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ALBERTA OCCUPATIONAL MEDICINE NEWSLETTER

EDITORIAL COMMENTS

"You should ask your patient what sort of pains he has, what caused them, how many days he has been ill, whether the bowels are working and what sort of food he eats. So says Hippocrates in his work 'Affections'. I may venture to add one more question: 'What occupation does he follow?' " (Bernardino Ramazzini, "Diseases of Workers", 1713).

Ramazzini's classical advice to physicians is getting harder to follow and act upon nowadays, not least because of "she" as well as "he". Jobs are very diverse and the nature of them is changing rapidly. This introduces new health risks and ways of dealing with them, which may take time to be evaluated.

This independent quarterly newsletter therefore aims to present up-to-date information as crisply and directly as possible and to encourage discussion of it within its pages. Contributions in the form of articles, letters or questions will be welcomed and should be addressed to the editor, whose address appears on this page. Telephone calls are also invited, to give suggestions and/or criticisms, or to discuss potential contributions and their format.

In this issue Dr. Ian Arnold discusses the nature, effects and management of hydrogen sulphide poisoning. There is some controversy about the practical consequences of the new information he cites, that giving nitrite as an emergency treatment is only likely to be of value at a very early stage. There is some evidence that after a lapse of time of a few minutes it may not only be valueless, but actually slows down H₂S removal.

Dr. Cameron Hill, Director of Safety, Health & Fitness for Petro-Canada, thinks that it is better to concentrate on the undoubted priority of cardiopulmonary resuscitation (CPR) and oxygenation, and that by the time this has been looked

after, probably nitrite administration will be too late to be effective. If this is true in practice, then the use of nitrite may actually interfere with successful resuscitation. Those on the scene at the time will usually be first-aiders or fellow-workers and they should not be diverted from CPR by looking for the "magic antidote". In the final analysis, the best course of action with respect to giving nitrite depends on the circumstances at the time of treatment, bearing these points in mind.

Also later in this issue, Dr. Bill Csokonyay seems to feel that charity begins at home, in that physicians and other health workers should consider protecting themselves against hepatitis B. A safe and effective vaccine has now been developed against this unpleasant disease, but its availability seems to be limited. Although surgeons and pathologists are not so likely to develop it as are workers and patients in dialysis units or male homosexuals, they and other health care workers are appreciably at risk. This has implications for protecting medical students and residents early in their careers even more than mature practitioners.

An admirable review by Dr. David Hoar, Ph.D., concerning visual display terminals (VDT's) and effects on pregnancy and the fetus, appeared in the latest issue of the "Bulletin of the Hereditary Diseases Program of Alberta". This gave a balanced and expert view of the evidence. This editor would answer the question "Would one advise one's pregnant daughter to change her congenial job as a VDT operator?" with "NO". Personally, we would also defend her right to change her job without penalty if she were convinced, without good evidence, that her child would be harmed. This "right" and its justification spreads beyond the technical health sphere. It is cited because unless this issue is taken into account, the viewpoints of some

groups, such as organised labour, cannot be fully understood. We agree with Dr. Hoar that further research concerning VDT's and health would be desirable.

To conclude on a less controversial note, Dr. Ted Couillard of the Links Associate Clinic, 10951 124 Street, Edmonton, Alberta's Provincial Representative on the Canadian Council on Occupational Medicine, has informed us that the council is throwing open its membership to all physicians engaged in the practice of occupational medicine, full or part-time. The Council is directed to the improvement of the practice of the specialty through education, research and experience. It is an affiliate of the Canadian Medical Association. Those interested may apply for membership at the current annual fee of \$25.00.

Those who are interested in joining a multidisciplinary occupational health association, may get further information about the Alberta Occupational Health Society from Ms. Janet Tate, 519-D 33rd Street N.W., Calgary, Alberta, T2N 2W5. The subscription is \$10.00.

Both the organizations mentioned have been in existence for over 10 years and have aims which, although different in focus, are fully compatible.

In the next issue, a brief review of the major organizations in Alberta active in occupational health will be included, plus articles on reproductive hazards of the workplace and the significance of human hair analysis in toxic exposure evaluation.

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HYDROGEN SULPHIDE

Ian M. F. Arnold, M.D., M.Sc., D.O.H.S.*

Description

Hydrogen sulphide (H_2S), is a colorless flammable gas which can be liquefied under pressure. It has a vapour density of 1.189 and tends to accumulate in low lying areas.^{1, 2, 3} Hydrogen sulphide may be found in over 25 industries and, in Alberta, is associated particularly with the petroleum, chemical, pulp and paper industries, and food processing plants. Hydrogen sulphide may be disposed of by flaring of it may be used to make high quality sulphur and various other sulphide and organic sulphur compounds.

Acute Poisoning

Hydrogen sulphide poisoning is diagnosed primarily by history and symptom complex. History of exposure may be through knowledge of the source, changes in the various detector apparatus (such as lead acetate paper, gastech tubes, etc.), or odor detection. Unfortunately, the sense of smell is not reliable, as it deteriorates at high atmospheric H_2S levels (above 100 parts per million). Laboratory techniques for analysis of blood sulphide ions have not yet been fully developed and research is currently underway to develop reliable methods of exposure assessment. The general laboratory assessment of patients who have suffered from H_2S "knock down" should probably include blood gases, chest x-ray, complete blood count, and possibly electroencephalogram, computerised axial tomography, and electrocardiograms.

Pathophysiology

Hydrogen sulphide is second only to hydrogen cyanide in the speed and severity of poisoning. It acts as a direct lung irritant causing pulmonary oedema, and is a systemic toxin. The classical explanation of the mechanism of action of H_2S is that it interferes with the cytochrome oxidase enzyme, particularly in the central nervous system.⁴ Recent research has indicated that, unlike hydrogen cyanide, H_2S tends to augment the compound action potential of nerves thus placing the classical theory in question.⁵ It should be noted that elevated blood alcohols may increase susceptibility to H_2S poisoning.⁶

Treatment of Hydrogen Sulphide Poisoning

The victim must be rapidly removed from further exposure and during this procedure, the rescuer must wear self-contained breathing apparatus (preferably of a positive pressure type).^{7, 8} Initially, cardiopulmonary resuscitation must be carried out, contaminated clothing removed, and eyes copiously flushed to remove irritants. Conscious patients must be kept inactive, as H_2S can produce a sudden blood pressure fall.

Treatment with nitrites is recommended in the Poisindex literature and Harrison's Textbook of Internal Medicine. The theory behind this treatment is that nitrites induce methaemoglobin production which in turn binds the free sulphide ion to form sulfhaemoglobin. Recent research has indicated that, to be effective, nitrites should be given within a few minutes of the poisoning.⁹ Obviously, the ABC's of initial resuscitation must first be carried out. Amyl nitrite may be given, initially, as an inhalant; one ampoule (0.2 - 0.3cc) every five minutes. Since excess methaemoglobin production will impair oxygen transport, nitrites should not be given when systolic blood pressure is below 80 mm of mercury. Sodium nitrite may be given slowly intravenously (2.5 - 5cc per minute) as 10cc of a 3% solution in normal saline. Amyl nitrite ampoules should not be stored below 15°C and should not be kept beyond expiry date (about one year).

Methaemoglobin production can be also induced by the use of pyridoxine, 25 mg/kg intravenously.

Further treatment may require the use of mechanical ventilation with positive end-expiratory pressure, and steroids may be a useful mode of treatment to forestall pulmonary oedema. Ophthalmological consultation should be considered if the eye problems appear severe. Assessment should be made for other musculoskeletal injuries. Convulsions often occur in these victims and may be extremely violent, and have been controlled successfully through the use of valium and morphine. Amnesia up to 72 hours following poisoning has been reported.¹⁰ This correlates well with a report in the literature of experimental effects on CNS tissue (in animals) up to 72 hours past exposure, thus suggesting the knock down victim should avoid H_2S exposure for 48 - 72 hours post knock down.¹¹

Subacute and Chronic Effects

It does not appear that there are any persistent effects of hydrogen sulphide poisoning at highly toxic levels other than those effects associated with the complications of the poisoning. There is a great need for research into the effects of hydrogen sulphide levels under 50 ppm, as very few studies have been done in this exposure range.¹² The occupational exposure limit in Alberta is set at 10 ppm and there has been only one reported study on effects of H_2S at levels under this range.¹³ The Russian literature has reported some teratogenic effects of hydrogen sulphide but their studies included a combined exposure to H_2S and carbon disulphide and it is unclear whether these effects were due to the H_2S or the carbon disulphide (which is known as a teratogen).¹⁴ Reports of medical complaints during low level air pollution, particularly associated with hydrogen sul-

phide, indicated that the primary complaint was a symptom of nausea although some other complaints of upper respiratory type symptoms were noted.¹³

Medical Services Branch, Workers' Health, Safety & Compensation has been concerned about the effects of hydrogen sulphide on the work place for a number of years. During the past year, a program has been developed to educate physicians and paramedical personnel on the effects of hydrogen sulphide and suggested treatment protocols. This program has been presented throughout the northern half of the province during 1982 and will be continued in the southern half in 1983.

Summary

Hydrogen sulphide is a highly toxic gas found in a number of industries in the Province of Alberta and has been responsible for a number of fatal accidents over the past several years. A treatment protocol has been outlined and a brief discussion of the pathophysiology and the future direction of H_2S research has been also given.

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HEPATITIS B VACCINE AND HEALTH CARE WORKERS

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Several research groups and reviewing bodies have recommended that Heptavax-B (MERCK) be utilized in the prevention of hepatitis B in high risk groups such as health care workers. Dienstag and Ryan¹ reported in 1982 that a seroepidemiologic survey of health care workers revealed a 16% prevalence of markers of hepatitis B virus which was greater than the prevalence in blood donor volunteers (5%). The risk of hepatitis B virus infection to hospital employees is underestimated by clinical attack rates. The following table is offered as some data showing the differences in prevalence and attack rates in the U.S.A.:

Sequelae of hepatitis B infection are: resolution 90%, carrier state 5%, persistent hepatitis 3.5%, and active hepatitis 1.5%. As epidemiologic facts unfold, we learn in addition, that within Canada there are high prevalence rates among some of our native people³ and immigrant populations⁴.

Cost benefit analyses are ongoing and underway, but immunization programs are held up by the cost of the vaccine, the limited quantities available, and the identification of those whom we most want to protect initially.

Various studies done during the phase of evaluation of the vaccine have shown that adverse reactions occur in about 25% of the volunteers — but these were no more serious than local soreness, erythema at the injection site, local swelling, warmth, induration, low grade transient fever, malaise, fatigue and a variety of other mild constitutional symptoms that

were transient. Reassurance has come from both the manufacturer of the vaccine and various other authorities^{5,6} regarding the possible transmission of acquired immuno-deficiency syndrome — no cases have been reported in large clinical trials of the vaccine in the U.S.A. and reassurance is expressed in the literature to the effect that even if AIDS were subsequently shown to be caused by a serum-transferred virus, all known classes of virus are inactivated by steps used in preparation of the hepatitis vaccine. The vaccine is said to provide protection for about five years after three doses administered at day one, one month, and six months.

The cost of the vaccine, although high, is not prohibitive — especially when one looks at the analysis of cost to society of each of the serious sequelae of hepatitis B mentioned above. More frightening is the strong association of carrier state of HBV with later cirrhosis or primary liver cancer.

At issue is whether or not to screen potential vaccinees prior to administration for markers of HB infection. (Unnecessary administration, versus cost of screening tests versus cost of vaccine). To the present knowledge, no additional adverse reaction has occurred when the vaccine has been administered to those who are positive for such markers. The general feeling is that when the risk is high, one does not necessarily need to screen for markers of infection if cost overall of such a program to a large group such as health care workers is an issue.

It is hoped that in Alberta, we will soon embark upon a program to vaccinate high risk hospital personnel, using as a guideline the figures listed above as the order in which to offer vaccine to health care workers. Perhaps a survey among a random sample of hospital employees, or of all health care workers, could be carried out to produce a baseline figure of prevalence in Alberta using serological markers, prior to administration of the vaccine; or alternatively, sera could be drawn at the time of vaccination. This would be of use to help further quantify the risk to health workers in other areas, and for new employees. However, it is not necessary to qualify and justify the use of vaccine in each and every individual health care worker prior to vaccination.

As further epidemiologic evidence becomes available, we will be able to better set out the indications for use in other groups as well. Hearsay tells us in Alberta that vaccination of health care workers is already under way at several Toronto hospitals, and hopefully we will not be far behind.

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Prevalence of HBV Exposure and Annual Attack Rates in Representative Groups²

Population Group	Prevalence of HBV Markers	Annual Attack Rates
I. Health Care Workers		
Dialysis staff	34-39%	3-11%
Oral surgeons	30	5 (est.)
Staff of custodial institutions	22-33	13-20
Surgeons	23-28	5
Nurses in high risk units	7-47	1-11
Blood bank workers	6-26	1- 2
Lab technicians	11-26	1- 3
Physicians (general)	12-19	2
Dentists (general)	14-15	2 (est.)
Surgical house offices	10-17	4-10
Nurses (general)	5-21	1
II. High Risk Patients		
Dialysis patients	42-59	3-14
Hemophiliacs	76-96	13-20
III. Institutionalized Persons		
Mentally retarded	50-90	1-10
Prisoners	42	5-10 (est.)
IV. Other Groups		
Homosexual men	60-68	12-19
Intravenous drug users	50-71	4-33
Household contacts of HBsAg carriers	26-61	2-5 (est.)
Promiscuous heterosexuals	15-31	2- 5
Military (U.S.A.)	7-20	0.5 (current)
General U.S.A. population	5-10	12 (Viet Nam) 0.1

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COMING EVENTS: — ALBERTA

"An Update In Occupational Medicine"

DATE:

Friday, March 25, 1983

PLACE:

Orange Lecture Theatre,
Faculty of Medicine
University of Calgary

TOPICS & SPEAKERS:

"Skin in the Workplace"

- K.A. Barber

- R.J. Rycroft

"Occupational Lung Diseases"

- D.V. Bates

- G.T. Ford

- W.A. Whitelaw

"MEDICHEM" - 11th International Congress on Occupational Health in the Chemical Industry"

DATE:

September 26-29, 1983

PLACE:

The Calgary Westin Hotel
4th Avenue and 3rd Street S.W.
Calgary, Alberta

COMING EVENTS: — ELSEWHERE

May 8 - 13, 1983

10th World Congress on the Prevention of Occupational Accidents and Diseases, Ottawa, Ontario.

July 19 - 22, 1983

Second International Conference on the Clinical Chemistry and Chemical Toxicology of Metals, Montreal, Canada.

November 9, 10, 11, 1983

"Canadian National Congress of Occupational Medicine"

PLACE:

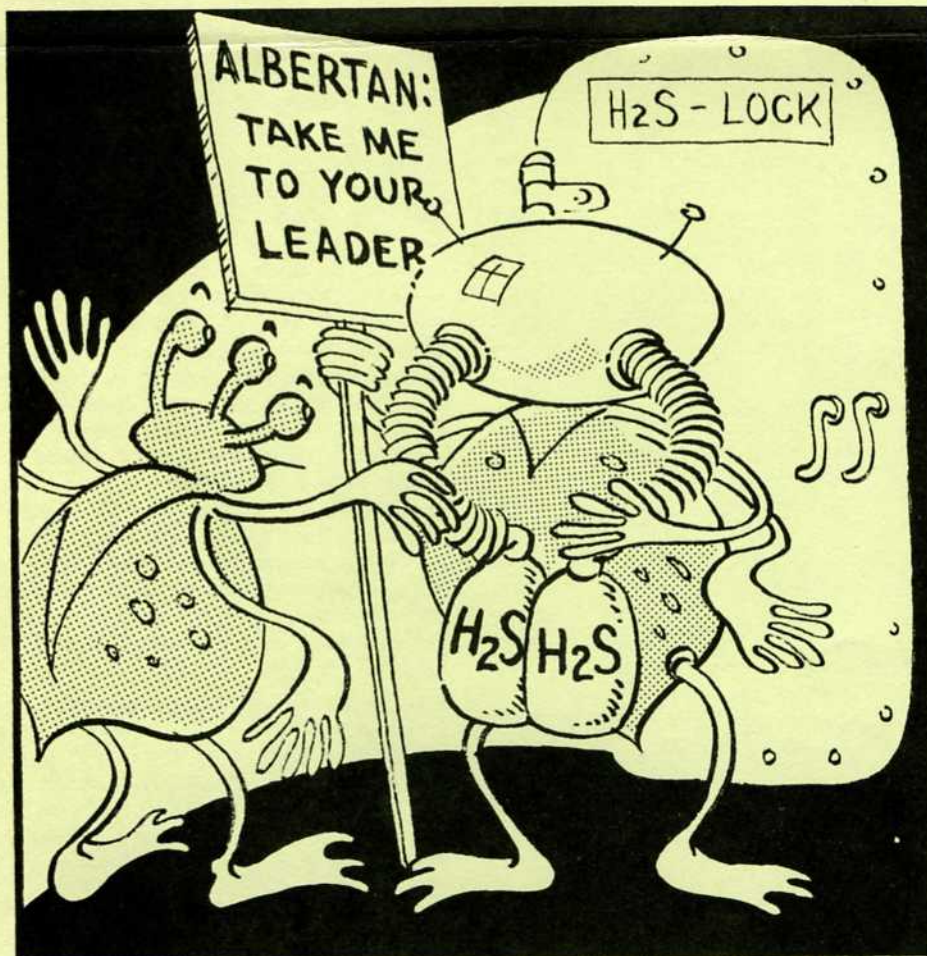
The Westin Hotel, Toronto

To be held in conjunction with the annual meetings of the Canadian Council and the Canadian Board of Occupational Medicine.

N.B.

Further information concerning any of the above may be obtained from the editor, John Markham: (403) 284-6940.

Dr. G. Jamieson



YOU WON'T NEED THE H₂S BOTTLES! THE ATMOSPHERE IS JUST LIKE HOME!

FROM THE JOURNALS

Dung Lung: A report of toxic exposure to liquid manure.

Osborn LN and Crapo RO

Ann Intern Med 1981; 95: 312-314

This unlikely title describes an incident in which three workers were killed and one became seriously ill by being overcome by H₂S in a manure pit. This is a classical cause of poisoning by H₂S and reminds one of its tendency to pool in low lying places.

Hydrogen sulphide poisoning in a hospital setting

Peters JW

JAMA 1981; 246: 1588-1589

H₂S poisoning occurred when strong acid became mixed with plaster of paris sludge in a hospital drain.

Personality characteristics of successful bomb disposal experts

Cooper CL

JOM 1982 (Sept); 24: 653-655

Salient personality characteristics of individuals performing successfully in this stressful occupation were said to be: low level affiliation and affection motivation, difficulty in forming and maintaining close personal relationships and a tendency towards non-conformity. This seems surprising, because it arose from a comparison with others in the same occupation, done with the objective of identifying the characteristics associated with success in stressful occupations.