CRD summary
This review found that ropivacaine was effective for intravenous regional anaesthesia and the addition of muscle relaxants and fentanyl could reduce the local anaesthetic requirements. Insufficient information on the size of the effects, means that the reliability of the authors' conclusions is unclear.

Authors' objectives
To provide an updated review of drugs for intravenous regional local anaesthesia and to evaluate the efficacy of opioids and muscle relaxants as additional treatments.

Searching
MEDLINE and EMBASE were searched for relevant studies, published in English from January 1986 to July 2011; search terms were reported. The reference lists of included articles and published reviews were checked for additional studies.

Study selection
Double-blind randomised controlled trials of local anaesthetics for intravenous regional anaesthesia, or opioids or muscle relaxants as additional treatments, were eligible for inclusion. Trials that had been retracted from publication were excluded.

Most of the patients in included trials were having hand surgery or other upper limb surgery; some trials were of healthy volunteers. Lidocaine, prilocaine and ropivacaine were the most common local anaesthetics and were compared with each other. The opioid additions to local anaesthesia were morphine, fentanyl, meperidine, sufentanil and tramadol. The muscle relaxant additions were pancuronium, atracurium, mivacurium and cisatracurium.

The authors did not state how many reviewers selected the trials.

Assessment of study quality
Two reviewers evaluated methodological quality, using the five-point Jadad scale for randomisation, allocation concealment, use of blinding, and descriptions of withdrawals and dropouts. Higher Jadad scores indicated better quality. Any discrepancies between the reviewers were resolved by consensus.

Data extraction
Data on intra-operative effects, postoperative outcomes and side-effects were extracted by two independent reviewers. Outcomes were positive, if significant intra-operative or postoperative benefits were observed, or negative, if there were no differences between the intervention and control groups.

Methods of synthesis
The results were summarised in a narrative review.

Results of the review
Thirty-one trials (n=1,523 patients) were included in the review; four were of both opioids and muscle relaxants. Thirteen trials had Jadad scores of two points, four had three points, 10 had four points, and four had five points.

Local anaesthetics: Nine trials assessed local anaesthetics (n=516). There were no differences between lidocaine, prilocaine and ropivacaine in the onset of sensory block (seven trials), and the onset of motor block (six trials). Three trials found significant postoperative benefits with ropivacaine, compared with lidocaine, with lower pain scores, and a longer time to first analgesia, but there were no differences in one trial. There were no significant side-effects. Ropivacaine caused delays in sensory recovery (five trials) and motor recovery (three trials). Similar tourniquet
tolerance times were found across all local anaesthetics.

**Additional opioids:** Sixteen trials assessed opioids (n=761). Compared with no additional opioid, there were no clinically significant benefits with morphine (two trials; n=57), fentanyl (seven trials; n=345), and meperidine (one trial; n=20) and there were no significant increases in side-effects. Sufentanil (two trials; n=125) appeared to provide significantly faster onset of sensory block. Tramadol provided faster onset of sensory block and tourniquet tolerance, but the postoperative benefits were not consistent and the risk of minor side-effects was increased.

**Additional muscle relaxants:** Ten trials assessed muscle relaxants (n=494). Two out of six trials reported faster onset of sensory block and motor block when muscle relaxants were added to local anaesthetics. There were no significant changes in tourniquet tolerance and intra-operative analgesia. Two trials found that less postoperative analgesia was administered. One trial reported signs of toxicity and delays in motor recovery with mivacurium in addition to local anaesthetic.

**Authors’ conclusions**

Ropivacaine was effective for intravenous regional anaesthesia and improved postoperative analgesia. Muscle relaxants enhanced the motor block, but delayed motor recovery and, with fentanyl, they produced an equivalent quality of intravenous regional anaesthesia, at a reduced dose of local anaesthetic, but slowed the onset of sensory block.

**CRD commentary**

The review addressed some clear questions and the criteria for the inclusion of trials were defined and reproducible. Two appropriate databases were searched for relevant published articles; the restriction to published trials means that some studies might have been missed and there was a risk of publication bias. Only English-language studies were included, which introduced a risk of language bias.

Steps were taken to minimise reviewer error and bias in quality assessment and data extraction, but they were not reported for trial selection. Methodological quality was assessed and about half of the trials were of poor or moderate quality. The authors decision not to combine the results in meta-analysis was justified due to the variety in the interventions. The authors used vote counting of positive and negative results to summarise them, and there was little information on the size of the effect in each trial.

There was a risk of missed trials and a potential for language and publication biases. The lack of information on the size of the effects means that the reliability of the authors' conclusions is unclear.

**Implications of the review for practice and research**

**Practice:** The authors stated that additional opioids and muscle relaxants were not recommended for routine use.

**Research:** The authors stated that the efficacy and potency ratio of ropivacaine, compared with other local anaesthetics, should be investigated. The safety of local anaesthetics should be researched. Future trials should study new additional treatments that could provide effective analgesia after tourniquet removal.

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