bon dioxide combining power. A careful check was made throughout in order to govern the dose of sodium bicarbonate and not produce an alkalosis.

Patient 10, with a moderate acidosis of 40, was given a moderate dose of soda and glucose, but soda was continued by mouth and the carbon dioxide rose to 82 within twenty-four hours. Had the carbon dioxide combining power not been checked and the sodium continued, the patient might readily have developed an alkalosis—an uncompensated alkali excess.

It will be seen that four patients required more than one intravenous injection to bring the carbon dioxide combining power to a normal level. Five hours after the first injection in those cases in which convulsions still persisted, the carbon dioxide was again taken and a further injection of sodium or glucose and sodium was administered intravenously if the carbon dioxide combining power was still low. A check at intervals of the alkali reserve is very necessary as in cases 11 and 12, to insure a sufficient dose of glucose and soda and to provide against an alkalosis.

The first two patients in our series received sodium only intravenously. The first case is of especial interest in that the carbon dioxide combining power was raised from 36 to 50 in five hours following the intravenous injection of 12 Gm. of sodium bicarbonate, which undoubtedly fortified the patient to combat the further lowering of the carbon dioxide of the blood plasma consequent on anesthesia and surgical strain.

The total dose of glucose for the patient ranged from 12 to 75 Gm., and the sodium bicarbonate, from 6 to 40 Gm. No accurate dose of sodium bicarbonate could be determined from this small series to be given intravenously to raise the carbon dioxide to normal, as it will be seen that the amounts varied considerably in individual cases. However, from experience, I gave not more than 10 Gm. in the three cases cited in which carbon dioxide was unobtainable. This dose of sodium I considered to be a safe amount.

I realize that cesarean section in these desperate cases may evoke distinct criticism. However, if it is possible to place these patients in condition for surgery and under such a condition save both mother and child with little danger of a recurrence of convulsions, it is a question whether the risk is not justified by the result.

If the gravid patient has reached the period of fetal viability, the prospect of saving the child for which the mother has planned must be taken into consideration. The main contraindication to a cesarean section, other than a possible infection, is the grave acidosis, which without rectification will be further accentuated by the anesthesia and operative strain. The cesarean operation meets the indication of a loss of a pint of blood with the substitution of a bicarbonate solution which dilutes, neutralizes the acid toxins, stimulates elimination, and corrects the acidosis. Our experience would lead us to the conclusion that the intravenous administration of soda and glucose or soda alone makes surgery relatively safe in cases in which it would otherwise be ill advised. The diminished alkali reserve deprives the parturient of her strongest line of defense against toxemia and infection.

The only logical diagnosis of acidosis is possible by securing the carbon dioxide of the blood plasma. To treat a conjectured acidosis with unlimited sodium by mouth is not only dangerous but not infrequently has led to an alkalosis, tetany, anuria and death.

In the patients with excessive vomiting in pregnancy, treated in the Murphy Memorial Hospital, the laboratory shows a distinct lowering of the carbon dioxide combining power of the blood plasma, and, treated intravenously with sodium bicarbonate, or sodium and glucose, were speedily relieved. Some of them returned to the hospital every three or four days until recurrence of the vomiting ceased.

Finally we realize perhaps a lack of conclusiveness in these cases, since the glucose and sodium were used coincidently in most of them; but when in these as well as the hyperemesis cases, sodium was added to the glucose or given alone, the rise in the carbon dioxide combining power was much more rapid and spectacular. The glucose undoubtedly in stimulating the carbohydrate metabolism indirectly eventuates in a certain elevation of the carbon dioxide, but the need in the emergency cases is speedy neutralization and elimination of acid toxins, which the sodium apparently directly effects.

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TREATMENT OF SCARLET FEVER WITH STREPTOCOCCUS ANTITOXIN *

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Scarlet fever is a disease subject to wide variations in severity from year to year, and even within seasons. It would seem that the value of streptococcus antitoxic serum [1] in the treatment of this condition might best be determined by studying a relatively large number of scarlet fever patients within a short space of time. The patients considered in this report were admitted to the hospital within a six months' period.

Several scarlet fever serums have been used in this hospital during the last year, under rather rigorous conditions, in that only in severe cases, oftentimes apparently hopeless cases, was serum given. The results have been encouraging enough to lead us to institute an accurate, thoroughly controlled test of what appeared to be a reliable serum, and to study its effect on scarlatina of all degrees, from the very mild to the very severe.

The cases include only those received at the hospital on or before the third day of the rash. They were classified clinically, when admitted, as moderate, moderately severe, or severe. Primary rhinitis and sinusitis or transient renal disturbance indicated by albumin, blood or casts in the urine constitute two important factors in judging the severity of early scarlatinal infection, aside from the degree of fever, rash and general clinical condition. The varying incidence of these two conditions in this series (table 2) would seem to emphasize the division into these three clinical groups.

For the first hundred cases, each alternate patient was given scarlet fever serum irrespective of severity, but the results obtained were such that thereafter serum was given to the more acutely ill. It is apparent from table 1 that this has led to a severe test of the serum, in that the majority of the serum treated cases fall into the severe and moderately severe groups, while most of the controls are in the moderate and moderately severe groups.

* From the Municipal Contagious Disease Hospital.

1. Dick, G. F., and Dick, Gladys H.: Therapeutic Results with Concentrated Scarlet Fever Antitoxin, J. A. M. A. **84**: 803 (March 14) 1924; ibid. **85**: 1693 (Nov 28) 1925.

Only cases of scarlet fever uncomplicated by other communicable diseases have been included.

The serum used was a concentrated antitoxin prepared according to the Dick method. One therapeutic dose was injected into the muscles of the thigh at the time of admission. In some severe cases this was repeated in from twelve to twenty-four hours, but not more than three doses were given to any one patient. This serum was restandardized at the hospital, and one therapeutic dose was found to represent more than the equivalent of antitoxin necessary to neutralize 250,000 skin test doses of toxin.

TABLE 1.—*Clinical Course*

Type of Case	Number of Cases	Eruption: Day of Onset	Eruption: Duration in Days	Serum Given: Day of Disease	Serum Given: Day of Rash	Day of Disease When Desquamation Began	Duration in Days of Fever	Average Duration of Disease in Days	Days in Hospital after 28th Day of Disease
Moderate									
Control.....	242	2.2	4.1	...	...	9.7	6.3	30	513
Serum treated	50	3.0	3.5	3.0	1.8	11.0	5.7	28.9	45
Moderately Severe									
Control.....	101	2.2	4.5	...	...	10.2	9.7	37.3	889
Serum treated	197	2.1	3.6	2.7	1.7	11.3	5.4	30.0	371
Severe									
Control.....	24	1.2	6.3	...	...	12.8	9.5	42.9	268
Serum treated	70	2.1	4.2	3.2	2.1	12.3	8.8	31.3	215
Total									
Control.....	367	2.1	4.3	...	...	9.9	7.4	33.2	1,670
Serum treated	317	2.2	3.8	2.9	1.9	11.1	6.2	30.0	631

possibly the result of the foreign protein injected. Weli marked decline in temperature is evidenced during the second twenty-four hours, usually to approximately normal levels. The total febrile period in days is shorter in those patients receiving serum.

The effect on the eruption is usually striking. The typical punctate rash is definitely faded within from eighteen to twenty-four hours, and may be absent, with only a subcuticular flush persisting. The determination of just when the rash has disappeared is, however, in the presence of this erythematous flush, a matter of opinion. I have preferred, therefore, to judge the effect of the serum by the disappearance of all skin manifestations, both punctate eruption and erythema. The figures in the following tables are on that basis. By this standard, the eruption, in both degree and extent, is distinctly influenced by serum treatment.

Corroborative evidence of the milder skin lesion is shown by the type of desquamation. Desquamation commences somewhat later for serum treated than for control cases. The degree of desquamation is markedly less in patients receiving serum, being usually slight, and sometimes lasting only a few days. More serum treated persons complete the desquamation period within the ordinary twenty-eight days' stay in the hospital.

Patients are regularly discharged from the hospital on the twenty-eighth day of their illness. The excess of hospital days over the normal isolation period, necessitated by persisting complications, was more than twice

TABLE 2.—*Complications of Scarlet Fever*

Type of Case	Number of Cases	Severe Cervical Adenitis, per Cent	Suppurative Otitis Media, per Cent	Catarrhal Otitis Media, per Cent	Mastoiditis, per Cent	Primary Rhinitis and Sinusitis, per Cent	Secondary Rhinitis and Sinusitis, per Cent	Renal Complications: Acute Nephrosis, per Cent	Renal Complications: Albuminuria, per Cent	Renal Complications: Secondary Nephritis, per Cent	Cardiac, per Cent	Arthritis, per Cent	Serum Reactions, per Cent	Abscesses, per Cent	Peritonsillar Abscess, per Cent	Bronchitis, per Cent	Bronchopneumonia, per Cent	Trifacial Neuralgia, per Cent	Suppurative Mastitis, per Cent	Septicemia, per Cent	Deaths, per Cent
Moderate																					
Control.....	242	19	7	10	1.2	3.7	5.3	3.3	2	0.8	2	4.5	8.0	1.2	1.2	0.4	...	...	...	...	0.4
Serum treated.....	50	8	4	6	0	2	2	...	6	...	2	2.0	30.0	...	...	...	...	...	...	...	...
Moderately Severe																					
Control.....	101	45	16	20	2	16	20	8	6	7	3	10	9	1	2	...	1	...	...	...	...
Serum treated.....	197	8	5	7	5	9	1.5	7	3.5	2.5	1.5	3.5	26	...	1.5	...	...	0.5	0.5	...	0.5
Severe																					
Control.....	24	48	43	9	17	39	22	17	...	17	17	35	18	9	...	4	13	4.0	...	4	25.0
Serum treated.....	70	25	13	13	3	32	3	18	1.5	3	3	3	22	1.5	1.5	1.5	3	...	...	3	4.3
Total																					
Control.....	367	28	12	13	2.5	9	8	5	3	4	3.0	8	9	1.6	1.4	0.6	1.1	0.3	0	0.3	1.9
Serum treated.....	317	12	7	8	0.9	13	1.8	8	3	2.2	2.2	3	26	0.3	1.2	0.3	0.6	0.3	0.3	0.6	1.3

The general method of treatment of the two groups has been identical, except that convalescent scarlet fever serum has been used in a few of the more critically ill control patients.

In attempting to evaluate the antitoxic serum, attention has been directed to three factors: the effect on the general clinical course of the disease; the complications following the initial febrile period, and the effect of the serum on hemolytic streptococci in the nose and throat.

EFFECT OF SERUM ON THE CLINICAL COURSE

The behavior of the fever is an important index in judging the effect of serum on the general course of the disease. The temperature curve has been favorably modified.

The definite drop in temperature described by Dick has not been observed so frequently, but there were many instances of a decline from 104 or 105 F. to 99 F. within twenty-four hours. The immediate result has frequently been a rise rather than a fall in temperature, as great in the control series as in the serum treated patients. This affords an added index of the milder clinical course after serum treatment. The isolation period for cases of moderately severe and severe scarlet fever averaged, in this series, from a week to ten days less for serum treated cases than for control cases. The economic importance of this shortened isolation time is not to be disregarded.

The figures in table 1 show variations in these respects for cases of the three degrees of severity mentioned. There is also indicated the average day of the disease on which serum was given, with the corresponding day of the rash.

COMPLICATIONS

The most common complications have been in the cervical lymph glands and the ears. A certain degree of cervical adenitis, particularly in the acute febrile period, may be considered a part of the picture of scarlet fever. Cases of cervical lymphadenitis develop-

ing in the postfebrile period, with well marked enlargement and tenderness of the glands, accompanied by a rise in temperature, are deemed complications.

Suppurative otitis media is an important complication of scarlet fever because of its relative frequency and the long continued isolation necessitated by the presence of purulent discharges. The condition was only one third as frequent in the moderately severe and

TABLE 3.—*Incidence of Complications According to Severity of Disease*

Type of Case	Number of Cases	Uncomplicated		One Complication		Multiple Complications	
		Number	Per Cent	Number	Per Cent	Number	Per Cent
Moderate							
Control	242	141	58	71	29	30	12
Serum treated	50	41	82	6	12	3	6
Moderately Severe							
Control	101	20	20	40	40	41	41
Serum treated	197	145	74	41	21	11	6
Severe							
Control	24	0	0	4	17	20	83
Serum treated	70	24	35	35	50	11	15
Total							
Control	367	161	44	115	31	91	25
Serum treated	317	210	66	82	26	25	8

severe groups when serum was given; in the mild cases there was an appreciable difference between serum and control cases. Definite involvement of the mastoid cells was noted infrequently, but more commonly in the control cases than in those treated with serum. None of the cases were severe enough to demand operation.

An appreciable number of patients in both the control and the serum treated groups, seventy-four in all, entered the hospital with rhinitis and sinusitis. This was not considered a complication, but is included in the table of complications (table 2) as an index for judging the relative severity of cases. When rhinitis and sinusitis developed after the active febrile stage of the disease, it has been so considered. Of thirty-five such instances, twenty-nine were in patients not receiving serum, six in the serum treated group.

An appreciable number of renal complications was not observed in either group. Forty-five cases, twenty in the control and twenty-five in the serum treated group, showed disturbances of renal function in the febrile period in the form of transient albuminuria and sometimes casts. This, again, has not been considered a complication but more a part of the disease. It is the type of renal disease common to many acute infections, characterized pathologically by cloudy swelling of the kidney and more a retrogressive than an inflammatory change. For lack of a better name this has been termed acute nephrosis.

There was an occasional secondary albuminuria, and uncommonly acute nephritis. I have considered as nephritis cases in which albumin, with blood or casts, persisted in the urine for an appreciable period and was accompanied by general signs of the condition.

Definite cardiac complications have been infrequently noted. An appreciable percentage of the patients had a heart murmur when admitted, about 18 per cent for the entire series with no appreciable difference between the two groups. As a rule the murmur disappeared with rest in bed, and only about 2.5 per cent were discharged with the murmur persisting. Six cases of bacterial endocarditis were determined, two in the serum treated and four in the control group. The subsequent history of those discharged as convalescent could not be obtained in all instances, but one case in the serum treated group is known to have proved fatal three weeks after the patient left the hospital, one in the control group three months subsequent. There was one case of pericarditis developing on an old organic lesion.

The relatively large incidence of serum reactions is attributed, in some measure, to the use of a serum not sufficiently aged. They were only two severe reactions, but in one instance diphtheria antitoxin had been given as well just previous to admission. The symptoms ordinarily have been confined to an urticarial rash, rarely associated with mild edema and arthritis. Serum reactions in the control series followed the injection of 1,000 units of diphtheria antitoxin, given to all scarlet fever patients, during the early part of these observations.

Four deaths occurred among the serum treated cases, seven in the control group. Of the deaths in the serum treated group, one was a septic type of scarlet fever; the second patient was in a state of coma on admission and died one and one-half hours later; the third was a case of surgical scarlet fever in a boy convalescing from lobar pneumonia and a recent rib resection for empyema; the fourth was a case of toxic scarlatina in a mongolian idiot.

The deaths in the control group included three from a secondary bronchopneumonia; one secondary meningitis with septicemia; one acute nephritis; a toxic case in a person with pulmonary tuberculosis with death twenty-four hours after admission; and a toxic case in a mongolian idiot.

The incidence of complications in the two groups is set forth in table 2. The percentages for the several complications are in this series favorable to those receiving serum.

The number of patients having a convalescence free from complications was appreciably greater among those who had serum, than in the control group. Table 3

TABLE 4.—*Average Duration in Days of Complications*

Type of Case	Cervical Adenitis		Suppurative Otitis Media		Catarrhal Otitis Media		Mastoiditis		Primary Rhinitis and Sinusitis		Secondary Rhinitis and Sinusitis		Albuminuria		Nephritis		Arthritis	
	Number	Average Days	Number	Average Days	Number	Average Days	Number	Average Days	Number	Average Days	Number	Average Days	Number	Average Days	Number	Average Days	Number	Average Days
Moderate																		
Control	46	10.9	17	26.8	24	5.9	3	6.7	9	8.6	13	14.8	3	5.3	2	12	11	9.2
Serum treated	4	6.0	2	18.5	3	3.7	0	...	1	28.0	1	25	3	10.0	0	....	1	5.0
Moderately Severe																		
Control	45	16.4	16	41.4	20	7.5	2	14.5	16	13.6	20	17.9	6	13.3	6	25.2	12	6.6
Serum treated	16	9.0	10	21.5	13	6.2	1	5	18	10.8	8	30.7	6	11.3	5	11.6	7	10.1
Severe																		
Control	11	16.5	7	49.6	2	8.5	4	17.8	6	19.7	2	17.5	0	0	3	18	8	7.3
Serum treated	16	9.3	8	14.5	9	6.6	2	5	21	11.4	3	9.3	2	20.5	1	22	3	3.7
Total																		
Control	102	13.9	40	36.6	46	6.7	9	13.3	31	13.3	35	16.7	9	10.7	11	20.8	31	7.7
Serum treated	36	8.8	20	18.4	25	6.0	3	5	40	11.5	7	20.5	11	12.6	6	13.3	11	7.9

represents a division into three main groups, those patients in whom the disease ran an uncomplicated course, those developing a single complication, and those having two or more complications. Not a severe control case was free from complications, while 35 per cent of similar cases in which serum was being given were. Development of multiple complications was a common occurrence among the more severely ill control patients. There was a definite relationship between the severity of the infection and the development and number of complications in both serum and control groups.

Aside from the decrease in the number of complications following serum treatment, there is a well marked difference in duration and intensity. Cases of cervical adenitis cleared up in a third less time. Suppurative otitis media in serum treated patients terminated in less than half the number of days, as compared with the control cases. The same holds true for acute nephritis and other complications (table 4).

HEMOLYTIC STREPTOCOCCI IN THROAT AND NOSE AFTER SERUM TREATMENT

From this study it would appear that hemolytic streptococci disappear more quickly from the nose and throat of patients receiving antitoxic serum. It is

TABLE 5.—*Hemolytic Streptococci in Nose and Throat of Scarlet Fever Patients: Number of Positive Cultures*

Type of Case	Number of Cases	Culture on Admission		After 7 Days' Hospitalization		After 14 Days' Hospitalization		Twenty-Eighth Day of Disease		Discharge Culture	
		Throat	Nose	Throat	Nose	Throat	Nose	Throat	Nose	Throat	Nose
Moderate											
Control....	65	65	27	46	18	47	12	35	17	33	17
Serum.....	14	14	4	9	4	7	4	4	1	1	1
Moderately Severe											
Control....	29	29	13	29	6	23	7	22	11	18	8
Serum.....	63	63	17	38	13	31	11	16	6	18	7
Severe											
Control....	8	8	5	8	6	6	3	5	4	4	3
Serum.....	23	23	13	17	10	13	6	11	5	11	5
Total											
Control....	102	102	45	83	30	76	22	62	32	55	28
Serum.....	100	100	34	64	27	51	21	31	12	30	13

realized, of course, that antitoxic serum may possess some bacteriolytic properties, particularly if bacterial suspensions as well as toxin are used as antigens. The early neutralization of toxins acting on the mucous membranes of the nose and throat may favor nonspecific bacteriolytic activity. The phenomenon may be comparable to the usual prompt disappearance of diphtheria bacilli from the upper respiratory tract following administration of diphtheria antitoxin.

Cultures were taken when the patients were admitted to the hospital. It is interesting that in all instances they yielded hemolytic streptococci. Cultures were repeated after seven days, again after fourteen days, and on the twenty-eighth day of the disease, the usual time of discharge. Patients confined to the hospital for longer periods because of complications had cultures taken on the day of release.

The diagnosis of hemolytic streptococci is based on cultural appearance on blood agar plates and morphology. Streptococci in the nose and throat at the time of discharge have not been confirmed as scarlet fever streptococci. Work is in progress on this point.

The percentage of cultures showing hemolytic streptococci is indicated in table 5. There is a difference in the number of persons of the two series harboring streptococci in the second week of the disease. There is a decrease in cultures from the throat in the serum treated group when contrasted to the nontreated group. It may be significant that almost twice as many patients of the control group were discharged from the hospital with hemolytic streptococci in the nose and throat as in the case of those who received serum. This point is important from the public health aspect of the disease, in relation to return or secondary cases of scarlet fever. It may offer additional evidence to render practicable a quarantine period, based on freedom of the nose and throat from scarlet fever streptococci.[2]

CONCLUSIONS

Scarlet fever antitoxic serum exerts a favorable and well marked effect in reducing the severity of the febrile stage of the disease, on the course and duration of the fever, on the extent and duration of the skin lesions, and on the period of isolation.

There are fewer complications in patients receiving serum. A favorable effect on complications is evidenced by a lessened severity and duration, as well as incidence.

Apparently the administration of antitoxic serum was associated with the reduction of hemolytic streptococci in the nose and throat of convalescents.

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GIARDIASIS IN CHILDREN

REPORT OF THREE CASES *

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Reginald Miller [1] states that chronic enteritis due to *Lamblia intestinalis* has "hardly met with the recognition it deserves as a cause of chronic diarrhea in children. It may produce a slight deficiency in growth. The abdomen is often prominent but the general nutrition usually remains fair. The stools show, in addition to the lamblia cysts, much undigested food and mucus, without traces of blood. The amount of fat in the feces may be above normal, but does not rise to the figures found in the diarrheic type of celiac disease." Miller then briefly reports two cases of chronic diarrhea in children which were mistaken for celiac disease but proved to be giardiasis.

In another article [2] the same author gives a comprehensive review of the studies of giardiasis in children in England, and from a study of twenty-three cases he concludes that the infection is by no means rare, that it produces a chronic enteritis, and that the resultant diarrhea is often severe enough to retard growth and development. True carriers even in children may be found infected with giardiae but without symptoms.

Although Lambl, more than sixty-five years ago, described the occurrence of this parasite in children, and army officers, sanitary officers and protozoologists since then have amassed a large amount of literature on these flagellates, the pediatricians of the world, with the exception of Miller of England, have apparently ignored the subject. For a long time the giardiae were

2. Hoyne, A. L.: Scarlet Fever: Its Treatment, Illinois M. J. **48**: 465 (Dec.) 1925.

* Read before the St. Louis Medical Society, Sept. 28, 1926.

1. Miller, Reginald: Lancet **1**: 330 (Feb. 13) 1926.
2. Miller, Reginald: Arch. Dis. Childhood **1**: 93 (April) 1926.