Local anaesthetic techniques are part of the multimodal approach to postoperative pain management. This involves the use of opioids, non-steroidal anti-inflammatory drugs (NSAIDs), paracetamol and local anaesthetics. The purpose of this editorial is to review whether or not instillation of local anaesthetics into the peritoneal cavity is a worthwhile modality in routine clinical practice during some intra-abdominal procedures.

Data from a nationwide survey in the UK of anaesthesia for gynaecological laparoscopy revealed that local anaesthetic solutions are administered commonly, particularly into the wound and the peritoneal cavity. For this type of ambulatory surgery and anaesthesia, the main advantage of using local anaesthetics is that they do not have the adverse effects of opioids, which may delay recovery and discharge from hospital. These effects include postoperative nausea, sedation, impairment of return of gastrointestinal motility, and pruritis. In addition, time to return of bowel function in the postoperative period may be reduced when the use of opioids is obviated by administering local anaesthetics.

Although NSAIDs provide morphine-sparing effects, they do not appear, on their own, to provide sufficiently reliable postoperative analgesia for minimally invasive laparoscopic surgery. In addition, they have the disadvantage that they may cause gastric irritation in addition to impairing platelet and renal function. In the perioperative period, many patients are at risk of these problems because of enforced starvation, dehydration and tissue trauma. Additional methods of analgesia are thus necessary.

Local anaesthetics have been administered into the peritoneal cavity during minimally invasive procedures, such as laparoscopic cholecystectomy and gynaecological laparoscopy for sterilization and diagnosis, in addition to open abdominal procedures, such as total abdominal hysterectomy. The rationale for this route of administration is that the peritoneum is exposed to block of visceral nociceptive conduction, thereby providing an additional mechanism of analgesia. However, absorption from the large peritoneal surface may also occur, and this may be a further mechanism of analgesia.

It has been shown after radical retropubic prostatectomy that i.v. lidocaine 1.5 mg kg\(^{-1}\) bolus and 2–3 mg min\(^{-1}\) infusion reduced morphine consumption and total pain scores significantly compared with placebo. These data are supported by a clinical trial in which i.v. lidocaine produced a concentration-dependent reduction in pain scores when the plasma concentration exceeded 1.5 \(\mu g\) ml\(^{-1}\). In addition, it has been shown in rats that administration of systemic lidocaine may suppress peripheral ectopic impulse discharge and inhibit central excitatory responses to glutamate. With bupivacaine, the range of mean plasma concentration (0.92–1.14 \(\mu g\) ml\(^{-1}\)) after intraperitoneal instillation of plain bupivacaine 100–150 mg is well below the toxic concentration of 3 \(\mu g\) ml\(^{-1}\). Similar systemic concentrations have produced neurological symptoms, such as paraesthesia, tingling and perioral numbness, in unanaesthetized volunteers during i.v. infusions of bupivacaine. However, it remains unclear whether these concentrations produce a measurable postoperative analgesic effect.

Although laparoscopic cholecystectomy is a minimally invasive procedure, it is associated with intra-abdominal, incisional and shoulder pain after surgery. Many clinical trials have been carried out to assess if intraperitoneal instillation of local anesthetics to the gall bladder bed and right subdiaphragmatic space has produced any analgesic effect. Of 13 clinical trials in a systemic review of intraperitoneal administration of bupivacaine 50–200 mg in volumes of 10–100 ml, significant reduction in overall pain occurred in seven trials but not in the other six. In addition, supplementary analgesic consumption was reduced significantly in five trials. This systematic review of bupivacaine concurs with a subsequent clinical trial in which intraperitoneal lidocaine 200 mg in 200 ml instilled under the right diaphragmatic surface increased time to first analgesia from 25 to 105 min after laparoscopic cholecystectomy. Interestingly, in a recent study, an intraperitoneal combination of local anaesthetic and NSAID was shown to be more effective in reducing pain scores and opioid consumption than either placebo or intraperitoneal local anaesthetic with i.v. NSAID. Analgesic effects were greater in patients who had intraperitoneal lidocaine 200 mg with intraperitoneal tenoxicam 20 mg diluted to 200 ml compared with either placebo or intraperitoneal lidocaine 200 mg in 200 ml with i.v. tenoxicam 20 mg. Thus it would appear that, for laparoscopic cholecystectomy,
Intraperitoneal local anaesthetic solutions produce a modest analgesic effect which may not be adequate for routine analgesia.

Clinical trials of intraperitoneal instillation of local anaesthetics during gynaecological laparoscopy appear to demonstrate more effective analgesia, possibly because this operation is less traumatic than laparoscopic cholecystectomy. In a systematic review of bupivacaine or etidocaine dripped onto the Fallopian tubes during laparoscopic sterilization under general anaesthesia, pain scores and supplementary analgesic consumption were reduced significantly for up to 2 h after surgery. Furthermore, intraperitoneal lidocaine, infiltrated into the mesosalpinx or into the Fallopian tubes, or coating Filshie clips, produced similar analgesic effects. This has been confirmed in awake postpartum patients when intraperitoneal 0.5% lidocaine 80 ml reduced the need for supplementary fentanyl, ketamine and rescue general anaesthesia during tubal ligation. In addition, intraperitoneal instillation of ropivacaine 150 mg during gynaecological laparoscopy produced a statistically significant 24 h morphine-sparing effect compared with placebo.

The intraperitoneal cavity appears also to be an effective route for postoperative analgesia after administration of local anaesthetic in combination with an opioid. In a clinical trial of 100 patients undergoing laparoscopic tubal ligation, pain scores at rest and on movement were significantly lower in patients who had a combination of intraperitoneal meperidine 50 mg and intraperitoneal 0.125% bupivacaine 80 ml with epinephrine 1:200 000 compared with those who had a combination of i.m. meperidine 50 mg and intraperitoneal 0.125% bupivacaine 80 ml with epinephrine 1:200 000.

In summary, it seems that intraperitoneal instillation of local anaesthetics is effective for gynaecological laparoscopy but may not be so for laparoscopic cholecystectomy. Laparoscopic cholecystectomy is a longer procedure with greater tissue dissection than gynaecological laparoscopy. Recent evidence suggests that instillation of local anaesthetics both into the peritoneum and into the incision may be required after laparoscopic cholecystectomy. Instillation of ropivacaine 286 mg in 66 ml in this way during laparoscopic cholecystectomy produced lower pain scores and reduced morphine requirements compared with placebo.

While intraperitoneal local anaesthetics have produced analgesic effects after gynaecological laparoscopy, they have not done so after total abdominal hysterectomy via a Pfannenstiel incision. Intraperitoneal instillation of either 0.5% bupivacaine 20 ml with epinephrine 1:200 000 diluted to 50 ml with normal saline or 2% lidocaine 20 ml with epinephrine 1:200 000 diluted to 50 ml with normal saline did not demonstrate any opioid-sparing effects compared with placebo. It is likely that while intraperitoneal local anaesthetics may block visceral nociceptive conduction after minimally invasive surgery such as gynaecological laparoscopy, they do not block afferent nociceptive transmission from cutaneous sites. It appears that a combination of intraperitoneal and incisional administration of local anaesthetics is required after open abdominal procedures. Epinephrine 5 μg ml⁻¹ with 0.25% bupivacaine 30 and 20 ml administered into the peritoneum and incision respectively produced morphine-sparing analgesia for 4 h after total abdominal hysterectomy via a Pfannenstiel incision.

The difference in outcome of studies on intraperitoneal instillation of local anaesthetics may result from the type of surgery and the location, dose, type and timing of instillation. The failure in some studies to show an analgesic effect may result from rapid dilution of local anaesthetic in the peritoneal cavity. It is not possible, however, to increase the dose of local anaesthetic without increasing the risk of systemic toxicity. Although potentially more toxic than lidocaine, bupivacaine has the advantage that it has a longer duration of action. However, in clinical trials the analgesic effects of bupivacaine have been short-lived. It has been shown in a mouse model that intraperitoneal bupivacaine in a liposomal formulation may prolong the duration of action and also reduce the possibility of systemic toxicity. An alternative is levobupivacaine, the S(-) enantiomer of bupivacaine, the analgesic effects and duration of which are thought to be similar to those of racemic bupivacaine but with a reduced risk of systemic toxicity, thus allowing administration of a larger and more potent dose.

The intraperitoneal route of administration of local anaesthetic is simple: it does not involve additional central neural axial block and is particularly suited to the practice of ambulatory anaesthesia. However, for this route to be useful as a routine for pain management during all forms of minimally invasive surgery, it must not be limited by the dose of local anaesthetic. Thus the search goes on for newer, less toxic local anaesthetics that have a longer duration of action. It is hoped that this development may lead ultimately to improvements in convalescence and to a reduction in the risk of hospital readmission after minimally invasive surgery.

A. Ng
G. Smith
University Department of Anaesthesia, Critical Care & Pain Management
Leicester Royal Infirmary
Leicester LE1 5WW
UK

References

2 Ng A, Parker J, Toogood L, Cotton BR, Smith G. Does the opioid-sparing effect of rectal diclofenac following total
12 Devor M, Wall PD, Cataln N. Systemic lidocaine silences ectopic neuroma and DRG discharge without blocking nerve conduction. Pain 1992; 51: 261–8
29 Foster RH, Markham A. Levobupivacaine. Drugs 2000; 59: 551–79