CONTINUOUS INTERCOSTAL NERVE BLOCKADE FOR PAIN RELIEF FOLLOWING CHOLECYSTECTOMY

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SUMMARY
Continuous intercostal nerve blockade was used to provide analgesia after cholecystectomy. The blockade was maintained by the insertion of a single extradural catheter into an appropriate intercostal space and by "topping-up" with local anaesthetic on demand. Of the patients studied, 92%, and 76%, required no additional analgesia in the first 24 h and first 48 h following operation, respectively. Measurements of peak flow were obtained on the 1st day after operation. A mean improvement of 37% on pre-“top-up” peak flows, was found. It is suggested that continuous intercostal analgesia is a safe, reliable and powerful form of analgesia which may improve respiratory function after cholecystectomy.

The relief of pain following cholecystectomy is usually achieved by the injection of intermittent doses of opioid drugs. Less frequently, extradural analgesia (Spence and Smith, 1971; Gjessing and Tomlin, 1979) or repeated intercostal nerve blockade (Moore, 1975) is practised. However, not infrequently, the pain relief is inadequate (Bevan, 1964) and it has been shown that patients who have difficulty in coughing and breathing deeply following operation, have an increased risk from pulmonary atelectasis and ventilation-perfusion abnormalities (Bendixen, Hedley-Whyte and Laver, 1963; George, Hornum and Mellemgaard, 1967).

O'Kelly and Garry (1981) produced continuous pain relief in a patient with unilateral, multiple fractured ribs using intercostal nerve blockade with an extradural catheter placed in one of the intercostal spaces.

The author gained experience with this technique on patients with multiple fractured ribs and noted that patients with up to eight fractured ribs could be rendered completely free from pain with a single injection. The technique was used on more than 18 occasions in patients with four to eight rib fractures (unilateral) and then extended in an attempt to give continuous intercostal analgesia following cholecystectomy. In these patients also, initial experience was gained before the present study was undertaken.

PATIENTS AND METHODS
Twenty-five patients undergoing cholecystectomy, with or without common bile duct exploration, through a subcostal (Kocher's) incision, were studied.

Following premedication with an appropriate dose of diazepam or morphine, anaesthesia, induced with thiopentone, was maintained with nitrous oxide in oxygen and neuroleptanalgesia. An appropriate neuromuscular blocking drug was administered. At the end of the operation an extradural catheter was inserted to an intercostal space once the patient was awake.

An aseptic technique was used and, with the patient in the left lateral position, an appropriate intercostal space was selected (usually between the seventh and eighth or eighth and ninth ribs). Following local infiltration of the skin with lignocaine, and following skin puncture, a 16-gauge disposable Tuohy needle (Portex Ltd) was introduced at the angle of the rib (approximately 7 cm from the midline posteriorly). The needle was advanced until contact was made with the upper rib. The needle was then "walked" down the rib and advanced 3 mm under the lower border of the uppermost rib. In many cases a slight "give" could be felt as the intercostal muscles were pierced.

Following a negative aspiration (to exclude accidental puncture of a blood vessel or the lung) and with the bevel of the needle pointed medially, an extradural catheter was advanced 3–4 cm into the intercostal space and the needle was withdrawn. In most patients the catheter could be threaded as...
easily as into the extradural space. If difficulty was experienced with the introduction of the catheter, both the needle and the catheter were withdrawn and the needle was reinserted through the same skin puncture site, but angled 10–20° towards the midline. Following a negative aspiration, the catheter was secured in position and taped to the back. A micropore filter was attached.

The local anaesthetic was introduced, with the patient in a semi-sitting position, with about the same amount of resistance to flow as is usually found in the extradural space. The patients remained in a semi-sitting position for 20 min.

Twenty millilitre of 0.5% bupivacaine plain (Marcain) was used in all patients except one (a 41-kg 13-yr-old girl), who received 0.5% bupivacaine plain 15 ml.

Arterial pressure, heart rate and respiration were monitored in the recovery area. The patients then returned to the general wards where all further analgesia was given “on demand”. The patients were instructed to request analgesia as soon as they considered their degree of analgesia to be inadequate. The staff nurses in attendance, who were all familiar with “on demand” extradural analgesia, were instructed to inform the duty anaesthetist when analgesia was requested. The intercostal blockade was then “topped-up” by the anaesthetist with the same volume and concentration of drug. The author personally assessed the adequacy of analgesia at least twice on the day of operation, twice on the 1st day, and once on the 2nd day, following surgery.

On the 1st day after the operation, respiratory peak flow was estimated with a Wright spirometer to assess, in an objective way, the improvement in respiratory function afforded by the intercostal analgesia. All patients were familiar with the Wright spirometer and had performed peak flow estimations before operation. The mean of three estimations of peak flow was obtained. Measurements of peak flow were obtained when the patient requested analgesia, and again 30–40 min after the top-up. All estimations of peak flow were supervised by the author.

The catheter was removed 48 h after insertion.

RESULTS

Of all 25 patients studied, 15 were female and 10 male. Their ages ranged from 13 to 61 yr (mean 41 yr) and their weights were between 41 kg and 85 kg (mean 65 kg). Four patients underwent common bile duct exploration in addition to cholecystectomy.

In 23 of the 25 patients (92%), analgesia was considered to be adequate for the first 24 h and no supplementation of analgesia (with opioids) was requested. Of the two patients who found the analgesia inadequate, one patient had good relief of pain initially but found a subsequent top-up ineffective. The catheter was later found to have been dislodged into the subcutaneous tissue. The second patient, the 13-yr-old girl, was initially satisfied with the relief of pain, but the duration of blockade (initially 6 h) decreased with time and the author decided to remove the catheter to prevent toxicity resulting from overdosage of bupivacaine.

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<th>TABLE I. Postoperative analgesic requirements</th>
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<td>Opiate supplementation of intercostal blockade</td>
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Nineteen of the patients (76%) were satisfied with the degree of analgesia from the intercostal blockade over the 48-h period and requested no supplementation before removal of the catheter. Thirteen patients admitted to having no pain whatsoever following “top-ups” even on provocation by coughing or deep inspiration.

Four patients were given opiate analgesics within 48 h of operation. These developed tachyphylaxis to the local anaesthetic between 24 and 48 h wherein the duration of analgesia between “top-ups” decreased and the catheters were removed.

The mean duration between the initial dose and the first top-up of local anaesthetic was 7.2 ± 2.7 h (SD). The mean duration between the first and second “top-ups” was 6.9 ± 2.7 h.

The mean peak flow achieved on the 1st day after the operation, when pain began to return and a top-up was requested, was 154 ± 14 litre min⁻¹ (SEM). Thirty to forty minutes later, following the top-up the mean peak flow was 212 ± 19 litre min⁻¹. The improvement was significant (P < 0.01; Student’s t test).

Clinical and radiological examinations were performed in all patients following placement of the catheter and no evidence of pneumothorax was
found. No cardiovascular changes occurred and no changes were noted in arterial pressure or heart rate. Attempts at assessing the number of dermatomes blocked using this technique met with failure. Most patients appreciated no difference in pinprick sensation between the dermatomes on either side of the body. Some patients experienced hyperaesthesia over the dermatomal distribution of the gall bladder. In only one patient did the author find evidence suggestive of unilateral sympathetic blockade as described by O’Kelly and Garry (1981).

DISCUSSION

A technique of continuous intercostal analgesia which is simple, effective and, in this study, without complication has been described. Pain relief was given on an “as required” basis and was discontinued if the patient considered it inadequate or ineffective.

Twenty-three of the 25 patients did not consider that any further analgesia was necessary within the first 24 h. In five patients (20%) tachyphylaxis developed to the local anaesthetic. In one patient this occurred within 24 h; in the other four analgesia was considered adequate, but because of the shortening duration of effect it was considered better to discontinue this form of analgesia. On subsequent questioning many patients expressed a preference for the intercostal analgesia although the sedative effect of morphine was considered by many to be a benefit not conferred by the regional analgesia.

Since the estimations of peak flow on the day before operation were not personally conducted by the author on all patients, it was not considered acceptable to compare these with the post-top-up values. This is unfortunate, since such a comparison might have given valuable information about postoperative respiratory changes unrelated to pain.

The improvement in post-top-up peak flows (mean of 37%) might lessen the risk of pulmonary complications in the period after operation. Further studies on this aspect are indicated. The improvement in peak flow at least confirmed the efficacy of the technique.

This study can only be considered a preliminary study on a new technique of inducing intercostal analgesia following cholecystectomy. How an injection of a large volume of local anaesthetic into a single intercostal space can induce analgesia over a large number of dermatomes is unclear. Nunn and Slavin (1980), in their anatomical study, suggested that spread of the drug through the flimsy fibres of intercostalis intimis muscle was responsible. Moore (1981) refuted this idea in a subsequent anatomical study. Spread of the local anaesthetic medially into the extradural space is a possibility, but with such a large volume of local anaesthetic and such a large field of ensuing analgesia, one would expect to see changes in arterial pressure in keeping with extensive extradural blockade. No such changes were found. Spread of local anaesthetic to the paravertebral space remains a further possibility. Local anaesthetic travelling medially could travel up and down in the paravertebral space, thus inducing analgesia unilaterally over a large number of dermatomes. If unilateral paravertebral blockade is the mode of action of this technique, then a unilateral dermatomal distribution should be demonstrable. This was not the case; in many patients hyperalgesia was found which may be a result of referred pain from the gall bladder bed (the equivalent of Boas’ sign of acute cholecystitis). This effect could serve to cloud the true dermatomal distribution of the blockade.

In conclusion, it can be stated that continuous intercostal analgesia after cholecystectomy can be achieved using the described technique, but that the exact nature and extent of the blockade is yet to be elucidated.

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REFERENCES


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**KONTINUIERLICHE INTERKOSTALE NERVENBLOCKADE ZUR SCHMERZDÄMPFUNG NACH CHOLEZYSTEKТОМИE**

ZUSAMMENFASSUNG


**BLOC NERVEUX INTERCOSTAL CONTINU DANS L’ANALGESIE APRES CHOLECYSTECTOMIE**

RESUME

Un bloc nerveux intercostal continu a été utilisé pour obtenir une analgesie après cholecystectomie. Le bloc a été entretenu par la pose d’un cathéter péridural unique dans un espace intercostal approprié et par des réinjections d’anesthésique local à la demande. Parmi les patients étudiés, 92% et 76% n’ont pas eu besoin d’analgesie de complément au cours respectivement des 24 et des 48 premières heures post-opératoires. Des mesures du débit respiratoire de pic ont été faites le premier jour post-opératoire. Une amélioration de 37% par rapport aux valeurs avant réinjection a été retrouvée. Nous suggérons que l’analgesie intercostale continue est une forme d’analgesie puissante fiable et sans danger qui peut améliorer la fonction respiratoire après cholecystectomie.

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**BLOQUEO CONTINUO DEL NERVIO INTERCOSTAL PARA ALIVIAR EL DOLOR DESPUÉS DE LA COLECISTECTOMÍA**

SUMARIO

Se utilizó el bloqueo continuo del nervio intercostal para proveer analgesia después de la colecistectomía. El bloqueo se mantuvo mediante la inserción de un único catéter extradural en un espacio intercostal apropiado y dosificando anestesia local según la demanda. De los pacientes estudiados, el 92% y el 76% no necesitaron analgesia complementaria durante las primeras 24 y las primeras 48 horas después de la operación, respectivamente. Se obtuvieron mediciones del flujo máximo el primer día después de la operación. Se observó una mejora media del 37% en los flujos máximos anteriores a la dosificación. Se considera que la analgesia intercostal continua es segura, técnicamente fiable, además de ser una forma de analgesia que puede mejorar la función respiratoria después de la colecistectomía.