EARLY PATHOLOGICAL CHANGES IN CHRONIC BRONCHITIS

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I had not seen the excellent film shown here until this morning, when my talk was prepared, and it seems that from it you have already learnt most of the pathology of chronic bronchitis. Still, I do not think that the Brompton Hospital workers should be allowed to get the feeling that they know everything about bronchitis, and so I am going to try to say a few things they did not mention.

The respiratory tract is a very important barrier against organisms, one of the most important barriers of the body. Its construction is not very simple. There are three layers of cells developing into two principal surface cells. One is the surface ciliated cell and to each of these cells there are between 250 and 300 cilia. The other cell is the goblet cell.

On top of the cilia is a layer of mucus which forms another protective barrier. The mucous sheet is moved along the surface of the cilia at a speed of about one centimetre every minute and makes its way up the trachea, trickles into the oesophagus and is swallowed; the patient is not conscious of this happening. This is a natural cleansing mechanism and it would seem not unexpected, and in many ways beneficial, that if a patient inhaled a large quantity of irritant cigarette smoke, or air polluted with sulphur dioxide or many micro-organisms, the amount of mucus would be increased.

One of the early stages, with early changes, which after all is the subject of today's symposium, is as follows:

There is an increase in the number of goblet cells. Practically the whole of a bronchus may be lined by an almost continuous layer of these cells all the way round, all apparently pouring out mucus. It is difficult for the morbid anatomist to see early changes in chronic bronchitis because most of this material is from autopsies. But we see it sometimes in premature deaths from other diseases, and from accidents, especially if the victim smoked cigarettes.

Of course, cigarette smoke is high on the list of substances thought responsible for chronic bronchitis, so let us look a little deeper into

the histological changes. In some bronchi all the cilia have disappeared and the epithelium is represented by irregular-looking cells which lie in a rather haphazard arrangement. This is squamous metaplasia of the bronchus. In the absence of cilia the mucous sheet cannot be moved over that part of the mucosa. It has been shown that if one follows the mucus travelling along a bronchus up to one of these patches of squamous metaplasia, it does not move over the patch. If the patient continues to inhale the irritant substance, it will thus tend to accumulate on the patches. Eventually more atypical changes appear and these are very serious because they may include squamous carcinoma of the bronchus.

We have not been particularly struck by the number of inflammatory cells in chronic bronchitis, but occasionally we do see some. This, as previous speakers have mentioned, is something that we associate more with asthma, and we have seen cases of asthma masquerading as cases of chronic bronchitis, and are so diagnosed clinically. In asthma there is a tendency for the epithelium to drop off, and every now and then one can see, in the sputum, strips or clumps of ciliated cells which have been cast off. This process must play a very important part in the lowered resistance to infection that many asthmatics suffer and in the tendency some have to develop chronic bronchitis.

Another thing seen more in asthma than in chronic bronchitis is thickening of submucosal muscle.

In the film shown today, hyperplasia of the bronchial glands was well described, so I do not think I need to say very much more about it. In a normal bronchus the glands are small. In severe chronic bronchitis they may reach an enormous size. Dr Restrepo and I worked out the areas of bronchial glands in sections very carefully and showed that on average the areas of the bronchial glands were increased in chronic bronchitis. The change was very widespread. The glands were enlarged throughout the length of the trachea and down the principal bronchi. Such extensive changes would be compatible with the effect of inhaled irritant substances.

There is a tremendous amount known nowadays about the pathology of chronic bronchitis, and it is only possible here to give a brief description of the sort of things we encounter at autopsy. Dilation of the distal bronchi is very common and almost like a mild bronchiectasis. There are many patients who have had severe airways obstruction for years, and died from it, but when the pathologist looks into the bronchi he finds them dilated. Obstruction is probably due to mucus accumulating in them. We have not completely explained this finding yet, but they probably dilate because of inflammatory damage and because the bronchioles are obstructed. As the patients breathe in, the air cannot get through

the bronchioles and the pressure in the supplying bronchi increases abnormally and stretches them.

One study we did was to follow in serial sections the bronchioles of patients who died but showed little or no emphysema at necropsy. In one case we found the bronchioles showed numerous small stenoses.

Dr Wootliff and I have carried out many post-mortem bronchograms on chronic bronchitics. The contrast medium enters secondary lobules near the centre. It then goes through the non-respiratory bronchioles and alveolar ducts in the rest of the lobule. If these structures are damaged by inflammatory disease then the bronchioles will be dilated, i.e. centrilobular emphysema.

In distensive centrilobular emphysema, which we see extremely commonly in routine autopsies, there is dilation of the respiratory bronchioles in the centre of the lobule.

Figure 8 is an example of destructive centrilobular emphysema. Notice that the pulmonary arteries of these little lesions are now stripped of lung tissue and run across the spaces as strands. Obviously, if these lesions occupy the centres of secondary lobules they must have a very profound effect on the function of those lobules. The pigment is inhaled soot, which very conveniently marks the lesions.

Perhaps I might make the point here that the alveolar walls in the affected areas are completely destroyed at this stage. The effect is rather like that of a forest fire. Only a few trunks (the pulmonary arteries) survive.

Another kind of emphysema is shown, i.e. panacinar emphysema, in figure 9. In this example which is severe, most of the alveolar walls have been destroyed. No surviving alveoli were found in the lung at all. You can see that it would still be possible for blood to flow through the pulmonary arteries there, but unfortunately no alveolar walls exist in which it could be oxygenated.

In paraseptal emphysema, which we described, one sees at the periphery of the secondary lobule stretched strands of damaged parenchyma. Of course, we can show various amounts of emphysema in a lot of people who have been ill for a long time and who have died of a respiratory disease. But every now and then patients die with little or no emphysema at all. I understand from Dr Simpson whose views we studied in this connection, that when he visited the United States recently he found very few workers agreeing with us on that. I expect them to agree in time, as they did over the use of the term ' chronic bronchitis '!

In summary we see in autopsies on chronic bronchitics, lesions the

whole of the way down the respiratory tract, right to the alveolar walls. What is known of the pathology of chronic bronchitis and of emphysema has certainly improved in recent years.

THE PHYSIOLOGICAL BACKGROUND—NORMAL AND DISTURBED

Dr P. A. Emerson (*Consulting physician, Westminster Hospital*)

It is my task to give you a theoretical background to the more pragmatic information that you will have from the later speakers about the various pieces of apparatus and the various ways of assessing patients with chronic bronchitis. This is a ' second M.B.' on respiratory physiology.

Definition of ' early chronic bronchitis '

The definition of chronic bronchitis is a clinical one and it seems easy enough to say, " We will pick out a number of patients who have a chronic or recurrent cough with expectoration, which cannot be attributed to some other cause ", and then to say, " You have chronic bronchitis. We will study your pulmonary function and see what we find ". The difficulty, however, is that one cannot really know whether or not these patients also have some significant degree of emphysema. By general consensus of opinion now, the degree of emphysema can only be accurately diagnosed on morphological grounds, such as you have just seen in those wonderful slides that Dr Heard has shown you. It is relatively easy to make a diagnosis in these circumstances though not of course so easy to prepare the specimens and slides.

But for the clinician it is much more difficult; if the chest x-ray shows gross evidence of emphysema, he can make an intelligent guess and say, " There is a lot of emphysema here ", and he will usually be right in these circumstances, so that such patients can usually be excluded from the studies. But if we are considering less severe emphysema it is very much more difficult. It is well recognized that even in random autopsies a significant degree of emphysema may be found in patients who have not complained of a cough, and indeed some people would almost regard this as part of a normal ageing process. So the point I want to make is that when I speak of chronic bronchitis I mean chronic bronchitis diagnosed on the basis