Several reports have indicated that effective and prolonged pain relief can be obtained in man by the injection of small doses of morphine into the extradural space (Behar et al., 1979; Cousins et al., 1979; Bromage, Camporesi and Chestnut, 1980). Compared with the i.m. administration of morphine, extradural application has a longer duration of action and is associated with fewer side-effects such as nausea and vomiting (Reiz et al., 1981).

However, undesirable side-effects of extradural morphine such as respiratory depression, pruritus and urinary retention have been noted in several studies (Scott and McClure, 1979; Boas, 1980; Hales, 1980; Reiz and Westberg, 1980; Bromage et al., 1981). Although frequencies between 3% (Magers et al., 1980) and 100% (Weddeland and Ritter, 1981; Bromage et al., 1981) of acute urinary retention have been shown, little attention has been paid to this effect. Reiz and others (1981), studying a small group of patients, noted urinary retention in 20% and 0% of patients after extradural and i.m. morphine respectively.

The present study compares the frequency of urinary retention during postoperative pain relief with extradural and i.m. morphine with special reference to the influence of high-level and low-level extradural morphine administration.
On the 4th day after operation the height of the catheter tip was tested with 1% lignocaine 5 ml by noting the dermatome level of subjective change in sensation to cold.

During the first 24 h from the start of the operation 2.5–3.0 litre of fluid was given i.v.

Initially extradural morphine was administered at 20-min intervals until complete pain relief at rest was reported. Thereafter, morphine was given only at the request of the patient in a dose sufficient to obtain complete pain relief.

All patients were taken to the same recovery unit for 14–18 h after surgery.

Urinary retention was noted if the patient had the sensation and discomfort of a full bladder or the anaesthetist could palpate a distended bladder. The patient was then encouraged to void during the following hour.

**Statistical methods.** The frequencies of urinary retention in the three groups were compared by a rank sum test.

**RESULTS**

Four of 36 patients in the extradural group were excluded from the study (dural puncture, two patients; slip of catheter, one patient; missing test, one patient).

Urinary retention occurred in all three groups of patients, in 33–50% of patients (table I). There was no statistically significance between the three treatments.

Retention occurred 11.4–13.2 h (means) after start of morphine treatment (table I).

Two patients urinated after i.v. administration of naloxone 0.4 mg, two patients urinated after i.m. administration of carbachol 0.125–0.250 mg s.c. The remainder of patients with urinary retention received a bladder catheter.

The cumulative dose of morphine needed during the first 2 h of therapy was similar for the three different routes of administration with mean values ranging from 13.4 to 16.5 mg (table II). After 24 and 48 h the amounts needed in the group of patients treated with i.m. morphine were about two to three times as great as the requirements of patients receiving extradural morphine (table II).

Respiratory depression was not noted in any patient and, except for one case of severe itching, no side-effects were noted.

**DISCUSSION**

The use of extradural morphine for pain relief is based on the work of Snyder and Childers (1979), Yaksh and Rudy (1976, 1977), and Yaksh (1978) in animals. They attributed the effect of such treat-

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### TABLE I. Clinical data and randomization of 52 patients receiving postoperative analgesic therapy with morphine

<table>
<thead>
<tr>
<th>Treatment group</th>
<th>No. patients</th>
<th>Age (yr) (mean ± SD)</th>
<th>Urinary retention (No. patients)</th>
<th>Time (h) after start of therapy (mean and range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.m.</td>
<td>20</td>
<td>48.1 ± 13.0</td>
<td>4:3</td>
<td>11.4 (3–21)</td>
</tr>
<tr>
<td>Extradural</td>
<td>12</td>
<td>46.8 ± 15.3</td>
<td>2.2</td>
<td>12.1 (7–19)</td>
</tr>
<tr>
<td>High-level</td>
<td>10:10</td>
<td>40.0 ± 11.9</td>
<td>4:6</td>
<td>13.2 (7–18)</td>
</tr>
<tr>
<td>Low-level</td>
<td>8:4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### TABLE II. Cumulative doses of morphine (mg) (mean ± SD) administered i.m. and extradurally

<table>
<thead>
<tr>
<th>Treatment group</th>
<th>No. patients</th>
<th>Time after start of therapy (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0–2</td>
</tr>
<tr>
<td>I.m.</td>
<td>20</td>
<td>16 5 ± 3.5</td>
</tr>
<tr>
<td>Extradural</td>
<td>12</td>
<td>14.3 ± 3.2</td>
</tr>
<tr>
<td>High-level</td>
<td>20</td>
<td>13 4 ± 3.5</td>
</tr>
<tr>
<td>Low-level</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
EXTRADURAL MORPHINE AND URINARY RETENTION

ment to a selective spinal analgesia caused by direct action of the narcotic on spinal opiate receptors that are richly distributed in the posterior horn of the spinal cord. Magora and colleagues (1980) clearly showed that the opiate was present in the cerebrospinal fluid 10–20 min after extradural injection of morphine 2 mg, and that it reaches peak values of 28 ng ml⁻¹ after 35 min.

A significant amount of morphine reaches the systemic circulation with an average peak concentration of 49.7 ± 35.6 ng ml⁻¹ within 5–30 min after an extradural injection of 10 mg per 70 kg compared with 61.6 ± 31.1 ng ml⁻¹ within 15–30 min after a similar dose given i.m. (Weddel and Ritter, 1981). As the frequency of urinary retention seems to be similar after i.m., high-level and low-level morphine injection, the effect on the urinary bladder, if influenced by morphine at all, seems to be peripheral.

The nervous control of the urinary bladder is complex, mediated via both the parasympathetic and the sympathetic nervous system (Nyo, 1969). Sacral parasympathetic nerve fibres via the pelvic nerves mediate detrusor contraction, while sympathetic nerve fibres via the inferior mesenteric plexus and the hypogastric nerves from the 10th thoracic to the 4th sacral sympathetic ganglia (Todd and Mack, 1966) are essential for the sphincter function of the urethra. It is known from in vitro studies on isolated strips of detrusor muscles from rabbit and man (S. E. Husted, unpublished observations) that morphine and encephalins serve as potent presynaptic inhibitors of acetylcholine release from postganglionic neurons, an effect completely reversed by naloxone. It is still uncertain if urinary retention during morphine therapy involves an effect on the tone of the internal sphincter (Magora et al., 1980) or on parasympathetic outflow from the sacral cord (Yaksh, 1981), or a local anaesthetic effect on bladder innervation (Boas, 1980). An effect via specific receptors, however, seems plausible as systemic administration of naloxone can antagonize these symptoms (Yagishita et al., 1978; Bromage et al., 1981).

A central effect of morphine on sensation and discomfort of the full bladder may contribute to the occurrence of urinary retention during treatment with morphine.

Symptoms of urinary retention usually occur about 12 h after commencing morphine therapy (Weddel and Ritter, 1981), when relatively large doses may have been given. Bromage, Camporesi and Chestnut (1980) used an initial extradural dose of 10.3 ± 2.5 mg in patients after upper abdominal surgery to obtain complete pain relief.

REFERENCES


RETENTION D'URINES AU COURS D'ANALGESIES A LA MORPHINE I.M. OU PAR VOIE PERIDURALE

RESUME

Au cours de la période post-opératoire, cinquante-six patients en bonne santé subissant une cholecystectomie ou une intervention
pour ulcère duodénal ont reçu de façon aléatoire de la morphine i.m. par voie péridurale “haute” ou “basse”. Trente-cinq pour cent des patients du groupe i.m., 33% de ceux du groupe péridurale “haute” et 50% du groupe péridurale “basse” ont souffert de rétention d’urines, dans tous les cas au cours des premières 24 h. La dose totale moyenne de morphine, nécessaire pour soulager la douleur, était du même ordre de grandeur (13,4—16,5 mg) pour tous les groupes, au cours des premières 2 h de traitement alors que les quantités étaient de deux à quatre fois plus importantes après 24 et 48 h avec la voie i.m. par rapport à la voie péridurale. Un effet périphérique de la morphine sur la vessie est possible et le mécanisme d’action est discuté.

URINRETENTION WAHREND I.M.- UND PÆRIDURALANALGESIE MIT MORPHIUM

ZUSAMMENFASSUNG
Postoperativ erhielten sechsundfünfzig gesunde Patienten, die sich einer Cholezystektomie oder einer Operation wegen eines Duodenalulcus unterzogen mußten, nach Randomisierung i.m., und “hoher” oder “tiefer” pæridural appliziertes Morphium. 35% in der i.m. Gruppe, 33% in der “hohen” und 50% in der “tiefen” Gruppe litten an Unnretention innerhalb der ersten 24 h. Die durchschnittliche (kumulative) Dosis, die zu Schmerzzerleichterung notwendig war, bewegte sich in der selben Großenordnung (13,4—16,5 mg) während den 2 ersten Stunden der Therapie bei allen Gruppen, während die Mengen bei der i.m. Anwendung zwei- bis viermal größer waren nach 24 und 48 Stunden, verglichen mit der pæriduralen. Eine periphere Wirkung des Morphiums auf die Harnblase ist möglich und der Wirkungsmechanismus wird diskutiert.

RETENCION DE ORINA DURANTE LA ANALGESIA CON MORFINA ADMINISTRADA INTRAMUSCULAR Y EXTRADURALMENTE

SUMARIO
Cincuenta y seis pacientes sanos sometidos a colecistectomia u operaciones de úlcera del duodeno, recibieron un “alto nivel” de morfina administrada intramuscularmente o un “bajo nivel” de morfina administrada extraduralmente, ambas durante el periodo posoperatorio y de forma aleatoria. El 35% del grupo de administración intramuscular, el 33% del de “alto nivel” y el 50% del de “bajo nivel” sufrieron retención de orina, presentándose este hecho durante las primeras 24 horas en todos los grupos. La dosis media acumulativa de morfina necesaria para aliviar el dolor, quedó en la misma gama para todos los grupos (13,4 a 16,5 mg) durante las 2 primeras horas de terapia, mientras que las cantidades fueron de entre dos y cuatro veces superiores después de 24 y de 48 horas, al compararse el grupo de administración intramuscular con el de la ruta extradural. Es posible el efecto periférico de la morfina en la vejiga de la orina y se discute el mecanismo de la actividad.