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Laparoscopic inguinal hernia repair: quality of recovery following the use of intraperitoneal bupivacaine

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In a prospective, randomized, double-blind study in 40 adult patients undergoing laparoscopic inguinal hernia repair, we have compared the quality of recovery following intraperitoneal administration of either 0.15% bupivacaine with adrenaline 1 : 666 000 100 ml ($n = 20$) or 0.9% NaCl 100 ml ($n = 20$). Quality of recovery was assessed in terms of postoperative pain, opioid requirements, nausea and vomiting, change in bowel habit and time to discharge. Patients in the bupivacaine group compared with the saline group had significantly lower visual analogue pain scores on arrival in recovery (2.0 (1-3) vs. 5.5 (4-7.5), $P < 0.05$). Reporting of severe pain and absent-mild pain (verbal rating scale) over the 48 h period studied significantly favoured the bupivacaine group ($P < 0.05$). Postoperative morphine requirement was significantly less in the bupivacaine group (2 : 20 vs. 10 : 20, $P < 0.05$). There were no significant differences between the two groups in terms of nausea and vomiting, change in bowel habit, or duration of hospital stay. Serum bupivacaine assayed in 10 further patients did not approach accepted toxic levels. These data suggest that intraperitoneal bupivacaine, in the dosage used, is effective in reducing postoperative pain following laparoscopic inguinal hernia repair.

Key words: Surgery, inguinal hernia repair, laparoscopy; local anaesthetics, bupivacaine; anaesthetic techniques, intraperitoneal

Introduction

Inguinal hernia is a common condition occurring in 3-8% of the population. In the UK 80 000 repairs are performed annually¹. Combining a laparoscopic approach with preperitoneal mesh repair aims to decrease both the morbidity associated with groin wounds and the convalescent time, whilst achieving a low rate of recurrence.

Quality of recovery following surgery is a major consideration, and postoperative pain may particularly limit the scope of procedures amenable to a day-case basis². The use of perioperative opioids is recognized as increasing the incidence of postoperative nausea and vomiting (PONV), and potential benefits exist for the optimal use of non-steroidal anti-inflammatory drugs (NSAIDs) and local anaesthetic techniques. Intraperitoneal (ip) administration of local anaesthetic has been shown to decrease shoulder-tip pain following gynaecological laparoscopic surgery³, but not to be effective in reducing pain after laparoscopic cholecystectomy⁴. We have investigated the effect of ip bupiva-

caine on the quality of recovery following laparoscopic inguinal hernia repair.

Patients and methods

This double-blinded, prospective study was approved by the Hospital Ethics Committee. Forty patients of ASA groups I and II who were to undergo laparoscopic inguinal hernia repair on a day-case basis were studied. All patients gave informed consent and were instructed in the use of a visual analogue pain scale. Any patient with a history of allergy to non-steroidal anti-inflammatory agents, bleeding diathesis, renal disease, asthma or peptic ulceration was excluded.

No premedication was given. All patients received a standardized anaesthetic. General anaesthesia was induced with propofol 2.0 mg kg⁻¹ and vecuronium 0.1 mg kg⁻¹ was given to facilitate intubation and ventilation. All patients received ketorolac 10 mg intravenously at induction. Anaesthesia was maintained with a propofol infusion 6-10 mg kg⁻¹ h⁻¹, nitrous oxide (65-70%) and oxygen (30-35%). Standard monitoring was used. The anaesthetist was at liberty to adjust the propofol infusion, give further increments of vecuronium and treat any bradycardia with glycopyrrolate according to normal practice. At the end of the pro-

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cedure, residual neuromuscular blockade was antagonized with neostigmine 2.5 mg and glycopyrrolate 0.5 mg. Postoperatively all patients were prescribed up to 20 mg im of morphine, if they complained of pain.

Patients were randomly allocated to one of two groups: group A (the control group) or group B (the bupivacaine/study group). All patients received a laparoscopic inguinal hernia repair, using the preperitoneal mesh technique. Having anchored the mesh and closed any peritoneal defect with staples, a sterile suction catheter was introduced into the preperitoneal space via the 5 mm trocar.

Group A received 0.9% NaCl 100 ml and group B 0.15% bupivacaine with 1 : 666 000 adrenaline 100 ml (70 ml 0.9% NaCl plus 30 ml 0.5% bupivacaine with 1 : 200 000 adrenaline). This was injected through the suction catheter, under direct vision, into the inguinal area with the patient tipped head up.

The degree of postoperative pain was assessed with a visual analogue score (VAS; 0–10 cm) and a verbal rating scale (VRS; 0 = no pain, 1 = mild pain, 2 = moderate pain, 3 = severe pain). Assessments were made at time 0 (arrival in recovery), 1 and 4 h. Further assessments were made at 12, 24 and 48 h postoperatively via return of questionnaire. Morphine requirements were assessed in the first four postoperative hours. Nausea and vomiting were assessed as present or absent and change in bowel habit interpreted as subjective diarrhoea or constipation. The time of hospital discharge was recorded.

In 10 further patients, all of whom received the study solution, venous blood samples were obtained for analysis of plasma bupivacaine levels. Samples were obtained 5, 15, 30, 60, 120, and 240 min after ip administration. Bupivacaine levels were measured using high pressure liquid chromatography (HPLC), based on the method described by Monkman, Armstrong, Flanagan, Holt and Rosevear⁵. Plasma was obtained by centrifugation and kept frozen at -20°C until assay.

Results are expressed as mean (SD); pain scores are expressed as median and percentiles. Data were analysed using the Northwick Park statistics package on an IBM-compatible computer (MS-DOS 6.2). Unpaired *t* tests and Welch's test were used for parametric data. Non-parametric data was analysed using χ^2 with Yate's correction, Fisher's exact and the Mann-Whitney *U* test. $P < 0.05$ was considered statistically significant.

Results

All patients were male. The two groups were similar with respect to age, weight, duration of operation and duration of hospital stay (Table 1).

Peak plasma bupivacaine concentrations were measured 120 min after administration (Table 2) and were below accepted toxic levels (2–4 $\mu\text{g ml}^{-1}$).

VAS pain scores at time 0 were significantly lower in the bupivacaine group compared to the saline group (Table 3). The number of patients with VRS of severe pain at any time over the 48 h period were significantly

Table 1. Patient characteristics (mean (SD))

	Group A NaCl (n = 20)	Group B bupivacaine (n = 20)
Age (yr)	45 (14)	48 (12)
Weight (kg)	76 (8)	78 (9)
Duration of operation (min)	61 (15)	53 (13)
Duration of hospital stay (min)	298 (30)	287 (43)

Table 2. Mean (SD) plasma bupivacaine concentrations after ip administration

	Time after administration (min)					
	5	15	30	60	120	240
Bupivacaine ($\mu\text{g ml}^{-1}$)	0	0.02 (0.04)	0.07 (0.06)	0.13 (0.05)	0.15 (0.07)	0.14 (0.09)

fewer in the bupivacaine group compared to the saline group. Also the number of patients with VRS of absent or mild pain over the entire 48 h period were significantly greater in the bupivacaine group compared to the saline group (Table 4). Significantly fewer patients in the bupivacaine group compared to the saline group (2 : 20 vs. 10 : 20, $P < 0.05$) required postoperative morphine. Nausea, vomiting and constipation were similar in the two groups. No patients complained of diarrhoea.

Table 3. Postoperative VAS pain scores following ip administration of NaCl or bupivacaine after laparoscopic inguinal hernia repair

VAS (h)	Bupivacaine group		Control group	
0	2.0	(1.0–3.0)	5.5	(4.0–7.5)*
1	2.0	(1.0–2.5)	4.0	(3.0–6.0)
4	2.0	(1.0–2.0)	4.0	(2.0–5.0)
12	2.0	(1.0–3.0)	3.5	(3.0–5.0)
24	2.0	(0.25–2.75)	3.5	(2.0–5.75)
48	1.0	(0.0–2.0)	2.0	(1.0–4.0)

Data represent median (25th and 75th percentile) scores.
* $P < 0.05$.

Table 4. Postoperative nausea, vomiting, constipation and VRS pain scores

	Bupivacaine group (n)	Control group (n)
Nausea	3	5
Vomiting	1	1
Constipation	6	5
VRS 0 or 1 (over entire 48 h period)*	13	2
VRS 3 (at any time over 48 h period)*	1	6

* $P < 0.05$
(n) = No. of patients.

Discussion

Laparoscopic inguinal hernia repair had an uncertain beginning because of the variety of surgical techniques initially described. However, the placement of preperitoneal patches of non-absorbable mesh using either a transperitoneal or a preperitoneal approach, is now emerging as the repair of choice⁶. Stoker, Spiegelhalter, Singh and Wellwood have reported that laparoscopic repair induces less pain than open repair, and enables patients to return to normal activity and work more quickly⁷. Jago has highlighted the amenability of this technique to day-case surgery and predicted a low recurrence rate⁸.

The administration of intraperitoneal local anaesthetic has produced conflicting results. Narchi, Benhamou and Fernandez first described its use in reducing shoulder pain after diagnostic laparoscopy³. They subsequently demonstrated that the addition of adrenaline (1 : 320 000–1 : 800 000) to the local anaesthetic solution significantly decreased peak serum local anaesthetic concentration (C_{max}) and the time to reach the peak (t_{max})⁹. Ip administration of 20 ml of 0.25% plain bupivacaine did not reduce postoperative pain following laparoscopic cholecystectomy. This may have been an ineffectively low dose of plain bupivacaine.⁴

NSAIDs have been shown to be effective in reducing post-laparoscopy pain¹⁰. Although the initial recommended dose of ketorolac has been reduced from 30–10 mg, its early efficacy may be similar¹¹. The avoidance of opiates and the utilization of propofol infusions aim to minimize postoperative nausea and vomiting in day-case surgery.

This study would have been improved by assessing postoperative pain during patient movement¹². In addition, laparoscopic port entry sites were not infiltrated with local anaesthetic which is recommended¹³. However, the results of this study suggest that the ip administration of 100 ml 0.15% bupivacaine with 1 : 666 000 adrenaline is effective in reducing postoperative

pain and the requirement for supplementary opiate analgesia following laparoscopic inguinal hernia repair.

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