should be given in small doses (8 to 20 units) every four hours on the basis of urine examinations. It may be necessary to give such patients 20 g. of glucose by intravenous injection with the pre-operative dose of insulin, and fluid feeds containing 20 g. of carbohydrate every four hours for the first day after the operation.

Special Difficulties

Diabetic ketosis is often complicated by symptoms which suggest the presence of an acute abdominal emergency. These symptoms usually subside as the ketosis is corrected. Two young patients in this series had unnecessary laparotomies performed on account of the occurrence of symptoms suggestive of acute appendicitis while they were ketotic. Such a situation may give rise to grave diagnostic difficulties. The patient is often rather uncooperative and there may be physical signs such as abdominal tenderness and rigidity. The presence of a leucocytosis is of no assistance, as there is nearly always a very high white blood count in diabetic coma. In such cases the history is of more value than the examination. If it is found that thirst, polyuria, and drowsiness preceded the abdominal symptoms it is likely that ketosis is responsible for the whole clinical picture, but when the symptoms appear in the reverse order it is more likely that the ketosis is the result of an acute abdominal emergency.

Conclusions

Modern developments have improved the prospect for the surgical diabetic to such an extent that the overall mortality rate in such patients is little higher than that in non-diabetics. Degenerative vascular disease is common in diabetics and gives rise to most of the serious difficulties encountered. The diabetes of a considerable number of patients admitted to surgical wards was undiagnosed before admission, and the recognition of the disorder by routine urine-testing is of paramount importance before such patients are subjected to operative treatment. General anaesthesia is now so satisfactory that there is no special need for regional anaesthesia in the diabetic patient. Full co-operation between the surgeon and a physician who is specially interested in diabetes is of the greatest importance in the successful management of surgical diabetics.

Summary

The problems of the control of diabetes in surgical patients are discussed.

Details are given of a series of 300 consecutive surgical diabetics.

The majority of the patients were over 50 years of age.

Gangrene of the foot was the most common single disorder.

Forty-one of the patients were not known to be diabetic when they were admitted to the surgical wards.

The overall mortality rate was 9.3%.

Diabetic coma was unimportant as a cause of death.

REFERENCES

Barach, J. H. (1949). *Diabetes and its Treatment*, pp. 158, 162. New York.
Lawrence, R. D. (1950). *The Diabetic Life*, p. 150. London.
Root, H. F. (1946). In E. P. Joslin's *The Treatment of Diabetes Mellitus*, p. 679. London.
Wilder, R. M. (1941). *Clinical Diabetes Mellitus and Hyperinsulinism*, p. 213. Philadelphia and London.

INCIDENCE AND TYPE DISTRIBUTION OF CAPSULATED H. INFLUENZAE STRAINS

BY

BETTY DAWSON, M.B., Ch.B.

AND

K. ZINNEMANN, M.D.

(From the Bacteriology Department, School of Medicine, Leeds)

In 1945 Straker reported on the incidence of capsulated *Haemophilus influenzae* strains in healthy children. She found that the incidence varied from 8 to 19% in the individuals examined. Little is known about the proportion in which each of the six known types of *H. influenzae*, a–f, contribute to the carrier rate in this country. Straker merely stated that some of the strains isolated from children belonged to type b, and that in 60 adults swabbed regularly for four years capsulated strains were found occasionally, but that type b was absent. Platt (1937) examined 86 nasopharyngeal strains and identified three of these as type e and one as type a. There is a certain element of doubt regarding his findings, as his typing results were obtained with purified fractions of the capsular substance, while his experiments when employing the usual precipito-agglutination technique gave confusing results. Apart from these two reports no investigations have been carried out on the incidence of the six *H. influenzae* types in this country. Ounsted (1950, 1951) suggested that *H. influenzae* meningitis in children arises from infection with type b strains, the virulence of which has been increased by several previous passages through partially immune older sibs. In view of this interesting hypothesis exact knowledge of the incidence of the *H. influenzae* types has gained an added importance.

Present Investigation

The investigation was undertaken with a view to obtaining data on the occurrence and distribution of the six *H. influenzae* types in the nasopharynx of children in the Leeds area. The recent M.R.C. inquiry into the effectiveness of different prophylactic whooping-cough vaccines provided us with a convenient source of per-nasal swabs from children with upper respiratory infections. These children were either whooping-cough suspects to be examined bacteriologically or their contacts.

Technique.—The children were seen by Dr. G. R. Baxter, who is in charge of the immunization centre at Leeds, and he took nasopharyngeal mucus by means of per-nasal swabs mounted on a flexible curved and non-corroding wire, with a view to isolating *H. pertussis*. The swabs were delivered to the laboratory with the least possible delay and were inoculated at once to Bordet–Gengou plates containing 5 units of penicillin incorporated in 15 ml. of medium. From these plates subcultures were made after three to four days' incubation at 37° C. to 10% heated blood (chocolate) agar plates, and any *H. influenzae* strains detected in this way were examined for their colonial appearance. Strains with mucoid colonies thus isolated were examined for their agglutinability by means of the slide-agglutination technique with specific type sera a–f, and, if positive with one of these sera, the Neufeld test ("capsule swelling") was carried out with the homologous and the five heterologous sera.

Results

In this way 868 swabs from 650 cases were examined during the period August 1, 1948, to December 31, 1950. Capsulated H. influenzae strains were found in 31 children of the ages of 0 to 4 years—that is, in 4.7%. In only one case was a typable H. influenzae strain isolated together with H. pertussis, while the simultaneous occurrence of non-capsulated H. influenzae and H. pertussis was a frequent experience. In one child aged 2½ years types b and c were present simultaneously. On the other hand two siblings aged 2 and 5 years harboured each a different type of capsulated H. influenzae—namely, types f and d. Apart from this pair of siblings no relationship or close contact could be established between the 31 carriers.

In Table I the type incidence and distribution of the Leeds strains are compared with the corresponding figures obtained from 847 children by Alexander (1943) in New York. The

TABLE I.—*Type Distribution of Capsulated H. influenzae Strains Isolated from the Nasopharynx of Children With and Without Upper Respiratory Infection*

	H. influenzae Type						Total
	a	b	c	d	e	f	
Leeds (1948–50)	2	6	1	4	8	11	32
New York (1943)	3	14	1	1	2	3	24

17 cases labelled by Alexander as severe have been excluded from Table I because no comparable ones are included in the Leeds series. These severe cases· of Alexander's consisted of a number of conditions accompanied by bacteriaemia and also of cases of obstructive infections of the respiratory tract and meningitis, all these conditions without exception being due to H. influenzae type b.

While in the New York investigation H. influenzae type b was found nearly five times as often as any of the other types, the distribution in the Leeds area differed significantly. Type e occurred 33% more often than type b, and the number of type f strains was nearly double that of type b. After type b the next in frequency was type d, followed by type a, while type c, as in New York, was isolated once only.

During the same period of observation 10 cases of H. influenzae meningitis occurred in the Leeds area, and H. influenzae strains from 31 further cases in various parts of England and Wales were sent to this department to be typed. All 41 meningeal strains, including the 10 strains from cases in the Leeds area, were of type b.

The age groups of children examined in this series were largely determined by the original purpose of the investigation—that is, to test the effectiveness of various pertussis vaccines. It is felt, therefore, that on account of this selection, and pending more investigations on less selected patients, no conclusions should be drawn from the age distribution of capsulated H. influenzae strains as shown in Table II.

TABLE II.—*Distribution of Capsulated H. influenzae Strains from Nasopharynx of Children According to Type of Strain and Age Group*

Age in Years	% of Total*	H. influenzae Type						Total
		a	b	c	d	e	f	
Under 1	6·7	0	1	0	0	0	0	1
1	46·9	2	3	0	2	7	6	20
2	27·4	0	2	1	1	0	2	6
3	7·0	0	0	0	0	0	2	2
4	5·6	0	0	0	1	1	1	3

* 6·4% of the total number of patients were either over 4 or their ages had not been supplied.

Organisms Other than H. pertussis and Capsulated H. influenzae Isolated from Penicillin/Bordet–Gengou Plates

A· partial survey of the non-pertussis flora was attempted in about half the children investigated. From 370 cases 468 swabs were examined in this respect so far as the organisms

were able to grow in the presence of 0.3 unit.of penicillin per ml. of Bordet–Gengou medium. Table III gives the relevant figures.

TABLE III.—*Bacterial Flora Other than H. pertussis and Capsulated H. influenzae in 468 Swabs as Cultured on Bordet–Gengou Medium Containing 0.3 Unit of Penicillin per ml.*

Organism	No. of Swabs in which Present
Non-capsulated H. influenzae	384
H. para-influenzae	5
Neisseria, excluding N. meningitidis	149
B. friedländeri	8
Staph. ulbus and aureus	11
Non-haemolytic streptococci	4
Coliform bacilli	2

The predominance of non-capsulated H. influenzae and Neisseria in the nasopharyngeal flora is explained by the relative insensitivity of these organisms to the concentration of penicillin present in the medium. On the other hand, this concentration of penicillin may have eliminated different proportions of capsulated and non-capsulated H. influenzae strains sensitive to this concentration (Gordon and Zinnemann, 1945). These authors found non-capsulated H. influenzae strains to be somewhat less sensitive to penicillin than capsulated strains. For this reason figures for the relationship of capsulated to non-capsulated strains are not given, as the experimental error introduced in this way cannot be assessed.

Discussion

In the histories of cases of H. influenzae meningitis the most frequently found antecedents are a respiratory infection or a fall on the head (Allibone et al., 1951). Conceivably, in both instances pathogenic organisms present in the nasopharyngeal flora can be responsible for the ensuing meningitis. In view of the fact that all of 10 cases of H. influenzae meningitis occurring during the same period in the Leeds area and 31 cases elsewhere in England and Wales were caused by type b strains, it is somewhat surprising to isolate types e and f more frequently than type b from the nasopharynx of a selected group of children. One would expect the carrier rate of H. influenzae type b to be appreciably higher than that of any other type. Results corresponding to these expectations were obtained by Alexander in New York in a comparable group of children during an 18 months' investigation prior to 1943. It might be argued that the discrepancy between the New York and Leeds figures can be explained by a higher sensitivity of H. influenzae type b strains to the concentrations of penicillin present in our Bordet–Gengou medium used for isolation. However, the data published by Hewitt and Pittman (1946) do not suggest that any significant differences exist in the penicillin sensitivities of the six H. influenzae types.

Two conclusions may be derived from these considerations: (1) type distribution of capsulated H. influenzae strains differs with the locality and period of investigation ; and (2) for some as yet unknown reason type b strains are more virulent for man than any of the other five known capsulated H. influenzae types.

Experimental evidence to support the second suggestion is not available, although it has been found by various authors (Pittman, 1931 ; Chandler et al., 1937 ; Raettig, 1939–40; Allison et al., 1943) that capsulated strains are more virulent for white mice than non-capsulated H. influenzae strains. It is known that the capsular polysaccharides of the six H. influenzae types are serologically (Pittman, 1931, 1933) and chemically different (MacPherson et al., 1949), and these differences might account for differences in virulence. In this context it is interesting to note that it was shown recently that the antigenic. composition of the capsule of freshly isolated H. influenzae type e strains is more complex than had been supposed hitherto (Williamson and Zinnemann, 1951).,

Whether the presence of capsulated H. influenzae strains in the nasopharynx causes distinct clinical symptoms is difficult to decide from this study, as many of the children in whom no pertussis and no capsulated H. influenzae strains were found suffered from a persistent cough. It is gener-

ally recognized that the presence of *H. influenzae* in meningitis (Rivers, 1922 ; Zinnemann, 1946 ; Allibone *et al.*, 1951), and probably also in bronchiectasis (Allison *et al.*, 1943), is responsible for the formation of a very tenacious greenish-yellow mucopus. Such pus in the nasopharynx may well produce a cough resembling a whoop.

Summary

From per-nasal swabs of 650 children aged 0–4 years 32 capsulated *H. influenzae* strains have been isolated.

Type f was found 11 times, type e 8 times, and type b 6 times, the other three types occurring less often.

The fact that the most frequently isolated types were not *H. influenzae* type b, while type b was the causative agent in all of 41 cases of *H. influenzae* meningitis occurring during the same period in Leeds and various other parts of England and Wales, suggests that this type is more virulent for man than the other five known *H. influenzae* types.

We are greatly indebted to Professor J. W. McLeod for access to the bacteriological material. We are glad to acknowledge Dr. G. C. Turner's help in providing us with *H. influenzae* strains from the whooping-cough inquiry after one of us (B. D.) had left the department.

REFERENCES

Alexander, H. E. (1943). *Amer. J. Dis. Child.*, 66, 160.
Allibone, E. C., Pickup, J. D., and Zinnemann, K. (1951). *Lancet*, 1, 610.
Allison, P. R., Gordon J., and Zinnemann, K. (1943). *J. Path. Bact.*, 55, 465.
Chandler, C. A., Fothergill, L. D., and Dingle, J. H. (1937). *J. exp. Med.*, 66, 789.
Gordon, M., and Zinnemann, K. (1945). *British Medical Journal*, 2, 795.
Hewitt, W. L., and Pittman, M. (1946). *Publ. Hlth Rep., Wash.*, 61, 768.
MacPherson, C. F. C., Alexander, H. E., and Leidy, G. (1949). *J. Bact.*, 57, 443.
Ounsted, C. (1950). *Lancet*, 1, 161.
—— (1951). Ibid., 1, 800.
Pittman, M. (1931). *J. exp. Med.*, 53, 471.
—— (1933). Ibid., 58, 683.
Platt, A. E. (1937). *J. Hyg., Lond.*, 37, 98.
Raettig, H. (1939-40). *Zbl. Bakt., Orig. Abt. I*, 145, 386.
Rivers, T. M. (1922). *Amer. J. Dis. Child.*, 24, 102.
Straker, E. A. (1945). *Lancet*, 1, 817.
Williamson, G. M., and Zinnemann, K. (1951). *J. Path. Bact.*, 63, 695.
Zinnemann, K. (1946). *British Medical Journal*, 2, 931.

INFANTILE CORTICAL HYPEROSTOSIS

BY

W. J. MATHESON, M.D., M.R.C.P., D.C.H.

Physician

AND

MARY MARKHAM, B.Sc., M.R.C.S., L.R.C.P. D.C.H.

Senior Registrar

Children's Hospital, Leicester Royal Infirmary

Although a few isolated cases of infantile cortical hyperostosis had probably been recorded previously, the first full description of the disease was given by Caffey and Silverman (1945) ; their report was closely followed by those of Smyth *et al.* (1946) and Caffey (1946). The disease, which affects the sexes equally, always becomes manifest before the age of 6 months (Caffey, 1950). Its three cardinal signs are excessive irritability, localized swellings in the soft tissues, and periosteal thickening of various bones. This last feature is always seen in bones underlying the swellings of soft tissues, but is often demonstrable radiologically in other bones. Fever, leucocytosis, and anaemia may also be present. The course of the disease extends over months, with unpredictable remissions and relapses, but in all cases observed by Caffey (1950) complete clinical cure has resulted.

The majority of cases have been described by North American authors. MacGregor and Davies (1949), reporting the second recorded case in this country, found 28 in the literature ; they included, however, a case described by Ellis (1939) which must be regarded as not proved, while two of the cases of Caffey (1946) and two of Smyth *et al.* (1946), occurring in children over 1 year old, are more likely to be examples of hypervitaminosis A, a view now shared by Caffey himself (1950). Up to 1949, therefore, 24 proved cases had been described : since then 15 have been added, three of which are in the British literature (Astley, 1950 ; Sakula, 1950 ; and Smitham and Palmer, 1950). Although the disease is probably not as uncommon in this country as would appear, its true incidence can be judged only if recognized cases are reported. It is of importance also to determine the mortality rate accurately, since the disease is not invariably as benign as in Caffey's series. Two cases have been described (van Zeben, 1948 ; Mossberger, 1950), in which the patient died of secondary infection, as did one of the two reported here.

Case 1

A female infant aged 15 weeks was first seen by one of us (W. J. M.) on July 28, 1950, because of fever and swelling of the face. The baby, an only child, was born at term after an uneventful pregnancy and normal delivery, and weighed 7¼ lb. (3.3 kg.). She was bottle-fed and had been given cod-liver oil but not orange juice. The mother and father were both healthy. She had been well until a week previously, since when she had been feverish and fretful, although she had taken feeds well. On the previous day the right side of the face had been noticed to be swollen.

On examination her rectal temperature was 99.4° F. (37.5° C.) and pulse 166. Her weight was 14 lb. (6.4 kg.). She did not seem to be acutely ill and no abnormality other than the facial swelling was found. This was present over the whole length of the right mandible and appeared to be part of the bone itself. It was not tender and the skin was unaffected.

A provisional diagnosis of infantile cortical hyperostosis was made, skiagrams were taken, and the mother was asked to bring the child back in three days. Next day, however, she became alarmed at the condition of the baby, who, at her doctor's request, was admitted to hospital.

On admission the physical findings were essentially unchanged. There was a persistent pyrexia at 100–101° F. (37.8–38.4° C.). Eight days after admission she developed
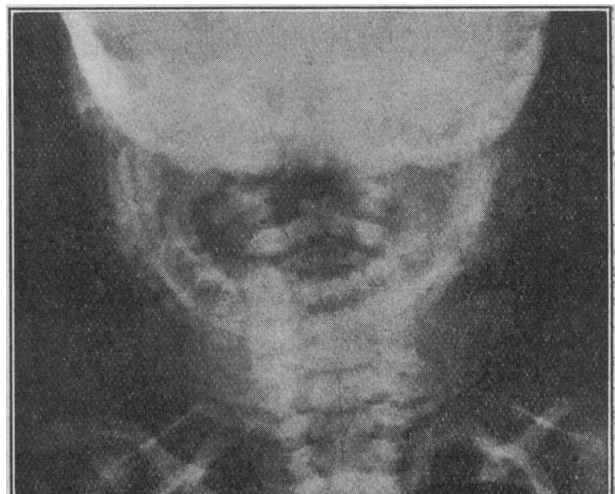

FIG. 1.—Case 1. Periosteal thickening of the mandible.