

THE LANCET

Vinyl Chloride, P.V.C., and Cancer

At the end of 1972 a man of 71 died in the Victoria Hospital, Blackpool, from a rare form of neoplasia, angiosarcoma of the liver. He had worked for 20 years as a process worker making polyvinyl chloride (P.V.C.) from vinyl chloride (V.C.). The details of the case are given by Dr LEE and Dr HARRY on p. 1316: according to them, this is the nineteenth case of its kind, though the first in the United Kingdom. Cases of hepatic angiosarcoma in men exposed to V.C. have been previously reported in the United States of America,¹ Sweden, and Germany.

The reaction of experimentalists to the situation is to ask why nobody heeded the results of work on rats, published in 1971. VIOLLO and his colleagues² reported the occurrence of cancers which were later found to have arisen in the acoustic duct, and cancers of the lungs, bones, and other sites in 17 out of 25 rats exposed to 30,000 p.p.m. V.C. for 20 hours a week. The answer may be that, in some eyes, experimentalists have too often cried "cancer-wolf" on quite inadequate evidence of real hazard. In any case it could have been argued that 30,000 p.p.m. is very high in comparison with human exposure levels to V.C. in most P.V.C.-manufacturing plants in 1971. The reaction of the Department of Employment Factory Inspectorate has been to set a new interim upper limit for exposure to V.C. in P.V.C. manufacturing plants at 50 p.p.m. with a maximum time-weighted average exposure of 25 p.p.m. However, these limits will almost certainly be lowered in view of CESARE MALTONI's claim to have produced angiosarcomas of the liver by exposing rats to only 50 p.p.m. V.C. (reported on May 10 at a meeting organised by the American Cancer Society and New York Academy of Sciences). The reaction of the manufacturers, through the Chemical Industries Association Ltd., has been to pool their experience and resources in the production of a guidance document for P.V.C. processors.³ There is no indication that P.V.C. is itself dangerous or that it depoly-

merises to produce V.C. But unreacted V.C. which is present in newly manufactured P.V.C. may be released during storage and when the material is heated during manufacture of P.V.C. products. Compounding processes known as dry blending, Banbury/2 roll mill compounding, extrusion compounding, and paste mixing, and fabrication processes such as extrusion, calendaring, and paste spreading may be associated with release of V.C. into the atmosphere. Carefully planned ventilation at appropriate points in P.V.C. processing plants is therefore recommended. The reaction of food-packaging experts is still awaited. By the time P.V.C. sheeting is used for wrapping food its V.C. content is probably low and very little may find its way into food or into the atmosphere of the food supermarket or domestic kitchen. Nevertheless, information is needed. At the very least the public should be told—if it is true—that the grades of P.V.C. used for wrapping food are pretreated to remove as much free V.C. monomer as possible.

To date, all those workers who have developed angiosarcoma of the liver have a history of intermittently heavy exposure to V.C. over periods of from 12 to 27 years in P.V.C.-manufacturing plants. There have been no cases among P.V.C. processors. Most examples of heavy exposure date back to the early days of P.V.C. manufacture before certain other, non-cancerous, health hazards associated with exposure to V.C. were recognised. Raynaud's phenomenon (acro-osteolitis) in response to V.C. was reported as early as 1957⁴⁻⁶; more lately, chronic liver poisoning leading to portal obstruction, bleeding from oesophageal veins, and splenic enlargement were identified as V.C. effects. Their discovery led to ever-increasing efforts to protect workers from exposure to V.C. Nobody knows how many more cases of V.C.-induced angiosarcoma of the liver will come to light. Optimists will argue that the conditions in industry have so greatly improved that we may already have seen the worst. Pessimists, however, will say that we have so far probably seen only those cases with the shortest latent interval resulting from the heaviest exposure, and that an epidemic of cases with longer latent intervals associated with lesser exposure is yet to come. Moreover, an effect of V.C. on the incidence of certain less rare forms of cancer may so far have passed unnoticed. Whatever happens, the V.C. episode will have provided a salutary lesson. It will not be quite so easy in the future, as it has been in the past, for any chemical manufacturer to assume, until proved otherwise, that a chemical to which workers are exposed is carcinogenically safe. There must surely be more sys-

1. Creech, J. L., Johnson, M. N. *J. occup. Med.* 1974, 16, 150.
2. Viollo, P. L., Bigord, A., Caputo, A. *Cancer Res.* 1971, 31, 516.
3. Vinyl Chloride Monomer: Advisory Note for the Guidance of PVC Processors. Published by Chemical Industries Association Ltd., Alembic House, 93 Albert Embankment, London SE1 7TU, June 12, 1974.

4. Lester, D., Greenberg, L. A., Adams, W. R. *Am. ind. Hyg. Ass. J.* 1963, 24, 265.
5. Lange, C. E., Jühe, S., Stein, G., Veltman, G. *Int. Arch. Arbeitsmed.* 1974, 32, 1.
6. Jühe, S., Lange, C. E., Stein, G., Veltman, G. *Dr. med. Wsch.* 1974, 98, 2034.

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rematic evaluation of industrially used chemicals for carcinogenic risk to workers. In its own area, the thalidomide disaster was a milestone. Vinyl-chloride angiosarcoma is a milestone in occupational hygiene.

Specialisation in Surgery

Sir CHARLES ILLINGWORTH¹ once declared, in a somewhat whimsical address, that general surgery had no future. The Joint Committee for Higher Surgical Training set up by the Royal Colleges has recognised eight specialties; and now general surgery styles itself the ninth (or first). In fact, almost half the surgeons in Britain are in a recognised specialty other than general surgery. Institutional inertia has, however, ensured that both colleges and universities still act on the assumption that surgery really means general surgery. Most undergraduate teaching is still carried out in so-called general surgical wards, although in teaching hospitals many of these are highly specialised. But when it is suggested that students or preregistration house-officers should spend a major part of their surgical time in specialist units there is talk of these being unsuitable. It is difficult to see why, if it is accepted that the educational purpose at this stage of training is to expose young minds to the principles and practice of surgery in general, rather than to general surgery. This means becoming familiar with preoperative assessment, dealing with the patient and his family, liaison with the anaesthetist and nursing staff, post-operative care, and the like. Technical details of what happens in the operating-theatre are of little consequence at this stage, so what is the essential educational difference between one surgical specialty and another? Undergraduates would want to spend some time with abdominal and accident/orthopaedic surgeons, but beyond this electives could be organised to complete the surgical component of the practical curriculum.

At the postgraduate level the failure to acknowledge that general surgery is only one among many specialties has a more serious effect. Still imprisoned by the regulations for the "general" F.R.C.S., all surgeons must complete a considerable time in general surgery and then face an examination largely organised by general surgeons. One proposed training scheme for surgeons begins no sooner than two years after qualification and permits rotation to specialties only after 2 years' continuous training in general surgery. A more balanced attitude is evident in two other regions which allow for 18 months each in general surgery and in the other specialties, with alternating periods of 6 months in general and in specialty surgery. Such a scheme ensures that those who will become general surgeons

have had exposure to some specialties, and it enables specialist surgeons to gain experience in fields other than their own and general surgery. One hopes that, in time, there may be a move towards the specialist F.R.C.S. for more surgeons, as already applies in Canada and Australia for almost all the accepted specialties but in Britain is available only for ophthalmology and otorhinolaryngology. This should reduce the need for specialists to spend some of their, intellectually speaking, most productive years working in spheres largely irrelevant to their ultimate careers.

Earlier specialist work might provide a solution to another problem, which is the limited amount of research carried out in the surgical specialties. When a major funding body lately discussed why this should be so, it was told that the prolonged training periods required for specialists left young men with little time for diversions into research; also that the limited academic establishment in the specialties was a disincentive to research-minded surgeons in training, who mostly opted for general surgery (which offered a number of senior university posts to which they could aspire). Although some chairs in orthopaedic surgery have been established, other specialties have had to be satisfied with the occasional personal chair, which often does no more than acknowledge the local pre-eminence of an established and largely clinically oriented surgeon. Such a personal chair provides no sound basis for a proper department and it provides no substructure or promotional ladder for younger academic surgeons, because there is no assurance that a vacancy will arise in the future. The solution lies in the hands of the professors of (general) surgery. Already several younger ones are making specialists welcome in their research laboratories and are anxious to include them in their wider academic teams. A few have created specialist academic departments headed by professors, or by senior lecturers with some independence; but many more have proceeded to make second chairs in general surgery. Certainly no medical school would want chairs in all eight specialist branches (nor is the University Grants Committee likely to allow this kind of pluralism). But it would benefit surgery in general if each school had two or three specialist chairs, chosen according to the particular opportunities and facilities already existing locally. This would provide a reasonable career structure for younger academics in the specialties, would enable serious and continuing research programmes to be supported, and would strengthen the school of surgery in that particular university. This strengthening would be more likely if the academic departments of surgery in a university were grouped into a division of academic surgery—to borrow a useful administrative term from the National Health Service. In such a division the specialist professors should be expected to contribute fully to the task of

1. Illingworth, C. *Scott. med. J.* 1962, 7, 1.

Evidence of cancer link shielded from industry

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By BOB KUTTNER
The Washington Post
WASHINGTON — Evidence existed as early as 1971 that low doses of vinyl chloride caused cancer in laboratory animals, according to an internal technical report by the World Health Organization's International Agency for Research on Cancer.

The researcher isn't identified, but several prominent U. S. cancer scientists believe he is Dr. L. P. Viola, the Italian researcher whose earlier work first alerted the chemical industry to the possible carcinogenic (cancer-causing) effects of high doses of vinyl chloride.

So far, 14 deaths from a rare liver cancer called angiosarcoma have been reported among U. S. chemical workers exposed to vinyl chloride gas, which is the base ingredient for one of the most common plastics, polyvinyl chloride.

The disclosure last Jan. 22 by B. F. Goodrich that three workers in its Louisville, Ky., plant died of angiosarcoma led to a crash research program by several federal agencies, including National Institute of Occupational Safety and Health and the Labor Department's Occupational Safety and Health Administration (OSHA).

Consequently, OSHA adopted an emergency standard lowering exposure limits to

vinyl chloride, workers from 500 parts per million to 50 parts per million, and NIOSH has recommended a permanent permissible level of zero.

In the wake of these findings, the chemical industry has been sharply criticized by cancer scientists for failing to fully inform either the government or its own plant physicians about the results of European studies showing links to cancer as early as 1971.

"If the latest report means what it seems to mean," said Dr. Irving Selikoff, Director of the Environmental Sciences Laboratory at Mt. Sinai School of Medicine in New York, "then we're nearly four years behind where we should be."

"You don't automatically assume that animal studies are conclusive, but the industry should have at least notified their own doctors," he added.

"It's inexcusable that they didn't tell the government," said Dr. Sidney Wolfe, Director of the Nader-sponsored Health Research Group.

"It would have been appropriate for them to tell us about the European studies as soon as they knew," added a NIOSH scientist.

According to the Manufac-

turing Chemists Association, the principal industry trade association, the MCA invited Dr. Viola to discuss his study with U. S. industry representatives in May 1971. The preliminary studies showed vinyl chloride was carcinogenic at levels of 30,000 parts per million.

By November 1971, the MCA was aware that concentrations of 5,000 parts per million "and perhaps less" also could cause tumors in laboratory animals.

According to the latest World Health Organization (WHO) report, which summarizes a meeting held last June, a laboratory in Italy during that period — presumably Dr. Viola's — was also finding that concentrations as low as 500 parts per million could cause tumors, including angiosarcomas of the liver. Those results have not yet been published.

Subsequently, the European chemical industry sponsored another series of experiments by a second Italian scientist, Dr. Caesare

parts per million, NIOSH director Dr. Marcus Key told an Aug. 21 Senate hearing on vinyl chloride that at the meeting "No mention was made to us about liver cancer, and no mention was made to us about the name of the Italian scientist."

Only after B. F. Goodrich reported that its Louisville

plant physician, Dr. John Creech, independently discovered three cases of angiosarcoma did the trade association fully reveal the Maltoni findings to NIOSH officials. Even at that point, according to NIOSH sources, the MCA asked NIOSH to keep the findings secret.

Dr. Maurice Johnson, Goodrich's medical director,

confirms that he knew about the Maltoni study, but said that he saw no need to notify the company's plant physicians. "It was by no means a finished study," he said.

When Goodrich's Dr. Creech found the third case of angiosarcoma among plant workers, Dr. Johnson said, "that was the clincher."



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