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Clumping of Extracellular Encapsulated Pneumococci in Sputum for Control of Serum Therapy.

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In a previous report¹ it was shown that clumping of encapsulated extracellular diplococci in pneumonic sputum could either occur spontaneously or be induced by the intravenous administration of specific horse- or rabbit-serum. Further evidence that antibody is responsible for the clumping has been obtained from a patient infected with type 8 pneumococci. Nine hours after the intravenous injection of 160,000 units of rabbit serum the clumped pneumococci in the sputum showed "*Quellung*" in preparations to which methylene blue alone had been added. At the present time, clumping has been induced after the administration of Types 1, 2, 3, 5, 7, and 8 serum. Spontaneous clumping, now believed to represent evidence of developing active immunity, has been observed in patients infected with Types 1, 2, 3, 4, 5, 7, 8, 12, 18, 19, 24 and 25 pneumococci.

The induction and maintenance of clumping has a direct bearing upon the outcome of the pneumonia, as shown in Table I. Sixty-nine roentgenographically proved cases of pneumonia were followed from the sputum by the method previously described.² All of the

TABLE I.

Type	Cases	Bacteremia	No clumping induced		Induced but not maintained		Induced and maintained	
			Rec.	Died	Rec.	Died	Rec.	Died
1	20	7	0	1	0	0	18	1
2	26	8	0	2	0	3	17	4
3	5	2	0	2	0	0	3	0
5	2	1	0	0	0	0	2	0
7	11	5	0	1	0	0	9	1
8	5	2	0	1	0	0	4*	0
	69	25	0	7	0	3	53	6

* Patient subsequently developed a type 2 pneumonia during convalescence and expired.

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¹ Frisch, A. W., PROC. SOC. EXP. BIOL. AND MED., 1938, **39**, 473.

² Frisch, A. W., PROC. SOC. EXP. BIOL. AND MED., 1939, **40**, 48.

patients received either horse or rabbit antipneumococcic serum; 10 were given sulfanilamide† in addition to serum.

The 10 patients who either failed to develop or to maintain clumping, expired. In 47 of the 53 serum-treated patients who recovered, clumping in the sputum was induced and maintained throughout the acute stages of the disease. The remaining 6 recovered cases showed clumping of extracellular pneumococci in specimens of sputum obtained before serum therapy was instituted. Although clumping was induced and maintained in 6 patients, they failed to recover. One (Type 2) in the author's opinion, died of asphyxia. Another (Type 2) was convalescing and expired shortly after an attempted aspiration of an interlobar empyema. A third (Type 7) was suspected of having bacterial endocarditis and developed pneumonia and meningitis in the hospital. The fourth patient (Type 2) showed clumping a few hours before death. In the remaining cases, one (Type 2) was complicated by secondary infection from a decubitus ulcer and the other (Type 1) by delirium tremens.

In 26 of the above patients the dosage of serum was controlled by using the appearance of clumps of encapsulated pneumococci in the sputum as an index of adequate therapy. Three (Types 2, 3, 8) received large amounts of serum but clumping either failed to develop or was not maintained, and they expired. In the remaining 23 cases, clumping was successfully maintained and the patients recovered. In 3 of them (Types 1, 5, 7) no dramatic drop in temperature and pulse occurred, although clumping had been induced and was being maintained. All 3 patients recovered without receiving additional serum.

The sputa of 4 of the 23 patients contained only a few encapsulated extracellular pneumococci which were already clumped before treatment was begun. In these cases it was felt that regardless of the amount of serum given, the patients would recover. They received the following therapy. The first case (Type 1) was treated with 100,000 units of horse- and the second (Type 1) with 30,000 units of rabbit-serum. The third patient (Type 7) received 20,000 units and the fourth (Type 7) 10,000 units of antipneumococcic horse serum. A fifth case with a similar sputum-picture (Type 8) was given no serum. Under routine therapy each of these patients would have received from 100,000 to 250,000 units, yet with no serum at all or with doses ordinarily considered inadequate, all 5 of the patients responded by crisis. These preliminary data are encouraging enough to warrant the further study of clumping of encapsulated pneumococci in the sputum as a method for the control of serum therapy.

† The effect of sulfanilamide is largely bacteriostatic and does not influence the clumping. Therapy with this drug will be discussed in a future communication.