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Aspiration in seriously ill patients: a study of amylase in bronchial secretions

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SUMMARY Bronchial secretions from 21 patients with moderate to severe chest infections were obtained by transtracheal aspiration. Six seriously ill patients showed greatly increased levels of amylase activity in the bronchial secretions compared with those found in the 15 less ill patients. This amylase was almost certainly derived from oropharyngeal contents and its presence suggests that aspiration may be more common in comatose and semi-comatose patients than is generally appreciated.

Percutaneous transtracheal aspiration (TTA) is a method of collecting bronchial secretions by inserting a needle and cannula through the cricothyroid membrane below the larynx.[1] The specimens obtained are usually uncontaminated as judged by the lack of buccal epithelial cells on microscopy and the purity of bacterial cultures obtained.[2] To our knowledge amylase activities have not previously been measured in bronchial secretions to assess the degree of contamination by oral contents.

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Patients and methods

Twenty-one patients were studied as part of a larger project to evaluate the use of transtracheal aspiration (TTA) in the management of difficult chest infections in a general hospital. All were moderately or severely ill with chest infections (Table). Four of the

Amylase estimations in serum, transtracheal aspirate (TTA) and expectorated sputum (ES) in patients with severe and moderate chest infections

Serum amylase IU/l	*TTA amylase IU/l*	*ES amylase IU/l*	*Diagnosis*	*Grade of illness*	*TTA examination organisms isolated*
379	78 000	621 500	Pneumonia	SEVERE	*Strep pneumoniae, Strep pyogenes, Staph albus, Neisseria* sp
163	56 370	NA	Pneumonia		*Klebsiella pneumoniae, Candida* sp
187	8 100	NA	Pneumonia		*Staph aureus*
197	10 390	74 700	Pneumonia		*Strep pneumoniae, H influenzae*
145	4 410	255 300	Pneumonia		*Strep pneumoniae, H influenzae*
75	145 300*	56 800	Pneumonia		*Strep pneumoniae, H influenzae, Strep viridans*
615	620	98 900	Pneumonia	MODERATE	*Proteus* sp
85	4 470	115 000	Chr bronchitis		*H influenzae*
306	3 590	109 700	Chr bronchitis		*Pseudomonas* sp
137	700*	91 500	Chr bronchitis		Nil
380	1 200*	250 000	Chr bronchitis		Nil
125	1 370	11 100	Chr bronchitis		*Strep pneumoniae, H parainfluenzae*
236	1 300	52 000	Pneumonia		Nil
274	2 390	148 600	Chr bronchitis		*H influenzae*
305	540	362 000	Bronchiectasis		*H influenzae*
425	2 250*	NA	Pneumonia		*E coli, Pseudomonas* sp
344	450	273 700	Lung abscess		*H influenzae, Bacteroides* sp
NA	740	61 500	Chr bronchitis		*B catarrhalis*
NA	970	217 500	Chr bronchitis		*Strep pyogenes, H parainfluenzae*
359	2 600	140 900	Chr bronchitis		*B catarrhalis*
152	330*	NA	Pneumonia		Nil

*Saline used to obtain specimens.

six seriously ill patients were semi-comatose and had received pharyngeal suction on the Intensive Care Unit, although none had been intubated. The 15 less ill patients were fully conscious and had not received oral hygiene.

TTA was carried out in the standard manner described by Pecora[1] with only minor modifications. Droperidol was administered intravenously in a dose of 2-10 mg to some alert patients as premedication, but never in sufficient dose to affect consciousness. In five patients (see Table) a small volume of normal saline was introduced into the trachea via the cannula to facilitate sampling. Expectorated sputum (ES) was collected either immediately before or during the TTA procedure in alert patients, but pharyngeal suction specimens were used in some of the seriously ill. Specimens were stored at +4°C for a variable period of up to three weeks before estimation of the amylase activities. Sera taken at the time of the procedure were stored at −20°C for similar periods before analysis.

Amylase activities in ES, TTA samples, and serum were estimated by hydrolysis of a water insoluble blue starch polymer with the Phadebas amylase test kit (Pharmacia Diagnostics). The specimens were diluted and homogenised with dithro-threitol (Sputolysin) which allows dissolution of the mucus and was shown not to affect amylase activity. Particulate matter was removed by centrifugation. The reproducibility of this method for estimating amylase in sputum and tracheal aspirate is poor, due partly to the lack of homogeneity of the samples, and partly to the difficulty of pipetting viscous material, with a coefficient of variability of 27% on nine paired samples.

Bacteriological methods, to be reported in detail elsewhere, included Gram-stain examination as well as culture, and counterimmunoelectrophoresis.

Results

Amylase activities in serum, TTA and ES are listed with the bacteriological and microscopic findings in the Table. In seriously ill patients the mean TTA amylase activity was 50 000 IU/l while in the less ill patients it was 1565 IU/l ($p < 0.0005$). The mean ES amylase activity was 206 000 IU/l. The mean serum amylase activity was 260 IU/l.

Discussion

In our study, the activities of amylase in the TTA samples of the less ill, alert patients were significantly higher than serum activities. Lung tissue, however, is known to contain amylase at a higher concentration than serum[3] and at levels compatible with our results so that the difference in amylase activities between the TTA and serum samples do not necessarily imply contamination by oropharyngeal sections. The very high activity seen in the comatose patients, however, cannot be accounted for in this way and is highly suggestive of aspiration. The bacteriological findings are to be discussed in detail elsewhere, but it is noteworthy that more than two bacterial species were found on only three occasions, each of them in the seriously ill patients. Multiple isolations are common when aspiration has occurred.

The seriously ill patients had all undergone pharyngeal suction and nasogastric intubation as routine nursing procedures whilst in the Intensive Care Unit and these procedures might have encouraged aspiration leading to the high levels of amylase activity found in their TTA samples. Patient 9 who did not undergo such procedures also had high activities, however, suggesting that aspiration may occur in unconscious people without additional factors. The relevance of our findings to semicomatose and seriously ill patients without chest infections is not known, as we did not feel ethically justified in including such patients in this study.

Two conclusions can be drawn from this study. First, that although TTA is a valuable diagnostic method in difficult pulmonary infections, contamination by oropharyngeal flora is not uncommon and will cause difficulties of interpretation. This limitation of TTA has also been noted in a comparison of sputum, TTA and lung aspirates by Davidson *et al.*,[4] and the frequency of contamination by pharyngeal contents established by the use of methods such as a tracer organism[5] or methylene blue.[6] Second, these findings serve as a reminder of the frequency and importance of aspiration in seriously ill patients. Even in normal people, aspiration is evidently common enough, since bronchograms can be demonstrated in healthy volunteers after instillation of lipiodol into their noses while asleep.[7] Aspiration during anaesthesia is also frequently found in studies using marker dyes.[8] Nevertheless, cultures of TTA samples from healthy volunteers are usually sterile, suggesting that oropharyngeal contamination in these subjects does not occur, or that clearance mechanisms are very efficient.[9] By contrast, aspiration is a common, potentially serious, and underrecognised event in seriously ill patients.

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