INTERCOSTAL NERVE BLOCKADE PRODUCING ANALGESIA AFTER APPENDICECTOMY

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Appendicectomy is the commonest emergency abdominal operation. One in six of the U.K. population is affected [1], the maximum incidence being in the third decade [2]. On the first day after surgery, opioid analgesics are usually required and are prescribed most often as on-demand i.m. injections.

Intercostal nerve blockade (ICNB) may provide good analgesia of long duration following upper abdominal surgery [3, 4] and urological procedures with loin incisions [5]. There is no published report on the use of ICNB after operations to the lower abdomen. The most commonly used incisions used for uncomplicated appendicectomy are within the dermatomes supplied by the 10th, 11th and 12th thoracic nerves on the right [7]. It should therefore be possible to provide analgesia following appendicectomy using ICNB.

PATIENTS AND METHOD

The study was approved by the local Ethics Committee and informed consent was obtained from patients or their guardians.

Patients were studied if the proposed incision was the gridiron, Lanz, or a modification of these. Patients excluded were those younger than the age of 14 yr, the obese (where palpation of the ribs would be difficult, or a paramedian incision was to be used to facilitate surgical access) and those with a history of previous psychiatric illness. Before induction of anaesthesia, the patients were allocated randomly to one of two groups, the control group or the ICNB group.

Anaesthesia was standardized. Following pre-oxygenation for a minimum of 3 min, anaesthesia was induced with thiopentone 4–5 mg kg⁻¹. Cricoid pressure was applied and suxamethonium 1–1.5 mg kg⁻¹ was administered to facilitate intubation of the trachea. After there were signs of recovery from suxamethonium, vecuronium 0.1 mg kg⁻¹ was given. All patients received fentanyl 1 μg kg⁻¹. Ventilation was controlled using intermittent positive pressure ventilation. Anaesthesia was maintained with halothane 0.5–1% and 67% nitrous oxide in oxygen.

After induction of anaesthesia, patients in the ICNB group were turned onto their left side and 3 ml of 0.25% bupivacaine with adrenaline 1 in 200000 was injected into the subcostal groove of each of the 10th, 11th and 12th ribs on the right. The technique used was that described by Moore [8–10] at the angle of the rib using a 3.5-cm 23-gauge needle.

At the end of surgery, residual neuromuscular blockade was antagonized with neostigmine 50 μg kg⁻¹ and atropine 25 μg kg⁻¹. On the return of adequate spontaneous respiration the patients were turned onto their left side and the trachea

SUMMARY

Intercostal nerve blockade of the 10th, 11th and 12th thoracic nerves on the right side was compared with i.m. papaveretum as analgesia after appendicectomy. Patients with intercostal nerve blockade had significantly less pain at 0, 4, 8 and 12 h after operation and required less papaveretum (mean 0.26 mg kg⁻¹/24 h) compared with the controls (mean 0.62 mg kg⁻¹/24 h). There were no complications in either group. Intercostal nerve blockade may provide better quality analgesia following appendicectomy than i.m. papaveretum alone.
extubated before the patients were transferred to the recovery area.

Both groups of patients were prescribed papaveretum in a dose of approximately 0.25 mg kg$^{-1}$. The papaveretum was given by the ward nursing staff at their discretion should the patients request analgesia. The ward nursing staff were not aware of the group to which patients had been allocated.

Following recovery from anaesthesia, heart rate and arterial pressure were recorded and the intensity of any pain was assessed. Assessment of pain was made by the patients using a scale of 0–10 where 0 = no pain at all, and 10 = most pain [11]. This method of pain scoring was used because it was found to be learnt more easily by the patient than the linear analogue scale and required no hand–eye co-ordination, which we had found to be poor in some patients during the early phase of recovery.

Observations were recorded at 0, 4, 8, 12, 18 and 24 h after surgery. In addition, the time of administration of the first dose of papaveretum, the total number of doses and the total dose of papaveretum given during the 24-h study period were noted.

The presence of peritonitis, defined as either the presence of free fluid in the peritoneal cavity, or inflammation spreading to either parietal peritoneum or onto the bowel wall surrounding the appendix with or without inflammatory exudates, was recorded. The duration of stay in hospital was also noted.

The results obtained were analysed using the Mann–Whitney $U$ test to determine statistical significance. A value of $P \leq 0.05$ was considered significant.

## RESULTS

Thirty patients (ASA I or II) were studied, 15 in each group. There were no significant differences between patient characteristics of the two groups (table I).

Pain scores at 0, 4, 8 and 12 h were significantly different (fig. 1, table II). The patients in the control group had higher scores, although the severity of their pain became less during this time. At 18 h and 24 h after surgery there were no significant differences in the pain scores between the two groups.

In the control group there were two patients with local peritonitis and both of these patients reported pain scores in the mid range. In the ICNB group there were five patients with peritonitis; three reported low to mid range pain scores and the other two patients reported the highest pain scores and received more injections of papaveretum, with the first dose administered before all the other patients in the ICNB group.

The time from the end of operation to the first dose of papaveretum is shown in figure 2. In the first 2 h after surgery, eight patients in the control group received papaveretum while no patient in the ICNB group required analgesia. After 4 h a total of 11 patients in the control group needed papaveretum, but only the two patients described above had needed postoperative analgesia in the ICNB group. Six hours after operation, 14 patients in the control group and seven in the ICNB group had received papaveretum. By 8 h all patients in the control group had received...
INTERCOSTAL NERVE BLOCK

**Fig. 2.** Time from the end of surgery to the first dose of papaveretum.

**TABLE III.** Mean and range total dose of papaveretum administered in the 24 h following surgery. *P < 0.01

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<th>Mean dose (mg kg(^{-1})/24 h)</th>
<th>Range</th>
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<tbody>
<tr>
<td>Control group</td>
<td>0.62</td>
<td>0.17–1.23</td>
</tr>
<tr>
<td>ICNB group</td>
<td>0.26*</td>
<td>0–0.86</td>
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analgesia, whereas in the ICNB group a total of only 10 patients had needed papaveretum, seven within the first 6 h and three more in the following 10 h.

The number of doses of papaveretum given to both groups was significantly different. Thirty-one injections of papaveretum were administered to the control group and 16 doses were administered to the ICNB group (*P* = <0.05). The total dose of papaveretum that was administered to the control group in the first 24 h was 0.62 mg kg\(^{-1}\) (range 0.17–1.23) compared with 0.26 mg kg\(^{-1}\) (range 0–0.86) in the ICNB group (*P* = <0.05) (table III).

Throughout the observation period heart rate and arterial pressure remained within normal limits for all patients in both groups, with no significant differences between them.

The mean hospital stay in the control group was 3.4 days (range 3–5 days) and that in the ICNB 3.7 days (range 2–10 days). With the exception of one patient in the study group, who had a pyrexia for which no cause was found, the hospital stay was not significantly different between the groups.

**DISCUSSION**

After appendicectomy, pain is severe during the first 24 h and opioid analgesics may be required. They are given usually i.m. on request from the patient. This regimen of pain relief is one of the least effective methods of providing postoperative analgesia [12].

It might be expected that patients receiving the largest doses of papaveretum would report the lowest pain scores. In this study, patients with ICNB reported lower pain scores, but received a smaller total dose of papaveretum than control patients. This reflects a better quality of analgesia provided by ICNB when compared with i.m. papaveretum. Analgesia proved to be of long duration following a single ICNB at the time of operation. Patients in the control group required their first dose of papaveretum sooner after the completion of surgery than did the ICNB group. Five patients in the ICNB group required no papaveretum in the postoperative period.

However, two patients obtained no relief of pain from the ICNB. Both these patients had local peritonitis which was noted at the time of surgery. It is possible that the failure of the ICNB to provide analgesia in these patients may have resulted from inflammation spreading to involve areas of peritoneum innervated by nerves other than thoracic nerves 10, 11 and 12 on the right. Pain sensation from inflammation of either small or large bowel is transmitted to the spinal cord through the splanchnic sympathetic nerves. However, the most likely possibility is that the ICNB had failed. If this were so, our success rate of 87% is similar to that in other series of ICNB. For example, Mulroy [13] reported 56 of 70 blocks placed at the angle of the rib produced analgesia to pinprick in the corresponding dermatome: a success rate of 80%.

In our series, there were no complications from the ICNB. The commonest complications of ICNB are intravascular injection and pneumothorax [14]. Pneumothorax should be rare when blocking the three lowest thoracic nerves, because the injections are made below the reflections of the visceral pleura [6]. An accidental intravascular injection of the local anaesthetic, even if all the injection (bupivacaine 7.5 mg) were
to be given intravascularly, is unlikely to be significant clinically [15].

In conclusion we have shown that ICNB of the 10th, 11th and 12th thoracic nerves on the right provides good analgesia after appendicectomy.

REFERENCES