

appeared so that between November 18 and December 15 he lost thirty-seven pounds in weight. Six months later his urine contained much less albumin and a few casts and he looked very well. One and one half years later and three years later he was seen. The last time his urine showed a very slight trace of albumin and a very rare hyaline cast. His blood pressure was normal and for two years he had been steadily at work in a machine shop running a lathe and feeling perfectly well.

Was this a case of nephritis with a complicating purpura or does it belong to the group I have been discussing? I must confess I do not know. Abdominal pain of various types does occur often in typical chronic nephritis without skin lesions and I usually call my students' attention to this as a type of symptom in chronic nephritis, that often leads to diagnostic errors. On the other hand I am inclined to think that in many patients hematuria, albuminuria, and other renal disturbances occur as part of the disease entity here under consideration and that these renal disturbances are due to kidney lesions similar in nature to those occurring in the skin. In this sense the renal lesions are not truly those of nephritis. This probably explains why in these patients with seemingly so severe a renal lesion progression into a true chronic nephritis is not often seen.

#### CONCLUSIONS

There is a definite clinical entity in which with skin lesions of the erythema group (purpura, erythema, urticaria, angioneurotic edema) visceral lesions occur as the result of the same type of lesion. The most common of these visceral manifestations are arthritis, gastro-intestinal symptoms, hematuria and various disturbances of renal function. The visceral disturbances occur unaccompanied by the skin lesions. The symptomatology of the group is very complex and without the presence of the skin lesions at a given time the cases present great difficulties in diagnosis.

### THE INFLUENCE OF THE HIGH CALORY DIET ON THE COURSE OF TYPHOID FEVER\*

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The various studies concerning the high calory diet which have been carried out in Bellevue Hospital during the last ten years, have established beyond question the value to the individual typhoid patient of the maintenance of an optimal state of nutrition.<sup>1</sup> Contrary to the common belief, it was found that large quantities of selected foods could be taken without disturbance of digestion. Likewise, it was found that food is absorbed by the typhoid patient practically as completely as by healthy men. Under the high calory diet the febrile loss of body protein is reduced to a minimum or altogether prevented. Investigations of the total metabolism of typhoid patients have shown that large amounts of food are consumed with avidity, any excess over the immediate needs being laid by for future use.

None of these studies, however, furnished more than indirect evidence of the influence which the high calory diet might exert on the natural history of typhoid fever. On account of the wide variations in the course of the disease in different seasons, such evidence can be obtained only from the study of a series of cases extending over a number of years.

A statistical study has therefore been undertaken of the course of typhoid fever in patients on the high calory diet and in an equal number of patients on diets (milk, broths, egg albumin water) furnishing not more than from 1,000 to 1,500 calories a day. The number of cases available is not sufficiently large to justify comparison of the frequency of the rarer symptoms and complications; even with respect to the commoner features of the disease, only tentative conclusions are drawn unless the evidence is overwhelming.

*Material.*—The material consisted of 444 patients, half of them on the high calory diet and the other half on a milk diet. All of the patients were treated on the second medical division of Bellevue Hospital except forty-five of those on the milk diet. The majority of the patients were under my personal care, thus eliminating differences in the course of the disease which might be attributable to different methods of treatment other than diet. The histories cover the years from 1903 to 1914, inclusive. As far as possible, cases in corresponding years have been selected, but the use of the high calory diet became so general throughout the hospital about 1911 that, in order to complete the milk series, it was necessary to utilize 113 histories from 1903 to 1906, inclusive.

The histories were taken from the records *seriatim*. All patients were classified as high calory cases if the attempt had been made to nourish them liberally, even if it failed or was only partially successful.

A moderate number of histories were unsuitable for analysis, the reasons being doubt as to the diagnosis, entrance into the hospital late in the disease, and death within a week of admission. Of the fatal cases excluded, three were on the high calory diet and twelve on milk. Fifty-five of the high calory cases were mild, 149 were severe, and eighteen were fatal. Forty-four of the milk cases were mild, 104 were severe, and thirty-nine were fatal.

*Duration of the Disease.*—There is no evidence to indicate that the duration of the febrile period of the disease or the range of temperature is affected by diet except, perhaps, that long recrudescences are rarer in patients who are well nourished.

The total duration of the disease, however, is shortened, in some instances, by months. That is, the long convalescences, formerly so common, have not been observed. The records with respect to convalescence are by no means complete, but a number of patients have reported back to the hospital from time to time. All of them have stated that they felt perfectly well and were physically able to follow their occupations (many of the patients were laborers) even within a short time after their discharge.

*Condition of the Mouth.*—While it is recognized that the condition of the mouth, including the tongue, in typhoid fever is dependent on the amount of attention bestowed on it by the nurse, it may be stated that the mental condition of patients who are well nourished is so good that they themselves keep their mouths clean. The only histories containing notes to the effect that the lips and tongue were in poor condition were found in the milk group.

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1. For the bibliography of the papers by Drs. Shaffer and Du Bois, Mr. Gephart, and the author, see *Arch. Int. Med.*, August, 1914, p. 163; *ibid.*, 1915, pp. 882, 887.

*Nausea and Vomiting.*—Nausea and vomiting occurred in 19.3 per cent. of the high calory cases and in 22.6 per cent. of the milk cases. The difference is negligible. Nausea and vomiting were more frequent among the earlier high calory cases when the diet was limited to milk, cream, lactose, and eggs; these symptoms became less common as other articles of food were added to the diet. Nausea and vomiting did not always coexist in the same patient. Lactose at times caused vomiting without nausea. Most often nausea and vomiting followed attempts to increase the food too rapidly or when the food mixtures were too rich. Some patients vomited the high calory diet and milk indifferently. A few patients had persistent and uncontrollable vomiting due either to recent excesses in alcohol or to the disease per se.

*Tympanites and Diarrhea.*—Though often associated, these did not always occur together. Tympanites occurred in 17.6 per cent. of the high calory cases and in 31.5 per cent. of those on milk. Extreme grades of tympanites were rarely observed among the high calory cases. Diarrhea occurred in 16.2 per cent. of the high calory cases and in 48.6 per cent. of those on milk. Temporary diarrheas of one to several days' duration have been included in the percentage for the high calory cases but not in that for the milk cases.

For comparison, the statistics of the Hamburg (2,240), and Leipzig (1,875) cases, as given by Curschmann,<sup>2</sup> may be cited. Continuous diarrhea occurred in 36.1 per cent. of the cases in the Hamburg epidemic, temporary diarrhea in 29.7 per cent., making a total of 65.8 per cent. In the Leipzig cases, continuous diarrhea occurred in 25.6 per cent. and transient diarrhea in 37 per cent., with a total of 62.6 per cent. Normal stools occurred in 5.2 per cent. of the Hamburg cases and in 4.4 per cent. of the cases in Leipzig.

The practice followed in Bellevue Hospital of giving a daily enema to all typhoid patients has made it impossible to ascertain what proportion of patients would have had spontaneous daily movements of the bowels and what proportion were constipated. With respect to the characters of the stools themselves, those from the high calory cases were notable for their normal color and consistence. A large proportion of the stools of the milk cases contained undigested milk curds.

Tympanites and diarrhea were observed more frequently among the earlier high calory cases. After 1911, only nine of these patients suffered from continuous diarrhea. Many patients entering the hospital with profuse diarrhea developed normal stools in the course of several days under the influence of the high calory diet.

Gradually it was learned that, except in a few patients, tympanites and diarrhea are due to an excess in the diet of one or another of the foodstuffs. Tympanites most frequently results from an excess of lactose; diarrhea most often from an excess of cream. Occasionally, the opposite was true. In one instance, tympanites disappeared when eggs were discontinued. Patients who at first were unable to take the desired amount of food usually could be educated to do so by graduating the increase. In the last few years, it has been found possible to control tympanites and diarrhea, in practically all instances, by rearrangement of the diet. In rare cases, tympanites and diarrhea always

followed the attempt to increase the food beyond 1,000 to 1,500 calories, in spite of frequent alteration of the proportions of protein, fat, and carbohydrate.

Reference may be made in this connection to Torrey's<sup>3</sup> study of the intestinal flora of some of the high calory cases of this series and of other cases on a milk diet. Torrey found that patients who were able to take large amounts of food without digestive disturbances possessed a flora dominated by the *Bacillus acidophilus*, and that patients with an initial putrefactive flora were capable of developing a favorable fermentative flora, with disappearance of tympanites or diarrhea, under the influence of the diet. Exceptionally, the putrefactive type of flora persisted in spite of alteration of the diet—these were the patients who could not be liberally nourished. The therapeutic application of these results was at once apparent and at my request Dr. Torrey prepared a pure culture of *Bacillus acidophilus* for administration to typhoid patients. The bacillus was used first for patients entering the hospital with tympanites and diarrhea in order to hasten the transformation of the flora; later it was given more or less as a routine measure. The results have been satisfactory.

Through the investigations of Torrey, and of Hull and Rettger,<sup>4</sup> it is now known that the beneficial influence of the high calory diet on the intestinal flora is due to its lactose content.

When tympanites and diarrhea occur in typhoid fever (except perhaps in the prodromal stage for which we possess no data), they are the result of an unfavorable flora, which, in nearly all instances, is in turn dependent on an unsuitable diet. Tympanites and diarrhea, therefore, are not due to the specific action of the typhoid bacillus and should not be considered as essential symptoms of the disease.

*Nervous Symptoms.*—Three and six-tenths per cent. of the high calory cases were described in the histories as stuporous, restless, or toxic, as compared with 10.81 per cent. of the milk cases; 7.65 per cent. of the high calory cases were delirious throughout the greater part of the active period of the disease, 13.5 per cent. of the cases were delirious for one to several nights. Some of the patients with prolonged delirium, though nominally high calory cases, took very little food. In some instances the delirium followed intestinal hemorrhage.

Thirty-eight and three-tenths per cent. of the milk patients had well-marked delirium (20.7 per cent. of them sank into the typhoid state) while 3.60 per cent. were mildly delirious.

Twenty-one of the high calory cases that entered the hospital in a delirious condition, or the typhoid state, gradually cleared as the food was increased. Occasionally patients taking large amounts of food became delirious for short periods. None of the high calory patients who received the desired quantity of food developed the typhoid state. In eight of the fatal cases with severe nervous symptoms, the patients took less food than they required, for the most part under 2,000 calories a day.

The practically complete absence of severe nervous symptoms in patients who were able to take sufficient food and the disappearance of these symptoms with improvement in the patient's nutrition, warrant the conclusion that severe nervous disturbances, including the typhoid state, occur in typhoid fever only when the patients are undernourished. In other words,

2. Curschmann in Nothnagel's Encyclopedia of Practical Medicine, volume on typhoid and typhus fevers.

3. Torrey: Jour. Infect. Dis., 1915, 15, 72.

4. Hull and Rettger: Jour. Bacteriol., 1917, 2, 47.

severe nervous disturbances are not due to the specific action of the typhoid bacillus, but rather to the action of the bacillus in the presence of partial starvation. The well known fact that the typhoid state is not peculiar to typhoid fever lends support to this view.

The foregoing conclusions should not be interpreted to mean that typhoid patients, even when well nourished, may not develop delirium. Some persons become delirious whenever the temperature reaches a certain height irrespective of the cause of the fever.

*Body Weight.*—Loss of weight in typhoid fever was formerly so constant that it was considered a characteristic phenomenon of the disease. While the records of the patients in the milk series contain no reference to weight (the method of weighing patients had not then been devised), it can scarcely be doubted that all of them lost more or less in weight and in general, the severer the fever, the greater was the loss.

A large number of the patients in the high calory group were frequently weighed. The majority of them lost some weight during the active period of the disease, usually only a few pounds. The emaciation which was so common among the milk cases did not occur if the patients took reasonably large amounts of food. In a few instances, there was a gain in weight, even at the height of the fever or during a relapse. In all cases, as the appetite improved and the quantity of food was increased, the lost weight was regained in the later stages of the fever or early in convalescence. In other words, loss of weight is not a symptom of typhoid fever, but an indication that the patient is receiving insufficient food.

*Complications.*—As stated above, the number of cases in this series is not sufficiently large for comparisons of the rarer complications in the two groups to possess much value. Yet in some instances the results are striking.

There were a total of 110 complications in eighty-one of the high calory cases and 144 complications in ninety-one of the milk cases.

*Intestinal Hemorrhage.*—This occurred in 9.45 per cent. of the high calory cases. The hemorrhage was moderate in 5.40 per cent. and severe in 4.05 per cent. of the cases.

Among the milk cases, moderate hemorrhage occurred in 5.40 per cent., severe hemorrhage in 9 per cent. making a total of 14.40 per cent.

The difference in the incidence of hemorrhage in the two groups is too small to possess much significance, yet closer analysis brings out an important difference in the mortality from hemorrhage.

Twenty-one of the high calory cases were complicated by hemorrhage. Two of the patients died; one from hemorrhage alone, one from hemorrhage, pneumonia and cholecystitis, giving a mortality from hemorrhage of 9.5 per cent.

Hemorrhage occurred in thirty-two of the milk cases. There were nine deaths; six from hemorrhage alone (18.7 per cent.), and three from hemorrhage with other complications (9.4 per cent.). The total mortality from hemorrhage among the milk cases was 28.1 per cent.

The frequency of intestinal hemorrhage, according to Curschmann, varies from 4 to 6 per cent. The mortality among cases with hemorrhage varies from 20 to 44 per cent.

In both groups of the present series, therefore, the incidence of intestinal hemorrhage is greater than

usual, but the mortality from hemorrhage appears to have been lowered by the high calory diet.

With respect to the individual patient, intestinal hemorrhage seems to cause but little, if any more disturbance when the patient is well nourished, than the loss of an equal amount of blood by a healthy man. Occasionally a patient became delirious after a hemorrhage. One patient recovered after the loss of two quarts (estimated) of blood.

*Perforation.*—This occurred in two of the high calory cases (0.9 per cent.), and in seven of the milk cases (3.15 per cent.). The average incidence of perforation is placed at from 2 to 3 per cent. One of the high calory patients with perforation died. Six of the milk patients with perforation died, namely, 85.7 per cent. Tentatively, the conclusion may be drawn that the high calory diet lessens the liability to perforation.

*Recrudescences and Relapses.*—Recrudescences occurred in 6.75 per cent. of the high calory cases and in 11.3 per cent. of those patients on a milk diet.

Relapses occurred in 18 per cent. of the high calory cases and in 14.9 per cent. of the milk cases.

From these figures it is probable that diet is without influence on the frequency of recrudescences and relapses. Prolonged recrudescences, however, are apparently less common and relapses are better borne by patients who are well nourished.

*Mortality.*—Death occurred in 8.10 per cent. of the high calory cases and in 17.6 per cent. of the milk cases. This does not, however, express fairly the reduction in the mortality rate among the high calory cases which includes all deaths (except three who died within a week of admission to hospital) irrespective of circumstances which may have determined the fatal issue. Seven of the eighteen fatal high calory patients were unable, for one reason or another, to take the amount of food they required; thus, one had been on a ten day debauch, one vomited practically everything which was given him, one had status lymphaticus, one had been in the hospital for many weeks with abscess of the prostate before developing typhoid. Another of the fatal cases developed diphtheria. If we deduct these eight cases from the total, there remain ten deaths which are justly chargeable to the high calory group. This gives a mortality rate of 4.50 per cent. as compared with 17.6 per cent. for the patients on the milk diet.

*Clinical Picture.*—The statistical evidence which I have cited conveys but an imperfect impression of the profound changes which the high calory diet brings about in the natural history of typhoid fever.

While there is, obviously, considerable variation in the course of the disease in different patients, the most striking change in the clinical picture is the practical absence of severe, and, in many cases, of all nervous phenomena. The patients lie in easy positions in bed, such as a healthy man assumes while resting. The severer cases may be somnolent, at intervals flighty, but they are easily aroused. When awake they are alert, their eyes are bright, their facial expressions are natural. The patients lose very little weight and a casual inspection of them gives no hint of the nature or severity of the illness. Many patients read the daily papers and magazines while still running high temperatures. At meal times they turn on their sides, often propping themselves on their elbows, and eat from well filled trays without assistance from the nurse.

If this picture is contrasted with that of the severely toxic, half starved patient, with hollow cheeks, listless expression, staring eyes, and restless, emaciated forms, it is difficult to believe that they portray the same disease.

*Influence of High Calory Diet on Treatment.*—The use of the high calory diet has greatly simplified the treatment of typhoid fever. The amount of "nursing" is reduced to a minimum. While the preparation of the food undoubtedly demands more time than the administration of a glass of milk every two hours, this additional attention is more than counterbalanced in other directions. The use of drugs has been almost eliminated.

Every patient receives a saline or soap-suds enema in the morning and, as a rule, the bowels require no further attention during the day. If tympanites or diarrhea should develop, it indicates that the diet is improperly arranged and relief is obtained through alteration in the proportions of the foodstuffs.

No attempt whatever is made to control the fever. High temperature is believed to be a potential danger only when patients take insufficient food. Antipyretic drugs are considered dangerous; hydrotherapy, unnecessary. A cleansing bath is given every morning and, if alcohol "sponges" make the patient more comfortable, he receives one or more a day. In my opinion, hydrotherapy owes whatever value it possesses to reduction in total metabolism and not, as has so often been stated, to stimulation of the nervous system. If the increase in total metabolism can be covered by food, the cold bath loses its purpose.

In the absence of delirium, patients do not require constant watching to prevent them from getting out of bed and perhaps out of the window. They are not incontinent of feces and urine, with the consequent frequent changes of the clothing and bed. The tendency to bed sores is thereby lessened.

Fewer patients require cardiac stimulants, though I frequently give strychnin toward the end of the fever, or during convalescence, to restore tone to the musculature of the heart and blood vessels.

#### SUMMARY

A comparative study of 222 cases of typhoid fever on the high calory diet and of an equal number of cases on a milk diet has brought out the fact that the natural history of the disease, as it has previously been known, is profoundly altered by the maintenance of an optimal state of nutrition. The range of temperature apparently is not affected, but the total duration of the disease is shortened, in some instances by months, through the shortening of convalescence. Certain symptoms which hitherto have been attributed to the specific action of the typhoid bacillus have been discovered to be due to faulty methods of treatment, in particular, to an inadequate or improperly balanced diet. Complications are rendered less formidable, and perhaps less frequent, by maintaining the patient in the best possible state of nutrition. Moreover, the mortality from the disease is reduced by from 50 to 75 per cent.

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#### ABSTRACT OF DISCUSSION

DR. E. F. DU BOIS, New York: It has been my privilege to be associated with Dr. Coleman for seven years, and I have been able to see almost all of the typhoid patients he has treated during this time. One cannot help being markedly

impressed by the change in typhoid fever as brought about by the Coleman-Schaffer diet. The picture of the patient is changed completely; the typhoid state is seldom seen; extreme apathy is rare; patients require comparatively little attention. Baths do not seem to be necessary. Medication in typhoid fever seems to be almost a thing of the past. As to mortality, the statistics speak for themselves. The general clinical impression of all who have seen a large number of typhoid patients fed on this diet is that the patients are infinitely more comfortable. There is still room for discussion as to the exact number of calories needed by the typhoid patient. The actual number of calories produced by the patient's own body amounts to some 2,000 calories a day. The question is whether one should be satisfied in giving that amount, or should give more. If one wishes to keep the patient in nitrogen balance, one must give about 4,000 calories, but that requires special training on the part of the nurse. Good trained nurses can administer 3,000, but most nurses have difficulty in giving 2,000 calories. At least 3,000 should be given, if possible. Most of the poor results are found in patients who have not been able to take 1,500 calories a day.

I think every one here must have been struck by the contrast between the subjects of the last two papers; that is, diabetes and typhoid fever. In diabetes Dr. Allen and Dr. Joslin have shown the necessity of keeping the calories as low as possible; in typhoid fever Dr. Coleman and Dr. Schaffer have shown the necessity of keeping the calories as high as possible. In modern medicine it is necessary to know the amount of calories in a patient's diet.

DR. DUDLEY ROBERTS, Brooklyn: About four years ago my interest in Dr. Coleman's work led to an examination of his patients in Bellevue Hospital. At that time I was struck with three things: (1) his patients did not look as if they had typhoid fever at all; (2) there was a slight fullness of the abdomen in practically all cases, and (3) there were some difficulties in carrying out the high caloric feeding in private or even hospital practice. Since that time we have had about 100 cases in the wards of the Brooklyn Hospital and these impressions have all been confirmed. When the patient is properly nourished, typhoid fever presents an entirely different picture from the classic one. I have about come to the conclusion that what we have known as typhoid fever is largely the picture of starvation. Slight fullness of the abdomen is usually present and need cause no anxiety. The difficulty of using the high caloric diet we have solved to our satisfaction by the use of food formulas of definite caloric value per given measure, and by insisting that the caloric intake of the patient be known from hour to hour through proper charting.

It is to be feared that Dr. Coleman's work will be damned by too faint praise. We are not dealing with a little more liberality, but with a definite attempt to supply the bodily needs of the patient. An uncorrected mortality of 5 per cent. in our series and no deaths in cases in which high caloric feeding was actually put in practice, make a striking contrast to previous mortality percentages. Fully as important is the amazingly rapid convalescence. This is a monumental work that Dr. Coleman has done, and the plan of treatment should become the generally accepted practice.

DR. C. H. BREIDENBACH, Dayton: Much opposition prevails, and always will, to radical departures from long established practice. I want to supplement Dr. Coleman's work with a report of 137 patients with typhoid fever on high caloric diet.

If we take home Dr. Coleman's message, we will benefit by attendance on these sessions. Some forceful character must arouse us from our lethargy. Here is a preventable disease, exacting, in this country, a toll of 35,000 lives annually—an economic loss of thirty billions in ten years. We have sought too eagerly the spectacular, mysterious and unexplored.

Of our series, seventy-six cases were treated by the high calory diet method from the onset. The results in these cases were gratifying and convincing. The entire aspect of the disease was changed. Noteworthy facts were as follows: absence, or only the slightest suggestion, of the terrifying, distressing, exhausting delirium and the ghastly emaciation which constituted the typhoid picture of the past; 32 patients lost less than 5 per cent. in weight; 20 maintained normal weight;

24 gained from 3 to 5 per cent; 1 died of intestinal hemorrhage.

Sixty-one patients came under observation after the disease had made considerable progress. These patients responded promptly to high calory feeding, delirium began to subside, pulse improved, temperature declined; the benefits of feeding were manifest within forty-eight hours.

Our routine treatment of typhoid will not be regarded as ultrascientific; it is, however, pregnant with gratifying results, although dubbed the C. O. D. treatment—castor oil, opium, and diet. Castor oil every other day will prevent the distention complained of by Dr. Coleman, and is less likely to provoke hemorrhage and perforation than most of us fear. For delirium, opium to the point of narcotism if required to end the coma vigil, tremor, twitching, etc. Narcotism of short duration will restore reason, improve pulse and reduce temperature. One patient died manifesting perforation. Necropsy revealed a thrombosed superior mesenteric artery with necrosis of sections of the small intestine.

Our mortality of 2 per cent. could not be maintained on this or any other treatment, but it is significant. Our policy is, hands off! No meddlesome treatment, allowing temperatures to run wild; 107 F. is the peak; when this is reached (and it usually is in from three to five days) the hour of improvement has been marked. The next morning, remission will be startling and gratifying, adding weight to Vaughan's suggestion that "In acute infections, high temperatures are perhaps beneficial, in that they may favor the formation of antibodies."

These cases extended over the past three years. We are so well satisfied with results that, until we have a more comprehensive knowledge of the pathologic chemistry of this and other acute infections, we shall not starve our patients, interfere with temperatures, deny them refreshing sleep, or rob them of "Granny's" ever pleasant physic, castor oil.

DR. MAX EINHORN, New York: I rise to substantiate the great value of Dr. Coleman's work in typhoid fever. I had some experience in this line in the German hospital for quite a number of years. I was always in favor of feeding the patients quite well, but I was of the opinion that the diet should be a liquid one, and gave the patients milk and raw eggs; but later, when I became acquainted with Dr. Coleman's work, I started in with the same methods, and in the hospital all my patients were treated according to his methods, with excellent results. I do not want to say that symptoms, with somnolence in typhoid fever are all due to starvation, but I will say that in a patient who is well nourished these symptoms are reduced. A weak patient will become delirious from the toxin of fever, while the well nourished patient will have the same amount of toxins but, with a high diet will not show so many symptoms. While it is not starvation alone that develops these severe phenomena, the symptoms due to the toxins can be greatly reduced by sufficiently raising the standard of nutrition in the body. I think you will find in Leyden's book on dietotherapy that many years ago the problem was raised whether, in typhoid fever in which there is a great expenditure of heat, more so than in health (while a normal healthy person expends 2,400 calories a day, a typhoid fever patient will expend 3,000 to 4,000 calories), it was possible to give enough heat to the body so that the expenditure should be balanced. This was not definitely answered until Dr. Coleman took it up and showed that it was possible to replace the entire amount of calories in typhoid fever when there was a severe disease in the intestines and high fever. Even here the body can be supplied with adequate nutrition, and that is a great advance, for which we should congratulate Dr. Coleman.

DR. E. P. JOSLIN, Boston: Overfeeding during an infectious disease would seem to be an ideal method by which to produce diabetes. I have seen no such case during recent years, but I am sure Dr. Coleman has some information on this point. There is, as we all know, a strong feeling among many physicians that infectious diseases are closely connected with the etiology of diabetes.

DR. A. E. ROUSSEL, Philadelphia: I feel that I should offer some few points of criticism. I wish to report that I have treated over 260 consecutive cases of typhoid fever at the Howard Hospital; 213 of these patients were treated on the

modified diet—neither the milk diet nor the Coleman diet. On forty-nine of them I tried the Coleman diet. It may be that I was not sufficiently enthusiastic in carrying out the Coleman diet in these cases. The number of intestinal hemorrhages was large in the cases on full diet; the abdominal distention was more marked, and diarrhea was more universally present. Now, personally, as a teacher, I believe that probably the truth lies between these two extremes. But no matter what the diet today, the question of leaving temperatures of 107 alone is absurd and dangerous in the extreme. I would not care to treat that way. I repeat the fact that under the modified diet my mortality was 4 and a fraction of 1 per cent.; my mortality on the Coleman diet was over 8 per cent. It is possible that I may not have applied it as well as Dr. Coleman, but it is not difficult to carry out, and I followed his directions carefully. I want to say that we should not be carried away by too much enthusiasm. The intensity of typhoid fever is not as great as it was formerly, with a mortality of about 18 per cent. I think that hydrotherapy, which is bound to stay, has done much to modify its virulence. It appears to me that the cases that I see in consultation in the country and smaller towns are of a more severe type than those in the city. For example, I have knowledge of some cases that originated at a sea shore hotel with a mortality of 100 per cent. This is a degree of virulence that seems to be beyond any form of treatment. *In medio tutissimus ibis*. I think we should not go to extremes one way or the other.

DR. H. A. CHRISTIAN, Boston: Dr. Roussel has touched on one important point in the consideration of statistics in acute infectious diseases, and that is the importance of recognizing that from year to year there is a variation in the curve of mortality. Therefore we must not compare the results of treatment of typhoids or pneumonias of one year with those of another year without making allowance for that variation. I did not catch in Dr. Coleman's paper whether the statistics of the patients on the high calory and low calory diets represent patients in the same or different years. If they represent patients in different years, allowance must be made for variations in the severity of the disease. I think it is important to make that clear. Alternate cases in a given hospital treated, one case in one way and another case in another way, will give more valuable data than taking cases in one year to compare with those in another.

Typhoid fever has changed, as I have seen it in the last five to seven years. Typhoid that is described in the textbooks, typhoid that our students read about, cannot be illustrated at present by the typhoid patients we have in the wards. We have to say to our students that this will impress you of the typhoid you have read about in the books because it is so different. Whether that is due to the feeble virulence of the organism, or to our treatment, is an important thing to know. I have carried out the Coleman treatment in my cases. The results have been satisfactory, but being skeptical, I wonder how much is due to the Providence that determines the pathogenicity of the organism, and how much to our treatment of the disease.

DR. WARREN COLEMAN, New York: In regard to the question of Dr. Joslin, of diabetes and typhoid, in practically the whole series of cases, sugar was present in the urine of only one patient. Of course the urine was not examined every day in all the high calory cases, but I think diabetes could not have been present without our having discovered it. In the case I am speaking of, it was glycosuria; as far as is known, none of the patients developed diabetes during convalescence. The important fact with regard to the patient who had glycosuria was that his sugar tolerance increased at the same time that we increased the carbohydrate intake. That was one of the cases we studied very carefully. The patient was put on the Benedict respiration machine every other day for a long period, so that we knew exactly what was going on with respect to his metabolism, and the sugar tolerance increased in spite of the fact that the carbohydrate intake was raised. One point with regard to Dr. Roussel's remarks is that the more experience I have had, the more important it appears to individualize the feeding. All patients cannot be fed by rule of thumb. It is an individual question entirely. Also, if the patient's intestinal flora is of the putrefactive type at

the beginning, it will take longer to raise his tolerance for the feeding than if he had a favorable fermentative flora. In some cases one can greatly increase the milk sugar and in others not. It is necessary to find out the kind of food the patient requires. With relation to the question of years of the cases in the two groups, raised by Dr. Christian, that is in the paper, I omitted it because I did not wish to take up too much time. As far as possible, the cases were selected in corresponding years. I think the fact that the cases cover a period of ten years to some extent counterbalances the defects in this respect.

## THE INFLUENCE OF LABOR ON THE BRAIN DEVELOPMENT OF THE CHILD \*

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The possession of a healthy mind in a healthy body is the first and indispensable condition for survival in the struggle for existence. In view of the far-reaching and disastrous results of mental enfeeblement in the individual, the home and the community, it becomes the duty of the physician to investigate all possible sources of intellectual deficiency and to eliminate all etiologic factors amenable to control. The idiot by heredity, the victim of congenital variation of germ plasma or of embryonic insufficiency of internal secretions, whose brain anomaly dates back to early intra-uterine life, is beyond our help except to the extent that we may benefit him by glandular therapy and educational methods.

Conditions are altogether different in the case of a healthy, well developed child that has traveled safely through the months of fetal evolution and reached the journey's end only to be wrecked during the process of his entry into the world.

Preventable traumatism to the skull and its contents is the subject to be considered in this paper. The rescue of even a single human being from feeble-mindedness incurred through injury at birth is such an important matter that it has occupied my mind for years, ever since in my student days I witnessed an almost incredibly long protracted labor, culminating at last in the spontaneous delivery of a living child. While practically free from external blemishes, it was almost a foregone conclusion that this infantile skull harbored a bruised and congested brain, with hemorrhagic areas and extensive destruction of nerve cells which would in turn lead to arrested brain development and feeble-mindedness.

Instrumental delivery, more particularly by the obstetric forceps, has often been accused of being the cause of birth traumatism, and has undoubtedly caused serious mutilations in the hands of the unskilled; but its action can never be so prolonged or profound as the molding of the soft cranial bones in very narrow or otherwise obstructed pelvic passages.

### INJURY TO BRAIN IN DIFFICULT LABOR

Unduly prolonged or otherwise abnormal deliveries may damage the child's brain through three mechanisms: (1) direct contusion of the brain substance; (2) local congestion and rupture of intracranial vessels by the overriding parietal bones, and (3) general

congestion of the venous system caused by an obstruction of the fetal circulation and resulting in capillary rather than in diffuse meningeal hemorrhages.

Prolonged general compression of the child's skull in the birth-passages in difficult unassisted labors is one of the causes of displacement of the cranial bones and a resulting circulatory disturbance in the venous sinuses, according to Kundrat.<sup>1</sup> In a paper on Wormian bones in fontanels and their effect on child-birth, Dr. Grace Peckham Murray<sup>2</sup> called attention to the possibility of obstetric damage to the infantile cranial contents during the second stage of labor as the time of greatest pressure. Based on personal experience in three lengthy labors with three stillbirths, she points out the detrimental influence on the child in consequence of the unduly prolonged labor. ("Instruments were not used in either instance, as there was a constant expectation that the labors would terminate naturally.")

If the damage to the brain and nerve centers may be sufficient to destroy life, as in the three cases reported by this observer, it is not unreasonable to assume that other infants may survive with irreparably damaged brains. The question also arises whether these Wormian bones in fontanels, especially in the posterior fontanel, by preventing the overlapping of the sutures and normal molding of the child's head, may not contribute their share to the exposure of well developed infants to the danger of idiocy and imbecility through the prolonged compression of the skull in the birth passages.

It is a pity that surviving children born after unaided but unduly prolonged labors have never been systematically studied in their primary school work and later mental development. Equally regrettable is the lack of reliable information regarding the birth conditions of the children in institutions for the feeble-minded. As a rule, there is at best a bald statement to the effect that the birth was natural, without comments on the duration of the labor, or that it was terminated by instrumental delivery, which is often held responsible for the feeble-mindedness. In this manner a prejudice unwarranted by the actual facts is created against the obstetric forceps. Goddard<sup>3</sup> states, however, that "since many normal children are delivered by the use of instruments with more or less temporary deformity to the head but without any effect on the mentality, it is unreasonable to conclude in those cases where there is both hereditary feeble-mindedness and a history of instrumental delivery that the latter is the cause of the mental deficiency."

Obstetric clinics, at least so far as I have been able to ascertain, keep no notes on this subject, and I have therefore endeavored to collect some data from institutions for feeble-minded children. I am well aware of the imperfections of these brief statistics, and I offer my figures chiefly in the hope that they may serve to stimulate a needed interest and invite a better study of the subject both in obstetric clinics and in homes for the feeble-minded.

A study of causes of mental defect, active at time of birth in 5,000 cases (from the Pennsylvania Training School for Feeble-Minded Children at Elwyn, Pa.), shows the following results: instrumental deliv-

\* Read before the joint meeting of the Section on Obstetrics, Gynecology and Abdominal Surgery and the Section on Nervous and Mental Diseases at the Sixty-Eighth Annual Session of the American Medical Association, New York, June, 1917.

1. Kundrat: Ueber die intermeningealen Blutungen Neugeborener, Wien. klin. Wchnschr., 1890, **3**, 887.

2. Peckham, G.: Wormian Bones in Fontanelles and Their Effect in Childbirth, Med. Rec., New York, 1888, **33**, 412.

3. Goddard: Feeble-mindedness, Its Causes and Consequences, New York, 1914, 447.