RECURRENT VARIOLA.

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A SECOND attack of smallpox is of such rarity as to deserve recording. In the available works on the subject, few references are made to it. I can find but the following:—

According to Marson,¹ during the one hundred and nineteen years since the founding of the London Smallpox Hospital not a single instance has been recorded of a patient being admitted with smallpox a second time. Although Baumbler,² "In the smallpox hospital in London, from the years 1836-1851, among 5797 cases, 47 cases occurred, therefore, less than one per cent. of second attacks."

MacCombie³ writes, "I have not seen an attack of smallpox in any person who bore unmistakable evidence of having had smallpox." Immermann,⁴ "Rarest of all, without doubt, are the true relapses, but such are really now and then observed. Somewhat more frequently, though rarely enough, second attacks occur, between which and the first attack (experienced in youth) a series of decades usually intervenes. Aitken⁵ quotes a case reported by Roupel of three attacks, a lady of M. Guinet, who had it five times; a case of Matson of seven attacks; and one by Baring, a surgeon attacked on every attendance upon a case.

All agree that a second attack is mild. The classical case of Louis XV of France, who had an attack of the discrete form at the age of 14 and succumbed to confluent smallpox at 64, is the familiar exception.

B. P. F., age 50; had discrete smallpox at age of four; in proof of which many typical scars are to be seen distributed generally over the trunk. When mustered into the Federal service as a member of the local company Massachusetts Coast Artillery, at the beginning of the Spanish War, the medical officers verified his statement on physical examination and exempted him from the customary vaccination. Because of the presumed immunity by his early attack, he was employed by the Board of Health as general utility man at the smallpox hospital last June, for a short time while one patient was there.

March 15 the hospital was reopened as smallpox again appeared, and F. resumed work, transferring patients from their homes, destroying infected bedding, clothing, etc., mingling freely with the patients, who numbered eighteen.

March 30 he complained of headache, backache, and chilliness which aroused suspicion of possible second attack. After a few doses of aspirin he resumed work, feeling perfectly well.

April 4 he awoke and found a general maculopapular eruption on his body. Similar lesions were seen on the soft-palate; the varioloid ran a rapid course without incident.

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² Wilson: Modern Clinical Medicine, Infectious Diseases.

³ Allbutt: A System of Medicine. Vol. iii.

⁴ Nothnagel: Encyclopedia of Practical Medicine.

⁵ Whittaker: American Text-Book of Theory and Practice of Medicine. Vol. ii.

Medical Progress.

REPORT ON PROGRESS IN PEDIATRICS. BOILED MILK IN INFANT FEEDING.

BY JOHN LOVETT MORSE, A.M., M.D., BOSTON.

THE effect of the heating of cows' milk on its nutritive value as a food for infants has been a matter of considerable interest to American pediatricists for some years. Two important articles on this subject have recently appeared. In one, Lane-Clayton¹ sums up the available data on the boiling of milk and compares the results in a considerable number of babies, part of whom were fed on breastmilk and part on boiled cows' milk. In the other, Brennemann² reports a comparative study of the digestibility of raw and boiled cows' milk, based on the results obtained in a young adult, who was able to empty his stomach at will. His findings are most interesting and throw much new light on the subject.

Janet E. Lane-Clayton, in her Report to the Local Government Board upon the Available Data with regard to the Value of Boiled Milk as a Food for Infants and Young Animals, summarizes the experimental evidence as to the comparative nutritive value of raw and boiled milk of the same and of a foreign species as follows:

I. There is no evidence to show that boiled cows' milk is markedly inferior to raw cows' milk as a food for young calves, at any rate after the first two days of life.

II. The salt content of the milk is of great importance.

III. If young animals are fed upon the milk of a suitable foreign species they appear to thrive somewhat better if the milk is given boiled than if given raw, the only exception being in the case of germ-free milk.

IV. In those cases in which the health of the animals was inquired into after the cessation of the experiment, no difference could be detected in the animals fed by different methods of artificial feeding.

V. All the animals fed by different methods of artificial feeding were inferior to the breast-fed animals, both at the time of the experiment and afterwards.

She points out that the clinical evidence as to the relative nutritive value of raw and boiled milk as a food for infants is rather scanty, that most of the available evidence is from sick rather than well babies, that details as to the source, quality and preparation of the milk are often lacking, that most of the series of cases have been small and that the observations have usually been of short duration.

She concludes from her study of the literature and from the unpublished results of Prof. Theimich of Magdeburg that the data available are insufficient to justify any definite conclusions as to the comparative value of raw and boiled human milk as a food for infants. She calls attention to the fact, however, that the

great variety in the chemical composition of the milks of different species justifies the assumption that the milk of each is especially adapted for the young of that species; and that the slight changes in the chemical composition produced by boiling might be expected, therefore, to have more effect on nutrition when the milk is of the same species than when of the less well adjusted milk of a foreign species. The evidence is sufficient to show, however, that many babies thrive well on boiled human milk. She concludes, therefore, that either the changes produced by boiling are insignificant or the fine adjustment of the milk to the species is not as important as usually supposed.

After reviewing the clinical evidence in regard to infants fed upon raw and boiled milk of a foreign species, she concludes that, if children healthy or not markedly atrophic are considered, no great difference can be detected between the nutritive values of raw and boiled milk, provided that the quality of the milk is the same. If markedly atrophic or sick children are considered, there appears to be a good deal of idiosyncrasy, some doing well only upon the one form of food and some only upon the other. The value of much of the clinical work on this subject is very much reduced by the absence of control cases and in this respect the earlier work is especially deficient, as also in regard to the details of the milk given.

She calls attention to the fact that the metabolism experiments which have been done in this connection show nothing as to the comparative value of raw and boiled milk as a whole, but merely as to the nutritive value of individual elements of the milk. She then reviews the stock literature as to the influence of the boiling of milk on the production of scurvy and rickets and wisely refrains from drawing conclusions.

She then reports her own study of a series of healthy babies at the Infants' Consultation of the Naunyn Strasse in Berlin. The babies were divided into two classes, those fed entirely or almost entirely on the breast and those fed entirely on boiled milk. One hundred and seventy of the first and 154 of the second series were under observation over four months. An examination of the babies still in attendance at the end of the first year showed that 30 of 116 of the first series and 31 of 120 of the second showed signs of rickets. There was a significant difference between the average weight of infants fed upon the breast and of those fed upon boiled cows' milk, in favor of the former. An analysis of the other possible factors showed that the most important factor in the production of this result was the method of feeding. This difference was greatest in the early weeks and months. The babies in the two series doubled their birth weight at about the same time.

These experiments unfortunately show nothing as to the relative nutritive value of raw and cows' milk in infant feeding. The results obtained in these infants fed on boiled cows' milk

were, however, extremely favorable, and as the author says, "would scarcely be expected to be surpassed had raw cows' milk been used." She rightly, however, attributes the excellence of the results in large measure to the care and supervision exercised at and through the Consultation.

Brennemann, in his paper entitled "An Experimental Study of Milk Coagulation in the Stomach, Together with Clinical Observations on the Use of Raw and Boiled Milk" states that the housewife and dairyman are practically familiar with the fact that boiled milk forms a different curd from raw milk. Pediatricists have, however, quite ignored the fact that raw and boiled milk are not identical foods. If they have compared them at all, it has been rather from the bacteriological than from the physiological point of view. Boiled cows' milk forms in the stomach, as does human milk, nearly a liquid food, while raw cows' milk is not even a soft food, but a solid food, so solid, in fact, that unless modified in some way and given in careful moderation it may form hard masses that pass undigested throughout the whole alimentary tract and appear as hard curds in the stools.

He then calls attention to the fact that Talbot demonstrated that these hard, tough curds were casein curds in contradistinction to the small soft white curds formed from fat. This was denied by the Germans, who said that there were no such things as casein curds. He also shows that the explanation of this discrepancy was that Talbot and other American clinicians used raw milk mixtures, while the Germans used boiled milk mixtures. The Germans, like the Americans, found these curds as soon as they fed raw milk.

Brennemann and Ibrahim, working independently, offered as an explanation for the invariable occurrence of these hard curds when enough raw milk was fed, that, while boiled milk formed fine, soft curds in the stomach, raw milk formed large, hard curds that under given conditions would be passed through the whole digestive tract before they were completely digested. The evidence for this explanation is threefold:

1. Experiments in vitro. When rennin is added to raw milk in a beaker, at a proper temperature, the milk will quickly form a dense, hard coagulum that separates rapidly and completely from the whey. Boiled milk under the same conditions coagulates more slowly, separates less completely and forms a soft, finely divisible curd that differs but little from a thick liquid.

2. The clinical observation that babies fed with raw cows' milk will at times vomit hard, rubbery curds of enormous size.

3. When raw milk is injected into the rectum of babies and retained for a time, the next bowel movement will contain typical hard curds indistinguishable from those that occur when

raw milk is fed by mouth. If the milk is returned in a short time the curds are soft and white. If after four or five hours, they are smaller and harder, somewhat changed in color and rounded or bean-shaped, an exact parallel to what occurs when these curds are present clinically. When rushed through rapidly, as in diarrhea, they resemble more nearly a fresh milk coagulum. The longer they stay in the bowel the harder, more rounded and more stained they become. When boiled milk is injected in the same way, no such typical hard curds are formed.

He then attempted to explain the processes going on in the stomach that produced these hard curds, it being impossible to be certain that beaker experiments represented what took place in the stomach. Czerny maintained, for example, that the constant motion of the stomach prevents the formation of large, hard curds. The fact that large and unusually hard curds are formed from raw milk, when milk and rennin are constantly stirred or shaken in a glass shows conclusively, however, that motion does not prevent the formation of large hard curds. In fact, the whole curd content of the beaker is often collected in one hard mass.

The only way to determine whether there are other conditions present in the stomach that cause the milk to act differently from that in the beaker is by a study of what goes on in the stomach itself. Such a study is very difficult, however, because the stomach tube is, on account of the size of the curds, worse than useless. He was, however, fortunate enough to find a healthy young adult with normal digestion and normal stomach contents, who could promptly and with but little effort empty his stomach by the simple method of passing his finger into his throat. Forty experiments were made in this young man with raw and boiled milk and with various "milk modifiers." While these observations were made on the adult and only such application can be made to the infant as known identical, physiological conditions warrant, nevertheless, they can at least form a working basis for clinical observation in the infant.

He used certified milk, raw or boiled actively for five minutes, both being taken at 95°F. on an empty stomach in five minutes. The milk was usually whole, but sometimes fat-free. The contents of the stomach were vomited at various intervals. The curds from raw milk were hard and rubbery, always large, sometimes enormous. Some of them were four or five inches long and one or two inches thick, one being so large that it could not be vomited and had to be re-swallowed. The curds from boiled milk were small and relatively soft. The separation from the whey was complete with raw milk, incomplete with boiled milk. The whey left the stomach much more quickly when raw milk was used than when boiled milk was used. Complete emptying of the stomach occurred much later with raw than with boiled milk. The results ob-

tained with pasteurized milk were midway between those from raw and boiled milk, but nearer to raw than to boiled, especially as regards the separation of the whey.

Raw milk was then taken more slowly, 20 to 45 minutes being occupied, in order to more nearly approximate the conditions in infancy. No curds were returned when 30 minutes or longer were taken in sipping the milk, simply whey. A few small curds were obtained when only 20 minutes was taken. The explanation is that when milk is taken slowly a small number of curds, too large to be returned, are formed. Laboratory experiments corroborate these unexpected findings, showing that fresh curds tend to coalesce as fast as they are formed.

The dilution of raw milk with an equal or greater amount of water resulted in the formation of smaller and more spongy curds. Dilutions with an equal amount of barley water reduced the size of the curds to that of peas or smaller. Sodium citrate in the proportion of two grains to the ounce prevented the formation of curds, and in smaller amounts reduced the size of the curds materially. Bicarbonate of soda had the same effect as sodium citrate. Five per cent. and ten per cent. of lime water did not prevent the formation of curds, which were about midway in size between those from raw and boiled milk, but made them much softer.

Brennemann believes that it is not unfair to assume that, as all the ferments of the adult are present and active in the stomach of the baby, the same relative reactions take place there as in the adult. He believes that there are certain symptoms which are common with the use of raw milk and which disappear when the milk is boiled. These are:

1. The hard or tough curds of infants' stools. These, he states, and quotes Ibrahim in corroboration, can be produced in every infant by giving it enough raw milk. They will promptly disappear when the milk is boiled. These curds are nearly always accompanied by other evidences of indigestion, especially diarrhea. Whether they are the result of some other factor in raw milk that produces dyspeptic symptoms or whether they themselves mechanically produce these symptoms remains to be demonstrated.

2. Diarrhea and dyspepsia. The improvement when milk is boiled suggests that the proverbial constipation from boiled milk may be due to the fact that boiled milk is more readily digested and more completely assimilated than raw milk.

3. Vomiting.

4. Colic and discomfort. These are often relieved when the milk is boiled.

The fact that boiled and citrated milk are peculiarly alike in their effect on digestion, although they have nothing else in common except the fact that by them the coagulation of casein is inhibited, leads him to believe that the deter-

mining factor in raw milk dyspepsia is the nature of the coagulum. He finally draws certain conclusions, namely: that raw milk and boiled milk are clinically very different foods; that the most striking difference between them, as shown experimentally, is in their reaction to rennin; that the casein of raw milk, unless modified so that it will not form hard, large coagula, offers serious difficulties in digestion that are not present in boiled milk; and, lastly, that these differences between raw and boiled milk should always be borne in mind in comparing clinical, therapeutic and experimental results in infant feeding.

¹ Lane-Clayton: Local Government Board Reports. N. S., No. 63.
² Brennemann: Journal American Medical Association, 1913, ix, 575.

Reports of Societies.

NEW ENGLAND PEDIATRIC SOCIETY.

MEETING HELD AT THE BOSTON MEDICAL LIBRARY, MARCH 1, 1913. JAMES S. STONE, M.D., PRESIDENT; FRITZ B. TALBOT, M.D., SECRETARY.

DR. ALFRED F. HESS, New York, read a paper on

THE PATHOGENESIS OF CASEIN CURDS IN THE STOOLS OF INFANTS.

ABSTRACT.

In the stools of infants we find besides small, soft fatty curds, larger and harder curds which were described a few years ago by Talbot. It has been shown that these curds contain some casein, but it has not been demonstrated absolutely where or how they are formed. By feeding the infants directly into the duodenum by means of the duodenal catheter, Dr. Hess showed that these curds disappear, only to reappear when mouth feeding was again instituted, thus showing that they are formed in the stomach, and if the stomach is circumvented, they disappear from the stool. A second argument leading to the same conclusion is the fact that the interior of these curds is white and not bile-stained as we should expect it to be were they moulded after having been mixed with the bile in the upper duodenum. By means of the catheter, it was shown that the trypsin in these cases is normal and likewise that these curds are so formed that they cannot be digested by the trypsin of normal children. Heating the milk to 170 degrees F. inhibits their formation. However heating it to 147 degrees for 45 minutes, which is the method of pasteurization advocated by the municipal boards of health, does not affect their formation. The question, therefore, is pertinent, whether milk should not be heated to this higher temperature and obviate this non-digestion of casein. The children showing these casein masses presented no other abnormal clinical symptoms. It is true that these curds are found somewhat more frequently in cases where there is some intestinal derangement. However, the primary factor in their formation is the delayed emptying of the stomach, and intestinal disturbance merely aids their appearance in the stool. Dr. Hess emphasized the point that this is not merely a raw milk phenomenon but

also a pasteurized milk phenomenon, and also the fact that a substance, in this instance casein, which is readily digested by the intestinal ferments may escape digestion when it is given to the intestine in a dense and compact form such as these masses present.

DISCUSSION.

DR. FRITZ B. TALBOT: I have been extremely interested in the interesting paper of Dr. Hess, which adds so much to our knowledge of the digestion of casein, and I think he should be congratulated for the careful way he has gone at the subject. It also gives us a new point of view from which to study the casein digestion. I agree with everything that he said with one exception, and that is something rather that he left unsaid. He said that in the majority of the children whom he saw that had casein curds it did them no harm, at least it did not seem to bother them much, and I think that this is quite true of a large number of babies that we see in our practice here. But there is a class of babies, not a large class, which have casein curds coincidentally with acute digestive symptoms, and in that class, whatever may be the cause, those babies always become quickly better when the amount of casein is diminished in the food. There is one phase of the question which has puzzled me a great deal, and that is the fact that babies can apparently take, say, two-thirds whole milk and one-third water or barley water, as the case may be, and pass casein curds, and some of those babies that are having the casein curds have symptoms of indigestion, and when the milk is boiled or the milk is changed so that the babies do not have casein curds, why is it that those babies can digest the same amount of protein, or casein, which previously was apparently doing them harm?

DR. MAYNARD LADD: I was very much interested in this paper and particularly in what Dr. Hess said in regard to the emptying time of the stomach. The percentage of casein in the curds is an important factor. One case that I have been studying with the Röntgen ray, a normal breast-fed infant, on milk of a certain analysis, had an emptying time apparently of two and one-half hours. That same child on modified milk, of the same composition, with the percentage of casein in the same as in the breast milk, had the same emptying time, i.e. two and one-half hours. This child on subsequent days with the casein percentage raised to 3.50%, the other elements remaining the same, had the emptying time increased to six and one-half hours, and again to seven and one-half hours showing apparently that the increase in the amount of casein for that particular child (which represented fully five times as much as she was getting in the breast milk) more than trebled the emptying time of the stomach.

DR. HESS, in closing: I have here some curds from the stomach which have been dried out and they can hardly be distinguished from those passed in the stool. They merely have been dried for twenty-four hours and have come to look very gradually like the curds in the stools. In one case the curds which were vomited were brown on one side like the curds in the stool; they evidently had been dried out on that surface against the mucous membrane. They are rather softer than the curds in the stool because they have not been compressed in going through the different valves and openings. The red ones are those spoken of in my paper as having