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Best evidence topic

## In children undergoing umbilical hernia repair is rectus sheath block effective at reducing post-operative pain? Best evidence topic (bet)

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## ABSTRACT

A best evidence topic was constructed according to a structured protocol. The question addressed was: In children undergoing umbilical hernia repair is a rectus sheath block (RSB) better than local anaesthetic infiltration of the surgical site, at reducing post-operative pain? From a total of 34 papers, three studies provided the best available evidence on this topic. One randomised clinical trial showed RSB had a better analgesic effect in the immediate post-operative period. In another randomised trial opioid consumption in the peri-operative period was found to be significantly lower in patients administered RSB. These improvements in pain and analgesia consumption need to be balanced against the expertise, training, equipment required, time implications and complications of performing a RSB.

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## 1. Introduction

A best evidence topic was constructed according to a structured protocol. This has previously been described in the International Journal of Surgery [1].

## 2. Clinical scenario

You are due to do a day case paediatric umbilical hernia repair (UHR) on a busy list and the anaesthetist decides to administer a rectus sheath block (RSB) before the surgical incision. Your paediatric surgical consultant suggests a nerve block may not be necessary and instead we could infiltrate the wound with local anaesthetic at the end of the procedure. The consultant anaesthetist argues a RSB gives better pain control post-operatively. You decide to search the literature for the best available evidence.

## 3. Three-part question

In [children undergoing umbilical hernia repair] is [a rectus sheath block better than local anaesthetic infiltration of the surgical site,] at [reducing post-operative pain]?

## 4. Search strategy

Evidence was searched using Medline and Embase. The following terms were searched: (umbilic\* ADJ3 herni\* [title, abstract] OR umbilical hernia [MeSH Terms]) AND (((rectus OR umbilic\* OR para-umbilical OR para-umbilical) ADJ3 block\* [title, abstract]) OR ((nerve block OR regional anaesthesia) AND (rectus abdominis muscle) [MeSH Terms])). Papers published in English were considered and given the paucity of information on this topic no limit on the publication year was applied. The search was duplicate filtered and reference lists of all relevant papers were searched for secondary references. The search was current as of 5th June 2014.

## 5. Search outcome

34 papers were found using the reported search. Of these 5 were duplicates, 6 were not related, 4 were in languages other than English, 4 dealt with adult patient population, 2 were conference abstracts and did not answer the question and 3 were letters of correspondence. Of the remaining 10 papers, 6 did not answer the question. Three papers compared RSB with local anaesthetic infiltration (LAI) and represent the best evidence to answer the clinical question.

## 6. Results

The results of the three papers (three prospective randomised clinical trials) are summarised in [Table 1](#).

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**Table 1**  
Best evidence papers.

Author, date, country	Patient group	Study type, level of evidence	Outcomes	Key results	Comments
Dingeman et al. [9] 2013 USA	52 patients (age 3–12 years) randomly assigned to one treatment group: RSB ( $n = 27$ ) vs. LAI ( $n = 25$ ) Both treatments administered at the end of the procedure. No significant differences in baseline patient demographics or length of stay in PACU Surgical case duration significantly longer in RSB group (39 vs. 30 min; $P = 0.04$ )	Prospective, randomised clinical trial. Level II	Post-op pain scores at defined intervals for the first 24 h after surgery Post-op analgesia use Parent's perception of child's pain at 12 and 24 h after surgery	First obtainable post-op median pain scores were 0 in both groups. Subsequent pain scores at 10 min intervals after arrival in the PACU till discharge remained: – 0 in the RSB group – 1 in the LAI group  (0 = no hurt; 1 = hurts just a little bit) Pain scores were found to be significantly lower in RSB group at: 10 min ( $p = 0.04$ ), 30 min ( $p = 0.01$ ), $\geq 40$ min ( $p = 0.03$ ) after arrival in the PACU. The percentage of patients reporting no pain (score 0) at these times was significantly higher in the RSB group ( $p < 0.05$ ). No significant difference in: - pain scores after discharge from PACU, - pain assessment by parents at 12 and 24 h after surgery - post-op analgesia use No significant difference in: - Post-op analgesia requirement - Post-op pain scores - Time to rescue analgesia.  14 patients were given an intra-operative dose of morphine (11 LAI group vs. 3 RSB group). Peri-operative mean opioid consumption was significantly higher in the LAI group (mean: 0.13 mg/kg) than the RSB group (mean: 0.07 mg/kg). ( $p = 0.008$ ) No significant difference in: - post-op morphine use - post-op pain scores	Well designed and rigorously conducted trial. Mean difference of 1 point in pain scores between the groups is modest, however considered significant by investigators. Study demonstrates short-term post-op analgesic benefits of RSB over LAI; benefits not sustained.
Gurnaney et al. [8] 2011 USA.	54 patients (age 5–18 years) randomly assigned to one treatment group: RSB ( $n = 27$ ) vs. LAI ( $n = 27$ ) RSB administered before surgical incision, LAI at end of procedure. No significant differences in baseline patient demographics	Prospective, randomised clinical trial. Level II	Post-op analgesia (opioid) use Post-op pain scores at time of PACU admission, at hourly intervals and at discharge. Time to first rescue analgesia	No significant difference in: - Post-op analgesia requirement - Post-op pain scores - Time to rescue analgesia.  14 patients were given an intra-operative dose of morphine (11 LAI group vs. 3 RSB group). Peri-operative mean opioid consumption was significantly higher in the LAI group (mean: 0.13 mg/kg) than the RSB group (mean: 0.07 mg/kg). ( $p = 0.008$ ) No significant difference in: - post-op morphine use - post-op pain scores	Poor quality randomised trial. Potential for selection bias with trial design. Not all patients accounted for in final analysis. Peri-operative differences in mean opioid consumption are modest.
Isaac et al. [10] 2006 Canada	13 patients (age 1–8 years) randomly assigned to one treatment group: RSB ( $n = 7$ ) vs. LAI ( $n = 6$ ) Both treatments administered at the end of the procedure. Mean age difference between the groups was 2 years.	Pilot study, randomised trial Level II	Post-op pain scores at 10 min intervals till discharge. Post-op analgesia use (IV morphine administered if pain score $\geq 8$ ) Parent's perception of child's pain at 12 and 24 h after surgery	No significant difference in: - post-op morphine use - post-op pain scores	As pilot study, small sample size, power limited, possibility of type II error. RSB not ultrasound-guided. Concluded RSB has no advantage over LAI for post-op pain management in children undergoing UHR.

LAI: local anaesthetic infiltration.

PACU: post-anaesthesia care unit.

RSB: rectus sheath block.

UHR: umbilical hernia repair.

## 7. Discussion

UHR is one of the most commonly performed day case operations in the paediatric population and is usually carried out in children over the age of three. To improve pain management following UHR, LA is usually administered either as a RSB or

infiltrated at the wound site. The RSB for UHR in children was first suggested by Ferguson and colleagues [2]. The authors describe a potential space that exists between the posterior aspect of the rectus muscle and the posterior wall of its sheath. Administering local anaesthetic (LA) in this space allows distribution at various levels affecting multiple intercostal nerves. Courreges et al. [3]

described a different technique and called it the para-umbilical block. They suggested that infiltration of LA at the middle of the rectus abdominis, both over and under the sheath would result in spread around the anterior cutaneous branches whatever the anatomical variation. To our knowledge no consensus on the best technique has been achieved. The recent advent of ultrasonography for nerve blocks allows direct visualisation of anatomical structures, improves the accuracy of LA placement and as a result the quality of blocks [4,5].

UHR is typically a well-tolerated procedure. Even as the use of regional anaesthesia for post-operative pain management in paediatric surgery has increased, the use of RSB for UHR remains variable [6]. There is no consensus on whether RSB for UHR is more effective for post-operative pain than infiltrating the wound site with LA at the end of the procedure. Administering a RSB requires an ultrasound machine, trained anaesthetist, adds to the operating time and is associated with risks such as peritoneal puncture and haematoma [7,8]. In comparison LAI of the wound is relatively straightforward and less time consuming.

Dingeman et al. [9] carried out a well-designed prospective, observer-blinded, randomised clinical trial comparing the analgesic effects of ultrasound guided RSB versus LAI in the wound site in children undergoing UHR. The primary outcome was comparing patient-reported post-operative pain scores using a validated pain rating scale at defined intervals within the first 24 h after surgery. Fifty two patients were randomly assigned to the two treatment arms (RSB  $n = 27$ ; LAI  $n = 25$ ). The study was powered at 80% to detect a difference of 1 point or more in pain scores between the two groups. A significance level of 0.01 was set and the Mann–Whitney test used to compare pain scores.

First obtainable median pain scores were 0 (no hurt) in both groups. Subsequent median pain scores at 10 min intervals after arrival in post anaesthesia care unit (PACU) remained 0 in the RSB group till discharge from hospital. Median pain score in the LAI group was 1 (hurts just a little bit) 10 min after arrival in the PACU and remained 1 at 10 min intervals till discharge from hospital. The authors reported median pain scores were significantly lower in the RSB group at 10 ( $p = 0.04$ ), 30 ( $p = 0.01$ ) and 40 min or longer ( $p = 0.03$ ) after arrival in PACU compared to the LAI group. There is some ambiguity in the interpretation of these results as the authors set a significance level of 0.01, however  $p < 0.05$  was considered statistically significant.

The percentage of patients reporting no pain (score 0) was significantly higher in the RSB group compared to the LAI group ( $p < 0.05$ ) in the PACU. There were no significant differences in pain scores obtained after discharge at home or in the use of analgesia between the groups at any time post-operatively. Overall, this study has demonstrated the short-term analgesic benefits of RSB but these benefits were not sustained. This is a well-conducted randomised trial; however, does a difference in pain scores of a single point justify the administration of a peripheral nerve block?

In another prospective randomised observer-blinded study, Gurnaney and colleagues [8] compared the use of opioid medication in patients who received RSB and those who received LAI to the surgical site. The study was powered at 80% to detect a difference of 0.1 mg/kg in opioid (morphine IV) requirements between the two groups with a 0.05 significance level. Fifty-four patients were successfully randomised to receive LAI ( $n = 27$ ) or RSB ( $n = 27$ ), however not all patients randomised were accounted for in the final analysis. Only 23 patients in the LAI group and 22 patients in the RSB group were included when analysing peri-operative and post-operative morphine consumption.

There was a statistically significant difference in peri-operative but not post-operative opioid use between the two groups. Due to persistent tachycardia during the intra-operative period, 14

patients were given a dose of morphine (11 LAI group vs. 3 RSB group). The peri-operative mean opioid consumption in the LAI group (mean: 0.13 mg/kg; 95% CI [0.09–0.17 mg/kg]) was significantly higher than the RSB group (mean: 0.07 mg/kg; 95% CI [0.05–0.09 mg/kg]). In the post-operative period opioid use was not significantly different between the two groups. The differences in time to rescue analgesia and pain scores were also not statistically significant.

Even though the investigators concluded RSB provides better analgesia and reduces opioid use in the peri-operative period, the difference in mean opioid consumption between the groups is modest and probably not clinically significant. This study is limited by its poor trial design. The randomisation, treatment allocation and blinding process have not been described in any detail which reduces the rigor of the trial and not all patients were accounted for in the final analysis.

Issac and colleagues [10] carried out a pilot study to compare the efficacy of RSB with LAI for pain control after UHR in children. Fourteen children were randomised to receive one of the two analgesia modalities. There were no significant differences in pain scores or morphine consumption between the groups. The authors concluded RSB has no advantage over LAI for post-operative pain management in children undergoing UHR. As this was a pilot study it is limited by its small sample size and therefore possibility of a type 2 error. There was also a 2 year difference in mean age between the groups which may have biased the results.

## 8. Clinical bottom line

RSB seems to be marginally better than LAI into the wound site for short term pain control in children undergoing UHR. One randomised clinical trial showed RSB had a better analgesic effect in the immediate post-operative period, however these effects were not sustained and the differences in patient reported pain scores were modest. In another randomised trial opioid consumption in the peri-operative period was found to be significantly lower in patients administered RSB. The differences in mean opioid consumption were again modest. These improvements in pain and analgesia consumption need to be balanced against training needed to perform RSB, equipment required, cost, time implications and potential complications of RSB.

There is a need for further large scale randomised clinical trials powered to detect clinically significant differences in pain and analgesics administered. On the basis of the current available evidence the use of RSB marginally improves pain control in children undergoing UHR but this is probably not strong enough to demand a change in practice.

### Ethical approval

N/A.

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None.

### Author contribution

Kapil M. Rajwani – literature search, analysis, main author.  
Sarah Butler – literature search and editing of manuscript.  
Anies Mahomed – analysis, review and editing of manuscript.

### Conflict of interest

None.

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