Typhoid Fever
in
Children

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London, W.
March, 1898

Professor Fraser,
Dean of the Faculty of Medicine,

Dear Sir,

I beg to submit, for the approval of the Medical Faculty, the following Thesis, for the degree of M.D.

It has been composed entirely by myself.

Since obtaining my degree of M.B. in 1893, I have been engaged in Hospital and Private Practice.

I have the honour to remain

Dear Sir

Your faithfully,

George Philips
Introductory Remarks.

Abstract.

Page 1. The diagnosis of Typhoid Fever in children as compared with adults. — Difficulty in diagnosis under 2 years. — Its rarity at that age. — The frequent absence of characteristic symptoms.

Page 2. Liability to acute as regards age of child. — Frequency as compared with the span of life. — Severity of disease usually increases with increase in age of child.

Page 3. Exceptions.

Page 4. Differences between child and adult.

In children (1) frequent abortion character.

(2) Insignificance of local lesions.

(3) More fevers.

(4) Less frequent other complications.

(5) Lower mortality.
There is no great difficulty surrounding the diagnosis of Typhoid Fever in the adult, when once the most characteristic symptoms are present; we have eliminated by careful examination of the chest the possibility of Acute Tuberculosis. With children, however, the diagnosis is much more difficult; this difficulty may be present throughout the whole course of the disease; possibly the presence of an Epidemic in the place is the factor that finally enables you to rightly appreciate the exact significance of symptoms, which, hitherto, proved only too obscure. This last remark applies more especially to children under 3 years; in whose Typhoid is fortunately very rare, is usually met with during the course of an Epidemic. In children of this age, the group of symptoms almost entirely masked by the febrile bronchial catarrh which accompanies them. Also in the case of hectic or syphilitic children, or even if such complications be absent, a Chronic Enlargement of the Spleen is
often noticed; so that, this important symptom cannot be taken into consideration in forming the diagnosis.

If we exclude those rare cases of typhoid fever occurring under one year—Marchion quoted a case in a child of 6 months; Henoch quoted 2 cases in children between 6 to 7 months. — Typhoid fever in children up to 5 years is comparatively rare; but from 5-15 years is by no means infrequent; although it occurs far less often than scarlet fever, measles etc. The younger the children, therefore, the more rarely are they attacked; & the greater are the differ-
ences in the attack, course, complications of the disease; as compared with adults. As the child gets older these differences become less & less marked; although in rare instances, a very young child may be as severely attacked, or may present the same grave complications, e.g. haemorrhage from the bowel; as we meet with in


adults. Hinck quotes the following case of fatal hemorrhage in a boy of only 5 years.

"In a boy of 5 years, copious evacuations of fluid, 9 clotted blood occurred on the 16th day of the illness, which was followed by a rapid fall in the temperature from 103.5° to 98.1° F. within a few hours; but this only lasted till the following day, when gave place to a renewal of the high temperature. The case ended fatally on the 20th day. At the p.m. we found extensive ulceration.

Hinck. Dis. of Children. N. Y. p. 332."
is wise, if he uses circumspection, in conveying to the friends his opinion. For if he merely abruptly mentions that the child has typhoid fever; then after an illness of 5-6 days, the patient sits up in bed, and asks eagerly for food; the symptoms all suddenly disappear; the friends may doubt the accuracy of his diagnosis, unless he has forewarned them that this may take place. For it is this, the abortive character of typhoid fever in childhood, that constitutes clinically the chief difference. It is observed not only in mild cases but also in cases with a violent commencement. The next most important difference is the insignificance of the local lesion in the bowels, as found after death. Cases may occur in which during life no doubt has existed as to the diagnosis of typhoid fever; yet the post mortem examinations have shown only such slight changes in the intestinal glands, that confirmation of the diagnosis has had to depend almost exclusively on the bacteriological
Examination. This disproportion in children
is the rule rather than the exception, whereas
in adults the converse holds good.

The mild course of the disease; the
less frequent severe complications; and
as a result, the lower mortality amongst
children, have all been described by
authors as differences. When, however,
we come to consider more closely the
pathological anatomy, we find that
these differences, depend mainly on the
insignificance of the local lesion in
Ruge's patches and the solitary glands of
the small intestine, and scarcely it
could be classified as differences for pi.
Pathological Anatomy

Abstract

page 6. The Intestinal Region

Enlargement of Intestinal glands,
usually of small intestines — The accompanying
Inflammatory Enteritis — Enlargement of
Intestinal glands present in other diseases in
children under 3 years — Value of Bacteriologic
pages 7 — at examination in these cases — superficial
character of enlargement — limitation to gland
substance — usually heal without forming
Aetter — Sorer enlargement exceptional.

pages 8. Condition of Peritonaeum — Enlargement
of Mesentery Glands.

page 9. Bronchitis — Broncho-pneumonia —
Enlargement of Upright — rupture —
page 10. — Presence of Typhoid Scales — Rarity
in children of Intestinal Haemorrhage.

page 11. — Necrosis of bowel. —

page 12. — Cardiac.
Under this heading we meet with many differences; the most important of which occur in the Intestinal Tract & the Lung.

The solitary glands & Ryrie's patches of the small intestine are enlarged, in the early stages of the disease, into soft swellings; or usually show on section infiltration & increased vascularity. The mucous membrane of the bowel, between & around the glands is slightly swollen & covered with a considerable quantity of glistening mucus. Anatomically, therefore, we have to deal with a Catarhal Entitity; without the Cephalous venous transudation, that is met with in Simple Intestinal Catartha, Cholera Norbus etc. These conditions, when found in children under 3 years of age, prove nothing, unless cultures from intestinal glands, mesenteric glands & other organs show the Typhoid Bacillus; because, up to this age, the Ryrie's patches, solitary glands become enlarged, in simple intestinal Catartha & various infectious Ailments.

* Holt. 1879. Disease of Infancy & Childhood, p. 1009.
If the bowel affection is more severely developed, a few solitary follicles or one or more follicles of a Peyer's patch show signs of commencing ulceration. This ulceration, unlike that which occurs in the adult, usually consists merely of a reticulated loss of substance, in the frayed or jagged edges of which, can be seen the remains of the follicular tissue. This is best observed by gently shaking the bowel under water. Such losses of substance, it appears, heal without leaving a connective tissue scar; the regeneration taking place from the gland substance, left in the edge or base of the superficial erosion. Hillich drew attention to the mild character of the process in children, the scarcity of the ulcers and their small size; all of which characteristics he attributed, to the preponderance of the "plaque mole" of Louis. In some cases, the ulceration of the bowel in children presents exactly the same characteristics as that found in adults. As in adults, it
commences in the ileum & is most fierce in the neighbourhood of the ileocolical valve.
More rarely, ulceration may be met with in the jejunum & the commencement of the large intestine. True, or widespread, typhoid ulceration in children under 1 year is exceedingly rare.
The Peritonem. In children peritonitis is rarely present as a result of the ulceration. It is only when perforation has taken place that we meet with it.
The mesenteric glands are enlarged co-incidentally, with the intestinal glands. Their appearance, as in adults, varies according to the stage of the disease, at which death occurs. In raucity & serofulosis children, the condition of the mesenteric glands usually met with in these diseases, may be so altered by the typhoid infection, as to render it impossible to distinguish, recent, from Chronic Enlargement.
The affection of the Bronchial mucous mem-
brane is the next most important Con-
Sideration. Although bronchitis and
Respiratory complications, are common enough in adults, suffering from Typhoid, and frequently lead to a fatal termination; yet in children, the intense inflammation and consequent swelling of the bronchial mucous membrane, and the readiness with which this spreads to the Capillary tubes and gives rise to broncho-pneumonia, constitutes a special danger, pathological difference. The Bronchitis, in no way differs from that due to an independent cause; except that, occasionally, we meet with swelling of the bronchial glands accompanying it.

In very young children a similar swelling on the inguinal glands not infrequently occurs.

The swelling of the Spleen is usually very marked, a soft, friable mass, with rounded, imperceptible edges, the distinguishing characteristics of which, even during life, may be appreciated on palpation and differentiated from the hard, sharp bodies of the enlarged Spleen of Fieb's, or Syphilis. Rupture of the Spleen, which according to Rabkansky,
is liable to take place in adults suffering from Typhoid, is not mentioned by him as ever occurring in children.*

The presence of the Typhoid Bacillus in the spleen, mesenteric glands & intestinal glands & occasionally in the kidney & other organs, is as easily demonstrated in children as in adults.

The pathological appearances just described, are those that we expect to find in a child who has died of Typhoid. Especially is this true with regard to the superficial character of the ulceration; its limitation to the gland follicles; its rap tendency to extend widely into the adjacent mucous membrane; or deeply into the muscular coats of the bowel. It is on this account, that, Intestinal Haemorrhage and Perforation of the Bowel, are so uncommon in children.

The following case that might have gone on to perforation has come under my own observation.

* A little girl aged 3 years, who had a Stricture

"attack of Cynoephobia, with extreme dyspepsia of the brain."
"Symptoms; died in a coma-like condition, apparently"
"from exhaustion, on the 17th day. On p.m. Examination"
"This was found, extensive ulceration in the immediate"
"neighbourhood of the ileo-cecal valve. The extent of"
"the ulcer, was due to the fusion together of a"
"number of small ulcers; towards its center, it had"
"advanced, up to the peritoneal covering of the bowel,"
"which, however, was still intact. In this case, it"
"seems very probable, that perforation would eventually"
"have taken place, if death had not ensued earlier."
"This was two clinical points of interest in the"
"case. The absence of haemorrhage from ulceration"
"of some intestinal vessel; and the fact, that the child"
"although perpetually comatose, always appeared to"
"feel pain on palpating the ileo-cecal region.

The changes in the other organs
myocardium, liver, kidney etc. are,
for the most part, the same in children
as adults. The waxy r-granular
degeneration of the voluntary muscles, as
first described by Lexer, is rarely observed
in children; the same may be said
of muscular haematoma (Verchoff).
On the other hand, the degeneration
of the heart muscle, in which it becomes soft, pale and extremely friable; it shows on microscopical examination, thick, granular infiltration of the muscular bundles, with rupture here and there, but with the situation still preserved, is present in children about as frequently as in adults.

Other changes may be found in the various organs after death, which are due to complications during life; these changes do not differ from those due to independent causes, and consequently need scarcely be considered here, but will be mentioned later, when studying the clinical aspects of the disease.
Causation

Abstract. Pre-disposing Causes.

Page 15. Pollution of Tulahem Springs — moisture — potential sources.
Page 16. Thames Valley — soil — Dr. Robertson's experiments.
Page 17. Fever air — Alessi's experiment.

Exciting Cause v. Dissemination.

Page 20. The Typhoid Bacillus — Typhoid Infection — chief sources of infection — bowel flora, urine. — Channels by means of which the organism enters the body of the recipient.

Page 21. A. Pollution of drinking water occurring at.
   I. Source
   (1) Well.
   (2) Springs.
   (3) Rivers.
   II. Course — intermediate supply — close proximity of drain v. main.
   III. Periphery. Example of pollution.

Page 22. at Periphery at Unio: College Hospital. — The same.
Page 23. B. Pollution of milk — cans washed in infected stream — watered milk — direct contact — cow (8).
Page 24. C. Pollution of other foods.
In view of the recent epidemics at Maidstone, Hythe & Clifton, it may perhaps be permitted to enter more fully into the causation of the disease, than the title of this paper permits to justify.

**Predisposing Causes.**

The sexes are attacked in about equal proportion, but from the ages of 3-20, the mortality amongst males, appears to be greater than amongst females.

Age: Children are more frequently attacked than adults, although the Registrar-General has pointed out with reference to Infantile Encephalitis, that probably many of the deaths so registered, are "not due to this disease, but to some undetected cause manifesting itself in febrile symptoms." In Epidemics, however, it has frequently been observed, that in a family where all alike have been exposed to infection, the children exclusively, or in greater proportion, have been attacked by the disease. The greater percentage of cases amongst children whose age ranged from

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4-15 years, was remarked upon in the Maidstone Epidemic.

Mode of Prevalence. Typhoid fever is an endemic disease in this country as well as on the continent and in America. Often, in this country, it becomes suddenly epidemic; it is most often, through contamination of the drinking water, sometimes through the water up milk and other beverages.*

In London, it appears, that both the prevalence and mortality of this disease are greatest in Autumn least in the spring and early summer. Muchison gives the months in the order of greatest prevalence as follows:—October, November, December, August. A very similar relation to seasons, according to Hersch, is obtained for a number of European towns, including Paris and Berlin, also for Massachusetts and Boston. In New York, the maximum prevalence, 1871白legge's day, occurs in September.

Temperature, moisture and soil. Typhoid fever is always most prevalent after dry

*Special discussion on The Prevention of Typhoid Fever 1877
A hot summer, whereas Autumns following cold winter summers are more free from the disease.* The pollution of the Tutsham Spring, in the Maidstone Epidemic 1897, seemed to offer an explanation, why this is so in some cases. "This spring is a surface spring, only 3 feet below the turf of an ungazed meadow, the soil being of Clay. During the hot summer of this year, the clay had dried into a cracked, fissured mass; which means, that direct channels are provided by nature, to the surface springs immediately below; thus ensuring injection of the water the easiest possible manner. And this is exactly what happened; a number of hop pickers were actually allowed to encamp in the very fields in which the spring is situated; on inquiry by the Med. Officer of Health, it was found that the Colony, bunched, during its stay, from Endicott." Pettetoff's view, that a rapid fall in Subsoil water, that has attained an unusual height, leaves behind in the superficial layers of the soil the germs of the disease - so leads to an outbreak; although applicable to Munich,

* Murchison. Treatise on Contaminations. p. 344.
has not been found to explain the rise and fall of Typhoid fever in other localities, during other epidemics, or for other conditions, notably those of contamination of water or food stuffs with matter directly derived from sewage or indirectly from bowel evacuation of Typhoid fever cases had to be considered. Dr. Thorne 1867 showed that an outbreak was coincident with rise of public water after great drought. On the other hand, the reason why warm, damp localities is often followed by an outbreak of the disease may possibly be explained by the fact, that these conditions, warm and moisture, apart from saturation, are most suitable to the propagation of the Typhoid Bacillus. The experiments recently performed by Dr. Robertson prove that the Typhoid Bacillus is capable of growing or multiplying in the soil; that under certain conditions amongst which occasional supplies of organic matter appear to be the most important - these organism

Can survive during protracted heat, cold & wet from one summer to another.*

*?**

**\textbf{Stoves Gas.} The experiments of Allacci, carried out at the \textit{Hygienic Institute at Rome}, on the breathing of stoves gas as a predisposing cause of infection with Typhoid, clearly show, that as far as rats, guinea pigs & rabbits are concerned that the inspiration of putrid gases predisposes to the action of even attenuated Typhoid. The experiments consisted in inoculating 2 distinct lots of the above mentioned animals with the same quantity of pure cultures of Typhoid. The 1\textsuperscript{st} had been exposed to the influence of stoves gas prior to inoculation. The 2\textsuperscript{nd} was the control experiment. The result showed:

<table>
<thead>
<tr>
<th>Lot</th>
<th>Animals exposed previously to stoves gas</th>
<th>Animals not previously exposed to stoves gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>1\textsuperscript{st}</td>
<td>Both inoculated with same quantity of pure cultures of Typhoid Bacillus</td>
<td>15 p.c. died</td>
</tr>
<tr>
<td></td>
<td>rats</td>
<td>75 p.c. died</td>
</tr>
<tr>
<td></td>
<td>guinea pigs</td>
<td>75 p.c. died</td>
</tr>
<tr>
<td></td>
<td>rabbits, all \emph{died}.</td>
<td></td>
</tr>
</tbody>
</table>

In conclusion Allacci states that predisposition is probably diminished by protracted breathing of the said gases.

This last statement agrees with Murchison who writes with regard to Priors works "That it is not probable that this occupation predisposes to the disease." With regard to this question, it is the opinion of Mr. Thompson, Prof. Corfield and others, that the air of privy drains, which has become specifically contaminated, may, if allowed to find its way into dwellings through defective house connection, cause, from time to time, enteric flux amongst the inhabitants of such dwellings. * Mr. Adams of Maidstone writes "There is no evidence that Privy gas contains, or has ever been known to contain, typhoid germs. It is, of course, not impossible that alive or partially alive bacilli may be suspended in the air. Thus Kassurié (quoted by Prof. Birchfield in Allbutt's System) passed a pulverised spray of water over a quantity of alive Typhoid Bacilli and found that the particles of spray carried the bacilli some distance. We believe we are correct in asserting

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* Stevenson v. Murphy 1870. A Treat. on Typhus U.S. p. 320.
That up to the present the only pathogenic germ that has been found in pure air is the Streptococcus pyogenes aureus which was identified by Ehrlich. Indeed Kirschnitz has said that "we are entitled to affirm, with a probability bordering on certainty, that presumably pathogenic germs will never be found in pure air."

The other predisposing causes may be briefly summarised by saying: that Typhoid is independent of bad ventilation, of overcrowding; attacks all classes, independently of rank, or occupation, or previous disease; although certain families seem to be especially prone to infection as e.g. the present Royal Family. Recent residence, is quoted by Murchison, and others, as a strong predisposing cause. Long residence in an infected locality probably gives immunity from the disease (Hirsch)

Exciting Cause Transmission.

It is not within the scope of this paper to deal with the bacteriological evidence, with respect to the causation of the disease. It may be sufficient to...
Day, the ability of the Enteric fever virus to multiply in water or milk, is a strong indication, that it is a living organism.

Further, epidemiological facts support the view, that this organism is definitely facultative, being capable of thriving and multiplying, not only in water or milk, but also in the soil (Thompson).

Typhoid fever is a communicable disease, but looked at in the light of modern experience of epidemics it is doubtful whether it is infectious in the popular sense; this point however, still remains a subject for discussion. New cases occur, from time to time, which cannot always be attributed to known, recognized, cause of infection. The bowel excreta — according to Wright & Temple the urine*, are the channels, by means of which, the virus is mainly given off from the body of the patient. These, therefore, constitute the great source of infection; they may enter the body of the recipient, either by the contamination of

Drinking water, or milk or food, or by the excreta drying, becoming detached or being carried by the air, or by flies. (a)

Reservoirs & Public water supplies must be regarded as causes of Epidemics of Typhoid. The contamination may take place at the Source, course or Reshipse.

I. Source. (1) Wells. The now Classical report of Typhoid at Redhill, from the pollution of the Caterham wells, will serve as an example of direct delusion of an act by specific excreta. Other causes of the pollution of well water are; leakage from a sewer as at Guildford; by the tricklings from the surface of an adjacent Swineage farm; by back flow from a river; by leakage from foul ponds & cesspools.

(2) Springs. The pollution of the Tutsham Springs already referred to in the recent Maidstone Epidemic. Given the fact of contamination, wells & Springs

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(a) Stevenson, Murphy 1893. A Treatise on Hygiene VI p.320.
(1) J. E. Spurr.
are especially dangerous, because there is no escape for the polluting matter, except into the supply pipes.

(3) Rivers. These, when polluted, have an outlet other than the supply pipes; they have the additional advantage of oxidation by sunlight.

II. Course. The most common cause of pollution in the course, is intrusion of foul air or liquid by leaking water-pipes during intermissions in the supply. This danger is increased by the common practice of laying the water mains and sewer-pipes side by side.

III. Periphery. Pollution at the periphery. That is, through the taps, is most important. It is liable to occur whenever a tap is left turned on; a vacuum is produced in the supply pipe by intermission of supply, so that, foul gas or liquid or even solids are sucked back into the house-pipe or main.* The recent outbreak of typhoid fever amongst the nursing staff at University

*Dr. E. U. Root. Opening address. Special Resolution on the Adoption of Ontario Papers 1897.
College Hospital is an example of peripheral pollution; although not quite such a good one, as the report by Dr. Buchanan on the outbreak at Cairns College, Cambridge, because at University College Hospital the tap was not "on the main". The cause of the pollution at University College Hospital was briefly this:

During the summer vacation, on account of certain improvements that were being made in the hospital, the nurse's dining room was temporarily closed. In order to get drinking water at the new dining premises, a connection was made with a pipe leading from the kitchen as shown in the diagram. This pipe also supplied water for cooking Typhoid infected linen prior to disinfection. Before the water was used for the vessels the cistern was cleaned out, being previously
Emptied by turning on the taps. Presumably, (in the
case of invasion, the cleansing of the intestine and the
drinking of the water, justify the conclusion) some of
the infected material from the wat may have then been
aspirated into the cistern.

Other Causes of Pollution at the Pumphrey are
common, as e.g. leakage of stand pipes; flooding of the streets with sewage after
heavy rains etc.

Milk may be the Cause of Epidemics as
has been shown more than once in Plague.
The infection takes place either by cleansing
the utensils in contaminated water; or
adding contaminated water to milk to make
up sufficient quantity; or direct contact
of a person suffering from Typhoid with
the milk.

Dr. Allen M. O. H. to Pietermaritzburg, has
also informed the opinion, based on experience
in Africa, that cows suffer from a disease
similar to Typhoid in Man which can
be communicated through the milk.


Contamination of foodstuffs as butters & cheese; from infected milk; as well as ice creams, aerated drinks etc from infected water; or watercress & oysters lying in sewage polluted water; have all been given as causes of Enteric fever, & may explain the origin of many cases which at the time appeared obscure.

The period of incubation is commonly about 3 weeks; but may, in some instances not exceed one or two days.

Symptoms v Clinical Course

Abstract.

Page 25: Stage of Incubation.
26. Stage of Invasion - gradual onset.
27. Symptoms of Gastric + Bronchial Canal - malaise -
irregular but sustained temperature.
28. Stage of Advance Vomipion - paraly- -
nomic symptoms now appear - characteristic temp-
29. Stature - facial expression - loss of appetite - vomiting -
30. Diarrhea or constipation - characteristic of nausea -
Abdominal distention, tenderness, rigging - Enlarge-
ment of spleen - rosette - little rumble
31. If spits in children - the urine - the various
symptoms.

Stage of Resolution, the marked remission -
gradual fall in the temperature - symptoms gradually disappear.

32. Stage of Convalescence - recovery. -
Grave Cases - increase in nervous symptoms -
33. Convalescence - delirium - Cerebral State - convulsion -
coma - death. Broncho-pneumonia - respira-
ory embarrassment - cardiac failure - returns
convalescence or death.
Typhoid fever in children begins gradually; the insidiousness of the Invasion being, if possible, more marked than in adults. From this cause the exact date of onset is difficult to determine. If seen in the first days of Invasion, there is fever, flushed tongue; loss of appetite; frequently pains in the joints. These joint pains occur without any swelling, or other evidence of Rheumatism, but coupled with the headache, which is, probably, as common a symptom in children as in adults; they tend to make the child irritable under examination. Diarrhoea may or may not be present. Some bilious vomiting may have occurred, but as there are no other abdominal symptoms, the case appears to be one of acute Gastric Catarrh.

During the next few days there is not much alteration in the condition of the child; the pulse is somewhat accelerated; the skin feels hot and rough; the edges of the tongue show commencing reddening, in place of the fur. There may have

* Murchison's Treatise on Contagious Fever 1853, p. 533.
been some Epistaxis. Sleep is disturbed;
the child is falling away; is fretful, &
readily lies in bed. At this stage, however,
the prostration is never persistent, it is
present for a time, when the child appears
to recover itself & sit up, may take up
a toy, or play for a little time, only
however, soon to get tired, the back again
in bed. This is a loose cough, with
somewhat increased frequency of inspiration,
especially towards night, as the fever increases.
If the temperature has been taken 2, or 3 times
in the 24 hours, the fever is seen to be a
continuous one, with a gradual increasing
Evening rise, but with Remissions each
morning. Physical Examination gives
negative, rather than positive results; with
the exception of a few rhonchi in the lungs,
the gastric symptoms, already referred to,
nothing definite can be made out, &
although the physician recognises that,
he is face to face with a Distinct &
furious disease, he is not yet in a
position to eliminate, Acute Gastro Catarrh
—"Gastro-icterus" of older children — Mental
It is not until the 2nd week, that the other symptoms — Enlargement of the spleen; Characteristic temperature curve; V. rotula; — pathognomonic of Typhoid, make their appearance. On the other hand, the initial symptoms during the Stage of Invasion are often so slight that the physician is not called in until the beginning of the 2nd week, the period of Advance V. Eruption.

The symptoms, already referred to, are now more exaggerated. The rate of the pulse, generally corresponds to the degree of fever, being rapid at night, but slowing down again in the morning; in some cases, however, it is moderate throughout the whole course of the disease, seldom exceeding 90 per minute; it is regular, easily compressible. The temperature, by this time, has reached its height, which is maintained for some days, but still retains its remittent character. Each day, it begins to rise early in the afternoon, and attains its maximum, between 9 or 10 p.m.; about midnight, it again begins to fall; the greatest remissions
being between 6 & 8 a.m. The skin, is
hot & dry, but during the remissions, is
often covered, with a clammy sweat.
Unless the case is a very mild one, the
facial expression, now, begins to indicate
the weakness & prostration of the Child;
the apathy; the pallid complexion, with
malar flush; the wrinkles brow; & dilated
pupils; are the most noticeable. The lips,
are dry & cracked; the tongue is covered
with a white fur, except at the edges of
point, which are unusually red; the
breath has a sweet insidious smell; the
appearance of the fauces is normal.
The Child has no appetite; but perpetually
calls out for drink; which is often
taken so greedily, that it is vomited
up again almost as soon as swallowed.
Although Constipation may exist during
the whole period of the Disease, diarr-
rhoea is, perhaps, most usually met
with, there being 3, 4, or more motions
in the 24 hours; the motions are
watery, & yellowish in Colour, & either
resemble in their general appearance,
the stools of uncomplicated intestinal catarrh, or present the characteristic "tea soup" appearance. Often diarrhea, constipation, alternate with one another, during the course of the disease. The abdomen is slightly distended and tympanitic; although the gastric, left hypochondriac, and right iliac regions, are usually somewhat fuller than the general surface. There may be some pain and gurgling on palpating the right iliac region. The enlargement of the spleen, at the commencement of the second week, can as a rule, be easily palpated, as a roundish, soft tumour, under the edge of the ribs. This is rendered more easy, at the commencement of the 2nd week, because, at this time, the distension of the abdomen is not very great. In children, tympanites is seldom as marked as in adults. From the 7th to the 12th day, the characteristic roseola makes its appearance, occurring as in adults, in successive crops, of small, round,
somewhat sharply defined, slightly raised, red papules; they disappear on pressure, but appear again, when the pressure is removed. They are, most frequently seen on the abdomen and lower part of the thorax, only occasionally on the back, scarcely ever on the thighs. Their number in children is usually very limited.* The urine at this stage is dark or light coloured. The serious symptoms, the numbed condition of the head, & vertigo continue. The child may be very drowsy, but is quite conscious, the memory is good, towards night, however, the exacerbations of the fever, gives rise to disturbed sleep, restlessness, & slight delirium.

Towards the end of the 2nd, in the beginning of the 3rd week, as we approach the period of resolution, the remissions in the temperature, which in adults are well marked, in children are often greatly exaggerated (Rermitant stage, Liebrecht's)
At the same time, the temperature is seen to be falling, so that, as the 3rd week advances, it assumes an intermittent type, some mornings, even being, subnormal. The rise in the evening temperature still continues, but if no complications supervene, ceases to occur, about the 21st day. In favorable cases, towards the end of the 3rd week, the symptoms gradually disappear; y with the return of the evening temperature to the normal, convalescence may be said to commence.

Although convalescence is always gradual, it is surprising, how rapidly children recover their strength, as compared with adults.

In worse cases, the 3rd week shows an increase in the nervous and bronchial symptoms. Comatose, may occur, which is interrupted by delirium; or the delirium may become constant, or only cease during the remissions in the temperature. Occasionally, the child lies motionless, apparently sleeping, but seems to understand questions, although the answers are usually unintelligible. Accompanied with this, there is increased
frequency of the pulse; dry brown tongue; 
and increase in the abdominal symptoms.

Under these conditions, unless the child rally,
death may result from heart failure; or with 
the increased wasting and exhaustion, the 
"Typhoid State" is produced, or death take 
place by coma.* According to Wels, con-
volutions may precede the coma, and constitute 
a not infrequent mode of fatal termination 
in children.** Again, especially in young,
and delicate children, increased perspiration may 
collect in the finer ramifications of the 
bronchial tubes, and the child being too weak to 
expect it by coughing, a blocking of the capil-
lar tubes, collapse of many of the air 
Widles may take place. As a result of this, 
death may easily supervene, from the combined 
effects of respiratory embarrassment, and cardiac 
failure. In serious cases, such as the 
above, if recovery takes place, convalescence 
is naturally delayed, and it may be weeks, 
or months, before the child is far from danger.

*March 1873. Tract in Contained from p. 4299.
Further Consideration, and
Analysis of Principal Symptoms

Abstract:

34, Temperature - average duration - remission

35, fall of Temperature - lysis - crisis

Epistaxis

Alimentary System - lips - tongue

36, appetite - Vomiting - prognostic significance

State of the Bowels - frequently constipation in

37, children - possible cause, Cattichal, Marchionis's

38, character of motion - Intestinal haemorrhage

39, - its vary in children: Tympanitis - gurgling - add. pain

40, Haemopoietic System - spleen - midle's

41, Circulatory System - distillation of blood

- cardiac failure - pulse, on page 28,

Respiratory System, Bronchitis, Pneumonia

Integumentary System - the kid in children

42, as compared with adults - Sudamina

43, Urinary System, Retention, Urine, Analysis

Nervous System, Sensory Functions

44, Cerebral, Mental Functions - Ulcers

45, - Convulsions - Aphasia - Anokynia -

46, Epileptiform Convulsions - possible causation
The foregoing description of Typhoid fever in children, is capable of numerous variations. In further consideration of the subject, keeping in view the main object of the paper, as to the differences between Typhoid in children and adults, it will be well to follow the ordinary methods of Case taking.

Temperature. The average duration of sustained temperature, is probably shorter in children under 10 years of age, than in older children and adults. Morse,* in 75 cases under 10 years of age, gives the average duration 17.3 days; whilst in 202 cases from 10-15 years, the average duration is 22.6 days.

The remissions in the temperature, already referred to, during the period of advance & eruption, are not invariably present, but when absent, they usually indicate some dangerous complication. In rare cases an inversion of the order of the remissions may occur. In abortive cases, the

temperature usually falls by crisis, instead of lepis. Henoch quotes the following case in point:*

"Boy of 3 years, duration of acme 7 days; temperature 103.3° on the 1st day; 106.3° fever; pulse 160, on the following day temperature normal, 98.5° on the 99.5° pulse 88. After this no return of fever."

Epistaxis amongst children is a fairly common symptom, may occur at any period of the disease; Barré and Hélier mention that in 10% cases they met with epistaxis in 1/5 of the number.

Alimentary Ulcer: In children by constantly picking their lips, during the course of the disease, may produce ulceration, especially at the angles of the mouth, which only heal slowly, during the convalescence. The tongue, as occasionally happens in adults, may be entirely red, smooth, ophaged, with a clean surface. The cracked and deep fissuring of the tongue, are not so frequently met with in children. Ross

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of the epithelium of the tongue in patches, as met with in other gastric disturbances in children, is also often observed. The loss of appetite, is nearly always present; in favourable cases the appetite begins to return, in the stage of resolution and convalescence becomes established. The craving for food is usually very marked.

Vomiting, is common in children than in adults; (Montmollin, Hinck) when present it is generally at the onset of the disease, and for the most part occurs after drinking.

* Murcison regarded vomiting at this period of the disease, as a favourable symptom; Löschner, others however considered it a bad prognostic sign. Vomiting after the 2nd week, is a serious symptom and usually indicates commencing peritonitis.

State of the Bowels. Diarrhoea is not so frequently present, in children as in adults. Carmichael gives it, as the


* Murcison. Treatise on Contagious Fevers. 1873 p. 532.
Result of this experience, that Constipation is as frequent as Diarrhœa, * in cases of average severity. The existence, or non-existence of Diarrhœa, depends largely, on the unsuitable, or suitable feeding of the Child.** Morse states, that in children under 10 years, Constipation was present in $\frac{2}{3}$ of the number of cases, $\frac{1}{3}$ diarrhœa only in $\frac{1}{3}$. The cause of the greater tendency to Constipation among children is difficult to determine. According to Murchison, the insignificance of the intestinal lesion will not account for it. He writes "there is no relation between the intensity of the diarrhœa, and the extent of the intestinal lesion found after death."† Wilks also mentions, the case of a girl, who died at the end of the 3rd week, her bowels had been confined; * after death, the small intestines were found, filled with firm Seybola, with an ulcer beneath each.

* Carnichael Diseases in Children 1873, 466, 55.
† Murchison, A Treatise on Contaminated food 1873. a: 524.
† Wilks Physiologiae Chem. dajo truns v. 1, 150.
Even when there is considerable apathy or dullness, children of only one year, usually let the nurse know when they want attending to. It is only in cases in which there is deep coma, that the motions are passed involuntarily; also, in the later periods of the disease, or convalescence, when the child, although quite conscious, is weak, or averse to disturbance, he may pass his motions under him.* The motions may be quite normal in appearance only very bad smelling. The loose motion, may present the well-known character of the colour of café-au-lait. The reaction of the stools; their separation into layers; the difficulty of demonstrating the presence of the Typhoid Bacillus; the occasional presence of worms; apply to children and adults alike. Intestinal haemorrhage, as previously referred to in the pathology, is very rare in children. Only exceptionally, is the cause of death in children suffering from Typhoid. Out of 946 cases collected from Hospital Reports by More, he only

found it present in 3, p. c. The abdomen, is either normal in appearance, or distended, never retracted. Tympanitis is only exceptionally developed to such an extent, as to interfere with the respiration; in very young children, it may be entirely absent. In children, it is often difficult to determine, the amount of tenderness, or even its existence, on palpating the ileocecal region. The presence, or absence, of gurgling, is of much diagnostic value, as Rosehne, Stroeh & others, have shown that this symptom, is present in simple diarrhea of children, in the left, as well as the right, iliac region. True abdominal pain, is mentioned by Barthez & Illiet, as occurring occasionally in children. They quote a case in a boy of 11 years, who during the course of Typhoid fever, was prostrated with severe pain in the abdomen, which lasted for 36 hours without intermission. The condition of the stools was not referred to. *Hinch considers that these pains are colic, due to focal ac-
cumulation, that they occur most frequently before defecation, & are relieved by the action of the bowels.

Haematopoietic System. Enlargement of the Spleen, is almost invariably met with after death, yet during life, it is often difficult to estimate. If it is increased to 2 or 3 times its normal size, it can be palpated through the abdominal wall. If, however, there be much distention of the stomach & colon, palpation & percussion, are alike difficult. These difficulties, may in part, account for the wide divergence in statistics. In 131 cases of Typhoid in Children, Tappy* discovered Enlargement of the Spleen in 109 cases; whereas Barthy + Ricket, met with Enlargement, only in 28 out of 105 cases.

The Urinal screen test, has met with as satisfactory results in Children as in adults.

*Tappe. Histo Typhoide chez les Enfants. 1839
+Barthy, Ricket. Traité des Maladies des Enfants. 1858. 6th Ed.
+Coblence v. Bormann. The Exam. of 103 Cases of Typhoid Fever by Urinal Screen Test. 1867. 6th Ed. J. Dec. 6, 1874.
The reaction, as a rule, takes place somewhat earlier in children than in older patients.

**Circulatory System.** As in adults, we may have degeneration of the heart muscle, dilatation of the ventricles, as a result of the wasting and emaciation.

With the remissions in the temperature, which usually take place in the early morning, marked and alarming collapse, may take place, which sometimes ends fatally, especially, if coma and leucopenia be very pronounced.

**Respiratory System.** The Bronchitis has already been referred to. Hypostatic pneumonia may also occur.

**Integumentary System.** Although the character of the rash is the same as in adults, certain differences are described in children.

1. The spots are less numerous, usually not more than 6, being present at one time.

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*British med. Army 1877. '*

From: "The Reaction in Children," (Prae. Oct. 18, 1877)."
Early, more than 20, Barthély & Rellet only
once in III. Cases found a Kopie rash.
Hinnock, however, observed 10 in 302. Cases.
2. The rash appears earlier than in adults;
may occur as early as the 2nd day. — The
Eruption Selbom lasts longer than 7-8 days.
3. The Eruption is more frequently absent
under 10 years of age, than between
the ages of 10-30.
4. Barthély & Rellet were of opinion, that
in Children the Sore was fewer, less
Absent, in severe, than in milder cases. +
The presence of Suddenia-Noctiles, are probably
more common in children, due to the more
frequent Kopie oozes, occurring during
the greater remissions in temperature.

Barthély & Rellet 1853, Traité des Malad des Enfants u.I. 684.
* Hinnock. Lectures on Children's Diseases. New Ed. Dr. Traub.

U.I. 3214.

Murchison 1848, A Treatise on Contined Fever, p. 511.
Jauquin 1839. — Deux Types de Eclampsie. Dr. Austin.
Barthély & Rellet 1853. u.I. 653. (P.P. Dr. Chir.
Murchison 1873, part 511.

Barthély & Rellet 1853. u.I. 633.
Urinary System. Retention of urine is not common in children suffering from typhoid. The chief points with regard to the urine, which have been fully described by Parker, Vogel, Mosso, etc., are briefly these. The quantity during the first 8-10 days is diminished about one half; during this time it is dark, strongly acid, of high specific gravity. As the fever advances, the quantity of urine increases, of a pale colour, low specific gravity, the acidity diminishes. The daily quantity of urine is increased throughout the whole period of the disease, although this increase is most pronounced during the first week.

According to Wright & Simple, typhoid bacilli are nearly always present in the urine.

Nervous System. Sensory Functions.
Cutaneous hypoesthesia of the lower extremities and abdomen, is mentioned by Marchion, as occurring most frequently in children. It may occur in the

*Wright & Simple 1875. Lancet July 27.*
first week, or not until Convalescence, it is not a formidable symptom. * Baker & Hillet, speak of Anaesthesia, as an occasional grave symptom in children.

Headache, condition of the pupils, & Vertigo, have already been considered. Weakness to Common during Convalescence.

Cerebral & Mental functions. Although the delirium, presents much the same character as in adults, it occurs earlier, is seldom so violent, & under 10 years of age, is not so frequently observed. Taupin, as well as, Barthe & Hillet, mention delirium, as occurring in about 1/3 of their cases; whereas, Murchison found delirium present in adults, in 67, p.c. * Henoch considers that serious nervous symptoms in children, even after they have reached the age of 11 or 12 years, to rare. He mentions violent & passionate Screaming, as occasionally taking the place

* Murchison 1843. A Treatise on Continued Fever. 542

Murchison 1873 -- -- -- -- 534
of delirium in young children.*

Convulsions, may be very pronounced; what has been known as overwhelming at the outset of the disease, that the child fell asleep 2 or 3 times during breakfast.

Aphasia, as also Amblyopiae, may rarely occur during the intermittent period, or at the commencement of Convalescence. Rehn has also described paralysis of the language muscles; Bouchet has observed haemorrhages into the retina, in children with Typhoid.

Epileptiform Convulsions are mentioned by West, Barthez & Allier as sometimes occurring in Typhoid. They do not occur at the outset, as is the case with Steller FEVER, Pneumonia, etc., but during the course of the disease, in the 3rd or 4th week, if they are not convulsions which are due to a sudden rise in temperature, they

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* Henoch. Lerr. on Di. in Children Mus. St. die. UJ. 329
* West. 1854. Lee. on Di. in Sy. (Chilblain). 338.
* Rehn. Deutscher Arch fur Klii. Heid. XCVII
  S. F. 1.
are more numerous. Rare such are wont to be, *as frequently followed by paralytic symptoms, in the muscles of the face or eye.* Usually also, when a post mortem examination has been rendered possible, pericranial thickening has been found between the meninges of the brain, or a purulent meningitis is discovered. *Köchlin* published a series of such cases, which drew attention to the fact, that, purulent meningitis may occur not merely as a sequel of typhoid, but also may exist tolerably simultaneously with the symptoms of the disease. He writes: *"Dass die Meningitis purulenta nicht nur als Nachkrankheit, sondern auch so gänzlich gleichzeitig mit den Symptomen eines Restyphus vorliegen kann.*

The differential diagnosis between the disease, must in such cases be exceedingly difficult. Köchlin's cases occurred independently of pyrexia or middle ear disease, no suspicion of tubercle was raised. *Trousseau* has recorded a case of typhoid complicated with tubercular meningitis.

*Köchlin. Aus dem Franz Joseph-Kinderhospital Bd. 4 S. 469.*

*Trousseau. 1859. Union Med. Abt. 6.*
Abstract

Diagnosis

Page 47. Acute Paedri Catarrh - Difficulty in eliminating the various manifestations of Acute Tuberculosis. - The exclusion of other diseases which resemble Typhoid in its early stages.

Relapsed

Page 47. Relative frequency in children.

Complications

Page 49. Bowel complications less frequent in children. - Relative frequency of Lung complications. - Other complications.

Prognosis

Page 50. Value of Temperature Chart in this relation. - The presence or absence of Nervous Symptoms. - The presence or absence of Complications.
From the foregoing considerations, it is
apparent, that although Typhoid Fever may
be suspected, its diagnosis, in children, is
often difficult.
In the early stages of the disease, Acute
Gastric Cataract has to be eliminated, as
already shown in the clinical description.
This is mainly affected by time. Later
in the disease, the various manifestations
of Tuberculosis, closely resemble Typhoid.
In Acute Military Tuberculosis, we have so
many symptoms, common to both diseases;
that, should there be a Tubercular family
history, it is scarcely possible to exclude
the disease, except, by prolonged observation.
The only sure diagnostic sign, between
the two diseases, is the occasional presence
of Tubercle in the Choroid, in Acute
Tuberculosis. Do also with
Tubercular Meningitis. Although many
distinguishing rules are given, such as:
The greater urgency of the vomiting; the
moist tongue; the retracted abdomen;
the absence of diarrhoea & rash; the
greater proclivity of the Central Symptoms;
Aguing; the occasional fall in the temperature to normal; in Tubercular Meningitis, the Enlarged spleen; rash; Characteristic temperature; & diarrhoea in Typhoid. All these rules may be unavailing at the bedside; also under 5 years, the time of greatest frequency of Tubercular Meningitis, the Characteristic Typhoid Symptoms, are usually, less distinct. Tubercular Peritonitis is not so difficult to eliminate as in this disease the temperature soon becomes abnormal & the abdomen is usually retracted.

It is, however, in cases such as those that the Widal serum test will probably be of the greatest service. The other diseases which are sometimes mistaken for Typhoid, but as a rule, are easily excluded at the end of a few days are; Septicaemia, usually as a result of acute Osteo-myelitis or from Chronic abscess; Influenza; the other septicematas; v Tubianicisio.

Relapses are relatively as common in children as in adults. Barthez & Pillon note 3 in 111 cases.

Complications. As mentioned in the pathology elsewhere, the grave bowel complications, haemorrhage, perforation; peritonitis, are less frequently met with in children. As in adults, lobular pneumonia is more common than lobes pneumonia. Annot considers that in children, lobular pneumonia is comparatively rare. His statistics show 16, in 303 cases. The consolidated area may break down, or abscess, or gangrene result; or tubular deposit may take place. Amongst the complications, which are common in children, than adults may be mentioned otorrhoea; parotitis, with great swelling of the loose cellular tissue of the neck; diphteria (Barthez & Pillon mention 6 cases as occurring in their 111), cancer of the tonsils. Dropy without any abnormality of the urine, has been frequently observed in children by Stoeker, as also by
Barking Hiccup. Epiglottis, is probably not so frequently met with in children as in adults.

**Prognosis.** As a rule, the younger the child the better the prognosis; even known in older children, the graver complications, are less frequent than in adults. Thus, for a case without complications, in an otherwise healthy child, with a temperature not exceeding 103.5°-104° F. The prognosis, although guarded, would be favorable. As in adults, high temperature, or a sudden increase in the height of the temperature, or the absence of morning and evening remissions, are bad prognostic signs; so also, are very pronounced nervous symptoms. Muscular tremors, especially if the mind is clear, indicate deep sleep; rapid altercation, or that account, are to be regarded as grave symptoms.
Treatment

Abstract


Treatment of disease. - milk diet only

- 52. when possible. - Value of diet in controlling diarrhoea. - medicinal remedies. - Constipation


Antipyretic remedies. - Cod liver. - Cod liver oil. - Quinine. - local. - Spraying. - Antipyretic

- 54. drugs. - Bronchitis. - Cardiac

- 55. Failure. - Treatment of complications.

Attention to diet during convalescence.
The treatment of Typhoid fever in children does not differ materially from that employed in adult patients.

Prophylactic measures, in both cases, are of paramount importance. Complete isolation when possible; separate attention to soiled bed clothes; linen; complete disinfection or destruction of Typhoid stools.

The treatment of the disease, should be conducted in a cheerful, well ventilated room, and if the case be one of only moderate severity, with a temperature not exceeding 103° F.; this resolves itself, for the most part, into careful regulation of the diet and attention to the bowels.

If milk agrees with the child, this should be the only diet, given in small quantities at a time, mixed with 1/3rd barley, or lime water; the amount per day, regulated by finding out, exactly how much the child can digest. If the milk disagrees, or too much be given, casts will appear in the stools. The quantity should then be diminished, and the milk boiled, or perhaps more lime water
added, or peptonised. If however, the milk still disagrees, mutton or chicken tea should be substituted. *Carnichael considers, that, by thus carefully regulating the quantity & quality of the diet, & not overtaxing the impaired digestion, diarrhoea, may in many cases be prevented; & in some cases, successfully treated, by this means alone. If however, diarrhoea becomes severe, Carbonate of Bismuth with Chalk or Drick's powder, or in older children, Tincture of Opium, may be necessary. Constipation, on the other hand, is often very troublesome. Although Beef, & malt teas are slightly laxative, they may be substituted for the milk, other remedies are often necessary. Many Physicians, especially in Germany & America, recommend that a Colonel purge should be given, if the case is severe within the first week. Certainly in cases with constipation, very fevered Tongue, much headache, this treatment appears beneficial; but of the Colonel.

Carnichael 1892. Diseases in Children, pg. 53.
also, is converted in the Stomach, into the peroxide of Mercury, and acts as an antispetic to the bowels. During the course of the disease, Constipation is best relieved by Castor oil or soap vitamin enemas. Under no circum-
stances should.a strong purgative be given. Salol, Naphthalene, & other intestinal antispetics are recommended when the motions are very offensive, there is much flatulence.

As the patient is getting better, the temperature falling, Eggs, may be beaten up with the milk, Custard, or arrowroot, may be taken. It is wise however, to make no material alter-
ation in the diet, until a week has Elapsed, after the return of the temperature to normal.

In Children, conti-
nuous antipyretic remedies are rarely required. Hinchliff considers, that cold baths, even the cold pack, are not so well borne, by children as adults. That the first bath must always be considered in the light of an experiment, it should not be again tried if followed by symptoms of collapse. Soaping the Child with cold water, or the
Application of ice bags to the head and abdomen, alternately, usually are sufficient in all cases. Of Antipyretic Drugs, Quinine is taken well by children; Phenacetin also suits most cases. On the other hand, Salicylate of Soda, may give rise to vomiting and alarming Collapse, when given in large doses, to reduce the temperature.

Bronchitis does not usually require special treatment.

Although Cardiac failure may take place at any time, during the Course of the Disease, it requires the administration of Brandy or other Stimulants; the time the Child is most liable to it, is in the Early Morning, just after the Remission in the Temperature. At such time, it is always advisable to give some nourishment; frequently also stimulant, in order to prevent Collapse. If in spite of this precaution

*Bartholomew B. Frizter as quoted in Clarke's
Carmichael Diseases in Children 1872 p. 53.
\(^2\) Hinchliffe lecture on Children's Diseases Edn. St. Tran.
Vii p. 53
heart failure takes place, injections of ether, hot fomentations, or other remedies may be necessary.

Haemorrhage from the bowel, or other complications, should be treated on the same lines, as those employed in other patients.

When children are very restless, a lukewarm bath, 90-93° Fahr., is often followed by comfort and sleep. In cases in which the delirium is noisy, Chloral Hydrate given by the mouth, or as an Enema is recommended (Hinoeh)

As already stated, Convalescence is usually rapid in children. It is during this period, however, that the greatest supervision must be exercised, to prevent the child taking unsuitable food, as the appetite is frequently voracious.