Regional anaesthesia in paediatric day case surgery

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Paediatric day-case anaesthesia and pain control

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Purpose of review

More surgery on children is being carried out on a day-case basis and we review the anaesthetic management. Selection of appropriate patients and procedures is vital and careful preparation of children and families minimizes fear and anxiety and streamlines the organizational aspects of care. Simple, noninvasive general-anaesthetic techniques with modern agents are recommended. Good analgesia is important and is based upon local or regional blockade, nonsteroidal antiinflammatory drugs and paracetamol, with opioids being reserved for rescue analgesia. Omission of opioids helps to minimize postoperative emesis. Discharge home is facilitated by clear instructions about activities, dressings, wound care and continuing pain control.

Recent findings

Oral clonidine premedication, new, safer local anaesthetic agents, ultrasound guidance for blocks and prolongation of single-injection caudal blocks with clonidine or ketamine are recent developments. Guidelines for safe sedation and analgesia for procedures are available. Behavioural and cognitive changes can be seen in children after anaesthesia and surgery and parents should be informed of this possibility.

Summary

Children benefit particularly from day care and recent advances in anaesthesia and pain management have allowed a huge expansion of this modality of care with a consequent reduction in the need for children to be in hospital.

Keywords

ambulatory care, anaesthesia, analgesia, day-case surgery, paediatric

Curr Opin Anaesthesiol 19:617–621. © 2006 Lippincott Williams & Wilkins.

Blocks for pain management in children undergoing ambulatory surgery

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Current Opinion in Anesthesiology 2011, 24:627–632

Purpose of review

Data from the USA show that the number of paediatric outpatient procedures has increased by almost 50% during the time period 1996–2006. Despite this increasing trend with regards to ambulatory surgery in children postoperative analgesia is still often suboptimal. The aim of this review is to give an overview of different regional anaesthesia techniques that successfully can be used in paediatric ambulatory surgery.

Recent findings

Regional anaesthesia, especially the increasing use of ultrasound-guided peripheral nerve blocking techniques, provide maybe the best way of achieving high-quality early postoperative pain relief and the use of continuous peripheral catheters appear very promising in order to extend analgesia after the return home. If used appropriately the use of regional anaesthesia may in some instances even make it possible to bypass the recovery room.

Summary

Current evidence strongly supports the use of various regional anaesthetic techniques in paediatric outpatient surgery. However, further studies are needed to identify the incidence and severity of pain following different common ambulatory surgical procedures in children as well as comparative prospective randomized trials comparing different regional techniques as well as comparing regional anaesthesia to the best current combination of oral analgesics.

Keywords

ambulatory, anaesthesia, bupivacaine, child, clonidine, ketamine, levobupivacaine, regional, ropivacaine, surgery

Ambulatory surgery in children

- Out-patient surgery in children did increase by 50 % from 1996 to 2006.

JA Rabbitts et al. Anesth Analg 2010; 111: 1011-1015.

Incidence of pain following discharge after ambulatory surgery in children

- < 86 % experience pain at home

MA Fortier et al. Pediatrics 2009

PRA in ambulatory surgery- Goals

- Reduced need for general anaesthetics
  - Fast recovery
- No need for opioids
  - Fast recovery & Reduced PONV
- Smooth emergence/PACU stay
  - Reduced pain & PONV
- Excellent analgesia
  - In PACU
  - During home transport & early period at home

PRA in ambulatory surgery- Goals

- Ultimate goal:

- Adequate pain relief during the first 24 h
  - Single injection technique
  - Catheter/Home pump

PRA in ambulatory surgery

- MULTIMODAL analgesia!!!

- PRA plus:
  - Paracetamol
  - NSAIDs (e.g. ibuprofen, diclofenac)
  - Corticosteriods- single dose
  - (oral opioids)

Subumbilical surgery

Spinal blockade

Kuopion yliopiston julkaisuja D. Lääketiede 203
Kuopio University Publications D. Medical Sciences 203

TO PER-ORM
WITH KIND REGARDS

Hannu Kokki

Spinal Anaesthesia in Children

Evaluation of Puncture Characteristics of Various Needles and Block Efficacy of Various Local Anaesthetic Solutions

Spinal blockade

- EMLA/Amitop patch
- Premedication
- Awake or lightly sedated

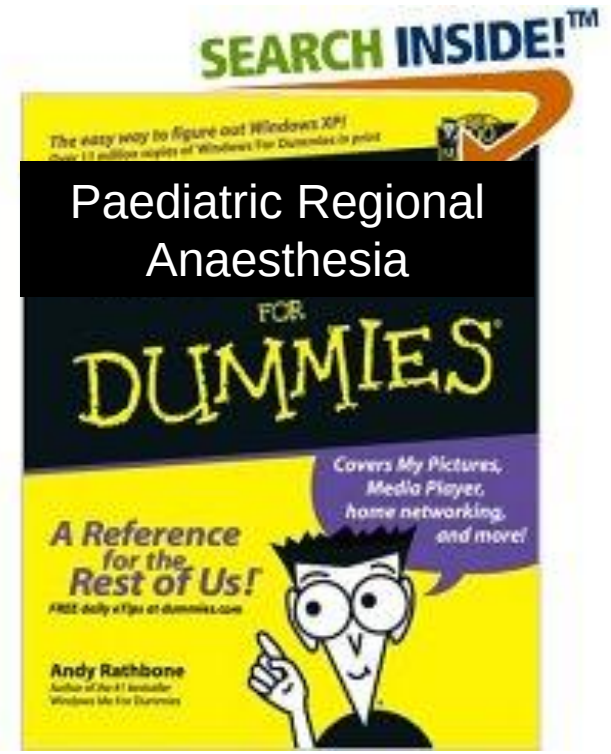
- Excellent intraop & early analgesia
- Reduced risk for PONV

Spinal blockade- limitations

- Short duration- sometimes insufficent for bilateral hernias
- Clonidine 1 mcg/kg increases duration but still short duration
- Need for early supplemental postop analgesia due to short duration
  - Risk for PDPH
  - Bedrest, caffein containing fluids (e.g. Coke, Red Bull)
  - Occational need for blood patch
- Not widely used outside a few dedicated centres

Caudal block

- Most extensively used block world wide
- Easy to learn
- ”One size fits all”



Caudal block

- Residual postop motor block
  - Not an issue with Ropi 0.2 % or Levo 0.25 %

    G Ivani et al. Pediatr Anesth 2005; 15: 491-494.

Caudal block

- Urinary retension
- Frequent fear of surgeons
  - Incidence 2 % do not differ from GA alone

    AL Pappas et al. Anesth Analg 1997; 85: 706
  - Postop morphine administration: 13.5 % !!!

    Z Esmail et al. Pediatr Anesth 1999; 9: 321-327
- Bladder scan > 10ml/kg -> catheterization

  E Koomen et al. Pediatr Anesth 2002; 12: 738-741
- Info: should void within 12 h

Caudal block- Limitation

- Regress in a cranio-caudad fashion
- Duration of sensory block:
  - Thoracic dermatomes: 2-4 h
  - Lumbar dermatomes: 4-8 h
  - Sacral dermatomes: 8-12 h

- Maybe not optimal for surgery involving thoracic dermatomes, e.g. orchidopexy, IHR

Caudal block- Adjuncts

- Commonly used (59 % in UK)

  JC Saunders, BJA 2002; 89: 707-710.

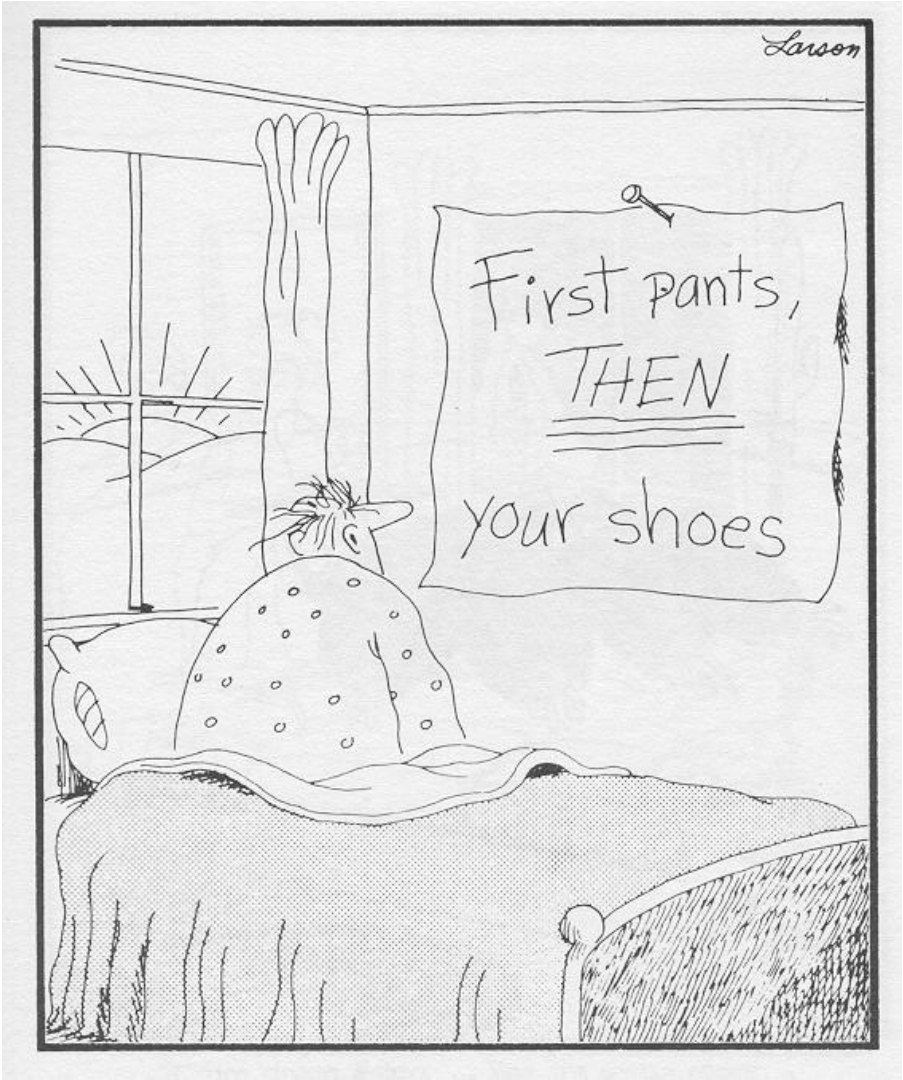
- Clonidine 1-2 mcg/kg increase duration of postop analgesia by approx 4 hrs

  A Schnabel et al. Pediatr Anesth 2011; 21:1219-1230.

  – Additional spin-offs: PAED-PONV-Shivering reduced, desirable postop sedation

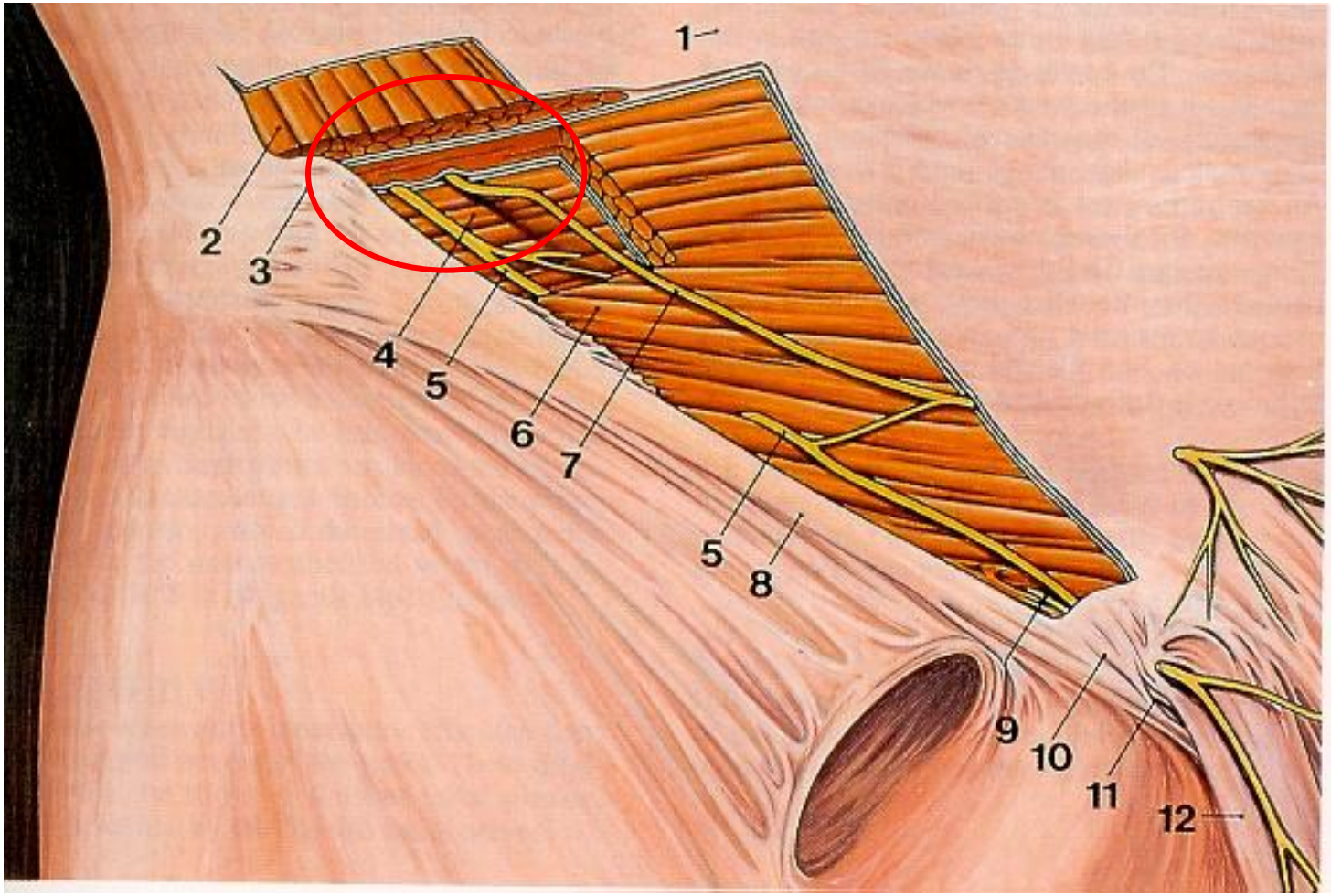
- S-Ketamine 1 mg/kg + Clonidine 1 mcg/kg and no (!) LA -> approx 24 h of postop analgesia

  H Hager et al, A&A 2002; 94: 1169-72.



Adjuncts cannot salvage
a suboptimal block technique!!!

Ilioinguinal/Iliohypogastric nerve block



Ilioinguinal/Iliohypogastric Blocks in Children: Where Do We Administer the Local Anesthetic Without Direct Visualization?

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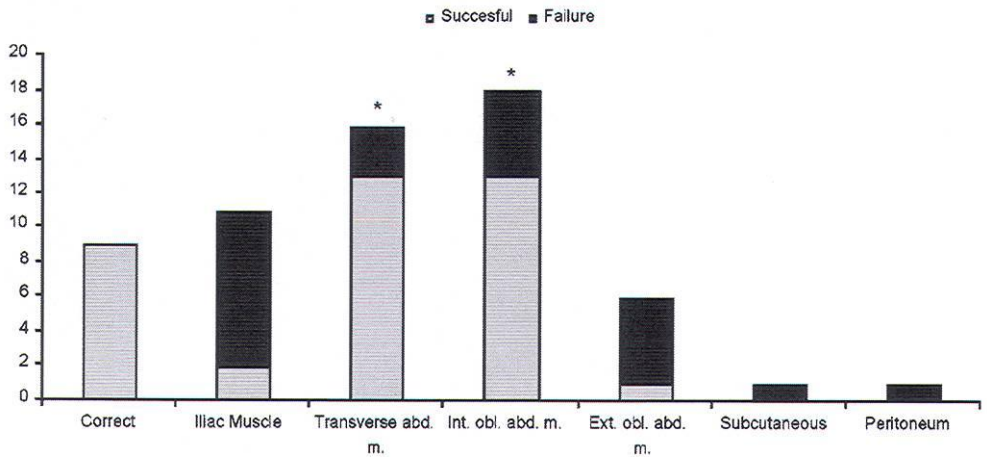
Adrian Bösenberg, MBChB, FFA (SA)†
Stephan Kapral, MD*
Harald Willschke, MD*
Michael Felfernig, MD‡
Stephan Kettner, MD*



Anesth Analg 2008; 106: 89-93.

British Journal of Anaesthesia 95 (2): 226–30 (2005)
doi:10.1093/bja/aei157 Advance Access publication May 27, 2005

BJA

Ultrasonography for ilioinguinal/iliohypogastric nerve blocks in children†

H. Willschke[1], P. Marhofer[1]*, A. Bösenberg[2], S. Johnston[2], O. Wanzel[3], S. G. Cox[2], C. Sitzwohl[1] and S. Kapral[1]

Table 2 The range of distances measured from the anterior superior iliac spine and the skin to the iliohypogastric and ilioinguinal nerves and from the ilioinguinal nerve to the peritoneum in children of three different weights

Weight (kg) (no. of patients)	Anterior superior iliac spine–ilioinguinal nerve (mm)	Skin–ilioinguinal nerve (mm)	Skin–iliohypogastric nerve (mm)	Ilioinguinal nerve–peritoneum (mm)
5 (8)	5–10.3	5–9	3.9–7.8	1–4
13 (5)	6.3–13	4.8–8.9	5.4–8.9	1.7–4
16 (4)	11.3–13	5.4–12	5.5–11	3–4.6

- Ultrasound vs. Fascial click
  - Reaction to incision: 4 % vs. 26 %, p = 0.004
  - Postop analgesia in RR: 6 % vs. 40 %, p < 0.001

Optimal volume: 0.1 ml/kg H Willscke et al. Anesth Analg 2006102: 1680-1684

Paravertebral blockade

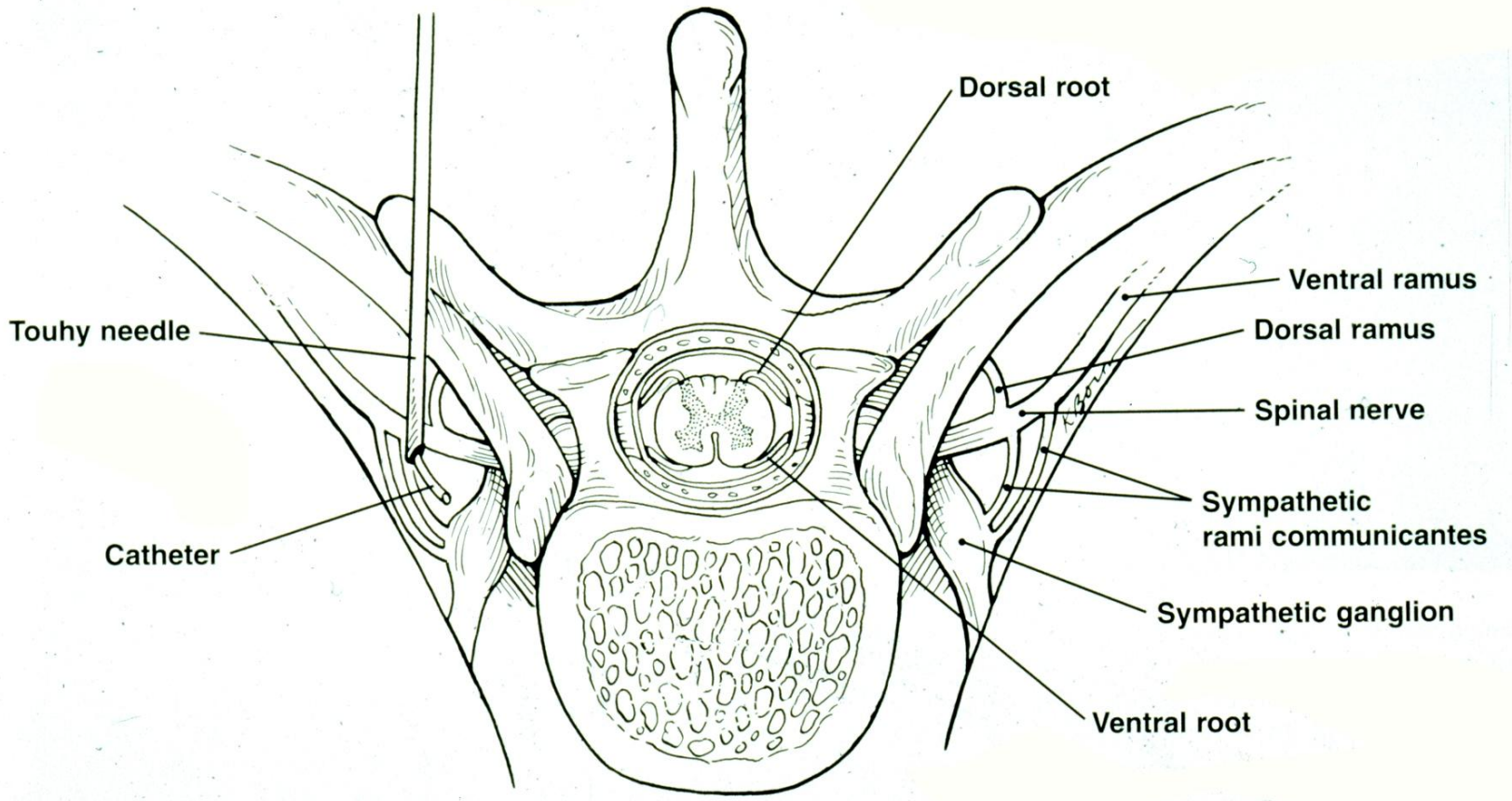


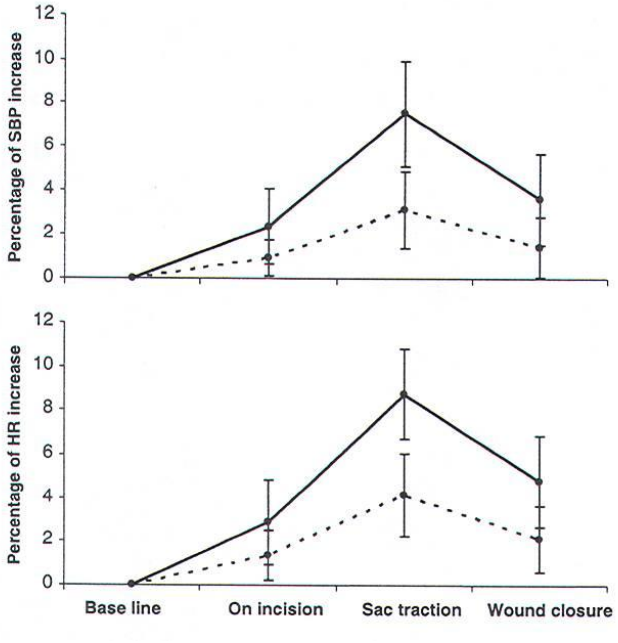
Fig 3. Anatomy of the PVS and the correct position of the Touhy needle and catheter.

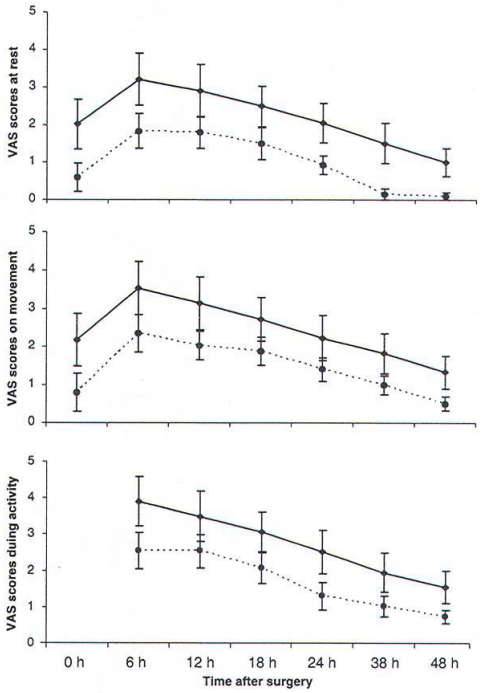
Anaesthesia, 2006, **61**, pages 1064–1068 doi:10.1111/j.1365-2044.2006.04833.x

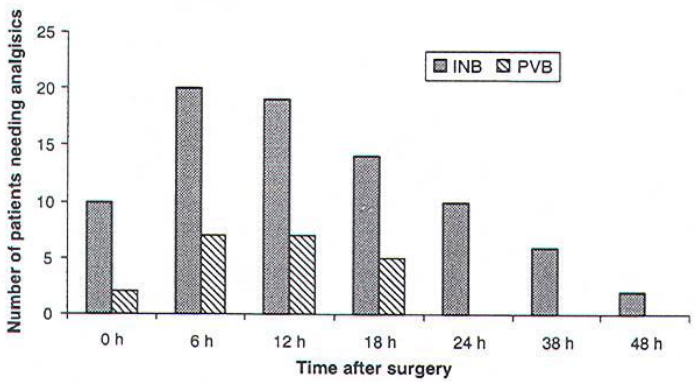
A comparison of nerve stimulator guided paravertebral block and ilio-inguinal nerve block for analgesia after inguinal herniorrhaphy in children

Z. M. Naja,[1] M. Raf,[2] M. El Rajab,[3] N. Daoud,[4] F. M. Ziade,[5] M. A. Al Tannir[6] and P. A. Lönnqvist[2]

- Prospective, randomized, observer-blinded
- Ilioinguinal (intraop by surgeon n = 40) vs. PVB (non-USG n = 40)







Orchidopexy

- Caudal and ilio-inguinal blocks are often suboptimal
  - does not include adequate blockade of the testicular innervation (dull, deep, aching component) transmitted thru Th 10-12
- Th 12/L 1 paravertebral maybe the future?
  - often surprisingly long duration of postop pain-relief from single injection

JB Eck et al. Techn Reg An Pain Manag 2002; 6: 131-135

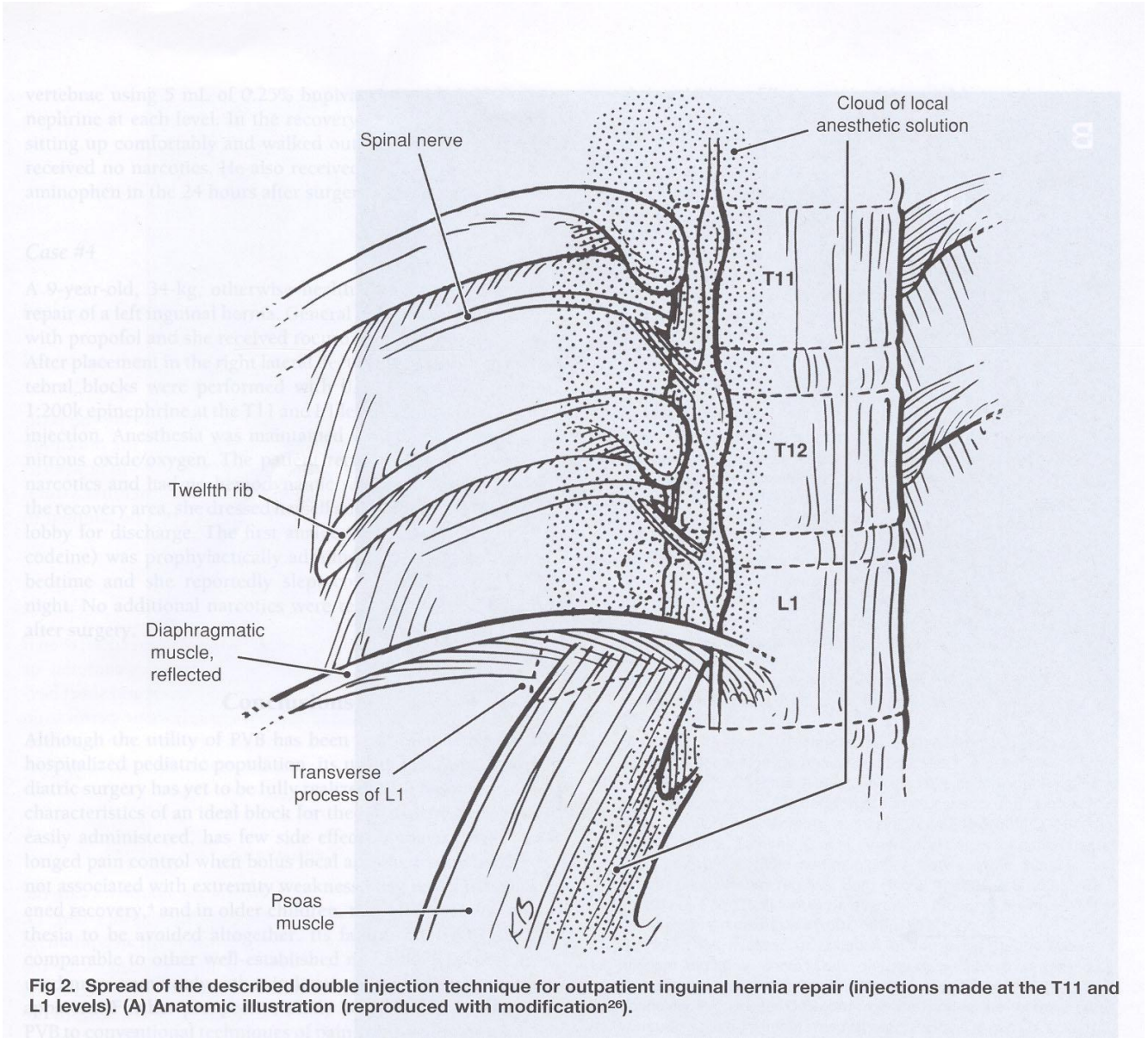
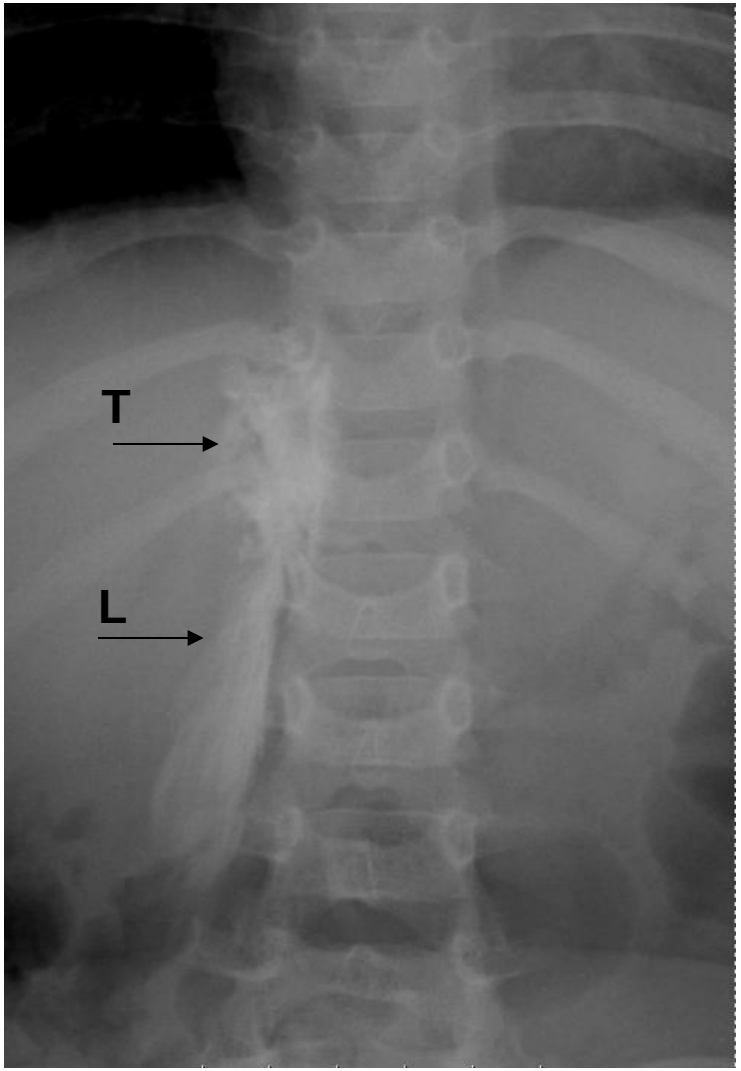


Fig 2. Spread of the described double injection technique for outpatient inguinal hernia repair (injections made at the T11 and L1 levels). (A) Anatomic illustration (reproduced with modification[26]).

JB Eck et al. Techn Reg An Pain Manag 2002; 6: 131-135



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BJA

Lateral ultrasound-guided paravertebral blockade: an anatomical-based description of a new technique

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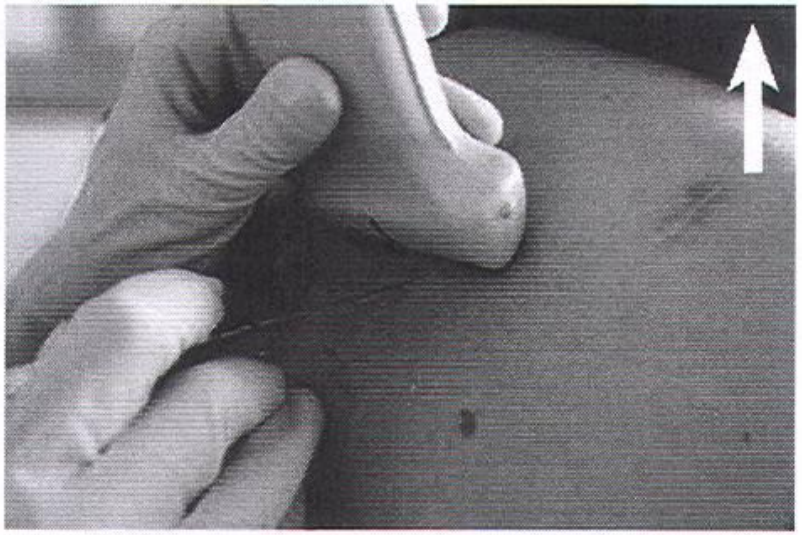


Fig 2 Out-of-plane needle guidance technique for PVB on the right side (simulated image). The white arrow indicates cranial direction.

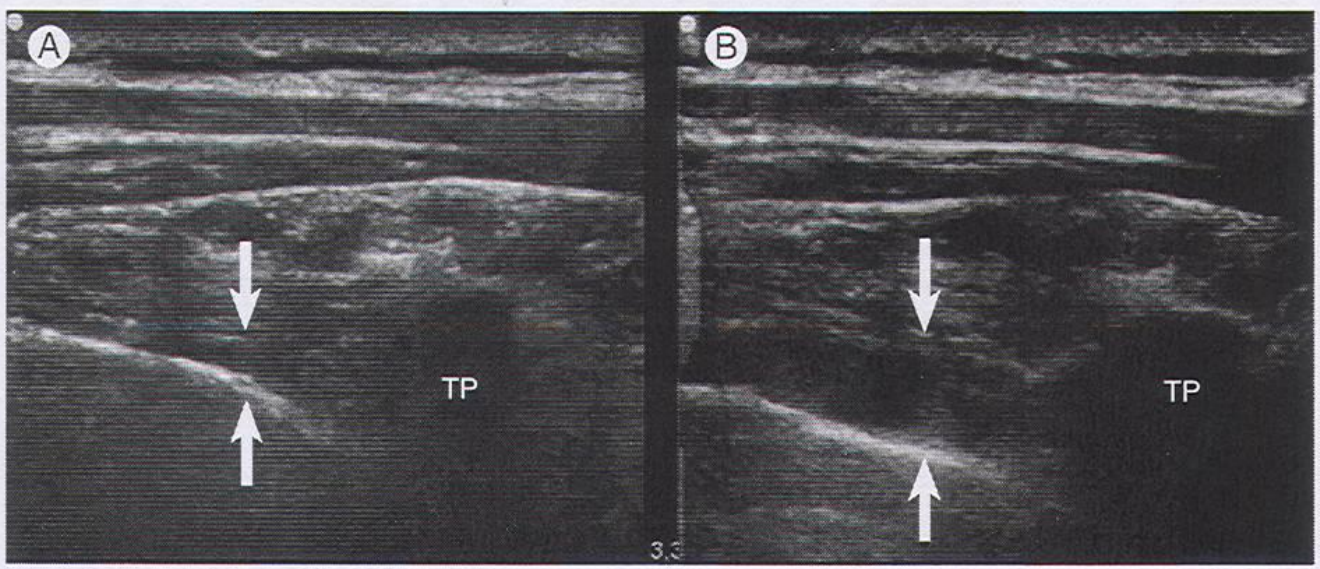


Fig 5 Ultrasound illustration of the PVS (between the arrows) before (A) and after administration (B) of 12 ml of local anaesthetic.

Lower extremity

- Few indications in true ambulatory paediatric surgery
- Limitation: risk for postop muscular weakness/paralysis
- Knee surgery (e.g. Mb Schlatter, Arthroscopy)
  - Abductor canal block of saphenus nerve)
- Foot surgery
  - Ankle block, selective tibial nerve block in FP

Upper extremity

- Major painful surgery rare in children < 10 yrs
- Local infiltration often enough

- If shoulder surgery:
  - interscalene or wound catheter

- If major surgery below the shoulder:
  - SC or IC BPB

Catheter techniques

- Peripheral nerve catheters
- (Wound catheters- not yet any real paediatric experience in out-patients)

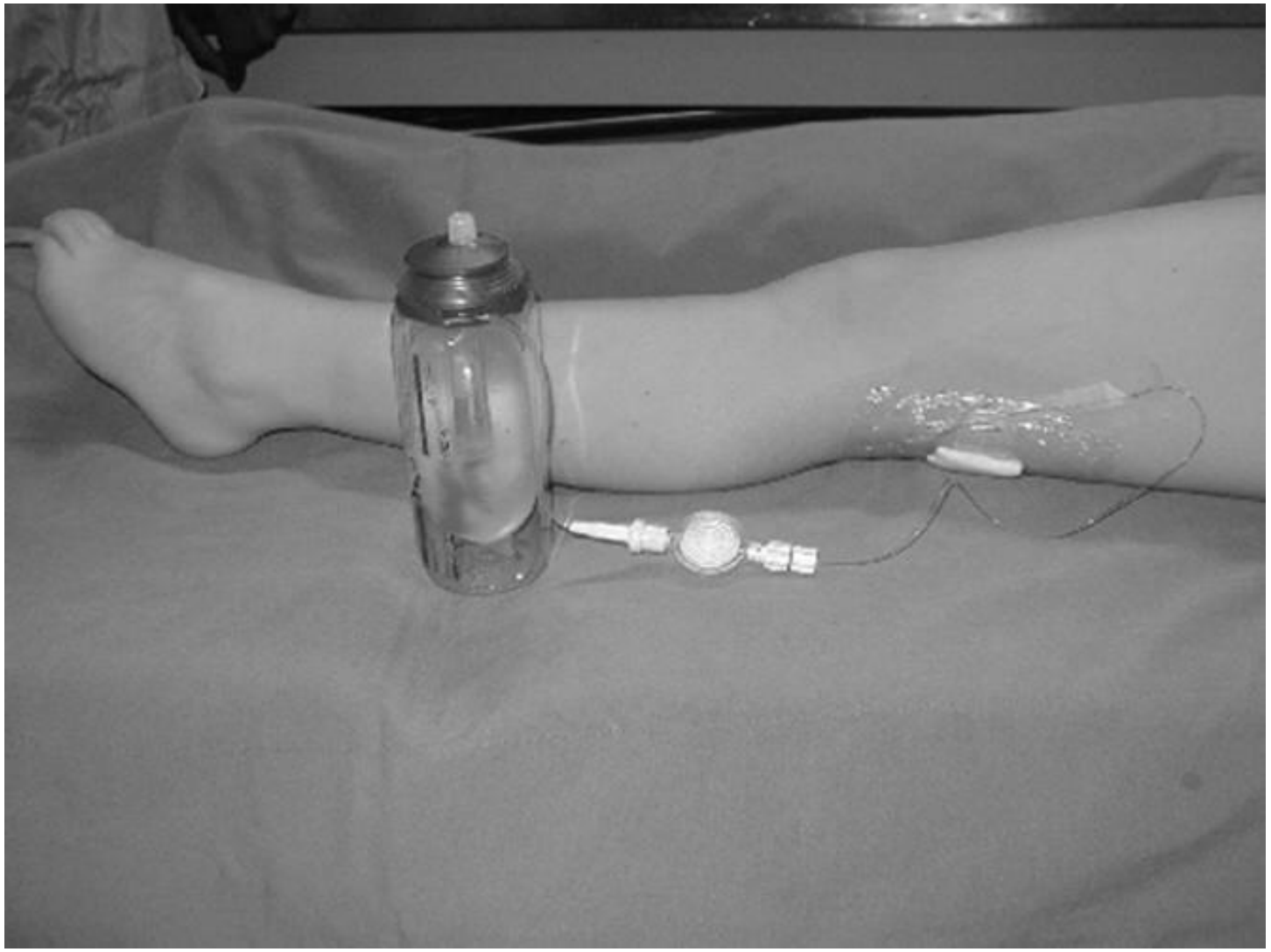
- Prerequisites:
  - No verbal issues- parents must fully understand
  - Clear written instructions
  - Telephone follow-ups

C Dadure et al

- Continuous peripheral nerve blocks at home for treatment of recurrent complex regional pain syndrome I in children. Anesthesiology. 2005; 102: 387-91.

- Perioperative continuous peripheral nerve blocks with disposable infusion pumps in children: a prospective descriptive study. Anesth Analg. 2003; 97: 687-90.

Continuous infusion of 0.2% ropivacaine *via* a popliteal catheter with a disposable elastomeric pump in a 12-yr-old child.



Continuous Peripheral Nerve Block for Postoperative Pain Control at Home: A Prospective Feasibility Study in Children

Hugues Ludot, M.D., Joëlle Berger, M.D., Vincent Pichenot, M.D., Mohamed Belouadah, M.D., Karim Madi, M.D., and Jean-Marc Malinovsky, M.D., Ph.D.

Background and Objectives: We assessed the feasibility and efficacy of postoperative pain control by continuous peripheral nerve blockade (CPNB) in children after early home discharge under parental surveillance.

Methods: All children scheduled for primary elective ankle or foot surgery under sciatic popliteal CPNB and general anesthesia were evaluated. After obtaining the surgeon's consent, the children were discharged on either the day (D) of surgery (D0), or on postoperative D1 or D2 (depending on whether they needed a plaster cast or a suction drainage). The CPNB was continuously infused, using an elastomeric pump. Before the procedure, the parents were taught how to assess their children's pain, to use rescue analgesia, and to manage an infusion elastomeric pump device, and when to call the hospital in case of emergency. The children returned to the hospital for catheter removal and the recording of any postoperative event.

Results: Forty-seven children were entered into this observational study. Two were discharged home on the same day, 30 were discharged home 1 day after surgery, and 15 were discharged home 2 days after surgery. The mean duration of infusion elastomeric pump at home was 3 days (range, 2 to 4 days). Analgesia was rated as excellent or good in 89% of the cases, and the quality of sleep was always good, except for three patients. Some minor untoward effects were recorded. Two children returned to the hospital because of accidental disconnection of the infusion elastomeric pump from the catheter. Four patients presented skin redness at the puncture site, but no infection was observed, and all catheters remained sterile. No parents called the hospital. The children's quality of life was rated as excellent or as satisfactory overall, by both the children and their parents.

Conclusions: Shortening hospital stays with the use of at-home CPNB under sole parental supervision is feasible, after selecting children with a suitable family environment. *Reg Anesth Pain Med 2008;33:52-56.*

Key Words: Postoperative analgesia, Ambulatory surgery, Peripheral nerve blockade, Local anesthetics, Continuous analgesia.

Target age: 3-15 yrs

Median: 11 yrs; range 3-15 yrs

Table 1. Times of Discharge and of CPNB Withdrawal, and Duration of Infusion by Elastomeric Pump in the Children of the Present Study

Time of discharge at home	D0		D1			D2	
Time of CPNB withdrawal (postoperative days)	D2	D3	D3	D4	D5	D4	D5
Duration of infusion elastomeric pump at home (days)	2	3	2	3	4	2	3
Number of children (n = 47)	1	1	8	15	7	10	5

NOTE. D0 corresponds to day of surgery, D1 to postoperative day 1, and D2 to postoperative day 2.
Abbreviations: CPNB, continuous peripheral nerve blockade; D, day.

Perioperative Continuous Peripheral Nerve Blocks with Disposable Infusion Pumps in Children: A Prospective Descriptive Study

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Continuous peripheral nerve blocks (CPNB) after pediatric major orthopedic surgery are not widely used. We conducted a prospective descriptive study to evaluate the effectiveness of disposable elastomeric pumps for CPNB in children. After inducing general anesthesia, 25 consecutive children scheduled for major orthopedic surgery received a 0.5-mL/kg bolus of a mixture of 1% lidocaine with epinephrine and 0.25% bupivacaine in axillary, femoral, or popliteal catheters. After surgery, disposable pumps with 0.2% ropivacaine were connected. Pump flows were adjusted to the patient's weight. Postoperative pain was evaluated using a visual analog scale or Children and Infants Postoperative Pain Scale scores at H1, H6, H12, H24, and H48, as well as amounts of rescue analgesia, adverse events, and motor and sensory block. An ambulation score for the children was also evaluated. Eleven popliteal, nine femoral, and five axillary continuous blocks were performed. All the blocks were effective for surgery. The mean total dose consumption of 0.2% ropivacaine was 10.1 mg/kg. Disposable pump flow varied from −9.61% to +8.6% compared with the theoretical one. Postoperative analgesia was excellent. The median of pain score was zero at each period studied. Sensory and motor block were noted at H1 and decreased from the sixth hour. No adverse events were noted. We concluded that the use of elastomeric disposable pumps for CPNB in children was an effective technique.

(Anesth Analg 2003;97:687–90)

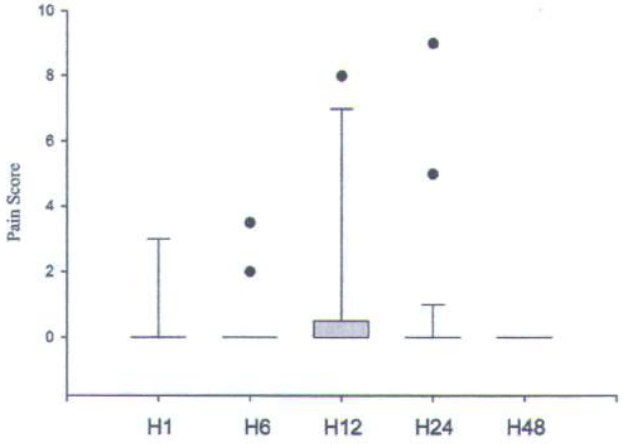

Figure 2. Visual analogic scale (VAS) or Children and Infants Postoperative Pain Scale (CHIPPS) score values on movement. The box represents the 25th–75th percentiles, and the dark line is the median. The extended bars represent the 10th–90th percentiles, and the dark circles represent values outside this range.

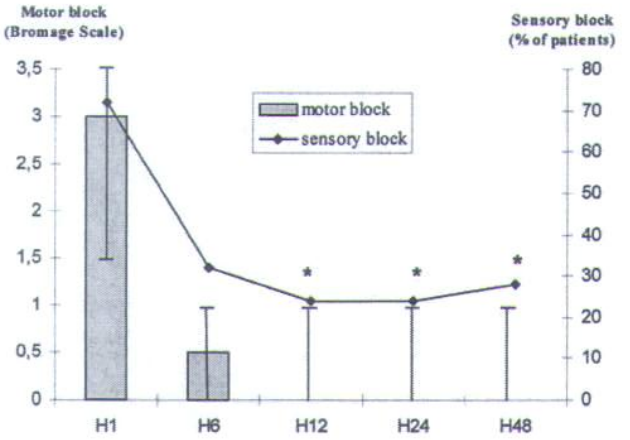

Figure 3. Evolution of motor block values and percentages of patient with a sensory block during the studied period. For the Bromage scale values, at each period, the vertical lines represent the 25th–75th percentiles, and the box is the median. *$P < 0.05$ versus H1 for Bromage scale values and percentage of patients with a sensory block.

n = 25
Median age: 10 yrs (range: 1-15yrs)
Median weight: 34 kg (range: 15-75 kg)

Continuous Peripheral Nerve Blockade for Inpatient and Outpatient Postoperative Analgesia in Children

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BACKGROUND: This is an audit of the continuous peripheral nerve blockade (CPNB) program that was implemented at our institution to provide postoperative analgesia after orthopedic procedures in children.

METHODS: We reviewed the departmental regional anesthesia registry and the medical records of consecutive children who received CPNB for postoperative analgesia at The Children's Hospital of Philadelphia between February 2003 and July 2006. Patients were prospectively followed until cessation of the effects of CPNB and/or resolution of any related complications. Data collected contemporaneously included presence of sensory and motor blockade, pain scores in inpatients, opioid administration, and complications related to CPNB.

RESULTS: A total of 226 peripheral nerve catheters were placed in 217 patients. One hundred eight patients (112 catheters) were discharged home with CPNB. The ages ranged from 4 to 18 yr (13.7 ± 3.4). Local anesthetic solution (0.125% bupivacaine [n = 164], 0.1% ropivacaine [n = 12], or 0.15% ropivacaine [n = 27]) was infused at an initial rate of 2–12 mL/h based on patients' weights and locations of catheters. The mean duration of local anesthetic infusion was 48.4 ± 29.3 h (range 0–160 h). The percentage of patients who did not require any opioids in the first 8, 24, and 48 h after surgery was 56%, 26%, and 21%, respectively. The incidence of nausea and vomiting was 14% (13% in outpatients, 15% in inpatients). Complications were noted in 2.8% of patients. Three patients had prolonged numbness (>24 h) that resolved spontaneously; one developed superficial cellulitis that resolved with a course of antibiotics; one had difficulty removing the catheter at home and one developed tinnitus 24 h after starting CPNB that resolved quickly after clamping of the catheter followed by removal.

CONCLUSION: It is feasible to implement a CPNB program to provide an alternative method of inpatient and outpatient postoperative analgesia after orthopedic surgery in children when appropriate expertise is available. Patient and family education along with frequent follow-up are crucial to detect and address adverse events promptly.

(Anesth Analg 2007;105:1234-42)

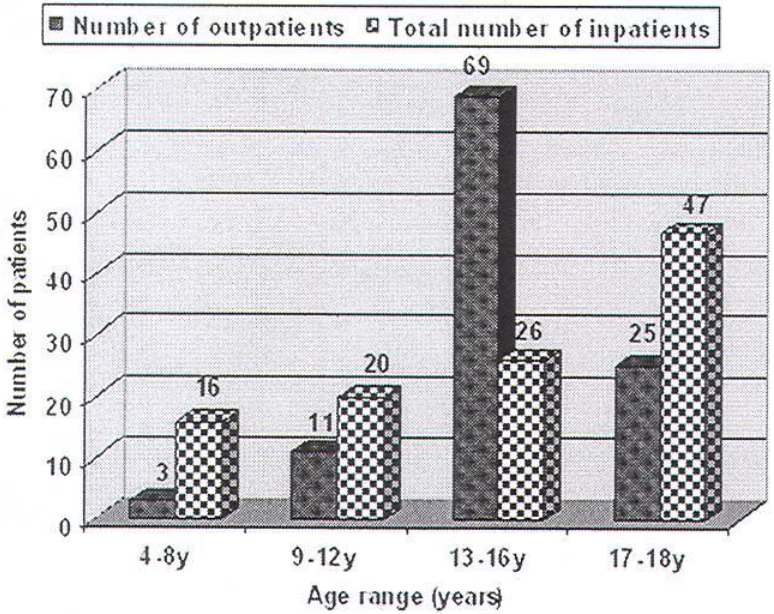

Figure 1. Age group distribution of outpatients and inpatients with continuous peripheral nerve blockade.

Table 2. Date of Discharge of Patients After Surgery who Went Home with Indwelling Peripheral Nerve Catheters

Catheter location and total number (n = 112[a])	POD # 0	POD # 1	POD # 2 and later
Interscalene (n = 11)	4	6	1
Infraclavicular (n = 11)	3	6	2
Lumbar plexus (n = 2)	0	1	1
Femoral (n = 82)	31	47	4
Sciatic (n = 6)	1	4	1

POD = postoperative day.

[a] Number of patients who were discharged home with catheters was 108 (four patients had dual catheters; hence n = 112).