

There was a marked relationship between the seventh-day fat output and the baby's weight gain in hospital.

The breast-feeding history of 148 of these subjects was known until the 13th week. In 23, breast-feeding was terminated for reasons unconnected with the adequacy of lactation. In the remaining 125 there was a marked relationship between fat output on the seventh day and the duration of breast-feeding.

Accurate weights during the first three months of life were known for 83 of the infants, and, although there was a strong relationship between fat output and weight gain during the first month, there was none after this time. This effect is presumably due to the elimination of those infants initially fed on milk of low nutritive value, leaving at the breast only those for whom the milk was at least adequate.

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REFERENCES

- Albanese, A. A. (1951). *Pediatrics*, **8**, 455.
 Clements, F. W. (1949). *Infant Nutrition, Its Physiological Basis*. Wright, Bristol.
 Gunther, M., and Stanier, J. E. (1951). *Spec. Rep. Ser. med. Res. Coun., Lond.*, No. 275.
 Hytten, F. E. (1954a). *British Medical Journal*, **1**, 175.
 — (1954b). *Ibid.*, **1**, 249.
 — (1954c). *Ibid.*, **1**, 912.
 Illingworth, R. S. (1953). *The Normal Child*. Churchill, London.
 Jeans, P. C., and Marriott, W. McK. (1947). *Infant Nutrition*. Moseby Company, St. Louis.
 Kon, S. K., and Mawson, E. H. (1950). *Spec. Rep. Ser. med. Res. Coun., Lond.*, No. 269.
 Naish, F. C. (1948). *Breast Feeding*. Oxford Univ. Press, London.
 Read, G. D. (1949). *Lancet*, **1**, 721.
 Richardson, F. H. (1925). *J. Amer. med. Ass.*, **85**, 668.
 Sydow, G. v. (1944-5). *Acta paediat., Stockh.*, **32**, 756.
 — (1952). *Ibid.*, **41**, 449.
 Waller, H. K. (1946). *Arch. Dis. Childh.*, **21**, 1.
 Yung-en Kao (1948). *Acta paediat., Stockh.*, **36**, 233.

CARCINOMA OF THE MIDDLE EAR

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This report is concerned with carcinoma arising primarily in the epithelium of the middle-ear cavity or mastoid air cells. The disease is rare. We have been able to find only 120 cases in the literature, and even this figure is only approximate, as the accounts often include cases of growth arising in the external meatus. Risch and Lisa (1938) gave a full account of many previous case reports and a comprehensive bibliography. It is usually impossible to decide clinically whether one is dealing with a carcinoma of the tympanum or of the external meatus, but the former has some distinct features, illustrated by the following six cases.

Case 1

A married woman aged 62 was first seen in July, 1947, complaining of having had right-sided otorrhoea for five months and pain in the right side of the lower jaw for three months. She was found to have an incomplete right facial paralysis of the lower motor neurone type, induration in the inferior portion of the right parotid gland, granulation tissue deep in the meatus, and a blood-stained discharge. Malignant disease was suspected, and was confirmed by biopsy of the aural granulation tissue, which revealed "a well-differentiated squamous-cell carcinoma, almost completely keratinized." It was decided that irradiation should be the first means of treatment, and 8,200 r was given from August 18 to October 9 by tele-radium (5-g. unit) and deep x rays.

On December 19 the temporal bone was explored through a post-aural incision. As the mastoid process and the middle ear were found to be largely replaced by tumour an extensive excision was performed. The facial nerve, although not identified, was removed with the tumour tissue, as the facial paralysis was later found to be complete. The dura and the temporo-mandibular joint were not involved. The pain disappeared after the operation, and the disabilities resulting from the facial paralysis became the patient's chief concern and were to some extent rectified by a right tarsorrhaphy and a fascial sling. There has been no evidence of recurrence.

Case 2

A man aged 44 was seen for the first time in November, 1951. He had suffered from bilateral otorrhoea for twenty years, but came for advice because of increasing deafness. Both middle ears were extensively damaged, but both were dry. A hearing-aid was prescribed. One month later he developed a right facial paralysis. Examination then showed granulations protruding through a large postero-superior perforation in the right drum. He complained of severe pain in the ear, but there was no mastoid tenderness. A right radical mastoidectomy was performed (post-aural approach) in the belief that this was a case of chronic infection with an acute exacerbation. A good deal of granulation tissue was found in the mastoid process and tympanum, together with much erosion and destruction of bone. The horizontal portion of the facial nerve was exposed. The wound was packed with bipp ribbon gauze

and left open, and a fortnight later, as the cavity appeared clean and was covered with healthy granulations, a skin graft was applied and the posterior incision closed.

Shortly after this operation the patient complained of increasingly severe pain in the ear. The cavity was dressed after a week, when much of the graft was found lying free in the cavity, and granulations covered the facial ridge. It was then felt by one of us (R. P.) that the abnormal course of the case was suggestive of a growth, and biopsy confirmed this suspicion, revealing "active squamous-cell carcinoma." The cavity was explored again and all diseased bone and muscle was excised, leaving the sigmoid sinus, jugular bulb, and parts of the membranous labyrinth exposed. The temporo-mandibular joint was opened, as the growth had invaded it and had also spread to the dura overlying the tegmen tympani. Permission to remove the pinna had not been obtained, and it was removed a week later. The material excised at this operation showed "a fairly well differentiated squamous-cell carcinoma with invasion of the temporal muscle, the facial nerve, and the temporal squame." A course of irradiation was given to the open wound, 5,455 r by deep x rays and teleradium (10-g. unit) over 55 days. The cavity appeared to heal well from the bottom, but the pain persisted. By July, 1952, he began to suffer from fits, and he died of an intracranial extension in September, 1952.

Case 3

A man aged 75 was first seen in February, 1952, having had severe left-sided earache and otorrhoea for four months. Both the pain and the discharge, which was blood-stained, had increased steadily and were associated with a recent increase in deafness. The pinna was displaced downwards and outwards by a brawny oedema over the mastoid process, and in the external meatus there was a bloody and foul-smelling discharge, whilst bare bone was palpable in the floor of the canal. A diagnosis of carcinoma of the tympanum was made on clinical grounds, and on March 17 the left mastoid was explored through a post-aural incision. The whole of the temporal bone lateral to the labyrinth capsule had been replaced by a growth, which was also invading the temporo-mandibular joint. A wide excision was performed. The operation was followed by a partial left facial paralysis of the lower motor neurone type. Material removed at operation was sent for microscopical examination and showed, "extensive invasion by squamous-cell carcinoma of the pinna, the parotid gland, and the mastoid process." He was then treated by a combination of deep x rays and teleradium (10-g. unit), and a total dose of 3,855 r over 36 days was given. The pain was unrelieved, although, as in Case 2, the operation cavity was left wide open. He died of coronary occlusion in June, 1952. Post-mortem examination revealed residual carcinoma in the petrous apex.

Case 4

A spinster aged 52 was referred by her doctor with a diagnosis of carcinoma of the right ear, for which a limited local excision had been performed nine months previously. She complained of severe and constant earache, and there had been three recent attacks of bleeding from the ear. The right external auditory canal was very stenosed and contained a thin and foul-smelling blood-stained discharge. There was a complete conductive deafness. In a smear of material taken blindly from the depths of the stenosed meatus carcinoma cells were found.

Accordingly, on February 11, 1952, the right temporal bone was explored through a post-aural incision. The epitympanic space and the posterior meatal wall were replaced by a growth, which was also spreading forwards into and above the temporo-mandibular joint, as well as deeply and anteriorly into the dura of the middle fossa. As much as could be reached of this growth was excised, and the anterior and superior walls of the cavity were coagulated by diathermy. The posterior bony wall of the cavity was

covered with a Thiersch graft, a large meatal opening was fashioned after Ballance's method, and the wound was closed. The material obtained at operation was examined and showed "(1) no neoplastic change in the meatal skin, (2) invasion of the medial end of the meatal skin tube, and (3) active islands of squamous-cell carcinoma in the tegmen tympani." The patient was then treated by irradiation, receiving a total dose of 5,900 r in 69 days by a combination of teleradium (10-g. unit) and deep x rays. She died on November 11, 1952, from intracranial spread of the original lesion. The local pain was unrelieved by treatment.

Case 5

A married woman aged 68 was first seen in February, 1953, with a history of discharge from the left ear for many years. For the past year she had had pain in the left side of the face and head, and the discharge had become blood-stained. Examination showed signs of previous suppuration in the right ear. On the left side there was a partial facial paralysis, and granulations were growing out of the middle ear into the meatus. Because of the history and the clinical findings, some of this granulation tissue was removed for biopsy, and a squamous-cell carcinoma was revealed.

On March 10 the left temporal bone was explored through a post-aural incision. The mastoid portion of the bone and the whole tympanum had been replaced by tumour tissue, which did not, however, appear to have penetrated the dura. So far as possible, the growth was removed, and examination of the material obtained at operation showed: "(1) In one area there is evidence of chronic inflammation with lymphocytes and foam cells. There is an area of hyperplastic squamous epithelium loosely attached to this tissue. (2) Squamous-cell carcinoma with cornification. There are areas of fairly deep infiltration." After operation the patient was treated by a combination of teleradium (10-g. unit) and deep x rays, receiving a total dose of 5,560 r in 39 days. Pain was not a pre-operative feature of importance, and disappeared after treatment. There is still no evidence of recurrence, and the radical cavity is soundly epithelized. A slight facial palsy persists.

Case 6

A married woman aged 55 was first seen on January 12, 1954. She had suffered from left otorrhoea since childhood and from lumps below and anterior to the ear for six months. A fleshy polypus occupied the meatus, and there was a hard nodule the size of a pea in the pre-auricular region and a much larger mass in the subgastric area. Biopsy of the polypus revealed an early squamous-cell carcinoma developing in granulation tissue. The patient was referred to the Radiotherapeutic Research Unit of the Hammersmith Hospital, and the ear was treated on the 8-million-volt linear accelerator. From February 1 to March 15 a dose of 5,820 r was given. The middle ear became dry and fibrotic in appearance and the pre-auricular gland disappeared. A very extensive block dissection of the left side of the neck was carried out on April 24. Nodes in the subgastric area and others from behind the mastoid attachment of the sternomastoid muscle contained squamous-cell carcinoma. The patient left hospital on May 7.

Discussion

Clinical Features

Previous writers have emphasized certain points which are to be found in these cases.

1. *Pain*.—This was a feature in all of our cases, and in three of them was unrelieved by treatment. Furstenberg (1924) and Bowman (1940) believed that the pain was due to the pressure of the expanding tumour within a rigid bony framework. However, an expanding lesion like a cholesteatoma does not cause pain by its presence, although pain may occur when an acute infection supervenes. The

pre-operative pain in these cases may well be due to secondary infection, but the persisting post-operative pain, occurring even in a widely laid open cavity, is inexplicable. It cannot be due to direct involvement of the dura, as the dura over the temporal bone is not a site from which painful stimuli can be elicited (Wolff, 1948). Nevertheless, in Cases 2, 3, and 4, in which pain was a dominant symptom, the dura was invaded by the growth, whereas the pain disappeared after operation in Cases 1 and 5, in which there was no dural involvement. We are not prepared to offer any explanation of these observations. Pain is a common symptom in cancer, and its cause is often obscure.

2. *Chronic Suppuration*.—A history of genuine chronic suppuration was obtained in only two of our six cases. In the other cases the otorrhoea could be attributed to the presence of tumour rather than to pre-existing suppuration.

3. *Facial Paralysis*.—This was a presenting symptom in two cases, and was present but unnoticed by the patient in one case.

4. *A Blood-stained Aural Discharge*.—This was present in four out of the five cases.

5. *Sequestration of Bone*.—This was present in one case.

6. *Post-aural Swelling*.—This was present in one case.

7. *Metastasis*.—Neighbouring or distant metastasis has rarely been reported in the literature, but it occurred in Case 6. Whether the method of treatment adopted was the correct one remains to be seen, but the result so far has been satisfactory.

From our experience it seems that pain and the presence of a blood-stained discharge, particularly if there is also a facial palsy, are the most reliable indications of malignant disease in the middle ear. The diagnosis must be clinched by biopsy.

Cause of Death

The cause of death is usually given as malignant cachexia. In some cases invasion of the meninges leads to fatal intracranial complications. In others a fatal haemorrhage occurs from erosion of the jugular bulb or the carotid artery. Death from a distant metastasis has not been recorded.

In our series, one patient died from coronary occlusion and two from direct intracranial spread of the disease.

Treatment

In so far as so rare a disease can be said to have any settled mode of treatment, it would be a combination of surgery and radiotherapy. One of our cases received radiotherapy before surgery, whilst the others were treated by post-operative irradiation (at the Royal Cancer Hospital, London, under the direction of Dr. M. Lederman). The extent of the operation varied with the extent of the disease. As in all cancer surgery, no anatomical boundaries were respected, and no attempt was made to preserve any involved structure which could be excised.

For instance, in most cases the inner ear was removed in whole or in part; in two cases considerable portions of the capsule of the temporo-mandibular joint were excised; and in one case the pinna was sacrificed. When the region of the facial nerve was involved in growth no attempt to preserve the nerve was made at the expense of a skimmed excision.

However, in Cases 2, 3, and 4, pursuing the disease anteriorly would have meant excision of the temporo-mandibular joint and the adjacent part of the base of the skull, with no certainty, even then, of reaching the limits of the growth. In the light of subsequent events, this is probably the course which should have been followed to give the patient the best possible chance, as it seems clear that radiotherapy is unavailing in growth so deeply buried in bone. In Case 3 the whole bony meatus and the parotid gland should perhaps also have been excised in order to comply with the essential requirements of tumour surgery. These are speculative suggestions, offered after reflecting

on the clinical course of these few cases, and applying general surgical opinions which are commonly accepted. The tumours are not highly malignant, and distant metastasis is almost unknown. The problem, then, is entirely one of adequate local removal, and this seemingly applies particularly to the bone, as irradiation appears to be effective in controlling the soft-tissue invasion. Before embarking on any case a clear idea must be entertained of the possible directions of spread in the bone and a feasible means of excising these areas. Such excisions are not insurmountable technical problems, provided they are not presented suddenly in the course of an operation conceived in lesser terms.

Prognosis

The prognosis of middle-ear carcinoma is very poor indeed. Only one case is to be found in the literature in which the patient has survived for more than five years. In this series six cases are reported; one patient is alive and well six and a half years after coming under observation, and one other, treated a year ago, was also alive and without any evidence of recurrence at the time of writing. In both these cases the disease did not involve the dura, which is the factor enormously worsening the outlook.

Summary

Six cases of carcinoma of the middle ear are described. Suggestions for more radical surgical excision are offered.

REFERENCES

- Bowman, R. J. (1940). *Ann. Otol., St. Louis*, 49, 225.
 Furstenberg, A. C. (1924). *Ibid.*, 33, 677.
 Risch, O. C., and Lisa, J. R. (1938). *Laryngoscope*, 48, 668.
 Wolff, H. G. (1948). *Headache and other Head Pain*, p. 66. Oxford Univ. Press, New York.

ANGULAR STOMATITIS AND ITS ASSOCIATION WITH ARTIFICIAL DENTURES

BY

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Angular stomatitis is seen by the general physician as evidence of nutritional (especially vitamin B) deficiency or of anaemia; but such patients rarely visit the dermatologist. Nevertheless, many patients suffering from angular stomatitis are seen in dermatological and dental departments, and few of them are found to be suffering from general nutritional disease. Most of these patients show a local infective cause for the condition or have some dental fault or both.

The series of patients reviewed in this paper were drawn from the dermatology department of the General Infirmary at Leeds, and the work was done in conjunction with the staff of the dental school.

The literature on the subject is vague; but Vickers (1949) made an important contribution, and his approach has been followed.

There appears to be little doubt that there are several aetiological factors, and in some cases more than one of these may be contributory, so that careful consideration of each particular patient is necessary if treatment is to be successful. Generally accepted aetiological factors include: (1) infection; (2) ariboflavinosis; (3) generalized seborrhoeic or flexural eczema; (4) sensitization to dental materials; and (5) malocclusion.