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THE INDUSTRIAL INJURIES ADVISORY COUNCIL

POSITION PAPER 21

TESTICULAR CANCER IN FIRE FIGHTERS

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Testicular cancer in fire fighters

Position paper 21

Summary

1. This position paper details the Industrial Injuries Advisory Council's (IIAC) review of an association between testicular cancer and fire fighting. To recommend to Ministers that a disease be added to the list of prescribed diseases for which Industrial Injuries Disablement Benefit (IIDB) is payable, the Council generally seeks robust epidemiological (population-based) evidence that the risk of the disease is more than doubled in relation to certain occupational exposures. Studies have noted an increased risk of testicular cancer in fire fighters, but it is not clearly greater than doubled. The Council concludes that, at present, there is insufficient evidence to recommend prescription for testicular cancer in fire fighters.

Introduction

2. In 2007 the Industrial Injuries Advisory Council's (IIAC) attention was drawn to a review and meta-analysis, undertaken by a Working Group of the International Agency for Research on Cancer (IARC), indicating that risks of testicular cancer were doubled among male fire fighters [1].

3. Fire fighters are potentially exposed to many toxic combustion products, including several probable or possible carcinogens. Levels of short-term exposure to respirable particulate matter, benzene, benzo[a]pyrene, 1,3-butadiene, and formaldehyde may occasionally be high. Accordingly, the Council has undertaken a literature review to assess the risks of testicular cancer in fire fighters. This paper sets out the Council's position following this review.

4. Testicular cancer is a comparatively rare disease. Around 2,000 cases are diagnosed in the United Kingdom each year. However, it is the commonest cancer affecting men aged 20 to 39 years. The usual presenting symptom is a lump or swelling in part of one testicle, which is often painless. Treatment for testicular cancer is usually successful nowadays and most men can be completely cured.

5. In the unborn child the testicles develop inside the abdomen and descend into the scrotum at birth, or during the first year of life. Risks of the disease are higher in men who have had a testicle that has failed to descend. A family history of testicular cancer, in a father or brother, may be another marker of elevated risk. Testicular cancer is more common in white men than African-Caribbean or Asian men and occurs more commonly in wealthier social groups. The reasons for this are not known. Risks may also be higher after mumps orchitis (inflammation of the testicles arising from mumps infection) and possibly following injury.Testicular cancer arises from the germ cells (those used to make sperm) and exists in two main forms called seminomas (40-45%) and non-seminomas.

The Industrial Injuries Disablement Benefit Scheme

6. IIAC is an independent statutory body set up in 1946 to advise the Secretary of State for Social Security on matters relating to the Industrial Injuries Scheme. The major part of the Council's time is spent considering whether the list of prescribed diseases for which benefit may be paid should be enlarged or amended.

7. The Industrial Injuries Disablement Benefit (IIDB) Scheme provides a benefit that can be paid to an employed earner because of an industrial accident or Prescribed Disease.

The legal requirements for prescription

8. The Social Security Contributions and Benefits Act 1992 states that the Secretary of State may prescribe a disease where he is satisfied that the disease:

    i. ought to be treated, having regard to its causes and incidence and any other relevant considerations, as a risk of the occupation and not as a risk common to all persons; and

    ii. is such that, in the absence of special circumstances, the attribution of particular cases to the nature of the

employment can be established or presumed with reasonable certainty.

9. In other words, a disease may only be prescribed if there is a recognised risk to workers in an occupation, and the link between disease and occupation can be established or reasonably presumed in individual cases.

10. In seeking to address the question of prescription for any particular condition, the Council first looks for a workable definition of the disease. It then searches for a practical way to demonstrate in the individual case that the disease can be attributed to occupational exposure with reasonable confidence. For this purpose, reasonable confidence is interpreted as being based on the balance of probabilities according to available scientific evidence.

11. Within the legal requirements of prescription it may be possible to ascribe a disease to a particular occupational exposure in two ways – from specific clinical features of the disease or from epidemiological evidence that the risk of disease is at least doubled by the relevant occupational exposure.

Clinical features

12. For some diseases attribution to occupation may be possible from specific clinical features of the individual case. For example, the proof that an individual's dermatitis is caused by his/her occupation may lie in its improvement when s/he is on holiday, and regression when s/he returns to work, and in the demonstration that s/he is allergic to a specific substance with which s/he comes into contact only at work. It can be that the disease *only* occurs as a result of an occupational hazard (e.g. coal workers' pneumoconiosis).

Doubling of risk

13. Other diseases are not uniquely occupational, and when caused by occupation, are indistinguishable from the same disease occurring in someone who has not been exposed to a hazard at work. In these circumstances, attribution to occupation on the balance of probabilities depends on epidemiological evidence that work in the prescribed job, or with the prescribed occupational exposure, increases the risk of developing the disease by a factor of two or more. The requirement for, at least, a doubling of risk is not arbitrary. It follows from the fact that if a hazardous exposure doubles risk, for every 50 cases that would normally occur in an unexposed population, an additional 50 would be expected if the population were exposed to the hazard. Thus, out of every 100 cases that occurred in an exposed population, 50 would do so only as a consequence of their exposure while the other 50 would have been expected to develop the disease, even in the absence of the exposure. Therefore, for any individual case occurring in the exposed population, there would be a 50% chance that the disease resulted from exposure to the hazard, and a 50% chance that it would have occurred even without the exposure. Below the threshold of a doubling of risk only a minority of cases in an exposed population would be caused by the hazard and individual cases therefore could not be attributed to exposure on the balance of probabilities. The epidemiological evidence required should ideally be drawn from several independent studies, and be sufficiently robust that further research at a later date would be unlikely to overturn it.

14. Testicular cancer, when found in the workplace setting, is clinically indistinguishable from testicular cancer in other settings. Hence, the case for prescription would require epidemiological evidence of a greater than doubling of risk in relation to specific occupations or occupational exposures.

Review of the evidence and conclusions

15. Concerns about a possible association between testicular cancer and work as a fire fighter first arose when Bates *et al.* described a cluster of cases in fire fighters from Wellington in New Zealand [2]. Although not a controlled epidemiological investigation, the observed cases in the cluster were compared with those expected, based on data from the New Zealand Cancer Registry, to derive an approximate estimate of relative risk for 1980-91, and this was markedly elevated at 8.2.

16. Bates *et al.* conducted a follow-up inquiry, based on a historical study of mortality and incidence in New Zealand fire fighters [3], and reported a standardised incidence ratio (SIR) of 1.55 for the period 1977-96, but an SIR of 2.97 during the later years of study (1990-1996) when the reporting of cases was considered more complete. An apparent, though not statistically significant trend was found with years of employment in paid service fire fighting. The later period of follow-up, in which risks were more than doubled, is such that original members of the cluster would have been excluded from this analysis.

17. Stang *et al.* in Germany, stimulated by the Bates data, conducted a case-control study of 269 testicular cancer cases and 797 controls, and reported an odds ratio 4.3 for ever working as a fire fighter [4]. There was no apparent trend by duration of fire fighting and findings were not statistically significant, there being relatively few fire fighters in the study sample.

18. Bates *et al.*, in 2007, then reported on a much larger Californian cancer registry study of 800,000 cancers, including about 3,700 cancers in fire fighters [5]. In this study the odds ratio (a measure of relative risk) was also raised, but only 1.3 to 1.5 fold (depending on the choice of controls). This time risks were higher in 1988-1995 (OR 1.9) than in 1996-2003 (OR 1.3).

19. A second large investigation, published by Ma *et al.* in 2006, investigated a cohort of nearly 37,000 fire fighters from Florida, among whom more than 1,000 cancer cases were found [6]. The SIR for testicular cancer was 1.6 – an increased risk close to that of the Californian Cancer Registry estimate.

20. The meta-analysis which prompted this review [1] covered only four reports in fire fighters – three of mortality and one of cancer incidence. However, it excluded at least 13 other mortality papers mentioned in the bibliographies of the other reports, including 12 which showed no clear association between deaths from testicular cancer and fire fighting. The meta-analysis also excluded a negative case-control study from New Zealand (Pearce *et al*., 1987 [7]), the rules for exclusion apparently relating to the difficulty of combining dissimilar studies to derive a single best estimate of effect.

21. Some authorities have argued that studies of mortality may underestimate risks from testicular cancer, as the disease is eminently curable. However, the meta-analysis

report of the IARC Working Group drew mainly on mortality information, while not incorporating much of the negative mortality information previously published.

22. Estimates of relative risk appear to have varied by time period. This may reflect the play of chance (the more finely divided the data the smaller the sample size is and the greater the opportunity for chance findings to be noteworthy); but Bates *et al.* have suggested alternatively that fire fighters may have been exposed to certain noxious combustion products, the effects of which showed up in 1988-1996 but not at earlier or later periods. The composition of materials consumed in fires may well have changed over time.

23. In summary therefore, discounting the original cluster, several studies from different countries (New Zealand, Germany and the United States) have shown a doubling of risks over certain time intervals. However, most studies of mortality have not suggested an association and the two largest and most recent incidence studies (from California and Florida), post-dating the IARC Review, point to a less than doubling of risks (relative risks of 1.5 to 1.6).

24. No plausible biological mechanism has so far been proposed for the association between testicular cancer and fire fighting, and no specific agent or agents identified as risk-conferring.

25. The International Agency for Research on Cancer Working Group that produced the index review concluded, in December 2007, that there was “limited evidence of carcinogenicity in humans”, and proposed classifying occupational exposures of fire fighter as “possibly carcinogenic to humans” [8].

26. Having considered the matter, the Council has concluded that while there is evidence of an increased risk of testicular cancer in fire fighters, at present there is insufficient evidence that risks are clearly doubled and at present insufficient evidence on which to recommend prescription. Should new evidence come to light, the Council will of course review its position.

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