Lung Puncture in the Diagnosis of Acute Pneumonia in Children and Adults

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Introduction

There are many difficulties associated with making bacteriological diagnosis of acute pneumonias. In bronchopneumonia it is the rule to obtain mixed cultures from sputum, and to find a pathogen in dominance is an exception. Even in lobar pneumonia, in which the pneumococcus is expected in large numbers in the sputum, the same problem prevails. The clinical and X-ray pictures and the response to treatment are classical, but the "rusty sputum" loaded with pneumococci is rarely seen. In children there is the added difficulty of their tendency to swallow their sputum.

The way to avoid the flora of the middle and upper respiratory tract is to take the specimen directly from the lung by puncture. The technique is well established and is safe if cases are properly selected (Bullova, 1935; Finland, 1961; Klein, 1969; Hughes, Sinha, Cooper, Shah and Bose, 1969).

In both adults and children lung punctures were carried out in an attempt to determine the efficiency of the method in making a bacteriological diagnosis in acute pneumonias and to determine the organisms responsible for such infections in the Rhodesian African. In each case permission was obtained from the patient by one of the doctors in charge of the case and in the presence of a nurse or interpreter.

Materials and Methods

(a) *Adults*

Over an eight-month period male and female patients admitted to the wards of Harare hospital with a diagnosis of acute pneumonia were considered for inclusion. Following clinical examination, the patients were X-rayed either in the ward or in the Department of Radiology. Those in which there were well-defined areas of pulmonary consolidation were selected for further investigation. Sputum and throat swabs were taken for routine culture and a white count performed. The technique of lung puncture followed that reported elsewhere (Bullova, 1935; Klein, 1969). Essentially a 20-gauge $1\frac{1}{2}$-inch needle was attached to a disposable 10 or 20 ml. syringe and plunged with or without local anaesthetic into the area of consolidation. The plunger was drawn and a negative pressure maintained until the needle was completely withdrawn. Immediately the tip of the needle was immersed in warm tryptose phosphate broth in a bijou bottle and the plunger worked once or twice. This procedure was followed whether or not material could be seen on the needle or within the syringe. The bottle was resealed and placed in an incubator overnight.

(b) *Children*

Over a two-month period 16 children were admitted to the paediatric wards of Harare hospital with clinical evidence of pneumonia. On admission all these children were X-rayed and, where radiologically and clinically consolidation could be proved, lung puncture was undertaken immediately after cough swabs were obtained. The criteria for lung tap was present in seven of the cases and the procedure followed that for adults and that used in other surveys (Klein, 1969; Hughes *et al.*, 1969). In the remaining nine cases cough swabs only were taken. The material was treated in the same way as that of the adults.

The routine cultures were set up from the cough swabs, sputum and tryptose phosphate broth on to blood, chocolate and MacConkey's agar. The organisms grown were identified and typed by standard methods. Where possible, treatment with antibiotics was withheld until after the specimens had been taken. Where treatment had already begun its nature and duration were noted.

Results

(a) *Adults*

Table I is a summary of experience with adult patients. In 13 out of the 23 in which lung punctures were undertaken, organisms were obtained in pure culture. Twelve were pneumococci, one streptococcus viridans (of doubtful significance) and one achromobacteria. The pneumococci were typed and eight fell into pool A types and one each to pools B, C and D.

Though pneumococci could be picked from the mixed cultures obtained from sputum or on the cough swabs, in no case were they in sufficient prominence for an accurate diagnosis to be made.

Table I

ADULTS — LUNG PUNCTURE

No.	Sex	Age	Type	Isolation
11/2	M	40	B	Str. pneumo
26/2	M	20		Nil
28/2	M	—		Viridans
19/3	M	37	C	Str. pneumo
16/4	M	—		Nil
16/4	M	—		Nil
23/4	F	7	A	Str. pneumo
30/4	M	38		Nil
11/6	M	40	A	Str. pneumo
28/7	F	10	A	Str. pneumo
30/7	M	23		Nil
20/8	M	28	A	Str. pneumo
22/10	M	23		Nil
11/12	M	—		Nil
6/1/70	F	30		Nil
3/1/70	F	2	D	Str. pneumo
7/1/70	M	26	A	Str. pneumo
12/1/70	M	21		Achromobacter
21/1/70	M	30		Nil
24/1/70	F	33	A	Str. pneumo
28/1/70	M	75	A	Str. pneumo
5/2/70	F	25		Nil
25/2/70	F	27		Nil
13/3/70	M	—	A	Str. pneumo

(b) *Children*

From four of the seven cases submitted to lung puncture, organisms were isolated; three of these were in pure culture. It should be noted that in two of the negative cases antibiotic therapy had been initiated at least 12 hours before the procedure was undertaken. The mixed culture grew coliforms and streptococcus viridans and those in pure culture, a pool A pneumococcus, a pool B pneumococcus and a haemophilus influenzae. In none of the cases in which the diagnosis was made by lung puncture were the same organisms apparent in the sputum or in cough swabs. Amongst the cases in which it was deemed unwise to perform lung punctures, one showed a pure culture of pneumococcus and five others lactose fermenting coliforms and *Klebsiella* spp. A point of note is the disparity between the lung puncture and cough swab cultures where both were done together. It must be assumed now that the likelihood of coliforms in the sputum being of significance in childhood pneumonia is not very great.

It is quite apparent that both in children and adults the introduction of antibiotic therapy within a few hours is likely grossly to impair the chances of making a bacteriological diagnosis.

Table II

(a) COUGH SWAB ONLY

No.	Sex	Treatment before swabbing	Isolation
1.	M	1 day penicillin	Mixed. No pathogens
2.	M	Nil	Lactose +ve coliforms
3.	M	Nil	Lactose +ve coliforms
4.	M	Nil	Lactose +ve coliforms
5.	F	Nil	Mixed. No pathogens
6.	M	Nil	Mixed. No pathogens
7.	F	Nil	Klebsiella spp.
8.	F	1 dose penicillin	Coagulase +ve staph. Lactose +ve coliforms
9.	M	Nil	Pneumococcus

(b) LUNG PUNCTURE AND COUGH SWAB

No.	Sex	Age	Pretreatment	Lung Puncture	Isolation Cough Swab
1.	F	3 yrs.	20 hrs. Cystapen Sulphadimidine	Nil	Mixed. No pathogens
2.	M	2 yrs.	Nil	*E. coli* *Str. viridans*	*Str. viridans* B-haemolytic strep.
3.	M	11 mths.	Nil	Nil	Lactose +ve coliforms
4.	M	2 yrs.	Nil	*Str. pneumo* Pool A	Mixed. No pathogens
5.	M	11 mths.	Nil	*Str. pneumo* Pool B	Mixed Lactose +ve coliforms
6.	F	1 yr.	1 hr. Cystapen Sulphadimidine	*Haemophilus influenzae*	Mixed Lactose +ve coliforms
7.	M	1 yr. 1 mth.	12 hrs. Cystapen	Nil	Mixed growth No pathogens

Discussion

As a diagnostic method lung puncture has a number of advantages over the more conventional cough and throat swabs and sputum examination. The specific organism responsible for the infection is distinguishable from those colonising the upper respiratory tract, the changes in the microbial flors during infection can be accurately identified and treatment modified accordingly, the significance of unusual or unexpected organisms which may be found in debilitated, mal-nourished or immunologically depressed patients can be assessed and the presence of true mixed infection, often the cause of therapeutic failure, genuinely established. Such, for example, is frequently the case in lung abscess, a condition which might lend itself to this procedure. There were unfortunately none in this series.

Accurate diagnosis leads to well-designed treatment and to informed anticipation of organisms likely to be responsible for particular types of infection in the community. This pilot survey indicates, as was expected, that adult lobar pneumonias in Rhodesia are generally pneumococcal and that the types involved are the same as those found elsewhere in the world (Pool A comprises types 1, 2, 4, 5 and 18). Successful punctures were obtained in about 50 per cent. of cases, which compares well with surveys elsewhere. Of greater importance is that, in all those, pathogens were isolated and were clearly the organisms responsible for the disease. Further, the cultures are such that the diagnosis can be made rapidly after primary incubation and full sensitivities reported at the same time.

There were too few paediatric cases to make any generalisation except that the technique is apparently safe and simple, and confers the same advantages as in adults. No special equipment is required and the procedure can be performed by resident staff. There were no complications in this series, though haemoptysis and pneumothorax have been reported in less than 1 per cent. of cases.

If cases were properly selected, the technique could be used routinely. Bacteriologically this would be highly desirable, though it may not be acceptable totally by clinicians. It is, however, recommended when difficulties in diagnosis or in response to treatment arise.

Summary

(1) Lung punctures were undertaken in selected cases of pneumonia in adults and children admitted to Harare Hospital.

(2) In 13 out of 24 adults and 4 out of 7 children organisms were isolated in pure culture rapidly. Where respiratory swabs were examined simultaneously, there was little correlation with the puncture specimen. The puncture method has distinct advantages.

(3) The technique is safe and can be widely applied.

(4) Pneumococci mainly belonging to the types in Pool A (1, 2, 4, 5 and 18) are the usual cause of acute pneumonias in Africans at Harari.

References

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