EFFECT OF AGE ON AMNESIA AND SEDATION INDUCED BY FLUNITRAZEPAM DURING LOCAL ANAESTHESIA FOR BRONCHOSCOPY

K. KORITILA, L. SAARNIVAARA, J. TARKKANEN, J.-J. HIMBERG AND M. HYTONEN

SUMMARY
Bronchoscopy was undertaken in 79 outpatients using local anaesthesia plus an i.v. injection of flunitrazepam 0.01 mg kg⁻¹. The co-operation of the patients and the ease of bronchoscopy were good regardless of the age of the patient. There was an increase in amnesia for the bronchoscopy with increasing age, but the most distinct difference between different age groups was that the amnesic action of flunitrazepam was evident earlier and persisted longer in patients of more than 60 yr. Eye co-ordination and ability to stand steadily and walk on a line returned to normal more slowly in patients more than 60 than in those less than 60 yr, but no differences in recovery were noted between patients less than 40 and those of 40-59 yr, or between those 60-69 and those more than 70 yr.

Local anaesthetic techniques are preferable to general anaesthesia in outpatient procedures such as bronchoscopy since such patients require less supervision in the period after operation (Korttila, 1978). Bronchoscopy under local anaesthesia, often a disagreeable and frightening experience, can be made more acceptable to the patient if he is sedated lightly and does not remember the procedure afterwards (Korttila et al., 1978).

Previous comparisons of diazepam and flunitrazepam when used to produce such sedation have shown that flunitrazepam has a better and more prolonged amnesic action than otherwise comparable doses of diazepam (Korttila and Linnoila, 1975, 1976; Dundee et al., 1976; Korttila et al., 1978).

Although the degree and duration of the amnesic action of the diazepam have been studied extensively (Dundee and Pandit, 1972; Gregg, Ryan and Levin, 1974; Flinn, Wineland and Peterson, 1975; Dundee and George, 1976; Korttila et al., 1978), no report has been concerned with the effect of age on the amnesic action of diazepam or other benzodiazepines.

We have studied the effect of age on the sedation produced by flunitrazepam during bronchoscopy undertaken under local anaesthesia. In particular, the effect of age on the amnesic action of flunitrazepam has been investigated.

PATIENTS AND METHODS
Patients and sedation
Seventy-nine patients undergoing diagnostic bronchoscopy as outpatients were studied. There were four age groups, each receiving the same amount of flunitrazepam (table I). Any patient who had taken psychotropic or other drugs known to interact with the benzodiazepines was excluded. Informed consent was obtained from each patient.

TABLE I. Characteristics of test groups receiving flunitrazepam 0.01 mg kg⁻¹ for sedation during bronchoscopy (mean ± SD)

<table>
<thead>
<tr>
<th>Age group (yr)</th>
<th>No. of patients</th>
<th>Age (yr)</th>
<th>Weight (kg)</th>
<th>Height (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 40</td>
<td>19</td>
<td>33 ± 4.1</td>
<td>68 ± 16</td>
<td>174 ± 10</td>
</tr>
<tr>
<td>40-59</td>
<td>26</td>
<td>52 ± 5.8</td>
<td>72 ± 10</td>
<td>169 ± 8</td>
</tr>
<tr>
<td>60-69</td>
<td>19</td>
<td>65 ± 3.1</td>
<td>68 ± 12</td>
<td>168 ± 8</td>
</tr>
<tr>
<td>More than 70</td>
<td>15</td>
<td>73 ± 1.7</td>
<td>69 ± 12</td>
<td>170 ± 8</td>
</tr>
</tbody>
</table>

Lignocaine (Lidocain, Orion, Helsinki) 170-200 mg was sprayed on the pharynx (2 ml of a 10% solution), larynx and trachea (5-6 ml of a 3% solution) before the injection of the drugs. Atropine (Atropin, Orion, Helsinki) 0.01 mg kg⁻¹ was injected i.v. 5 min before the sedative. Flunitrazepam (Rohypnol, Roche, Basel) 0.01 mg kg⁻¹ was given at a rate of 0.05 mg min⁻¹.

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Clinical observations and subjective assessments

The systolic and diastolic arterial pressures were measured by auscultation, and the heart rate was counted at the wrist before, during and after the procedure (Korttila et al., 1978).

The bronchoscopist (J. T.) rated both the efficiency of anaesthesia and the co-operation of the patient (ease of bronchoscopy) on a visual analog scale (100 mm long) between poor (0 mm) and good (100 mm). The patient rated the pleasantness of the procedure in the same manner.

Assessment of amnesia

Amnesia was assessed in a manner similar to that used by Dundee and Pandit (1972). The subjects were shown a bank note, a picture of the President of Finland and a stamp as a recognition and memory test. The first object was shown just after the injection of flunitrazepam, the second after the bronchoscope was removed and the third 15 min after the injection of flunitrazepam. Two hour after the injection of flunitrazepam the patient was asked which objects he or she could remember. Recollection of the i.v. injection and of the insertion and removal of the bronchoscope was sought also.

Evaluation of recovery

The initial recovery of the patient was determined by Romberg's test and by his ability to walk on a straight line (Korttila, 1976a). Assessments were made initially when the patient arrived in the operating theatre, and then 30, 60 and 120 min after the injection of flunitrazepam.

Visualization test (James, 1969). The subject had to trace each of 10 inter-mixed lines from their origin on the left side of the paper to their termination on the right without the aid of a tracing finger. The score was the number of correct tracings made in a 3-min period.

Aiming test (James, 1969). A piece of paper (20 cm × 30 cm) with 15 rows of 20 open circles (diameter 2 mm). The subject had to place a dot inside each of as many circles as possible in 3 min. The dot must not touch the edge of the circle; the score was based on the number of correct responses.

Speed anticipation test (Takei & Company Ltd, Tokyo). A small round patch of light with a diameter of 12 mm glided at a constant speed from right to left along a horizontal depression in a grey screen in the subject's line of vision, disappeared behind a black wall and stopped. The subject had to estimate the time the gliding light would have needed to pass through the black wall if it had continued at the same speed. He or she pressed a key at the instant the patch should have reappeared from behind the black wall. The correct anticipation time was 2.08 s. The apparatus and testing procedure have been described previously (Maruyama and Kitamura, 1961).

This test was used before and 2 h after sedation. After instruction, two training trials were made, followed by 10 trials for measurements. The score was registered as mean ± SD of 10 anticipation times; a coefficient of variation was calculated also.

Questionnaire

Each patient received a sealed envelope containing a questionnaire concerning the bronchoscopy and the patient's opinion of its acceptability (Korttila et al., 1978). This was answered on the day after the procedure.

Drug concentrations in serum

Venous blood was sampled from a cubital vein 2 h after the injection of flunitrazepam. Sera were stored at −22 °C until the concentrations of serum flunitrazepam were assayed after extraction by electron-capture gas–liquid chromatography according to a modification of the method of de Silva and others (1976).

Data analysis

Statistical analysis of the data was carried out using the non-parametric Chi-square test and Student's t test for independent means between the groups and for dependent means within the groups.

RESULTS

The principal differences between the different age groups were that, in addition to a more frequent amnesic action of flunitrazepam with increasing age, the amnesia attributable to flunitrazepam was evident significantly earlier and persisted significantly longer in older patients. Instead of a close age–recovery relationship, there was clearly a more prolonged recovery in patients of more than 60 yr than in younger patients.

Cardiovascular effects and the performance of bronchoscopy

In each age group both the systolic and diastolic arterial pressure remained almost unaltered during bronchoscopy and were decreased slightly (always less than 15 mm Hg systolic and 6 mm Hg diastolic) afterwards. Heart rate increased by an average of 10 beat
min⁻¹ in each age group. The mean time (± SD) to perform the bronchoscopy was similar in each age group:

<table>
<thead>
<tr>
<th>Age group (yr)</th>
<th>Mean time (± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>under 40 yr</td>
<td>3.6 ± 2.4 min</td>
</tr>
<tr>
<td>40–59 yr</td>
<td>3.8 ± 1.6 min</td>
</tr>
<tr>
<td>60–69 yr</td>
<td>4.1 ± 1.4 min</td>
</tr>
<tr>
<td>over 70 yr</td>
<td>4.8 ± 2.2 min</td>
</tr>
</tbody>
</table>

Subjective assessments

As regards the efficiency of the local anaesthesia and the co-operation of the patients, no statistically significant differences between the various age groups were noted. However, the older patients had a higher rating in these assessments for the ease of bronchoscopy (table II). Patient acceptability of the procedure was similar in each age group (table II).

Table II. Efficacy of local anaesthesia and co-operation during bronchoscopy (0 = poor, 100 = good) and acceptability of procedure determined after 2 h (0 = unpleasant, 100 = pleasant) (mean ± SD)

<table>
<thead>
<tr>
<th>Age group (yr)</th>
<th>Efficiency of local anaesthesia</th>
<th>Co-operation of patients</th>
<th>Acceptability to patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 40</td>
<td>59 ± 37</td>
<td>63 ± 38</td>
<td>50 ± 17</td>
</tr>
<tr>
<td>(n = 19)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40–59</td>
<td>65 ± 34</td>
<td>66 ± 33</td>
<td>56 ± 12</td>
</tr>
<tr>
<td>(n = 26)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60–69</td>
<td>74 ± 30</td>
<td>71 ± 31</td>
<td>52 ± 15</td>
</tr>
<tr>
<td>(n = 19)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>More than 70</td>
<td>76 ± 34</td>
<td>78 ± 32</td>
<td>59 ± 19</td>
</tr>
<tr>
<td>(n = 15)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Amnesia

Patients of more than 60 yr had significantly more difficulty in recognizing the pictures shown to them than those less than 60 yr (fig. 1). Half of the patients over 60 yr recognized the picture shown after removal of the bronchoscope (5–6 min after the injection of flunitrazepam), the corresponding figures being 90 and 81% of the patients less than 40 and 40–59 yr.

When the patients were asked about the pictures shown 2 h after the sedation, there were no significant differences in the peak amnesic actions of flunitrazepam in the different age groups. More than 90% of the patients of more than 60 yr, 74 and 77% of the patients less than 40 and 40–59 yr respectively, did not remember the picture shown 5–6 min after flunitrazepam (fig. 2).

In older patients the amnesic action of flunitrazepam started significantly earlier and persisted longer than in the younger patients (fig. 2). Its duration was especially long for the patients of more than 60 yr.

Amnesia for the insertion or removal of the bronchoscope increased with age (fig. 3). Forty-two per cent of the patients less than 40 yr did not remember scope
removal 2 h after completion of the procedure, compared with 73% for those of more than 70 yr.

**Recovery**

The patients’ ability to stand steadily and walk on a line after sedation is shown in figures 4 and 5. These functions were similar for the two younger age groups (patients less than 60 yr) and similar in the two older age groups (patients more than 60 yr). One hour after the injection of flunitrazepam 0.01 mg kg\(^{-1}\) 60% of the patients aged 60-69 or more than 70 yr could not stand steadily, compared with only 5 and 12% of the patients less than 40 and 40-59 yr respectively. Two hour after sedation each patient less than 40 yr and all except one less than 60 yr could stand steadily and walk on a straight line, whereas 21% of those aged 60-69 yr or 33% of those more than 70 yr could not.

**Visualization and aiming tests.** Eye co-ordination improved after sedation in patients of less than 60 yr, but was impaired in patients more than 60 yr, as compared with the results before the injection of flunitrazepam (table III). In the aiming test, the number of circles properly dotted did not change significantly after sedation in any age group. Because of poor vision most of the patients more than 70 yr could not perform the tests.

**Speed anticipation test.** The ability to estimate the speed of a moving light is considered worse if the speed is rated faster than is correct (Maruyama and Kitamura, 1961). In this study the speed anticipation time in each age group was similar before and 2 h after sedation (table IV). However, there was an age-related increase in the average coefficient of variation of 10 succeeding speed estimations, and this result indicates residual drug effects in the groups of older patients.

**Questionnaire**

In each age group the acceptability of both sedation and the procedure was confirmed (table V). Despite an injection of atropine and local anaesthesia of the respiratory tract, no retrograde amnesia was
## FLUNITRAZEPAM AMNESIA AND SEDATION FOR BRONCHOSCOPY

### TABLE III. Recovery (visualization and aiming tests). Mean ± SD before sedation and change ± SD 2 h afterwards

<table>
<thead>
<tr>
<th>Age group (yr)</th>
<th>Visualization test, number correct</th>
<th>Aiming test, number correct</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before sedation</td>
<td>Change 2 h after sedation</td>
</tr>
<tr>
<td>Less than 40</td>
<td>22.2 ± 2.5</td>
<td>5.7 ± 1.9*</td>
</tr>
<tr>
<td>40-59</td>
<td>9.9 ± 1.1</td>
<td>3.5 ± 0.8**</td>
</tr>
<tr>
<td>60-69</td>
<td>10.1 ± 2.9</td>
<td>−0.4 ± 1.6</td>
</tr>
</tbody>
</table>

* P < 0.001 v. 60-69 yr; **P < 0.001 v. patients less than 40 yr or 60-69 yr.

### TABLE IV. Speed anticipation time (means ± SD) before and after sedation and change in average coefficient of variation (mean ± SEM) 2 h after sedation

<table>
<thead>
<tr>
<th>Age group (yr)</th>
<th>Before sedation (s)</th>
<th>2 h after sedation (s)</th>
<th>Change in coefficient of variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 40</td>
<td>1.67 ± 0.53</td>
<td>1.49 ± 0.70</td>
<td>−3.4 ± 3.9</td>
</tr>
<tr>
<td>(n = 11)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-59</td>
<td>1.43 ± 0.59</td>
<td>1.55 ± 0.73</td>
<td>−0.5 ± 2.6</td>
</tr>
<tr>
<td>(n = 23)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60-69</td>
<td>1.41 ± 0.46</td>
<td>1.24 ± 0.54</td>
<td>+3.5 ± 2.9</td>
</tr>
<tr>
<td>(n = 16)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>More than 70</td>
<td>1.18 ± 0.48</td>
<td>1.23 ± 0.78</td>
<td>+5.3 ± 4.7</td>
</tr>
<tr>
<td>(n = 10)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

associated with flunitrazepam administration. Fewer than 12% of patients would have preferred general anaesthesia. On the day after sedation only 20% of the patients of more than 40 yr remembered the bronchoscopy, the corresponding recall being 47% in patients less than 40 yr.

### Drug concentrations in serum

Because of the great variation in concentrations there was no significant age-related residue of flunitrazepam 2 h after injection (table VI). However, patients more than 70 yr had on average twice as much flunitrazepam in the serum 2 h after sedation than those less than 40 yr.

### DISCUSSION

Expense, and a shortage of personnel, dictate that bronchoscopy is performed usually as an outpatient procedure in Finland. Therefore, topical anaesthesia with light sedation is considered preferable to general anaesthesia because of the slow recovery usually associated with the latter (Korttila, 1978).

### TABLE V. Answers to the questionnaire (numbers are % of total)

<table>
<thead>
<tr>
<th>Age group (yr)</th>
<th>&lt; 40 (n = 19)</th>
<th>40-59 (n = 26)</th>
<th>60-69 (n = 19)</th>
<th>&gt; 70 (n = 15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remembered</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>local anaesthesia</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>insertion of needle</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>93</td>
</tr>
<tr>
<td>bronchoscopy</td>
<td>47</td>
<td>19</td>
<td>21</td>
<td>20</td>
</tr>
<tr>
<td>Would like next bronchoscopy performed similarly</td>
<td>89</td>
<td>89</td>
<td>95</td>
<td>93</td>
</tr>
<tr>
<td>Remembered</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>standing</td>
<td>100</td>
<td>100</td>
<td>95</td>
<td>93</td>
</tr>
<tr>
<td>walking on line</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>80</td>
</tr>
<tr>
<td>marking spots</td>
<td>93</td>
<td>85</td>
<td>79</td>
<td>87</td>
</tr>
<tr>
<td>looking at moving light</td>
<td>95</td>
<td>92</td>
<td>95</td>
<td>93</td>
</tr>
<tr>
<td>Following afternoon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>normal</td>
<td>84</td>
<td>85</td>
<td>79</td>
<td>100</td>
</tr>
<tr>
<td>unusually tired</td>
<td>16</td>
<td>15</td>
<td>16</td>
<td>13</td>
</tr>
<tr>
<td>sore throat</td>
<td>11</td>
<td>12</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>miscellaneous</td>
<td>5</td>
<td>8</td>
<td>5</td>
<td>13</td>
</tr>
</tbody>
</table>
Flunitrazepam was used as an i.v. sedative in this study since previous results with healthy volunteers (Korttila and Linnoila, 1975, 1976) and with patients (Dundee et al., 1976; Korttila et al., 1978) indicated that flunitrazepam had a better and more prolonged amnestic action than had comparable doses of diazepam. The dose of flunitrazepam used (0.01 mg kg\(^{-1}\)) was comparable clinically to a 0.125-mg kg\(^{-1}\) dose of diazepam, with the exception of its better amnestic action (Dundee et al., 1976; Korttila et al., 1978).

The early discharge of patients from hospital after outpatient procedures emphasizes the need for, and the importance of, testing for recovery after sedation. The tests used in this study, however, do not indicate "street-fitness" or psychomotor recovery (Korttila, 1976a, b, 1978). Both Romberg's test and walking on a line are easy to perform, and they are indices of the co-ordination skills which are affected to the greatest degree and for the longest time after sedation with flunitrazepam (Korttila and Linnoila, 1976).

The visualization test and the aiming test proved to be sensitive measures of mental function after cyclopropane anaesthesia (James, 1969). It is true that subjects who are untrained show an improvement in performance when the tests are repeated. However, we used the tests to reveal differences between recovery in different age groups.

The speed anticipation test used has been suggested previously as an aptitude test for the discrimination of accident-proneness (Maruyama and Kitamura, 1961). The test should discriminate between accident-prone drivers and non-accident-prone drivers with the efficiency ratio of 77.5\%. We used the test to gain information of its usefulness in assessing recovery from anaesthesia in the clinical situation. It was found that, at least with respect to flunitrazepam sedation, the test was of little value in the assessment of recovery, since such a simple test as walking on a straight line was as good an index of prolonged recovery as was the speed anticipation time. The increase in the average coefficient of variation indicated age-dependent residual effects of flunitrazepam, but the anticipation time itself was similar before and 2 h after sedation. This relative insensitivity of the speed anticipation test as a measure of the residual effects of flunitrazepam agrees with our previous results with healthy volunteers (Korttila and Linnoila, 1974, 1976) and indicates that, with the exception of co-ordination skills, flunitrazepam does not have any major residual effects on other psychomotor skills.

**Effect of age on the action of flunitrazepam**

**Amnesia.** As mentioned previously, the effect of age on the amnestic action of diazepam has not been studied. Gregg, Ryan and Levin (1974) have reviewed thoroughly the supposed mechanisms for the amnestic effects of diazepam.

In our study, when amnesia for bronchoscopy was sought, there was a linear increase in the amnestic action of flunitrazepam with increasing age. However, when the amnestic action and its duration were investigated more thoroughly with memory cards, the amnestic action of flunitrazepam was evident earlier and persisted longer in older compared with younger patients, but there was no significant difference in the peak amnestic effect between the different age groups.

Gregg, Ryan and Levin (1974) noticed that the main difference in the amnestic effects of higher doses of diazepam, in comparison with smaller doses, was in the duration of the effects rather than the depth of amnesia.

**Recovery.** It has been shown previously that after the i.v. injection of a 0.01-mg kg\(^{-1}\) dose of flunitrazepam the eye-hand co-ordination of healthy volunteers was impaired for as long as 6 h after the injection and for at least 10 h after 0.02 and 0.03 mg kg\(^{-1}\) of flunitrazepam (Korttila and Linnoila, 1976).

An increase in the sensitivity to the effect of nitrazepam in old age has been reported (Castleden et al., 1977). After a single 10-mg oral dose of nitrazepam subjects more than 70 yr felt less awake and made more mistakes in a psychomotor test administered 12 and 36 h after medication than did those less than 40 yr.

In the present study the state of recovery 2 h after the injection of flunitrazepam was similar in patients whose ages ranged from less than 40 yr to more than 70 yr. However, there was a distinct difference in the ability to stand and walk and in eye co-ordination after sedation in those less than 60 yr when compared with those more than 60 yr. The finding in this study that the patients' ability to walk on a straight line was the best index of delayed recovery agrees with the prolonged vertigo and unsteady gait observed by us in

**Table VI. Concentration of flunitrazepam in serum (mean ± SEM) 2 h after i.v. injection of flunitrazepam 0.01 mg kg\(^{-1}\)**

<table>
<thead>
<tr>
<th>Age group (yr)</th>
<th>No. of patients</th>
<th>Concentration (ng ml(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 40</td>
<td>11</td>
<td>19 ± 3.3</td>
</tr>
<tr>
<td>40–59</td>
<td>21</td>
<td>32 ± 8.5</td>
</tr>
<tr>
<td>60–69</td>
<td>17</td>
<td>29 ± 6.7</td>
</tr>
<tr>
<td>More than 70</td>
<td>9</td>
<td>43 ± 2.3</td>
</tr>
</tbody>
</table>

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young healthy volunteers after injections of flunitraze-
pam (Korttila and Linnoila, 1976). Although it is possible to discharge a patient from hospital, accompanied, 2–3 h after light flunitrazepam seda-
tion, patients should not drive or operate machinery
for at least 24 h after sedation.

**Drug concentrations in blood**

Residual amounts of drugs in the blood may be
related to the duration of the effects of the drugs
(Ghoneim and Korttila, 1977).

In respect of benzodiazepines, there seem to be
great differences in the influence of age on their
pharmacokinetics. Klotz and others (1975) have
demonstrated a four- to five-fold increase in the half-
life of diazepam as a function of age, whereas the
plasma concentrations and half-life of nitrazepam
were similar in young and elderly patients (Castleden
et al., 1977).

In a previous study (Korttila and Linnoila, 1976)
of flunitrazepam 0.01 mg kg^{-1} i.v. in young subjects,
the mean serum concentration of flunitrazepam 2 h
after administration (5.5 ± SEM 0.7 ng ml^{-1}) was
less than that of elderly patients in the present study,
but in respect of patients of more than 40 yr no age-
related residue of flunitrazepam was noted.

**Dosage recommendations**

Based on these and our previous results (Korttila
and Linnoila, 1976; Korttila et al., 1978) we recom-
 mend that, when amnesia is sought with flunitraze-
pam i.v., dosage should be:

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Dosage</th>
<th>mg kg^{-1}</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 40 yr</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>40–60 yr</td>
<td>0.015</td>
<td></td>
</tr>
<tr>
<td>more than 60 yr</td>
<td>0.01</td>
<td></td>
</tr>
</tbody>
</table>

These doses should induce amnesic action of 5–
15 min duration for more than 80% of patients, allowing
them to be discharged from hospital, accompanied,
2 h after sedation.

**ACKNOWLEDGEMENTS**

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Hoffmann-La Roche & Co. Ltd, Basle, Switzerland.

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0.01 mg kg\(^{-1}\). La coopération des malades et la facilité de la bronchoscopie ont été bonnes quel que soit l’âge du malade. Il y a eu une augmentation de l’amnésie pour la bronchoscopie au fur et à mesure que l’âge était plus avancé, mais la différence la plus nette entre les différents groupes d’âge a été que l’action amnésique du flunitrazépam a été évidente plus tôt et s’est maintenue pendant plus longtemps sur les malades âgés de plus de 60 ans. La coordination des yeux, la possibilité de se tenir debout sans vaciller et celle de marcher en ligne droite sont redevenues normales plus lentement, chez les malades âgés de plus de 60 ans que sur ceux moins âgés, mais on n’a remarqué aucune différence du point de vue récupération entre les malades de moins de 40 ans et ceux dont l’âge se situe entre 40 et 59 ans, ou entre ceux dont l’âge se situe entre 60 et 69 et ceux âgés de plus de 70 ans.

**DIE WIRKUNGEN AUF VERSCHIEDENE ALTERSKLASSEN, VERGESSELLICHKEIT UND BERUHIGUNG BETREFFEND, WÄHREND ORTLICHER BETÄUBUNG DURCH FLUNITRAZEPAM BEI BRONCHOSKOPIE**

ZUSAMMENFASSUNG

Eine Bronchoskopie wurde in 79 ambulanten Patienten durchgeführt, dabei wurden eine örtliche Betäubung plus eine intravenöse Injektion von Flunitrazepam 0.01 mg kg\(^{-1}\) gegeben. Die Mitwirkung der Patienten und die Leichtigkeit der Bronchoskopie waren unabhängig vom Patientenalter gut. Mit fortschreitendem Alter kam es zu einer Vertiefung der Betäubung für Bronchoskopie, aber der grösste Unterschied zwischen den verschiedenen Altersklassen war, dass der betäubende Effekt von Flunitrazepam sich in über 60 Jahren alten Patienten viel früher zeigte und viel länger anhielt als in jüngeren. Die Augenkoordination, das ruhige Stillstehen und das Entlangschreiten auf einer geraden Linie wurde in Patienten über 60 viel langsamer wieder normal, als in Patienten unter 60. Kein Unterschied wurde aber in der Erholungsdauer zwischen Patienten unter 40 und denen zwischen 40 und 59 Jahren, oder zwischen 60 bis 69 und über 70 Jahren bemerkt.

**ZUSAMMENFASSUNG**

Se sometieron 79 pacientes de consultorio a broncoscopia, aplicando anestesia local más una inyección intravenosa de flunitrazepam 0,01 mg kg\(^{-1}\). La cooperación de los pacientes y la facilidad de la broncoscopia fueron buenas, cualquiera fuera la edad del paciente. Aumentó la amnesia por broncoscopia cuanto más avanzada fuera la edad, pero la diferencia más notable entre los diversos grupos de edades fue que la acción amnésica de flunitrazepam se evidenciaba antes y perduraba más en aquellos pacientes cuya edad superaba los 60 años. La coordinación de los ojos y la habilidad de pararse con estabilidad y caminar en línea recta volvieron a la normalidad más lentamente en los pacientes con más de 60 años que en aquellos con menos de 60 años, pero no se produjeron diferencias en la recuperación de los pacientes con menos de 40 años y aquellos de 49–50 años, o entre aquellos de 60–69 y aquellos que superaban los 70 años de edad.