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# Clinicians' Reasons for Overuse of Skull Radiographs

Richard O. Cummins<sup>1</sup>

Observations based on a high yield indication list (HYL) revealed that 80% of posttraumatic skull radiographs requested by physicians were not indicated. To investigate this possible overuse of radiography, 15 resident physicians who had used the HYL in a university emergency room were interviewed. The interviews included a questionnaire, case simulations, and discussion of actual head trauma patients. Several general reasons for the overuse were detected: (1) overriding indications to the HYL; (2) basic problem-solving strategies of the physicians (pattern recognition, method of exhaustion, and hypothesis generation and evaluation); (3) the context of the decision-making (patient and family expectations, mentor and peer pressure, malpractice threat, time management concerns); (4) fear of uncertainty; and (5) routines. It was found that overuse of diagnostic radiography was not perverse or irrational, but was produced by a complex mixture of actual expectation of yield from the procedure, personal approaches of the individual physicians, and pressures in the decision-making environment.

Several reports have described posttraumatic skull radiography as an overused procedure, producing insufficient diagnostic information or therapeutic impact to justify the number of examinations physicians request [1-3]. One project attempted to reduce the rate at which physicians requested skull films by supplying the physicians with a list of high yield indications [4, 5]. Later, when we measured physician response to a modified form of this high yield indication list (HYL), we observed that almost 80% of the radiographs were requested for patients who had no indications (Cummins RO, LoGerfo JP, Inui TS, Weiss NS, unpublished data). This surprising observation of so many unindicated radiographs stimulated the present study.

Our hypothesis was that clinicians were not perverse or irrational in their requests for posttraumatic skull films. Rather, they ordered radiographs for a variety of reasons—reasons with an underlying credibility and logic. To detect the rationale clinicians were using, we undertook an exploratory, descriptive study. For this preliminary project, overuse of skull radiographic examinations comprised radiographs that were not indicated according to the high yield indication list (fig. 1) [4]. By using a research interview method [6], we identified several reasons for possible overuse of skull films by clinicians.

## Subjects and Methods

We interviewed a total of 15 first and second postgraduate year resident physicians who were in the emergency room at Harborview Medical Center in Seattle, Wash. This busy facility handles about 90 patients per day. All the physicians had used the HYL, which had been available for over 6 months.

The interviews comprised three parts: questionnaire, case simulations, and discussion of actual head trauma patients. The questionnaire explored knowledge of head trauma, and included scale item questions that asked if the physicians agreed or disagreed with ordering skull films in various clinical situations.

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- \_\_\_ 1. Unconsciousness (including unarousable alcoholic) at time of presentation to emergency facility.
- \_\_\_ 2. Documented decreasing level of consciousness or progressive mental deterioration.
- \_\_\_ 3. History of previous craniotomy with shunting tube in place.
- \_\_\_ 4. Skull depression or subcutaneous foreign body palpable or identified by probe through laceration or puncture wound.
- \_\_\_ 5. Hemotympanum or fluid discharge from ear.
- \_\_\_ 6. C.S.F. discharge from nose.
- \_\_\_ 7. Battle's sign.
- \_\_\_ 8. Bilateral orbital ecchymosis (Raccoon eyes).
- \_\_\_ 9. Unexplained focal neurological signs.

Fig. 1.—High yield indication list for requesting skull radiography.

The case simulations described patients who had none of the high yield indications. The physicians were asked to consider their current practice and decide if they would obtain skull films. Those physicians who stated they would not were given a series of additional clinical items that altered the decision-making situation in several areas: expectations of radiographs by patient, family, mentors, and peer group; training program policies; litigation threats; and time management methods. Next, the physicians were asked if they would request skull films considering the additional data.

Finally, the interviewer (R.O.C.) selected several head trauma patients from the patient log of the previous day. These patients had been evaluated personally by the physicians being interviewed. The physicians were requested to review their decisions on ordering skull films, to discuss each patient's presentation, and to trace the process they had followed for each decision.

## Results

The questionnaire and case simulations used in these interviews stimulated discussion. For this preliminary study we did not analyze the responses in a formal descriptive manner. Instead, we subjectively interpreted these conversations, recognizing the potential biases of this ethnographic approach; sampling, interviewer, and interpretation [6].

The interviews identified several reasons for requesting non-HYL films: overriding indications, problem-solving strategies, context of decision-making, fear of uncertainty, and routines.

### Overriding Indications

The resident physicians disagreed with our definition of overuse, insisting the HYL omitted important indications for skull films. By their criteria, most radiographs they requested were indicated, and overuse had not occurred. For them, a report of unconsciousness, brief amnesia, or severe trauma, plus physical findings of hematomas, lacerations, or intoxication, were indications, but had been omitted from the HYL. Because the HYL did not include these and similar

indications, the physicians argued it lost much clinical usefulness, and they could ignore it.

### Problem-Solving Strategies

Though our main focus was on why physicians requested skull films, we soon recognized that individual decisions for radiographs were inseparable from a clinician's total decision-making strategy. The physicians seldom recalled making specific decisions to request or not to request skull films. Instead, skull films were a central component in their overall tactics for evaluating trauma patients. This evaluation generated a series of classification decisions: well/unwell, fracture/no fracture, intracranial damage/no intracranial damage, admission needed/admission not needed, disposition can be made/disposition cannot yet be made. Skull films were indispensable, not to identify fractures, but to make these numerous decisions. A negative film was as useful for this determination as a positive examination.

From our discussions we detected three decision-making approaches; requests for skull films seemed to be an integral part of each. First, some physicians displayed the pattern recognition (or Gestalt) approach [7], reaching confident decisions by using rapidly acquired clinical impressions. Their decisions to order radiographs stemmed logically from their perception of the severity of the injury and the quantity of trauma sustained.

Second, others followed the method of exhaustion [7, 8] meticulously obtaining the history, performing the physical examination, and collecting laboratory and radiographic data before making their decisions. To these physicians, skull films were fundamental for describing the patient in exhaustive detail.

The third and predominant approach was to consider each possibility as a hypothesis [9, 10] that was confirmed or disconfirmed on the basis of skull radiography. Several physicians admitted that radiographic procedures were more helpful in evaluating their hypotheses than were history and physical examination.

These three approaches were not exclusive. A single physician would use different strategies from patient to patient, and certain physicians would use elements from all techniques.

### Context of the Decision to Order Radiographs

The case simulations, which did not alter the patient's clinical presentation but rather the patient-physician environment, revealed additional reasons for radiography requests. For example, most of the physicians interpreted an expectation of radiographs by patients or family members as a demand for radiographs. Accounts were given of patients who came to the emergency room, not for a physician's evaluation, but solely to be radiographed. For busy clinicians it was easier to obtain radiographs than to persuade anxious patients that identifying skull fractures had little usefulness.

Mentor and peer pressure were other constituents of the environment in which requests for radiographs were made.

In this teaching institution, highly respected attending physicians constantly reviewed the performance of the interviewed physicians. House officers managed patients with an awareness of the teachings and approaches of these authoritative mentors—mentors who emphasized complete evaluation of patients, rather than decreased use of radiographic examinations. The discovery of pathology produced social and professional rewards; the omission of a skull series did not.

Malpractice fear provoked few requests for films. The physicians expressed concern over malpractice litigation only after specific questioning. Resident physicians perceived themselves protected from legal disputes. By contrast, they were attentive to the legal ramifications of head injuries from assaults, domestic and public quarrels, and motor vehicle accidents involving intoxicated drivers. Radiographic examinations were regularly performed on such patients to document injuries "for the record."

Another contextual feature that modified physicians' decisions was the amount of time required for radiographs. To manage their time efficiently, some clinicians would request radiographs after a brief evaluation. Then, when the patient returned from the procedure, a complete history was obtained and physical examination performed with radiographic findings immediately available. Disposition decisions, such as sending the patients home or admitting them to the hospital, could be made at once. Other physicians preferred to perform serial neurologic examinations on head trauma patients, and the time spent in radiology was conveniently used to separate two of these examinations. In some instances, when evaluation was difficult, the time required for radiography was used to postpone decision-making.

### *Fear of Uncertainty*

A strong fear of uncertainty seemed to underlie each physician's decisions. They wanted to be certain they had chosen the correct classification. To discharge a patient from the emergency room after head trauma was to classify that patient as well. The fear of mislabeling a patient as normal if the patient was really ill forced physicians to obtain numerous radiographs [17–19].

### *Routines*

Finally it became apparent while discussing actual cases that physicians occasionally request radiographs without following an obvious strategy. With no more information than a glance at the chief complaint on the emergency room sheet or a brief statement from a nurse, they would procure skull films. We can only speculate on the frequency of this routine ordering of films.

## **Discussion**

Physician requests for radiographic procedures are not based on absolute indications, but are highly discretionary. Audits of patient referrals to radiology show notable varia-

tions among comparable physicians [11, 12]. Likewise, successful attempts to reduce physicians' orders for examinations suggest that physician requests vary independent of patient characteristics (Cummins RO, LoGerfo JP, Inui TS, Weiss NS, unpublished data) [11, 13]. Our research interviews confirm the discretionary nature of radiographic requests and suggest a number of reasons why this is so.

In contrast to other studies [12, 14–16], we could not attribute overuse of radiographic examinations to ignorance of the disease being considered or the procedures used for evaluation. Different clinicians have different indications for requesting radiographs. When faced with a list of recommended indications from academic radiologists, the clinicians we interviewed disagreed. This was not a perverse noncompliance, as has been implied [5], but was an honest disagreement over the proper indications.

Definite problem-solving strategies generated most requests for radiographs. Whether using the method of exhaustion [8], the Gestalt approach [7], or hypothesis generation and evaluation [9, 10], these clinicians confidently arrived at their decisions. We were surprised by the ability certain physicians had to move from one patient to another using various strategies; perhaps the elemental approaches are not as imperative and deeply ingrained as previously thought. This strategic flexibility, which contrasts with the observations of Elstein et al. [9] and Kassirer and Gorry [10], may be due to the clinical inexperience of our resident physicians in contrast to the expert clinicians in the other studies.

We observed that the context in which decisions are made plays a cardinal role in requests for skull films. This is not an original observation [12–14], but should be restated. Mentor and peer group pressure, patient and family demands, malpractice threats, time management concerns, and personal routines may combine to defeat efforts (such as continuing education, financial incentives, or performance surveillance) to modify physician behavior.

Our study has limited generalizability because it occurred in a university hospital, engaged only young physicians in training, and enlisted few subjects. These limitations should have limited the study's observations, with most physicians displaying the same behavior and attitudes. On the contrary, however, we were impressed with the rich diversity of thought and performance in the physicians we interviewed.

Skull radiography is a benign, convenient examination offering no discomfort or danger to the patient. A similar study of more expensive, uncomfortable, and inconvenient radiographic procedures would probably yield even more complex observations.

Our study had one other obvious limitation. Although the candor of the physicians we interviewed was noteworthy, observations that physicians make about their behavior may be incomplete, misleading, and even inaccurate [10]. We had no way to assess this limitation.

We agree completely with the observation of Abrams [15] that "discrete factors appear to underlie the actual or potential overuse of x-ray examinations." Our inquiry to identify some of these factors was confronted with the conflict between radiologists' and clinicians' definitions of overused radiographs. Even though referral criteria can reduce radi-

ography requests (Cummins RO, LoGerfo JP, Inui TS, Weiss NS, unpublished data), such criteria were not acceptable to clinicians as a method of defining overuse.

Noncompliance with the referral criteria was based on a number of considerations that were neither irrational nor reprehensible. Clinical logic, routines, concern for patients, social and professional pressures, and ingrained problem-solving strategies produced the "unindicated" radiographs.

Many of these ingredients can become targets for efforts to reduce excessive radiographic examinations. However, it would be unrealistic to ignore the complexity of clinicians' reasons for ordering radiographs. Much of the behavior we observed resulted from "bounded rationality" [20] and "non-perfectability of man" [21], and to us seemed logical and understandable.

#### ADDENDUM

Since acceptance of this manuscript, the unpublished data by Cummins et al. has been submitted and accepted for publication: Cummins RO, LoGerfo JP, Inui TS, Weiss NS. High yield referral criteria for post-traumatic skull roentgenology: response to physicians and accuracy of criteria. *JAMA* 1980 (In press)

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