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Finally, radiology indicates only a possible actual source of bleeding, and where two seen endoscopy has the unique value of demonstrating the true site of bleeding. Thus endoscopy should be carried out only when endoscopy proved negative.

Endoscopy in Relation to Management:

The value of early endoscopy in management is that it tells the clinician the site of bleeding and the nature of the underlying lesion. Since acute mucosal lesions often heal rapidly and may be difficult to deal with surgically, while chronic peptic ulcers tend to be inoperable and to be amenable to surgery, endoscopic examination could allow early decisions on management.

However, whether or not this will reduce mortality remains to be evaluated. Other possibilities from early endoscopy, such as reduction in transfusion and reduced hospital stay, must also be considered.

Emergency Endoscopy Services

For the best possible results endoscopy should be carried out within 24 hours of the patient's admission, although there is still a good diagnostic yield up to 48 hours after admission. Early endoscopy involves the endoscopist in much time and effort, and, if done in facilities with properly trained paramedical

staff are not easily available, it is prohibitively time consuming.

It is inconceivable that a district general hospital with one gastrointestinal consultant trained in endoscopy could provide an adequate service for acutely bleeding patients. Such hospitals planning to develop an endoscopy service should bear the manpower aspects carefully in mind when doing so. Ideally two consultants with the help of middle-grade medical staff trained in endoscopy should be employed in each hospital.

Requests for reprints should be addressed to J. A. H. F.

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Public Health

PROPORTIONAL MORTALITY AMONG VINYL-CHLORIDE WORKERS

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Summary In a proportional-mortality analysis of one hundred and sixty-one deceased workers in two plants using vinyl chloride, a 50% excess of deaths due to all cancer was seen. Specific sites of cancer with the greatest excess included stomach and biliary tract, lung, and brain. The excess of cancer was seen mainly in men who died after age 60. Also, there was a trend in time in the ratio of observed to expected deaths: since 1970 there have been twice as many cancer deaths as expected have occurred.

INTRODUCTION

In Feb. 15, 1974, four fatal cases of angiosarcoma of the liver among men who worked in a polyvinyl-chloride polymerisation plant were reported.¹ We present here a proportional-mortality analysis of all known deaths among workers in that plant. Also included are deaths in men who worked in a plant in which vinyl chloride is produced.

METHODS

Vinyl-chloride monomer is produced at a plant in Calvert City, Kentucky, and is polymerised into polyvinyl chloride at a plant in Louisville. These plants have been in operation since the late 1930s.

Whenever an active or pensioned employee at these plants dies, a copy of the death certificate is obtained. An abstract of the certificate is made and the certificate is sent to the insurance company. Using these sources, one hundred and sixty-one deceased White males who were employed at one of the two plants were identified. No information was available on workers who left employment before retirement. For all but nineteen a copy of the death certificate was obtained. For the remainder the cause of death as recorded in the company abstract was used. Deaths from 1947 through 1973 were ascertained. Of these deaths, one hundred and thirty-five occurred among Louisville workers and twenty-six were among Calvert City workers.

The distribution of causes-of-death was tabulated using the code on the death certificate. The expected distribution was calculated on the basis of proportional-mortality ratios for United States White males. The observed deaths from all causes were stratified into 5-year age/time-specific groups, and age/time/cause-specific proportional-mortality ratios were multiplied by these numbers to obtain the stratum-specific expected numbers.²

RESULTS

The patterns of mortality among workers in the two plants were similar, so all men were grouped together. As seen in table 1, a 50% excess of deaths due to cancer was observed ($\chi^2=5.7$, $p<0.02$). In addition to the four deaths previously reported,¹ a fifth man who died of angiosarcoma of the liver was identified. Also, there was one cancer of each of the following sites: gallbladder, common bile duct, and

TABLE 1—OBSERVED AND EXPECTED DEATHS IN VINYL-CHLORIDE WORKERS*

I.C.D. no.†	Cause of death	Observed	Expected	Obs./exp.
140-205	All cancer	161	161.0	1.0
150-159	Digestive	41	27.9	1.5
155	Liver and biliary tract	13	8.3	1.6
162, 163	Lung	5	0.7	11.0
193	Brain	13	7.9	1.6
200-205	Lymphatic and hematopoietic	5	1.2	4.2
	Other cancer‡	5	3.4	1.5
330-334	C.N.S. vascular	5	7.1	0.7
400-468	Circulatory	8	9.5	0.8
800-895	External	66	68.6	1.0
960-969	Suicide	22	24.5	0.9
	All other causes§	10	5.3	1.9
		24	30.5	0.8

* Expected numbers based on age/time/cause-specific proportional mortality ratios for U.S. White males.

† International Classification of Diseases, seventh revision.

‡ Nasopharynx 1, prostate 1, kidney 1, thyroid 1, undetermined 1.

§ Includes 2 cirrhosis (4.4 expected).

liver (type unspecified). There were five brain tumours—three glioblastoma multiforme and two of unspecified type. There was a 60% excess of cancer of the lung, of the following cell types: bronchogenic (one), anaplastic (one), adenocarcinoma (three), unspecified (eight). There were two unusual other types of cancer—thyroid and nasopharynx.

There was an excess of deaths due to suicide: ten observed and about five expected.

The observed and expected numbers of all cancer according to age and year of death are presented in table 11. Excess death due to cancer was seen primarily in men who died before age 60. There was a trend in the observed/expected ratio with year at death. Before 1965 no excess of deaths due to cancer was observed. However, since then there has been an increase in the proportion of death due to cancer, so that since Jan. 1, 1970, death from cancer has occurred twice as frequently as would be expected on the basis of U.S. vital statistics data.

TABLE 11—OBSERVED AND EXPECTED DEATHS DUE TO ALL CANCER ACCORDING TO AGE AND YEAR OF DEATH

Characteristic	Category	Observed	Expected	Obs./exp.
Age at death (yr.)	< 50	11	7.6	1.4
	50-59	17	8.1	2.1
	60+	13	12.2	1.1
Year of death	< 1965	12	11.4	1.1
	1965-69	10	7.3	1.4
	1970+	19	9.2	2.1

DISCUSSION

These data include the original four vinyl-chloride workers who were known to have died with angiosarcoma of the liver. Four other workers with fatal cancer of the liver and biliary system have been identified. In addition, there is a suggestion that at least two other types of cancer—lung and brain—appear with excess frequency in vinyl-chloride workers. It also appears that the relative frequency of all cancers is increasing with time. While no projection may be made with certainty, additional excess cancer among vinyl-chloride workers would seem likely.

An analysis using proportional-mortality ratios does not take into account the absolute risk of dying in the population being studied. Thus, it is possible that the mortality-rate in the vinyl-chloride workers is less than that of the United States population. For example, the mortality in White steelworkers was 86% of that expected¹ and in White cotton textile workers 79% of that expected.² However, even if each of the observed/expected ratios in table 11 were multiplied by 0.8 (80%) an excess of cancer, especially of the liver and biliary tract and brain, would prevail. Further, the increase with time in the ratio for all cancers would still be observed, since each of the observed/expected ratios in table 11 would be multiplied by 0.8.

Another theoretical objection to a proportional-mortality analysis is that a high ratio of observed to expected deaths may be due either to an excess of one cause of death or a deficit of another cause of death. Based on the data in table 1, it seems most likely that the high ratio for cancer reflects an excess of cancer, since the ratios for each of the four major categories other than cancer are all in the range of 0.8-1.0.

It will be several years before a final conclusion can be made with respect to the carcinogenic potential of vinyl chloride. Since any harmful effect in an individual may require many years of exposure, we believe that current exposure must be controlled.

Requests for reprints should be addressed to R. R. M.

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Packaging for Safety

HOSPITAL admissions of children with suspected accidental poisoning by medicines are not on the increase, and death of the child is a very unlikely result of such incidents. All the same, the work-load involved, the unpleasant nature of the treatment, and the worry to parents justify a hard look at any proposal to make medicines safer. A working-group of the Medicines Commission has just reported on the packaging aspects of this question.¹ The working-group opposes the compulsory introduction of reclosable child-proof containers and comes down in favour of a step-wise introduction of non-reclosable containers, where potentially dangerous tablets and capsules are packed in individual units in strip or blister packs. Among the objections to the reclosable containers comes one from the Department's lawyers; under the draft British Standard such containers would need to be tested on children who would have to be taught how to open them to see if they were capable of repeating the operation. If a child so tutored poisoned himself the testers might be held liable. But the D.H.S.S. legal division adds a further objection: "the position in law is that no parent or guardian of a child of tender years is entitled to give consent to any procedure which is not for the benefit of the child." Medical research workers have long feared that this was so, but has the Department, now the commissioner of much clinical research, stated this publicly before?

¹ Medicines Commission. Report on the Presentation of Medicines in Relation to Child Safety. Obtainable from the D.H.S.S., 33 St Finsbury Square, London EC2A 1PP.

Letter

ACRODERMATITIS
LETHAL INHIBITION
DEFICIENCY

SIR,—Last year we described a child under treatment for acrodermatitis, a condition of which requires a synthetic diet containing either glucose or fructose in addition to sucrose (Diodoquin).¹ Small amounts of sulphate daily led to restoration of normal growth and the child stubbornly resisted a change of therapy. Review of the case revealed that it had been months and it appeared responsible for delay in the child's rapid return to normal, as did the child's prompt and complete response to the diet.

It was then appreciated that the pathogenesis of the clinical improvement was, as shown by the child's rapid return to normal, the return of normal body weight tested clinically of the remaining eight patients under my care. Hattie, and at the time completely from the diet.

All of the children were and are thriving; furthermore they enjoy rapid increase in the all the children (except soon as zinc was added, conspicuous when diodoc the patients has had the last patient in indicates that quite physiological limits of zinc sulphate daily) a complete relief of symptoms daily intake seems to doses, in order to deal and the like, in which the element. Puberty require increased a cope with the growth that Prasad and his alkaline phosphatase plasma of zinc-deficient and hypogonadism.

High doses of zinc are well tolerated by children known to have the known toxic limit.

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