Pancreatic Dornase Aerosol in Pulmonary, Endotracheal and Endobronchial Disease

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Pulmonary complications such as atelectasis, pneumonitis, lung abscess and thick tenaceous sputum are frequently an important factor in morbidity and mortality of many medical diseases and with post-operative and post-traumatic states. Antibiotics have controlled many of the infectious phases of this problem, but the obstructive phenomena remain unsolved. The use of expectorants or vapor inhalations has been of limited usefulness. Endotracheal aspirations or bronchoscopy are frequently necessary, but are traumatic and not always successful even when repeated.

In recent years the use of enzymes and/or enzyme activators such as streptokinase-streptodornase (Varidase), trypsin and of detergents such as alevaire has been popularized. Trypsin has been shown to be effective by many investigators but not universally. Serious complications have been reported, and almost all authors advise use of antihistamines and/or epinephrine inhalations with trypsin. The effects of these drugs themselves have not been considered in these reports.

Varidase has been used with less success. Detergents, particularly alevaire, are in common use and have been reported to be effective. Continuous therapy by tent or nasal catheters, or repeated treatments each day for several days are necessary to obtain results.

Pancreatic desoxyribose-nuclease (dornase) prepared by the method of McCarty was first used in patients with thick purulent sputum, such as those with bronchiectasis, with excellent results. Satisfactory results with a purified pancreatic dornase have been reported, with a review of pharmacological effects of the drug. No irritating effects were noted. Pancreatic dornase and trypsin have been used together with good effect but many serious reactions.

We set out to evaluate the usefulness of this purified pancreatic dornase in all pulmonary conditions presented as unresolved by standard procedures. The local effects and general reactions to dornase were also studied by clinical and laboratory means, including bronchoscopy and pathological examination of resected specimens. The effect of pancreatic dornase on the discovery of malignant disease by cellular cytology from bronchial washings was also studied.

Materials

Pancreatic desoxyribose-nuclease (dornase) was furnished in sterile vials of 100,000 units. Sterile diluent was supplied in vials of 10 cc.

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*Supplied by Sharp & Dohme Inc., West Point, Pa. Through courtesy of Dr. R. T. Smith
This material is completely soluble in 2 cc. of the diluent. In solution the material loses activity rapidly and should be discarded if not used within an hour. The pH of the material will vary with the amount of diluent used from pH 7.6 with 10 cc. to pH 3.2 with 2 cc.

Methods

In the early cases the 100,000 units of dornase were dissolved in 5 cc. of diluent and 2-3 cc. were used in an aerosol inhalor using oxygen for nebulization at a flow rate of about 5-6 L/minute. The usual rate of use was about 1 cc. in 10-15 minutes. In a few instances hand bulb nebulizers were used but with much less satisfactory results. Since there were no complications or irritation with the first few cases, the concentration was increased to 100,000 units to 2 cc. of diluent in the usual case. In an occasional case where prolonged use was contemplated, the patient was started with the more dilute and later changed to the more concentrated solution. All prebronchoscopy patients except the first 10 were given the more concentrated solution.

Clinical Material

One hundred and four patients, 91 in Memorial Center for Cancer and Allied Diseases, nine in the New York Hospital, and four from other hospitals in New York City, were given dornase inhalations. Results were evaluated by their own physicians, by the author, and by a review of the charts.

With 65 patients pancreatic dornase was used as an aerosol immediately before local anesthetization for bronchoscopy.

Thirty-nine with unresolved pulmonary disease, primary or secondary, were considered therapeutic cases. All had failed to respond to the usual

FIGURE 1

*Figure 1 (Case 1):* From x-ray film of December 23, 1954 showing atelectasis of left lower lobe after bronchoscopy and alevaire inhalations.—*Figure 2 (Case 1):* From x-ray film of December 31, 1954 after dornase inhalations showing complete re-expansion of previously atelectatic lobe.
methods of treatment or were actually going down hill while under the usual methods of treatment. Since most of them were seriously ill, it was impossible to discontinue all other treatments at the time of starting dornase. However, in only two instances were definitive drug changes, which themselves could have produced marked improvement, made at the time of or sufficiently close to the time of institution of dornase therapy, to confuse the picture.

Results

1. Prebronchoscopy Cases

Of the 65 patients who received dornase inhalations in preparation for bronchoscopy, 56 bronchoscopies were completed. Twenty-eight of the 56 were ultimately proved to have carcinoma of the lung. Of these, 20 (71 per cent) had positive or suspicious cytological studies on this single examination. In contrast the washings of 26 patients without carcinoma were reported negative by our cytologists.

There were no complications or reactions to the dornase in this group of 65 cases. The mucosa appeared normal throughout except where disease was present and biopsies of the mucosa in instances negative for tumor failed to show any reaction. One with chronic bronchitis gave the typical picture for that disease. Two patients had active tuberculosis proved by smears and culture, and there was no subsequent evidence of spread or increase in the disease process. Three others had inactive tuberculosis or Boeck's Sarcoid with no evidence of increase in the disease. Two coughed up large bronchial plugs following the inhalation before actual passage of the bronchoscope with definite relief of symptoms of chronic cough and segmental atelectasis.

2. Therapeutic Cases

Thirty-nine patients with uncontrolled pulmonary complications or disease were treated with dornase. Of these, 13 were cured of the pulmonary complication or disease, 12 were markedly and permanently improved and eight were improved temporarily, while receiving dornase and for limited periods after its use. Only three were unchanged, and in three it was impossible to evaluate the results satisfactorily.

There was no serious complication from the use of dornase and only four patients had symptoms which could possibly have been due to the enzyme. Two complained of nausea after the inhalations; one was receiving radiation therapy for carcinoma of the lung and had been nauseated before the dornase was started, the other postoperative atelectasis following gastrectomy and suffered from dumping syndrome. Two patients had sore throats, both during a second course of therapy. In only one of them does dornase seem to be implicated justifiably with irritation after each inhalation in the second course of treatment. The second patient had a severe monilia infection secondary to heavy antibiotic dosage.

The best and most dramatic results were with those having atelectasis, all being cured by relatively few (3 to 5) treatments. The next best results
were in those with thick tenaceous mucus with partial segmental atelectasis and great difficulty raising the sputum, making naso-tracheal aspirations necessary in many cases, before dornase was used. The poorest results were in those with pulmonary complications secondary to advanced malignant intrathoracic tumors.

**Group I—Patients with Atelectasis**—Four patients with lobar atelectasis; two with undetermined origin, and two post-operatively showed complete relief of symptoms and objective physical signs or x-ray film evidence of complete relief of the atelectasis.

Case No. 1, F. W., Norwegian Hospital. This eight year old boy had a proved atelectasis of the left lower lobe, by symptoms, physical findings and x-ray films. He had received alevaire inhalations and had been bronchosced on two occasions in an attempt to relieve the atelectasis. The condition only became worse (Fig. 1). He received two inhalations of pancreatic dornase on December 29, and one on December 30, 1954. Following this, there was complete relief of the atelectasis by symptoms, physical signs and x-ray film (Fig. 2). He was entirely well until May 1955, when he had a second attack of atelectasis, again relieved completely by two inhalations of pancreatic dornase.

Case No. 2, R. B., Memorial Hospital No. 40688, was a 49 year old white female with clinical and x-ray evidence of right middle lobe and right lower lobe atelectasis. She had been treated in another hospital for two weeks with aerosols, antibiotics and bronchoscopy without relief and was admitted to Memorial Hospital on January 9, 1955, for resection of a probable tumor. She received five inhalations of pancreatic dornase from January 11 to 14, 1955, with increase in sputum after each of the first four, and

**FIGURE 3**

*Figure 3 (Case 3):* From x-ray film of December 22, 1954 showing evidence of right lower and right middle lobe atelectasis with elevation of diaphragm.—**FIGURE 4 (Case 4):** From x-ray film of January 10, 1955 identical with that of January 6, 1955 which reproduced poorly, showing complete relief of atelectasis.
expectoration of a large bronchial plug 3 to 4 cm. long and about ¾ cm. in diameter, after the fifth inhalation. This gave complete relief of symptoms and she was discharged two days later as cured with normal chest x-ray film.

Case No. 3, M. D., Memorial Hospital No. 38976. This 52 year old white woman had radical cystectomy performed on December 14, 1954. By December 17, she was known to have atelectasis of the right lower lobe with elevation of the diaphragm and displacement of the mediastinum to the right. She was treated with naso-tracheal aspirations daily, obtaining some secretion, but no improvement of the atelectasis was shown by clinical signs or by x-ray films on December 20, 22, and 27 (Fig. 3). On December 28, after fluoroscopy which showed no change she was started on pancreatic dornase twice daily (100,000 units/5 cc.). The following day, there was improvement of the atelectasis by physical examination and fluoroscopy. On December 31, she was discharged after complete clearing of the chest was demonstrated on physical examination and by fluoroscopy, confirmed by x-ray films of the chest (Fig. 4).

Case 4 was similar in diagnosis, treatment and results.

**Group II—Patients with Pulmonary Complications of Medical Diseases**—Four patients with thick mucoid secretions and segmental atelectasis associated with serious chronic diseases, were treated with dornase.

They were acutely and chronically ill with serious primary diseases, with superimposed pulmonary complication. All had been treated actively for both the primary disease and the pulmonary complications without significant improvement before being considered for dornase therapy. This included continuous alevaire by tent or frequent alevaire inhalations. All responded well to dornase. Cases No. 5, 6 and 7 could be considered as completely cured of their pulmonary complication. With case No. 5 with hypertensive cardiovascular disease and pulmonary edema, and Case No. 6, with lupus erythematosus, all other drugs for treatment of the pulmonary complication were discontinued at the beginning of dornase. Both had complete relief of the pulmonary complication after two and three days of treatment.

Case No. 7, W. T., New York Hospital No. 696633. This 70 year old white man was admitted to New York Hospital on March 18, 1955, with severe cerebral vascular accident, hypertensive cardiovascular disease and pulmonary edema. He was placed on apresoline, hexamethonium, penicillin and streptomycin and other drugs for relief of pulmonary edema and control of symptoms. He was unable to raise the thick tenaceous bronchial secretions. Frequent endotracheal aspirations were necessary and he was on alevaire inhalations from March 26, with only increasing difficulty from his pulmonary disease. Increased congestion and patches of pneumonitis were observed on the x-ray film on March 24. There was steady progression of symptoms until March 27, when he was cyanotic while out of the tent and had obvious left lower lobe consolidation with temperature of 39.0° C. This day he went into shock and looked moribund according to his attending physician's note. Levophed was started and
naso-tracheal aspirations were necessary at least every 20 minutes. Despite
this, the lungs could not be kept clear. On March 28, his temperature was
40.0 °C., he was still in shock and was cyanotic even in oxygen. Following
the first inhalation of pancreatic dornase, it was noted that it was easier
to aspirate the sputum and his lungs cleared more than previously. He
was given two inhalations that day and then was started on tetracycline
250 milligrams every eight hours. On March 28, he was much improved but
still slightly cyanotic when out of the tent for a short time. His tempera-
ture was 38.6 °C. By March 30, he was able to aspirate himself and to sit
up and feed himself. His lungs were almost clear, the sputum was much
less viscid and he was able to cough it up most of the time and only had
to be aspirated or aspirate himself infrequently. His temperature was
37.7 °C. Dornase was discontinued April 2. His course continued to show
improvement and he was discharged about one month later.

Case No. 8 was only temporarily improved after each treatment and
for a short time after each of the two courses of treatment. With the first
course other treatments were continued but for the second all other treat-
ments were discontinued, with no change in results.

Group III—Post Thoracotomy Patients—Eight patients who had thorac-
tomy with rib resection were treated for thick tenaceous sputum, and/or
segmental atelectasis or pneumonitis. This type of patient is particularly
difficult to manage because of the already poor pulmonary function and
poor tolerance to further loss of function and their inability in many
instances to develop effective cough because of chest pain and the poor
respiratory exchange. Naso-tracheal aspirations are frequently effective,
but are time-consuming, unpleasant to the patient and complications may
follow their frequent use. Bronchoscopy is limited in frequency.

In these eight patients, naso-tracheal aspirations were unnecessary after
the start of dornase inhalations. Four of them were considered cured of
their pulmonary complications by relatively few inhalations, two in two
cases, three in one and six in the fourth. These results were almost as
dramatic as were those in the patients with lobar atelectasis.

Case No. 12, J. S., Memorial Hospital No. 42306 is an example of the four
cured cases. This 72 year old white male had upper lobectomy. March 15,
1953, for metastatic carcinoma of the lung, when tracheostomy was per-
formed because of expected respiratory difficulty. Post-operatively he
had difficulty with thick mucoid sputum, necessitating frequent aspiration
through the tracheostomy and still with failure to clear the lungs of numer-
ous coarse, moist rales. On the fourth post-operative day, he developed
fever of 103° F. due to focal atelectasis confirmed by x-ray. Two inhala-
tions of dornase (100,000 units/2 cc.) were given on March 22 and 23. Following
the first treatment, the secretions thinned and the patient was able to raise
them much more easily, and there was no further necessity for endotracheal
aspirations. His temperature fell on the next day and he was discharged
three days later on the 18th post-operative day.

A fifth patient had marked improvement in fluidity and ease of raising
the sputum, but his fever was not markedly changed by the drug and so he
could not be considered cured. He was one of the two who suffered from sore throat and mouth which in his case was shown to be due to severe monilia infection, secondary to massive antibiotic treatment.

Two had only temporary improvement with decrease in viscosity of tenaceous sputum and ease in suctioning sputum. Both succumbed to their disease the day after beginning treatment.

Only one failed to show any definite improvement.

Group IV—Patients with Advanced Intrathoracic Carcinoma—These 10 patients obviously were poor cases for any type of treatment, but the complication of thick tenaceous mucus, or atelectasis was considered so serious as to warrant all possible attempts to relieve them.

Only one could be considered as being completely relieved of complication. Case No. 17, P. I., Memorial Hospital No. 39681. This 65 year old white man had been explored on September 24, 1954, when a non-resectable carcinoma of the left lung with abscess formation was found. He developed complete atelectasis of the lung by the fourth post-operative day and four days later had spiking fever with chills. For the next month he continued to have temperature elevation to 100° to 102° F. in spite of crysticillin, gantrisin, chloromycetin and terramycin in large doses. On the 46th post-operative day he was started on pancreatic dornase by inhalations. There was rapid defervescence of fever, improvement in his appetite, in his general feeling of well being and ease of expectoration with at first an increase in the amount of sputum to a large quantity, and then decrease in sputum. The temperature rose to above 99° F. only two times after November 11. He was discharged on November 22. For three days before discharge, he had been completely free of fever without significant cough or distress in his chest and feeling better than at any time during his hospitalization.

Four other patients were definitely improved, giving a total of five (50 per cent) in this group who showed definite improvement. One of these patients had two courses of dornase with temporary improvement after each.

Four had temporary improvement during the time of actual use of dornase with regression after it was discontinued. One of them, F. S., Memorial Hospital No. 36903 was the second of the two who complained of irritation of the mouth and throat during his second course of treatment. Only one, an outpatient receiving one inhalation daily for dry cough, while receiving radiation therapy to the chest was unimproved.

Group V—Patients with Tracheostomy—Three patients were treated in this group. Two with so-called tracheitis sica, and one with temporary difficulty with tenaceous sputum after total laryngectomy and tracheostomy. The latter received only one treatment with temporary improvement.

The two with tracheitis sica were severe cases with thick sputum and plugs, with frequent obstruction necessitating emergency aspirations as well as frequent cleansing of the tracheostomy. One of over a month’s duration was completely relieved after 12 daily instillations as an outpatient. The second had three courses of treatment with complete relief during the treatment, and with recurrence when dornase was discontinued between...
the first and second and the second and third courses. Following the last course he was completely relieved. The third had only one inhalation which resulted in improvement of his condition.

**Group VI—Miscellaneous**—This group comprises seven patients, all different in their basic disease process and pulmonary problem.

Case No. 30, V. K., New York Hospital No. 705707, a 39 year old white male was admitted on March 18, 1956, with cellulitis of the nose and lung abscess evidently of long duration. He had cough with thick tenaceous sputum and temperature of 39.5°C. He was given penicillin 600,000 units every eight hours from March 18 to 24, and 250 mgm. of achromycin every four hours from March 22 to 25. He was on streptomycin from March 24, until April 23. There was no change in the lung abscess with antibiotic therapy (Fig. 5), and he continued to have fever of 38.6°C to 39.5°C. He was started on pancreatic dornase on March 27, when he received two inhalations. Two were administered on March 28. He was bronchoscoped on March 30, but there was no positive finding. Pancreatic dornase three times daily was reinstituted on April 1, when the temperature rose only to 37.8°C and thereafter remained essentially normal until April 9, when dornase inhalations were discontinued. At this time he had temperature of 37.3°C for three consecutive days and the abscess cavity could not be visualized on routine posterior anterior and lateral x-ray films (Fig. 6). On April 10, after stopping dornase, his temperature was 37.8°C and it remained persistently 37.8°C throughout his hospital course until toward the end of hospitalization. Tomograms were taken on April 19, which showed a very small cavity present in the center of the area of the previous abscess cavity. He was continued on bed rest and nothing but streptomycin treatment through May 10, when he was again placed on dornase three

**FIGURE 5**

*Figure 5 (Case 30):* From x-ray film of March 26, 1956 showing abscess cavity which had increased slightly in size while on antibiotics.—*Figure 6 (Case 30):* From x-ray film of April 8, 1956 after 11 days of dornase, and the day before it was stopped. Note failure to demonstrate cavity, though changes remain in the area.
times a day for three and one-half days. His temperature dropped from 38° C. to 37.5° C. Tomograms on May 14, showed no evidence of cavity and he was discharged.

Case No. 31, H. P., Memorial Hospital No. 38346 was a 57 year old white male ultimately shown at operation to have lipoid pneumonia. With six inhalations of dornase he improved clinically and even by x-ray film. Pathological examination of the resected lobe failed to show any unusual bronchial or alveolar changes due to dornase.

Case No. 32, H. McC., New York Hospital No. 706642. This 65 year old colored window washer had multiple rib fractures and other severe injuries. He was unable to cough up thick tenaceous sputum because of chest pain and was rapidly developing signs of atelectasis and pneumonitis with fever to 101° F. by the day after admission despite antibiotics. Two hours after the first inhalation there was thinning and increased ease in raising the sputum. There was lysis of fever and clearing of pulmonary signs in three days.

Case No. 33, K. B., Memorial Hospital No. 16156. This 47 year old white woman with asthmatic bronchitis and segmental atelectasis had marked improvement with inhalations of dornase at weekly intervals. Prolonged improvement followed the last inhalation after which she coughed up two large (2 cm. x ¼ cm.) and several smaller plugs.

Two other patients also showed definite improvement. The last patient was moribund and though he showed marked thinning of the sputum permitting easier aspiration, succumbed to his general disease.

**Group VII—Indeterminate Cases**—Three patients could not be properly evaluated because of inadequacy of records. None of them had any undesirable reaction to the drug.

**Discussion**

From our results and previously reported series of cases, pancreatic dornase would seem to be a useful tool in controlling pulmonary disease secondary to plugging of bronchi by mucoid or thick purulent secretions. Results have been excellent in those patients with acute disease and there has been improvement in almost all cases treated, even those with far advanced disease.

In general it was noted that with the first inhalation of dornase there was loosening of secretions and cough and increase in the quantity of sputum to double or triple that previously obtained. This might continue for three or four treatments and with the few resistant cases it continued even longer. In the satisfactory cases this increase would occur with only the first or second treatment. Following the period of increased secretion there would be rapid decrease in the amount of sputum until in those rated cured or improved there was no significant sputum production. This course of events would lead to the opinion that the dornase effect was not one of irritation but rather an actual lysing of the sputum permitting clearing of the airway.

These good results have been obtained, happily, without serious complications of the treatment itself. Indeed, there have been few reactions of
any type even with prolonged use and with repeated courses of treatment. Two patients had sore mouths following dornase but only one was thought to be properly blamed on dornase, the other probably being due to monilia infection. Two had nausea and vomiting after dornase but both had other reasons: one had a dumping syndrome and the other was receiving radiation therapy. Only one in this entire group asked to have the dornase discontinued. This is in contradistinction to trypsin which, although also effective, has been followed frequently by severe irritation and some serious reactions.

Studies of the bronchial tree by bronchoscopy failed to show any significant change in 56 patients studied. Biopsies and cellular cytology likewise failed to reveal any demonstrable change, which is at variance with the results following trypsin where metaplasia has been reported.

In those in whom complete cure of an acute lesion such as atelectasis is to be obtained, this usually occurs with relatively few inhalations. In more chronic diseases such as tracheitis sica and chronic lung abscess, or lung abscesses secondary to tumor longer courses have been necessary.

Unfortunately we have had only two questionable asthmatics, since these as a group have given unsatisfactory results with inhalation therapy with enzymes alone or alevair alone in most reported series. Our two cases were both improved. Two others coughed up large bronchial plugs with relief of symptoms, although not proved to be asthmatic patients.

SUMMARY

Pancreatic dornase has been used in a total of 104 patients, in two groups: Group I: 65 who received inhalations before bronchoscopy, and Group II: 39 who received inhalations for treatment of pulmonary disease.

None of the 65 who had inhalations before bronchoscopy had any reaction to the drug. Sixteen of the 28 proved carcinomas (57 per cent) gave positive cytologies and 20, (71 per cent) gave positive or doubtful cytologies. There were no false positives.

Patients with acute pulmonary disease such as atelectasis secondary to mucus plugs or thick tenaceous sputum respond most rapidly and satisfactorily to pancreatic dornase. Those with more chronic disease respond slower but remarkably well, while those with advanced malignant disease or chronic pulmonary disease with dry cough, such as post-radiation bronchitis, respond less satisfactorily or poorly to the drug.

Even with repeated inhalations and repeated courses of inhalations, only a few had minor complications.

This enzyme would seem to be particularly useful in post-operative thoracic surgical and post-traumatic patients with thoracic injuries.

RESUMEN

Se ha empleado la dornasa pancreatic en 104 enfermos correspondientes a dos grupos:

Grupo I: 65 que recibieron inhalaciones antes de broncoscopía y Grupo II: 39 que recibieron inhalaciones para el tratamiento de una enfermedad pulmonar.
Ninguno de los 65 que tuvieron inhalaciones antes de broncoscopia tuvieron reacción alguna a la droga. Dieciséis de los 28 carcinomas demostrados (57 por ciento) dieron citología positiva y 20 (71 por ciento) dieron citologías positivas o dudosas. No hubo falsos positivos.

Los enfermos con enfermedad pulmonar aguda tal como la atelectasia seudaria a tapones mucosos y a esputos espeso tenaz, respondieron más rápidamente y satisfactoriamente a la dornasa pancreática.

Aquéllos con enfermedad más crónica respondieron más lentamente pero notablemente bien en tanto que los que tenían enfermedad maligna o enfermedad crónica con tos seca, tales como los de bronquitis post-irradiación, respondieron menos satisfactoriamente o de modo deficiente a la droga.

Aun con inhalaciones repetidas y series reiteradas de inhalaciones sólo unos pocos tuvieron complicaciones menores.

Esta enzima parece ser especialmente útil en los recien operados de tórax y después de traumatismos con daño torácico.

**RESUME**

L'auteur a utilisé la "dornase pancréatique" sur un total de 104 malades répartis en deux groupes: le groupe I comporte 65 malades, qui reçurent des inhalations avant bronchoscopie, le groupe II 39 malades, qui reçurent des inhalations pour traiter une affection pulmonaire.

Aucun des 65 malades qui eurent des inhalations avant la bronchoscopie, n'eut la moindre réaction au produit. 16 malades parmi les 28 carcinomes reconnus (57%) donnèrent des cytologies positives, et 20 (71%) des cytologies positives ou douteuses. Il n'y eut aucune réponse positive fausse.

Les malades atteints d'affection pulmonaire aiguë telle que atélectasie secondaire à des bouchons muqueux ou à une expectoration épaissie et tenace, répondirent le plus rapidement et de la façon la plus satisfaisante à la "dornase pancréatique." Ceux atteints d'affections plus chroniques répondirent plus lentement, mais remarquablement bien, tandis que ceux atteints d'une affection maligne, d'une affection pulmonaire chronique, avec toux sèche, telle que bronchite post-radiothérapique, répondent d'une façon moins satisfaisante, ou faiblement au produit.

Même avec des inhalations répétées, et des séries répétées d'inhalations, un petit nombre seulement de malades eurent des complications secondaires.

Cet enzyme semblerait particulièrement utile dans la chirurgie thoracique post-opératoire, et pour les malades atteints de traumatismes thoraciques.

**ZUSAMMENFASSUNG**


Keiner der 65, die vor der Bronchoskopie inhaliert hatten, hatte irgend
Eine Reaktion auf das Medikament. 16 der 28 nachgewiesenen Carcinome (57%) ergaben positive cytologische Befunde und 20 (71%) ergaben positive oder zweifelhafte cytologische Befunde. Irrtümlich positive Befunde kamen nicht vor.

Kranke mit akuter pulmonaler Erkrankung so wie Atelektase infolge Schleimproff oder dickem, zähem Sputum reagieren besonders schnell und befriedigend auf Pancreas-Dornase. Diejenigen mit mehr chronischen Erkrankungen reagieren langsamer, aber bemerkenswert gut, während diejenigen mit fortgeschrittener bösartiger Erkrankung oder chronischer Lungenkrankheit mit trockenem Husten sowie bei Bronchitis nach Bestrahlung weniger befriedigend oder schlecht auf das Mittel ansprechen.


REFERENCES