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Preoperative biochemical screening

Routine urine testing is good enough in patients under 50

Biochemical investigations are carried out before a surgical operation either because a patient's condition indicates the need or to detect clinically inapparent abnormalities that may affect surgical and anaesthetic management. Nobody would argue about the first indication, but there is little agreement on the second. The inexperience of junior staff together with anxiety about litigation may lead to excessive testing. Clinical laboratories are under increasing pressure to reduce expenditure, and eliminating unnecessary tests is an essential step. The experience of other disciplines is encouraging: when firm guidelines were issued for routine preoperative chest *x* ray investigations, for example, their frequency was reduced by half with no apparent increase in morbidity or mortality.[1 2]

The more common conditions that may be detected biochemically and are of particular concern in anaesthesia and surgery are renal and hepatic disease, diabetes mellitus, and abnormal serum electrolyte concentrations, which may occur in various circumstances. Operating on a patient with appreciable renal or hepatic impairment or on one who is incubating viral hepatitis may precipitate further deterioration in function and even overt failure.[3-5] If muscle relaxants are given in normal doses to patients with severe renal impairment their effects may recur when the action of the reversing agent, usually neostigmine, wears off.[6] The main concern in diabetes is unrecognised hypoglycaemia under general anaesthesia, but this is more likely to happen in patients with diabetes who are being treated. Diabetic ketoacidosis, on the other hand, may arise in undiagnosed diabetes and cause major problems, and indeed death, if unrecognised during a prolonged major operation. Serum sodium and potassium concentrations are the most frequently requested preoperative biochemical investigations,[7] of which potassium is the more important. Hyperkalaemia predisposes to cardiac arrest, particularly when suxamethonium chloride (a depolarising muscle relaxant) is given, and hypokalaemia to cardiac arrhythmias, which may be exacerbated by other anaesthetic agents such as halothane.

Routine preoperative biochemical screening has been examined in only four studies.[8-11] In three of them unsuspected abnormalities were found in 0·2%,[8] 0·2%,[9] and 1%[10] of cases. The fourth[11] found that 10% of patients over 40 had biochemical abnormalities but that under this age there were none; no indication was given about these abnormalities, but they are said to have made no difference to management.

Screening of other patients—those being admitted to hospital,[12-16] those in general practice,[17] blood donors,[18] and those undergoing health screening[19]—has shown unsuspected abnormalities in serum electrolyte concentrations in around 0·06%[12-14 17] and a raised urea or creatinine concentration in less than 1% of those under 40 and in 3-5% of those over 60.[14 15 17 19 20] The blood glucose concentration was abnormal in 1-8%,[12-14 16 17 19] and the aminotransferase activity was abnormal in 1-5%.[12 14 15 17 19]

Unfortunately, few clinical details are given in any of these studies so that the importance of the findings is not clear. Unexpected abnormalities in electrolyte concentrations, however, seem to be rare, as do those of urea and creatinine in patients under 50-60. The frequency of diabetes mellitus makes some preoperative assessment of glucose metabolism essential, but factors other than diabetes affect the blood glucose concentration, which is unreliable in screening for diabetes.[16] Diabetes of any importance should be evident in the results of a routine urine test. Testing the urine will also detect unrecognised renal disease, and if proteinuria is found then renal function should be assessed by a measurement such as serum creatinine concentration.[21] Nevertheless, it is important to ensure that testing of urine is carried out correctly.[22 23]

The importance of an isolated moderate rise in aminotransferase activity is not clear but is unlikely to be important in relation to anaesthesia and surgery unless the patient is incubating viral hepatitis. Given the large functional reserve of the liver, patients with mild chronic liver disease usually tolerate anaesthesia and surgery well.[3-5] Disease severe enough to cause defects in clotting, abnormal drug metabolism, or hepatic failure is likely to be evident clinically. Serum aminotransferase activity may be used to detect viral hepatitis during the preicteric stage, but a rise is not inevitable until the patient becomes jaundiced.[24] The appearance of bilirubin in urine often precedes jaundice and may offer a cheap alternative.[25] Moreover, patients who are subsequently found to have viral hepatitis often have non-specific symptoms like flu or complain of general malaise at the time the blood is drawn.[26 27] Hence such unexplained symptoms in patients undergoing elective surgery may warrant further investigations, with the need for careful history taking.

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Living under pylons

If electromagnetic fields are carcinogenic the effect is weak

Electromagnetic radiation may be natural or man made. It includes short wavelength, high frequency waves—for example, *x* rays, γ rays, and other forms of ionising radiation—and long wavelength, low frequency waves—for example, ultraviolet, visible light, infrared, microwaves, television emissions, radiofrequency fields, and other non-ionising radiation. Extremely low frequency fields have much lower electromagnetic energy, longer wavelengths (thousands of kilometres), and frequencies from 30-300 Hz. The carcinogenic, leukaemogenic, and genetic effects of ionising radiation on health are well known, and exposure to low frequency non-ionising radiation has been linked to various ill effects, mainly on the eyes and skin. The effects of extremely low frequency electromagnetic fields on health have not, however, been as well established and yet have recently received much publicity in Britain. Exposure to artificial, extremely low frequency fields occurs around high voltage transmission and distribution electric lines. Household, workplace, and public electrical appliances also generate such fields at a lower intensity. Public exposure and concern are mainly related to living in homes below or near overhead power lines. Occupational exposures occur in electric substation installations and in those working with equipment for generating and transmitting electricity.

The reported effects of extremely low frequency fields on cell and tissue functions are diverse and sometimes contradictory. The studies of Delgado *et al* showing gross morphological abnormalities in chick embryos exposed to very low frequency magnetic fields gave support to the apparent link between adverse outcomes of pregnancy and working on video display terminals.[1] The findings were not, however, replicated in other studies, and the observed clusters of adverse outcomes to pregnancy could have been explained simply by chance.[2] The discussions on the work of Delgado *et al* raised the possibility of a "window effect," in which very low frequency magnetic fields at a narrow frequency band could produce harmful effects.

Substantial experimental evidence shows that some organisms are sensitive to magnetic fields of low intensity.[3] Extremely low fields that induce high current densities in tissues and extracellular fluid may alter the development, behaviour, and physiology of higher organisms.[4] In humans clinical effects such as interference with cardiac pacemakers and metallic surgical implant devices and the stimulation of bone growth have been described.[3]

Some epidemiological studies on extremely low frequency electromagnetic fields have suggested that they increase malignancy. One of the earliest case-control studies showed in 1979 that those who lived in homes near high current configurations had a significantly higher relative risk of leukaemia and tumours of the central nervous system than those who lived near low current configurations.[5] A similar study in 1980 in a different locality showed no correlation between childhood leukaemia and the proximity of homes to power lines.[6] Since then there have been several studies giving positive as well as negative results.

Savitz and Calle in 1987 reviewed 11 epidemiological studies of leukaemia and occupational exposure to electromagnetic fields.[7] Four showed no excess leukaemia, and the others showed that men in certain exposed occupations had a modest excess risk of leukaemia. The limitations of these studies included the few exposed patients who had leukaemia, possible errors in assigning cause of death and determining exposure, and other confounding factors.

More recently Coleman and Beral reviewed 11 epidemiological studies that considered residential and occupational exposure to extremely low frequency fields[8]; six[9-14] were included in the earlier review by Savitz and Calle.[7] The most consistent finding was a small increased risk of leukaemia, especially acute myeloid leukaemia, in electrical workers. There was, however, no obvious link to specific jobs in the electrical industry. Confounding factors could not be ruled out, and there were the same problems of assessing exposure. Studies of links between extremely low frequency electromagnetic fields and suicide and the outcome of pregnancy have given results that are either inconsistent or uncertain.[8]

If extremely low frequency electromagnetic fields do cause leukaemia or other malignancies then a general increase in these malignancies in the general population might be expected as the use of electric power for each head of the population increases. Also children with leukaemia exposed to extremely low frequency fields might be expected to be younger than those without such exposure. Neither of these propositions seems to be true. At the most the carcinogenic