THEESIS.

by

Robert Pitcairn Cockburn.
Digestive Derangements in Infancy.

(Clinical aspects of digestive derangements in infants caused by improper feeding.)

by

Robert Pitcairn Cockburn
M.B., C.M.  M.R.C.S.  L.R.C.P.

Thesis for degree of Doctor of Medicine
University of Edinburgh.
April 25th, 1892.
<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>Classification</td>
<td>2</td>
</tr>
<tr>
<td>Etiology of irritation</td>
<td>3</td>
</tr>
<tr>
<td>Unsuitable food</td>
<td>4</td>
</tr>
<tr>
<td>Cow's milk</td>
<td>5</td>
</tr>
<tr>
<td>Composition</td>
<td>8</td>
</tr>
<tr>
<td>Contamination</td>
<td>11</td>
</tr>
<tr>
<td>Bacteriology</td>
<td>15</td>
</tr>
<tr>
<td>Gastrointestinal Canal</td>
<td>18</td>
</tr>
<tr>
<td>Bacteriology of Lacteas</td>
<td>22</td>
</tr>
<tr>
<td>Symptoms of acute irritation</td>
<td>23</td>
</tr>
<tr>
<td>&quot;Chronic&quot;</td>
<td>36</td>
</tr>
<tr>
<td>Intoxication</td>
<td>41</td>
</tr>
<tr>
<td>Symptoms of Intoxication</td>
<td>42</td>
</tr>
<tr>
<td>Loss of fluid</td>
<td>54</td>
</tr>
<tr>
<td>Defective assimilation</td>
<td>57</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>61</td>
</tr>
<tr>
<td>Prophylaxis</td>
<td>66</td>
</tr>
<tr>
<td>Treatment</td>
<td>67</td>
</tr>
<tr>
<td>Complications</td>
<td>76</td>
</tr>
<tr>
<td>Results</td>
<td>78</td>
</tr>
</tbody>
</table>
During the years 1876-8 I was resident at the East London Children's Hospital, Shadwell; for the first year as House Physician, for the last 2 as Resident Medical Officer. During this period I treated nearly 12,000 (twelve thousand) out-patients, under the staff, 3639 in-patients.

Of the out-patients a large majority suffered from gastro-intestinal disorders. Of the in-patients comparatively few were admitted for gastro-intestinal disease (223 out of a total of 1530 in 1878) but very few left the hospital without having suffered from some digestive derangement. About 33% of the total admissions to the wards were children under two years of age.

Before the recent additions to the staff at Shadwell Hospital the work of the residents was very severe. The calls upon the time, especially of the Res. Med. Off., so incessant as to put accurate statistical work out of the question. In the following pages therefore impressions have to take the place of statistics in many instances.
My work at Shadwell was mainly clinical, and I therefore touched as short a possible on the pathological side of my subject.

Classification:—

The attempt, in the ward, to follow a pathological classification is shown so often in the post-mortem room, to have been unsuccessful, that it seems better in the present state of our knowledge to abandon the attempt.

I propose to divide the symptoms into those of:

I Irritation. implying by this term the direct action of irritants on the walls of the alimentary canal.

II Intoxication, i.e. the effects produced by the entrance into the circulation of the products of microbic activity. Irritation, intoxication may produce their effects either directly or
indirectly by 

leading to: 

A. Imperfect assimilation of food. 
B. Loss of fluid. 

As a complication of Irritation I regard Infection, i.e. the entrance into the circulation of pathogenic micro-organisms themselves. It occurs most frequently, perhaps only, when irritation has gone the length of ulceration. 

Schemes of Treat of the 

I. Etiology of 
   A. Intoxication 
II. Symptoms 
III. Diagnosis 
IV. Treatment 
V. Results & Complication 

I. Etiology of Gastro-Intestinal Irritation 
   A. Causes are Predisposing 
   B. — — Exciting 
A. Circumstances which lower the vitality of the child: 
   1. Dampness 
   2. Want of fresh
(3) want of sunlight  (4) cold, especially
then applied to abdomen.  (5) fatigue.
(6) maternal youthfulness or weakness.
(7) immaturity of child.  (8) Presence of
some disease of congenital syphilis.

(1) damp.

Case 1. Two children, aged 2 months, and 2 years respectively,
begin to suffer from digestive derangement shortly after their removal to a new
house. This was situated on the outskirts
of East London, was well lighted, drained
and not in a crowded district. It
was however exceedingly damp. Its attention
in diet had been made to account for
the trouble as change in diet or other treat-
ment improved it. Later, general
tract entered (suffocating, bronchitis	finally pneumonia) the children were
removed to a dry house where they speedily
recovered their health.

2. Want of fresh air is a fertile source of gastro-intestinal
disorder. Many cases in the ward which
receive all treatment while the weather is
bad, children are confined to the house
recover quickly when the day is spent in the garden.
(3) Want of sunlight.

One corner of the infants ward at Sandwell used to be shielded from direct light by a wooden screen at the door. It happened repeatedly that the child in this corner was found not to digest its food. Removal to a better lighted bed resulted in recovery, but when the child was placed again in this corner its appetite failed again & dyspepsia appeared. The experiment was tried of letting large sheets of glass into the wooden screen & the objection to this corner was removed. In child so cold the digestion of food is sometimes delayed.

(4) Case 3: Child aged 3 years was given a cup of milk after a prodigious meal at the hospital. She was then carried, scantly clothed, about the streets by her drunken mother for 3½ hours. She was then returned to make a complaint about her cut head, for which she had come to the hospital originally. The child was exceedingly cold & vomited the milk she had taken 3½ hours previously curdled but undigested.

(5) Extreme fatigue interferes with digestion.
(6) The children of very young parents often suffer from marasmus due to defective digestive capacity as do children with imperfectly developed gastro-intestinal functions or immature infantes.

(8) Diseases such as tuberculosis or congenital syphilis which lower the patient's vitality are common antecedents to digestive disturbances.

B. Exciting Causes.

(1) Suitable food given in an unsuitable way.

(2) Unsuitable food.

(4) Too much at a time. Child's desire for food is not a safe criterion of the stomach's power of digesting it.

(6) Too frequently. This is injurious partly because stomach does not get time to rest secondly because overstimulation of the breast leads to excess of casein in the milk. (1)

(c) Irregularly. It seems probable that the stomach even in early infancy acquires the habit of secreting gastric juices readily at certain intervals, food given at unequal periods is ill digested.

(d) In insufficient quantities may be due to absolute insufficiency or to the milk being too watery. The latter is due to errors in diet or to the intervals of suckling being too long. An inadequately nourished child is very liable to attacks of gastro-intestinal disorder.

(2) Unreliable food.

Breast milk may be unreliable owing to errors in suckling, or in diet, insufficient exercise, emotions, disease of breast, or general disease, menstruation or pregnancy, or in the case of a wet nurse to the fact that her own child is much older than the foster child. In the vast majority of cases the unreliable food is not breast milk, Rowson loc. cit.
among hand-fed children.

Food may be given for the digestion of which the child's alimentary canal is unprepared as far as amniotic diet to a young infant during the first two months which altogether is scanty. Ptyalin is secreted only by the parotid the submaxillary secreting none till after that period. (1) The chylolytic ferment does not appear in the pancreas till the second month, nor scanty till the 6th or 7th. (2)

Food, such as cows' milk, which is too rich in fat or proteins. The milk of Jersey cows is often extremely rich in fat. An average amount of fat in ordinary cows' milk is from 3.70% - 4.30%. That of a Jersey cow may have as much as 5.0% or 5.20%. (3) It is probably owing to this that Jersey cows' milk so often disagrees with children. The percentage of proteins in cows' milk is much higher than in woman's 4.0% : 1.50%. (3)

(2) Foster. Physiology 5th Ed. p. 1541.
(3) Hall - Diseases of Infancy & Childhood p. 171.
(c) Liquids given too cold.
Cold milk or water when given to some infants will regularly bring on an attack of dyspepsia.
Food which is indigestible mechanically such as tough meat or hard cards.

Be casein of cows' milk forms a hard curd, that of breast milk a flocculent one.
Moreover the quantity of proteids coagulable by acids (in cows' milk) is four times as great as that of the non-coagulable, while in human milk the latter predominates (Leeds).

According to Rudin & Chevane (1)
Rottschield (2) the difficulty in digesting cows' milk is not due to the nature of the curd but to the presence of bacteria. Rudin & Chevane found that children did better on sterilized milk undiluted than diluted, Rottschield confirms this observation.

Here I may remark that great differences in the results obtained by different observers are due to differences in the class of children treated. Children at Shadwell are affected

(2) L'allaitement mixte; L'allait natur.
by slight defects of diet which a child in a healthier place would not notice, & Shadwell children at a convalescent home will thrive on a diet which would prove quite indigestible in the hospital. Still making every allowance in this direction I find it difficult to understand this experience of the French writers. After repeated trials at Shadwell the idea of giving the children to take undiluted cow's milk was abandoned. The only exception were two or three very vigorous children on the surgical side who could take the undiluted milk. Possibly the Paris milk is not so rich as the London!

Ill-health of the cow may make the milk unsuitable. Cows who are still fed in the winter, put out to graze in the spring, frequently get diarrhoea. Their milk is then apt to disagree.

Fodder, such as brewers waste, turnip tops & sometimes gives a bitter taste to the milk & renders it hard to digest.

Permeability of cows milk in the majority of cases is due to Bacterial activity. Milk in the cows udder is sterile; from the moment it enters the body to the time of its absorption by the alimentary canal
it is exposed to every kind of infection. It is liable to become infected:

(a) In the cow's teats
(b) From air in the byre.
(c) Particles of dirt from the cow's body or teat.
(d) The hands of the milker.
(e) Milking pail, other dairy utensils.
(f) In churns during transport.
(g) From substances added in adulteration.
(h) Milk jugs, other household receptacles.
(i) Infants' bottle.
(k) Infants' alimentary canal.

(2) Cow's teats. These are cleaned sufficiently by allowing first part of milk drawn off to escape.

(3) Air of byre. Freeman (quoted by Holt. 1894, p. 144) exposed plate to the air of byre, obtained 1800 cultures in 2 minutes.

Bacteria may be in the fodder, litter, walls, etc. of byre or in the cow dung.

Fodder. Auerbach found that the addition of fresh grass to milk set up butyric acid fermentation, but that 6 weeks old hay had no such effect. (1) Berlin Klin. Wochenschr. 1893 No 14)
i.e. that the 6 weeks drying had killed the bacillus.

The presence of bacteria (which are particularly concerned in gastro-intestinal irritation) on fodder has not been demonstrated sufficiently yet but that other forms are found on fodder to affect the milk has been shown, so it is at least probable that the other bacteria may do the same. For instance, Moeller (1) found on Timothy grass a bacillus which closely resembles Koch's tubercle bacillus.

In Norway a clootted milk (Taetmælk) is much used, which is. The clotting is caused by a bacillus found on the leaves of the common Butterwort (Pinguicula vulgaris) leaves of this plant are either placed in the milk or put in the cows fodder (2).

(2) Dairy Bacteriology, Freundreich, pp. 73-82.
it undisturbed till later, infection was avoided.

(1) well of byre. Freundreich gives a case of infection of a byre by the "straining milk" bacillus in which complete disinfection of the whole byre was necessary.

(2) Cow dung.

Flugge found that cow dung in summer, when cow was fed on green food, contained many more microbes than when it was fed on dry fodder, that the annual byre were harder to keep clean and consequently infection was more common. To show the extent to which milk can be contaminated with cow dung reference may be made to Renke's observations. Renke examined 90 specimens of milk in Halle and found cow dung in each, varying in amount from 14.5 to 186.0 million per litre.

Auerbach found that milk infected with the dung of cows fed on certain plants

(1) Freundreich loc. cit.
gave the same results as when it was injected directly by the plant.

a) Particles of dirt from the udder or flecked off the body by the swing of the cows tail often fall into the milking pail.

b) It is the custom of many milkers to dip their hands into the milk in order to obtain a better hold of the teats.

c) Milking pails are sterilized.

They should too be provided with a sieve to catch any particles of dirt that may fall into them.

d) Churns. The ordinary churn is so high that the bottom cannot be easily reached by the average arm to be cleaned.

When the cleaners fingers do reach the bottom it will be seen that his axilla (frequently unwashed & often sweating freely) rests against the edge over which the milk is to flow.

e) Irritant water is sometimes added to milk.

f) Milk pugs, basins etc in the house are often cleaned very imperfectly & the milk is exposed to numerous chances of infection.

The infant's bottle, especially the sort with a
long rubber tube is a fertile source of infection.

lastly the child's alimentary canal in summer especially may swarm with bacteria which are ready to form irritants and toxins out of even sterile food.

Bacteriology of milk.

Bacteria in milk may act directly or indirectly on specific organisms of a disease or indirectly by setting up changes in the milk. The latter may be harmful because of toxins produced or because of formation of acids.

There is hardly any limit to the number of varieties of microbics that may be found in milk.

Some of general diseases such as diphteria, typhoid, scarlatina, tuberculosis, etc.

The two latter according to Holtt may occur without disease of the udder.

Staphylococci, streptococci etc.


Diseases of infancy.
Bacilli which have a great influence on milk but are not of importance (so far as is known) elsewhere.

Hügge(1) heated milk to 90-95°C. This killed the lactic acid bacillus, the protein group or most of the B. coli communis. The remainder grew slower, which thrived better at a temperature of 30°C than at 20°C.

Luebber(2) went through Hügge's experiments and corroborated his results. In boiled milk he found (a) one pathogenic obligative anaerobic bacillus giving to the strong smell produced by this microbe when decomposing milk, it is not likely to be administered.

(b) 3 virulent aerobes or facultative anaerobes. These peptonize casein leaving sugar and fat untouched. Introduced by mouth into alimentary canal of puppies they set up severe diarrhoea killing the animal in 4-7 days. Old dogs were not affected. The severe phenomena produced in the puppies were those of intoxication as bacilli being found in the circulation post mortem.

---

(1) Hügge Zeitschr. f. Hyg. 1894 p. 272
(2) Luebber- Ped XXII p. 1.
Luebert came to the conclusion that toxic principle was in the bodies of the bacteria that these had to be present in sufficiently large numbers to produce toxic symptoms.

An argument against keeping milk long in hot weather.

Acid formation.

In gastro-intestinal derangements in infants there is an abnormal quantity of acids in the circulation (1) with a corresponding increase in the amount of NH₃ excreted in the urine (2). The acids are lactic, acetic, butyric, and other fatty acids. The source of them is the fat in the milk; the sugar proteins have little effect on their production.

(2) Czerny & Keller: do. Bd 45 p. 274
   Van der Bergh: do. " p. 268
At present it is not known which bacteria produce which particular toxins or irritants. There are three groups of bacteria concerned. (1) The normal inhabitants of the gastro-intestinal canal.

(2) The bacteria commonly found in milk at any time. (3) Special ones which only appear after prolonged heat or reach the alimentary canal either in the milk or by these or other channels.

The difficulty in the way of finding a specific microbe lies partly in the fact that the virulence of the normal inhabitants varies greatly at different times under different conditions, especially in association with other bacteria. Partly that the virulence of a bacillus can be raised almost indefinitely by passage through animals, and also that under cultivation, bacilli lose their characteristics if a virulent, capsule, pneumococcus can be cultivated into a non-virulent, uncapsulated streptococcus with no diplococcal characteristics.

Before going on to pathological conditions it will be well to touch on some of the physiological characteristics of the child's alimentary canal.

**Bacteria normally present.**

Before birth the intestinal canal is said to be sterile (1), but a few hours after birth it is invaded both by the mouth and anus. According to Escherich only two bacteria are invariably present—the B. lactis aerogenes and B. coli communis. According to Rothien (2) the B. butyricus is also always present.

Van Nutteren (3) found a variety of bacteria in the stomachs of infants; here I need only remark that he found about 20 times as many bacteria in the stomachs of breastfed children as in those of breastfed. Also that digestion had little effect on them, so that they were to be found in an active state in the fasting stomach. It is a suggestive coincidence

---

(3) Wroth. No. 22. 1888.
that the mortality from intestinal diseases among children brought-up on cow's milk should have been found (by Beccik.\(^1\)) to have been just 20 times that of breast-fed children.

Some of the characters of these bacteria are of the utmost importance clinically.

**B. lactis aerogenes.**

Inhibits the upper part of the intestine, decomposes milk sugar with formation of lactic (Escherich\(^2\)) or acetic (Raginszky\(^3\)) acids. It has no action on starch. It not only does not decompose casein but inhibits the action of the casein decomposers. Lower down the canal where the milk sugar is absorbed the casein fermenters have free play. Escherich deduces a line of treatment from these facts.

**B. Coli Communis group.**

These flourish chiefly in the colon, they decompose albumen, salts form lactic acid. The members of the group differ from one another not only in

---

(1) Arbik. 6th Congr. f. Hg. Vienna 1887.
size, shape, motility, or number of flagella but also in virulence. Some coagulate bulk in 48 hours others only after 20-25 days. As a rule the B. coli Comm. are harmless; occasionally they become virulent. Their virulence can be increased directly by passage through animals, indirectly by association with other bacteria. (4) Widal & Nezançon found they became virulent when inoculated along with B. typhosus. In the same way other bacilli when associated with B. coli Comm. become virulent or more so. (3)

e.g. Widal & Nezançon found a non-pathogenic streptococcus became virulent when injected with B. coli Comm. subsequent passage through animals increased its virulence.

In two cases in which the virulence of streptococci was increased by association with B. coli Comm. lesions of the cells of the anterior cornua in the spinal cord of rabbits were produced. (Ibid)

(2) de Klecker. Annal. Inst. Pasteur. IX 1940.
The B. Typhosus of Rokitansky is harmless. The B. Pneumococcus is the Proteus group are not infrequently seen, but may become virulent (1). Finally the pneumococcus though not a normal inhabitant is frequently found. It plays an important part in producing some of the complications of gastro-enteric disease. In dysentery septicaemia, intestinal disturbances are often very acute.

The 

The faeces in infants normally are in colour dark green till the cream has been passed, then become golden yellow in breast-fed, pale yellow in infants fed on cow's milk. The colour depends to some extent on the amount of casein in the food more on the quantity of fat. An increase in casein makes the stools pale; an increase in fat deepens the golden colour. Sugar, rather than sugar have the same effect as cream. In this respect with underfeeding the colour may change to green. Odour slightly sour, not offensive. Consistency soft, butter-like in breast fed, firmer with cow's milk, with the latter there.

is a larger residue of cases of fat.

Reaction

In breast-fed is always acid (due to lactic acid according to Affelmann) & fatty acids according to Kiedel). Composition varies considerably.

Proteins of breast milk form only 1.5% of the dry residue (Affelmann).

Fats vary from 4-35% (Affelmann & Tschernoff).

Bilirubin, hydrochloric acid, cerebrospinal fluid, mucus epithelium \\

and occasionally.


Symptoms of Acute Irritation.

Expression: acute

Varies with the child. In mild cases in chronic cases is pensive, discontented. In severe cases anxious or frightened. In still more serious acute cases in advanced chronic cases the child often has a pre-occupied look as if absorbed in its own thoughts. This is also common in meningitis.

In mild cases the first change in expression
may be noticeable when the child is asleep, or may be imperceptible when it is awake. One of the earliest manifest characteristics is a raising of the brows as if in surprise with a drawing back of the angles of the mouth often not amounting to a smile during sleep.

The earliest indications of digestive derangement are to be observed when the child is asleep, in some children, this circumstance may prove of great value. In premature or wasted infants, the slightest error in diet is often followed by swift disasters, one or two meals of unsuitable food may under the good effects of several weeks' careful treatment. The harm is done so quickly that by the time the more obvious symptoms are observed the disorder may have acquired an undesirable amount of momentum.

When observing a sleeping child care must be taken not to leave an unnatural amount of light on its face, to see that it is not too hot. The first change is that the child sleeps quietly but is more readily awakened than usual.
that he awakes repeatedly of his own accord sometimes with a violent start. Healthy children when first put to sleep often wake up 2 or 3 times before getting properly under weight. The dyspeptic child exaggerates these phenomena. The start differs too in the two children. If a healthy infant be held in the nurse's arms, sometimes tickles the axilla gently, the child, in a great many cases, will give with a curious sort of start, a cry with delight.

Healthy children sometimes starting in their sleep give a similar start. The dyspeptic child's start expresses fear or repulsion. The distinction is of small clinical importance but I am convinced it exists.

All this time the child may not have cried. Children vary a good deal in this respect but in many cases dyspepsia may have made considerable progress before the child cries. These symptoms alone may in certain conditions warrant a change in diet. If, for instance, a wasted infant, the proportion of one of the constituents of the milk has been recently increased, it may be well to diminish it for a few days.
Attitude

With discomfort in the abdomen older children often lie on their faces. With intestinal pain, especially with flatulence, the legs are drawn up, back stiffened, the head may be retracted. In one case (No 4) at 4 months the degree of retraction was extreme but was quickly stopped by applying a poultice to the abdomen giving a dose of a carminative. It recurred with the attacks of colic. The child recovered completely and developed no signs of meningitis subsequently.

In serious cases the patient often lies with the back of the head applied to the pillow instead of one cheek.

In many cases there is nothing characteristic about the attitude at all.

Alimentary System.

Lips may be unaffected unless irritation has gone on to inflammation a shot often become dry and cracked. Tongue usually clean dry until inflammation sets in then becomes thickly furred.

Appetite is usually diminished in acute irritation it is often capricious, during
fasting child may be so uncomfortable as to take anything that is offered. This is not true appetite for, if the discomfort be alleviated by a poultice, the child will refuse the food. Where there is fever or loss of fluid the patient may be very thirsty. A child of 7 or 8 months in these circumstances who offered two cups, one containing water, the other milk or some food will choose the former.

Eructations are common of sour smelling gases. Flatulence is also common, where the intestines are affected. Dilation of the stomach can be detected very seldom in acute cases which have not had previous gastric trouble. Personally I have never satisfied myself of its existence.

Where there has been previous gastric irritation, it can be seen where there is retortation with lightheadedness of muscles throughout the body. Regurgitation is exceedingly common & most often is the earliest waking symptom of gastric irritation. There is no such thing as "physiological vomiting." The milk regurgitated may be unchanged, or curdled or go on in the same

\[\text{\textcolor{red}{\textbf{？}}}\]
Vomiting. The vomited matter usually consist of curdled milk, curd, fatty acids, bile if severe. If irritation has gone on to inflammation mucus serum blood may be present. The mucus seems to be the only reliable evidence of inflammation of the mucous membrane.

Peristalsis is delayed at first for a longer or shorter time (i.e., where there is no intoxication). Food may be found in the stomach 5 or 6 hours after a meal whereas normally the stomach should be empty in about 2 hours, at the same age.

Later on peristalsis is much increased. Carrin & Roger found sour in the stools 4½ hours after it had been given by mouth where the irritation is low down the colon, prolapse of the rectum may take place. Feces undergo considerable changes.

Blood-streaked. The earliest change sometimes is the appearance in the stools of undigested lumps of fat or cascin.

This is followed, (in some cases preceded) by change in odour, the normal sour smell becoming more accentuated and penetrating. From this slight change the smell may range through that of the different volatile fatty acids found in the faeces to the putrid smell of *Clostridium botulinum* to that of diseased fish.

**Colour.** The golden yellow may change to very pale yellow nearly white without other evidence of biliary disturbance. May get quite white without jaundice. The colour may then change to greenish yellow finally green.

With great excess of fat the stools may acquire the glistening character described by Kiedert and others but this does not happen often. I have not seen these stools more than 10 or 12 times.

The green colour is very common, the green portion may be mixed with yellow or the whole motion may be uniformly green. Its shade it ranges from pale emerald to nearly black. I have seen a curious

---

peacock-blue green shade. The odour of these was
sickening to a degree, of decayed fish
combined with a suggestion of new mown
hay. I saw these stools in children with
severe inflammation of the gut's intestinal
canal in summertime. 10 out of 12 cases
died.

The ordinary green colour in most cases
is bilirubin derived from bilirubine. The change
Kiedert \(^1\) thought was due to acids formed by
fermentation in the intestines but Pfeiffer \(^2\)
has shown the change to be due to alkalis probably
in the small intestine. In their passage through
the large intestine the motions may become
acid again without affecting the colour.

This intestinal alkalinity is a pathological
condition. Green stools are seen where
the child is underfed \(^3\) . They also appear
when too much milk is taken, owing perhaps
to the supply of HCl being insufficient to
form an acid combination with all the proteins.

The administration of alkalis will turn stools green.

\(^1\) Kiedert, Jahrb. f. Kinderheilk. XII p. 187.

\(^2\) Pfeiffer ---- B248 p. 165

\(^3\) Czerny & Mooser ---- 38 p. 430.
In a few cases a chromogenic bacillus is responsible for the green colour. (1)

The motions may be dark owing to presence of blood or coloured by drugs.

Consistency varies in every possible degree from the normal butter consistency to a specific gravity little above that of water.

In some severe cases fairly solid faces are passed accompanied by a quantity of fluid.

Reaction usually acid, sometimes neutral or alkaline (of watery stool) or very rarely alkaline in one part and acid in another.

Number varies from constipation in the early stage of irritation to one every few minutes in severer. The number to be regarded as pathological varies with the child. Some pass 4 daily. I should look however with suspicion on 4 if they were in any respect abnormal treat the child.

Mucus.

The presence of mucus is very important as indicating inflammation. According to Hott, nasal oblique limbs of mucus indicate dosage Rev. of Med. XIV 1030.
inflammation of the large intestine, microscopic particles that of the small.

With rufuse in the color stools may be seen consisting entirely of mucus and blood. I have known two cases diagnosed as intussusception, one operated on.

Fragments of membrane in cases of ileitis are sometimes seen, worms, ova, foreign bodies, undigested food (meat, pasty etc.) bacteria of all sorts, are found in other cases. Assimilation of food becomes impaired (p. 57).

Abdomen

In mild cases there may be nothing noteworthy.

Severe inflammation with numerous ulcers may be found post mortem with no tenderness on palpation during life.

Distention of the abdomen in recent cases is probably an intoxication phenomenon. Liver is frequently enlarged even in cases of short duration.

Hemopoietic

The serous glands are almost invariably found enlarged p.m. in severe cases.

In one mild case, dying from another cause, there was no enlargement.
Spleen usually is not affected.

Blood in short acute cases often no change. If the rapid anaemia occurs the an intoxication phenomenon. In cases of chronic irrit., great change occurs.

Circulatory

The circulatory changes in acute irritation are due to the pain felt. If there is only discomfort there may be no change. With advent of an attack of colic the pulse is at first quickened, then slowed.

Marked slowing of the pulse (as in a case described by Heno) is extremely rare. I have never seen a case.

Respiratory

Respiration usually is unaffected except during pain when it is quickened, slowed like the pulse. Slight asthmatic breathing I have seen 3 or 4 times, but a regular asthmatic seizure I have never seen. In one of these cases of asthmatic breathing (child aged 4 months) the wees worked, suggesting pneumonia strongly but...
The respirations were deep, not hurried. This was enough to exclude pneumonia, I believe. The absence of physical signs, a normal temperature, etc., do not exclude pneumonia absolutely. Cough, a short, dry cough, is common in dyspeptic conditions; commoner in chronic than in acute. In the latter cases there is frequently slight laryngeal irritation as well. The cry being coarse.

Integumentary.

Nodules, usually localized, sometimes general, is occasionally seen without jaundice or visible change. Sweating during attacks of pain is common; sometimes puritic eruptions. Arthralgia is not often seen in dyspepsia from milk. It is an intoxication phenomenon.

Urinary.

Quantity varies, after colic large quantities are often passed. If there is fever the usual changes accompanying high temperature occur, apart from intoxication albumen is seldom seen.

Nervous.

At first comes a stage of hyperacidity; patient is peevish, easily annoyed. There may be general
convulsive (apparently from reflex irritation apart from intoxication) or there may be local twitchings of face, or limbs, or of small groups of muscles. e.g. case aged 17 months, where twitching of right thumb was the only convulsive movement seen. Tonic contraction at the angle of the mouth is common. Tonic & irregular clonic movements may occur in different parts at the same time. e.g. case aged 7 months had twitching of both sides of the face equally & clonic movements of the arm, with rigidity of the legs. Castor oil brought away a mass of currants & patient quickly recovered.

Tetany is not infrequently seen either at onset of the attack or after 2 or 3 days. If irritation continues or was very severe a stage of depression ensues. Child becomes apathetic or may be collapsed. The mental functions may be temporarily impaired. e.g. child aged 2 years & 3 months had learned several letters & could say them without mistake. Immediately after the excitement stage of an attack of gastric irritation gastrointestinal
irritation she took up her book but seemed unable to remember any of the letters though she went over them voluntarily she was dull, confused and mixed up her words. After passage of half an offensive motion she quickly recovered.

Nefesek records a case of aphasia during sleep, night terrors and night terrors are common. The hallucinations of the latter may persist for some time after child is awake.

Symptoms of Chronic Irritation
Chronic irritation probably always results in more or less inflammation.
As far as the production of symptoms goes the inflammation seems to play a subordinate part since that one can have nearly all the symptoms of inflammation (diarrhoea, vomiting, prostration, pain, etc.) without any inflammation discoverable post mortem.

(1) Nefesek. Lectures on Child. 1862. T 171
and profound inflammation without
feverish sickness or pain. e.g.
(Case I) act. 13th. Post-mortem there was
found severe inflammation of the
large intestine & less in that of the
end of small. Several tubercular ulcers
in large intestine one nearly 3/4 inch
in diameter. The child had no diarrhea
or vomiting or pain on palpating abdomen.
4 such cases occurred in one summer.

**Expression** varies according to
the nature of the child & degree of irritation.
With long-continued mild irritation an expression
of friendliness or sufficiency is usually seen.
Some children acquire a look of absolute forlornness.
It varies partly with the way the child is
treated, more with the child's character. Some
children have a look of patient resignation.
This expression becomes more common
in the severer cases & towards the end of the
disease. Forehead becomes lined vertically above
the nose in recent cases, horizontally
in long-standing. The nasolabial line is
rarely absent
complexion often earthy. This tint not
infrequently clears away for a time to
return after a relapse. Sometimes the
complexion is translucent all the time.
The nose often becomes narrowed as if
pinched above the nostrils.
Attitude adopted may be any of those mentioned
under acute iritis (p. ) A common
position is for the child to lie against the
pillows with the elbows flexed close to
the ribs, the hands raised to level of the
shoulders, close to them, with the palms
turned forwards upwards. The back of
the head may be kept so persistently against
the pillow as to wear a bald patch there.
Appetite. Very capricious, sometimes the
child will refuse all food for several
days, become reduced greatly in strength.
This is not owing to pain or to an inability
to digest food for if it is fed with a
stomach pump the food becomes
digested. These spells of anorexia often
only last 3 or 4 days.
Irritation, vomiting may be absent
Nystagmus is very common.

Diarrhea is frequent in large majority of cases may be moderate or 4 or 5 motions daily there not very big, or there may be a similar number of very large motions, in these cases the patient loses very rapidly or there may be very numerous small motions. The latter indicate special involvement of the large—the former of the small—intestines. The death with few small motions is not so serious naturally as the other.

The alterations in the quality of the stools are similar to those described on (p. 1)

Abdomen—The great characteristic is flaccidity of the abdominal walls with induration of the skin. Sometimes it becomes as doubtful as it is in advanced cases of tuberculous meningitis. The muscular flaccidity affects the intestinal walls also, therefore the abdomen gets distended very easily. The stomach dilates too, but not as easily as the intestine. The liver is very frequently enlarged and is often found p.m. to be fatty.

Hepato-pleuritic, anaemia is always present.
often to a marked degree, chlorosis occurs, but is rare. Spleen is seldom enlarged apart from congenital affections, rickets, tuberculosis, etc.

The mesenteric glands are enlarged to some extent, probably in every case.

Circulatory.

There is sometimes a greyish or even bluish tint of the upper lip in severe cases; cyanosis of cheeks or chin. Pallor of the face or pallor round the mouth is very common. The heart may stop beating before respiration fails but as a rule the reverse holds.

Respiratory.

Respiration are not affected as a rule except by advancing weaknesses, then they become shallower. This effect is probably due to defective assimilation.

Catarrhs of the air passages are very common of rhinitis, pharyngitis, laryngitis, bronchitis, pneumonia.

Urinary, often copious, deposits of urate.

\textsuperscript{1} Tschernoff Jahrb. J. Kinderheilk. Vol 46 p. 153
Trees of albumen are seen occasionally frequently no change is found in the urine.

Nervous

The usual result of chronic irritation is depression of the nervous system. There is stiffness of the muscles, diminution for exertion or depression of the mental faculties. Taste is sometimes percepted apparently not due to local condition of the mouth. A child old enough to explain will say that the food tastes like some particular disagreeable thing.

Night terrors and disturbed sleep are common.

Intoxication

This term covers several morbid processes.

(1) It chiefly denotes the absorption of toxic substances (albumoses, alkaloids, etc.) produced from proteids by bacterial activity. This is the most important group. These toxins are probably the result of imperfect digestion.
(2) Some symptoms are probably due to the absorption of acids, which have resulted from fermentation.

(3) It is probable that some of the toxic substances are produced by the liver whose functions become greatly altered in gastro-intestinal intoxication. It is known that the capacity for digesting milk sugar is lowered in gastro-intestinal disease, probably owing to disturbance of the liver functions.

(4) It is possible that the kidney may add their contribution to the general toxemia, but as little is known about their action I may omit it here.

**Symptoms**

May appear a few minutes after taking food (or milk) where the toxin has been elaborated in the milk before taking it or not infrequently happens in the summer time. In these cases the child very rapidly comes under the influence of the poison which shows itself by profound depression. Where the symptoms appear more slowly there is frequently a short stage of excitement before the depression.

Expression. If the child is not unconscious, it often has a bewildered and confused expression reminding one of a child facing under the influence of chloroform. It vainly struggles to give expression to some emotion. Sometimes it lies quietly but looks about warily, as if it had a sense of impending disaster. At other times a child will become silent, quiet, and gradually pass into unconsciousness without a protest. At this stage (while in the above-mentioned stage) it makes ineffectual struggles often without uttering a sound. Usually, the movements are vague and purposeless sometimes they are movements of distress often it writhes the body about with arms held stiffly out, before it fists clenched and everted, head turning uneasily from side to side, lips firmly compressed.

The Gastrointestinal System

Lips, mouth, and tongue unaffected unless there be accompanying irritation. Flow of salivae sometimes completely inhibited for a time, as the condition passes off may become profuse. Vomiting usually incessant, the materials...
Marrow-wound being stomach contents sometimes curdled, often unaltered, like blood if the vomiting is vehement.

Diarrhoea is likewise urgent - the stools may be normal to begin with, unless the intoxication has supervened on a previous irritation, then become watery. In severe cases (as cholera infantum) the stools may consist of little but water & shreds of epithelium.

Liver. In about 1/3 of the cases in children post mortem found to be fatty. This fatty change may take place apparently in 2 days time; i.e. a child who was in perfect health a day before admission, was attacked with severe diarrhoea & vomiting & died the day after admission. Post mortem the liver was very fatty.

The digestive powers may be suspended for some hours, especially during the stage of depression. bulk removed from stomach after 6 or 8 hours may be quite unchanged. Drugs & stimulants given by the stomach may not work till some time later.

Peristalsis may be suspended & the muscles
of the alimentary canal become flaccid allowing passive distension of stomach and intestines. This is a bad sign.

Haemorrhages are not infrequently seen, sometimes from stomach, bowels more often subcutaneously. In the former case, post mortem, there may be nothing to show where the haemorrhage came from. In the latter common situations are the lower part of the abdomen, flexor aspects of the arms, anterior surfaces of the legs. Less common sites are the elbows & knees. In one or two cases the haemorrhages have been general. I have not seen a case in which they occurred on the peritoneal surfaces where the cause was a toxin introduced with or mixed in the milk. Their appearance is a bad sign but the prognosis is not always fatal.

in wanted infants similar haemorrhages are
sometimes seen but usually after infection has set in.

Spleen is sometimes enlarged & congested

If there has been much loss of fluid it may be anemic & tough.

The mesenteric glands in cases of pure intoxication are not enlarged.

**Circulatory**

During the short period of excitation the pulse is quickened, as the depression becomes evident it is slowed & feeble or at times becomes too rapid to count, the former much the more often. The heart sometimes fails before the respiration. It may become quite irregular.

*However* but this is not so frequently the case as an examination of the pulse would lead one to suppose. The pulse is not so safe a guide to the heart's condition as auscultation.

One characteristic very often observed in the severer cases is the weakening of the first sound compared with the second.

The heart sometimes shares in the general muscular listlessness & dilates on the right side. While it is very difficult to diagnose dilatation of the heart in children of 1 or 2 years of age
And one does well to be sceptical about one's observations when there is a priori reason for expecting, a certain condition which is found, still I feel confident that in dilatation can be frequently found in those severe cases in which there is rapid distension of the abdomen and slowing of the pulse.

Respiratory system is also profoundly affected. Respirations were usually quickened during the excitation period. In one case while the child was evidently in a state of hyperexcitement, looking about with a frightened air, starting when approached etc., the respirations were slow, full and panting while the heart was beating too rapidly to count. Sometimes they are very rapid, e.g. child at 8 months - 70 resp. per minute, this lasted only about 2½ hours.

Respirations may be irregular sometimes. In one case of an older child (5½ years) the respiratory mechanism seemed thoroughly disorganized, the respirations themselves being irregular with no regular rhythm.
more rapidly than the thorax. The proportion varied every few minutes, at one time it was as 7: 5 to 7 movements of aares 5: 5 of the thorax. The child died. There was no pneumonia at no meningitis visible to the naked eye. Bacterial examination of the brain fluids was not made.

In the latter stages the respirations became slowed and child dies from respiratory failure.

This slowing of the respiratory mechanism is similar to that caused in rabbits by poisoning with acids.

Integumentary system is affected chiefly by vasomotor changes (vide infra). The slight induration of the skin over the abdomen seems to be due rather to loss of fluid than to the intoxication.

Urinary

Urine may be suppressed temporarily, then if the loss of fluid by the bowel be not excessive be increased, or child may die without any increase. It is reasonable to suppose that a condition of uraemia exists not infrequently in severe cases though it is.

very difficult to prove its existence.

Transient albuminuria is not uncommon without blood casts. Inflam.

of the kidneys in severe cases (of cholera infantum), according to Ballard, is invariably present.

**Nervous System**

Depression of the nervous system is the characteristic feature of intoxication. It may be preceded or followed by a short stage of excitation shown by hyperesthesia. The child screams when anyone approaches it, or if the bed is shaken or door banged. It may be very irritable, restless, and occasionally in almost maniacal biting at people, biting its own fingers, tearing out its hair, clawing at the bedclothes. (One case at 2½ years had to have its arms confined, the fingers were bleeding; handfuls of hair were scattered about the bed.) Following this may come the stage of depression directly, sometimes trembling of the hands, feet, or general convulsions which are nearly always tonic (clonic are very rare).

usually there is a general stiffness of body limbs, the arms legs extended, the fingers clenched over the thumbs the arms crossed on the chest, the toes pointed sometimes in position of tetany. Sometimes this degree of rigidity is absent the limbs are in their usual position but resist movements.

Reflexes. The corneal is usually present but is oft very slow. Pupils affected irregularly. Perhaps the most common thing is for them not to be affected at all, next most frequently they are tightly contracted. Sometimes one is larger than the other. They react only sluggishly to light or accommodation. Very frequently, however, they react normally. When tightly contracted they do not respond at all.

The sucking reflex may be absent in 2 cases the passage of the finger behind the epiglottis produced no reflex. Lacrimal reflex may be unmarked allowing food to enter the lungs.

With regard to the skin & patellar reflexes they were present.
seen on the whole to be well marked, if not exaggerated, in the excitement stage & the less well marked in the depression stage but they vary very much.

Vaso-motor functions.

Extreme pallor is most common, sometimes with fugitive erythemas.

Sweating may be profuse & then in general. In one case the sweating was confined to the hands & forearms.

Urteria from milk intoxication is rare.

Transient icterus is not uncommon.

Transient edema may be seen in above case of localized sweating edema of hands & forearms followed the sweating.

That the edema sometimes seen are not always due to the diarrhea is shown by a case in which there was edema of legs & arms (up to knees & elbows) on admission. The edema disappeared while the diarrhea continued. Post mortem there was no nephritis.

Removable bulges at first become depressed coincidently with loss of fluid.
Locomotor System.

In the depression stage laxity of the muscles throughout the body is very characteristic of intoxication. The eyelids droop, eyes are turned upwards (as in sleep.) The muscles of the face are relaxed. In a wasted child whose face is wrinkled many of these may disappear leaving the skin smooth (as in an adult with paralysis of the face). The arms slugs lie limply.

The heart is weakened & the respiratory movements are shallow, partly from action of the poison on the respiratory centre, partly by its action on the muscular mechanism.

The muscles of the intestine & of the abdomen are affected as I have described above.

Temperature

In less severe cases, temp. is raised at the outset & then falls. This fall may be due (1) to improvement or to (2) further poisoning. In very severe cases it is often subnormal to begin with & may then (a) continue subnormal till death (b) rise to normal or a little above it.
tencephalic or (v) may rise to a great height 107 or 108°, result in death with hyperpyrexia or as very often happens rise to 103 or 104, remain at about the same level for several days, slowly descend into the chronic stage.

Some observations of Sidney Martin's (1)
on the action of the Klebsiella bacillus or B. anthracis are interesting.
The B. anthracis digests proteins forming successively various albumoses, peptones, lactic, tyrosin, finally an alkaloid.

"The albumoses are the fever producers, the alkaloids the coma producers." Death is due to the alkaloid.

In the case of the diphtheria bacillus the end product is an organic acid which is unimportant, the albumose is the poison.
The albumose of the anthrax bacillus in a medium dose causes a rapid, high rise of temperature, fever for several days, a larger dose a less pronounced rise, shorter fever. A fatal dose causes only a slight rise, sudden fall and death in a few hours. The analogy between

The temperature here, in severe intoxication, is suggestive.
To determine how low the temperature may fall, special thermometers are
necessary; the ordinary clinical ones are useless. In one case it fell
(in the rectum) to 89. In another to 91. Temperature not very infrequently
risks post-mortem.

Symptoms due to loss of fluid.
The expression is anxious, eyes become
sunken with dark, venous engorgement
of the lower, more rarely, of the upper lids.
The irises are half-closed. Mouth is
dry, without inebriation
Abdomen — skin slightly indurated

This induration sets in very quickly.
Kjellberg (1) believed it to be a reliable
indication of nephritis, but in numerous
cases it disappears when the loss of fluid
is stopped or when sufficient fluid is given.

(1) J. Kinderkranke. 1870, p. 275.
It may be found in over 80% of cases. A typical case was the following: A child of 8 months was admitted on the 3d on which the disease diarrhea, vomiting set in.

The case was one of cholera infantum with profuse watery diarrhea, but the vomiting though incessant before admission was not severe after it entered the wards; in 3 hours time the child was able to absorb large quantities of water from the stomach.

On admission at 10:15 the skin over the abdomen was not indurated; at 3 p.m., the loss of fluid having been immense in the interval, the skin was dry and indurated. By 6 p.m., the induration was well marked.

Hot water was given by the mouth as freely as the child would take it. The lower bowel was irrigated with hot water and saline solution to the extent of 1/2 pint was given subcutaneously, the two latter beginning at 5:30. By 10 the next morning the diarrhea had stopped, the skin over the abdomen had lost its induration. A diminution in the induration can be sometimes perceived after a large
subcutaneous injection of water.
One must be taken during examination that the abdomen is not distended with flatulence (as occasionally happens during a temporary abatement of the disease). The distension obliterates the appearance of ind activity.

Measures directed towards relieving the kidneys produces no effect on the indelibility unless it be to increase it. Integumentary.
The skin is often greasy or cyanosed round the mouth or the cheeks. Urine is diminished or suppressed. I do not think that albuminuria exists as often as some writers, as Kyllberg supposed, it is difficult to examine the urine in these cases but so far as I have seen it is not common. Blood is exceedingly rare.

Nervous system
The nervous phenomena are those described as hydrocephaloid.
The fontanelle is much depressed if the process is longcontinued especially
in wasted infants the skull bones may overlap the occipital and frontal always slipping under the parietals because the circumference of these bones at the lambdoid and coronal sutures is less than that of the parietals.

The parietals very seldom overlap when they do so the left is said to pass under the right. [1] I have never seen the parietals overlapping except once, in that instance the left passed under the right.

Mayer Jahrb. für Kinderheilk. 1883 p. 126.

Symptoms of imperfect Assimilation

An inability to digest food is not always primarily due to gastro-intestinal derangement. It may be owing to imperfect development of the digestive powers as in premature infants, or to lowering of digestive capacity owing to insanitary surroundings, or to congenital syphillis, tuberculosis etc.

Improper feeding however is very often the primary cause or equally often exaggerates
a preexisting digestive weakness.

The most striking characteristics of a wasted infant are (1) the dire results which follow slight indiscretions in diet and (2) its liability to infections.

**Appearance** (In a long-standing case) with wasting of muscles, disappearance of fat, the features become pinched and sharpened. The cheeks sink in, round the sucking pads which do not waste so rapidly, stand out prominent conically. The face ages quickly, numerous wrinkles appear. Sines round the angles of the mouth. The eyes remain bright but peer out, the eyelids droop, the eyebrows fall, the lids every day lose definition, the mouth is often quite different to that of a child who has wasted rapidly from acute gastro-intestinal irritation.

**Alimentary**

The mouth is often invaded by thrush. Appetite usually excellent, sometimes capricious, alternating.

**Defecation** The bowels are often constipated or relaxed.
Abdomen is often very prominent, its walls feeling with inelastic skin. Sometimes the abdomen is as tough as in a case of meningitis.
Liver usually enlarged.
Diarrhoea is commonly green (apart from gastro-intestinal irritation)
Hae mopidotic.

There is always anaemia, this may be profound. Sometimes there is extreme diminution in haemoglobin (10-18% in a case of Holsk (1))
The glands in neck, supraclavicular region are nearly always enlarged. The succentorius glands invariably so.

Circulatory
Circulation is feeble. Hands, feet, nose and cheeks are often cold and sometimes cyanosed. Haemic murmurs are common.

Respiratory
Breathing becomes weak in the later stages.Collapse of portions of the lungs is very common. In extreme cases the child seems to find the exertion of breathing so great he has to be stirred up frequently.

Holt, Dis. of infancy, 9th ed., p. 207.
This is especially liable to occur during sleep of about 7 or 5 months. They first admitted this child used repeatedly to stop breathing and had to be roused up. If left to itself the face would become intensely cyanosed & the pulse would begin to fail. A nurse had to be defeated to look after this one child to sit it up when necessary. As it improved the child could be trusted to breathe in the daytime but for several nights when asleep was very apt to stop breathing. It finally recovered.

Collapse of portions of the lung also apt to occur at night in particular about 4 or 5 a.m. when child's vitality is low.

Infections of the respiratory tract are common.

Skin becomes dry, with bronzing, desquamation, its elasticity diminishes & the hair falls out readily. Oedema over the skin is seen not infrequently even where there is no tubercle. The skin sometimes has an unpleasant odour.

If the child be washed clean, after being kept wrapped in a clean blanket & kept away from his bed allowed to sit warm this odour may be very often noticed in a few cases the children perspire freely.
especially about the head (with no other sign of rickets) one case (after 3 months) once had a curious attack of profuse perspiration accompanied by rapid breathing the whole lasting a few minutes,

Erysina in common & eczema intertrigos of subcutaneous shiners occasionally appear 20 to 50 there may be at one time.

Nervous system.

The children are irritable till the process has advanced then they become apathetic. Reflexes become dulled, unless over foreign bodies they excite little coughing. The corneal reflex becomes blunted. Ulcers form on lower half of cornea.

Purulent staph. media is exceedingly common.

Diagnosis.

In the most part irritative symptoms affect the alimentary canals locally while intoxication affects the nervous system in particular. The relevance of the symptoms, the constitutional disturbance
the absence of changed (in counted matter or stools) sufficient to account for the severity of the attack point to intoxication. If traces or streaks of epistheline are in the stools or vomit the case is one of irritation which has gone on to inflammation. In some cases it is impossible to draw a sharp line between the two as most of the severe cases both are present.

While different parts of the alimentary canal may be affected alone in very mild cases of short duration, severe or chronic cases it is probably affected throughout to a greater or less degree. Of the symptoms point only to the implication of one part. Tenbroeck examined 70 cases of disease of the digestive organs in children. In every instance where the intestine was affected with inflammation a similar condition was encountered in the stomach. Whether gastric symptoms were present during life or not? Ginger & Moore.

say that the stomach & intestine (in Appendix & gastro-senitis) are never affected alone.

This is too sweeping a statement as regards slight cases of the irritation from overfeeding. Affection of stomach alone in infants is not common but if there be gastric symptoms without alteration of stools it may be supposed to be present.

In some cases of ileo-colic irritation which even goes on to inflammation there may be no evidence of stomach being involved but as the statement of Remarque I have just quoted shows, the absence of evidence goes for very little.

The difficulty of diagnosing which part of the canal is affected in severe cases is very great & often quite impossible. The alterations in the stools I have mentioned above are the chief points. "From slight dyspeptic catarrh to extensive destruction of the mucous membrane there runs an unbroken series."

(1) CZERNY & MOOER. Jahrb. f. Kinderheilk. 1894 p.430
(2) FISCHL. 1895 p.127.
Frequent from other diseases.

The mild cases are not so difficult
to diagnose from other diseases
with the exception of meningitis.

The commencement of some cases
of gelatinous meningitis in infants
seen in its early stage (as when
the child contracts the disease in the
ward) is surprisingly like the onset
of mild gastro-intestinal irritation.
For several days the diagnosis
may be doubtful.

The vomiting of meningitis at first would
seem to be brought on by unsuitable food.

As if the tendency to vomiting were there
but had not advanced so far as to
produce emesis without the additional
stimulus from the stomach. Until
slight irregularity of the heart-beats
sets in. I do not know how they are
to be distinguished in any one case.

The irregularity of the heart occurs at
first only once in perhaps 80 or 100
beats, so that it is important to count the
heart-beats (by auscultation or by the pulse)
for one minute or a half of preferably two minutes.

The diagnosis of acute cases with sudden onset from the exacerbation is often impossible for 24 hours after appearance from pneumonia it may be diagnosed by persistent rapid breathing (without physical signs). The alteration in pulse respiration ratio is not so useful in young children as in adults.

The gastrointestinal disturbance so often seen in varicella usually follows the appearance of the rash. If it precedes it it is very rarely by more than 24 hours.

In 20 cases, I have seen the diagnosis lay between enterococcic enteritis or cholera. The diagnosis of the former was erroneously arrived at. Postmortem numerous follicular ulcers in the colon were found.
Proper Laxatives

Now that has been said above with regard to etiology I need not dwell minutely on the prophylaxis.

It lies practically in two principles

(1) To rear the child on the breast if possible. If this cannot be done to make the substitute as like breast milk as possible (as regard percentage composition & character of curd etc)

(2) To regard the child's alimentary canal in the same light as the surgeon nowadays regards a wound & to apply to it as nearly as can the principles of aseptic surgeons.

The Walker Gordon Dairy Co. have shown in what a remarkable degree pure of reposed milk can be kept for intelligent dairy men without sterilizing it.

While I was at Radwell the milk supply of the hospital was obtained from the Walker Gordon Co instead of from one of the large dairy companies.

A beginning was made with one ward to see if the results justified the increase in cost-
TREATMENT

of both irritation and intoxication consists in:
(a) removing the irritant or toxin from the alimentary canal
(b) preventing, as far as may be, the entrance of further irritants or food (milk) from which the intestinal bacteria can elaborate irritants or toxins
(c) combating the effects of intoxication by cardiac respiratory stimulants, or by supplying fluid
(d) exposing the irritated alimentary canal to sources of infection

(a) by emetics, stomach washing, purges, or enemata. At beginning of an attack in a vigorous child an emetic is very useful. In a very weakly child the stomach
the tube must be used with great caution as it causes dangerous colic in many cases. At Shadwell it was seen in three children very clearly. In one case the child died the moment the tube was introduced.

Where the child is vigorous the attack serious & washing out the stomach is very useful. Where it cannot be employed giving the child hot water (as hot as the nurse can resist) till it is sick I have found useful, the heat seems to neutralize to some extent the depressing effects of the emesis.

Castor oil is the best purgative. It is astonishing how well it is kept down in cases where the vomiting is not very severe. Probably the soothing effect on the irritated stomach counteracts its nauseating taste. It may be given through a tube with advantage:

Where it would not be tolerated Calomel or Pulv. Jalap. is one the next best things.

If the child is very weakly no purge should
he given recourse he had to an enema although naturally this is not so effective.

In all but the very mildest cases even in those during hot weather stops all milks for 12-36 hours or even longer.

Substitutes for milk.

A. Where the stomach is irritable nothing comes up (so far as I know) like Senneker's meat peptone. After trying most of the similar preparations I made no hesitation in saying that this is the best. A child may be kept on it for 6-10 days before any loss of weight indicates imperfect nourishment.

In many cases white of egg or water (albumen water) should be given for 12-24 hours. The Senneker is not more irritating but is expensive.

B. Where the stomach is less irritable the following may be tried: they are the best of the substitutes.

New meat juice of brands beef essence.

If the child improves it will often take unsweetened condensed milk (First Line Brand).
before it can digest cows milk.
Before the Walker Gordon milk was used at Hadwell the consumption of this condensed milk was (in 1887) 3461 lbs.
The Walker Gordon milk was used throughout the hospital from June 1st 1888. The consumption for 1888 of the condensed milk was 1140 lbs.

Less severe cases may have their diet altered as follows: albumen water for 12 hours then 12 hours of a mixture of 3 parts syrup to 1 part milk, then 12 hours of milk, then finally cows milk in succession.

There is little or no vomiting & much diarrhoea.
The child should be kept off cows milk for a longer period than where the stomach is mainly affected.
If the colon is much affected irrigation per rectum is most useful, mainly by removing irritants, partly by supplying fluid & partly by acting as a sedative.
A child which has been tossing about restlessly will frequently go to sleep after irrigation of the colon, or even after a large enema.
Loss of fluid is easily remedied by color irrigation. Even when there is profuse diarrhea, periodical-continuous irrigation will first relieve the diarrhea for a time, and allow absorption of considerable quantities of water.

Subcutaneously, or a good deal of fluid can be supplied, but I must confess that I have not obtained good results from this method that other people seem to have had. I have not found it better than color irrigation on the whole, though theoretically the former is the ideal method. The latter aboard.

Drugs occupy a secondary place, and should not be used till change of diet has been tried.

Of the anticholines: Perimunth, Carbolic acid, Lodine, Resorcin, Naphthalene, Calomel are the ones I have found most useful of the rest. Of these is Perimunth given in large doses (gr. XX - XXX every hour or two in a child a few drops)
A mixture of iodine & carbolic acid is most useful. It must not be given while the stomach is very irritable.

The dose we used at Shadwell was,


Trick. Lodi as mg for a child of 1 year. It was given in 30 of Camphor water or other aromatic vehicle every 24 hours.

Derron - which Hendon finds so useful, as I think on the whole less reliable than the above. It seems to suit some children however very well.

Reserpin & Nephthalen are distinctly less useful though good in some cases.

the former should be given till the urine becomes tinged & the dose then reduced to keep just short of this. It is of more value in stomach than integumentary affections. With regard to these antipertussis there is a good deal of individual susceptibility to particular drugs. Often by changing the drug rapidly one will be found to suit that particular child.

In spite of all that has been said against its use I believe that the drug...
in both irritation & intoxication is
opinion, given in combination with
some other of one of the antispastics.

It should be given in doses sufficiently
large to affect the nervous system,
but not in large enough quantities
to stop the diarrhoea, as it were vi stoma.

A great deal of the danger of 
intestinal irritation seems to come from
the nervous system; a sedative
will often enable the child to rally its
forces & overcome the irritant, where under
continued irritation it would succumb.

I have used opium more largely
than any other drug in these cases &
the more I see of them the more useful
I find it.

It is given with advantage in combination
with Perunica or with the Dodine
lactose acid mixture. A convenient dose
to begin with for a child of 1 year is 1/3m. of
Tr. opii every 4 hours.

Two cautions are necessary (a) It must
not be given, or only given with great care,
in the depression stage of intoxication.
(6) In chronic cases the prolonged administration of opium is injurious even though it checks the diarrhea. It is best given for a few days or a week and then suspended for 3 or 4 days. The child often does better when it is allowed to have a moderate amount of diarrhea than when it is checked altogether.

Where there is much mucous in the stools, small doses of castor oil are very useful. (1/2 every 4 hours to a child of 1 year). In fact if this fails no other drug seems to have any effect. It may be combined with opium if the stools are very frequent.

\[ \text{due to gastric irritation} \]

For persistent vomiting after washing out the stomach, small doses of cocaine are useful (or 1/2 in 30 of water every hour to a child aged 1 year). I have never seen any depressing effects. It may be given a few minutes before food, as the food so given will often be digested.

Boiling or other hot applications to the stomach are often useful.

For irriagation of the colon hot saline solution seems to do as well as anything. Tannic acid, silver nitrate, etc. do not
seem to be any better. Irrigation, with an alkali will turn the stools green. Bismuth ointment has a similar effect.

Astringents in gastro-intestinal irritation are very seldom used. I have never found a case which did not improve under a change of diet with the drugs I have mentioned which improved under astringents, the harm the latter do in some cases is not inconsiderable.

For cardiac respiratory weakness stimulants are nearly always needed in severe cases. Alcohol and strychnine are the only two on which I have relied. Ether is only indicated in sudden collapse. Sudden heart failure is much less common than respiratory failure or the latter can be remedied by outward applications as well as by any drug. Coughing seems to be very unreliable.

Strychnine is most useful. No cardiac weakness is safe to come on in the early morning. Strychnine (given by the mouth) an hour or so sooner e.g. at midnight or 2 a.m. frequently prevents it. A bright-red or colour of the lips indicate that the patient is under the influence of the drug, if it is best to diminish the dose then a little.
Complications

Inflammation of the mucous membrane of the alimentary tract renders it susceptible to various infections. Ulcers in the mouth are common. They may penetrate into the deeper layers of the mucosa so as to enter the circulation.

Infections of the air passages are most common. Rhinitis, pharyngitis, laryngitis, bronchitis, abscesses, pneumonia, with or without fluid to which not infrequently is purulent.

There is some doubt as to the source of the lung infection. Some of Marfan, (2) Mencel, (3) Czerny, Strocer etc., regard it as a direct infection from the alimentary canal. Others (Pawlowski) as due to other sources of infection of skin. (4)

Fischel (5) regards the pneumonia with gastro-intestinal condition as manifestations of common cryptococcal septic pneumonia.
In wasted infants pneumonia is clearly may set in without any rise of temperature. Rapid breathing till the physical signs appear may be the only symptom of this.

Meningitis - especiallyobotinous cerebro-
meningitis in young infants, has often preceded by gastro-intestinal infection but the direct connection is difficult to establish (1). More often there is an intervening pneumonia, & pneumococci are found in the cerebro fluids.

Very often there is a suppression in the middle ear (2) & on a few occasions direct extension to the brain can be demonstrated. Often there is extension absent. Probably the middle ear disease is secondary to the cerebral vomiting in some cases (2) the rounded matters getting up the mastoid tubes.

(2) Gropper, u. u. 1897 p. 7.
Infections of the skin are common as mentioned above. (Mumps, abscess, eczema, etc.)

Results of gastro-intestinal irritation and intoxication. Apart from the immediate effects lasting damage may be done to the child physically, i.e., it may for years after a severe attack be liable to further attacks exhibit a want of stamina which may lead it to succumb to some disease which in all probability would otherwise have been passed through unharmed.

It is very probable that the mental functions of a child may be impaired permanently by a severe attack of intoxication.

Changes in nerve cells have been observed in cases of gastro-intestinal disease (Müller's "Maneustenl Zeitschr. d. Klin. Med. 1898, Vol. 36, Heft 1") but not of a distinct gastro-enteritis type, the changes observed were those seen with various poisons. They were not caused by high temperature
Further investigation is necessary before we can speak confidently on this subject.

R. P. Cockburn.