OTITIS MEDIA AND MASTOIDITIS IN INFANCY

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Otitis media and mastoiditis occurring in infancy have long been recognized as most troublesome disorders and, of recent years, would appear to be receiving the attention they merit. The frequency of otitis media or otitis media and mastoiditis found both in the infants’ wards and in the autopsy room of the Alder Hey Children’s Hospital has led to this statistical and clinical enquiry into this common and frequently lethal occurrence.

Of the 1,324 infants under one year admitted to this hospital during the year 1936, 195 (14 per cent.) suffered at one time or another from otitis media or otitis media and mastoiditis. In a certain proportion the ear infection was undoubtedly secondary to some other pathological process. The remainder were cases in which the ear infection appeared to be responsible for the child’s illness and in which, in the majority, suitable treatment of the ear resulted in improvement. This latter and more interesting group is here called 'primary.' The difficulties of making such a classification will at once be apparent, and any case which seemed in any way doubtful has been included in the secondary group. The greatest difficulty was encountered in those associated with nutritional defect. A recent otitis occurring in an infant who had been under observation for some time for hypothrepsia or athrepsia was considered as secondary. A comparatively long history of otorrhoea or otitis and more recent failure to gain in weight was regarded as probably 'primary otitis.' Doubtful cases were placed in the group of secondary otitis. Some of these were perplexing.

For example, a hypothreptic child was admitted with a history of insufficient feeding for the past five weeks. At first the tympanic membranes showed lack of lustre and nothing else. After two weeks, during which the infant was ill, fretful, pyrexial and vomiting, the tympanic membranes showed more definite
signs of inflammatory change and otorrhoea began with improvement in the general condition. Although the acute symptoms subsided and the feed was suitable, the infant still did not gain weight and the ears continued to discharge profusely. Is the otorrhoea secondary to the under-nourished condition, or is the hypothrepsia secondary to the otitis, or is it a vicious circle?

Analysis of cases

The results of an analysis of the cases of secondary otitis media and mastoiditis are as follows:

I. Secondary otitis media

1. ASSOCIATED WITH RESPIRATORY INFECTIONS

Of the seventy-four patients, fifty-four recovered and twenty died. Seven were operated upon and of these three died. The percentage mortality for this group was 27.

2. ASSOCIATED WITH NUTRITIONAL DISTURBANCE

Of the twenty-one patients, eleven recovered and ten died. Four were operated upon and of these three died. The percentage mortality for this group was 47.

3. ASSOCIATED WITH OBVIOUS NASOPHARYNGITIS, BUCCAL INFECTION OR DEFORMITIES

Of the twelve patients, eight recovered and four died. The percentage mortality for this group was 33.

4. MIXED GROUP (nine patients of whom four died (D.)).

Otitis media—associated with faucial diphtheria (D.):

- cretinism.
- scalds of leg.
- severe conjunctivitis.
- abscess of eyelid.
- congenital hydrocephalus (D.).
- meningitis (D.).
- birth cerebral haemorrhage and atelectasis (D.).
- cervical abscess.

SUMMARY OF PREVIOUS BREAST FEEDING OF SECONDARY GROUP

<table>
<thead>
<tr>
<th>GROUP</th>
<th>MORE THAN 3 MTH.</th>
<th>1–3 MTH.</th>
<th>NONE OR LESS THAN 1 MTH.</th>
<th>ENTIRELY BREAST FED</th>
<th>NO. UNDER 9 MTH.</th>
<th>TOTAL NO. OF CASES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory Mortality, per cent.</td>
<td>11</td>
<td>36</td>
<td>13</td>
<td>31</td>
<td>3</td>
<td>55</td>
</tr>
<tr>
<td>Nutritional Mortality, per cent.</td>
<td>1</td>
<td>100</td>
<td>10</td>
<td>9</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Nasopharyngitis, etc. Mortality, per cent.</td>
<td>4</td>
<td>25</td>
<td>3</td>
<td>50</td>
<td>1</td>
<td>11</td>
</tr>
</tbody>
</table>
OTITIS MEDIA AND MASTOIDITIS IN INFANCY

OBSERVATIONS ON SECONDARY GROUP.—In the group associated with respiratory infections the greatest number of cases and the highest death rate (31 per cent.) occurs in the age group 3-9 months, while in the group associated with nutritional disturbance the greatest number occurs in the age group 0-6 months, i.e. the earlier months of life, with a death rate in this group of 45 per cent. In the group associated with nasopharyngitis, the greatest number is in the age group 0-6 months. The previous feeding of these children does not appear to influence the results noticeably.

II. Primary otitis media and mastoiditis

The 'primary' group has been sub-divided as follows:

(A) CLASSICAL MASTOIDITIS.—This sub-group includes those instances in which the child was admitted with mild constitutional disturbance, a history of otorrhoea, evidence of pain in the ear shown by restlessness and rolling of head, with redness, swelling and oedema over the mastoid process, i.e. signs of exteriorization. There were seven such patients, among whom the other ear was involved in four.

Treatment was by operation.

(B) OTITIS MEDIA AND LATENT MASTOIDITIS.—Here are included those cases in which the child showed signs of obvious otitis media, often without mastoiditis, and cases with or without local signs of otitis media, and involvement of the mastoid process without signs of exteriorization. This group has been divided further into:

I. Very toxic. These patients were admitted with a history of diarrhoea and vomiting, usually only of a few days' duration, some loss of weight, refusal of feeds, rolling of head, screaming attacks, fretfulness, drowsiness and, in a few, convulsions. It is noteworthy that in only three cases of this group was there a history of otorrhoea. On examination these infants were found to be dehydrated, grey and toxic, and in the majority toxicity was much more pronounced than dehydration. The fontanelle was depressed and the stools green, loose and frequent. Some had high temperatures, some moderately elevated and some subnormal. Some infants, admitted in fair condition, rapidly became very ill and toxic. Examination of the ears showed tympanic membranes acutely inflamed and bulging, dull red, mildly injected or apparently normal. In some cases myringotomy released pus with improvement in the general condition and fall in temperature. In others only serous fluid was obtained on myringotomy, but within forty-eight hours pus was discharging freely. In one case the tympanic membranes appeared normal throughout, the infection of the middle ears and mastoid processes being discovered at autopsy; in another no pus was obtained at myringotomy, but at the autopsy pus was found in both mastoids, the middle ears being relatively clear. In another both tympanic membranes seemed normal, and later both middle ears discharged spontaneously. In yet another, with a brief, acute history, the child
was admitted practically moribund with greyish tympanic membranes, and in the slender hope of averting a fatal issue bilateral posterior drainage was performed and thick pus found in both mastoids.

The treatment of this group comprised :—(1) Local : instillation of guttae acidi carbolici et glycerini (1 per cent.) ; local heat was applied and myringotomy performed if necessary. (2) General : parenteral fluid by the subcutaneous, intravenous or intra-peritoneal route. In the early stages these children were fed on skimmed lactic acid milk and later, as tolerance increased, on lactic acid milk formulae with varying percentages of glucose. (3) Operative : of the thirty-three cases in this group, ten were operated upon and of these eight died.

II. Mild cases. These patients were mildly ill in the sense that there was no toxicity, no dehydration and the constitutional disturbance was not marked. They were admitted with or without history of otorrhoea, sometimes unilateral, sometimes bilateral and usually ultimately bilateral. Some suffered from diarrhoea and vomiting, some did not. Screaming, restlessness, head rolling, fretfulness were common symptoms and in one or two there was a history of constipation. The temperature was sometimes elevated and sometimes normal. On examination, the general condition of these infants was good without signs of toxicity or dehydration, and no physical signs were discovered except in the ears. The tympanic membranes were sometimes inflamed and bulging, slightly injected or merely lacked lustre. Some had myringotomy performed and some discharged spontaneously. In this group 33·3 per cent. had discharging ears on admission, 25·6 per cent. were assisted by myringotomy unilateral or bilateral, 20·5 per cent. discharged spontaneously and 20·5 per cent. settled with local medical treatment and no surgical intervention.

The treatment was as follows :—(1) Local : guttae acidi carbolici et glycerini (1 per cent.) or a mixture of guttae acidi carbolici et glycerini and spiritus vini rectificatus, or the spiritus vini rectificatus (60 per cent.) alone. Myringotomy was performed if necessary. (2) General : these patients were always put on a feed of suitable caloric value, as intolerance to food was rarely present. (3) Operative : of the thirty-nine cases in this group, four were operated upon and all four recovered. One of these had bilateral posterior drainage, the others unilateral. Those operated upon had persistent otorrhoea with improvement in the general condition as evidenced by satisfactory taking of feeds and gain in weight.

Based upon the classification thus outlined the 'primary' group can be analysed in more detail as follows :

A. CLASSICAL MASTOIDITIS

There were seven such cases, of whom four were of normal weight and three were hypotherptic. All seven recovered. With regard to the previous feeding of the seven cases, five were under nine months, and only one had more than three months' breast feeding, two more than a month and two less than a month. Subsequent bottle feeding was on the whole good. Three had full vitamins, one vitamin C, one none.
OTITIS MEDIA AND MASTOIDITIS IN INFANCY

B. OTITIS MEDIA AND LATENT MASTOIDITIS. (I) VERY TOXIC GROUP

<table>
<thead>
<tr>
<th>AGE GROUP AND NUTRITIONAL CONDITION</th>
<th>NO. OF CASES</th>
<th>RECOVERED</th>
<th>DIED</th>
<th>OPERATION R.</th>
<th>D.</th>
<th>P.M</th>
<th>MORTALITY, PER CENT.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–3 months, N.</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td>90</td>
</tr>
<tr>
<td>H.</td>
<td>2</td>
<td>—</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.</td>
<td>5</td>
<td>—</td>
<td>5</td>
<td>—</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>11</td>
<td>1</td>
<td>10</td>
<td>3</td>
<td>5</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>3–6 months, N.</td>
<td>9</td>
<td>3</td>
<td>6</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>H.</td>
<td>4</td>
<td>—</td>
<td>4</td>
<td>—</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.</td>
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<td>—</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>13</td>
<td>3</td>
<td>10</td>
<td>2</td>
<td>4</td>
<td>76</td>
<td></td>
</tr>
<tr>
<td>6–9 months, N.</td>
<td>6</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H.</td>
<td>—</td>
<td>—</td>
<td>—</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>A.</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>8</td>
<td>1</td>
<td>7</td>
<td>1</td>
<td>3</td>
<td>87</td>
<td></td>
</tr>
<tr>
<td>9–12 months, N.</td>
<td>1</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H.</td>
<td>—</td>
<td>—</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>A.</td>
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<td>—</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>1</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Grand Total</td>
<td>33</td>
<td>5</td>
<td>28</td>
<td>2</td>
<td>8</td>
<td>11</td>
<td>84-8</td>
</tr>
</tbody>
</table>

N.—Normal weight or within 20 per cent. of normal weight.
H.—Hypotrophy : 60–80 per cent. of normal weight.
A.—Athrophy : less than 60 per cent. of normal weight.
R.—Recovered.
D.—Died.

B. (II) MILD CASES

There were thirty-nine such cases, of whom all recovered.

SUMMARY OF PREVIOUS BREAST FEEDING OF PRIMARY GROUP

<table>
<thead>
<tr>
<th>GROUP</th>
<th>MORE THAN 3 MTH</th>
<th>1–3 MTH</th>
<th>NONE OR LESS THAN 1 MTH</th>
<th>ENTIRELY BREAST-FED</th>
<th>NO. UNDER 9 MTH</th>
<th>TOTAL NO. OF CASES</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Very toxic</td>
<td>4</td>
<td>8</td>
<td>20</td>
<td>2</td>
<td>32</td>
<td>33</td>
</tr>
<tr>
<td>Mortality, per cent.</td>
<td>25</td>
<td>87</td>
<td>95</td>
<td>100</td>
<td>84-3</td>
<td>84-8</td>
</tr>
<tr>
<td>(ii) Mild cases</td>
<td>5</td>
<td>10</td>
<td>13</td>
<td>3</td>
<td>28</td>
<td>39</td>
</tr>
</tbody>
</table>

SEASONAL INCIDENCE OF PRIMARY GROUP

<table>
<thead>
<tr>
<th>MONTHS OF YEAR</th>
<th>ALL CASES</th>
<th>TOXIC GROUP</th>
<th>MILD GROUP</th>
<th>CLASSICAL GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>February</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>March</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>April</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>May</td>
<td>5</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>June</td>
<td>6</td>
<td>1</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>July</td>
<td>9</td>
<td>6</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>August</td>
<td>10</td>
<td>6</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>September</td>
<td>12</td>
<td>4</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>October</td>
<td>15</td>
<td>10</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>November</td>
<td>9</td>
<td>3</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>December</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Totals</td>
<td>79</td>
<td>33</td>
<td>39</td>
<td>7</td>
</tr>
</tbody>
</table>
ARCHIVES OF DISEASE IN CHILDHOOD

Observations

As a result of clinical experience we believe that in a certain proportion of cases otitis media and mastoiditis are responsible for the diarrhoea and vomiting syndrome in infancy.

This has been the experience elsewhere, notably Ebbs et alia (1937), Le Mée (1936), Ribadeau-Dumas et alia (1936), Marriott (1935) and Jeans (1926). Spahr (1929) and Holsclaw et alia (1930) report similar findings. Johnstone, Brown et alia (1930), who have conducted an exhaustive bacteriological research, are of the opinion that 'masked mastoiditis' is not an etiological factor in the diarrhoea and vomiting syndrome, and state that it is an enteral infection due to a variety of organisms belonging to the colon-typhoid-dysentery group.

It is striking that a majority of the cases in the toxic group occurred in babies of normal weight (fifteen cases) and a minority in the athreptic group (five cases). The relative absence of otorrhoea in the toxic group suggests that the early occurrence of the toxic picture, possibly coincident with involvement of the mastoid process, is due to pent-up infection in the middle ear and lack of satisfactory drainage. This view would appear to be supported by the improvement in the general condition—unfortunately, in the majority of cases, only temporary—which followed myringotomy and release of pus from the middle ear. The absence of otorrhoea is also a strong plea for the routine otoscopic examination of the tympanic membranes in cases presenting this distressing clinical picture, although, as Ebbs (1937) points out, the results of this examination may leave the clinician in considerable doubt. None of the mild cases which were already discharging or in which satisfactory drainage was established, either spontaneously or by myringotomy (i.e. 79 per cent.), developed signs of toxicity. It seems reasonable to suggest that the presence or early establishment of satisfactory drainage prevented the onset of the severe toxic symptoms. In classical mastoiditis, when infection becomes exteriorized, as indicated by redness, swelling and oedema over the mastoid process, symptoms of toxicity did not arise. Unfortunately this happy outcome is relatively infrequent.

In the group of classical mastoiditis there were no deaths. In the toxic group the death rate is regrettably high (84.8 per cent.) and the highest death rate appears to be in the age group 1–3 months. It is unfortunate that there was only one case in the age group 9–12 months, as this is possibly a misleading figure. In the mild group there were no deaths.

It is frequently stated that breast feeding, whenever possible, is a mother's best method of ensuring her child's successful avoidance of infection, and the results of the present analysis would appear to some extent to bear out this statement. Among the patients with classical mastoiditis only one had more than three months' breast feeding, while the remainder all had shorter periods. In the toxic group, leaving out of consideration for the moment the two entirely breast-fed infants who both died, it will be seen that the highest death rate occurs amongst the infants with no or less than one month's breast feeding, and in the mild cases the greatest number occurs amongst those with no or less than one month's breast feeding.
The results of operative interference are interesting, as, if an attempt is made to classify these cases according to operative results, they are found to fall into the three groups of the suggested classification:

(1) Classical mastoiditis—when operation is always indicated and the results good.
(2) Very toxic group—when the results are poor.
(3) Mild group—when the results are good in selected cases.

The French authorities (Le Mée, 1936; Ribadeau-Dumas, 1936) report satisfactory results from the operation of antrotomy on cases corresponding to those in the toxic group of the present series. We are unable to confirm this experience, as 80 per cent. of such cases operated upon died and 86 per cent. of those not operated upon died. We feel that once the infant's infection so overwhelms it as to produce symptoms of toxicity, its chances of survival are just as great with conservative treatment as with surgical interference.

It will be seen from the analysis of the seasonal incidence of the primary group that the greatest numbers occur during the months of July, August, September and October, the season of the year when diarrhoea and vomiting are most prevalent in infancy.

Summary

(1) An analysis of cases of otitis media and mastoiditis occurring in children under one year, admitted to the Alder Hey Children's Hospital during the year 1936 is made and classification is suggested as follows:—

I. Secondary.
   1. Otitis media associated with respiratory infections.
   2. Otitis media associated with nutritional disturbance.
   3. Otitis media associated with nasopharyngitis, etc.

II. Primary.
   A. Classical mastoiditis.
   B. Otitis media and latent mastoiditis.
      1. Toxic cases.
      2. Mild cases.

(2) Symptoms and treatment of the primary group are described in detail, and summaries of previous feeding of both groups are given.

(3) Results of operation in the primary group are commented upon, and the conclusion drawn that the cases in which satisfactory operative results are likely are those of classical mastoiditis and mild cases with chronic otorrhoea in which the infant's general condition is good or is rendered good by general treatment.

(4) An analysis of the seasonal incidence of primary otitis media and mastoiditis is given.

(5) Confirmation is afforded for the theory already advanced by numerous authors that the well-known 'diarrhoea and vomiting syndrome' is frequently caused by the presence of otitis media and latent mastoiditis, the pathology of
which is of the nature of a retention phenomenon with lack of satisfactory drainage.

We wish to acknowledge our indebtedness to Dr. W. E. Crosbie, Medical Superintendent, Alder Hey Children's Hospital, Liverpool, for permission to publish this work, and to Dr. Norman B. Capon for his helpful advice and criticism.

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Otitis Media and mastoiditis in infancy

Grace McConkey and Edward C. Ross Couper

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