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that can be likened to Dr. Roentgen's early attempts. In addition, the early models required between two and four minutes to render an image of each slice. This time has been considerably reduced and a better image can now be obtained in two to five seconds. However, it must be remembered that a considerable amount of time is usually expended positioning the patients on the table and injecting them with contrast material. Thus, even with the improved scanning time, studies may take 10 to 20 minutes for each patient, as many examinations require evaluation before and after the injection of contrast material. In addition, reproduction of the image on the screen may take an appreciable amount of time, and this in itself can reduce the daily quota of patients.

"The scanner is not a diagnostic panacea and it must be used with intelligence and restraint."

Another important factor is patient cost. Though fees charged for CT scanning have been reduced during the last year, the cost to the patient—$100 to $400—remains high, relative to most other diagnostic tests. Some centers have separate charges for examinations with and without the use of contrast material, and patients must pay the double rate if both examinations are performed.

The amount of radiation delivered during a CT scan is an aspect which has provoked little comment. The older, slower units deliver a dose of approximately two rads per slice, which is in the range of acceptability, but the newer models deliver a significantly larger amount of radiation to the patient. In an age in which we are all sensitive to the amount of radiation exposure patients receive, we must make a hard appraisal of our present practices. It would seem appropriate for medical physics departments to play a dominant role in this matter and compare the doses incurred by various machines currently on the market. Most patients undergo examination only once; however, repeated examinations of the brain over a prolonged period of time can result in damage to the cornea, and it is the responsibility of the radiologists to see that this sort of trauma does not occur. Future development entails reduction of the amount of radiation while preserving the quality of the image.

In sum, the criteria for formulating policy regarding CT scans are diagnostic reliability and superiority over other techniques, time and cost considerations, and the safety and well-being of the patient.

Governmental Regulation

In reality, CT policy is affected by developments that have little to do with real needs.

Distribution of CT scanners is a major problem currently facing the medical community. The scanner unfortunately made its appearance just at a time when rising medical costs had caught the attention of federal agencies; the scanner itself was blamed for the increase in health care costs, though this assertion actually has no merit. The federal government nonetheless felt compelled to involve itself in CT planning policy, and the certificate of need concept, making all equipment purchases over $100,000 subject to federal approval, grew out of these economic concerns. To further complicate the situation, recent HEW recommendations suggest that before a hospital can acquire a CT scan, neighboring units must conduct 4,000 examinations per year. Again, this is not founded upon a realistic assessment, as no CT unit can accomodate this many examinations. While the basic intent of these federal regulations is to prevent duplication of services and ensure adequate backup in terms of facilities and personnel, this sort of legislated distribution applies more logically to treatment modalities than to diagnostic techniques—and the scanner is primarily a diagnostic tool. The unfortunate result of this governmental intereference is a battle over the control of scanning equipment and, particularly where head units are concerned, a source of conflict between radiologists and neurologists. Another potential problem related to government involvement is the complete loss of quality control—for example, making CT units available to untrained practitioners and encouraging mistakes and unnecessary examinations by inciting centers to perform more scans than good policy would dictate. Further, government-imposed restrictions on purchases will depress the market and obviate research incentives among manufacturers.

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Hospital Expense

The cost of CT scanning units is very high, with prices ranging up to $750,000 for the newest and most sophisticated units. It is hoped that over the years prices will be reduced, although this has not been the case with other types of X-ray equipment, where prices have steadily increased. Ohio Nuclear recently marketed a dedicated head scanner at $95,000, presumably to circumvent the certificate of need stipulation. The drawback to this otherwise commendable unit is that it can accomodate only a relatively small number of patients. Most medical centers have managed to scrape together the necessary funds for a CT unit, recognizing it as a diagnostic necessity, though no one views such a purchase lightly.

The cost of maintaining a scanner is extraordinarily high (at our institution it runs to $300,000 per year); the claim that scanners are money-making devices is patently false. This maintenance figure includes various elements:

- Salaries for medical, technical and secretarial assistance—we have found it necessary to have two technicians on hand at all times that the machine is being used, and a physician is required to monitor the tests and inject contrast material.
- Space requirements—these are considerable, as the equipment is bulky.
- Depreciation of the equipment.
- Utilities—the system houses its own air conditioner.
- Servicing costs.
- Charges for contrast material, syringes and other supplies.

The impulse at many centers is to maximally utilize such a marvelous and costly piece of equipment. However, running a scanner on a 24-hour basis only serves to magnify the costs involved—and these costs are ultimately passed to the patient—by the requirement for several teams of physicians and technicians and inevitable overtime payments. Examinations conducted at odd hours are inconvenient for patients, and especially so for outpatients who may travel long distances to obtain the test. In addition, it is apparent that excessive use of CT equipment induces an increase in breakdown time.

"The medical and lay communities must act together to prevent this very important achievement from becoming a political football."

The Task of the Future

In the CT scanner we have a remarkable tool whose potential has hardly been approached. The medical and lay communities must act together in preventing this very important achievement of modern medicine from becoming a political football. Federal agencies are faced with solving the very pressing problem of increasing medical costs; we in the medical profession are faced with keeping bureaucratic intervention at a minimum. Above all, we cannot allow our accomplishments to go unused, nor our future to be subject to irrational restrictions.

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