Observations on the Influence of Occupation on the Health of the Coal Miners

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This short essay is not put forward with any claim to being a full account of all the complaints incidental to the occupation of a coal miner, but as a collection of observations made by a busy general practitioner, the greater portion of whose work is amongst colliers, and one whom in the general routine of his daily work is unable to find much time to look into the literature on the subject, but has had opportunities of observation on over 6000 coal miners of all ages; I have endeavoured in this treatise to set down the results of my own personal observations.

Living, as I have stated in the centre of a large colliery district, and the great majority of my practice being among coal miners, I thought that an enquiry into the
influence of their work and surroundings upon their health would be of interest.

Accordingly, I took particular note of all disease in miners which could in any way be attributed to their calling; I shall remark upon those diseases to which I have found coal-miners, as a body, subject.

Not that colliers are a delicate set of men; far from it; but that the conditions under which they work, I live eventually bring about changes in their bodies, which render them liable to certain diseases.

Very many improvements, however, have taken place of late years, rendering the conditions under which the collier works more conducive to the preservation of his health.

Some of these improvements have removed the causes of diseases which were more common two or three decades ago, than at the present day.

The employment in the pit of children of tender years (of both sexes) has been entirely dispensed with, and so deficiences from cramped positions or overtaxed strength
and rickety conditions, due to the absence from sunlight are rarely seen now, although many of the older men bear on their bodies, evidences of these.

Many of the old men and old women remember being taken down the pit by their fathers at the age of seven or made to draw baskets full of coal (which used to do duty for the present trucks) by means of a chain which passed between their legs and fastened round their waists, and kept the long day through at work under most unhealthy conditions.

Ventilation of the Colliery workings has vastly improved, as have also the hours of work, although we have not yet reached the much desired eight hours day for miners.

Before remarking on the health of the colliers the it would perhaps be all better if I described his ordinary working day.

Many of the large pits are at work night and day; so many of the men are employed on what is known as the night shift; i.e., working from about 8 o'clock at night until
six in the morning, for the purpose of illustration it is better to describe the ordinary day shift.

The collier has to rise early as the day shift men usually descend about 5 or 6 a.m. and often there is a walk of a mile or two from the house to the pit mouth; this is by no means a bad thing as it compels a little exercise in the fresh air every day.

Before leaving home a hasty breakfast of stewed tea, which has generally been standing in the teapot on the hob overnight, thick bread & butter, is taken.

Porridge is rarely seen now in a colliers house although that & jamnock which was a bread made chiefly of bran, used to be the chief articles of diet of the colliers of last generation.

After reaching the bottom of the pit some of the men may have a mile or even two to travel underground to reach the particular part in which they are working.

The height of the workings vary greatly, being in some places high enough for a
man to stand upright, while in others the height will only be about 20 inches, then the man has to walk all day long lying on his side in very little air space.

Some of these places are very dusty, the dust consisting of finely divided particles of coal. In others the coal does not make so much dust and it is well kept down by ventilation.

The temperature varies greatly, the majority of places being very hot and so the men walk clad only in their trousers and clogs, and as it is a very difficult matter to ventilate these warm places without causing a draught of cold air, so the collier becomes subject to colds and often Pleurisy and Pneumonia.

Meals are taken down the pit close to their work, their chief food being bread, cold meat and cheese with most frequently cold tea to drink.

The shift usually returns to the surface at about 5 p.m., having been about 12 hours underground.

Such is a brief sketch of the collier’s day.
and I thought that it would be an interesting subject for enquiring whether the health of a body of men working under such conditions as these, was affected thereby & if so in what manner.

There is a condition which is very evident whenever one sees a collier, and that is his Anaemic appearance.

You never see a ruddy collier no matter how well washed he is, and even if he has been off work for a week.

Ruddy boys leaving school and going down the pit soon lose their colour, and now and again you will meet with a condition almost like Chlorosis.

There are no murmurs heard over the cardiac region or no fruit de diable.

I have examined the blood of a considerable number of colliers & carefully estimated the percentage of Haemoglobin & in all of the cases I have examined there has been a diminution in the percentage of the Haemoglobin.

The best I have seen after a week of hard work only reached 87%.
The lowest I have found for the men appeared to be in good health and in no way inconvenience by it was 62%.

With regard to any alteration in the shape of the corpuscles, I may say that in all the cases I have examined I could discover no departure from normal.

The colours, however, of the red corpuscles of these men, when compared with blood corpuscles from an individual whose percentage of haemoglobin was normal; was found to be much paler in the colliers.

The number of the corpuscles did not seem to be affected in any way, at any time, for on counting the red corpuscles with a Janssen's Haemocytometer I found them in every case above 5,000,000 per cubic millimetre.

I found little or no variation in numbers in the same individual after a hard day's work or after a weekend rest.

This Anaemia of the colliers cannot, then, be from a deficiency of the corpuscles themselves but it appears to be rather from a deficiency of their colouring matter, it is what has been called an Oxychloroanaemia; and
that this colouring matter is not the Haemoglobin proper seems to be pointed out by the fact that with this Anaemia colliers suffer from no breathlessness on exertion or have no other symptoms of a deficiency of Haemoglobin.

If a miner has been off work for a few days or weeks, the percentage of Haemoglobin, as estimated with the Haemoglobinometer, gradually works up towards normal showing that the influences causing the condition have been removed.

The Anaemia then, is not a serious one. The direct cause is a matter of some difficulty to find out, but probably the absence from daylight is the main factor, this being supplemented by the breathing of a certain amount of Carbonic and other gases which are present in the air of the mine in a greater extent than in the air at the surface.

The quantity of the Carbonic Acid gas inhaled during a day's work not being in itself great enough to produce injurious effects, but the breathing of a mixture of several gases of a necessity lessens the quantity of Oxygen inspired also causing a slight deficiency of Oxygen supplied to the blood, possibly...
the Suppliemented Hydrogen inhaled has some destructive action on the fermentous constituents of the Haemoglobin.

Whatever the cause, the interesting fact remains, that there is a considerable amount of Anaemia which does not in any way seem to interfere with the bodily nourishment or health of the Coal Miners.

Effects on the Respiratory System.

The chief disease, if it may so be called, that coal miners as a body suffer from is a condition known as Collier's Lung.

This is a condition general to all colliers and it is dependent on the amount of coal dust inspired.

The air in which the collier spends his working day is impregnated with fine particles of coal, the amount of which varies greatly with the kind of coal and the efficiency of ventilation. The men themselves speak of "dusty pits" and "clean pits."

This dust is drawn into the respiratory passages - the lung - and gives rise to a
condition in the lung known as Anthracosis.

If the lung of a miner is examined it is found to be quite black, much heavier than normal. The black appearance being due to the small particles of coal absorbed by the lymphatics in their course along the interlobular septa and pleura can be well traced in the lungs of young collieries.

Often the pleura is adherent to the chest wall, but whether this is from localised pleurisy from irritation of the carbon particles, or from pleurisy from cold, or injury, it is difficult to say, for the colliers is very susceptible to Pleurisy after any trauma to the Thorax (in my experience) much more so than any other body of workmen. This fact may be due to the particles of coal dust irritating the injured area.

All the interlobular septa are very much thickened by an amount of fibrous matter which interferes with the expansion of the lung, and this becomes very evident in colliers who have worked down the pit for some years.

This thickening of the septum has a great
influence on the chest measurement during inspiration & expiration as also on the vital capacity.

I have examined the chests of colliers who have worked down the pit from a period of a few months up to 66 years and I have found that in men who have worked in the pit for 10 years and upwards, that the measurement of the chest in inspiration & expiration is greatly diminished, for example, the average difference in the circumference of the chest during inspiration & expiration in colliers who had worked 50 years & upwards in the pit, I found to be only to the extent of ½ inch.

In one case which died of Phthisis about 18 months after examination, I could hardly distinguish any appreciable difference of movement between inspiration & expiration. This man had worked 49 years in the coal pit.

In those who had worked upwards of 30 years in the pit, including those who had worked 50 years & upwards, the movement was slightly under an inch. But of those
Who had worked 50 years or upwards, were not included, the movement was about 1½ inches.

Not only is the movement diminished, but the amount of air inspired is affected; for measuring with a spirometer the average of those who had worked 50 years or upwards was 120 cubic, and the average of those who had worked 30 years or under 50 years was 160 cubic.

Figures such as the above illustrate clearly the deficiency of expansion in an anthracosed lung. The spirometer I took especially carefully checking each off with trials at several different times, so what is most striking is the good vital capacity of the men between 30 and 50 years of work, in proportion to the smallness of expansion.

The trachea and bronchi do not show any traces of pigmentation although in the majority of cases there is a well-marked catarhal condition.

The secretes of the respiratory passages from pigmentation can be accounted for by the action of the cilia of the mucus membrane lining the lungs, any particle of coal dust being
deposited on them is moved by the cilia back towards the Pharynx, whereas those reaching the lungs are seized by the amoeboïd capsules or carried or deposited in the lymphatics.

The subbronchial glands are pigmented and become quite harden, but if there is accompanying Phthisis, they may be found caseous. The tonsils are never pigmented, and this is a difficult matter to explain, as all the dust breathed has to pass over them and these are abundant amoeboïd cells in their crypts, and it is an extremely rare thing to meet with enlaid glands in the neck, negating the idea that the pigment might have been carried there by the amoeboïd cells, along the lymphatics from the tonsils.

In cases where there is only the fibroid thickening of the lung without any other complication, i.e., where there is Coal Miner's lung not accompanied by Bronchitis or Phthisis, very little can be noticed on inspection besides the limitation of movement and perhaps some retraction of the Apices. On percussion a dull note is found and
Colliery patches of well marked dulness can be found which are probably the areas of old pleurisy.

The breathing is rough, vesicular with prolongation of the expiratory sound, and this is more and more marked according to the stage of anthracosis.

This type of breathing is usually well marked all over the chest, but I have found it especially well marked in many cases along the lines of division of the different lobes of the lungs. The pigmentation not always being equally scattered may have something to do with this phenomenon.

Vocal tremulus is better marked all over the chest than in an ordinary individual.

The sputum, which is copious, owing to the cataract caused in the Trachea & Bronchi by the irritating particles of coal dust; is black and is mucous laden with minute particles of coal.

With regard to the condition known as Coal Miners Phthisis, this is in reality, as far as my personal experience goes, either Anthracosis plus Phthisis or Anthracosis plus Bronchitis + concurrent Bronchiectasis.
I have never found cavity formation without one of these two conditions being present, in fact very rarely without a true Tubercular infection having supervened.

Some authorities consider that large excavations may occur without the presence of Tubercle bacilli. It is quite possible that such excavations may occur but in nearly every case where I have been satisfied that there is a cavity formation I have been able to demonstrate the presence of Tubercle bacilli in the sputum, staining by the ordinary methods.

In these phthisical cases the clinical symptoms are those of pure phthisis, there are however few night sweats and as a rule little haemoptysis, this latter fact being in all probability due to the fibroid thicken up occluding the vessels before the part begins to break down.

Haemoptysis is more plentiful when phthisis occurs in the younger men who have not worked long in the pit, I have seen elderly colliers, who have worked 40 years in the coal pit, have extensive cavity formation and die of Phthisis without
coughing up a single speck of blood.

The sputum comes up in large quantities,
and often looks just like coal and the
Tubercle bacilli can be demonstrated in it.
By the usual methods of staining, there are
plenty of nucleus corpuscles laden with coal
dust or lung tissue in abundance.

Except in cases where there has been a
family History of Phthisis, the disease is
by no means rapid, as a rule it runs a
very chronic course.

There is no period of life free from others
from this Tubercular process, I have had it occurring at all ages between 20 and
70 years.

The prognosis in elderly men is always
gloomy but in younger colliers the disease
is amenable to treatment in about a
similar proportion to other men.

Many of the cases which are claimed under
the head of Coal Miners Phthisis are in
reality not Phthisis at all, but Bronchitis
and Emphysema.

There are two causes of Bronchitis in colliers

Firstly, working stripped and being exposed to draughts of fresh air for ventilation, and also great changes of temperature.

Secondly, from the inhalation of particles of coal which irritate the bronchi.

In all colliers, there is a greater or a lesser amount of Bronchial Catarrh, and this very easily passes on to Bronchitis, this, when acute causes Bronchiectasis and Emphysema; and it is this condition that has been called (or wrongly so) Coal Miners Phthisis.

The sputum is exceedingly copious, being usually laden with coal dust, sometimes having the appearance of ink. There are no Tubercular bacilli or no elastic tissue present.

The lung becomes emphysematous, round the edges, owing to the forced respiratory efforts on a patient weakened by the inhalation of coal dust, the bronchi become dilated; on physical examination are often mistaken for cavities due to the breaking down of the lung, and so there are some who believe that there is a condition including a breaking down of lung tissue in a coal miner, which
is not a Tubercular process. Personally I have never been satisfied about the formation of a cavity + not found Tubercle bacilli present in the sputum. The tendency of the carbon is to form fibroid thickening and not disintegration of the lung.

Euphysema when it occurs, is in the usual sites round the borders and it is a very common thing for the lung to be in a condition of extreme fibrous thickening, with the borders euphysematous due to the strain of the respiratory effort on a part of the lung that is weak + has not much fibrous tissue to support it.

In some cases the physical signs of Euphysema can be found where there is no Bronchitis and in otherwise healthy middle aged miners, and the only explanation I can offer of cases like these is that there has been a long strain on the lungs by some heavy work being attempted with the glottis closed, then when an inspiration is made the strained lung is subjected to a pressure greater than the ordinary pressure of the atmosphere.
for the Barometric pressure down a mine increases, roughly about 1 inch for every 1000 feet and as some of the cases mentioned work at a depth of over 600 yards below the surface, there must of necessity be a pressure considerably above the normal atmospheric pressure on the delicate structures of the alveolar septa of the lung.

This emphysema is in many cases the cause of the smallness in difference of measurement of the chest during inspiration and expiration in many old standing cases the lung being kept in the position of inspiration.

Pneumonia is a frequently occurring disease amongst coal miners.

The many changes of temperature and the various draughts to which they are exposed along with the inhalation of irritating particles make them very liable to this disease.

The chief point of interest is the acute pleurisy which usually accompanies it, due no doubt to the irritating particles of coal
in the thickened fibrous septa rubbing against
an inflamed pleura.

Pneumonic often occurs after a severe trauma-
ction in the region of the Thorax, and it
is by no means uncommon for Pneumonia
to supersede after the man has been a few
days in bed. This latter fact seems to me to
be much more frequent after injuries to the
chest in colliers than after injuries to the
chest in workmen engaged in any other occup-
ation.

In all cases of Pneumonia following a trauma-
ction I have found the diplococcus present
in the sputum in large numbers, looking as
if the organism acting on the extravasated
blood lying in the lung, was the cause
of the disease.

A pneumonia of this kind is very fatal
although for the first few days after the
accident the patient seems to be doing
well.

In conditions where there is much fibroid
thickening a Bronchitis or Emphysema there
soon comes to be interference with the
pulmonary circulation and in many of the older men there is a distended right side of the heart with its accompanying murmurs.

And in several cases of this kind I have heard a reduplication of the second sound of the heart as though the distended right ventricle were taking longer to expel its blood than the left.

In three of these instances I have met with what seemed to be a reduplication of the first sound.

Although one finds a fair proportion of damaged hearts, they cannot all be put down to laborious occupation for a good number of these cases can give a history of pneumonic fever, and as some occur in young men and lads who have not worked long in the pit and are in all probability congenital murmurs.

Anneurism in my experience is uncommon as I have never come across a case in a collier although I have attended many cases of severe strains and injuries which one would have expected Anneurism to
To follow, and I think that as a rule something of the nature of syphilis is required to weaken the vessel wall first, and as that disease is not much in evidence in this district, so the bloodvessels of our injured miners are not prone to form aneurisms.

Anyone who has had much to do with collieries will soon notice them complaining of vague pains in the abdomen or give the history of an old sprain or injury. Often these pains are most puzzling but the majority of them I think are the remains of a small localized peritonitis due to some old injury and that the adhesion being dragged upon causes the pain to be felt.

From the hazardous nature of their occupation, one would expect to find numerous nervous complaints in miners, yet occasionally one does come across nervous cases. How a man, strong looking men will come in quite a hemasthenic condition, thoroughly unrested and suffering from nervous tensions. Usually these cases have been working
in an atmosphere containing a high percentage of Carbonic Acid gas, and this was well shown. It was the case in the men working in one of the pits near base, which was on fire for about two years.

Men who were working to extinguish this fire were often brought up insensible from the inhalation of Carbonic Acid gas, and as I was often called in to attend these men, I soon noticed that in those cases that had been made insensible a few times in this manner, a narcotic condition would follow.

Other men seem to be affected by the general nervous strain of a collier's work, and especially so in men who have been buried alive or rescued, the nervous system will be completely unstrung, and for days the man is expecting the accident to happen again.

Cases of disease of the Spinal cord sometimes occur as the sequelae of injuries over the Spinal Column.

One man who has had three very severe
injuries to the back has developed symptoms of locomotor ataxia.

With regard to cases of myasthenus which has been supposed to be an affection to which collieries are particularly subject, I have seen three cases in coal miners, and I have also had three cases in persons in this district who are not coal miners; so one cannot conclude that it is a disease of miners of the present day.

Two of these cases of myasthenus occurred in miners who had got into the hemostic condition before mentioned, & the early yielded to treatment, the other case was chronic.

Myasthenus used to be much more common and is still common in pits where the old Daisy lamp is used.

This lamp used to give a very much smaller light and the various slights, being able to get to it also made that light very flickering, and the men used to hold the lamps below the level of
the eyes, looking over it at any object; which object appeared to move with the flickering flame; and it is this continuous movement of the eye which brings on the hypertrophy! And as the lamps mostly in use now have a lens round them and the flame is larger and steadier, so hypertrophy, at least in this district is getting an uncommon disease among coal miners.

Other eye complaints are chiefly due to injury from particles of coal flying into the eye.

The commonest is Corneal Ulcer following wounds of the cornea from pieces of coal embedding themselves in it.

The daily change from the darkness of the pits to broad daylight has very little effect on the sight, the eye accustomed itself in a few seconds.

Poisoning by gases especially Carbon Monoxide, Carbonic Acid Gas, and Marsh gas is by no means infrequent and as these are so well known I will not discuss their
effects; but there is a poisonous gas which occurs in the pit after the use of some explosives used by coal miners.

The gas is Dimtho-Benjo and it is a product of the combustion of an explosive known as Flobenite which is largely used by the miners on account of it being able to light for its explosion.

The explosive itself is packed in airtight cases and so does not have any effect on the miners until it is exploded.

That the substance itself is poisonous the following case will show (quoted from the British Medical Journal 11th April 1891 by W.H. Grygein M.R.C.S. (Flobenite having been sprinkled on the floor of the bed room to kill cockroaches).

T.G aged 16 years, complained blue black in hue to his very finger nails, tongue lips and mouth nearly black. Body and face livid. Temperature subnormal. He was shaky and cold. There was dyspnoea, respiration being hurried and laboured, Pulse 135 very weak, great depression.

It is however in the exploded or partially exploded state that I have had experience of it as a poison, and the symptoms
and the appearance of the patient are very characteristic.

In acute cases insensibility soon supervenes on inhaling the fumes, but consciousness soon returns on removal to the fresh air.

There is an intense cyanotic appearance all over the body and this is especially well-marked about the lips and fingers.

The bloodvessels of the conjunctiva are very injected and there is intense headache and giddiness and the mind is apt to wander.

In some cases there is pain over the region of the stomach and persistent vomiting and diarrhoea, both the vomited matter and the faeces smelling abominably. The tongue has a moist yellowish shine on it.

The heart’s action is increased and there is a feeling of suffocation.

There are tingling and burning sensations in variable parts of the body, often inco-ordination of muscular action, patches of hypoaesthesia.

The urine passed is very dark coloured.
having a smoky appearance and sometimes a peculiar purple colour.

I have never found any evidence of blood in it either by the microscope or Tincture of Prussic acid or azoric salt. Although in all probability this colouration of the urine is due to some breaking down of the haemoglobin.

Under treatment and after the lapse of a few days this condition improves, and instead of the cyanotic condition one finds a dusky greyish-purplish colour of the skin, drowsiness and lassitude and breathlessness on exertion, and if the blood is tested with the haemoglobinometer the haemoglobin registers very little more than 50 per cent.

The urine continues smoky for some days, and occasionally there is a slight diarrhoea.

In a case in which a friend of mine held a post mortem examination, there was a cyanotic appearance of the body.

On opening the skull the meninges were congested and on the surface of the brain were numerous punctiform ecchymoses. The lungs were highly pigmented from
The carbon particles and in the upper lobes the bloodvessels were considerably congested.

The heart had both ventricles full of very dark venous looking blood.

It has been contended that many of these cases are from poisoning by Carbonic oxide, but I have had cases of Carbonic oxide poisoning and I think it will easily be seen that these cases present quite a different clinical picture.

The cause of the coloration and also the breaking down of the blood corpuscles (which I have found diminished with the Haemocytometer) is most difficult to determine, it must be from some combination between the dinitrobenzol and the haemoglobin of the corpuscle.

There are few other causes at work influencing the health of the coal miners than those I have given a short sketch of.

Accident which are so very frequent I do not consider come within the province of this essay.
The coal mines always bear about with him, the marks of his occupation for many of them are literally tattooed all over their bodies. With little blue scars from cuts by coal and the coal dust taken into the tissues and lymphatics. The lot of the collier is not a particularly happy one, but science and wise legislation are gradually making his work safer and healthier and probably in years to come the number of the complaints he is subject to on account of his occupation will be considerably reduced.