Rigidity occurs, but is not so intense as that of a perforation; it is limited to the upper abdomen, and may be much more marked on one side than on the other. There is, of course, no loss of liver dullness nor evidence of free fluid, and no previous history of indigestion. The slight bulging of one side of the chest and its limited respiratory excursion are suggestive signs, and the diagnosis is established as soon as a stethoscope is applied to the chest. This will be completely confirmed by radiography.

In pneumonia and pleurisy the onset is much less sudden, so that they are not usually mistaken for a perforation. As we all know, the differential diagnosis in these conditions is more difficult in the case of children than in adults, owing to the greater frequency of abdominal reflex rigidity and tenderness in the former. I find in practice that the distinction is usually made instinctively rather than on the basis of physical signs, for these are notoriously misleading in these cases. A really high temperature, some increase in the respiration rate and disturbance of the pulse-respiration ratio, a flushed face with bright eyes, a hot skin, and respiratory expansion of the nostrils combine to paint a picture

which makes one hesitate to suggest an abdominal origin for the condition. In some cases there is a pneumococcal peritonitis as a complication, when early accurate diagnosis becomes almost impossible. There is no need to call attention to the fact that diminished air entry at the base is of little diagnostic value, for it is frequently found in cases of upper abdominal lesions due to diaphragmatic inactivity. Nor is it to be expected in the early stages of chest conditions, where mistakes are likely to arise, that the characteristic physical signs in the lungs will be well marked.

Conclusion

Despite the rapidly advancing knowledge concerning the mechanism of production of signs and symptoms, diagnosis in the case of upper abdominal lesions remains difficult. That the newer knowledge is of very real value, however, is indicated by the fact that operations of a purely exploratory nature are now much less common than they were in the past. When the average acute abdominal case comes to the operating table a reasonable anticipation of what is likely to be found has already been made.

EPIDEMIC NAUSEA AND VOMITING

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In March, 1936, there occurred in an English boarding school an epidemic which presented some novel features, and resembled the widespread epidemics recently reported in Denmark under the title of "epidemic nausea."* Its symptoms consisted either of vomiting of sudden onset or of nausea; to which was added in a quarter of the cases the sensation of giddiness, sometimes of considerable severity. The illness ran a short afebrile course, all the patients, with one exception, being fully restored to health within forty-eight hours; yet in spite of its apparent mildness the epidemic attacked within a period of fifteen days no less than one-half of the number of pupils and one-third of the adults in the school. Altogether among 117 residents there were fifty-two cases, this total including four pupils who became ill at their own homes within a week of leaving the school.

It is proposed here to describe this epidemic with special reference to the Danish outbreaks, and to discuss the problem of its possible nature.

English School Epidemic

The epidemic developed in a high-class boarding school for girls in Thanet on March 23rd, 1936, within a week of the end of term.

During the term there had been a certain number of colds but no serious epidemic or other illness, and on March 22nd the health of the school was excellent. On that day there were in residence 117 people: seventy-eight girls between the ages of 7 and 17 years, and thirty-nine adults, including resident mistresses, matrons, and eighteen maids. Visiting the school were some masters and mistresses, but no day girls. On the first day of the epidemic fourteen people (eleven girls

and three adults) were affected, of whom three experienced nausea only and eleven suffered from vomiting. Immediate inquiries were made into the question of the food supply for the day, the water supply, and drainage, but nothing of moment could be discovered. The epidemic developed as is shown in the accompanying table:

	Vomiting		Nausea Only		Total
	Girls	Adults	Girls	Adults	
March 23rd ...	10	1	1	2	14
" 24th ...	5	4	1	—	10
" 25th ...	6	1	—	—	7
" 26th ...	3	2	1	1	7
" 27th ...	3	—	—	—	3
" " ...	1 (h)	—	—	—	1
" 28th ...	3	1	2	—	6
" 29th ...	—	—	—	1	1
" 30th ...	—	—	—	—	0
" 31st ...	Term ended: school disbanded				
April 1st ...	1 (h)	—	—	—	1
" 2nd ...	1 (h)	—	—	—	1
" 6th ...	—	—	1 (h)	—	1
Totals ...	33	9	6	4	52

The table shows that four girls, marked (h), developed the disease after leaving the school. Their inclusion brings the length of the epidemic up to fifteen days, during which period fifty-two of the possible 117 people were attacked. There was no spread of the disease in the girls' homes, nor were any of the visiting masters and mistresses affected.

Symptoms.—The chief symptom was that of vomiting, which occurred in forty-two of the fifty-two cases. The sickness came on quite suddenly, so that several of the girls were sick wherever they happened to be in the school or grounds; but a great many, having gone to bed apparently well, woke up in the morning and were sick before they could get out of bed. Many of the patients were sick only once, and in no case did the vomiting go on for more than four to six hours. The onset of the vomiting is well shown in the following case.

A. R., aged 10. As subject to vomiting attacks she was removed from the school on the morning of March 25th to her home in London. On the next day at noon she was

* It appears that the Danish authors use the term "nausea" in its original meaning of "sea-sickness." It would thus include vomiting and giddiness, as well as the feeling of sickness, to which the meaning of the term is limited in the present paper.

inspected by one of us (R. M.), and was found to be looking very well, with a clean tongue, flat abdomen, and no gastric splashing. She took her food well throughout that day and retired to bed at night, taking a cup of ovaltine. At 6.30 the next morning, after sleeping well, she awoke and vomited the ovaltine which she had taken ten hours previously. She passed into an attack of vomiting, which lasted for forty-eight hours: this differed from her usual attacks in that there was no rise of temperature or signs of catarrhal infection.

Nausea was another prominent symptom, and, rather curiously, appeared as an alternative to the vomiting. Those that were sick showed little or nothing in the way of premonitory nausea; as already mentioned, they were attacked quite suddenly by the vomiting; but in ten instances there was nausea lasting for several hours and unaccompanied by vomiting. This type of attack was relatively rather more common amongst the adult patients, and was in some instances accompanied by severe giddiness.

Giddiness was complained of by thirteen of the fifty-two patients, and was particularly severe among those who suffered from nausea without vomiting, some of whom regarded the giddiness as the cause of their feeling so nauseated. The same symptom also occurred in nine of the group that vomited (eight girls and one adult). Like the other symptoms, the giddiness passed off after a few hours.

Other symptoms were chiefly remarkable for their absence, except for slight coating of the tongue and loss of appetite remaining for a few hours after the more urgent symptoms had passed off. Temperature readings were taken in all the cases arising in the school, but in only two instances was the temperature slightly raised at the onset of the symptoms (100°–101° F.). All the other cases were afebrile throughout. Other abdominal symptoms were notably absent. There were no complaints of abdominal pain or tenderness, and no case developed diarrhoea. No aperients were administered. No respiratory catarrhal symptoms were present.

Course and Treatment.—With the exception of the case separately reported above, the vomiting or nausea did not last for more than four to six hours, and, as already stated, many of the children vomited once only. During these hours all food was withheld, but as improvement set in clear fluids were given. On the second day the patients got up from bed, and were encouraged to take light diet. At the end of this time appetite returned, and on the third day the patients were back into the ordinary school regime and taking full diet. There were no relapses or complications. No medicines were given throughout.

Incubation Period.—The last case developed in a girl seven days after leaving school, and eight days after the last case had developed at school. The incubation period must therefore extend for at least eight days, but in most instances was probably much shorter—two to four days.

Danish Epidemics

The epidemic reported above bears a close resemblance to two outbreaks recently reported from Denmark, forming part of an extensive epidemic in that country. The first of the reported epidemics occurred in July, 1935, and was described by A. Rischel¹ under the title of "Epidemic Nausea?" The second occurred in December of the same year, and was reported by E. J. Henningsen² under the same title. He was of opinion that the epidemic he investigated was the same disease as that reported by Rischel.

1. The first reported epidemic occurred in a Danish island summer resort (Ankelt), and was thought to have been brought by travellers from the mainland, where, it was found later, large numbers of people had been affected. The first case arose in a shop, and four days later the disease developed in a boarding house and other houses in the neighbourhood. It affected fourteen families of visitors, taking twenty-five people out of a total of forty-one, and spread to the staff of the boarding house (eight cases in eleven persons) and their families. Altogether forty-seven people contracted the disease. The symptoms consisted of anorexia, nausea, vomiting, and giddiness, giving the picture of sea-sickness. In twelve instances towards the end of the illness there was mild diar-

rhoea with mucus in the stools. (No mention is made of the presence of blood in the stools, or of whether aperients had been used.) No babies were affected. Temperature readings were not taken in all cases, but were found raised in only two instances. Complete recovery occurred in from a few hours to two and a half days; many of the patients did not go to bed, but only rested. The incubation period was judged to be something between two and seven days. The author was of the opinion that neither food-poisoning nor sunstroke was responsible for the symptoms.

2. The second reported epidemic was part of a widespread epidemic which was occurring in various parts of Denmark. E. J. Henningsen investigated an outbreak which took place in December, 1935, in the town of Roskilde, and published his account without delay to encourage others to report on the epidemics then occurring elsewhere in Denmark. The epidemic lasted for two and a half weeks in Roskilde, during which time the author estimated that more than one-third of the total population contracted the disease. He investigated two groups of families, one working-class and the other well-to-do. In 107 households, comprising 423 members, no fewer than 171 people were affected. No age was immune. The symptoms and course of the illness were the same as in the previously reported epidemic, and Henningsen had no doubt that both outbreaks were due to the same disease. He specially mentions that in the Roskilde outbreak the stools of the patients contained neither mucus nor blood. Another interesting point concerned the occurrence of relapses in some of the Roskilde cases: in thirteen instances the symptoms recurred after an interval of two to seven days, during which the patient had seemed completely restored to health. Apart from these most of the patients were well within two days. The incubation period was taken to be usually about two days. Neither the water nor the food supply could be incriminated. The spread of the infection by faecal contamination was regarded as unlikely in view of the equally rapid spread of the disease in two quarters of the town presenting widely different housing conditions. Henningsen suspected that the epidemic primarily affected the central nervous system.

Discussion

Taking first the English epidemic without reference to the Danish outbreaks, its most prominent symptom was either vomiting or nausea. In a quarter of the cases giddiness was also present, and in some instances this was so severe as to be regarded by the patients as the cause of their sensation of sickness. The negative features of the epidemic are no less important, particularly the almost complete absence of febrile reactions and the complete absence of diarrhoea. As an epidemic it showed two peculiarities: the transient nature of the symptoms without relapses or complications, and the high proportion of the school community which was attacked by the disease. Taken as a whole the picture of this epidemic illness appears to be something new to paediatric literature.

Comparing the English epidemic with the Danish outbreaks, there is a close similarity in fundamental points: the presence of nausea, vomiting, giddiness, and anorexia; the rapidity of recovery; and the high proportion of inhabitants affected. The similarity in these matters of the symptoms, course, and spread of the disease is so close in all three epidemics as to leave little room for doubt that they were the same disease. The differences between the English and the Danish epidemics were three in number: first, the Danish outbreaks were in no sense institutional outbreaks, but affected large areas of the country; secondly, in the English epidemic there were no relapses, whereas some of the Danish patients experienced a second attack within a week of their original illness; and thirdly, diarrhoea occurred in a proportion of the Danish cases and was absent in the fifty-two English cases. The last point will be discussed again; but here it must be said that, if the English and

Danish epidemics are to be regarded as essentially the same disease, diarrhoea must be allowed as one of the symptoms of the syndrome, even though it did not occur in the English cases.

Aetiological Considerations

Both the Danish authors satisfied themselves that the epidemics which they reported were not examples of food-poisoning of the ordinary types. In the English outbreak, with so many cases arising in the first two days of the epidemic, such an explanation was naturally the first possibility considered. But as the epidemic ran its course it became clear that this possibility could be set aside, and this view was ultimately confirmed by the fact that four girls developed the disease within one to seven days after leaving the school.

The actual causation of the epidemic disease remains quite obscure, but it is not without interest to consider its possible nature, more particularly whether it is to be looked upon as a disease of the alimentary or of the nervous system.

Considered as primarily a disease of the *alimentary system*, it becomes difficult to account for the symptom of giddiness which was present, sometimes severely, in a quarter of the English cases, and on which the Danish authors have laid so much stress. Other points against this view are the absence of fever, the suddenness of the onset of the vomiting, and the absence in the English cases of diarrhoea, even though the Danish epidemics are taken to prove that this symptom is part of the epidemic syndrome. Setting these points aside, the English epidemic resembles one originated by some form of food contamination; the heavy incidence of cases in the first two days of the outbreak suggests this, although the same phenomenon may be seen in epidemic poliomyelitis, which all do not yet admit may be due to infected food.

In this connexion the only type of gastro-intestinal infection which seems to be worth considering is a possible gastric type of Sonne dysentery. The Sonne bacillus—as seen, for instance, in the wards of a children's hospital—produces an illness which lasts in individual children for two or three days only, spreads very rapidly and mysteriously, and involves a large proportion of the inhabitants of the ward. In these ways Sonne dysentery simulates the epidemics under discussion; but, on the other hand, Sonne dysentery is essentially a febrile illness associated with diarrhoea, with mucus and usually blood in the stools, and in typical outbreaks vomiting is little seen. R. E. Smith,⁴ however, has called attention to the gastric symptoms in Sonne dysentery, and has raised the question whether there should not be described a gastric type of this infection.

R. E. Smith described an epidemic of Sonne dysentery occurring in a school-house containing sixty-nine inmates (fifty-eight pupils and eleven adults). Of these, twenty-four were affected (twenty pupils and four adults). All cases were febrile, but in some the rise of temperature was very small. The illness lasted for from one to nine days, with an average duration of three days. Intestinal symptoms were frequent (diarrhoea, mucus with or without blood in the stools, abdominal pain, tenderness, and tenesmus). The gastric symptoms consisted of vomiting in five cases and nausea in eleven cases. No mention is made of the occurrence of giddiness.

Whether any of the cases with gastric symptoms were free of intestinal symptoms is not clear; if they were it is evident that they were very few in number, since, out of a total of twenty-four cases, gastric symptoms were complained of in sixteen instances and intestinal symptoms in twenty-two instances. Evidently intestinal symptoms

must have been present in most, if not in all, of the gastric group. However, the author was impressed by the importance of the gastric symptoms in the Sonne epidemic which he reported, and was prepared to think that the brunt of the infection might fall on the stomach rather than on the intestine.

In the Danish epidemics diarrhoea was present in a proportion of cases, though it did not occur in the English epidemic, and in the first Danish account the occurrence of mucus in the stools is specially mentioned, though whether aperients had been given is not recorded. The diarrhoea was mild, and occurred at the end of the attack. In the second reported Danish epidemic neither mucus nor blood appeared in the stools.

Thus, except that the occurrence of giddiness and the almost complete absence of fever remain unexplained, it might be held that the Danish epidemics represented a modified form of Sonne dysentery; in which case the English epidemic might be taken to be the same disease in a still more attenuated form, but it must be confessed that the chief attraction of this hypothesis lies in the fact that it provides a known cause for the epidemics described here.

Regarded as a possible infection of the *central nervous system*, the suddenness of the onset of vomiting, the occurrence of giddiness, and the absence of fever are in favour of such a hypothesis. Henningsen, in reporting the second Danish epidemic, suggested that the symptoms were not due to gastro-enteritis, but reflected an involvement of the nervous system. Evidently the same thought was in Rischel's mind, since he was at pains to exclude sunstroke as the cause of the first epidemic. The same possibility was considered in connexion with the English outbreak, but it is impossible to hazard any opinion on the type of infection of the nervous system which could be responsible for these epidemics. The Danish outbreaks occurred in July and December, 1935, and the English one in March, 1936, so that there is no evidence of any particular seasonal incidence as in poliomyelitis or epidemic hiccup.

"Epidemic vertigo" as described by O. Leyton⁵ does not appear to have been the same type of epidemic as reported in the present paper. The author was of the opinion that the epidemic was not a form of influenza as was suggested by A. N. M. Davidson.⁶

Perhaps if other epidemics are observed some cases of more than average severity will give a clue to the nature of the infection at work and the system of the body primarily affected.

Summary

An epidemic presenting apparently novel features has been described as occurring this year in an English boarding school. Its characteristics were: (1) the sudden onset of nausea or vomiting, sometimes accompanied by considerable giddiness; (2) the very short course of the illness; and (3) the high proportion of residents infected during the fifteen days of the epidemic. It is claimed that these characteristics show that it was the same disease as that described by Danish authors as "epidemic nausea" (sea-sickness), occurring in extensive epidemics in Denmark since the summer of 1935. Whether it should be regarded as a disease of the alimentary or of the nervous system has been discussed.

Miss Kylla Pauli is thanked for her kind help in translating the Danish literature.

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