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INDUSTRIAL DISEASES IN CONNECTION WITH THE MANUFACTURE

OF SODIUM AND POTASSIUM BICHROMATES.

By J. M. Buchanan, M.B.C.M.

Several writers have referred in the past to the Industrial Diseases connected with the manufacture of the above compounds and have referred to diseases which are not met with at present.

The manufacture of the above compounds is not quite similar in process now, but is equally active in attacking the septum of the nostril and abrasions of the skin.

I can quite imagine from my own experience on examining the men that some workers in the past have suffered severely from the diseases connected with this trade.

At present even under strict laws, workers are occasionally observed on examination with four chrome-holes on their hands, and who look upon them with indifference. They will not voluntarily go to have them dressed by Surgeon or attendant. I am afraid there is in this trade like in many others a contempt or indifference regarding any bad effects which may develop from the work.

The manufacture of these compounds is carried on in large sheds, covered with tiles and open freely to the wind which carries the light chrome dust in all directions.

The part in which the purified material is worked contains most chrome particles and there the effects of the dust are most apparent.

The dust in the air is minimised to a great extent by the use of/

of dust extractors above the most dusty and dangerous part of the process.

The law has recognised two (2) sets of workmen who suffer most from the Industrial Diseases connected with this trade viz:-

1. Chromemen.

2. Furnacemen.

"Chrome Men" are the chief sufferers from perforation of septum of nose, and chrome-holes.

Furnacemen suffer from perforation of septum and very rarely from chrome-holes.

I will therefore deal with the chromemen first regarding perforation of septum, as it is common to the two classes and can be better compared.

The septum of the nose is triangular in shape and is connected with the ethmoid behind, vomer below and nasal cartilage in front. The nerve supply comes chiefly from the 5th also a branch from the Vidian. ^{nerve} The blood supply is for the most part obtained from a branch of the superior coronary. ^{artery} The septum is seldom perfectly straight, its centre generally bending to one side or another, but most frequently to the left.

A man who is at work in the chrome-house for the first time may feel that he is suffering from cold in the head to a greater or less degree. Others feel an irritation in the nostril which causes them to sneeze more or less. This coryza is not general, as/

as some of the workers do not complain of nasal irritation.

In conjunction with this irritability of nose there is noticed within a few hours a milkiness of a small part of septum situated about $\frac{1}{4}$ " from the lower border and fully $\frac{1}{4}$ " (one quarter inch) from anterior margin. This milkiness shortly gives place to dryness with a slight coating of dust.

About the third ^{day} the septum may be distinctly ulcerated but generally it is not markedly ulcerated before the 5th day. From this time onwards, this part of the septum gradually becomes deeper and deeper ulcerated, being coated over with a yellowish pus, but the part where the milkiness first showed itself appears to be most deeply ulcerated. The ulcerative process extends upwards and backwards. Eventually there is a small part of septum. - the part of septum first affected - (about $\frac{1}{3}$ ") destroyed, remaining as a dark slough for a few days till its separation is completed. The perforation takes place from three weeks till six or nine months. I have observed several septums ^a which were perforated before the end of third week. The usual time is from three to six months, and in a few workers it is a little later.

I have not observed any worker in the chrome department with a complete septum after nine months.

The slough may vary a little in size.

After perforation the edges appear to be eaten away more in a backward and upward direction and less gradual ^b on the anterior edge.

The parts of septum attacked, in one normally placed, are identically opposite/

Milkiness after a few hours



opposite, hence the ulcerative processes go on equally from both sides.

The edge of perforation has a slight crust on it when nature is showing signs of healing, or, rather, when the blood supply to the part is sufficient to check any further ulcerative progress.

Section from before
backwards of Septum
other hand.

The septums which are abnormally situated having deviated from the middle line are attacked in a different way. In these septums one side may be freely attacked showing marked ulcerated action whereas on the other side the septum remains normal.

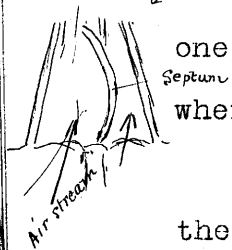
The side into which most ^{air} enters shows active ulceration and the other side little or none. This fact indicates that the air inhaled by the man has an irritating effect upon the septum, and also that the nostril which inhales most air suffers more freely from its corrosive influence.

If a septum be much deviated from the middle line the nostril which is contracted may remain normal till the ulcerative process from the other side makes its way through.

The whole of the septum is never destroyed, as sufficient is always left to support the nose in its normal shape.

I have never seen nor heard of a case of deformity of the nose arising from this perforation.

There is evidently a controlling influence to the progress of perforation not inherent in all parts of the cartilage. This influence, I believe is the increased blood supply towards its edge posteriorly and/



and in front because the air inhaled does not impinge upon it, at its anterior part.

During the ulceration and perforation of septums some men complain of a soreness of nostrils, others pay no attention and a few never know that the process is progressing. Indeed some men have informed me that their septums were normal and were surprised to be informed after examination that perforation had occurred. The perforation has never caused any worker such pain ^{as} which necessitated him to be absent from work or to seek advice.

Furnacemen are those who burn chrome ore and therefore do not inhale chrome dust in its most active condition. The septums of these men are also attacked, but generally at a much later date.

Dust is early noticed on the moist mucous membrane over a slightly larger area than on the septums of chrome men, for some weeks before ulceration is apparent. The ulceration may be continued till the sixth month or a year before perforation takes place.

Some of the men in this department have sufficiently active septums to resist the corroding influence of the dust, but in others I have noticed marked ulceration in ten days. There are about 10 p.c. of these furnacemen whose septums are normal. Undoubtedly some septums are more readily ulcerated than others. Even in this department occasionally a septum is perforated within three/

three months.

On some septums I have observed for weeks an inflamed ulcer as if nature was pushing forward an increased blood supply in order to resist the corrosion.

There have been several theories promulgated regarding the cause of this perforation.

Dr Legge in the Treatise on Dangerous Trades, page 432, writes "the limitation of the perforation of the septum is accounted for by the fact that the mucous membrane covering it is adherent forming the perichondrium and is far less vascular than the mucous membrane lining the nasal fossae. Once the nasal membrane is destroyed the blood supply to the cartilage is cut off and necrosis ensues. The ulceration having progressed upwards as far as the junction with the ethmoid, and backwards to the vomer, becomes arrested. Healing then takes place, the bone not being attacked, and the cicatrix usually becomes covered with ecthymatous crust of mucus"

This theory is partly correct in so far as the chrome dust in inhaled air attacks the weakest ^{part} of septum. This however to my mind does not explain the fact that it is at a particular spot or say the weakest part of a septum normally placed, which receives continuously, till perforation is developed, the brunt of the corrosive effect of the dust.

The mucous membrane on alae of nostrils never becomes inflamed.
When/

When air is inhaled through the nostrils the stream of air is contracted as it enters and strikes upon the septum before it passes onwards.

The momentum of force of the inhalation, and the focussing of stream of "Chrome Air" are shown on ^oseptum normally placed at a spot about $\frac{1}{4}$ " from the anterior and lower border on both sides of septum.

The air exhaled from an animal in a frosty morning is seen to diverge outwards; it is natural therefore to infer that the incoming stream converges, and plays on that part of septum which appears to receive the concentrated and continuous effect of the chrome dust.

If we observe the effect upon septums which are deviated from the middle line, there will be found marked and increased action upon a septum lining the open nostril, whereas in the contracted nostril the stream of chrome air passes more directly onwards and plays more upon the ala than on septum, hence there is no evidence of milkiness or ulceration on the side of septum in the contracted nostril. The chrome air has therefore no effect upon the weakest part of septum when the focussing of the stream of chrome air does not strike upon it.

After perforation the septum gives way more in a backward and upward direction which is further evidence of increased action upon a particular part of septum.

When perforation is complete the two streams of air pass through/

through the perforation and strike upon the ala of the opposite nostril before they pass onwards. The front part of septum is thus not acted upon by the chrome air as it is anterior to the stream of air inhaled.

Another theory is that ulceration is not connected with dust or steam laden with chrome, but in the great majority of cases due to the workers inserting a finger when covered with chrome liquor or dust into their nostrils.

I do not consider this ~~period~~^{theory} is correct, for a worker inserting his finger into his nostril would by the effort of insertion rub most of the chrome on his finger sufficiently deep into skin of ~~nasalis~~^{nas.} to produce inflammation, if not a chrome hole.

After such effect the worker would be prevented by pain from touching the septum.

If the finger did reach the septum it would be the anterior part which would suffer most from the chrome, and I know from examinations that the anterior part of septum remains entire, and also from absence of ^{any} deformity of nose.

"Constitutional Effects from Perforation of Septum"

The work of the men in the various processes of manufacturing the chrome is not of a skilled nature, and hence they frequently change their occupation. They may be engaged elsewhere at various occupations for months or years, but whenever they come back I have made specific enquiry regarding any illness they may have had or/

or if they had found any inconvenience from the septum being perforated. They have all declared that they had never experienced any ill effect or were liable to any illness during the time they were absent. These migratory labourers from their irregular habits would have shown or developed some ill effects from the action of the chrome, had there been any.—"Constitutional effects on the system". I have been unable to discover any deteriorating influence that chrome dust has upon the system. I have paid particular attention to their gums, tongue, and pharynx, and have failed to observe any definite lesion. Particular enquiry has been made regarding coryza, Bronchitis, Asthma, etc: without eliciting any information regarding any these diseases. Indeed many have been working for years and have enjoyed good health in general. Some of the regular workers have been with the Company as follows and were rarely off duty.

In 1901 (about time of appointment) there were men working whose periods of service ranged as follows.

Men --	4	over	30	years	working	
	13	"	20	"	"	
	11	"	15	"	"	
	13	"	10	"	"	
	7	"	8	"	"	etc.

The above men worked in the chrome house in which the most dangerous part of the process is carried on, and where any deteriorating effect must have shown itself.

"Chrome Holes".

If/

If we examine a workman's hands, who has been engaged for several years in the chrome department there will be observed cicatrices about the size of split peas here and there. They are not so apparent as smallpox marks.

A Chrome hole may be described as an ulcer formed by the repeated application of the chrome liquor. The more purified the material, the more active it is in its effects. We occasionally observe that one or two applications of the purified material on a weak part produces a chrome hole. Chrome holes vary a little in appearance. They usually present an elevated ring surrounding a circular slough. In other cases such as on the arm, body, and foot there may be a punched out ulcer with very little of the elevated ring surrounding it.

A curious fact regarding the development of these holes is, that they do not usually develop from a cut or bruise known to the workman, but from a slight abrasion of the skin unknown or disregarded by him. I have taken particular care in watching cuts, burns and blisters, etc., and have found that not more than five per cent of these develop into a chrome hole. If a man during his work scratches his hand, knocks his knuckles against anything or receives a punctured wound he usually ignores it as being too trifling to have it covered. Afterwards in working with the chrome liquor, or where there is chrome dust this weak or abraded part begins to smart slightly, producing a small dry red scab over it. The older workmen usually wash their hands and probably cover over the part/

part with some protective and the part though slightly ulcerated heals in a few days. If the workman continues work without taking warning from the smarting, the abrasion may develop in a few hours from the repeated application of the liquor or dust into a chrome hole. It therefore depends upon the care the workman exercises over these smarting parts, whether they will develop into typical or aggravated chrome holes.

Ordinary chrome holes have usually about $3/16$ of an inch of a slough, and a twelfth of an inch of a hard ring surrounding them. They vary very much in size in accordance with the care and cleanliness of the worker.

Chrome workers do not appear to obtain much if any immunity from working amongst the bichromates. During a period of five years I have examined a hundred men each year making a total of five hundred workmen in those five years. Of these five hundred

110	would be	affected with	1	chrome hole	.
36	"	"	"	"	2
28	"	"	"	"	3
					" and etc.

I have never seen any joint penetrated by a chrome hole although from the appearance of some of these holes one would infer that penetration had occurred. In one case of a man from another work the bone of the third phalanx was affected and a small spiculum of bone exfoliated. If a small particle of the bichromate gets under the lid of the eye, it produces a punched out hole on the sclerotic, but only a slightly inflamed part of the mucous membrane of the lid, evidently showing that the blood supply of the part controls the corrosive effect of the chrome.

There/

There has been some doubt in the past regarding the parts of the hand most frequently affected. I append the following table showing the number of times the different fingers have been affected during the five years.

	Right Hand.	Left Hand.
1st Finger.	10 chrome holes.	7 chrome holes.
2. "	19 " "	23 " "
3. "	29 " "	14 " "
4. "	27 " "	13 " "
5. "	30 " "	11 " "
Metacarpals.	30 " "	23 " "
Wrist.	2 " "	<u>Stomach</u> " "
Elbow.	1 " "	
Eczema.	7	

The following table will show at once the phalanges most frequently affected.

	Right Phalanges.	Left Phalanges.
1st	26 chrome holes.	14 Chrome holes.
2nd.	64 " "	44 " "
3rd.	25 " "	10 " "

The position of these chrome holes is evidently determined by the part most readily abraded, such as the second phalanges and the back of the hand.

It was thought in the past that the terminal phalanges especially at the nail was a favourite seat for a chrome hole but this is not my experience.

Eczema.

Eczema is another disease which attacks a few of the workers.

I could not say that the complexion of the worker has any determining influence in the development of the complaint as both fair and dark-haired people are equally affected. Some workers appear to have an idiosyncrasy for developing this disease, as it comes on in a day or two after exposure to the bichromate dust/

dust as a papular or a diffused eczema.

The papular rash is seen over face arms and neck creating a smarting and painful affection. In the diffused eczema the skin becomes reddened and inflamed giving rise to a considerable amount of pain. Once I have treated a case of sloughing of the fascia of the forearm in a man who was about ten days in the work. The deduction which I have drawn from these cases is that the pores of the skin are more open in some than in others.

The Legislative ^{will} ~~ive~~ has placed upon the men strict laws in order to prevent any ill effects from the trade diseases becoming aggravated. A Surgeon is appointed who is required to examine each man once a month as well as to hear any complaint. On the other hand if a man appears indifferent to his own cleanliness or care of person he may be suspended. Wash-hand basins are conveniently situated with abundance of water, etc. Each man requires to take a bath weekly. Overalls are supplied to the men and cloth inhalers are given to those who work in a dusty atmosphere. Dust extractors are placed over processes most dangerous to the men.

Treatment of the Industrial Diseases.

I have attempted to educate new workers to plug a little cotton wool into their nostrils or apply vaseline to their septums. They appear to feel their position in going about with their nostrils stuffed etc. and without exception fail to carry out the treatment.

Chrome/

Chrome holes are naturally from their method of production and with the hard ring surrounding them a little difficult to heal. Some of the men used to have the same chrome hole for months without any improvement and even with protection over them, while others would have theirs cured in a month ^{altno'} ~~and~~ working every day. During the last year or two I have threatened to suspend from work those whose chrome holes did not improve in a month. The result has been that these chrome holes were almost healed before my next monthly visit. An American writer has suggested that Sodæ Bisulph. in a five per cent solution should be applied to these sores in order to decompose the acid radicle of chrome, but I am afraid that workers would require to be covered over with this solution continuously before they could receive any benefit, because when chrome is applied to a part it acts immediately. The treatment which I have followed out is to protect the part with a soothing application surrounded by G. P. Tissue and elastic adhesive plaster. By these means I invariably get ordinary chrome holes to heal in fourteen days. With other chrome holes of a more severe type the process of healing may require a month. In the event of any chrome holes failing to heal or showing a tendency to become chronic, the man is suspended from the department and placed in another situation and invariably the chrome hole is healed within a month. During the process of healing the centre plug or slough is thrown off leaving whitish granulations/

granulations at bottom which gradually become more red as they rise to the surface; at the same time the ring surrounding a hole begins to disappear when the chrome applications are stopped. With cases of eczema the men are at once suspended from the chrome department and soothing applications applied. With slight cases of eczema, however, sleeves and gloves are used for the protection of arms and hands.

I consider the chief ^{part of the} treatment however in all cases is the removal of the worker for a short time from the chrome department.

The removal of the man allows the part to heal naturally with soothing treatment and teaches him that he must in future pay more attention to the care of his person.

*Composition, style, & grammar
extremely careless given for a thesis.*