**CORRESPONDENCE**

Exposure to asphalt or bitumen fume and renal disease

Editor,—The correspondence from Dittmer and Armitage provides further support for a causal association between exposure to various hydrocarbons and the development of renal disease. Since 1912, some case reports, case-control studies, and cross sectional studies together with animal experiments have provided compelling evidence for a causative role for hydrocarbon exposure in the development of both tubular and glomerular lesions.

We now report the case of a road worker exposed to asphalt and bitumen fumes who presented in 1990 at the age of 36 with nephrotic syndrome. He was then normotensive, had proteinuria with 24 hour urinary protein of 12.2 g, showed some clinical oedema, and his renal biopsy was consistent with a diagnosis of stage 2 membranous glomerulonephritis. Later that year he presented with an unexplained deterioration in renal function. This followed several weeks of abdominal pain, and he then had haematuria without pyuria, serum creatinine of 208 µmol/l with his previously normal value of 85 µmol/l, and a marked deterioration in his renal biopsy with 20 glomerular profiles per section and tubulointerstitial scarring occupying 40% of the biopsy.

Before developing renal disease, the patient had been employed as a road worker for more than 10 years, during which time he was repeatedly exposed to intermittent but high concentrations of asphalt or bitumen fumes. Since the diagnosis of nephrotic syndrome due to membranous glomerulonephritis, the patient stopped being exposed to asphalt and bitumen fumes. Subsequent assessments of proteinuria have shown a reduction of up to 50% from 12 to 5 g/day. However, he currently is hypertensive with serum creatinine 170 µmol/l, urea 10.4 mmol/l, serum albumin 30 mmol/l, and 24 hour urinary excretion of protein 5.0 g.

Searches of the scientific literature in 1990 and subsequently have not found any specific references to exposure to asphalt or bitumen and renal disease. We therefore investigated the issue further by means of (a) detailed fume analyses, and (b) a study of the renal health of road workers exposed to asphalt or bitumen. It was clear from the fume analyses that exposures in this industry include a wide range of aromatic and aliphatic hydrocarbons. Time weighted average exposures ranged from 0.4 to 8.9 mg/m³ measured as total organic fume (not including inorganic particulates), but short term or peak fume exposures were as high as 300–900 mg/m³.

During all his years exposed to these fumes, the patient had never been provided with or worn respiratory protective equipment.

The study of renal health included 92 people regularly exposed to asphalt or bitumen fumes as road workers, 38 hard rock quarry workers not occupationally exposed to hydrocarbons, and 43 office workers also not exposed to hydrocarbons.

Each participant was given a questionnaire which included questions about occupational and recreational exposures and medical history including renal disease. Urine and blood samples were collected for urinary chemistry, blood biochemistry, and microscopic analyses. Any person with an abnormal finding on blood or urine analyses were tested and examined by a nephrologist to assess the presence or otherwise of renal disease.

The criteria which determined an abnormal test result were as follows: (a) persistently raised serum creatinine >120 µmol/l; (b) persistently raised serum urea >7.5 mmol/l; (c) persistent microscopic haematuria or pyuria; (d) 24 hour urinary protein >150 mg/day; or (e) corrected creatinine clearance <90 ml/min.

The presence of renal disease was determined as pre-existing or idiopathic according to the following criteria: Pre-existing renal disease: (a) family history or history of renal disease; (b) abnormal renal ultrasound. Idiopathic renal disease: (a) no known cause for abnormalities; (b) abnormal creatinine, urea, and creatinine clearance; (c) abnormal proteinuria; or (d) abnormal urinalysis—haematuria or pyuria.

The findings of the study are summarised in tables 1–3.

We concluded from this study that: (a) workers regularly exposed to asphalt or bitumen fumes were far more likely to have evidence of early stage renal disease than those working in a quarry or office; (b) workers regularly exposed to asphalt or bitumen fumes were far more likely to have at least one abnormal renal function test than those working in a quarry or office; and (c) the renal dysfunction was non-specific, but the overall findings were consistent with previous findings—such as those from the similar study done by Yaqoob et al. We think that chronic glomerulonephritis and chronic tubulointerstitial nephritis are renal diseases which may result from exposure to hydrocarbons—such as those experienced from asphalt or bitumen fumes generated during road making.

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Sydney, NSW, Australia

GAVIN CARNEY
The Canberra Hospital, Canberra ACT, Australia

Correspondence to: Dr David Douglas, Locked Bag 14, Edgecliff NSW 2027, Australia.

2 Anderson K. Acute nephritis due to turpentine absorbed by the skin. BMJ 1912;3:861.

Authors’ reply—The report of Douglas and Carney of a further case of renal disease associated with hydrocarbon exposure, together with their cross sectional findings of those with prolonged exposure to bitumen and asphalt further strengthens the case for an association between renal disease and hydrocarbon exposure. Yaqoob et al have also convincingly shown, that in particular, proteinuria may be associated with hydrocarbon exposure.7

This highlights the need for a careful occupational and social history to be taken at the time of presentation. This case also highlights the need for performing a renal biopsy in adults presenting with unexplained proteinuria. If interstitial nephritis is found then a short course of steroids may result in a dramatic improvement in renal function as we noted in the case of our patient exposed to...

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**Table 1 Age and blood pressure**

<table>
<thead>
<tr>
<th>No exposure</th>
<th>Office</th>
<th>Quarry</th>
<th>Exposure to bitumen or asphalt</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>People (n)</td>
<td>43</td>
<td>38</td>
<td>92</td>
<td>173</td>
</tr>
<tr>
<td>Age (mean)</td>
<td>39</td>
<td>32</td>
<td>35</td>
<td>36</td>
</tr>
<tr>
<td>BP (mean systolic)</td>
<td>133</td>
<td>131</td>
<td>133</td>
<td>133</td>
</tr>
<tr>
<td>BP (mean diastolic)</td>
<td>86</td>
<td>83</td>
<td>83</td>
<td>84</td>
</tr>
</tbody>
</table>

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**Table 2 Renal disease**

<table>
<thead>
<tr>
<th>No exposure</th>
<th>Office</th>
<th>Quarry</th>
<th>Exposure to bitumen or asphalt</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of people</td>
<td>43</td>
<td>4 (9.3)</td>
<td>2 (5.3)</td>
<td>1 (1.1)</td>
</tr>
<tr>
<td>Pre-existing renal disease (n (%)) NS</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>12 (13.0)</td>
<td>12 (6.9)</td>
</tr>
</tbody>
</table>

**p<0.001.**

---

**Table 3 Renal function**

<table>
<thead>
<tr>
<th>No exposure</th>
<th>Office</th>
<th>Quarry</th>
<th>Exposure to bitumen or asphalt</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>People (n)</td>
<td>43</td>
<td>38</td>
<td>92</td>
<td>173</td>
</tr>
<tr>
<td>Haematuria</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Proteinuria</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Raised creatinine</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>At least one abnormality (n (%)) NS</td>
<td>4 (9.3)</td>
<td>2 (5.3)</td>
<td>24 (26.1)</td>
<td>30 (17.3)</td>
</tr>
</tbody>
</table>

**p<0.01.**
Cancer risk in the rubber industry: a review of recent epidemiological evidence

ERROR—Although the comprehensive review of the rubber industry reported by Kogevinas et al only considers papers published after 1982, several of these studies relate to groups of workers from much earlier eras—for example, 1910 for the German study, 1946 for the British Rubber Manufacturers Association (BRMA) study, and Veyss studies. By considering the findings of these earlier rubber workers along with studies of more recent groups of workers we are getting a picture of 80 years of cancer experience in the industry, which is not the same as the situation that exists today.

It should also be borne in mind that the very large cohort studies—such as the 34,000 workers in the BRMA study—have very much greater statistical power than those of the smaller studies, in which confounding factors and the role of chance are more difficult to evaluate. This does not seem to have been fully taken into account and indeed Kogevinas et al tell us that they have not “paid much attention to statistical significance”. This is disappointing as it is the omission of a full meta-analysis of the studies, which if it had been carried out, would have added considerable weight to their conclusions.

In general, the review would seem to endorse and reflect the evaluation by the International Agency for Research on Cancer (IARC) of the industry in the 1987 monograph, supplement 7—a moderate increase in risk of cancer at several different organ sites which are not consistently found in similar studies carried out in other parts of the world. Evidence suggests that there is a peculiar reflection on safety factors in the IARC evaluation in 1982, monograph 28, that there was “sufficient evidence for a causal association” between work in the rubber industry and developing cancer. The issues of general industrial health and possible compensation or litigation also need to be considered.

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ALISON J ARMITAGE
Plymouth Hospital, New Zealand


Cancer risk in the rubber industry: a review of recent epidemiological evidence

Kogevinas et al have given an interesting and important overview of health hazards observed in rubber workers employed during the past 80 years and I agree with him that more relevant, modern, and comprehensive epidemiology is necessary if we are to obtain a true picture of the situation today.

J K STRAUGHAN
British Rubber Manufacturers Association, Salsa House, Hollaway Circus, Birmingham B1 1EQ, UK


Although he concurs with the use of skin prick tests as an index of sensitisation, Kend- 
rick expresses reservations about my evidence of causality in respect of chest symptoms from u-amylase. This is understandable if I relied solely on his condensation of an already condensed report. Although my report re- 
vived from a comprehensive ongoing investi- 
gation, I had hoped I had summarised sufficient information to make my point.

His reservations seem to derive from the fact that papain was also handled in the 
workplace, and that some of those sensitised to u-amylase were also sensitised to papain.

At this factory papain and u-amylase were handled in pure form, seldom, and at different times and places. The association between handling one or other material and the development of symptoms was clear cut, and because of the short period of handling, with intervals of at least a month between these periods, there was time for symptoms to regress between exposures.

I had already validated a skin prick test for papain sensitivity, and was able to use the same test with u-amylase, and found a similar high level of sensitisation for both enzymes. Positive prick test findings seemed to confirm the specificity and likely mechanism of the typically asthmatic symp- 
toms from each enzyme.

Had I had any reasonable doubt as to cau-
sality I would not have published the 
warning. Happily, subsequent reports, in-
cluding the excellent one by Aitkin et al., 
of which Kendrick is a co-author, which in-
cluded inhalation challenge tests with fungal 
-u-amylase,1 have endorsed my conclusions and added further knowledge.

MICHAEL H FLINDT
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Editor.—In a letter to you,1 Hendrick points out that tabulated allergens to u-amylase and papain,2 makes generous reference to my other work on enzymes.

For clarification, I should point out that the evidence, supported by the findings with of amylase, that sensitisation and consequential symptoms may occur from proteases inde- 
dependently of proteolytic activity, must not obscure the fact that the proteolytic mechanisms may cause other clinical and subclinical effects. As well as skin irritation, non-
sensitised people may experience epistaxis or haemoptysis, whereas rhinorrhea or asthma are more likely to be due to allergy. Propensity to cause proteolytic effects varies between different proteases, and susceptibil- 
ity to such effects varies between people.1 I think I have experienced such effects myself, and possibility long term consequences have been described.

Occupational asthma due to amylase

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ity to such effects varies between people.1 I think I have experienced such effects myself, and possibility long term consequences have been described.

Health of children born to medical radiographers

Editor.—There are increasing concerns that parental workplace exposure to potentially hazardous agents could affect the health of future offspring. Since radiation is known to be a hazard to reproductive and later develop- 
mental outcome for parents exposed to medical x-rays, this study was undertaken in order to establish whether there were any long term effects on the health of their children. The study was a retrospective cohort study of all children born to parents employed in the medical radiation field in the UK between 1960 and 1980. The parents were classified into two groups: those who had been exposed to radiation and those who had not.

The results showed no statistically significant differences in the incidence of congenital anomalies, malignancies, or other health problems between the exposed and unexposed groups. However, there was a trend towards an increased risk of certain types of anomalies in the exposed group, particularly congenital heart defects. The study also found that the risk of childhood cancer was slightly increased in the exposed group, but this did not reach statistical significance.

These findings suggest that parental workplace exposure to medical radiation may have some long term health effects on their children, particularly increased risk of congenital anomalies and childhood cancer. Further studies are needed to confirm these findings and to determine the exact mechanisms underlying these effects.
of epidemiological associations, and reliance on personal memory will not provide the detailed data which allow chromosomal abnormalities to be grouped in a meaningful way when exploring possible environmental influences. The study of Roman et al. illustrates the need to confirm diagnoses reported in questionnaires whenever possible, and to obtain any additional information that may assist in the scientific evaluation of epidemiological results.

E JANET TAWN
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BOOK REVIEWS


The section entitled "Statistical methods: cross sectional study" (page 687) should read: In the cross sectional study, crude prevalence and age adjusted (Mantel-Haenszel) relative prevalences (95% confidence intervals (95% CIs)) were calculated by occupational group for the following outcomes: age adjusted hearing loss at 1–6 kHz greater than 30 decibels (dB) in either ear, pathological findings at lung auscultation (which were defined as rales, rhonchi, or crackling), forced expiratory volume in one second (FEV1) less than 80% predicted, diastolic blood pressure (DBP) \( \geq 95 \) mm Hg, abnormal findings in the electrocardiogram (ECG), body mass index (BMI) >27.8 kg/m\(^2\), \( \geq 95 \) mm Hg (not diastolic blood pressure >95 mm Hg).

The authors deeply regret these errors, which do not alter the conclusions of the paper. We kindly ask the reader to comply with these corrections when interpreting the data presented in tables 2 and 3.

CORRECTION


As indicated by the title, this book is the eighth in a series of proceedings on inhaled particles. These international symposia, held in 1960, 1965, 1970, 1975, 1980, 1985, 1991, and 1996 at various venues in the United Kingdom, were all sponsored by the British Occupational Hygiene Society (BOHS). Since the 1975 meeting, the proceedings were also issued simultaneously as special issues of the BOHS journal Annals of Occupational Hygiene. These symposia and their proceedings have served as landmarks documenting the state of the art in knowledge and techniques concerning human exposures to airborne particles, their deposition and clearance within the respiratory tract, and their health effects.

The broadening depth and scope of the symposia to now include radioactive, outdoor and indoor particulate matter have put a great strain on the organisers and especially on the editors. Additional pressure resulted from the fact that the two previous proceedings did not appear until three years after the meetings. Thus, the publication of this volume only one year after the symposium is a significant accomplishment and a tribute to the dedication of its new editors. A price for this accomplishment was the restriction of the 127 papers to four to six pages each, and the elimination of external peer reviews. The reviews and editing were done by the editors alone. Also, for the first time, there were no abstracts included in the papers and the questions from the audience, and authors' responses, that were notable features of the earlier volumes, were not included.

The quality of the papers and editing remain at a high level, and this volume should be a valuable addition to the bookshelf of all workers interested in the health effects of airborne particles. It may be that the price is high enough to limit its reachability.

MORTON LIPPMANN


Airborne fibre concentrations have been evaluated by the membrane filter method for over 30 years. The original method, which was developed for use in asbestos factories, has been adapted for use with many different types of fibre in both occupational and non-occupational situations. By the 1970s it was clear that there were substantial differences between laboratories when evaluating the same samples. Much of this could be attributed to variations in the detailed methodology and this started the quest to devise a "standardised" version of the membrane filter method. This book is the latest attempt to standardise the method. On this occasion to harmonise methods used for analysis of asbestos—for example, the European Reference Method (ERM) used throughout the European Union, with the previously published World Health Organisation method for man made mineral fibres (rockwool and glasswool). The new method is applicable to all fibre types, both organic and inorganic.

The method specification is contained within 17 statements which are supplemented by more detailed descriptions. It contains details of everything required from the type of filters to be used to the characteristics of the fibres to be counted. The accuracy, precision, and lower limit of measurement are also provided.

This is a specialist book which will be of limited interest to those not directly involved with measurement of exposure to fibres. However, it is clearly the authors' intentions to influence the appropriate national authorities to incorporate this version of the membrane filter method into their legislation. If this method does replace the ERM then measured fibre concentrations would probably increase, for some industries by perhaps as much as 50%. The implications for epidemiological studies, risk assessment, and standards setting need to be carefully considered.

JOHN W CHERRIE


This book is aimed at managers and others who wish to obtain an understanding of the principles of occupational safety and health in the United Kingdom. It is published by the Institution of Occupational Safety and Health (IOSH) and it is the recommended text for their safety appreciation course, Managing Safety.

The text is divided into four sections: safety technology, occupational health and hygiene, safety management techniques, and law. There are 68 short chapters which cover the essential factual information required by someone responsible for managing health and safety. Each chapter includes several self assessment questions and a bullet point sum-

BOOK REVIEW

Book review editor: R L Maynard

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This book, one of a series of reviews produced by the World Health Organisation (WHO) Health and Environment, provides a useful summary of the current understanding of the risks associated with both asbestos and more importantly, and less well-known, man-made mineral fibres. It provides useful baging of the lung function on the many types of fibre produced and used in industry and documents comprehensively the amount and types of fibre to be found in materials and in buildings in the United Kingdom. The book is risk to both healthy living and malignant and is hence too succinct to be used as a textbook in other situations. There are extensive commendations for further reading, although these are almost exclusively publications from the United Kingdom Health and Safety Executive or British Standards.

The index is particularly poor and seems to have been naively compiled with some completely unnecessary entries, which are unhelpful—for example, 45 entries referring to employees—or irrelevant—for example, an entry for yawning in respect of someone who has received an electric shock. The book is a useful resource for managers and others in the United Kingdom who plan to attend a basic course in health and safety. The sections on legislation give a good overview of the relevant acts and regulations, although they are probably insufficient to act as a reference for those trying to comply with the law.

JOHN W CHERRIE


Although the harmfulness to health of asbestos was originally described at the end of the 19th century, it was only in the 1960s after the publication of the seminal paper on mesothelioma in South African crocidolite workers by Wagner et al that general attention was drawn to these problems. The possibility that hazards from asbestos might extend to the general population rather than simply to workers in the asbestos industry gradually gained currency through the 1970s until in the 1980s the educated and reading public were informed by their newspapers that inhalation of as little as one fibre of the mineral could prove fatal. The debate on the risks associated with exposure to asbestos became extremely polarised in the United States, resulting in widespread and inappropriate actions by asbestos from buildings where it was found, thus putting at risk a large and relatively unprotected workforce of asbestos removal men.

As asbestos has proved to be an exceptionally useful material, industry naturally has required substitutes and various other fibrous minerals have been produced, increasingly since the 1930s. Of these the most common are used in insulation as rockwool and glasswool. As the fibres that make asbestos dangerous, namely fibre size and resistance to degradation are also those that make it industrially useful, concern has been raised as to whether such materials might imply similar risks to health.

This volume provides a powerful reminder, if such is needed, that tobacco use is a global phenomenon, with one third of adults now smoking, and two thirds of those residing in developing countries. The premise on which the report is that widespread tobacco consumption and public health are mutually incompatible, but readers seeking a comprehensive collation and consideration of the epidemiological evidence linking smoking and ill health will be disappointed. It is apparent that the WHO intends these data to be a baseline for a global programme of surveillance of smoking habits and tobacco control. Evidently much more work is needed to compile a similarly comprehensive account of the effects of tobacco use on health in many countries, particularly in the developing world. A valuable addition to future editions would be evidence from countries with well developed tobacco control policies of the extent to which lowering smoking prevalence reduces death and disability. This might encourage much needed policy initiatives in many other countries where tobacco control has yet to achieve prominence on the public health agenda.

DAVID P STRACHAN


This monograph gives full details of a study conducted to test the Gardner hypothesis—namely, that childhood leukemia and non-Hodgkin’s lymphoma result from the father’s
exposures to ionising irradiation before conception. This study has also been published as a paper in the BMJ, but this volume goes into far greater details than is available elsewhere. This is very much a book for the concerned specialist reader who wants the technical background to the BMJ article.

This study is essentially a record linkage exercise. The exposed fathers (and mothers) were defined as having records with the National Registry for Radiation Workers (NRRW) held by the NRPB. This is a database of over 120,000 people and it was linked with the national register of childhood tumours, a database of over 50,000 children with all types of cancers. Two other data sources on childhood cancers were also included.

For the three sources of data on childhood tumours, controls were found in various ways to ascertain if these children had a father in the NRRW. The parental estimated doses were created from the NRRW. In all a total of 200 fathers and mothers were linked to children with cancer. Eighty two children with leukaemia or lymphoma were linked to fathers’ records at the NRRW, as were 79 control fathers. The corresponding numbers for mothers were 15 and three.

The cases in the original Gardner paper were excluded and the results for fathers showed that case fathers had a 1.77 significant excess risk over control fathers for having a child with leukaemia or lymphoma. However, the risk was associated with the lowest dosages and there were no dose responses in any of the comparisons. In this sense the Gardner hypothesis is refuted!

Furthermore, the risk in mothers was also significantly and greater in magnitude than the fathers. However, the small numbers make this result unreliable and difficult to use to extrapolate risk.

The explanation of the association found in these NRRW members exposed to low doses is not known. It could be chance, it could also be due to misuse of film badges by those in high risk industries. This explanation is unlikely in that the cancers were distributed widely across industries in the United Kingdom and were not confined, by any means, to the nuclear reprocessing or related industries. It may be due to other exposures associated with the wider radiation industries where many other hazardous substances exist as well as ionising irradiation. Finally, it could be some other, more subtle aspect, of wearing a film badge. The authors speculate that this might be associated with the mobility of the parents, thereby linking these results with the Kinlen hypothesis which is based on ideas of infectivity associated with population mixing.

They do not produce evidence to suggest that film badge wearers are more mobile than other professions but the differences in behaviour may be more complex.

Further light might be shed on this association when the nuclear industry family study (NIFS) is analysed shortly. This study will answer some criticisms of the present study. For example, it is known that there are differences in behaviour of people within the nuclear industry and those outside it. The NIFS uses internal comparisons and so such differences can be accounted for.

Despite the lack of any explanation of this observation attention is now bound to be focused on other preconceptional and periconceptual exposures in both sexes and their possible links with childhood malignancies.

R A CARTWRIGHT