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# ASBESTOS IN INDUSTRY

Merle E. Gibson, M. D.
Medical Director
Inland Manufacturing Division
Dayton, Ohio



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# ASBESTOS IN INDUSTRY

My subject here today is asbestos. We are especially interested in the role of asbestos as a possible cause of cancer of the lung, that is, bronchogenic carcinoma, and the malignant pleural mesothelioma. Both the asbestos worker and the general population are involved in this problem as they are both exposed to this mineral asbestos in everyday life, in the factory and at home.

The literature is brimming with articles about asbestos, and in general seems to point an accusing finger at this mineral as a surefire cause of cancer of the lung. Today, we will take a look at this situation and try to come up with some conclusions and suggestions with regard to this interesting but possibly hazardous material.

First of all, you must understand that asbestos is everywhere. You cannot get away from it. I could spend the rest of the hour telling you of the everyday items containing asbestos. The very room you are sitting in contains asbestos. Your car, your range, your heater, your duct and vent work, carpets, floors, walls, paints, pianos, pipes, plaster, ceiling, roads, and many many others. I could go on and on. Let's just say asbestos is everywhere and it is very difficult to avoid it. How much is fixed and unable to be liberated into the atmosphere is most difficult to determine.

Now, is asbestos, the asbestos we live with, is it harmful? Is there anything to this theory that asbestos causes cancer? What about the man on the street, the insulation worker, the brake lining or clutch worker, or the wife at home simply ironing with her asbestos covered ironing board in your asbestos ladened house?

As you can imagine, there is a great deal of literature on this subject, and, as happens many times, you can find statistics that show both sides of the

problem and tend to prove opposite theories. I have sifted through most, if not all, of this literature and would like to give you what I think is important in dealing with asbestos, both at home and at work.

Asbestos is a fibrous material found in the ground in rock. It is mined in great quantities in the western hemisphere, mostly in Canada in the form of Crysotile. This material Crysotile accounts for about 94 or 95% of the world's production of asbestos, the other 5% being materials called Crocidolite and Amosite. All three are different forms of asbestos. The reason for its widespread use in industry is simply its physical properties. Asbestos is almost indestructable, it is heat resistant (hence the Latin word 'asbestos', or unburnable), it can be spun or woven, it is resistant to most chemicals, it resists decay and corrosion, it has a very high tensile strength, high adsorbent qualities, and its fibrous nature makes it ideal as a friction material.

Since it is virtually indestructable what we are doing is removing some four million tons of asbestos each year from the ground and putting it on the earth's surface and atmosphere in the form of asbestos products. The net result of course, since it's indestructable, is an accumulation of asbestos and more and more human exposure as time goes on.

Microscopically, asbestos is a great number of tiny fibrils or strands situated in a bundle or fiber. The fibers vary in length from about 200A to several millimeters. The fibers may be visible to the naked eye and, of course, visible with the light microscope. But as the diameter of the fiber decreases, even though the length of the fiber might be quite long, the fiber, now called a fibril may become invisible to even the light microscope. This, as you can see, makes accurate counting of asbestos fibers in the air very difficult because what you cannot see, you cannot count.



At General Motors, asbestos is used in several divisions in varying quantities. At Inland Manufacturing, it is used to make brake lining. It is brought in

in plastic 100 lb. bags and is then "fluffed" because of its tendency to pack down during shipping. From the fluffer, it is brought to the mixing area where resins, lead, cardilite, and other materials are added. The lead is another story altogether. It is then almost a semisolid and is put in metal drums. Next, the mixture is sent to the presses where the actual lining is made. After pressing it is ground, cut, and then baked, and finally sent to inspection as the final product. Brake lining at Inland for General Motors cars requires that about 34 tons of raw fluffy asbestos be used daily. (34 tons a day) The operation has been in production for some years and, at present, some 300 employes are exposed to asbestos fibers varying from 2 to 6 million particles per cubic foot of air. No face masks are worn.

Now, let's look at what happens when you breathe in asbestos fibers. The fibers, when in the air such as in the vicinity of the presses, tend to drift toward the floor at different rates of speed. The smaller fibrils may even stay airborne and actually float for a long time or be swept away by air currents. The particles enter the respiratory system, hopefully through the nose, and may follow the air currents downward. Most are trapped by the nasal mucous membrane; some by the throat, but many may enter the main stem bronchus and lower respiratory tract.

Here, the majority of fibers are removed by the mucociliary sweeping system or mucociliary escalator, which by and large is quite an effective process (which you will remember from your medical school days) except in heavy smokers. The chronic bronchitis of heavy smoking completely "bogs" down the whole process. Down in the terminal bronchiole, just before the alveoli are reached the body has no effective sweeping system because the pseudostratified ciliated columnar epithelium which did such a good job in the more proximal air passages now become a single layer of cuboidal cells and is ineffective in sweeping up fibrous debris. The job of removing the asbestos fiber now becomes the responsibility of large migratory scavenger cells to engulf the fiber and destroy it or take it to

the lymphatic system for disposal. These scavenger cells are called macrophages. It is here in the terminal bronchiole that the medical phenomenon the asbestos body is formed, apparently a reaction of the asbestos fiber and the macrophages to form a curious dumbbell-shaped, iron-staining structure. This is the cell found in the sputum of patients suspected of having asbestosis. It is known now, however, that one need not have asbestosis to have asbestos bodies in the lung. The asbestos body is found in a very high percentage of asbestos workers who do not have asbestosis and, also, up to 50% of normal people in ordinary life. In other words, the asbestos body can be found in healthy people and is not diagnostic of disease.

As you know when the patient is in persistant contact with high concentrations of asbestos, a type of fibrosis can occur causing decreased tidal volume and a decrease in the elasticity of the pulmonary structure. We give this the name asbestosis. I won't go into this condition here. We are all aware of asbestosis in asbestos workers.

For many years there has been recognition of the fact that people with asbestosis, in addition to their fibrosis, have a greater chance of acquiring cancer of the lung. This has been well documented by investigators. The logical conclusion in the prevention of cancer, therefore, was simply do not allow the asbestos worker to be so exposed as to cause asbestosis (fibrosis) and the chance for cancer will be virtually eliminated. The chest X-ray was thought to be the answer. Certainly, fibrosis can be seen radiologically and clinical asbestosis is easily diagnosed. Most asbestos plants began taking chest films every six months to a year. This plan has worked in the prevention of asbestosis because very early signs of fibrosis can be seen radiologically and the employe removed from asbestos. This not only theoretically prevented asbestosis but eliminated the potential of cancer of the lung.

As it turned out, the incidence of asbestosis has been greatly reduced partly because of early X-ray detection and because of reduced concentrations of asbestos at the job site over the years. However, it soon became apparent that lung cancer in employes exposed to asbestos continued to rise in spite of fewer asbestosis cases. This showed simply that one need not go through the stage of asbestosis and pulmonary fibrosis to acquire lung cancer from asbestos exposure. This prompted a whole new look at the hazards of asbestos inhalation. This is why I am speaking today.

Now, some conflicting statistics --
Cancer of the lung occurs eventually in 40% of those patients having prior asbestosis.

A slightly different study by Buchanon in 1965 showed that over 50% of males dying with asbestosis in England also had a lung tumor.

It was found in London Hospital that the malignant pleural tumor mesothelioma occurs in .3% of the normal population but in asbestosis, rises to 37%.

O'Donnell reported in 1965 that in 55 asbestos textile workers who had pathologically proved asbestosis, 28 had malignant neoplasms - 23 bronchogenic carcinoma - and 5 malignant mesothelioma.

For the year 1947 in Great Britain, it was established that 13% of those having asbestosis also acquired lung cancer as compared to 2-6% for the general population.

There are many other studies of this nature. I have tried to develop for you the fact that people having had asbestosis run a much higher risk of acquiring lung cancer. So be it.

Now let's take the asbestos worker not necessarily having asbestosis and see if we can determine his chances of acquiring lung cancer.

A study on New York insulation workers by Sielikoff in 1964 showed that they have lung cancer 6 to 7 times the expected rate. These men were considered

to have light intermittent exposure to asbestos.

Doll, in 1955, found the incidence of lung cancer in persons with long and continued heavy exposure to asbestos to be about 10 times the expected rate.

In a study of 371 men working in asbestos for 52 months, starting January 1963, it was found that 94 men died during that time, the expected number being less than half that amount.

Doctor Sielikoff's study showed that if the asbestos worker smoked cigarettes then the chances of dying of lung cancer are 90 times as great as the average man.

Nordman went even further by stating that carcinoma of the lung is an "occupational disease" among people engaged in asbestos work.

Dr. Cordova in his study states, "the longer the exposure to asbestos, the greater the risk of developing a malignant tumor; and the younger the individual when first exposed to asbestos dust, the earlier is the development of pulmonary carcinoma". Dr. Cordova mentioned exposure time from 12 months to 27 years.

Dr. Cordova also concluded that, "in the case of asbestos, there appears to be sufficient clinical pathological evidence to make it probable that it is a carcinogenic agent".

Now let's discuss asbestos as it relates to the man on the street. Dr. John J. Hanlon of the Department of Health, Education and Welfare stated in December of 1968 that, "asbestos fiber danger is not limited to those who work with asbestos". He mentioned autopsy studies at Mount Sinai Hospital in New York in which 80% of 70 shipyard workers had considerable amounts of asbestos fibers in their lungs. None of these men were asbestos workers.

Random autopsy studies from people of all walks of life (1,000 autopsies) Dr. Hanlon reports, showed 50% of the people had asbestos in their lungs. This has been backed up by other studies. It means that one-half of you

have asbestos fibers in your lungs, either as fibers or asbestos bodies. It was Dr. Cordova, in the preceding study, who suggested that "the asbestos body may very well be the carcinogen in the production of cancer of the lung".

Dr. J. G. Thompson's study at the University of Cape Town showed from 500 autopsies that one out of every four had asbestos bodies in their lungs. These were the ordinary non-asbestos workers, the urban dweller. At that time, Dr. Thompson pointed out there has been a tremendous increase in asbestos fibers in the world in the last twenty years (4 million tons each year). He also suggested that the air of city streets was a likely source of asbestos exposure and that the average automobile might be a major cause of the liberation of asbestos dust (brake linings and clutch facings). He pointed out that the half-life of the element Strontium 90 is eighteen years and that the half life of asbestos is an infinity of years and concluded that because of the continuous disintegration of asbestos products, such as brake linings, roofing material, and demolition of buildings, asbestos was constantly finding its way into the atmosphere as an "everlasting contaminant". Dr. Thompson predicted that in future decades in urban areas, "asbestos induced cancer would very well rival other known causes of cancer".

This is pretty rough stuff! If qualified investigators such as these are going to discuss asbestos-cancer relationships in terms of concentration on the street, how can we answer when asked about our worker exposed to 5 million parts per cubic foot of air all day long. One might answer the question by saying obviously, asbestos has got to go. On the surface it may seem ridiculous to talk about industrial exposure when we're worried about the man on the street at such diluted concentrations.

What have we shown so far? Well, it looks likely that asbestos induced fibrosis (or asbestosis) can and does cause lung cancer.

It looks as though asbestos workers have a greater chance of acquiring lung cancer than the normal population.

It could be that the man on the street is affected carcinogenically by asbestos but we have by no means proven this last point.

Some very recent work has been done to show that the dose of asbestos exposure is extremely important in determining one's chances of acquiring lung cancer. This leads us to the hope that the carcinogenic properties are, in fact, dose related and by lowering the concentration of asbestos we may prevent cancer of the lung. Perhaps things aren't so bad, after all.

Studies done on employes of asbestos mines in Canada show that before 1930, when tremendous doses of asbestos were in the environment of the worker, the amount of asbestosis and cancer far outnumbered the normal expectancy. Now, since that time, in combination with proper ventilation and worker protection the asbestosis and cancer rates are equal to the normal population. Now was this just a stroke of luck? Or did lowering the concentration actually reduce cancer?

Brake linings were the subject of the U. S. Public Health Service Report. Dr. J. Lynch reported that asbestos that might come from brake lining wear was an inconsequential health factor in urban air pollution because of dilution.

Drs. Enterline and Kendrick concluded that the amount of asbestos to which people in general may be exposed outside of industry is of little importance because of the dilution factor.

Even though these authors differ dramatically from the previous studies condemming asbestos, it brings up the idea that dilutions and concentrations may very well be critical in cancer control.