British Journal of Anaesthesia **103 (2):** 213–19 (2009)
doi:10.1093/bja/aep103 Advance Access publication May 13, 2009

BJA

Functional walking capacity as an outcome measure of laparoscopic prostatectomy: the effect of lidocaine infusion

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Background. Intravenous lidocaine infusion has been shown to affect postoperative pain intensity. This present study was performed to assess the effect of intra- and postoperative lidocaine infusion on postoperative functional walking capacity, as a measure of surgical recovery.

Methods. Forty patients undergoing laparoscopic prostatectomy were randomized to receive an i.v. infusion of either lidocaine 2 mg kg^{-1} h^{-1} during surgery and 1 mg kg^{-1} min^{-1} for the first 24 postoperative hours (lidocaine group) or an equivalent volume of saline 0.9% (control group). All patients received postoperative patient-controlled analgesia with i.v. morphine. Primary outcome was functional walking capacity, as assessed by distance attained during the 2 min walking test (2MWT), recorded daily for the first 3 postoperative days. Morphine consumption and pain intensity were recorded.

Results. 2MWT distance decreased by an average of 60% ($P<0.01$) in both groups on postoperative day 1 (from 150 m before surgery to 53 m), but the decrease was 26 m less in the lidocaine group ($P=0.009$). During postoperative days 2 and 3, the 2MWT distance increased to an average of 96 m, still 30% less than the preoperative values. There was a significant negative correlation on postoperative days 1 and 2 between the 2MWT distance, pain intensity and fatigue, and morphine consumption. Lidocaine infusion was an independent predictor of the degree of postoperative decrease in 2MWT distance. More patients in the lidocaine group were free from PCA on the second postoperative day ($P=0.011$).

Conclusions. Infusion of lidocaine during surgery and for the first postoperative day attenuated the deterioration in functional walking capacity, and had an opioid sparing effect.

Br J Anaesth 2009; **103**: 213–19

Keywords: anaesthetics local, lidocaine; pain, postoperative; recovery, postoperative; surgery, postoperative period

Accepted for publication: March 28, 2009

Intravenous lidocaine infusion has been used as an adjuvant during and after surgery in patients undergoing retropubic prostatectomy, laparoscopic cholecystectomy, and laparoscopic colon resection; it is associated with a significant postoperative opioid-sparing effect, earlier return of bowel function or shorter hospital stay.[1–3] Animal and human studies have shown analgesic, antihyperalgesic, and anti-inflammatory properties of i.v. lidocaine,[4 5] which could explain its effect in attenuating visceral pain associated with dissection of pelvic structures.

Surgical outcome has traditionally been reported in terms of mortality and complication rate. However, with major advances in surgical technology and anaesthesia, mortality and morbidity have become rare events. Similarly, the length of hospital stay has been used as a measure of outcome, but is influenced by the health-care system and the administrative culture. Recently, there has been some interest in assessing the influence of therapeutic interventions on the process of surgical recovery or return to baseline, with a particular emphasis on patient-reported outcomes of well-being.[6 7]

Physical activity is an important aspect of day-to-day life, and tests of functional exercise capacity like walking tests reflect every day activity.[8] These can be influenced by health status, pain, fatigue, and can help to quantify the recovery process. Although different walking tests (12, 6, and 2 min walking tests: 12MWT, 6MWT, 2MWT) indicate aspects of functional exercise capacity, the 2MWT has been found more suitable for patients in compromised health states in the early postoperative period.[9 10] Walking test is a measure that could be administered as part of an assessment to determine functional performance, to evaluate treatment effectiveness, or to assess readiness for discharge.[11]

This prospective, randomized, controlled trial was designed to analyse the effect of intraoperative and postoperative lidocaine infusion on the immediate postoperative functional walking capacity and other measures of recovery such as consumption of opioids and return of bowel function. It was hypothesized that by attenuating the inflammatory response and reducing analgesic requirements, lidocaine infusion would improve the capacity to mobilize, thus promoting earlier recovery.

Methods

Patients

The study was approved by the McGill University Health Centre Ethics Board (Gen#06–023) and was conducted between May 2007 and February 2008. Patients undergoing laparoscopic prostatectomy for prostate cancer aged 18–85 yr were eligible. Exclusion criteria were: ASA physical status $\geq$4, history of hepatic, renal, or cardiac failure, organ transplant, insulin-dependent diabetes mellitus, morbid obesity (BMI $>$40 kg m^{-2}), chronic use of opioids, allergy to local anaesthetics, or inability to comprehend pain assessments. Patients were instructed before surgery in the use of the visual analogue scale (VAS) to assess pain and fatigue. Before induction of anaesthesia, patients were randomly assigned (using a computer-generated randomization schedule and sealed brown envelopes) to two groups of 20 patients each: lidocaine group receiving an intraoperative and postoperative i.v. infusion of lidocaine, and control group receiving an equivalent i.v. infusion of saline 0.9%.

Anaesthesia and intraoperative care

Upon arrival in the operating theatre, baseline values of heart rate (HR), arterial pressure, oxygen saturation, and bispectral index (BIS) were recorded. The anaesthesiologists (S.L. and F.C.) who executed the study protocol were blinded to the group allocation and were not involved in preoperative or postoperative data collection. After premedication with i.v. midazolam 0.03 mg kg^{-1}, general anaesthesia was induced with fentanyl 3.0 μg kg^{-1}, propofol 2.5 mg kg^{-1}, and rocuronium 0.8 mg kg^{-1}. At induction of anaesthesia, the lidocaine group received an i.v. bolus injection of lidocaine 1.5 mg kg^{-1} up to a maximum of 100 mg, followed by a continuous infusion of lidocaine 2 mg kg^{-1} h^{-1} until the end of surgery. The control group received an equivalent volume of saline 0.9%. Anaesthesia was maintained with desflurane at an end-tidal concentration adjusted to maintain BIS values between 40 and 50, and HR and systolic pressure within 20% of baseline values. No supplemental fentanyl was given during surgery. 0.9% saline was administered i.v. at a rate of 6 ml kg^{-1} h^{-1} and intraoperative normothermia (nasopharyngeal temperature between 35.8 and 36.5°C) was maintained with forced air warming over blankets. All patients received dexamethasone 8 mg and droperidol 0.625 mg as prophylactic anti-emetics. Episodes of intraoperative hypotension (MAP $<$60 mm Hg), and bradycardia (HR $<$40 beats min^{-1}) were recorded, and treated with i.v. boluses of phenylnephrine 40 μg or atropine 0.4 mg, respectively. All patients received ketorolac 15 mg i.v. Desflurane was discontinued after the last skin suture, and intermittent doses up to 0.08 mg kg^{-1} of morphine were given i.v. at return of spontaneous respiration. Lidocaine and the saline infusions were discontinued before patients left the operating theatre.

All operations were performed using a standard laparoscopic technique with infiltration of bupivacaine 0.25% with adrenaline 1:200 000 at the trocar entry ports.

Postoperative analgesia and surgical care

Lidocaine infusion 1 ml kg^{-1} h^{-1} (or equivalent volume of saline 0.9%) was recommenced in the PACU and continued for 24 h. PCA morphine (1 mg bolus, 7 min lockout) was started in PACU and continued for 48 h. Patients also received acetaminophen 1.0 g 6 hourly and naproxen 500 mg 12 hourly for the first 72 h. Once PCA morphine was discontinued, patients were offered oxycodone 5–10 mg 4 hourly if the VAS (0=no pain and 10=excruciating pain) was $>$3 at rest. Ondansetron 2 mg i.v. was prescribed for persistent nausea (lasting $>$5 min) or vomiting. An i.v. infusion of dextrose 5% and saline 0.45% was started after surgery and continued for up to 48 h until the patients were tolerating oral fluids. Clear fluids were allowed during the first 24 h, and if tolerated, liquid diet and full diet were then offered. Starting on the first postoperative day, patients in both groups were encouraged by the nurses to mobilize twice a day, whether sitting or walking.

Readiness for hospital discharge was determined according to the following criteria: tolerance of solid food, passage of stool, absence of infection, VAS pain score $<$3, and ambulation without assistance. Patients were seen 4 weeks after surgery, at which time any complications were