CORRESPONDENCE

Risk of thyroid nodules in subjects occupationally exposed to radiation: a cross sectional study

Editor—We would like to comment on a recent paper by Antonelli *et al* on the risk of thyroid nodules in subjects occupationally exposed to radiation.[1]

The authors examine the prevalence of nodular thyroid disease in a group of 50 male medical workers in Pisa who were thought to be occupationally exposed to ionising radiation and compare them with two control groups of workers, without known occupational exposure to ionising radiation. The authors suggest that the significantly increased rates of thyroid nodules in the exposed group, compared with the control groups, is causally associated with their occupational exposure to ionising radiation.

However, as the authors acknowledge, the ionising radiation exposures of the exposed group are subject to substantial uncertainties and no exposure information is used in their analysis. There is also almost no accurate information on iodine deficiency for individual workers in either the exposed or control groups, iodine deficiency being a known risk factor for thyroid nodules, again a problem acknowledged by the authors. Moreover, although the cases were individually age matched with the controls, most of the analyses were performed ignoring this matching, the only form of age adjustment being stratification by fairly broad 10 year age groups. This approach is potentially problematic and could lead to a loss of efficiency as well as to possible confounding.[2]

If the median ionising radiation exposure in the exposed group given by the authors, 67·2 mSv, is taken at face value, then a doubling dose of about 73 mSv (95% CI 30 to 517) is indicated. This figure is much lower than that found in a recent combined analysis of incidence of thyroid cancer in the survivors of the Japanese atomic bombs and six medically irradiated groups, for which there was no significant excess risk among those exposed in adulthood.[3,4] All these considerations suggest that the increased risks of thyroid nodules found in the study of Antonelli *et al* are not necessarily causally associated with occupational exposure to ionising radiation.

MARK LITTLE
CHRIS SHARP
Medical Department,
National Radiological Protection Board,
Chilton, Didcot OX11 0RQ

1 Antonelli A, Silvano G, Bianchi F, Gambuzza C, Tana L, Salvioni G, *et al.* Risk of thyroid nodules in subjects occupationally exposed to radiation: a cross sectional study. *Occup Environ Med* 1995;52:500–4.
2 Breslow NE, Day NE. *Statistical methods in cancer research. Vol 1. The analysis of case-control studies.* Lyon: International Agency for Research on Cancer, 1980.
3 Ron E, Lubin JH, Shore RE, Mabuchi K, Modan M, Pottern LM, *et al.* Thyroid cancer after exposure to external radiation: a pooled analysis of seven studies. *Radiat Res* 1995;141:259–77.
4 United Nations Scientific Committee on the Effects of Atomic Radiation. *Sources and effects of ionizing radiation.* New York: United Nations, 1994.

Author's reply—(1) In the first paragraph Little and Sharp affirm that we report "thyroid nodules in the exposed group is causally associated with the occupational exposure to ionising radiation", but this was never said in our article. In fact we only suggest that occupational exposure to radiation may be a risk factor for thyroid nodules.[1]

(2) The occupationally exposed group was chosen among male subjects of the units of orthopaedics, haemodynamics, interventional radiology, and radiotherapy because it is known that the exposure to *x* ray films is certain (during angiography, radioscopy, etc.) and generally heavier than in other groups of medical workers. We indicated that cumulative dose was 67·2 mSv (SD 96·0), with an extremely high variability ranging from 3·6 to 690·0 mSv and we discussed the reliability of the dosimetric data but not about the uncertainty of the exposure.[1]

(3) The urinary iodine excretion is not a reliable variable because it is variable within subjects from one day to another in relation to the intake of different foods and beverages. The mean urinary iodine excretion in the population is the only reliable biochemical variable of the severity of the iodine deficiency. The mean urinary iodine excretion in Lunigiana (control group 1) is 49·8 μg/day while in Pisa (exposed group and control group 2) it is 88 μg/day; these data were indicated in the discussion.[1] However, iodine deficiency was also evaluated by a questionnaire. Only 12% of subjects presented a history of residence in iodine deficient areas for ⩾ 10 years in the exposed group and 10% in the control group 2 (Pisa); everybody presented a history of residence in iodine deficient areas in the control group 1 (Lunigiana). The prevalence of thyroid nodules is significantly higher in the exposed group not only in comparison with the control group 2 from Pisa, but also in comparison with the control group 1 from Lunigiana. So we think that iodine deficiency was accurately evaluated in our study.

(4) As to the problem of matching it should be noted that our study is not of the case-control type, as we sampled exposed and not exposed subjects, not cases and controls. In this situation matching by age followed by a crude analysis or by an analysis by relatively large age strata entails only a minimal, if any, loss of efficiency.[2]

(5) In our study we evaluated the prevalence of thyroid nodules and not of thyroid cancer in workers exposed to radiation. So any comparison with the results of incidence of thyroid cancer in the Japanese atomic bomb survivors and with their exposimetric data is not appropriate. Furthermore while in the Japanese study an acute (bomb survivors) or a short term (medically irradiated groups) and high dose exposure were considered, in our study a long term, low dose exposure is evaluated. Among the studies that evaluated the effects of long term, low dose exposure on the thyroid, most of them found a high prevalence of thyroid cancer or nodules in subjects occupationally exposed to radiation.[3–5]

So we suggest that long term, low dose occupational exposure to radiation may be a risk factor for thyroid nodules.

ALESSANDRO ANTONELLI
Institute of Clinical Medicine II
GIOVANNI SILVANA
Institute of Radiology,
FABRIZIO BIANCHI
CARMELO GAMBUZZA
Unit of Epidemiology and Biostatistics,
Institute of Clinical Physiology,
CNR, Pisa,
LUIGI TANA,
POUPAK FALLAHI,
LIDIO BASCHIER,
Sanitary Physic Unit, USL-12 Pisa,
Italy

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A cross sectional study of the independent effect of occupation on lung function in British coal miners

Editor—Lewis and colleagues conclude that coal mining has an effect on lung function independent of the effects of smoking, even in the absence of pneumoconiosis.[1] This is of course not a new finding, but is in line with the conclusions of much larger studies in which the carefully estimated exposures of miners to coal dust have been shown to relate to reduction in forced expiratory volume in one second (FEV_1) and to add to the effects of smoking; in none of these has the presence of pneumoconiosis had an important influence.[2] It was this and related work which led the Industrial Injuries Advisory Council (IIAC) to prescribe bronchitis and emphysema in coal miners.

The authors have misunderstood the reason that the chest radiograph was included as a criterion for certification in individual cases. The reason that I suggested to IIAC was that airways obstruction is a common finding in the general population as a consequence of smoking, and many miners smoke. A criterion was in my view necessary to allow a judgement to be made *in individual cases* as to the likelihood that exposure to coal dust had played an important part in the cause of the dysfunction. In the absence of measurements of dust exposure, two surrogates were possible; duration of time spent underground and the presence of category 1 change on the radiograph. The duration of time spent underground has a very poor relation with exposure and is only alterable by an employer as a preventive measure in a way which would act to the financial disadvantage of workers. The presence of category 1 change on the radiograph, especially if it includes irregular opacities as I recommended,[2] bears a good relation to cumulative dust exposure and provides a useful basis for preventive action. As it turned out, the IIAC took both options but did not include irregular opacities.

The outcome has been satisfactory in that many more miners have received benefits than would otherwise have been the case but, as I pointed out previously, any system that arbitrarily dichotomises a continuum will produce injustice. Some miners are undoubtedly in receipt of benefits for smoking whereas others with dust induced

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