demonstrates that a patient may have a relatively severe septicemia with an organism of low virulence and still not be very sick. The proof that we were dealing with a Type IV pneumococcus was established by injecting several cubic centimeters of one of the blood cultures in broth intraperitoneally into a white rat. The rat died in less than sixteen hours, and at necropsy showed a severe peritonitis, the exudate containing large numbers of gram-positive encapsulated diplococci which were bile soluble but did not react specifically with Type I, II or III serum. A second rat was injected intraperitoneally with 2 c.c. of sputum emulsion from the same patient. This rat also died over night. At necropsy an identical organism was recovered from both peritoneal exudate and heart's blood. The temperature and blood culture curves in this case are shown in Chart 2.

There were twelve cases in which the etiologic factor was undetermined. None of these patients had a positive blood culture, and all recovered.

A list of the hemolytic streptococcus cases with positive blood cultures is given in Table 3. There were five of these cases; all were complicated by empyema, and four of the patients died. This shows the gravity of septicemia in these cases. A. Y., who recovered, had a negative culture one hour before his opera-

Chart 2.—Temperature and septicemia curves in a case of Type IV pneumonia in which the patient recovered. Note the initial rise followed by the gradual fall in the septicemia curve, and the parallelism of the curves.

tion for empyema. Another culture taken the following morning was negative in the plates but positive in the broth. Cultures were repeated twenty-four hours later and were entirely negative. This case illustrates that a patient may have a slight hemolytic streptococcus septicemia and still recover. The supposition that a relatively small number of organisms gained access to the blood stream through the operative wounds seems reasonable. The patient apparently developed a rapid immunity and overcame the septicemia before it gained much headway.

In direct contrast to the foregoing case is that of M. A. This patient had a negative blood culture antemortem, and a second blood culture taken eight hours postmortem was negative both in the broth and in the plates. The necropsy disclosed a very extensive bronchopneumonia involving most of the right lung and part of the lower left lobe. In addition there was an empyema on the right side which had been diagnosed antemortem. This patient evidently died from a severe toxemia rather than from a septicemia. All the other hemolytic streptococcus patients with negative blood cultures recovered.

SUMMARY AND CONCLUSIONS

1. Blood cultures in pneumonia are valuable from the standpoint of prognosis and as a guide in the serum therapy of the Type I cases.

2. Septicemia is more common with the more virulent strains of pneumococcus and with *Streptococcus hemolyticus*.

3. Type I pneumococcus septicemia responds very promptly to immune serum treatment.

4. A moderately severe Type IV pneumococcus septicemia may be quickly recovered from.

5. The mortality in hemolytic streptococcus septicemia is very high, but one case is reported in which the patient had a slight transient septicemia and recovered.

SELECTIVE ACTION OF DILUTE SODIUM HYDROXID ON CERTAIN RACES OF THE PNEUMOCOCCUS*

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It was demonstrated by Neufeld in 1900 that pneumococci, in contrast to many species of bacteria, are readily soluble in bile. Neufeld¹ stated, on incomplete evidence, that the bile salt is the constituent of bile which is responsible for the lytic action on the pneumococcus. This statement found ready acceptance, very possibly because of the well-known action of bile salts in dissolving red corpuscles.² However, in the routine tests for the differentiation of pneumococci and streptococci, a solution of bile salts dissolves the pneumococcus so feebly and so irregularly that whole bile is used in preference to the purified salts. The concentration of bile salts in bile varies widely, but as a rule it is less than 1 per cent.; a 10 per cent. solution of bile salt, however, is recommended if these salts are substituted for bile in the solubility tests.³ One part of this 10 per cent. solution is added to nine parts of a broth culture of the organisms to be tested. Rosenow⁴ mentions the solution of pneumococci in 0.5 per cent. bile salt. Such behavior is exceptional; with a 2 per cent. solution of sodium cholate, Cole⁵ found that many typical strains dissolved incompletely or not at all.

It seems probable that other constituents of bile play an important rôle in the solution of the pneumococci. The pigments merit consideration because of their cytolytic action in the presence of light (photodynamic action). Some bactericidal but no appreciable bacteriolytic action could be demonstrated with pneumococci under the following conditions:

One per cent. of bilirubin was dissolved in salt solution with the aid of a little alkali. One part of this was mixed with nine parts of a suspension of pneumococci in salt solution. Strains belonging both to Group 1 and Group 2 were tested. The mixture was exposed in thin walled test tubes of ordinary glass, 1 cm. in diameter, to direct sunlight for five hours. The bile pigment became much lighter in color but this mixture remained turbid and stained preparations showed numerous pneumococci. Therefore it does not seem

* The observations reported in this paper were carried out at the Base Hospital, Camp Dodge, Iowa, and at the Pathological Laboratory of the Johns Hopkins Medical School, Baltimore.

1. Neufeld: Ztschr. f. Hyg., 1900, **34**, 454.

2. The term "bile salt" ordinarily indicates the salt of cholic acid conjugated either with glycocholate or taurocholate. Since the cholate radical is the active portion of the molecule, sodium cholate is sometimes employed instead of the conjugated products.

3. Hiss and Zinsser: A Textbook of Bacteriology, Ed. 3, New York, D. Appleton & Co., 1916, p. 370. Avery, Chickering, Cole, and Dochez: Monographs of the Rockefeller Institute, 1917, No. 7, p. 13.

4. Rosenow: Jour. Infect. Dis., 1910, **12**, 124.

5. Cole: Jour. Exper. Med., 1912, **16**, 644.

that the bile pigments alone could play any important part in the solution of pneumococci by bile under ordinary routine conditions.

The alkaline reaction of bile deserves attention since neither the pigments nor the bile salts can remain in solution in a distinctly acid medium. A specimen of calf's bile after autoclaving and filtration

physiological sodium chlorid solution, and then suspended in saline. This suspension was neutral to litmus.

Bile of young calves was autoclaved. Before use the clear supernatant fluid was filtered off from the resulting precipitate. Sodium taurocholate was used in 2 per cent. solution in physiological sodium chlorid solution. This solution was slightly turbid and distinctly acid, but it cleared promptly on neutralization to litmus with sodium hydroxid. For the tests with sodium hydroxid, a fifth normal solution was used, and strains readily soluble in this were tested in more dilute solution. One part of the suspension of pneumococci was mixed with one part of each of the preceding solutions, giving, therefore, in the final preparations, a concentration of 1 per cent. sodium taurocholate and tenth normal sodium hydroxid. Solution often occurred immediately, though to secure constant results the mixtures were incubated for one hour at 37 C. before the final readings were taken. The results⁶ are given in Table 1.

From the data in Table 1 it is seen that bile is a much better solvent for pneumococci than either sodium hydroxid (fifth normal) or sodium taurocholate (2 per cent.). In the cultivation of the pneumococci it has long been recognized that the development of acid in the medium inhibits growth; it was not evident, however, that some races are also very susceptible to alkali. The solubility in sodium hydroxid varies considerably even in the same immunologic group. It is unfortunate that a larger number of typical races were not available for study. The testing of a large number of strains of pneumococci might reveal some correlation between solubility in alkali and other characteristics, such as pathogenesis and virulence. In Table 1 it will be noted that a conspicuously large proportion of the atypical Group II strains are soluble in bile salt but not in sodium hydroxid. Of the strains in the borderline group between pneumococci and streptococci, it is noteworthy that none of these dissolve readily in either bile salt or sodium hydroxid. It would be impossible, however, to attempt any generalizations from a small number of strains.

In contrast to this ready solubility of some of the strains of pneumococci, it was found that ten strains of hemolytic streptococci isolated at Camp Dodge,

TABLE 1.—SOLUBILITY OF SUSPENSIONS OF PNEUMOCOCCI *

Strain	Whole Bile	Bile Salt 2%	Sodium Hydroxid	
			N/5	Effect of Higher Dilutions
Group I				
1.....	C	C	C	N/50 C
2.....	C	0	AC	
3.....	C	AC	C	N/25 C
4.....	C	0	C	N/100 C
Group II—typical				
5.....	C	0	C	N/100 C
Group II—atypical forms				
6.....	C	C	0	
7.....	C	C	0	
8.....	C	C	0	
9.....	C	C	0	
10.....	C	C	AC	
11.....	C	C	AC	
12.....	C	0	C	N/50 AC
13.....	C	0	P	
14.....	C	C	C	N/50 C
15.....	C	C	0	
16.....	C	C	C	N/100 C
17.....	C	AC	C	N/50 P
Group III				
18.....	C	0	C	N/10 AC
Group IV				
19.....	C	0	AC	N/25 AC
20.....	C	AC	0	
21.....	C	AC	C	N/100 C
Borderline group between pneumococci and streptococci				
22.....	P	0	P	
23.....	0	0	0	
24.....	AC	0	0	
25.....	AC	0	0	
26.....	AC	0	0	
27.....	AC	0	0	

* C, complete solution; AC, almost complete solution; P, partial solution; 0, no solution.

was titrated roughly against litmus paper; its alkali content corresponded roughly to a hundredth normal solution. The importance of avoiding an acid reaction in carrying out the bile solubility test was noted by Cole,⁵ who advises a slightly alkaline medium composed of primary and secondary phosphates. On using a stronger alkali, however, it will be seen from the following data that certain strains of pneumococci dissolve rather readily in dilute sodium hydroxid alone without the aid of bile. For example, one strain (Group 2) dissolved readily in twenty-fifth normal hydroxid. Another culture of the same strain after incubation for twenty-four hours at 37 C. was allowed to stand for one week at room temperature. The washed sediment of bacteria then dissolved in remarkably high dilutions of sodium hydroxid. One part of a very cloudy suspension of the washed bacteria cleared immediately when mixed with an equal part of a five hundredth normal solution. Almost complete solution took place with thousandth normal sodium hydroxid, a dilution that failed to react with litmus paper. This high degree of solubility was not found frequently, however, and it occurred only in the older cultures. Fresh cultures of several strains were tested for their solubility (1) in bile, (2) in sodium taurocholate and (3) in sodium hydroxid.

In order to secure a good suspension of pneumococci, inoculations were made from blood agar slants to glucose meat infusion broth. After eighteen hours' growth the broth cultures were centrifugalized, the sediment washed once with

TABLE 2.—EFFECT OF AGE OF CULTURE ON SOLUBILITY OF PNEUMOCOCCI *

Culture	Strength of Sodium Hydroxid			
	N/5	N/10	N/50	N/100
Strain 1, 18 hours' growth....	C	C	C	P
Strain 1, 12 days' growth....	0	0	0	AC
Strain 18, 18 hours' growth....	C	AC	0	0
Strain 18, 12 days' growth....	0	0	0	AC
Strain 23, 18 hours' growth....	0	0	0	0
Strain 23, 12 days' growth....	0	0	0	0
Strain 24, 18 hours' growth....	0	0	0	0
Strain 24, 12 days' growth....	C	C	C	C

* C, complete solution; AC, almost complete solution; P, partial solution; 0, no solution.

Iowa, showed no evidence of any solubility with fifth normal sodium hydroxid.

Some evidence was obtained in regard to the effect of the age of cultures on solubility of pneumococci in alkali. Four of the strains recorded in Table 1 were grown in glucose broth for twelve days and then tested according to the preceding technic. The results are given in Table 2.

6. These strains were collected and studied by Dr. Mildred Clough. I am much indebted to her for the use of this material and for her kind cooperation.

In Table 2 it is seen that, in the case of Strains 18 and 24, the older cultures were markedly more soluble than fresh ones. Strain 23 is of especial interest since neither the old nor the young cultures were soluble. Dr. Clough considers that this strain should probably be classed with the streptococci rather than with the pneumococci.

From the preceding data it is evident that, in testing the solution of pneumococci in bile, certain factors must be controlled in order to secure constant results; special attention should be given to the age of the culture and to the reaction of the medium.

Neufeld considers that the bile salts act specifically on pneumococci and thus resemble the immune bodies, in contrast to the chemical disinfectants, which act more or less alike on all bacteria. The solubility of certain strains of pneumococci in sodium hydroxid furnishes an example of a relatively high degree of specificity in a simple chemical substance.

In conclusion, it should be noted that the solvent action of bile on pneumococci is not easily explained. Moreover, the process may vary with the individual strains of pneumococci; this is indicated by the rather wide variation that different strains show in their solubility in bile salts and in alkali. The various constituents of bile, when isolated and tested separately, are less effective than the whole bile. An analogous situation exists in the effect of bile on certain ferments. A thorough explanation of the action of bile on pneumococci would be of service in any attempt at the therapeutic application of bile products in pneumococcal infections.

SUMMARY

The effect of bile salts does not adequately explain the solvent action of whole bile on pneumococci; in searching for other active constituents, no evidence was obtained of bacteriolytic action by bile pigments on pneumococci. Alkali in dilute solution (hundredth normal) was found to dissolve certain strains of typical pneumococci. A sufficient number of strains have not yet been tested for determining the exact relationship between solubility in dilute alkali and other characteristics of the pneumococcus, such as virulence and the immunologic groupings. Ten strains of hemolytic streptococci were tested and none were soluble in sodium hydroxid (fifth normal). In testing the solubility of pneumococci in bile, the age of the culture and the reaction of the medium are important factors. The explanation of this solvent action is by no means complete. It is quite possible that the process varies with the different strains of pneumococci; more complete data would be of value in any attempt at the therapeutic utilization of bile products in pneumococcal infections.

Utilizing Birth Records.—In the year 1916 over 172,000 searches were made of the records of births, deaths and marriages on file in the department of health in the city of New York, almost 100,000 being free searches of birth records for admission into school, obtainment of employment certificates and for granting of money to widowed mothers. Almost 20,000 paid searches were made of the records of births for various purposes. The uses to which the transcripts of the records of births were put were many, such as to obtain passports, to prove kinship in litigation of wills, etc., to obtain a license to marry in those cases in which the city clerk refuses to grant marriage licenses unless age is proved, to establish exact date of birth for use in criminal court, to obtain deposits in savings banks, etc.—W. H. Guylfooy, M.D., Registrar.

CONVOYS AND THEIR CARE

THE ADMITTING SECTION OF AN EVACUATION HOSPITAL DURING COMBAT

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While the admission of patients is normally included among the duties of the officer of the day, in actual warfare it has been found necessary to appoint a special admitting officer for this extremely important and difficult task. The term "difficult" must be qualified, in order to make its meaning clear. If, by admission, we merely understand the "taking up" of the wounded by means of their field medical cards, the filling out of data on their clinical records—Form 55 A—and assigning them by rotation to their respective wards, it stands to reason that a squad of orderlies whose handwriting is legible, under charge of a junior officer, will meet such demands satisfactorily. If, on the contrary, and as should be the case, the admitting officer must, in addition to supervision of paper work, personally act as sorting officer (*triage* of the French), then his duties immediately assume great importance. Not only should he be a surgeon of quick and mature judgment, but he must also constantly have in mind, or on paper: (a) the relative technical value of the different surgical teams in the hospital; (b) the special surgical teams on duty (thoracic, neurosurgical, etc.); (c) the hours of the different surgical shifts, and (d) the available beds in each surgical service.

PERSONNEL AND DUTIES OF THE ADMITTING SQUAD

One sergeant and from four to six privates of the Hospital Corps, selected for their clerical qualifications, will suffice for ordinary convoys; this number may have to be doubled or trebled if the casualties are pouring in by the hundred. Rapidity and accuracy are both essential; ambulances must be promptly discharged and blankets, pillows and stretchers returned in order not to hinder transportation problems. A varying number of stretcher bearers must also be assigned for duty during the emergency, as well as a squad of orderlies to wrap up and make out receipts for clothing.

The hospital organization must be made elastic enough to meet all contingencies, rigidity must give way to flexibility, if one does not wish to see the evacuation hospital grounds littered up with a tangled mass of ambulances, stretchers and walking wounded—precious hours wasted because sudden shiftings of duties and details have not been foreseen and worked out.

Each admitting clerk should possess a quick, legible handwriting, together with a general knowledge of wound nomenclature and accepted abbreviations.

The patients classed as walking cases line up in front of the clerks' table, give up their field medical cards, receive a ward ticket and pass on rapidly to the buffet.

Stretchers are laid in rows in the admitting tent and the clerks pass rapidly from one to the other, recording all necessary data in duplicate, for all urgent cases. As fast as the duplicate clinical record is filled out, with the ward number recorded on it, the stretcher