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SPUTUMDIAGNOSIS IN ASTHMA BRONCHIALE
WITH SPECIAL REFERENCE TO THE
OCCURRENCE OF A COMPLICATING
BRONCHIAL INFECTION

By

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In an earlier paper (*Bergman, Colldahl and Nilsson 1955*) it has been shown that bronchial secretion from asthmatic patients with no apparent increase of B.S.R. showed no more frequent bronchial infection compared with patients with healthy lungs. In patients with an elevated B.S.R., bronchial infection, however, was more common. The secretions were collected by sterile suction. An increase in temperature was of little value when conclusion was to be drawn of an eventual infection. A so-called "purulent sputum" diagnosed by macroscopic examination did not give any indication of infection or non-infection.

When culturing sputum, great difficulties arise depending on the risk for contamination of bacteria from the throat and mouth. In order to eliminate these faults *Henriksen 1937* and *Mulder 1937* washed sputum. *R. May 1952* reported results from cultures of sputa made from 44 cases of chronic bronchitis by using a random sampling method when selecting different parts from where the specimen of sputum was taken. He means that *hemophilus influenzae* and pneumococci are

TABLE I

Initials and age	B. S. R.	Quantity of sputum ml	Appearance ¹ of sputum	Bacterial flora in ²			Neutrophilic leucocytes/ Eosinophilic leucocytes in the differential count of blood	Temp. the day of taking culture	Skin test
				Sputum	Washed sputum acc. to Mulder	Sucked up bronch. secr.			
R. B. 55 years	33	80	sm	β -str.c. hem. infl. α -str.c. staph. alb. neisseria	γ -str.c. hem. infl. staph. alb.	hem. infl.	68/o ³	38.0	+
A. B. 57 years	5	30	sm	staph. aur. pnc. hem. hem. paracolon coliforme α -str.c. neisseria	staph. alb. paracolon coliforme neisseria	o	53/19	36.4	—
A. P. 58 years	24	65	sm p	str.c. pyog. staph. aur. α -str.c. γ -str.c. neisseria	coliforms sarcina γ -str.c.	hem. infl.	55/3	36.2	—

J. O.	63 years	29	150	sm	pnc. hem. infl. β -str.c. coliforms staph. aur. diphtheroids candida	α -str.c. staph. aur. coliforms	0	52/1	37.1	—
E. K.	35 years	12	50	smp	str.c. pyog. staph. aur. α -str.c. γ -str.c. diphtheroids neisseria micrococci	sarcina α -str.c.	0	39/20	36.5	—

¹ s = serous, m = mucous, p = purulent.

² α str.c. = α -streptococcus,

β -str.c. = β -streptococcus,

γ -str.c. = γ -streptococcus,

str.c. pyog. = streptococcus pyogenes,

staph. alb. = staphylococcus albus,

staph. aur. = staphylococcus aureus,

pnc. = pneumococci,

hem. infl. = hemophilus influenzae,

hem. hem. = hemophilus hemolyticus.

³ 68/o = 68 % neutrophils and 0 % eosinophils in the differential count..

⁴ + = one or more positive reactions in the skin test.

± = one or more questionable reactions in the skin test.

— = no positive reactions in the skin test.

organisms of importance in chronic bronchitis. These observations seem to be in good agreement with those of Mulder when he points out the great importance of hemophilus influenzae and pneumococci in chronic bronchitis. About the method of Mulder, *Blatt* 1955 says "This method has proved highly effective in the hands of some authors to distinguish between cases that are noninfected and those with a bacterial allergy".

As our method with suction through a tracheal tube and the methods when bronchoscopy are made, can only be performed with some difficulty on very ill patients, we have thought it to be of value to try one of the washing methods and also to compare the results so obtained with those from the ordinary sputum culture and from sterile suction.

METHODS

The sputum samples were taken in the morning. The patient rinsed his mouth with saline and then coughed in a sterile glass. Culture after washing three times according to Mulder 1937 and in the general way without washing was made.

In all patients the B.S.R., the quantity and the macroscopic appearance of sputum was followed.

RESULTS

In 5 patients the flora of sputum investigated through ordinary methods were compared with the floras obtained from washed sputum according to Mulder and from bronchial secretion collected through sterile suction.

The results are listed in Table 1. All patients had the diagnosis of asthma bronchiale.

As it is seen in Table 1, growth occurred in bronchial secretion in 2 out of 5 patients, both of them with B.S.R. above 15 mm. One patient of the three with sterile suction had B.S.R. 29 mm., the others, 5 and 12 mm. resp. From the appearance and direct microscopy of sputum it was not possible in these 5

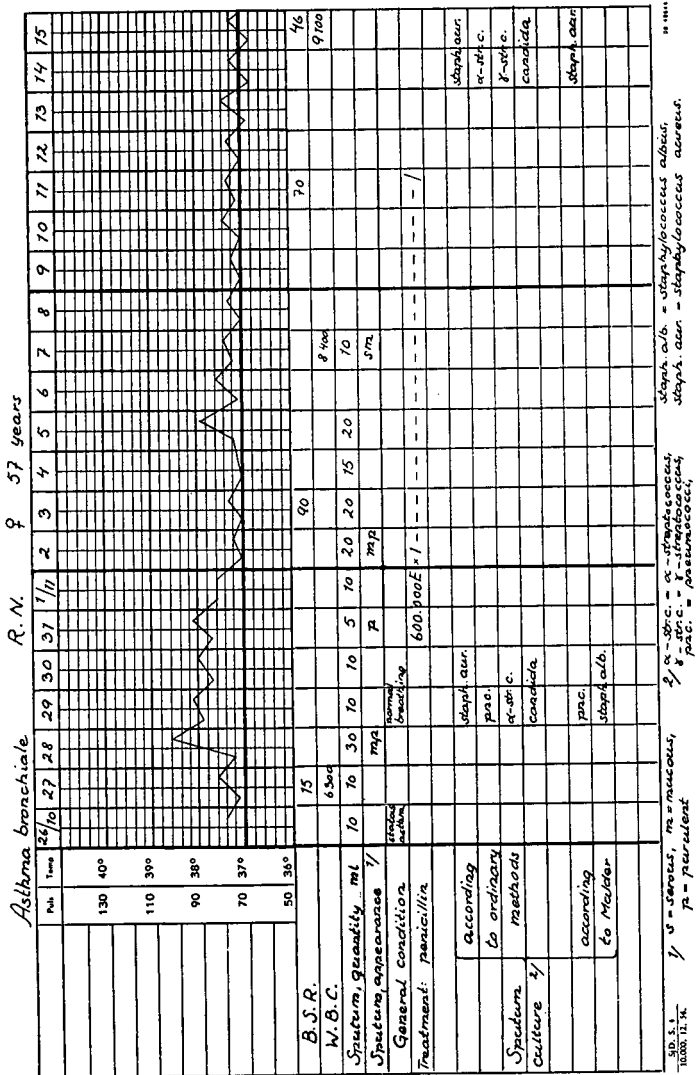


Fig. 1.

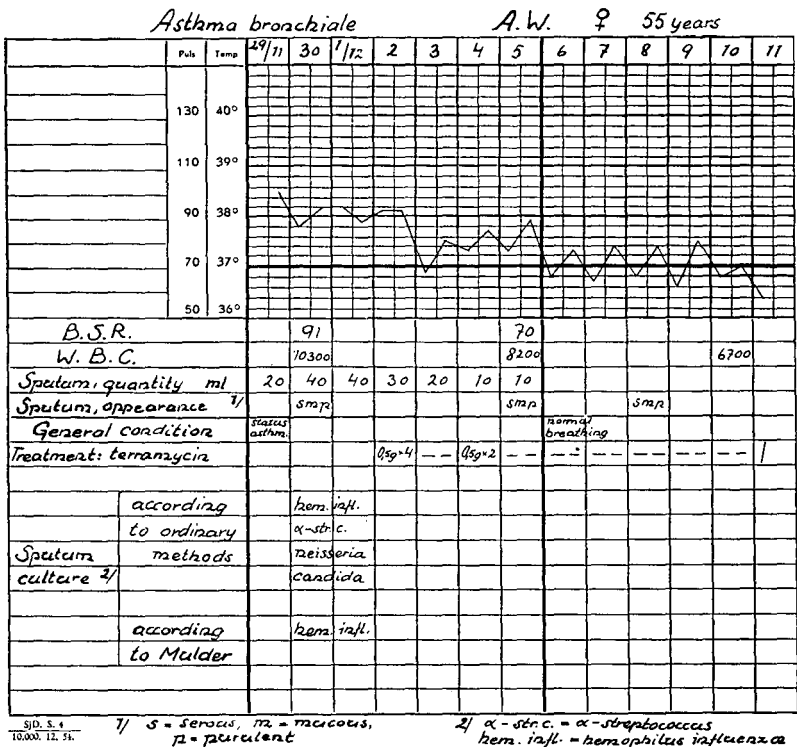


Fig. 2.

cases to get any indication for the judgement of an eventual infection of the bronchi. Bacterial flora in sputum showed in all 5 cases a great variety of microorganisms. With the washing method of Mulder the number of microorganisms was greatly diminished.

In Table 2, results from a comparison of 31 proofs have been listed. Culture has been made in the ordinary way and after washing according to Mulder.

As it is seen in Table 2, there are great differences in the bacterial findings from washed and unwashed sputum. Fewer microorganisms are found after washing. The saprophytes of the throat (α-streptococcus, γ-streptococcus, neisseria, sarcina, diftheroids, micrococci and staphylococcus albus) are found in

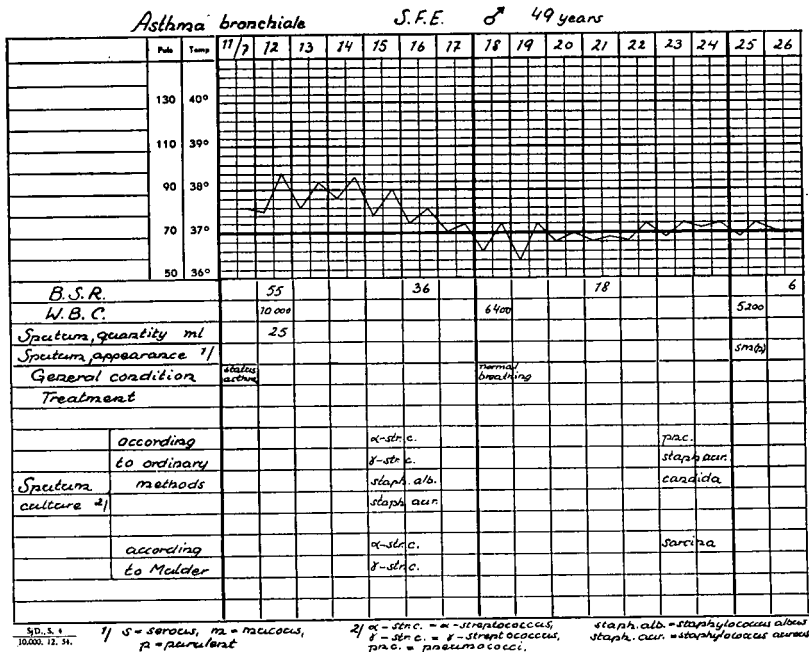


Fig. 3.

a greater number in the sputum cultures, but the three washings seem not to be able to eliminate these, as a rule non-pathogenic organisms. The same seems to be the case of candida. The pathogenic β -streptococcus has been found in 8 sputum cultures, but only in one after washing. In some cases, the cultures have been made from the same sputum sample before and after washing in order to see in what degree the divergences in the results depend on the possibility of the various distribution of the microorganisms in the sputum as shown by R. May 1953. The results were in good agreement with those listed in Table 2.

More often agreement with staphylococcus aureus, hemophilus influenzae, and pneumococci, "the respiratory tract pathogenic" microorganisms according to Tunevall and Waserman 1956, are found in both cultures. This yields especially to the both last-mentioned.

TABLE 2
*Number of organisms found by 31 sputum cultures, both from ordinary sputum
 and from washed sputum.*

	α -str.c.	γ -str.c.	β -str.c.	<i>Neisseria</i> sarcina diphtheroids micrococci	Staph. alb.	Staph. aur.	Pneumococci	<i>Hemophilus</i> <i>influenzae</i>	Coliforms <i>Klebsiella</i> <i>proteus</i>	<i>Candida</i>
Sputum	25	15	8	22	11	14	8	6	6	8
Washed sputum	12	10	1	8	12	7	7	4	4	3

α -str.c. = α -streptococcus,

γ -str.c. = γ -streptococcus,

β -str.c. = β -streptococcus,

staph. alb. = staphylococcus albus,

staph. aur. = staphylococcus aureus.

In cases where we have not used the suction through a tracheal tube, the method of Mulder has been used in order to get an indication if antibiotics should be given, and if so, which was the one of choice. Three cases are reported below.

Case R. N. Female, 57 years. See fig. 1. Asthma bronchiale since 19 years of age. A pneumococcus was found in Mulder-culture. After treatment with penicillin the patient felt better and the pneumococcus had disappeared. After 14 days a staphylococcus aureus was found but as the patient felt well and the temperature was normal, we expected with good result. B.S.R. went up to 90 mm.

Case A. W. Female, 55 years. See fig. 2. Asthma bronchiale since 10 years of age. Mulder-culture gave hemophilus influenzae. The patient was treated with terramycin with good result.

Case S. F. E. Male, 49 years. See fig. 3. Asthma bronchiale since childhood. Pat. was sent in in status asthmaticus. Mulder-culture showed only α -streptococcus and γ -streptococcus. In sputum culture, among others, pneumococci and staphylococcus aureus were found. According to these results we decided not to give antibiotics. The patient recovered this time with symptomatic treatment.

In these three cases some indication was given by the Mulder culture. In one case, S.F.E., expectance could be decided and in the two others the choice of antibiotic was made easier.

DISCUSSION

When the bronchial secretion was collected by catheterization through a tracheal tube we have, in our materials from 1955 and 1956, had growth only in $\frac{1}{3}$ of the cases. By washing sputum some of the bacteria can be removed but one cannot be sure to remove only the saprophytic organisms. The sputum sample also must not be too fluid for allowing washing. As it is shown in Table 2, agreement with pneumococci, hemophilus influenzae and staphylococcus aureus is somewhat more frequent than with the ordinary microorganisms of the mouth and throat. There are, however, great difficulties also in the first mentioned group depending on the fact that these organisms also can be normal inhabitants of the sputum. Robert May 1953 showed the great variations of bacterial distribution in sputum. He also stressed that the presence or absence of pus or a purulent appearance of sputum is not necessarily related to these variations. We have found that the macroscopic appearance of the sputum gives no indication of an eventual infection of the bronchi. The B.S.R. seems to us to be of much more value for this judgement.

Tunevall and *Wasserman* (1956) have pointed out, after culturing both bronchial secretion obtained by bronchoscopy and sputum, that the results from sputum cultures must be very cautiously estimated. They also established that the "respiratory tract pathogenes" found in secretion from bronchoscopy often were not recovered in the sputum cultures.

These observations show the great difficulties when judging of an eventual bronchial infection from the findings in sputum cultures even after washing.

This investigation also confirms the results of Mulder 1938 and R. May 1952 that hemophilus influenzae is one of the most common pathogens of the respiratory tract in asthmatic patients with bronchial infection.

SUMMARY

In 5 patients with asthma bronchiale the bacterial flora in the bronchial secretion collected through the sterile suction

method has been compared with the flora in sputum cultures obtained according to ordinary methods and to the Mulder technique with the following results: In all cases sputum culture showed pathogens. With the Mulder technique there was no true pathogens in three cases (A.B., A.P. and E.K.). In one of these cases (A.P.), bronchial secretion showed hemophilus influenzae. In these three cases it seems possible that washing according to Mulder has removed what else could have been judged as an infection. It is, however, also possible to find bacteria in the bronchial secretion that has not been detected in the sputum cultures prepared in the ordinary way or according to Mulder (A.P.).

In 31 cases (asthma bronchiale patients) the bacterial flora in sputum culture obtained by ordinary methods has been compared with the flora in sputum cultures obtained with the Mulder technique. With the last mentioned method the number of microorganisms has been diminished. This yields especially for those known as common non-pathogenic bacteria for the respiratory tract.

We mean that the method of Mulder is of value for the diagnosis of an eventual bronchial infection, specially in cases where sterile suction is not easily performed. In questionable cases a normal B.S.R. argues against a complicating bronchial infection.

Hemophilus influenzae seems to be one of the dominating pathogens when asthma bronchiale is complicated with an infection of the respiratory tract.

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