Comparative Evaluation in Peridural Anesthesia of Lidocaine, Mepivacaine and L-67, a New Local Anesthetic Agent

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A standardized technique for peridural anesthesia makes it possible to vary only one factor and observe its effect on a variety of anesthetic parameters. In this study the effect of changes in volume or concentration of local anesthetic agents and the effect of addition of epinephrine to local anesthetic agents was evaluated. An increase in volume or concentration of local anesthetic agents results in a decreased latency, increased incidence of complete blockage, increased incidence of muscle relaxation, increased duration of operative analgesia and increased incidence of hypotension. This technique also makes possible the comparative clinical evaluation of different local anesthetic agents. In this study Citanest (L-67), a new local anesthetic, was compared with lidocaine and mepivacaine. The local anesthetic activity of Citanest was found to be comparable to that of lidocaine and mepivacaine at equivalent doses. However, the enhanced safety of Citanest makes possible the use of a 3 per cent solution of this agent. In a 3 per cent concentration of Citanest, it possesses a local anesthetic activity superior to either 2 per cent lidocaine or mepivacaine. No toxic reactions or complications were observed in a series of 538 patients treated with Citanest while the incidence of adequate anesthesia in this group of patients was 97 per cent.

The lack of a standardized method for comparing new local anesthetic agents introduced into clinical trial has resulted in much confusion for the anesthesiologist. The value of peridural anesthesia for comparing clinical effectiveness of local anesthetics was proposed by the author over a decade ago. Since then, numerous articles have appeared in which peridural anesthesia has been utilized for clinical investigation involving anesthetics. Unfortunately, most of the reports are not comparable because techniques employed have not adequately considered the various factors affecting spread of solution and intensity of peridural blockade. Most descriptions of peridural anesthesia refer to some of these factors, such as volume, rate of injection and approach site. However, little attention is given to other variables such as gravity, the use of a needle or catheter for injection, type and size of needle, direction of the bevel at time of injection (particularly if a Huber point is used), body build, age of patient, operative site and operative procedure.

Since each of these variables, both independently and collectively, may affect the results of the anesthesia, a detailed investigation was conducted to determine the significance of each factor in regard to the spread of anesthetic solutions in the peridural space and the resulting intensity of anesthesia. The results of this study will be reported separately. The purpose of the present report is to present the results of a comparative evaluation of local anesthetic drugs, utilizing a standardized peridural procedure. The agents chosen were lidocaine, mepivacaine, and L-67 (Citanest), a new local anesthetic.

Citanest, a chemical analog of lidocaine (fig. 1), was synthesized by Lofgren and Tegnér in 1960 in an effort to find a local anesthetic with potency comparable to lidocaine, but whose toxicity was significantly reduced. Various pharmacological studies have shown that Citanest is as effective as lidocaine in the production of regional anesthesia in animals, while its toxicity, expressed as LD₅₀, is approximately 60 per cent that of lidocaine. Preliminary clinical studies conducted by Eriksson indicated that Citanest possesses anesthetic properties comparable to those of lidocaine while producing a longer

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Occasionally, a particularly cooperative patient was not given thiopental in order that the finding could be compared with those who were sedated as described. As a rule, sedation was established before the local anesthetic drug was injected so that testing could be initiated immediately afterwards.

**Caudal Approach.** Patients were placed in the jack-knife position and the anesthetic solution was injected through a 20 gauge needle at the rate of 2.0–2.5 ml./second. One minute following the beginning of injection, and every minute thereafter, the perianal area was pinched with a needle until there was no anal muscular winking response or movement. As soon as one side was anesthetic to needle probing, an Ochsner clamp was substituted as a summation stimulus. When no response on either side followed clamping of a segment for five seconds, that side was recorded as completely blocked.

**Lumbar Approach.** The patient was placed in the lateral decubitus position and the distance between the sacral hiatus and the seventh cervical vertebra was measured before flexing the patient. This information was recorded for inclusion in a long term study of the spread of anesthetic solution. Vasopressors were not used prophylactically and were employed only when the systolic blood pressure fell below 80 mm. of mercury; an intravenous drip of phenylephrine (1–2 mg.) was used in these cases. The back was then flexed and, following preparation of the approach site, a skin wheel was made over the second or third lumbar interspace. The skin was penetrated with a large, sharp needle to facilitate insertion of a 17-gauge, blunt-tipped Touhy needle. Using a midline approach, the needle, with the bevel pointing laterally, was advanced to a site just proximal to the ligamentum flavum. The stylet was removed and a 2 ml. syringe containing 1 ml. of distilled water was attached. The peripheral space was then identified by the loss of resistance technique. Following injection of the solution and aspiration, the bevel was directed cephalad and the syringe was removed. A styletted vinyl catheter, which had been marked prior to autoclaving with a crayon at a distance from the catheter tip comparable to the length of the needle.
and at 1 inch intervals beyond this, was then passed through the needle until the first en- 
circling reached the hub, thus indicating the 
tip of the catheter was at the bevel. The 
wire stylet was withdrawn 1 inch and the 
catheter advanced a comparable distance. 
The needle was withdrawn over the stylletted 
catheter, being sure that the needle was 
moved and not the catheter. The tip of the 
catheter then was pointing cephalad into the 
peridural space at a distance not greater than 
1 inch beyond its entrance. The remainder 
of the stylet was withdrawn and a 23-gauge 
noodle inserted. The catheter was positioned 
along the midline of the back towards the 
head and held in place with a two inch strip 
of tape. (Although this was the ideal time 
to inject a test dose, it was not done in this 
study in order that all the local anesthetic 
solution could be injected while the patient 
was lying in the supine position and ready 
for testing.) The patient was then turned to 
the supine position and the local anesthetic 
drug was injected at the rate of approximately 
1 ml/second.

Testing for analgesia began immediately 
with a 20-gauge needle to determine the 
rate and spread of solution. Testing was 
made both cephalad and caudad from the 
injection site. The needle (pin stick) level 
was checked every minute following injection. 
As soon as an area tolerated the needle 
stick, an Olschner (bite tooth) clamp was 
applied to the area and the onset of clamp 
anesthesia was determined. When the patient 
tolerated a firmly closed, but not locked, clamp 
for 5 seconds, the area was considered blocked. 
Since the first volume of solution would be 
distributed for the most part cephalad to 
second lumbar region and, therefore would 
include the lower abdomen, the onset of clamp 
analgesia in this area served as the end point 
for determining the latency period. The final 
test for analgesia was whether the patient moved on incision. Muscle relaxation was 
judged subsequently by the surgeon and the 
anesthesiologist as inadequate, adequate, or 
excellent. The latter classification was re-
erved for the patient believed to be ideally 
relaxed.

Duration of a block was measured in 
operations that lasted longer than the 
peridural block by observation of an increase 
in tone of the abdominal wall and/or in-
creased difficulty in keeping the bowel out 
of the operative area, return of pain during 
operation, or by return of the diastolic blood 
pressure to a normotensive pre-block state. 
Postoperative checks were restricted to return 
of leg movement. It was not believed worth-
while or practical to continue sticking or 
clamping the patient's skin to determine the 
effect end point in each patient. The onset 
of postoperative pain was also considered to 
be of little value because of the various 
factors affecting this subjective response.

Three series of investigations were carried 
out: (1) the effect of varying concentrations 
of local anesthetics on the various parameters. 
In this series the concentration of lidocaine 
and mepivacaine used did not exceed 2 per 
cent. However, when laboratory investiga-
tions revealed that Citanest had a much lower 
toxicity than lidocaine, a 3 per cent solution 
of Citanest was studied. (2) The effect of 
varying volumes of local anesthetics on various 
parameters. In this series lidocaine and 
Citanest alone were compared. (3) A clini-
cal evaluation of the safety and effectiveness of 
Citanest, the new local anesthetic. 
In addition, the effect of lidocaine solutions con-
taining epinephrine also was evaluated. No 
epinephrine was added to either mepivacaine 
or Citanest. Statistical analysis of the data 
was performed using either the Student's t test 
or the Chi square test.

In order to minimize the influence of vari-
ables related to the patient or surgery on the 
anesthetic action, patients of similar body 
build and age undergoing comparable surgical 
procedures were employed in the various anes-
thetic groups. Thus, for example, in the series 
involving caudal anesthesia the patients in 
the various groups ranged in age from 30–50 
and were classified as medium body build. 
Moreover, all were hemorrhoidectomy cases 
so that the operative site and procedure were 
identical. Likewise, in the lumbar peridural 
study all of the patients were females 30–45 
years in age, and ranging in height from 60 
to 66 inches. In each case a lower abdominal 
incision was made and pelvic surgery, e.g., 
hysterectomy, performed. Thus, it was un-
likely that variables pertaining to the patient
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analgesia. Latency varied as a direct function of concentration. Thus, for example, the latency for Citanest varied significantly from a mean of 6.4 minutes with the 1 per cent solution to 2.7 minutes with the 3 per cent solution \( (P = < 0.01) \) (fig. 2). At a concentration of 1 per cent mepivacaine had a significantly lower latency than either lidocaine or Citanest \( (P = < 0.05) \). No significant difference existed between 1 per cent lidocaine and 1 per cent Citanest. At a concentration of 2 per cent, no significant difference existed between the three anesthetics. The 3 per cent Citanest possessed a significantly shorter latency than 2 per cent mepivacaine \( (P = < 0.05) \) but not shorter than 2 per cent lidocaine \( (P = > 0.1) \).

With respect to incidence of complete blockade no significant difference was found among the three agents at equivalent concentrations. When the three local anesthetics were used in 1 per cent concentrations, the incidence of complete blockade varied from 65 per cent to 75 per cent. Increasing the concentration to 2 per cent increased the incidence of complete blockade to 95 per cent for all three agents. The use of 3 per cent Citanest resulted in complete blockade in all 20 patients.

Impairment of leg movement and the duration of operative analgesia also increased as a direct function of the increase in concentration (table 1). Equivalent concentrations of mepivacaine and Citanest produced the same

Table 1. Caudal Anesthesia: Effect of Varying the Concentration of Local Anesthetic Agent

<table>
<thead>
<tr>
<th>Drug</th>
<th>Number of Patients</th>
<th>Volume (ml)</th>
<th>Conc.</th>
<th>Epinephrine 1:200,000</th>
<th>Latency (minutes)</th>
<th>Partial Block</th>
<th>Technical Failure</th>
<th>Imipairment of Leg Movement</th>
<th>Duration of Operative Analgesia (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lidocaine</td>
<td>60</td>
<td>20</td>
<td>1%</td>
<td>No</td>
<td>3-11</td>
<td>5.8</td>
<td>6</td>
<td>None</td>
<td>75-90</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>20</td>
<td>2%</td>
<td>Yes</td>
<td>4-14</td>
<td>8.5</td>
<td>5</td>
<td>None</td>
<td>90-120</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>20</td>
<td>2%</td>
<td>Yes</td>
<td>2-7</td>
<td>3.9</td>
<td>1</td>
<td>Minimal</td>
<td>90-120</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>20</td>
<td>2%</td>
<td>Yes</td>
<td>4-13</td>
<td>7.9</td>
<td>2</td>
<td>Minimal</td>
<td>120-150</td>
</tr>
<tr>
<td>Mepivacaine</td>
<td>75</td>
<td>20</td>
<td>1%</td>
<td>No</td>
<td>3-14</td>
<td>7.8</td>
<td>7</td>
<td>None</td>
<td>165-120</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>20</td>
<td>3%</td>
<td>No</td>
<td>2-8</td>
<td>5.2</td>
<td>1</td>
<td>Minimal</td>
<td>120-150</td>
</tr>
<tr>
<td>Citanest</td>
<td>60</td>
<td>20</td>
<td>1%</td>
<td>No</td>
<td>3-14</td>
<td>6.1</td>
<td>5</td>
<td>None</td>
<td>90-120</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>20</td>
<td>2%</td>
<td>No</td>
<td>2-10</td>
<td>4.6</td>
<td>1</td>
<td>Minimal</td>
<td>120-150</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>20</td>
<td>3%</td>
<td>No</td>
<td>2-4</td>
<td>2.7</td>
<td>0</td>
<td>Moderate</td>
<td>135-165</td>
</tr>
<tr>
<td>Drugs</td>
<td>Number of Patients</td>
<td>Vol. (ml.)</td>
<td>Conc.</td>
<td>Epinephrine: 1:200,000</td>
<td>Latency (minutes)</td>
<td>Adequate Analgesia</td>
<td>Muscle Relaxation</td>
<td>Hypotension Below 80 mm Hg Systolic</td>
<td>Impairment of Leg Movement</td>
</tr>
<tr>
<td>---------</td>
<td>--------------------</td>
<td>------------</td>
<td>-------</td>
<td>------------------------</td>
<td>------------------</td>
<td>-------------------</td>
<td>------------------</td>
<td>-------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Lidocaine</td>
<td>20</td>
<td>10</td>
<td>2%</td>
<td>Yes</td>
<td>11-18</td>
<td>12.85</td>
<td>10/20 50%</td>
<td>0/20 0%</td>
<td>8/20 40%</td>
</tr>
<tr>
<td></td>
<td>38</td>
<td>15</td>
<td>2%</td>
<td>Yes</td>
<td>7-15</td>
<td>9.84</td>
<td>29/38 76.3%</td>
<td>12/38 31.6%</td>
<td>16/38 42.1%</td>
</tr>
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<td></td>
<td>40</td>
<td>20</td>
<td>2%</td>
<td>No</td>
<td>4-12</td>
<td>7.25</td>
<td>33/40 82.5%</td>
<td>16/40 40%</td>
<td>14/40 35%</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>20</td>
<td>2%</td>
<td>Yes</td>
<td>9-13</td>
<td>9.25</td>
<td>34/40 85%</td>
<td>20/40 50%</td>
<td>14/40 35%</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>30</td>
<td>2%</td>
<td>Yes</td>
<td>5-12</td>
<td>6.13</td>
<td>20/30 96.7%</td>
<td>21/30 80%</td>
<td>4/30 13.3%</td>
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<tr>
<td>Citanest</td>
<td>32</td>
<td>15</td>
<td>2%</td>
<td>No</td>
<td>8-16</td>
<td>11.12</td>
<td>24/32 75%</td>
<td>7/32 21.9%</td>
<td>15/32 46.1%</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>30</td>
<td>2%</td>
<td>No</td>
<td>6-12</td>
<td>9.10</td>
<td>20/20 100%</td>
<td>17/20 85%</td>
<td>3/20 15%</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>10</td>
<td>3%</td>
<td>No</td>
<td>9-17</td>
<td>12.15</td>
<td>16/20 80%</td>
<td>5/20 25%</td>
<td>8/20 40%</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>20</td>
<td>3%</td>
<td>No</td>
<td>8-16</td>
<td>10.41</td>
<td>28/30 93.3%</td>
<td>21/30 70%</td>
<td>5/30 16.7%</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>20</td>
<td>3%</td>
<td>Yes</td>
<td>10-16</td>
<td>12.63</td>
<td>19/20 95%</td>
<td>16/20 80%</td>
<td>3/20 15%</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>30</td>
<td>3%</td>
<td>No</td>
<td>5-14</td>
<td>8.30</td>
<td>30/30 100%</td>
<td>21/30 96.7%</td>
<td>1/30 3.3%</td>
</tr>
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<td></td>
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<td></td>
<td></td>
<td></td>
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</tbody>
</table>
of solution was increased. Thus, for example, the latency of 2 per cent lidocaine with epi-
epinephrine 1:200,000 decreased from a mean of 12.8 minutes at a volume of 10 ml. to 6.1
minutes at a volume of 30 ml. ($P < 0.01$).
The difference in latency between lidocaine
and Citanest was not comparable in this series
involving lumbar peridural anesthesia since
epinephrine was added to all but one of the
lidocaine groups, whereas no epinephrine was
added to the groups receiving an equivalent
concentration of Citanest.

The incidence of adequate analgesia also
increased as a function of the volume of anes-
thetic solution administered (fig. 3). The
inter-relationship between volume and concen-
tration of local anesthetic agent with respect
to the incidence of adequate analgesia also is
depicted in figure 3. Thus, at volumes of
10–30 ml. the incidence of adequate analgesia
was higher with 3 per cent Citanest than with
either 2 per cent lidocaine with epinephrine
1:200,000 or 2 per cent Citanest, although
the difference was not significant at the 0.05
level. When 30 ml. of solution were used,
adequate analgesia was obtained in 100 per
cent of the patients treated with either 2 or
3 per cent Citanest and in 98.7 per cent of
the patients treated with 2 per cent lidocaine
with epinephrine 1:200,000.

The effect of varying volumes of local anes-
thetic on the degree of muscle relaxation is
presented in figure 4. As can be seen the
incidence of excellent muscle relaxation in-
creased as a linear function of the volume of
local anesthetic injected. Thus, muscle relaxa-
tion was not considered excellent in any of
the patients treated with 10 ml. of 2 per
cent lidocaine with epinephrine 1:200,000, whereas
muscle relaxation was considered excellent in
80 per cent of the patients treated with 30 ml.
of this same anesthetic solution. Figure 4
also reveals the effect of anesthetic concentra-
tion on degree of muscle relaxation. As is
clearly shown the incidence of excellent
muscle relaxation was consistently greater in
those patients treated with 3 per cent Citanest,
than in the group of patients treated with
either 2 per cent Citanest or 2 per cent
lidocaine with epinephrine 1:200,000. This
difference was statistically significant at the
0.05 level. It is interesting to note that with
respect to the incidence of adequate analgesia (fig. 3), no difference was observed between the use of 2 or 3 per cent solution of Citanest when the volume injected was 30 ml. However, with respect to degree of muscle relaxation the 3 per cent solution of Citanest produced a consistently higher incidence of excellent muscle relaxation, even at volumes of 30 ml. (fig. 4).

The incidence of hypotension also increased as the volume of anesthetic solution was increased. For example, 15 ml. of 2 per cent Citanest produced a fall in systolic blood pressure below 80 mm. of mercury in 25 per cent of the patients, whereas 30 ml. of 2 per cent Citanest resulted in a 50 per cent incidence of hypotension \( (P = < 0.01) \). Increasing the volume of local anesthetic appears to have a greater effect on degree of hypotension than increasing the concentration. Thus, 30 ml. of 2 per cent Citanest (600 mg.) caused hypotension in 50 per cent of the patients, while 20 ml. of 3 per cent Citanest (600 mg.) resulted in hypotension in 38.7 per cent of the patients. In addition, a significant difference in the incidence of hypotension was found to exist between the lidocaine and Citanest treated patients. Thus, 30 ml. of 2 per cent lidocaine with epinephrine 1:200,000 produced hypotension in 67.7 per cent of patients, whereas 20 ml. of 3 per cent Citanest without epinephrine produced hypotension in only 37.6 per cent of the patients \( (P = < 0.05) \). Moreover, even the use of 30 ml. of 3 per cent Citanest (900 mg.) without the addition of epinephrine did not produce a greater incidence of hypotension than did 30 ml. of 2 per cent lidocaine with the addition of a vasopressor agent.

The duration of operative analgesia also increased proportionately as the volume of anesthetic solution was increased (table 2). The longest duration of operative analgesia was achieved with 30 ml. of 3 per cent Citanest. In patients treated with this anesthetic solution the duration of analgesia lasted for 165 to 195 minutes which was significantly greater than the longest duration of analgesia observed in the lidocaine group (120 to 135) minutes in those patients receiving 30 ml. of 2 per cent lidocaine with epinephrine 1:200,000) \( (P = < 0.01) \).

Clinical Trial with Citanest. On the basis of the comparative study conducted in the first two series, a clinical trial involving 538 cases was carried out in which Citanest was the only local anesthetic used. Table 3 presents a summary of the number of patients treated with varying concentrations of Citanest for different anesthetic procedures. In 97 per cent of the cases the degree of operative anesthesia was considered adequate both by the surgeon and anesthesiologist. In 16 cases alone did inadequate anesthesia occur. Faulty technique may have been the cause of the anesthetic failure in a number of these cases. In terms of safety no toxic symptoms or post-anesthetic complications were observed in any of the patients treated with Citanest, despite the administration of 600–900 mg. of Citanest as a single injection in 269 patients. The safety of this agent is probably best exemplified in the following case. A 63 year old man was operated on for placement of an aortic graft. Lumbar peridural anesthesia was produced with a 3 per cent Citanest. The pro-
Table 3. Summary of Clinical Trial with Citanest

<table>
<thead>
<tr>
<th>Concentration (%)</th>
<th>Initial Amount Used</th>
<th>Anesthetic Procedure</th>
<th>Operative Anesthesia</th>
<th>Side Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(ml.)</td>
<td>(mL.)</td>
<td>No. of Patients</td>
<td>Caudal</td>
</tr>
<tr>
<td>1</td>
<td>20</td>
<td>200</td>
<td>62</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>15-30</td>
<td>300-600</td>
<td>136</td>
<td>67</td>
</tr>
<tr>
<td>3</td>
<td>4-30</td>
<td>120-000</td>
<td>44</td>
<td>188</td>
</tr>
<tr>
<td>3 with epin. 1:200,000</td>
<td>20</td>
<td>600</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Totals</td>
<td>242</td>
<td>276</td>
<td>20</td>
<td>522</td>
</tr>
</tbody>
</table>

Overall incidence of adequate anesthesia = 97 per cent.
* Other = Axillary block, supraclavicular block, intrathecal injection.

Procedure lasted seven hours and by the end of the fifth hour, this patient had received 1,800 mg. of Citanest. At no time did the patient demonstrate any evidence of systemic toxicity. At the end of seven hours, 2,100 mg. of Citanest had been administered to the patient. There were no reactions and no complications during either the surgical procedure or in the post anesthetic period.

Discussion

Peridural anesthesia offers one of the most reliable means for the clinical evaluation of local anesthetic drugs, provided one is aware of the many factors affecting the spread of solution in the peridural space and the intensity of block. In this study a method standardizing the technique of peridural anesthesia is described that makes it possible to vary only one factor, e.g., volume or concentration of local anesthetic solution, and to observe the effect on various anesthetic parameters. The results obtained indicate that most anesthetic parameters vary as a direct function of the dosage regardless of volume or concentration. However, this may not be true for muscle relaxation and hypotension. The results depicted in table 2 suggest that 30 ml. of 2 per cent Citanest has a greater effect on muscle relaxation and produced a higher incidence of hypotension than 20 ml. of 3 per cent Citanest. This difference may be related simply to the greater portion of the peridural space occupied by a larger volume of anesthetic solution which in turn results in the blockade of more sympathetic and motor nerve fibers.

In comparison with two established local anesthetics, lidocaine and mepivacaine, the results indicate that Citanest, a new local anesthetic agent, is an effective local anesthetic agent whose clinical activity is comparable to that of lidocaine and mepivacaine in equivalent doses. However, a 3 per cent concentration of Citanest was superior to either 2 per cent lidocaine or 2 per cent mepivacaine in terms of anesthetic duration and produced a significantly greater incidence of excellent muscle relaxation. The clinical use of 3 per cent Citanest is made possible by virtue of its lower toxicity. The data suggest that the safety of Citanest in clinical usage may be two times greater than that of lidocaine or mepivacaine whose recommended maximum dosages are 300–400 mg. Although 900 mg. of Citanest was administered as a single injection to many patients in this study, no adverse reactions were observed, indicating that the adult toxic dose is greater than 900 mg. However, it should be emphasized that these large doses were used to evaluate the safety margin of Citanest in clinical practice. Effective anesthesia was obtained consistently at a dose level of 400–600 mg.

The greater safety of Citanest is probably related to the more rapid metabolism of this
agent and possibly to a difference in distribution as compared with that of lidocaine. The studies in man conducted by Englesson, Eriksson, Wahlqvist and Orntgren show that the plasma concentration of Citanest is considerably lower than that of lidocaine at all times following the intravenous injection of these two agents. Moreover, at forty minutes following the injection of either agent, 1.7 \( \mu \)g/ml. of lidocaine was found in plasma whereas almost no Citanest could be found in plasma at this time. The more rapid disappearance of Citanest from plasma plus the greater duration of anesthetic activity observed in our studies suggest a more rapid redistribution between plasma and cells and a slower egress from nervous tissue.

Summary

A standardized technique for peridural anesthesia has been described by which it is possible to vary only one factor and observe its effect on a variety of anesthetic parameters. In this study the effect of changes in volume or concentration of local anesthetic agents and the effect of addition of epinephrine to local anesthetic agents was evaluated. An increase in volume or concentration of local anesthetic agents resulted in a decreased latency, increased incidence of complete blockage, increased incidence of muscle relaxation, increased duration of operative analgesia and increased incidence of hypotension. The technique for peridural anesthesia described also makes possible the comparative clinical evaluation of different local anesthetic agents. In this study, Citanest (L-67), a new local anesthetic agent, was compared with lidocaine and mepivacaine. The local anesthetic activity of Citanest was found to be comparable to that of lidocaine and mepivacaine in equivalent doses. However, the enhanced safety of Citanest makes possible the use of a 3 per cent solution of this agent. In a 3 per cent concentration, Citanest possessed local anesthetic activity superior to 2 per cent lidocaine and mepivacaine. No toxic reactions or complications were observed in a series of 538 patients given Citanest while the incidence of adequate anesthesia in this group of patients was 97 per cent.

Xylocaine (lidocaine) is manufactured by Astra Pharmaceutical Products, Inc., Worcester, Massachusetts. Carbofine (mepivacaine) is manufactured by Winthrop Laboratories, New York, New York. Citanest is manufactured by Winthrop Pharmaceuticals, Inc., Worcester, Massachusetts. No generic name has been selected. Citanest was known by the code name of L-67 during clinical investigations.

References