

DONALD HUNTER

CADMIUM POISONING

An investigation to determine the incidence of chronic cadmium poisoning in men employed casting an alloy of copper-cadmium has been carried out.

Among sixty-three men exposed to cadmium fume, sixteen were found to have symptoms could be due to chronic cadmium poisoning. There were eight cases of emphysema and proteinuria, six cases of emphysema without proteinuria and two cases of proteinuria without emphysema.

Acute cadmium poisoning following the inhalation of cadmium oxide fume or dust has been known since 1858 (SOVET, quoted by PRODAN 1932). Ingestion of food or drink contaminated by small amounts of cadmium salts gives rise to acute gastro-enteritis (FRANT and KLEENAN 1941).

Chronic cadmium poisoning was not recognised until Friberg (1948 and 1950) and Baader (1951) described emphysema and proteinuria in men exposed to cadmium oxide dust. These men were making small briquettes of cadmium which are used in the manufacture of alkaline accumulators.

The symptoms and signs of chronic cadmium poisoning described by Friberg and Baader are dyspnoea and loss of weight. The dyspnoea is due to a vesicular emphysema of the lungs. In a high proportion of cases, protein which was unlike either albumen or Bence Jones protein was found in the urine. The protein is not coagulated by heat. In some cases there was also anosmia, chronic rhinitis and a yellow discoloration of the teeth.

An investigation to determine the incidence of chronic cadmium poisoning in men employed casting an alloy of copper-cadmium has been carried out.

The alloy is composed of copper with 1% cadmium. In the manufacturing process a master alloy, containing 30-50 per cent. of cadmium with copper is added to molten copper and stirred. This is done in two types of furnace. The older furnace was an open hearth type in which a crucible containing copper was lowered into a pit fire. When the copper was molten the master alloy was added and the mix stirred. The stirring was performed manually. The men on this type of furnace were exposed to a high concentration of cadmium fume. The newer type of furnace is electrically heated and controlled mechanically. Exposure to cadmium fume occurs only when the master alloy is added.

Sixty-three men who had been exposed to cadmium were examined. There were approximately twenty men in each of the three age groups, 36-45, 46-55 and 56-65. An equal number of men in the same age groups who worked in the same factory but had never at any time been exposed to cadmium were taken as a control group.

Each man was interviewed and a clinical examination made. Investigations included the erythrocyte sedimentation rate E. S. R. (WINTROBE), haemoglobin concentration and red blood cell counts, and estimation of plasma proteins. The first morning specimen of urine was examined for protein and sugar and each man was asked to provide a 24-hour specimen for the estimation of cadmium. The maximum ventilatory capacity and vital capacity were measured on the spirometer described by Bernstein and D'Silva (1952). Postero-anterior and left lateral radiographs of the chest were taken in expiration and inspiration.

The results of this investigation have not yet been analysed but it can be stated that in the group of men exposed to cadmium fume, the incidence of emphysema and proteinuria was significantly greater than in a control group.

The men in the exposed group were divided into three sub-groups. Men in group I had worked on the old pit fire furnace; those in group II had worked on the new electric furnace only and those in group III had worked in the same workshop as the men in groups I and II but had cast alloys other than cadmium-copper.

Group I was composed of fifteen men. All had worked for a minimum of fourteen years casting copper-cadmium alloy. Nine of these men are severely affected. Four have emphysema and proteinuria, three have emphysema without proteinuria and two have proteinuria without emphysema. Four men from this group are unable to work. Three are disabled by emphysema and the fourth one has renal failure with uraemia. The E. S. R. as measured by Wintrobe's method was raised in twelve cases and the haemoglobin percentage was below 100 per cent. in eight cases. Thirteen gave a past history of metal fume fever.

Group II consisted of seven men who had worked on the new process only for four to eleven years. Two men had emphysema which could be diagnosed on clinical examination and proteinuria. One man was so incapacitated by dyspnoea that he has been unable to work for the past seven years. He had worked on the furnace for eleven years. The E. S. R. was raised in three cases and the haemoglobin was below 100 per cent. in three cases.

Group III consisted of forty-one men who had worked in the casting shop casting other alloys but had never cast cadmium-copper. They had worked from three to forty years in the casting shop. Five men had emphysema which could be diagnosed on clinical examination, and two who

had worked in the casting shop for thirty and forty years respectively, had proteinuria as well. The E. S. R. was raised in eighteen cases and the haemoglobin percentage was less than 100 per cent. in fourteen cases.

There was no evidence of anosmia or of a yellow ring on the teeth in any of the sixty-three men examined. Thus of sixty-three men, sixteen were found to have symptoms which could be due to chronic cadmium poisoning. Eight had emphysema and proteinuria, six had emphysema alone and two had proteinuria alone. The E. S. R. was raised in thirty-three cases and the haemoglobin was less than 100 per cent. in twenty-five cases.

The control group was composed of sixty men of approximately twenty in each of the age groups 36-45, 46-55 and 56-65.

Four men in this group had chronic bronchitis with emphysema and one man was found to have albuminuria. The E. S. R. was raised in sixteen cases and the haemoglobin was less than 100 per cent. in nine cases.

It is important to point out that all the men in the exposed groups who now have symptoms were employed casting cadmium-copper during the years of the Second World War. The workshop was badly ventilated owing to blackout restrictions, which necessitated blocking all the windows and keeping all the doors closed at night. The alloy was urgently required for use in war and these men worked for long hours in an atmosphere which contained a high concentration of cadmium. At the present time adequate hoods with exhaust ventilation have been installed over the furnaces and the old pit fire type of furnace is no longer used.

The findings may be summarised:

- 1) Among sixty-three men exposed to cadmium fume, sixteen were found to have symptoms which could be due to chronic cadmium poisoning. There were eight cases of emphysema and proteinuria, six cases of emphysema without proteinuria and two cases of proteinuria without emphysema.
- 2) In a control group of sixty men, there were four cases of chronic bronchitis and emphysema and one case of albuminuria.
- 3) The erythrocyte sedimentation rate (E. S. R.) was raised in thirty-three of sixty-three men in the exposed group while in the control group the E. S. R. was raised in only sixteen of sixty men investigated.
- 4) The haemoglobin was below 100 per cent. in twenty-five of sixty-three men investigated in the exposed group, while only nine of sixty men in the control group had a haemoglobin of less than 100 per cent.

*Department for Research
in Industrial Medicine
(Medical Research Council)
London*

*Received for publication
15. VIII. 1953*

References

- Baader, E. W., (1951), Deut. Med. Woch. 76, 14, 484.
Bernstein, L., D'Silva, J. L. and Mendel, D., (1952) Thorax, 7, 3, 255.
Frant, S. and Kleenan, L., (1941), Journ. Amer. Med. Assoc., 117, 86.
Friberg, L., (1948), Journ. Indust. Hyg. & Toxicol., 30, 32-36.
Friberg, L., (1950), Acta Med. Scand. Supp. 240, 1-124.
Prodan, L., (1932), Journ. Indust. Hyg. and Toxicol., 14, 174.

Sadržaj

OTROVANJE KADMIJEM

Prikazano je istraživanje učestalosti kroničnog otrovanja kadmijem kod ljudi zaposlenih na lijevanju legura kadmija i bakra. Rezultati se mogu rezimirati ovako:

1. Između 63 eksponirana radnika nađeno je, da 16 ima simptome, koji bi mogli biti u vezi s otrovanjem kadmijem. Bilo je 8 slučajeva emfizema i proteinurije, 6 slučajeva emfizema bez proteinurije i 2 slučaja proteinurije bez emfizema.
2. U kontrolnoj grupi, koja se sastojala od 60 ljudi, bila su 4 slučaja kroničnog bronhitisa i emfizema, i jedan slučaj albuminurije.
3. Sedimentacija je bila povišena u 33 slučaja od ukupno 63 u eksponiranoj grupi, dok je u kontrolnoj grupi sedimentacija bila povišena samo kod 16 od 65 pretraženih ljudi.
4. Hemoglobin je bio ispod 100% u 25 slučajeva od 63 u eksponiranoj grupi, a samo 9 ljudi od 60 u kontrolnoj grupi imali su hemoglobin manji od 100%.

Department for Research
in Industrial Medicine
(Medical Research Council)
London

Radnja primljena
15. VIII. 1953