creased to the therapeutic limit, rather than by recourse to large dosage, thereby, in the former case, establishing immunity, and, in the latter, avoiding anaphylaxis. Apropos of the beneficial effect to be derived from treatment by this method, permit me to submit Chart 8, illustrative of Case 103 in my series.

So far as I am aware, I am alone in advocating the value and importance of alternating bacterial inoculations and tuberculin therapy in this type of tuberculous mixed infection. The inoculations should be given every four to seven days, the clinical symptoms permitting. The opsonic index is unreliable as a guide. Relative to tuberculin inoculations, I have used Bacillen Emulsion alone or Bouillon Filtrate alone, or a combination of the two, as practiced and advocated by Trudeau. The last, theoretically, seems to have the preference, but my results have been equally satisfactory with each. It all depends on the man behind the syringe.

It must be remembered that in the use of tuberculin we have a more potent instrument for evil than for good, unless it is properly administered. In careful hands, it serves as an invaluable aid in treatment and is Nature's own remedy to stimulate the bodily defenses. When tuberculin is so employed, the patients do better with than without tuberculin; their retention in the hospital is materially shortened and the complications, if they occur, are fewer and less severe.

CONCLUSIONS

From the study of the cases in this tabulated series the following conclusions seem justifiable:

1. The diseases contraindicated for bacterin therapy are the diffuse infections characterized by septicemia, pyemia and grave sapremia.

2. Those in which therapy by this agent is beneficial or curative are the superficial acute, subacute and chronic processes, especially the last two.

3. The acute cases, in which brilliant results can be uniformly expected, are those of acne vulgaris, furunculosis, carbunculosis and subcutaneous abscesses.

4. Subacute and chronic gonorrheal and tuberculous affections are amenable to bacterial immunization, and because of the impossibility and impracticability often of employing an autogenous bacterin the reliable stock preparations should be used.

5. Certain acute gonorrheal infections can be benefited.

6. It is questionable whether tuberculin therapy should ever be employed in very acute tuberculosis. Opinion is divided as to whether or not acute miliary tuberculosis and death supervened as a result of tuberculin therapy in one of our cases, No. 81 of the series.

7. The mixed infections in chronic tuberculous disease afford an important prospective field for *alternating bacterial inoculations and tuberculin therapy.*

8. Autogenous bacterins are always to be preferred over the stock preparations, and success or failure frequently depends on this fact.

9. Although the duration of the period of greatest potency of bacterins is undetermined, the best results have been obtained when the pus has been recultured and a fresh bacterin prepared every two to four weeks.

10. It is believed that the best effects, therapeutically, particularly in chronic cases, occur when the quantity of bacterin is slowly and cautiously increased during successive inoculations, thereby, as has been thoroughly demonstrated in tuberculin therapy, avoiding hypersusceptibility or anaphylaxis.

11. Therapy by both bacterins and tuberculins can be satisfactorily executed by keen observance of the clinical symptomatology. Reliance on the opsonic index as a guide is not only unnecessary, but often actually conducive to erroneous conclusions, owing to its variability.

12. Bacterin therapy, by virtue of its potency to do more harm than good, when unskilfully managed, will or should probably not become a universal therapeutic measure in the hands of the general practitioner, unfamiliar with bacteriology or work in the laboratory. Ignorance and wantonness are incompatible with ambition and energy, and an otherwise meritorious therapeutic agent thus abused will ultimately fall into disrepute.

13. Therapy by the employment of bacterins made from *Bacillus pyocyaneus* has been entirely useless.

14. Bacterins and tuberculins are not "cure-alls," but when intelligently used serve as invaluable aids to Nature in fortifying the bodily defenses, thereby accelerating convalescence, diminishing complications and promoting cure.

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PASTEURIZATION OF MILK*

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Public opinion in this country swings violently in one direction or another, occasionally on insufficient premises; and this, I think, applies to the present attitude among many pediatrists in this country concerning the pasteurization of milk.

We can all agree that what we want is a safe, raw milk, since we all wish, in the artificial feeding of infants, to approximate as nearly as is feasible the condition of the food as obtained by the infant at the breast.

The only questions for discussion, then, are: Can we obtain a safe, raw milk for the feeding of infants? And, if not, is milk injured by heating, and to what extent, and by what temperature?

There can be no question but that we can to-day feed all the infants of New York on a much safer raw milk than was possible five or ten years ago; but what is the extent of this element of safety? Take, for example, the best milks at present produced under the certified milk plan. How safe are these milks as a raw food for infants?

The danger of tuberculosis in such milk may be said to be fairly eliminated by well-aired, well-ventilated cow stables, and by the repeated tuberculin test. But tuberculosis is one of the lesser dangers in milk. The diseases concerning the spread of which we have most tangible and incontrovertible proof are typhoid fever, diphtheria, scarlet fever, and epidemic sore throat.

Our sanitary dairies do almost all that is possible to protect us from these diseases, but those of us familiar with this subject know that epidemics may occur from the sale of certified milks. No system of control can protect a milk-supply from a mild walking typhoid, or a typhoid-carrier among the employees, unless regular bacteriologic examinations are made of the urine and feces of the employees at frequent intervals; and I take it that no such system would at present be advocated.

Diphtheria has apparently been spread by the best of our milk-supplies; what protection have we against this in any raw milk?

* Read before the New York County Medical Society, Oct. 25, 1909.

Virulent diphtheria bacilli exist in the throats of many healthy persons, and, although our best dairies have some medical supervision, no supervision could be practically enforced that would protect the milk from a beginning diphtheria or a healthy diphtheria-bacillus carrier.

The same arguments will apply to other diseases carried by milk, so that, although in our best supplies the bacteria are only one-thousandth part as numerous as in the ordinary supplies, they are still present in sufficient numbers in most certified milk to cause our suspicion until we know their identity. Now if this is true of certified milk, how much more so is it true of our ordinary milk supplies! I think we may well say that at the present time there can be no absolute security in any raw milk. This being the case, why should we not use a heated milk in which there is security?

The opinion has become current in this country that heated milk produces poorly nourished children; that it causes rickets and scurvy; that it kills the life of the milk, and that it produces chemical changes in the milk which renders it less nourishing. It may be stated that these are opinions that prevail in this country and not abroad, and I am not willing to admit that in matters dependent on clinical and hospital observations we are superior to our confrères in Europe.

This opinion began to develop in our country at the time when milk was sterilized at a boiling temperature, sometimes for two days, adopting laboratory methods. The idea was given concrete form chiefly by an article published in the *American Journal of Medical Sciences,* in 1891, by Davis, of Philadelphia, and Leeds, the chemist, of Jersey City. This article, while giving no detailed clinical data, expressed the opinion that children fed on sterilized milk, although kept free from diarrhea, did not flourish, and the chemical basis for this opinion was expressed by Leeds, who advocated sterilization at 68 C. (155 F.) for six minutes instead of the boiling temperature which had previously been used.

From this time, however, it became evident that a boiling temperature was not necessary and that lower temperatures were sufficient to destroy the bacillus tuberculosis and the other organisms feared in milk, so that we gradually began to use lower temperatures and instead of a boiling temperature of 212 F., 175 F. for twenty minutes was used and later 155 F. for thirty minutes, while now we know that 140 F. for forty minutes will afford security. Nevertheless raw milk has become much more generally used, notwithstanding its dangers.

The opinion of Davis that boiled milk causes malnutrition in children is well answered by the fact that European physicians have been using it for the past twenty or more years without having made a similar observation.

Now as to the causation of scurvy: After scurvy had first been diagnosticated in this country by Dr. Northrup and the clinical picture clearly painted, many cases began to be reported, and, as this was at a time when milk was being sterilized, a good many of the patients were fed on heated milk. But I believe that, although scurvy developed after the milk was heated, the heated milk was not the cause of the scurvy.

Out of the 356 cases of scurvy collected and studied by the American Pediatric Society in 1897, 60 per cent. were fed on proprietary foods, 19 per cent. on sterilized cow's milk, 10 per cent. on condensed milk, 3.3 per cent. on breast-milk, and only 4.5 per cent. on pasteurized milk.

From these figures, therefore, we get very little to indicate any responsibility on the part of heated milk in connection with scurvy, while, on the other hand, we have the experience of physicians abroad who feed their babies on boiled milk and who have seen much less scurvy than has been seen in this country. Our scurvy developed to a great extent at the time when milk was being fed in extreme dilutions and after illness when the food was still further reduced.

Comby of Paris, who has had a very large experience, remarked several years ago that he had seen but five cases of scurvy, and in those cases the babies were all fed on diluted milk.

The original milk depots of Paris, founded in 1892, still dispense to babies milk heated to 115 C. (239 F.), which is absolutely yellow from the conversion of sugar into caramel, and I was told at this depot last year that in the long history of these milk depots, extending over sixteen years, but one case of scurvy had been observed.

It seems to me evident, therefore, that our assumed relationship between the heating of milk and scurvy is unfounded.

Another disease said to be caused by the heating of milk is rachitis, a disease which, to my mind, however, has little connection with feeding, the main etiologic factor being insufficient fresh air, for it is a disease of cold climates only, develops only in winter, and is most marked in those races which have been accustomed to outdoor life all the year round. It occurs with all sorts of food.

Now as to the manner of heating milk: Commercial pasteurization, which consists in heating milk to a high temperature for a few seconds, should be condemned. It is used for the purpose of keeping dirty milk sweet until it can reach the consumer. It should be insisted that milk be produced in a cleanly manner, so that it will keep sweet until it reaches the consumer. Some city milk is so dirty that it is heated at the dairy and again after it reaches the city, so as to prevent its becoming sour before it is delivered. Such milk should be poured into the gutter and not allowed to be sold as pasteurized milk.

The only safety for the consumer is to get his milk sweet and raw. Having obtained it, he should then render it safe by the use of the smallest amount of heat compatible with safety. A temperature of 140 F., but little higher than the temperature in which one can bear one's hand, if continued for forty minutes, with the milk in a closed nursing-bottle, is sufficient to kill all the bacteria that we know and fear in milk, at the same time changing neither the taste nor, so far as we know, the chemical composition or the ferments of the milk. Such pasteurization, to my mind, should be still used by every physician who is conscientious in his endeavor to secure the safety of the infant he is feeding.

CONCLUSIONS

1. There is no absolute safety in any raw milk.
2. Commercial pasteurization of milk, employed to keep it sweet until it can be marketed, should be condemned.
3. Milk is in no way injured, either in taste or by chemical change or action on ferments, by pasteurization at 140 F. for forty minutes.
4. Pasteurized milk does not cause malnutrition or scurvy or rachitis.

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