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, 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 not exposed to hydrocarbons.

Each participant was given a questionnaire which included information on 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.

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>

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>38</td>
<td>92</td>
<td>173</td>
</tr>
<tr>
<td>Pre-existing renal disease (% NS)</td>
<td>4 (9.3)</td>
<td>2 (5.3)</td>
<td>1 (1.1)</td>
<td>7 (4.0)</td>
</tr>
<tr>
<td>Idiopathic renal disease (%)**</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>12 (13.0)</td>
<td>12 (6.9)</td>
</tr>
</tbody>
</table>

**p<0.01.

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>17</td>
<td>17</td>
</tr>
<tr>
<td>Raised serum</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Creatinine</td>
<td>At least one abnormality (n (%))**</td>
<td>4 (9.3)</td>
<td>2 (5.3)</td>
<td>24 (26.1)</td>
</tr>
</tbody>
</table>

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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Authors’ reply.—The report of Douglas and Carney of a further case of renal disease associated with hydrocarbon exposure, together with their cross sectional study 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.¹

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...
Yaqoob M, Bell GM, Stevenson A, et al. Renal injury from exposure to 4-aminobiphenyl and 4-naphthylamine was not used in these studies. The Veys studies* (4 000 workers) followed up for 40 years. The Veys studies** (3 400 workers) carried out in this domestic epidemiology enable us to conclude, with considerable confidence, that in the United Kingdom occupational leukaemia was never a factor and that the problems of bladder cancer were not significant in the 1940s with the discontinued use of chemicals contaminated with β-naphthylamine. These studies also showed a small but nevertheless significant excess of stomach, lung, pharyngeal, and oesophageal cancers. With more detailed analysis, however, and consideration of confounding and socioeconomic factors, the occupational importance of these excesses seems to be less clear as time goes on. Geographical and confounding factors, and a lack of a clear time-dose response also lessen the possibility of occupational causes.

Having expressed our confidence in the United Kingdom findings, I re-emphasise that they are largely based on results from an earlier generation of rubber workers and that their experience may not be the same as the currently employed in a modern day rubber factory.

So that we may investigate more recent experience, the BRMA initiated a further collaborative project with Birmingham University, to carry out a new study of its members’ employees. The collection of data for this study will continue this year and it includes nearly 10 000 male and female workers with at least 12 months of employment and who were first employed between 1982 and 1991. This study involves 42 rubber factories engaged in manufacturing the full range of rubber goods. This cohort study will look at both cancer incidence and mortality and make full use of all available occupational hygiene and exposure data. Examination of the health experience generated by the study to date will take place later this year to see if there is sufficient information for a full analysis to be carried out or whether it would be appropriate to delay this until more data are available.

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

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

EDITOR—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)† and Veys 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 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’ of a moderate increase in risk of cancer at several different organ sites. It does not allow definite conclusions to be drawn yet.

Considerable heterogeneity exists between and within countries in exposure circumstances in the rubber industry. What we did in our review was to give a picture of the evidence for a causal association in this industry. This overall picture does not apply to all countries, nor to all periods. However, an overall picture may highlight conditions that are not easily recognised at a local level. One example is the identification of an increased risk for laryngeal cancer, which had not been previously reported although it seemed consistent between centres. Another example is the identification by Straughan (and others), that the British studies do not indicate an excess risk for bladder cancer after the discontinuation of use of β-naphthylamine. What is usually meant is that there was no significant excess risk, which is correct. What can be distinguished, however, looking at the overall picture (see figure 1 of our review) is a small but consistent excess risk for bladder cancer even in studies conducted in relatively late periods. There is a lack of detailed exposure information in most studies but it is probable that β-naphthylamine was not used in these late periods. We agree with Straughan that it is difficult to exclude the possibility that the observed small excess risk is due to a late effect of early exposures.

The findings of the large BRMA study are, indeed, more stable (statistically) than those of studies in the Nordic or other countries, but they are not necessarily either more or less confounded than those of other studies. We understand Straughan’s plea for a full meta-analysis in which large studies are not given the same weight as small studies. The variability of exposures over time, geography, and process argue against performing a meta-analysis which presumes homogeneity of exposure.

It is commendable that the BRMA has been and continues to be actively involved in examining risk of cancer among workers in the rubber industry. It would be interesting to see how a new study initiated by the BRMA will do justice to the concluding sentence of our paper: “The preventive measures taken in the rubber industry in recent years may decrease risks, but this has not been documented yet in epidemiological studies”.

Author’s reply—We thank Straughan for his comments. We agree that some of the studies we reviewed provide a picture of 80 years of cancer experience in the industry, which is not the situation existing today (in industrialised countries). We tried to identify and report separately for studies examining workers first employed before and after 1982. These studies did not clearly indicate the absence of an excess risk of cancer. Unfortunately the number of subjects and cancer deaths or cases in these studies is small and does not allow definite conclusions to be drawn yet.

Manolis Kogevinas
Maria Sala
Respiratory and Environmental Health Research Unit, Institut Municipal d’Investigació Mèdica, Barcelona, Spain


Inhalation of ammonium nitrate fuel oil explosive (ANFO): and possible concomitant exposure

EDITOR,—Donoghue1 reports on respiratory symptoms and rhonchi in a miner after exposure to ammonium nitrate fuel oil explosive (ANFO). As diesel fuel is the most commonly used fuel in ANFO the vapour he refers to might be components of diesel fuel. He excludes concomitant exposure to nitrogen dioxide because the inhalation occurred before any explosion took place. Although diesel powered machines are commonly used in underground work he does not discuss possible exposure to diesel exhaust. We have measured up to 15 ppm nitrogen dioxide during construction of a tunnel where the exposure to ammonium nitrate fuel oil explosive (ANFO) was very high. We have not been able to find any reports where similar concentrations of nitrogen dioxide were measured in the tunnel concerned or during the explosion. The miner has not worked with ANFO explosive since the tunneling operation where the high concentrations of nitrogen dioxide occurred. We would like to observe that the miner has respiratory symptoms and rhonchi and we would like to repeat the exposure to correct this situation.


6 Flindt MLH. Respiratory hazards from papain. Lancet 1978;i:430–43.

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.

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BOOK REVIEWS

Correlation, Correction, Book reviews


The section entitled "Statistical methods: cross sectional study" (page 687) should read:

In the cross sectional study, crude preval- ence and age adjusted (Mantel-Haenszel) relative prevalences (95% confidence intervals (95% CIs)) were calculated by occupational group. 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 (FEV,) less than 80% predicted, diastolic blood pressure (DBP) ≥ 95 mm Hg, abnormal findings in the electrocardiogram (ECG), body mass index (BMI) ≥ 27.8 kg/m², γ-glutamyl-transpepti- dase (GOT) > 28 U/l (measured at 25°C), reduced mobility of the spine (fingertips to floor test, Schober sign), local pain at the spine or tenderness of the paravertebral muscles (assessed by the paravertebral muscles and percussion of the spine), abnor- mal findings in the limbs (limited or disturbed mobility, pain, swelling, deformation, or am- putation) and skin abnormalities (eczema or inflammation, itching, or dyslalia).

Also corresponding headings in tables 2 and 3 (page 688) should read age adjusted hearing loss ≥ 30 dB (not hearing loss at 2, 3, and 4 kHz >105 dB) and diastolic blood pressure ≥ 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.

MORTON LIPPMAANN


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 differ- ences between laboratories when evaluating the same samples. This method is applicable to all fibre types, both organic and inorganic.

The method specification is contained within 17 statements which are supple- mented by more detailed descriptions. It contains details of everything required from the type of filters to be used to the characteris- tics 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 clear that the authors’ intentions to influence the appropriate national authori- ties to incorporate this version of the membrane filter method into their legislation. If this method does replace the ERM then measured fibre concentrations would prob- ably increase, for some industries by perhaps as much as 50%. The implications for epide- miological studies, risk assessment, and standards setting need to be carefully consid- ered.

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 recommend text for their safety appreciation course, Managing Safety.

The text is divided into four sections: safety technology, occupational health and hygiene, safety management, risk assessment, 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-
This book, one of a series of reviews produced by the World Health Organisation’s Environment and Health, 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 and informed information 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. After recognising the difficulties of measuring tiny respirable fibres, it summarises the scientific literature on fibre concentrations to be found in the general and occupational environment and makes estimates of the exposure of the United Kingdom population. There may well be a case to be made for using this book as a basic guide to the fibres debate, but perhaps not as a guide to the fibres debate, but perhaps not 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 commonly misspelled entries 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. There is a rare 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 being 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 action to eliminate 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 asbestos substitutes 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.

Anthony Seaton

Tobacco Or Health: A Global Status Report.


“Every 10 seconds, another person dies as a result of tobacco use”. This is the stark introductory sentence to this reference book compiled by the World Health Organisation as a source of standardised baseline information on tobacco production, trade, consumption, health effects, and control in WHO member states. The book is divided into two parts: the first, comprising 60 pages, attempts to summarise the global situation in the late 1980s and early 1990s. The second and larger part provides a series of “country profiles” for each of the member states, typically of one or two pages. These list the latest available information on demographic and general health indicators, tobacco production, trade and industry, tobacco consumption, and smoking prevalence by age and sex, and national tobacco control policies and programmes.

Designed as a reference text, this is not a book to be read from cover to cover. Its strength is the near comprehensive coverage of national statistics on tobacco production and use, which are usefully summarised in part one. These may suffice for readers with an epidemiological background, among whom the adverse health effects of smoking are taken for granted. For a more general readership, however, a notable weakness of this book is the paucity of information on the health consequences of tobacco use. The relevant chapter in the first part runs to only five pages, including four tables, and is supported by only two references, one of which is yet to be published (although the book was compiled as a series of recent articles in the Lancet). The discussion of health effects is entirely focused on mortality, mainly from broad groups of causes, such as total mortality, and cancer deaths. Remarkably, there is no mention of the disability and loss of productivity related to cardiovascular and respiratory diseases, nor of the consequences of environmental tobacco smoke. Where the health effects are assessed for individual countries in part two, figures are provided mainly for developed countries and relate principally to estimates of tobacco related deaths and trends in mortality.

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 upon which the report is based is that widespread tobacco consumption and public health are mutually incompatible, but readers seeking a comprehensive collation and consideration of the epidemiological evidence on 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 needs to be done 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

Cancer in the Offspring of Radiation Workers: A Record Linkage Study.


This monograph gives full details of a study conducted to test the Gardner hypothesis—namely, that childhood leukaemia 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

Inhalation of ammonium nitrate fuel oil explosive (ANFO): and possible concomitant exposure.

P Søstrand

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