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Intra-articular injection of warmed lidocaine improves intraoperative anaesthetic and postoperative analgesic conditions

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Background. Although local anaesthesia for knee arthroscopy is a well-documented procedure, arthroscopy under local anaesthesia is often interrupted because of intolerable discomfort and pain. Warming local anaesthetic solutions may increase its anaesthetic effect. We tested whether intra-articular injection of warmed lidocaine solution could improve intraoperative anaesthetic and postoperative analgesic conditions.

Methods. Patients in the warmed group received 20 ml warmed (40°C) lidocaine 1% intra-articularly 20 min before surgery. The patients in the control group received 20 ml room-temperature (25°C) lidocaine 1% intra-articularly 20 min before surgery. During surgery, the patients reported pain on a visual analogue scale (VAS).

Results. The median VAS pain score was 1.5 (range, 0.0–3.0) in the warmed lidocaine group and 5.0 (4.0–8.0) in the control group ($P<0.001$). The median intra- and postoperative analgesic requirements in the control group were significantly greater than that in the warmed group.

Conclusion. Warmed lidocaine injected intra-articularly provides improved intraoperative anaesthetic and postoperative analgesic conditions for patients undergoing knee arthroscopy.

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Local anaesthesia for knee arthroscopy is a well-documented procedure,[1,2] but is frequently interrupted because of intolerable pain and discomfort.[1,3,4] As a consequence local anaesthesia for arthroscopy often requires additional sedation and analgesia or even general anaesthesia.[1,3,4]

Warmed local anaesthetics induce a faster blockade of peripheral and central nerve blocks.[5,6] Also, warming increases the penetration of local anaesthetics into the tissue.[7] We thus hypothesized that the intra-articular injection of warmed local anaesthetics improves intraoperative anaesthetic and postoperative analgesic conditions for patients undergoing knee arthroscopy.

Methods

With approval of the local institutional ethics committee and written informed consent, we studied 24 patients (ASA I–II) scheduled for elective partial menisectomy under knee arthroscopy. Patients with sensitivity to amide local anaesthetics were excluded from the present study.

All patients received 0.3 mg kg^{-1} pentazocine i.m. 30 min before receiving anaesthesia, and were randomly allocated to two groups. Patients in the warmed lidocaine group underwent intra-articular anaesthesia with lidocaine 1%, 20 ml at a temperature of 40±0.2°C. Patients in the control group underwent intra-articular anaesthesia with lidocaine 1%,

20 ml at temperature (25±0.5°C). Twenty minutes after the intra-articular injection all patients were infiltrated with 5 ml room-temperature lidocaine 1% at each of the three portal sites and surgery was started. A tourniquet was not used. The patients were asked to assess the severity of pain on manipulation of the synovium/capsule, meniscus and cruciate ligament, using a 10-cm visual analogue scale (VAS) (0=no pain, 10=worst pain imaginable) by a blinded investigator who was unaware of the group assignment. When patients experienced unbearable discomfort or pain (VAS>5.0) during surgery, 15 mg of pentazocine was given intravenously every 30 min. Postoperative analgesia was supplemented with rectal diclofenac (25 mg) every 4 h on patient request.

Data are presented as median (range). Demographic data, duration of surgery, VAS, intraoperative pentazocine dose and 24-h analgesia requirement were analysed by the Mann–Whitney test. Data on gender were analysed using the Fisher's exact test. A P-value of <0.05 was considered to be statistically significant.

A pilot study with 10 patients showed that means (SD) of VAS were 1.6 (1.4) in the warmed group and 5.2 (1.6) in the control group, respectively. A group size of at least nine patients in each group would thus be sufficient to detect a difference of 3.0 on the VAS at a 1% level of significance with 90% power. We considered a difference of 3.0 cm on VAS to be clinically significant.

Results

The two groups were comparable with regard to age, gender, height, weight and duration of surgery (Table 1). The VAS in the warmed lidocaine group was 1.5 (0.0–3.0). This was significantly lower than that in the control group [5.0 (4.0–8.0); P<0.001]. Also the median intraoperative dose of pentazocine was greater in the control group [7.5 (0.0–15)] than in the warmed lidocaine group [0.0 (0.0–0.0); P=0.039) (Table 2). Also the 24-h diclofenac requirement was significantly greater in the control group [25 (0.0–75)] as compared with the warmed lidocaine group [0.0 (0–25); P=0.011] (Table 2).

Table 1 Patient characteristics. Data are median (range). There were no significant differences between the groups

	Control	Warmed
Age (years)	64 (41–70)	59 (42–65)
Sex (male/female)	3/9	4/8
Height (cm)	150 (143–169)	155 (145–168)
Weight (kg)	63 (46–84)	66 (46–81)
Duration of surgery (min)	50 (30–75)	51 (32–75)

Table 2 Visual analogue scale (VAS) and dose of penatzocine and diclofenac. Data are median (range). *Significantly different from the control group

	Control	Warmed*	*P*
VAS (cm)	5.0 (4.0–8.0)	1.5 (0.0–3.0)	<0.001
Pentazocine (mg)	7.5 (0.0–15)	0.0 (0.0–0.0)	0.039
Diclofenac (mg)	25 (0.0–75)	0.0 (0.0–25)	0.011

Discussion

Local anaesthesia for knee arthroscopy is a well-documented procedure.[1,2] However, perioperative pain and discomfort[1,3,4] often requiring sedation and the use of intravenous opioids are of concern. We found that the use of warmed lidocaine improves the quality of local anaesthesia for knee arthroscopy.

Local anaesthetics with a pK_a closer to the physiologic pH will have a higher percentage of non-ionized free base. This speeds the onset of the local anaesthesia, improves the quality of block and prolongs the blockade.[8,9] According to Powell,[10] pK_a of lidocaine is 7.57 at 40°C and 7.92 at 25°C. Warming of lidocaine thus may increase the speed of onset and the quality of local anaesthesia.[10,11]

Warming may also favour the permeation of lidocaine into the tissue. In addition, warming induced vasodilatation may have increased lidocaine absorption, resulting in higher systemic blood concentrations and thereby inducing an anaesthetic effect in the central nervous system. However, this remains a hypothesis as we have not measured lidocaine plasma concentration.

The present study shows that a warmed local anaesthetic solution injected into the knee joint improves intraoperative anaesthetic and postoperative analgesic conditions of patients undergoing knee arthroscopy.

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