263 hours of his time.[2] Zander and colleagues used 150 hours of doctors' time to make summary problem lists for 8,500 notes.[3] However, Elliott completed only 120 summaries in one year,[4] and Walker found sorting and pruning a better use of time than making summaries.[5] Marsh and Thornham, when converting to A4 records, used a secretary to construct a summary sheet for 17,000 records.

We discovered that the typist who had typed our summaries was a nurse, and so after introductory training and supervision, we set her to work. Each record is sorted into chronological order and tagged; a summary on the pink FP9A card is made of medical, social and family history, plus details of important allergies or any reactions. A separate summary of investigation results is made on the blue FP9B card, and a drug record form is compiled when appropriate. Old letters are extracted, and these, together with the completed file, are handed to the responsible doctor who reviews the summary and inspects any redundant material before it is destroyed. Important diagnoses are entered into our diagnostic index. Inevitably, the process is continuous, for all patients who join the list must have their notes sorted in the same way. Sometime in the future, perhaps, this may no longer be necessary.

Results

We are happy with the quality of our summaries as we check each one and as the records secretary has undergone thorough training. Working part-time, she has summarized over 2,000 notes. The first 1,000 took 102 working days, the time spent on each file being about 25 minutes. Allowing for 70 per cent reimbursement and tax relief for the secretary's salary, the cost has been 20 pence per file. The average number of whole-time equivalent staff employed per principal is only one, whereas we are allowed reimbursement for two. Perhaps a records secretary would be a sound investment for many other practices.

Acknowledgements

I would like to express my thanks to Jenny Davis, and to Drs Anthony, Harrod, Moss and Brown.

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Patients and radiation—an assessment of the risks

B. F. BURY

The radiologist's view: Dr Bury is senior specialist in radiology at Princess Mary's RAF Hospital at Halton in Buckinghamshire. He puts into perspective the hazards of radiation as they apply to routine referrals from general practice.

LIKE most practising radiologists I can be scathing in my criticism of clinicians who refer patients for 'unnecessary' investigations. However, as a sometime locum general practitioner I am uncomfortably aware that the request form, often the only contact between the radiologist and the general practitioner, may fail to tell the whole story. Quite apart from 'buying time' for the clinician, radiological investigation can act as a powerful placebo, and in this respect the value of a normal x-ray report cannot be overestimated. Only recently (March 1983, p.139) this *Journal* published an abstract of a paper demonstrating the positive symptomatic effect of a normal coronary arteriogram, and the same effect is undoubtedly seen with less sophisticated procedures. The general practitioner is the person to judge which of his patients are most likely to benefit from this, even though the investigation may not be justifiable on strictly clinical grounds.

If ionizing radiation were harmless we would not need to be so concerned about referral criteria, although we would still wish to avoid waste of time and resources. However, risks there undoubtedly are, and they should taken into account when deciding whether or not to refer a patient for radiography. I thought that it might be useful to review the hazards and try to put them in perspective, particularly at a time when patients are becoming more aware of the fact that medical investigation and treatment are not always wholly beneficial, and when new techniques are becoming available which can avoid the use of ionizing radiation.

The size of the risk

Although even the experts in radiation biology continue to argue about it, it seems probable that there is no such thing as a safe dose of radiation; that is, there is no threshold below which there are no harmful effects. This being so, it has become a basic tenet of radiation protection that even a tiny dose is potentially dangerous, and therefore to be avoided wherever possible.

In diagnostic radiology our main worry is that of genetic damage affecting future generations, and the risks will therefore apply more to younger patients and will vary in magnitude with the part of the body under examination. For example, radiography of the extremities, properly performed, should not involve any appreciable dose to the gonads. A plain film of the lumbar spine, on the other hand, cannot be performed without exposing the ovaries, and this needs to be taken into account when considering referral.

Table 1 shows the gonad doses achieved during some of the more commonly requested procedures. These figures are taken from a paper by Wall *et al,*[1] and are broadly in accord with those quoted by other authors. They refer to the age group which most concerns us, namely 16–45 year olds. The differences between male and female levels are of course due to anatomical factors.

The important facts to glean from this table are that barium enemas, IVUs and views of the lumbar spine and pelvis will all give significant gonad (and fetal) doses, and

Table 1. Gonad doses in milliGrays (mGy) with different radiographical procedures.

	Males	Females
Lumbar spine	0.64	3.9
Hip, upper femur	6.13	0.96
Pelvis	2.94	1.16
IVU	3.57	3.11
Plain abdomen	1.58	0.79
Barium enema	2.50	14.3
Barium meal	0.27	1.54

that these are also examinations frequently requested by general practitioners for their younger patients. An important point to remember is that any departure from ideal radiographic practice will considerably increase the dose, (not that this would be likely to occur in our department of course!).

Radiation and the fetus

What are the possible effects of radiation on the fetus? They fall into two main groups.

1. *Congenital malformation.* This can be lethal (miscarriage, stillbirth or perinatal death), or nonlethal. In humans the most frequent nonlethal effect is on the central nervous system, resulting in mental deficiency of various degrees.
2. *Induction of childhood malignancy.*

The only sensible way to view the contribution of radiation is against the background of the spontaneous incidence of abnormality in nonexposed pregnancies. The facts seem to be as follows:

1. The incidence of congenital handicap of all types in nonexposed pregnancies is of the order of one in 30 of all births.
2. The natural incidence of malignancy under the age of fifteen is one in 650.[2]

A fetal dose of 50 milliGrays (5 rads) would result in an additional one to two cases per 1,000 of congenital handicap. The same dose could be expected to induce, at worst, one extra case of childhood malignancy in every 200 births.[3]

Comparison with Table 1 will show that this dose of 50 mGy is quite a hefty one, and it is unlikely that the pelvic organs of a female patient would receive much more than 10 mGy even if she were inadvertently subjected to a barium enema. The same study[3] estimates that a dose of 10 mGy would result in an increase of one per 1,000 in the incidence of malformation and malignancy combined. This is in accordance with a survey by Doll.[4] Although the birth of even a single additional malformed child is a tragedy to be avoided if possible, it can be seen from these figures that in most cases of accidental exposure during pregnancy the worried mother-to-be can be reassured that her child is most unlikely to be affected.

The ten day rule

This really is a misnomer—it was never meant to be a rule but rather a recommendation. If it were a rule it would be an illogical one, since all the hazards to the fetus which the 'rule' is designed to avoid apply equally to the developing ovum, so there is no genuinely safe period during the menstrual cycle.

The disadvantage of having an apparently immutable ruling of this kind is the tendency to assume that patients in the first ten days of their cycle can be irradiated with impunity, and this is patently not the case. Conversely, investigations which involve no appreciable gonad dose are postponed, to the patient's disadvantage, because her last period started eleven days before!

The Royal College of Radiologists[5] recommend the avoidance of the following investigations in patients who might be pregnant: barium enema, barium meal, IVU, cystography, cholecystography, lumbar spine, pelvis, hips and abdominal angiography.

This would seem to be a more sensible approach than the unyielding application of the ten day rule, and I think this is now the attitude adopted by most x-ray departments. Indeed, a joint working party of the Royal College of Radiologists and Royal College of Obstetricians and Gynaecologists has concluded that there is no scientific basis for the ten day rule. Nevertheless, the International Commission on Radiological protection has shrunk from making this official, while admitting that its previous advice may have been too restrictive. The National Radiation Protection Board in its recent consultative document[6] retains the ten day rule amongst its recommendations, although it does emphasize that urgent investigations should not be needlessly delayed by unthinking application of the rule.

Conclusion

I think it is possible to propose a few guidelines on the basis of the risks outlined above:

1. Procedures involving significant radiation to the pelvis should be avoided in women who might be pregnant, and to this limited extent the ten day rule remains valid. Where the clinical condition of the patient demands prompt attention no delay can be justified, but the radiologist will be responsible for ensuring that all possible steps are taken to shield the ovaries and uterus, and to keep the number of exposures to the minimum necessary to make a diagnosis.

2. Investigations involving significant gonad dose (see above) should only be undertaken in young patients when good clinical indications exist, and where the result is likely to influence treatment.

3. Automatic application of the ten day rule in situations where no exposure of the gonads is likely to occur is not in the best interests of the patient and should be resisted. This places the responsibility firmly in the x-ray department to ensure that the proper measures for patient protection are applied.

4. Where inadvertent exposure of an early pregnancy has occurred, patients can be counselled in the light of the figures given above, and in most cases we have seen that the mother can be reassured that there is little risk of damage to her child.

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