



**FIGURE 1.** Whole-body scintigram (anterior view) in a 42-yr-old woman breastfeeding with the left breast 2 days after the second  $^{131}\text{I}$  treatment for thyroid carcinoma. There is intensive uptake in the left breast with nearly no visible radioactivity on the contralateral side or in the thyroid bed.

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**REPLY:** We read the comments of Grunwald et al. with interest. In our study (1), we were initially uncertain whether prolonged discontinuation of breast feeding would be required after total

thyroidectomy since the magnitude of the second exponential component of the  $^{131}\text{I}$  breast milk activity concentration curve (incorporation of  $^{131}\text{I}$  into thyroid iodoproteins and subsequent recycling) might be expected to be greatly reduced. This proved optimistic and we agree that breast feeding is contraindicated following  $^{131}\text{I}$  administration (2).

The absorbed dose to the lactating breast is high, although the validity of our model is uncertain. Mammary epithelial cell loss associated with involution may affect the consequences of this exposure. Confusion of breast  $^{131}\text{I}$  uptake with functioning metastases of thyroid carcinoma should not occur if the physician remains aware of this possibility.

A further issue is the period for discontinuation of breast feeding prior to  $^{131}\text{I}$  administration to minimize competition for  $^{131}\text{I}$  uptake and the absorbed dose to the breast. Bakheet and Hammami reported  $^{123}\text{I}$  or  $^{131}\text{I}$  administration within 1 wk of cessation of breast feeding and showed significant breast uptake in all patients (3). It is possible that the various patterns of breast uptake described may be related to the stage of involution. Repeat  $^{123}\text{I}$  administration in two patients demonstrated faint uptake at 5 wk and no uptake at 11 wk following cessation of breast feeding.

Studies of the composition of mammary secretion of women following abrupt termination of breast feeding show rapid alterations. Secretion involving transcellular transport (lactose, potassium) declines while leakage through intercellular junctions (immunoglobulins) increases. Most of the change occurs within 7-10 days, although secretory activity may still be present up to 42 days (4).

It would be sensible to discontinue breast feeding for as long as is practicable prior to administration of  $^{131}\text{I}$  but further information is required.

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## Diagnosis of Scaphoid Fractures: The Role of Nuclear Medicine

**TO THE EDITOR:** In a recent editorial in the *Journal*, Holder et al. (1) criticized our study published in the same issue entitled "Choosing a Strategy for the Diagnostic Management of Suspected Scaphoid Fracture: A Cost-Effectiveness Analysis" (2). They do not agree that the most efficient approach in the diagnosis of scaphoid fracture is a combination of first-day scaphoid radiography followed by bone scintigraphy.

Holder et al. state that the inclusion of a consecutive series of patients is not representative for long-term outcome or cost-effec-

tiveness analysis. They argue that the mechanism of injury and the location of the fracture and the corresponding blood supply of the scaphoid are of great importance for the development of complications, such as avascular necrosis, non-union and progressive osteoarthritis (3,4). We fully agree that a more proximal scaphoid fracture is more likely to develop complications. As previously published, however, our patient population was comparable with series reported in the literature: 40 of 56 radiologically proven scaphoid fractures (71%) were located in the waist of the scaphoid, while in 10 patients (18%) the fracture was located in the proximal pole and in 6 (11%) in the distal pole (5). Dislocation of the fracture was found in 25% of patients, 10 of 40 waist fractures, 3 of 10 proximal fractures and 1 of 6 distal fractures. In these patients, we did not encounter non-union, nor did we see secondary dislocation of any of the fractures with this approach. This strengthens our firm belief that our management protocol may reduce non-union rate substantially.

It is hard to estimate the true incidence of non-union when patients are treated adequately and promptly. This is due primarily to the fact that scaphoid X-series have been modified over the years. Second, various protocols of timing of repeated radiography have been used. Finally, new diagnostic modalities have been consistently compared to an inadequate gold standard. Thus, a comparison of studies is a difficult task. We attempted to define baseline assumptions based on the literature (including our own studies) and on the reported incidence of surgery for non-union of the scaphoid in the Dutch working population over the period 1982–1985. Since the assumption for the development of non-union is critical to our analysis, we performed a sensitivity analysis to compensate for possible over- or underestimation. Furthermore, we stratified for promptly treated and inadequately treated fractures, with non-union ranges of 0%–12% and 10%–50%, respectively. Holder et al. missed the point of this important feature of the cost-effectiveness analysis. The fact that the outcome of the analysis did not change when these percentages were applied in all possible combinations (Monte Carlo simulations), warrants our conclusion that the use of bone scintigraphy in the early management of occult scaphoid fracture is cost-effective.

They suggest that the technique we use to obtain scaphoid radiographs is insufficient. They refer to textbooks published since 1990. Our patients were included between 1987 and 1990, at which time the four views consisted of the postero-anterior in ulnar deviation, oblique (15° pronation and supination) and true lateral (6). Secondary signs, such as the fat stripe sign or soft-tissue swelling played a minor role in the management of acute patients with suspected scaphoid fracture. In the forementioned sensitivity analysis, we varied the sensitivity and specificity of scaphoid X-series at several time points. Similarly, the sensitivity and specificity of the bone scan varied over a range of 77%–100% and 88%–100%, respectively. Again, this did not substantially alter the conclusion of the cost-effectiveness analysis. It is worthwhile to consider the reliability of X-series and bone scintigraphy: The interobserver agreement of scaphoid radiographs was shown to be poor in patients with negative initial findings (7–9). If all patients with suspected scaphoid fracture were evaluated, the interobserver variability of the first-day radiographs would be acceptable ( $\kappa = 0.76$ ), which justifies the use of initial radiographs (10). The low (additional) sensitivity and the unacceptable interobserver variability ( $\kappa = 0.50$ ) of the repeated scaphoid X-series make this approach less useful. In contrast, the interobserver agreement for bone scans is high ( $\kappa = 0.80$ ) (11).

Finally, we would like to refer to recent studies of Waizenegger

et al. (12,13). They found that clinical symptoms in suspected scaphoid fracture were highly variable and that clinical examination of the wrist can do no more than heighten the suspicion that a fracture may be present (12). In their selected population of patients with occult scaphoid fracture (nondislocated, initial X-series negative) who had bone scintigraphy in their diagnostic management, no patient presented with non-union at review. This confirms that in the management of suspected scaphoid fracture, bone scintigraphy may benefit the outcome of nondislocated fractures (13).

In conclusion, bone scintigraphy is not only accurate for the detection or exclusion of scaphoid fractures but should also be used earlier rather than later in the diagnostic management of suspected scaphoid fracture. Furthermore, this approach is highly cost-effective; to save one case of non-union, an investment of ECU 2618 (\$3011.00 U.S.) is required.

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## Late Sympathetic Reinnervation and Normalization of Canine Myocardial Beta-Adrenergic Receptor Density Following Denervation

TO THE EDITOR: We previously (1) reported up-regulation of myocardial beta-adrenergic receptors ( $\beta$ -AR) and the absence of