BONE SCINTIGRAPHY IN MOORE HEMIARTHROPLasty WITH AND WITHOUT CEMENT FOLLOWING FEMORAL NECK FRACTURES
A Controlled Study

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In a controlled clinical trial patients with acute femoral neck fractures were allocated into two groups of treatment. One group (14 patients) had a Moore hemiarthroplasty cemented with methyl methacrylate, and the other (15 patients) a non-cemented prosthesis. Bone scanning with 99m-Tc-MDP was performed 6 weeks, 3 months, 6 months and 12 months after the operation. Increased activity without time-trend was found at the operated side during the entire observation period in both groups. The activity was equally increased in the two groups. No correlation was found between the scintigraphic activity and the functional hip assessment according to Merle d'Aubigné.

Bone scintigraphy is of no diagnostic value in the evaluation of a hemiarthroplasty, cemented or without cementation, during the first year postoperatively, as an increased activity might be expected through the entire period.

Key words: arthroplasty; bone cement; femoral neck fractures; nucleotide imaging

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Scintigraphic or scintimetric bone examinations are considered among the most important in evaluating painful total hip replacements (Bauer et al. 1973, Feith et al. 1976, Sjöstrand 1974, Spinelle 1975). Due to the design of the clinical series only the nosographic specificity and not the diagnostic specificity of the bone scintigraphy can be described, as all examinations were performed in patients with either known infection or pain or in successful cases (Wulff 1976). Evaluation of the diagnostic specificity demands a longitudinal follow-up with repeated examinations, as correlated to the clinical results.

Previous studies are based on total hip replacements with the use of bone cement. The clinical controlled trial presented compares the Moore hemiarthroplasty inserted with or without bone cement in a longitudinal study applying repeated bone scintigraphy. The following hypotheses were to be tested: 1) Cement fixation of the prosthesis will lead to less scintigraphic activity. 2) The scintigraphic activity will be normalized within 12 months, as after total hip replacements. 3) The scintigraphic activity is correlated to the total hip assessment. 4) Periarticular calcifications are connected with increased scintigraphic activity.

PATIENTS AND METHODS
This series concerns the first 29 patients, who were included in a clinical controlled trial about Moore
Table 1. Number of patients and scintigraphic examinations

<table>
<thead>
<tr>
<th>Scintigraphic examinations</th>
<th>Patients</th>
<th>6 weeks</th>
<th>3 months</th>
<th>6 months</th>
<th>12 months</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without cement</td>
<td>15</td>
<td>12</td>
<td>8</td>
<td>10</td>
<td>4</td>
<td>34</td>
</tr>
<tr>
<td>With cement</td>
<td>14</td>
<td>11</td>
<td>11</td>
<td>7</td>
<td>7</td>
<td>36</td>
</tr>
<tr>
<td>Total</td>
<td>29</td>
<td>23</td>
<td>19</td>
<td>17</td>
<td>11</td>
<td>70</td>
</tr>
</tbody>
</table>

hemiarthroplasty with and without cement fixation. This trial included 117 patients with femoral neck fractures, the median age being 80 years (range 70–93). The results of the clinical series have been presented recently (Sonne-Holm et al. 1982).

Scintigraphic method
A dose of 10 mCi methylendisponate marked technetium-99 isotopes were injected intravenously. One and a half hours later the bone scanning was performed with a SEARL LFOV gamma camera. The patients were examined 6 weeks, 3 months, 6 months and 12 months postoperatively. The scintigrams were evaluated by one of the authors (M. Dyrbøe) without knowledge of the type of prosthesis, clinical results or follow-up period at the examination. The scintigraphic activity was graduated into four stages. Score 1 = no increased activity in the operated hip, as compared to the contralateral, score 2 = slightly increased activity, score 3 = moderately increased activity and score 4 = highly increased activity. The observer evaluated the scintigrammes with a time interval of 1 month without any intrapersonal variation.

Clinical and radiological follow-up examination
The hip function was assessed according to a scale of 1–5 points (d’Aubigné & Postel 1954), where 5 points indicated the best results. The radiological examination included AP and lateral projections. The presence of periarticular calcifications, loosening of the prosthesis as well as acetabular migration and settling of the stem were recorded. The clinical and radiological assessments were undertaken at the same day as the scanning but without knowledge of the amount of scintigraphic activity.

One patient died before the 6 months’ follow-up examination. Because of a high morbidity among these elderly patients and further lethal cases not all patients could be followed according to the schedule, as seen from Table 1.

Statistical methods
For the evaluation of time trends of scintigraphic activity a signs’ test was applied for comparison of scores of the primary and final scintigrams. The distribution of scores in the two groups of prosthetic fixation was compared by applying a Mann-Whitney test without correction for ties.

RESULTS
Scintigraphic score 3 (moderately increased activity) was the most common following cemented as well as uncemented hemiarthroplasty for the first 6 months postoperatively (Table 2). At the 12 months follow-up all four patients in the uncemented group achieved score 2 (slightly increased activity). No significant differences were found in relation to the prosthetic fixation with or without bone cement (P > 0.1).

Comparison between the primary and final scintigraphic activity did not reveal any difference for 17 of 25 patients (Table 3). In the group of patients without cement fixation the scintigraphic activity decreased from moderately to slightly in-

Table 2. Mean scintigraphic score in the non-cemented and cemented group

<table>
<thead>
<tr>
<th>Time after operation</th>
<th>6 weeks</th>
<th>3 months</th>
<th>6 months</th>
<th>12 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without cement</td>
<td>2.8</td>
<td>2.9</td>
<td>2.7</td>
<td>2.0</td>
</tr>
<tr>
<td>With cement</td>
<td>2.9</td>
<td>2.9</td>
<td>2.6</td>
<td>2.9</td>
</tr>
<tr>
<td>P-value</td>
<td>&gt;0.1</td>
<td>&gt;0.1</td>
<td>&gt;0.9</td>
<td>&gt;0.1</td>
</tr>
</tbody>
</table>
Table 3. Changes in scintigraphic score with observation time

<table>
<thead>
<tr>
<th>No. of patients</th>
<th>Decreased</th>
<th>Unchanged</th>
<th>Increased</th>
<th>Total*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without cement</td>
<td>4</td>
<td>9</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>With cement</td>
<td>1</td>
<td>8</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
<td>17</td>
<td>3</td>
<td>25</td>
</tr>
</tbody>
</table>

* Two patients in each group were only examined one time.

creased in three patients and from highly to moderately increased in one. Cement fixation of the prosthesis was followed by decreased activity in one patient and increased in three (slightly to moderately increased).

No correlation between the scintigraphic activity and hip function was demonstrated ($P > 0.7$, chi-square test).

Periarticular calcifications were recorded among 9 of 27 patients. The average scintigraphic score was 2.8 points for patients with calcifications, as compared to 2.7 points for those without calcifications ($P > 0.1$). No acetabular migration was recorded. One patient sustained a deep infection 10 days postoperatively and had the prosthesis removed 1 year later. All scintigrams showed maximal activity in this case.

DISCUSSION

None of the four hypotheses, which were to be tested, could be proved.

Increased scintigraphic activity in bone tissue is claimed to be caused by an increased local metabolism (Bauer & Wendenburg 1959). Increased metabolism might be expected around bone cement as a result of thermal destruction of bone tissue in the postoperative period, but an increased osteoblastic activity might also be expected for the uncemented prosthesis until solid fixation is achieved. Settling of the prosthesis in the femoral shaft within the first year is an explanation of the poorer clinical results when cement fixation is not applied (Sonne-Holm et al. 1982).

In contrast to the results experienced after total hip replacements (Feith et al. 1976, Feith & Sloff 1974, Bauer et al. 1973, Creutzig 1976, Spinelli 1975, Wegmann et al. 1975) a decreased scintigraphic activity in relation to time could not be demonstrated in this series. Joint related scintigraphic activity is decreasing with age among normal persons (Nemec & Fridrich 1977). As the patients of the present series were older the demonstrated increased and prolonged scintigraphic activity around the prosthesis could be explained by an age related decreased activity in the contralateral hip.

Technical errors of the scintigraphic method could not explain the difference in results from previous publications, as a prolonged and increased activity was demonstrated. The evaluation of the scintigrams was performed blindly with a high reproducibility and is consequently considered to be unbiased.

While the scintigraphic method in an attempt to evaluate the amount of radioactivity in a hip fracture calls for a comparison of the sound hip with the fractured hip by way of polaroid or X-ray pictures, the scintimetric method relies entirely upon a comparison by a digital registration of the individual hip.

In theory, the scintimetric method would appear to be the most accurate one, however, literature still introduces a point of doubt in favour of the scintigraphic method.

The high frequency of periarticular calcification can be explained by the fact that the smallest shadowy change was registered as a calcification. This may also be the reason of the lacking correlation of scintigraphic score.

A possible explanation for the increased scintigraphic activity could be a constant cartilage destruction in the acetabulum (Jensen & Holstein 1975), which is not encountered following total hip replacements. This should not, however, lead to increased activity along the femoral stem.

In conclusion, bone scintigraphy is of no diagnostic value in the evaluation of a painful hemiarthroplasty of the hip during the first postoperative year, as an increased scintigraphic ac-
tivity might be expected through the entire period. The scintigraphic activity is independent of the use of bone cement for fixation of the prosthesis.

REFERENCES


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