Review protocol

Rectus Sheath and Transversus Abdominis Plane Blocks in Children

Reviewers
James K. Hamill, FRACS
Jamie-Lee Rahiri, MBChB
Andrew Liley, FRCA
Andrew G. Hill, MD (thesis), EdD, FRACS, FACS

1 Department of Surgery, The University of Auckland, and Department of Paediatric Surgery, Starship Children's Hospital, Auckland, New Zealand
2 South Auckland Clinical School, The University of Auckland, Auckland, New Zealand
3 Department of Anaesthesia, Starship Children's Hospital, Auckland, New Zealand

Contact address
James Hamill, Department of Surgery, Starship Children's Hospital, Private Bag 92024, Auckland 1142, New Zealand. jamesh@adhb.govt.nz

Center conducting the review
Department of Surgery, The University of Auckland

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Conflicts of Interest
The reviewers have no conflicts of interest to declare.
Background

The Problem

Surgical procedures, including ‘minor’ or ‘minimally invasive’ operations, can cause considerable pain (Russell, von Ungern-Sternberg, & Schug, 2013). Pain increases the rate of complication, is distressing, and may become chronic (Schug & Pogatzki-Zahn, 2011). Opiates give effective pain relief but their side effects include nausea, vomiting, pruritus, and respiratory depression (Russell et al., 2013). Non-opioid analgesics include paracetamol, nonsteroidal anti-inflammatory drugs, and tramadol. The N-methyl-D-aspartate (NMDA) receptor antagonist ketamine, the steroid dexamethasone, the alpha-2 antagonist clonide, and the anti-hyperalgesia agent gabapentin also have a place in paediatric acute pain management (Brasher et al., 2014), but the search for better analgesic methods continues.

Regional analgesia has shown considerable promise in paediatric surgery. Regional analgesia reduces opiate requirements, intraoperative general anaesthetic requirements, improves recovery, and has a proven safety record (Bosenberg, 2012). Ultrasonography guidance improves the accuracy of the local anaesthetic placement and may further increase safety (Dolan, Lucie, Geary, Smith, & Kenny, 2009) (Dolan & Smith, 2009). The two major types of regional analgesia are neuroaxial – epidural, spinal or caudal – and peripheral. Peripheral nerve blocks avoid the potential for spinal haematoma epidural infection.

The Intervention

The rectus sheath block is a peripheral regional analgesic technique, first described in children's surgery by Ferguson et al. who utilized the feeling of a 'pop' and sensation of 'scratching' to identify the anterior and posterior rectus sheaths (Ferguson, Thomas, & Lewis, 1996). Another regional analgesic technique was first described by Rafi in 2001, the 'abdominal field block', later renamed the transversus abdominis plane (TAP) block (Rafi, 2001).

To perform a rectus sheath block one places local anaesthetic in the space between the back of the rectus abdominis muscle and the front of the posterior rectus sheath. Ultrasonography demonstrates an hypoechoic lentiform shape. For a TAP block one places local anaesthetic in the neurovascular plane at the lumbar triangle of Petit. Dolan et al. found anaesthetic trainees placed rectus sheath blocks more accurately with ultrasound guidance – intraperitoneal placement of local anaesthetic was 20.9% with a tactile technique versus zero with ultrasonography – but the evidence for improved safety with ultrasound remains weak (Dolan et al., 2009) (Walker, McGrattan, Aas-Eng, & Smith, 2009).

Anatomy and Pharmacology

The anterior rami of T7-T12 supply motor and sensory fibres to the anterior abdominal wall. After leaving the intercostal space they enter the plane between internal oblique and transversus abdominis muscles,
piercing the posterolateral aspect of the rectus sheath to run between the rectus abdominis muscle and the posterior rectus sheath (Ferguson et al., 1996). The 7th and 8th nerves give motor fibres to the recti muscles and the 9th – 11th nerves sensation to the umbilicus. The tendinous intersections do not extend to the posterior rectus sheath but leave a potential space allowing local anaesthetic to spread up and down (Willschke et al., 2006). A bilateral rectus sheath block at or just above the level of the umbilicus should anaesthetize nerves T9 – T11 and provide analgesia for umbilical operations, including umbilical hernia repair and the umbilical port site at laparoscopy. The TAP block could also provide analgesia to the umbilicus and to the abdominal wall for a range of abdominal operations.

Plasma concentrations of local anaesthetic peak at around 45 minutes after a rectus sheath block (Wada et al., 2012) (Flack et al., 2014) (Kitayama et al., 2014) and at around 20-45 minutes after a TAP block (Kato et al., 2009) (Griffiths et al., 2010). Absorption kinetics seem similar for bupivacaine and ropivacaine (Wada et al., 2012) (Flack et al., 2014). Kitayama et al. found the addition of adrenaline significantly prolonged the time to peak plasma concentrations of ropivacaine after TAP blocks (from 18.5 – 43.9 minutes) but not rectus sheath blocks (Kitayama et al., 2014).

**Why it is Important to Perform this Review**

In 2010, Charlton et al. performed a systematic review and metanalysis of TAP and rectus sheath blocks (Charlton, Cyna Allan, Middleton, & Griffiths James, 2010). At the time only one paediatric paper had been published. Since then further studies in children have appeared. There has been no systematic review specific to children. This review will help us understand of the place of rectus sheath and TAP blocks in paediatric surgery and help direct future research.

**Methods**

**Review Question**

How effective are rectus sheath and transversus abdominis plane blocks at reducing pain and enhancing recovery after abdominal operations in children?

**Condition or domain being studied**

Paediatric abdominal operations including umbilical hernia repair and laparoscopic operations.

**Participants/population**

Inclusion: This review will consider studies involving children and adolescents aged 0-18 years.
Exclusion: Adults older than 18 years.

**Interventions, exposures**

1. Rectus sheath nerve block.
2. Transversus abdominis plane block.

**Comparators/control**

Inclusion: Local anaesthetic infiltration, placebo, or systemic analgesia only.

Exclusion: Another regional block, or the same block with different drugs or doses of anaesthetic agent.

**Types of studies to be included**

Inclusion: Randomized controlled trials.

Exclusion: Non-randomized studies, retrospective studies.

**Context**

Hospital inpatient setting, or day stay surgery setting.

**Primary outcomes**

1. Dose of opiate or non-opiate analgesia after the operation.
2. Number of participants needing rescue analgesic.
3. Time to first rescue analgesia.
4. Pain scores.

Primary outcomes will be considered up to 24 hours from surgery.

**Secondary outcomes**

1. Length of hospital stay.
2. Nausea.
3. Satisfaction.

Data extraction – Search Method for Identifying Studies

1. The primary reviewer will first search MEDLINE to analyze text words in the title and abstract and index terms. Next, the reviewers will incorporate the keywords and terms into strategies to search the databases chosen for the review.

2. Two reviewers will perform the searches of the databases of publishes studies, citation tracking and trials registries, enter results into a reference manager database and remove duplicates.

3. The reviewers will examine titles and abstracts to exclude irrelevant reports.

4. The reviewers will hand search reference lists from previously identified studies in an iterative process, and will produce a list of studies for full text review.

5. Two reviewers will independently examine full text reports to determine eligibility. Disagreements will be resolved by discussion, and by referral to a third reviewer if they do not reach consensus.

6. The reviewers will scrutinize the reference list of all identified reports, and will perform forward and backwards citation tracking from Web of Science for additional studies, as well as citation tracking from review articles.

   Two reviewers will independently extract data from included papers using a data collection form. Relevant data will be extracted concerning the participants, interventions, study methods and outcomes. If the reviewers require additional data they will make two attempts to contact the authors.

Data to be extracted

Total number of participants, age, gender, setting, country, diagnostic criteria, interventions, total number of intervention groups.

For each intervention and comparison group of interest: specific intervention, intervention details (sufficient for replication, if feasible).

Outcomes and time points (i) collected, (ii) reported. For each outcome of interest: outcome definition (with diagnostic criteria if relevant); unit of measurement (if relevant); for scales, upper and lower limits, and whether high or low score is good.

Results: number of participants allocated to each intervention group. For each outcome of interest: sample size, missing participants, summary data for each intervention group (e.g. 2×2 table for dichotomous data, means and standard deviations for continuous data).

Miscellaneous: funding source, key conclusions of the study authors, miscellaneous comments from the study authors, references to other relevant studies, correspondence required, miscellaneous comments by
the review authors.

**Searches**

*Searches for published studies*


EMBASE, Excerpta Medica database (1980 to present).

CENTRAL, The Cochrane Central Register of Controlled Trials.

Cochrane Database of Systematic Reviews – CDSR.

Web of Science Core Collection, citation tracking, related articles (1945 to present).

Google Scholar.

*Trial registers of ongoing trials*

WHO [http://apps.who.int/trialsearch/Default.aspx](http://apps.who.int/trialsearch/Default.aspx)

ClinicalTrials.gov (USA) [http://clinicaltrials.gov](http://clinicaltrials.gov)

Current Controlled Trials, ISRCTN Registry (UK)  [http://www.isrctn.com](http://www.isrctn.com)

Australian and New Zealand Clinical Trials Register, [http://anzctr.org.au](http://anzctr.org.au)

*Initial search of Medline (OvidSP)*

1  
(nerve or regional) and (block* or anesthe* or anaethe* or analg*).mp.

2  
(rectus and sheath).mp.

3  
(transversus and abdominis).mp.

4  
(TAP adj10 nerve*).mp.

5  
(abdominal and field).mp.

6  
(peripheral nerve block or regional nerve block).mp.

7  
paraumbilical.mp.

8  
or/1-7

9  
(laparoscopy* or minimal* invasive).mp.

10  
(pariet* periton* or viscer* periton* or appendi* or gall bladder or cholecystectomy* or spleen or splenectomy*).mp.

11  
umbilical hernia.mp. or Hernia, Umbilical/
Pain, postoperative/

((pain* or analges*) adj6 (perioperative or peri-operative or peri operative or postoperat* or post- operat* or after operat* or postsurg* or post surg* or post-surg* or after surg* or follow* surg* or follow* operat*))).mp.

(post-operative-pain or post operative pain or post-operative pain or postoperative pain).mp.

or/13-15

randomized controlled trial.pt.

controlled clinical trial.pt.

randomized.ab.

placebo.ab.

randomly.ab.

trial.ab.

groups.ab.

or/17-23

8 and 12 and 16 and 24

limit 25 to humans

limit 26 to (humans and "all child (0 to 18 years)")

Risk of Bias (Quality) Assessment

Two independent reviewers will assess papers for methodological validity using a risk of bias form. Disagreements between the reviewers will be resolved initially through discussion, and if need be by a third reviewer.

Data to be collected will include:

Sequence generation: Was the assignment to treatment groups truly random?
Allocation concealment: Was allocation to treatment groups concealed from the allocator?
Blinding of participants, personnel, and outcome assessors: Was knowledge of the intervention adequately prevented during the study?
Incomplete outcome data: Was incomplete outcome data adequately addressed?
Selective outcome reporting: Are reports of the study free of suggestion of selective outcome reporting?
Other sources of bias: Was the study apparently free of other problems that could put it as a high risk of bias?

Data Synthesis
Outcomes will be pooled in statistical meta-analysis, using aggregated data, or data at the level of individual participants if available. Effect sizes will be expressed as odds ratio for categorical data and weighted mean differences for continuous data; 95% confidence intervals will be calculated. Heterogeneity will be assessed statistically using Chi-square. We will present narrative synthesis of the studies.

Analysis of Subgroups or Subsets
None planned.

Restrictions
The reviewers plan no language or publication date restrictions.

References


