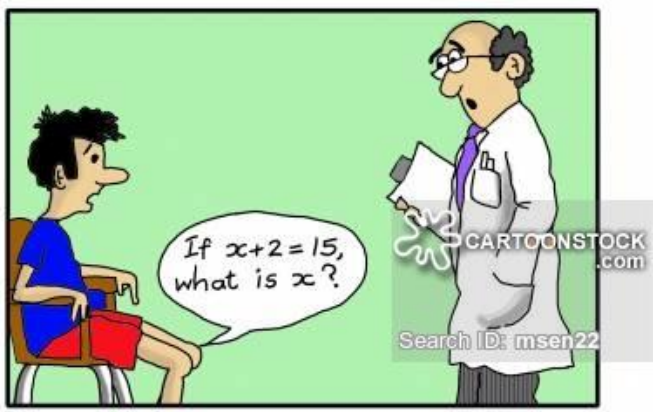
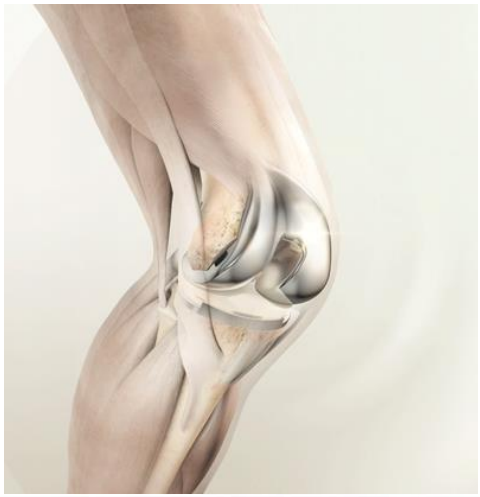
Pain after Knee Replacement

Adam Carney MA MB BChir MRCP FRCA
Nottingham University Hospitals NHS Trust
BSOA Committee Member



"It's my knee, Doctor. It's still giving me problems."



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neos Nottingham Elective Orthopaedic Services

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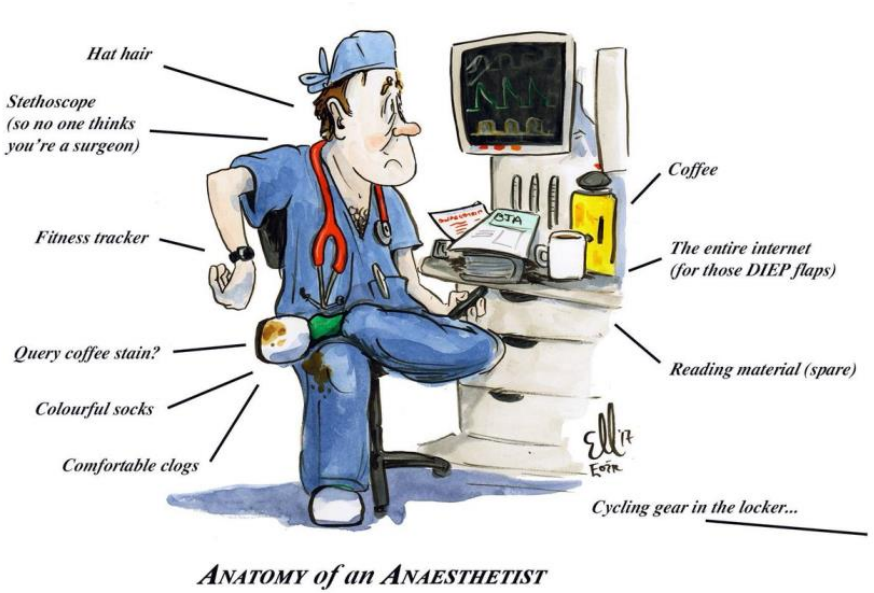
Conflicts of Interest

Travel Expenses

- EBPOM
- MSD
- RCoA
- STAPG



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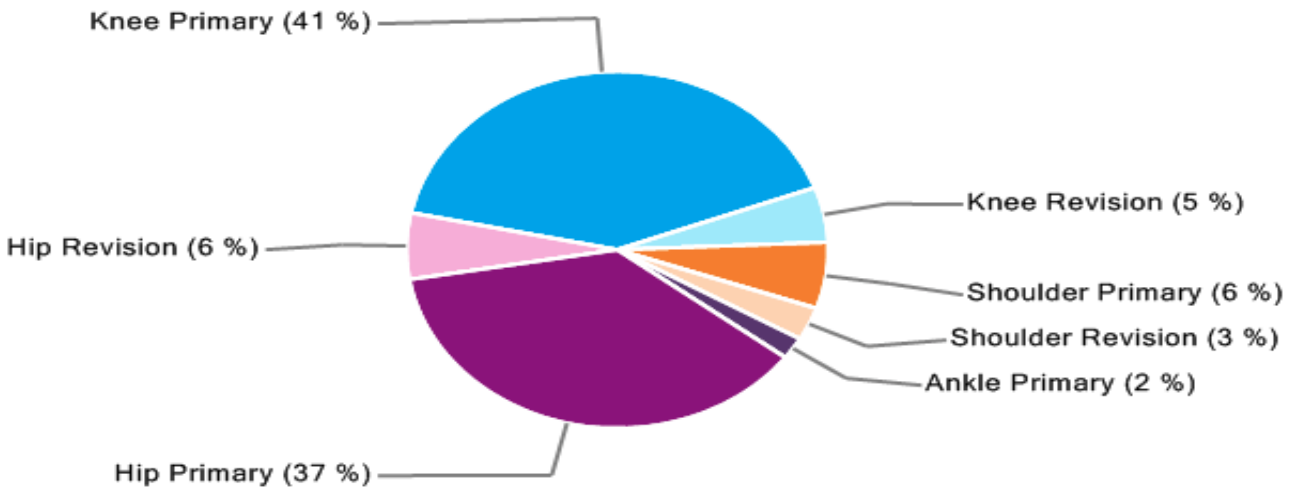
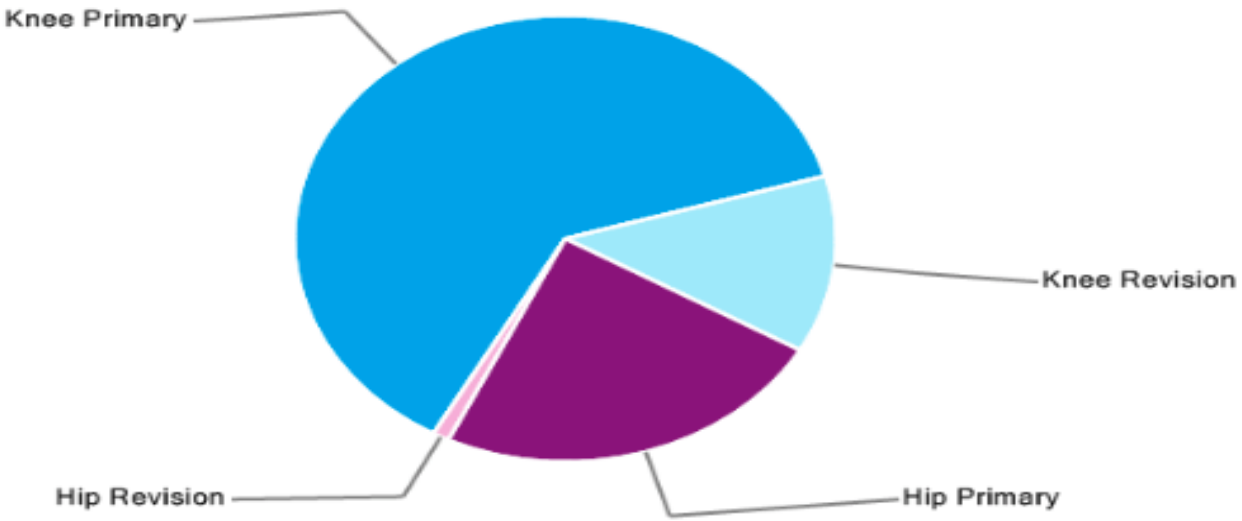
	Primary total prosthetic replacement using cement		Primary total prosthetic replacement not using cement		Primary total prosthetic replacement not classified elsewhere (e.g. hybrid)		Patello-femoral replacement		Unicondylar knee replacement		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.
Total knee primaries	84,830	86%	3,213	3%	521	1%	1,162	1%	8,865	9%	98,591
Patient physical status											
P1 - Fit and healthy	7,419	9%	317	10%	47	9%	293	25%	1,815	20%	9,891
P2 - Mild disease not incapacitating	62,341	73%	2,483	77%	396	76%	775	67%	6,370	72%	72,365
P3 - Incapacitating systemic disease	14,840	17%	408	13%	76	15%	90	8%	673	8%	16,087
P4 and P5	230	<1%	5	<1%	2	<1%	4	<1%	7	<1%	248
BMI											
Number with BMI data	66,109	78%	2,414	75%	342	66%	911	78%	7,333	83%	77,109
Average	31.03		31.33		30.83		29.65		30.20		30.94
SD	5.51		5.21		5.77		5.37		5.01		5.47

Data for 1 April 2014 - 31 March 2015



Operation Type	Operation Subcategory	Procedures Recorded for this Hospital	National Average
Hip Primary	-	668	218
Hip Revision	-	114	26
Knee Primary	Patello-Femoral Replacement	Fewer Than 5	4
Knee Primary	Total knee replacement	707	222
Knee Primary	Unicondylar Knee Replacement	9	25
Knee Revision	-	92	17

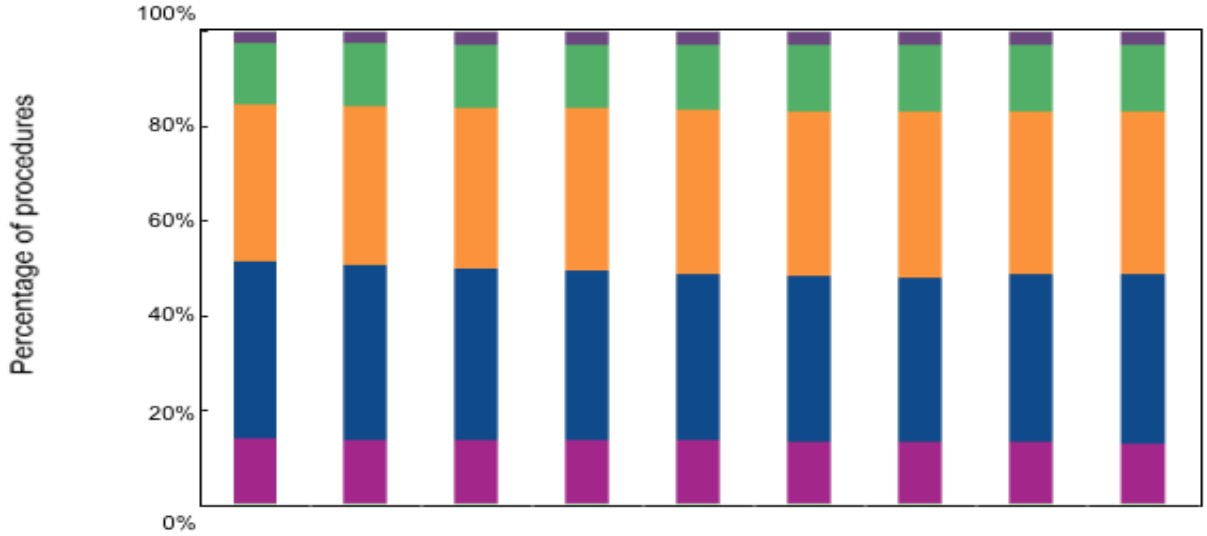
Data for 1 April 2014 - 31 March 2015



Operation Type	Operation Subcategory	Procedures Recorded for this Surgeon	National Average
Hip Primary	-	88	50
Hip Revision	-	Fewer Than 5	11
Knee Primary	Patello-Femoral Replacement	Fewer Than 5	3
Knee Primary	Total knee replacement	223	50
Knee Primary	Unicondylar Knee Replacement	8	13
Knee Revision	-	48	6
Total	-	367+	133

Age for primary knee replacement patients from 2007 to 2015

Gender: Female, Male



Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
<30	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
30-39	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
40-49	2%	2%	3%	3%	3%	3%	3%	3%	3%
50-59	13%	13%	13%	13%	14%	14%	14%	14%	14%
60-69	33%	34%	34%	34%	35%	35%	35%	34%	34%
70-79	38%	37%	36%	36%	35%	35%	35%	35%	36%
80-89	13%	13%	13%	13%	13%	13%	13%	13%	13%
90+	<1%	<1%	<1%	<1%	<1%	1%	1%	1%	<1%
Number of patients	66,981	74,381	76,396	79,035	82,624	86,565	86,131	95,308	94,437

27,500

36,830

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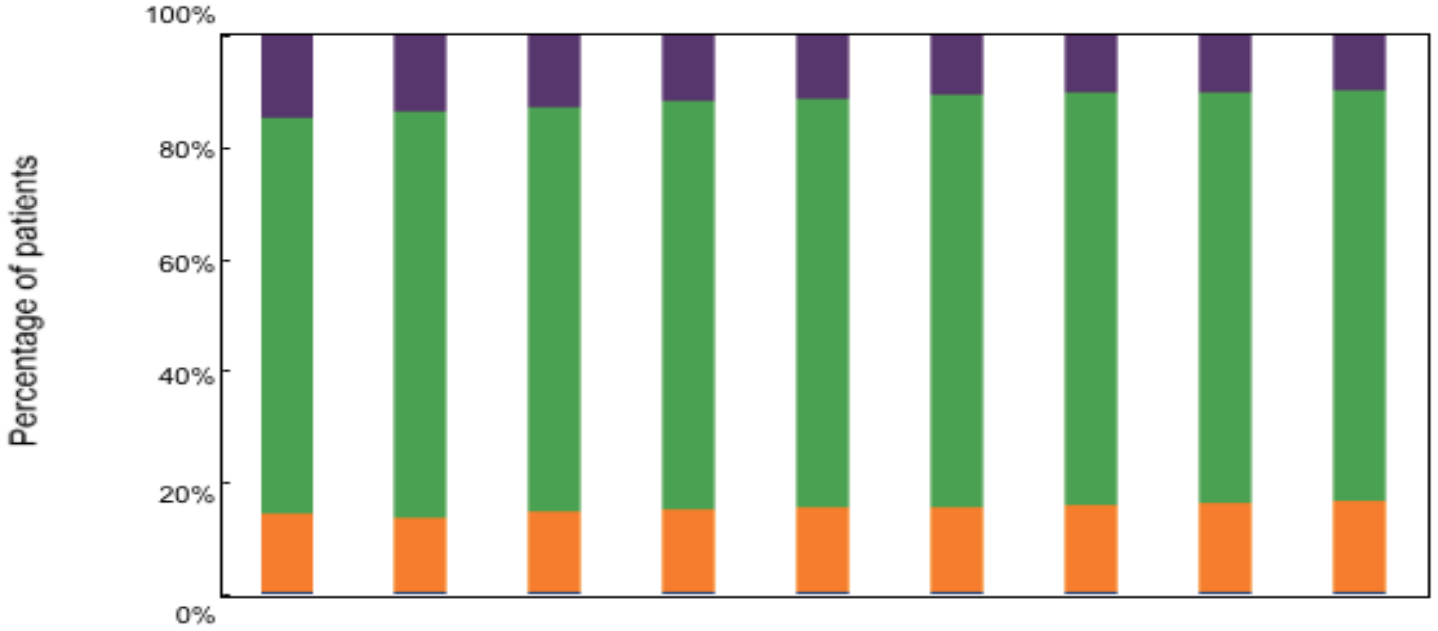
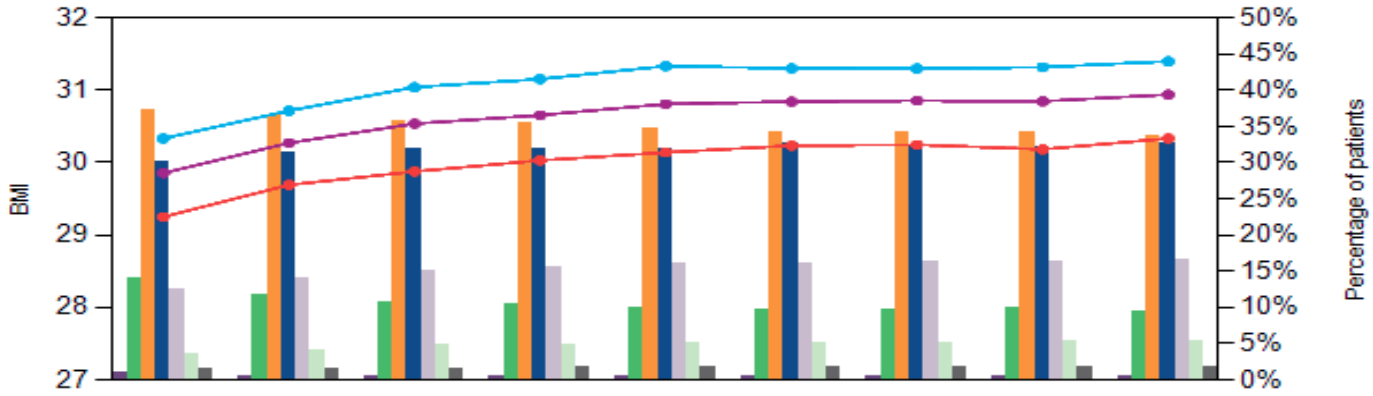
ASA grades for primary knee replacement patients for years between 2007 and 2015



Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
P1	15%	13%	13%	12%	11%	11%	10%	10%	10%
P2	71%	73%	72%	73%	73%	74%	74%	73%	73%
P3	14%	13%	15%	15%	15%	15%	16%	16%	16%
P4 and P5	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
Number of patients	73,734	77,826	79,365	81,713	85,030	88,987	89,855	99,326	98,591

BMI for primary knee replacement patients between 2007 and 2015.



	Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
n	Average BMI - all patients	29.85	30.27	30.54	30.66	30.81	30.84	30.86	30.85	30.94
	BMI 15-19	1%	1%	<1%	1%	<1%	<1%	<1%	<1%	<1%
	BMI 20-24	14%	12%	11%	10%	10%	10%	10%	10%	9%
	BMI 25-29	37%	36%	36%	35%	35%	34%	34%	34%	34%
	BMI 30-34	30%	31%	32%	32%	32%	33%	33%	32%	33%
	BMI 35-39	13%	14%	15%	15%	16%	16%	16%	16%	17%
	BMI 40-44	4%	4%	5%	5%	5%	5%	5%	5%	5%
	BMI 45+	1%	1%	2%	2%	2%	2%	2%	2%	2%
n	Average BMI - female	30.33	30.72	31.04	31.15	31.33	31.30	31.30	31.32	31.40
n	Average BMI - male	29.25	29.69	29.88	30.03	30.14	30.23	30.25	30.18	30.33

- Pain is the most frequent reason to seek medical help
- Multi-factorial / complex
- An unpleasant sensory & emotional experience associated with actual or potential tissue damage.

Pain Intensity on the First Day after Surgery

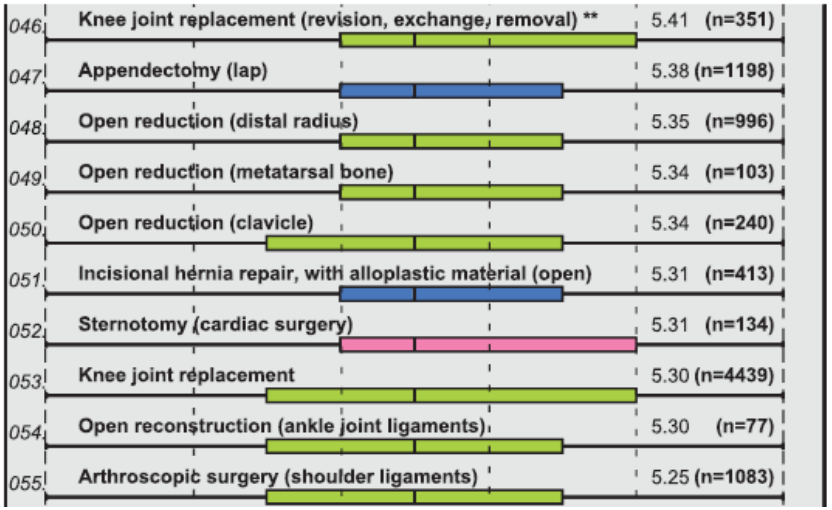
A Prospective Cohort Study Comparing 179 Surgical Procedures

Hans J. Gerbershagen, M.D., Ph.D.,* Sanjay Aduckathil, M.D.,† Albert J. M. van Wijck, M.D., Ph.D.,‡
Linda M. Peelen, Ph.D.,§ Cor J. Kalkman, M.D., Ph.D.,‖ Winfried Meissner, M.D., Ph.D.#

Anesthesiology, V 118 • No 4 934 April 2013

- Of 179 surgical procedures, 22/40 with highest pain scores include orthopaedic procedures on the extremities

- 20% of patients post TKA dissatisfied.
    - Persistent Post Surgical Pain
    - Limited function



Knee Surg Sports Traumatol Arthrosc
DOI 10.1007/s00167-013-2750-2

KNEE

Pain after knee arthroplasty: an unresolved issue

Irina Grosu · Patricia Lavand'homme · Emmanuel Thienpont

Table 2 Incidence of moderate-to-severe pain[a] after TKA by comparison with other surgical procedures

	Day 1 (%)	Day 3 (%)	Day 30	3 Months and over (%)	Neuropathic features
All surgeries in a general population	30	12	8–10 %	18.3 %	24 % (7–51 %)
THA	47	10	20 % 2 % severe pain	9 % (7–23 %)	1 %
TKA	58	45	52 % 16 % severe pain	20 % (10–34 %)	6 %

[a] Moderate-to-severe pain: defined as a pain score > 4 on a scale from 0 to 10 (0: no pain; 10: worse pain). Acute postoperative pain (day 1 and day 3); subacute pain (day 30) and chronic postsurgical pain (3 months and later)

- 78000 TKR in 2014
- 10-34% report chronic pain post TKR
  - 7500 – 25000
- 44-57% woken by pain in 1st 3 days
- 56% taking analgesia @ 30 days
- 40% @ 4 months / 25% @ 2 years

- Inadequately controlled perioperative pain is a risk factor for chronic pain
- Better that 1990's
- 22% pain at 7 years / 51% pain at 1 year

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    - 95% Chronic arthritis
        - » Central Sensitization
- Female gender
- Younger age
- High pre-op pain
- Complex psychological experience
    - Hypervigilance
    - Pre-surgical anxiety
    - Unrealistic expectations
    - Pain catastrophization
      - Negative orientation
      - Rumination
      - Magnification

Review Article
Knee Surg Relat Res 2017;29(2):80-86
https://doi.org/10.5792/ksrr.16.024
pISSN 2234-0726 · eISSN 2234-2451

KSRR
Knee Surgery & Related Research

Comprehensive Analysis of Pain Management after Total Knee Arthroplasty

Yong Seuk Lee, MD, PhD
Department of Orthopaedic Surgery, Seoul National University Bundang Hospital, Seongnam, Korea

- Chronic non-orthopaedic conditions associated with poorer TKR outcome:
  - Migraine
  - Fibromyalgia
  - Irritable bowel syndrome
  - Stroke
  - Chronic back pain
  - Head injury
- Psychological distress and amplification of pain

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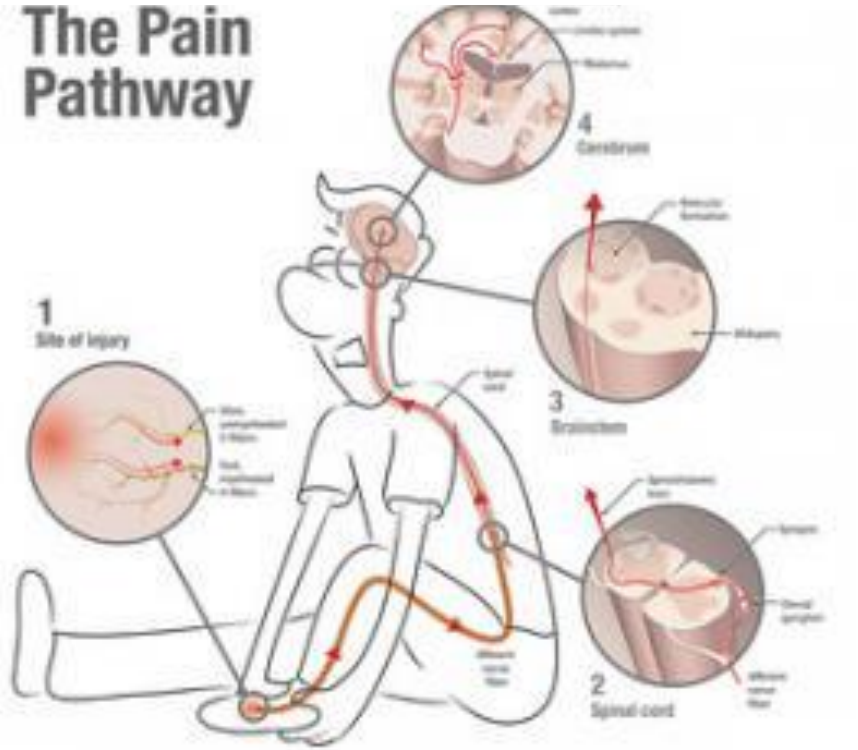
- Nociceptive
    - Activation
- Ischaemic
- Inflammatory
- Nerve damage
    - Neuropathic
- Hyperalgesia
    - Peripheral sensitization
    - Central sensitization



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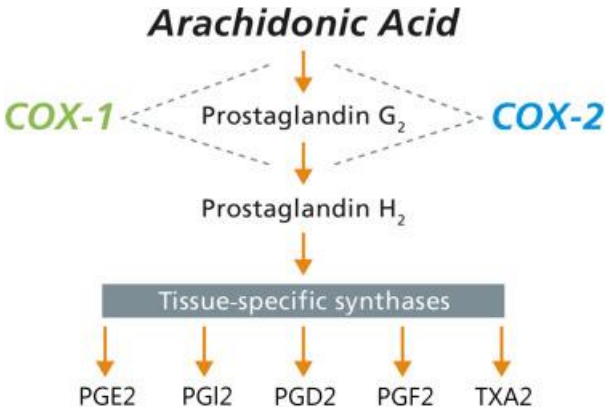
- Tissue trauma
  - Inflammation
    - Histamine
    - Bradykinin
    - Pro-inflammatory cytokines
    - COX-1
    - COX-2
    - Prostaglandins
      - PGE2
  - Ischaemia
    - Lactate
  - Stress response
    - Cortisol
    - CRP
    - IL-6



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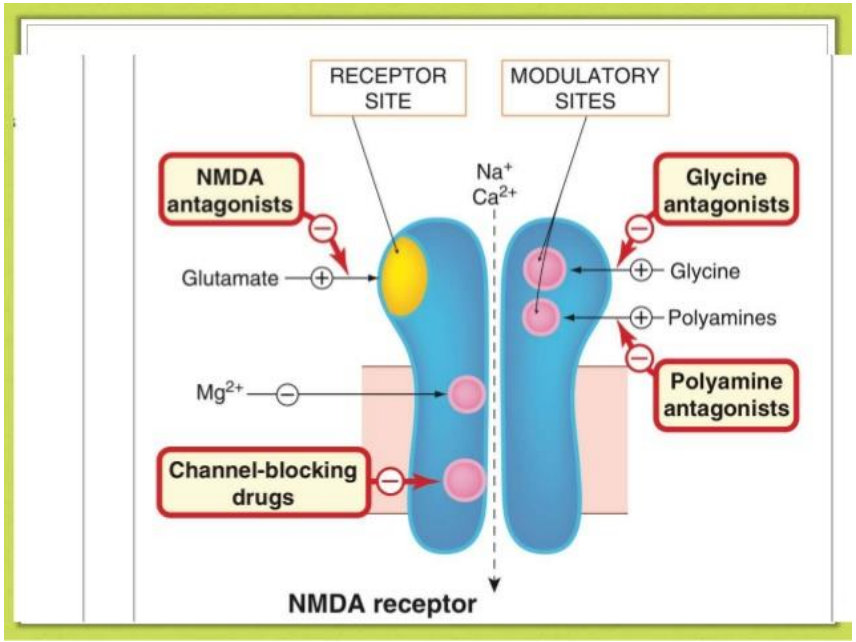
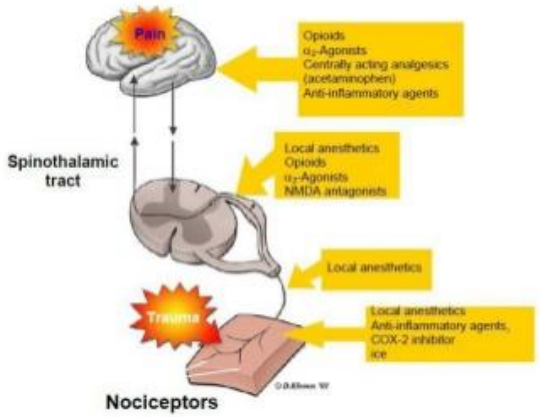
- Spinal expression of COX-1 & COX-2
- ↑ excitatory neurotransmitters
  - Glutamate
    - NDMA
  - Substance P
- ↓inhibitory processes



Multimodal Analgesia

Multimodal analgesia:
combination of pain medications that act on different receptors at various points in pain transmission.



- The combination of two or more modalities of pain control, i.e. drugs &/or techniques to obtain superior analgesic effect.
- It is more effective and associated with less side effects than high dose of a single theraputic agent (e.g. opioid analgesics)

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NUH LOWER LIMB ERAS[1] ANALGESIA GUIDELINE

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	Total Hip/Knee Replacement	Notes
***pre**operative:*	Consider Paracetamol NSAID [2] Zomorph™ [3] 10mg or 20mg	**Check when patient last took analgesia** **Do not use NSAIDS if GFR < 60**
***peri**operative:*	Spinal anaesthesia, +/- intrathecal diamorphine [4] Encourage surgical peri-articular local anaesthetic infiltration (LAI) or, in selected patients, use nerve block(s) **Use Ropivacaine 0.2% for LAI in weight - related volume** Consider tranexamic acid 10mg/kg (max 1g) at induction and at release of tourniquet / end of surgery	**All patients with intra-thecal opoids must have a urinary catheter** **Use low concentration LA in nerve blocks. Modify LAI if using nerve blocks (Be aware maximum safe dose LA)** **Tranexamic acid- caution in patients at risk of thromboses, DIC, seizures**
***post**operative analgesia:*	Paracetamol 1g qds po/IV Use NSAID unless contraindicated / GFR <60 Zomorph™ (10-20mg)or Longtec ™ (5-10mg) 12 hourly **Three post-op doses initially**[5] If no opoid in spinal / preoperatively, prescribe Zomorph™ / Longtec ™ for Recovery. Oramorph™ (10-20mg) / Shortec ™ (5-10mg) 2 hourly prn Consider Gabapentin [6]	**IV paracetamol: <50kg 15mg/kg qds >50kg with risk factors for liver damage 1g tds** **Limit Zomorph™ / Longtec ™ doses by crossing off further doses on chart** **If recovery room dose of opoid after 12pm, prescribe half usual dose OR prescribe short acting opoid (on front of chart) to allow full dose later that evening** **Nurses to ensure patients receive long-acting opoid at prescribed timing points**

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Cochrane Library

Cochrane Database of Systematic Reviews

Preoperative education for hip or knee replacement (Review)

McDonald S, Page MJ, Beringer K, Wasiak J, Sprowson A

Authors' conclusions

Although preoperative education is embedded in the consent process, we are unsure if it offers benefits over usual care in terms of reducing anxiety, or in surgical outcomes, such as pain, function and adverse events. Preoperative education may represent a useful adjunct, with low risk of undesirable effects, particularly in certain patients, for example people with depression, anxiety or unrealistic expectations, who may respond well to preoperative education that is stratified according to their physical, psychological and social need.

RCS
ADVANCING SURGICAL STANDARDS

ORTHOPAEDIC SURGERY

Ann R Coll Surg Engl 2011; **93**: 71–75
doi 10.1308/003588410X12771863936765

Pre-operative patient education reduces length of stay after knee joint arthroplasty

Samantha Jones[1,2], Mustafa Alnaib[1], Michail Kokkinakis[1], Michael Wilkinson[2], Alan St Clair Gibson[2], Deiary Kader[1,2]

ABSTRACT

INTRODUCTION The aim of this study was to evaluate the impact of a pre-operative education programme on length of hospital stay after surgery for primary and revision knee arthroplasty patients. The programme was introduced at our hospital in October 2006 to encourage patients to play an active role in their recovery process after surgery.

PATIENTS AND METHODS A multidisciplinary team educated knee arthroplasty patients about their care pathway, knee surgery, pain management, expected discharge goals, in-patient and out-patient arthroplasty rehabilitation. Prospective data were collected from 472 consecutive patients who underwent (primary or revision) knee arthroplasty in the period between January 2006 and November 2007. Patients were separated into two groups, one that received conventional pre-operative treatment ($n = 150$; Conventional group) and another that received the pre-operative education ($n = 322$; Education group). Length of hospital stay was compare using the Mann Whitney U test. In-patient complications, hospital re-admissions within 24 h and 3 months of hospital discharge were compared using the chi-squared test.

RESULTS The mean length of stay was significantly reduced from 7 days in the Conventional group to 5 days in the Education group ($P < 0.01$). In addition, 20% more patients were discharged early (within 1–4 days) in the Education group compared to the Conventional group ($P < 0.01$). There was no difference in the percentage of in-patient complications and re-admissions in 24 h ($P = 1.00$) and 3 months of discharge ($P = 0.92$) between the two groups.

CONCLUSIONS The results suggest that pre-operative education is a safe and effective method of reducing length of stay for knee arthroplasty patients.

Table 4 Percentage of patients discharged in 1–4 days and 5 or more days in the Conventional group (CG) and the Education group (EG)

Arthroplasty patients	*n*	1–4 days (CG)	1–4 days (EG)	5 or more days (CG)	5 or more days (EG)	*P*-value
Knee	472	37	57	63	43	< 0.01
Knee below 65 years	128	52	69	48	31	= 0.061
Knee over 65 years	344	31	52	69	48	< 0.01
Knee (females)	257	38	56	62	44	< 0.01
Knee (males)	215	36	57	64	43	< 0.01

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***peri**operative:*	Spinal anaesthesia, +/- intrathecal diamorphine [4] Encourage surgical peri-articular local anaesthetic infiltration (LAI) or, in selected patients, use nerve block(s) **Use Ropivacaine 0.2% for LAI in weight - related volume** Consider tranexamic acid 10mg/kg (max 1g) at induction and at release of tourniquet / end of surgery	All patients with intra-thecal opoids must have a urinary catheter Use low concentration LA in nerve blocks. Modify LAI if using nerve blocks (Be aware maximum safe dose LA) Tranexamic acid- caution in patients at risk of thromboses, DIC, seizures
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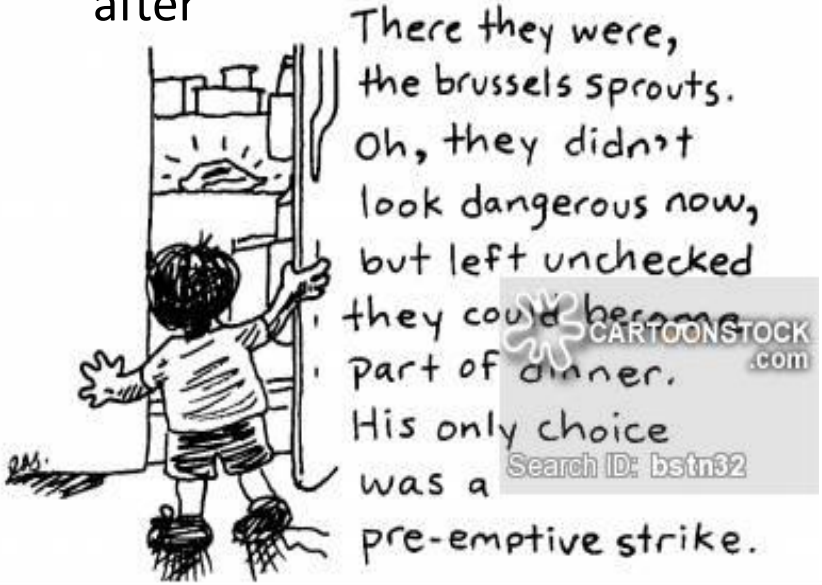
Pre-emptive

- Anti-nociceptive intervention
- Started before the procedure = more effective than same treatment administered during or after



Preventive analgesia

- Any peri-operative treatment aimed to control CNS sensitization and reduce the development of PPSP.
- Duration & efficacy of treatment more important than timing of administration of drugs.

Pre-emptive		
Before surgical incision	During Surgery	After Surgery
Preventive		

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British Journal of Anaesthesia **111** (3): 331–3 (2013)
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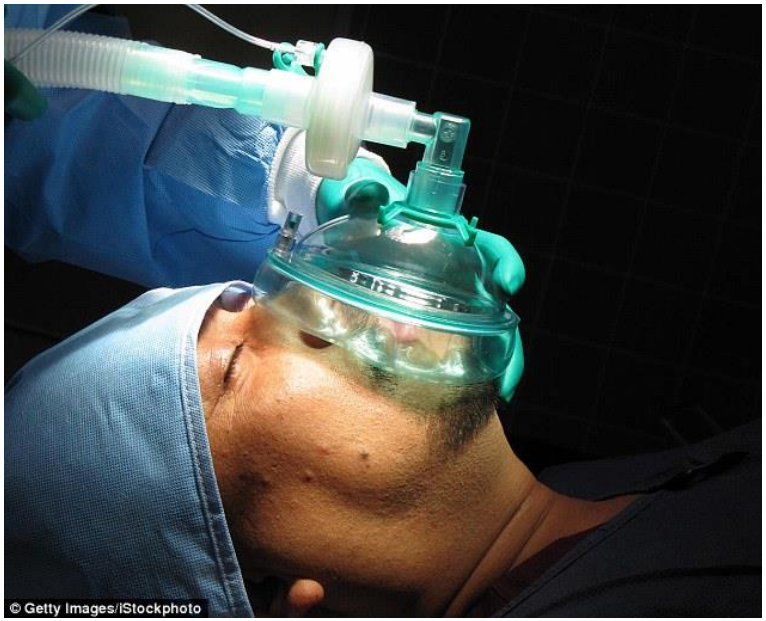
EDITORIAL IV

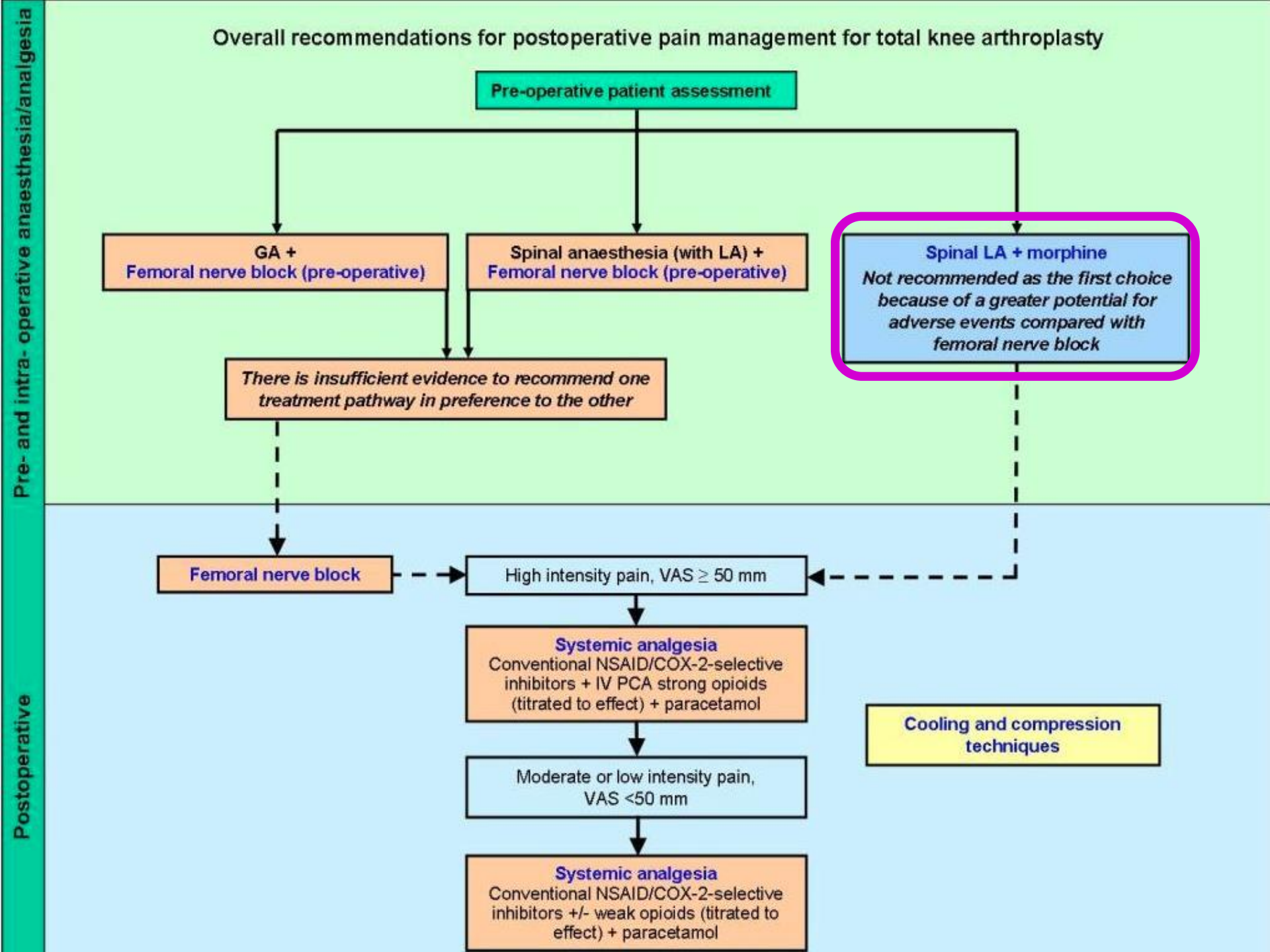
Does anaesthetic technique really matter for total knee arthroplasty?

C. J. L. McCartney* and S. Choi

Department of Anesthesia, Sunnybrook Health Sciences Centre and University of Toronto, Toronto, ON, Canada

* E-mail: colin.mccartney@utoronto.ca




Overall recommendations for postoperative pain management for total knee arthroplasty
Pre- and intra- operative anaesthesia/analgesia
Postoperative
Pre-operative patient assessment
GA +
Femoral nerve block (pre-operative)
Spinal anaesthesia (with LA) +
Femoral nerve block (pre-operative)
Spinal LA + morphine
Not recommended as the first choice because of a greater potential for adverse events compared with femoral nerve block
There is insufficient evidence to recommend one treatment pathway in preference to the other
Femoral nerve block
High intensity pain, VAS ≥ 50 mm
Systemic analgesia
Conventional NSAID/COX-2-selective inhibitors + IV PCA strong opioids (titrated to effect) + paracetamol
Cooling and compression techniques
Moderate or low intensity pain, VAS <50 mm
Systemic analgesia
Conventional NSAID/COX-2-selective inhibitors +/- weak opioids (titrated to effect) + paracetamol

Clin Orthop Relat Res (2009) 467:2379–2402
DOI 10.1007/s11999-008-0666-9

SURVEY (SYSTEMATIC REVIEW)

Does Regional Anesthesia Improve Outcome After Total Knee Arthroplasty?

Alan J. R. Macfarlane MBChB, Govindarajulu Arun Prasad MB BS,
Vincent W. S. Chan MD, Richard Brull MD

- Insufficient evidence to detect a difference in mortality / CVS Morbidity / Thromboembolism
- No difference in blood loss or duration of surgery
- RA reduced post-op pain / morphine consumption / opioid related side effects / LoS

Anesthesia Technique and Mortality after Total Hip or Knee Arthroplasty

A Retrospective, Propensity Score–matched Cohort Study

Anahi Perlas, M.D., F.R.C.P.C., Vincent W. S. Chan, M.D., F.R.C.P.C., F.R.C.A., Scott Beattie, M.D., F.R.C.P.C. (ANESTHESIOLOGY 2016; 125:724-31)

What We Already Know about This Topic

- The effects of spinal *versus* general anesthesia on 30-day mortality after total hip or knee arthroplasty remain unclear
- A propensity score–matched pair analysis was performed in 4,270 patients

What This Article Tells Us That Is New

- In the matched cohort, 30-day mortality rate was 0.19% (n=4) for those receiving spinal anesthesia and 0.8% (n=17) for those receiving general anesthesia (risk ratio, 0.42; 95% CI, 0.21 to 0.83; $P = 0.0045$)
- There was an association between spinal anesthesia and lower 30-day mortality

Anesthesia Technique and Mortality after Total Hip or Knee Arthroplasty

A Retrospective, Propensity Score–matched Cohort Study

Anahi Perlas, M.D., F.R.C.P.C., Vincent W. S. Chan, M.D., F.R.C.P.C., F.R.C.A., Scott Beattie, M.D., F.R.C.P.C.

	General Anesthesia (n = 2,135)		Spinal Anesthesia (n = 2,135)			
	n	%	n	%	RR (95% CI)	*P* Value
Dichotomous outcomes						
Death	17	0.8	4	0.19	0.42 (0.21–0.83)	0.0045
MI	28	1.31	27	1.27	0.97 (0.61–1.7)	0.892
MACE	36	1.69	29	1.36	0.81 (0.76–1.01)	0.3816
PE	25	1.17	18	0.84	0.67 (0.41–1.09)	0.2832
Blood transfusion > 2 units	93	4.36	70	3.28	0.62 (0.47–0.8)	0.0662
	Median	IQR	Median	IQR		*P* Value
Continuous outcomes						
Length of stay (days)	6.61	6.2–7.0	5.7	5.3–6.1		0.0001
OR time (min)	84.4	(83–85.8)	80.5	(79.7–81.7)		0.0001

IQR = interquartile range; MACE = major adverse cardiac events; MI = myocardial infarction; OR = operating room; PE = pulmonary embolism; RR = risk ratio.

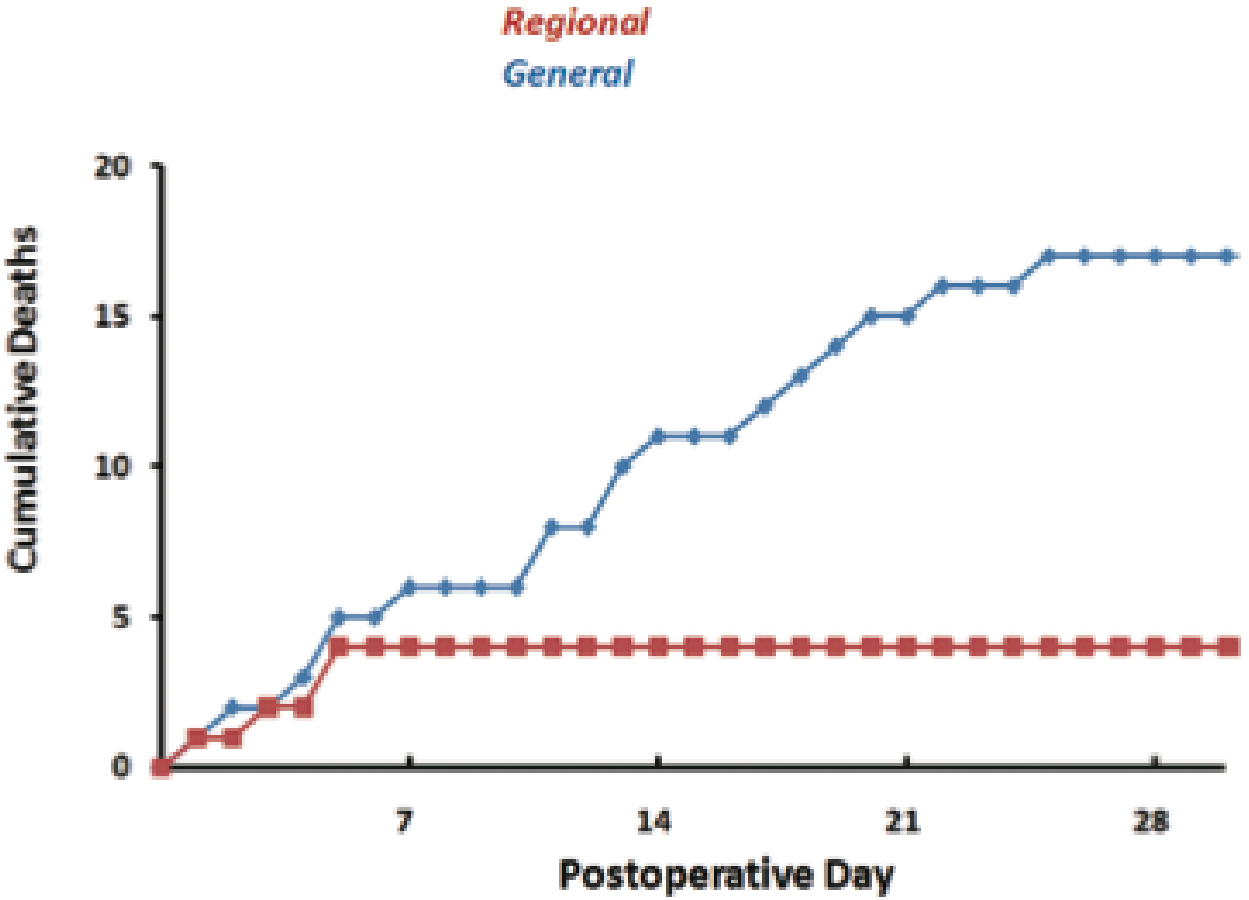


Fig. 1. Cumulative number of deaths over time within 30 days of the surgical procedure.

British Journal of Anaesthesia **111** (3): 391–9 (2013)
Advance Access publication 11 April 2013 · doi:10.1093/bja/aet104

BJA

Recovery after total intravenous general anaesthesia or spinal anaesthesia for total knee arthroplasty: a randomized trial†

A. Harsten[1]*, H. Kehlet[2,3] and S. Toksvig-Larsen[4]

Editor's key points

- Regional anaesthesia is often recommended for total knee arthroplasty (TKA).
- General anaesthesia (GA) and spinal anaesthesia (SA) were compared in a study of short term recovery parameters.
- The GA group had higher immediate pain scores, but shorter length of hospital stay, and reduced postoperative nausea and vomiting, pain and morphine consumption.
- GA has a more favourable recovery profile than SA in a fast-track protocol.

Background. This study was undertaken to compare the effects of general anaesthesia (GA) and spinal anaesthesia (SA) on the need for postoperative hospitalization and early postoperative comfort in patients undergoing fast-track total knee arthroplasty (TKA).

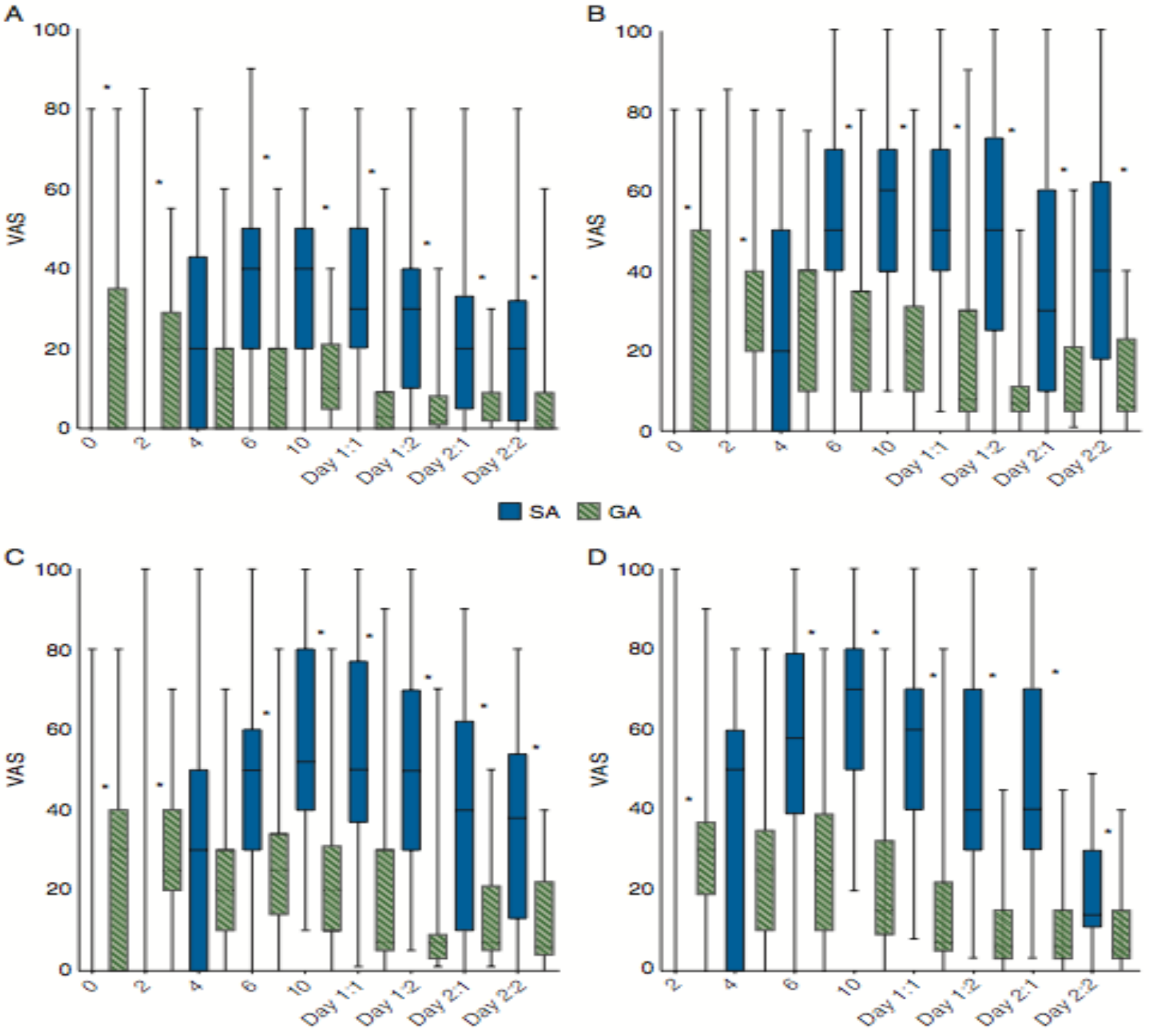
Methods. One hundred and twenty subjects were randomly allocated to receive either intrathecal bupivacaine (SA group) or GA with target controlled infusion of propofol and remifentanil (GA group). Primary outcome was length of hospital stay (LOS) defined as time from end of surgery until the subject met the hospital discharge criteria. Secondary outcome parameters included actual time of discharge, postoperative pain, intraoperative blood loss, length of stay in the Post Anaesthesia Care Unit, dizziness, postoperative nausea and vomiting, need for urinary catheterization and subject satisfaction.

Results. GA resulted in shorter LOS (46 *vs* 52 h, $P<0.001$), and less nausea and vomiting (4 *vs* 15, $P<0.05$) and dizziness (VAS 0 mm *vs* 20 mm, $P<0.05$) compared with SA. During the first 2 postoperative hours, GA patients had higher pain scores ($P<0.001$), but after 6 h the SA group had significantly higher pain scores ($P<0.001$). Subjects in the GA group used fewer patient-controlled analgesia doses and less morphine ($P<0.01$), and were able to walk earlier compared with the SA group ($P<0.001$). Subjects receiving SA would request a change in the method of anaesthesia in the event of a subsequent operation more often than the GA subjects ($P<0.05$).

Conclusion. GA had more favourable recovery effects after TKA compared with SA.

Keywords: anaesthetic techniques; i.v.; outcome; subarachnoid

Accepted for publication: 26 February 2013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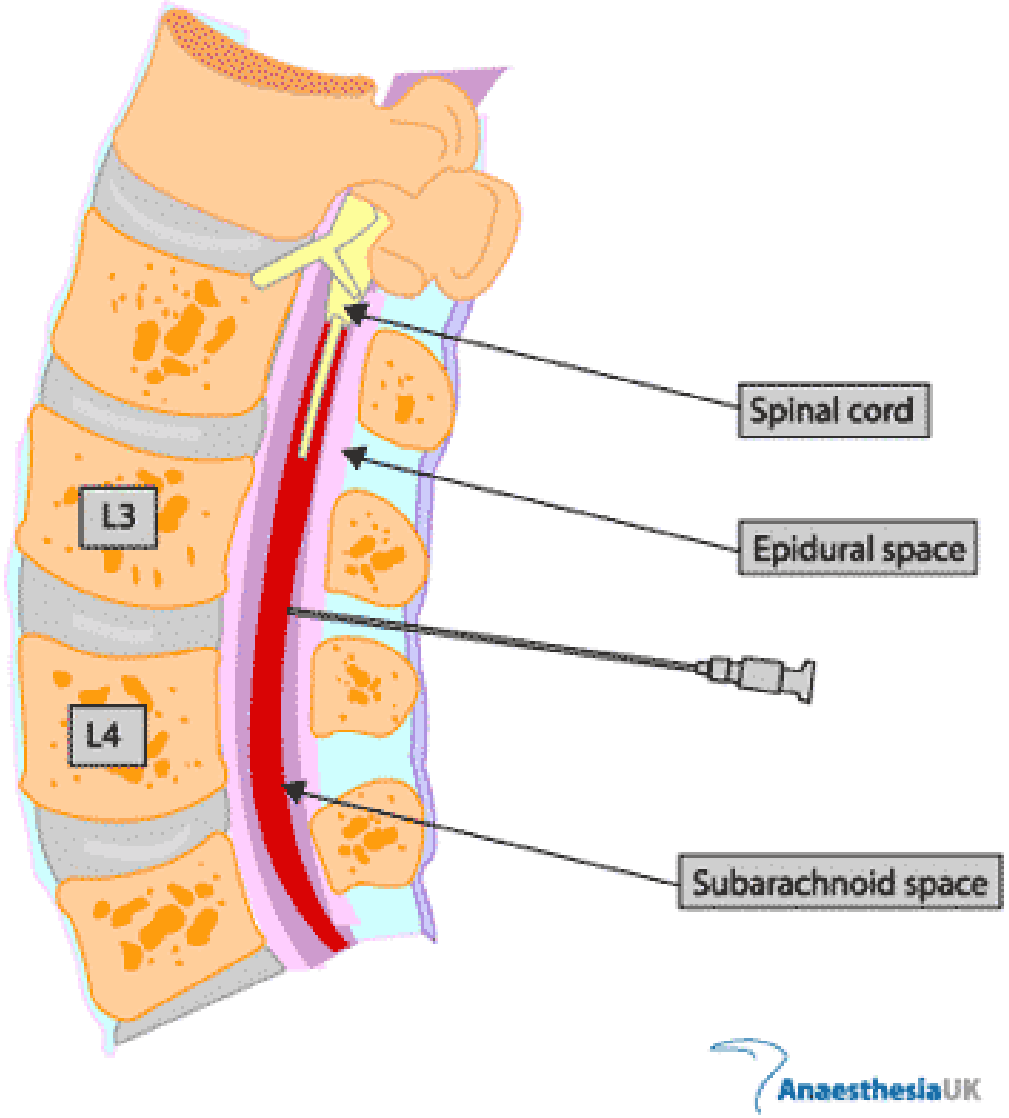
Spinal cord
Epidural space
L3
L4
Subarachnoid space
AnaesthesiaUK

Nottingham University Hospitals NHS

NUH LOWER LIMB ERAS[1] ANALGESIA GUIDELINE

Better for you
caring • safe • thoughtful

	Total Hip/Knee Replacement	Notes
***pre**operative:*	Consider Paracetamol NSAID [2] Zomorph™ [3] 10mg or 20mg	**Check when patient last took analgesia** **Do not use NSAIDS if GFR < 60**
***peri**operative:*	Spinal anaesthesia, +/- intrathecal diamorphine [4] Encourage surgical peri-articular local anaesthetic infiltration (LAI) or, in selected patients, use nerve block(s) **Use Ropivacaine 0.2% for LAI in weight - related volume** Consider tranexamic acid 10mg/kg (max 1g) at induction and at release of tourniquet / end of surgery	**All patients with intra-thecal opoids must have a urinary catheter** **Use low concentration LA in nerve blocks. Modify LAI if using nerve blocks (Be aware maximum safe dose LA)** **Tranexamic acid- caution in patients at risk of thromboses, DIC, seizures**
***post**operative analgesia:*	Paracetamol 1g qds po/IV Use NSAID unless contraindicated / GFR <60 Zomorph™ (10-20mg)or Longtec ™ (5-10mg) 12 hourly **Three post-op doses initially**[5] If no opoid in spinal / preoperatively, prescribe Zomorph™ / Longtec ™ for Recovery. Oramorph™ (10-20mg) / Shortec ™ (5-10mg) 2 hourly prn Consider Gabapentin [6]	**IV paracetamol: <50kg 15mg/kg qds >50kg with risk factors for liver damage 1g tds** **Limit Zomorph™ / Longtec ™ doses by crossing off further doses on chart** **If recovery room dose of opoid after 12pm, prescribe half usual dose OR prescribe short acting opoid (on front of chart) to allow full dose later that evening** **Nurses to ensure patients receive long-acting opoid at prescribed timing points**

Cochrane Library

Cochrane Database of Systematic Reviews

Femoral nerve blocks for acute postoperative pain after knee replacement surgery (Review)

Chan EY, Fransen M, Parker DA, Assam PN, Chua N

Nottingham University Hospitals NHS Trust

B.S.O.A British Society of Orthopaedic Anaesthetists

neos Nottingham Elective Orthopaedic Services

Femoral nerve blocks for acute postoperative pain after knee replacement surgery (Review)

47 RCTs

- **29 FNB vs PCA**
  - **FNB > PCA**
  - **FNB + PCA > PCA**
- **10 FNB vs Epidural**
  - **FNB = Epidural**
- **5 FNB vs LAI**
  - **FNB = LAI**
- **1 FNB vs PO Analgesia**
  - **???**
- **4 Continuous FNB vs Single Shot FNB**
  - **Continuous > Single Shot**

Clin Orthop Relat Res (2010) 468:135–140
DOI 10.1007/s11999-009-1025-1

Complications of Femoral Nerve Block for Total Knee Arthroplasty

Sanjeev Sharma MD, FRCSC, Richard Iorio MD, Lawrence M. Specht MD, Sara Davies-Lepie MD, William L. Healy MD

Table 2. Complications

Complication	Block	No block	p Value
Deep venous thrombosis	8 (1%)	1 (0.4%)	0.465
Pulmonary embolus	5 (0.7%)	2 (0.8%)	0.686
Atrial fibrillation	5 (0.7%)	1 (0.4%)	1.0
Ileus	2 (0.3%)	2 (0.8%)	0.259
Renal failure	2 (0.3%)	1 (0.4%)	0.576
Arthrofibrosis	2 (0.3%)	4 (1.5%)	0.036
Pneumonia	2 (0.3%)	4 (1.5%)	0.036
Fall	12 (1.6%)	1 (0.4%)	0.204
Reoperations	3 (0.4%)	0 (0%)	1.0
Femoral neuropathy/neuritis	5 (0.7%)	1 (0.4%)	1.0
Other complications	10 (1.4%)	5 (2.1%)	0.546
Total	56 (8.2%)	22 (9.1%)	0.495

Clin Orthop Relat Res (2010) 468:135–140
DOI 10.1007/s11999-009-1025-1

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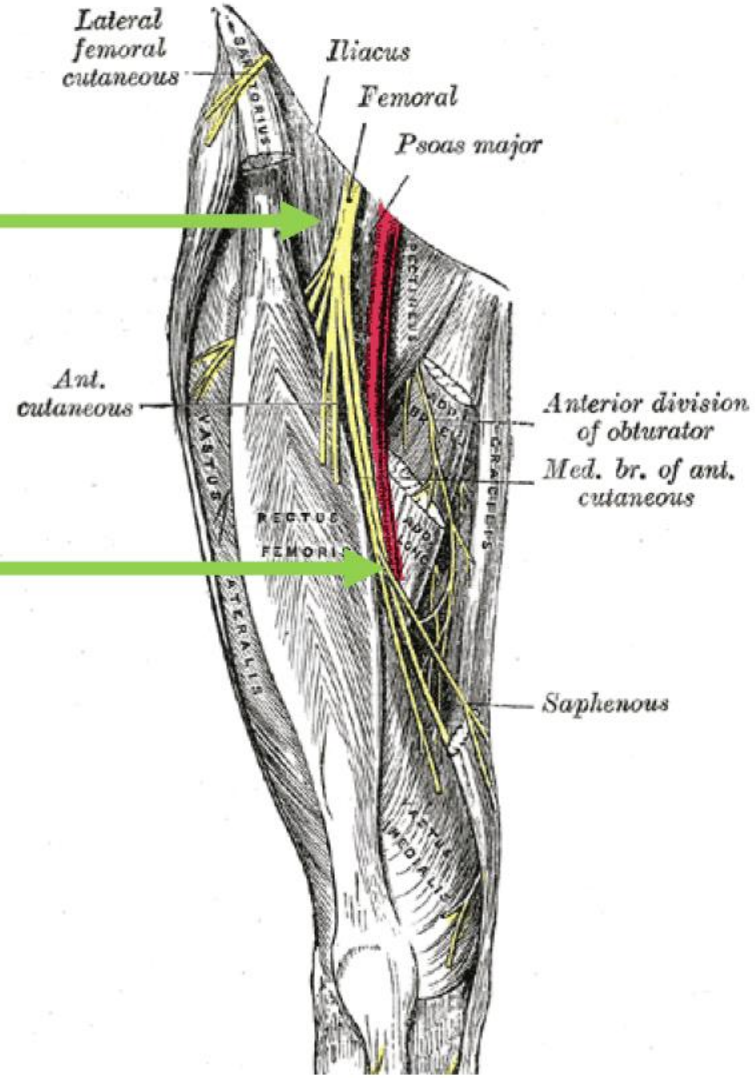
Sanjeev Sharma MD, FRCSC, Richard Iorio MD, Lawrence M. Specht MD, Sara Davies-Lepie MD, William L. Healy MD

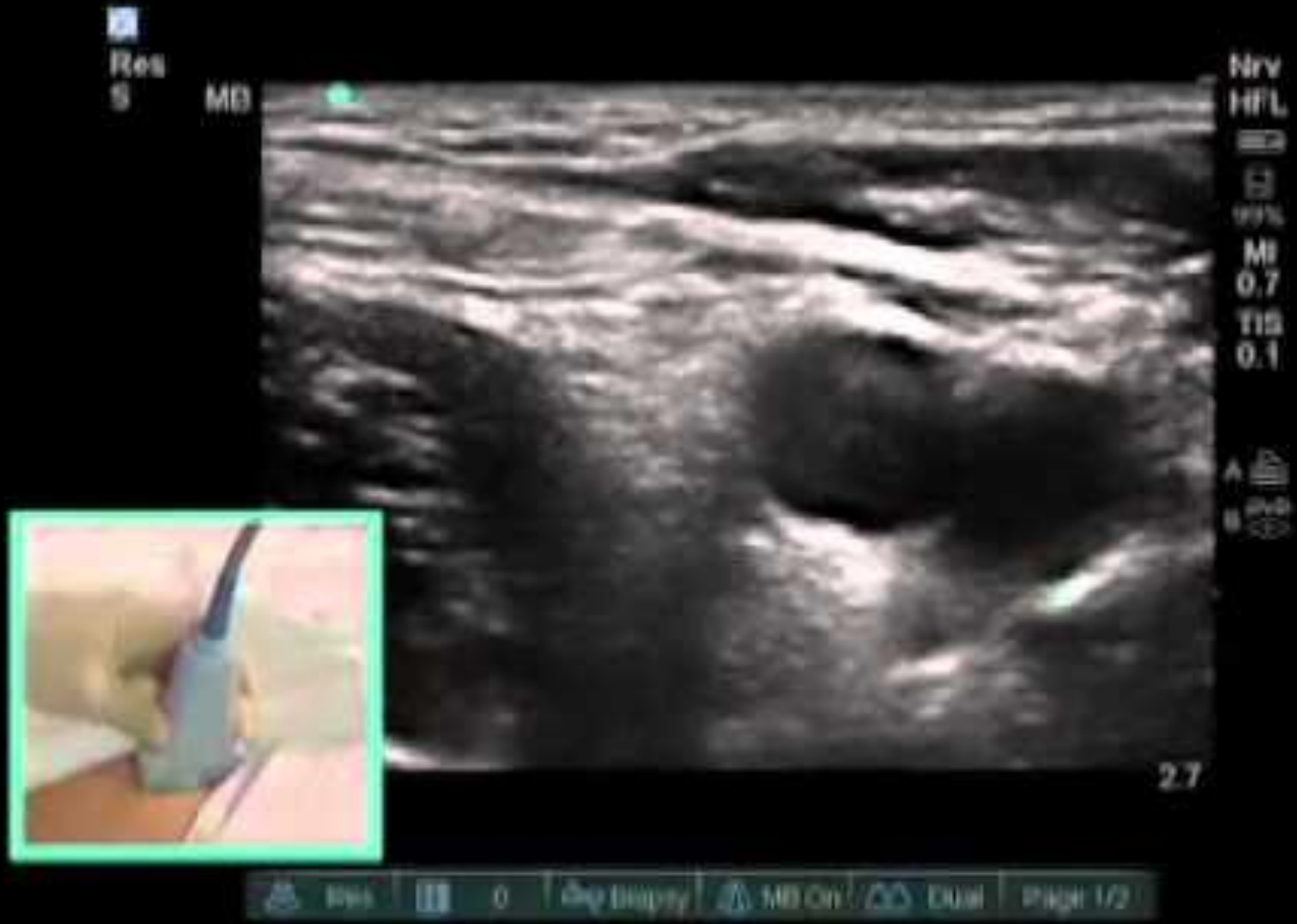
Table 3. Patient falls

Variable	Patient number													Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	
Femoral nerve block	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	13
Reoperation	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No	3
Alcohol abuse	Yes	No	No	Yes	No	No	No	No	No	No	Yes	No	No	3
Quadriceps weakness	N/A	Yes	N/A	No	2/5	N/A	2/5	Yes	3/5	Yes	N/A	Yes	Yes	8
Confusion	Yes	No	Yes	Yes	No	No	No	No	No	Yes	No	No	No	4
Diabetes mellitus	No	No	Yes	No	No	No	No	No	No	Yes	No	No	No	2
Time	5:00	10:00	16:00	18:00	3:50	22:45	23:00	22:15	23:20	22:00	20:15	13:20	03:30	
Postoperative day	1	1	0	1	2	0	1	2	2	3	1	2	3	

Femoral nerve block

Adductor canal block

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Medial

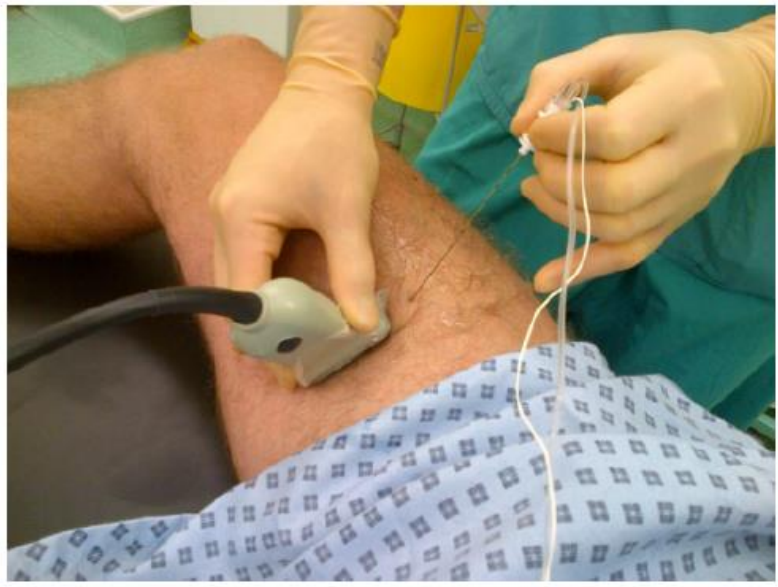
Lateral

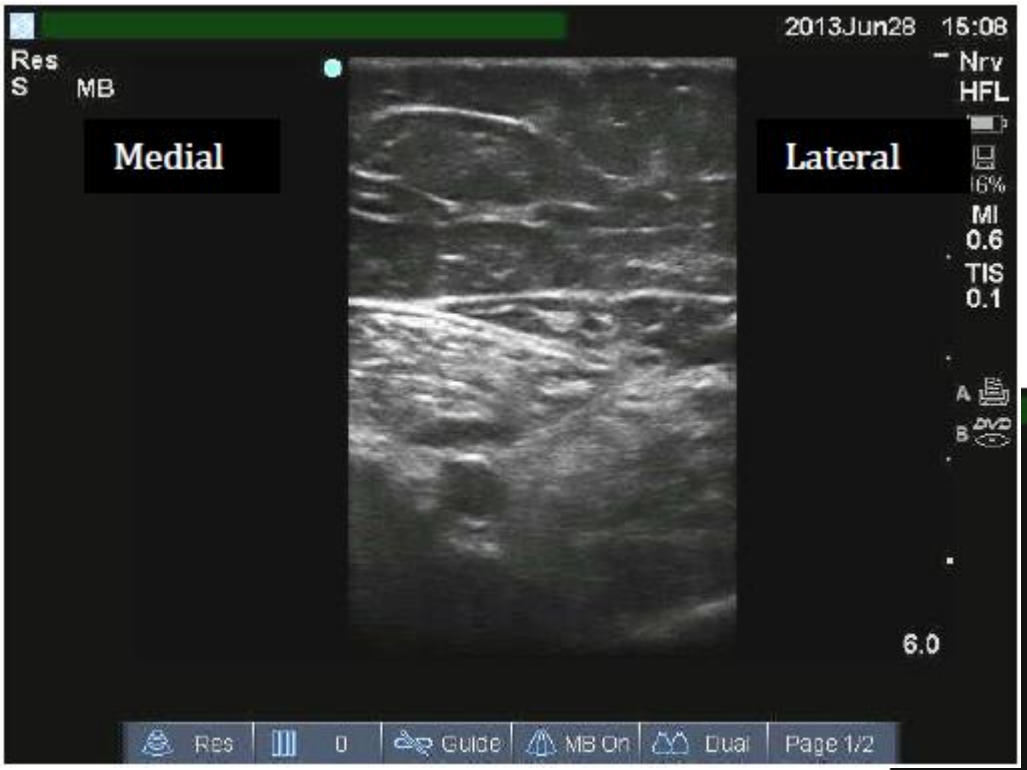
Sartorius

Vastus intermedius

Adductor canal

Femur

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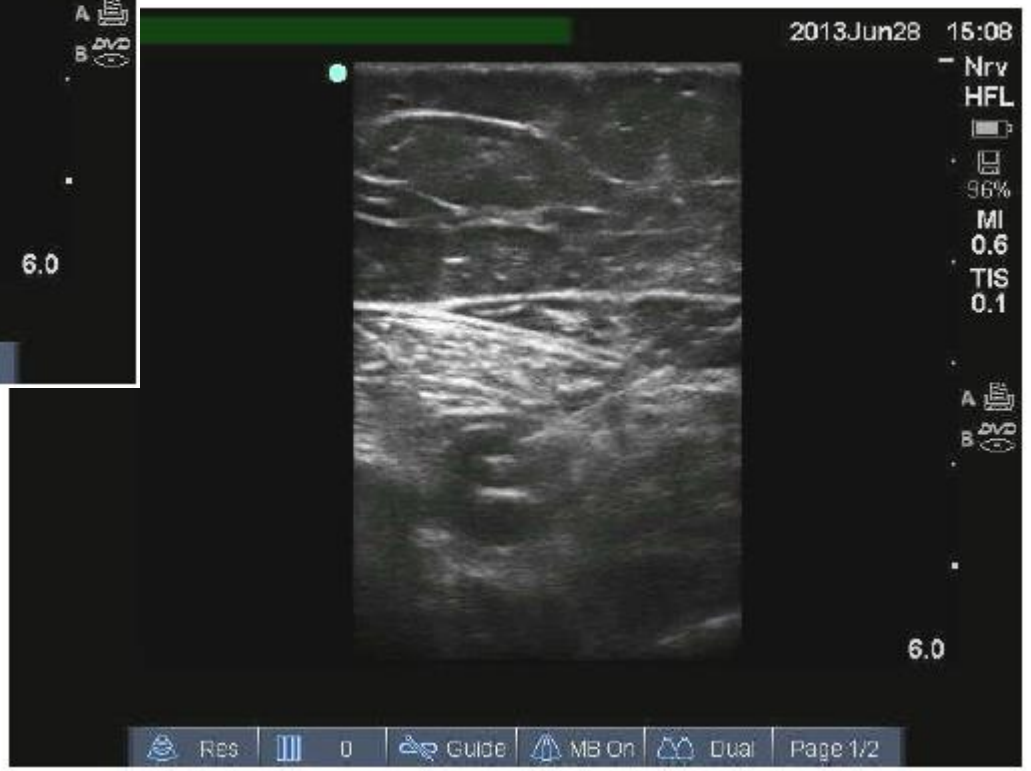
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Review Article

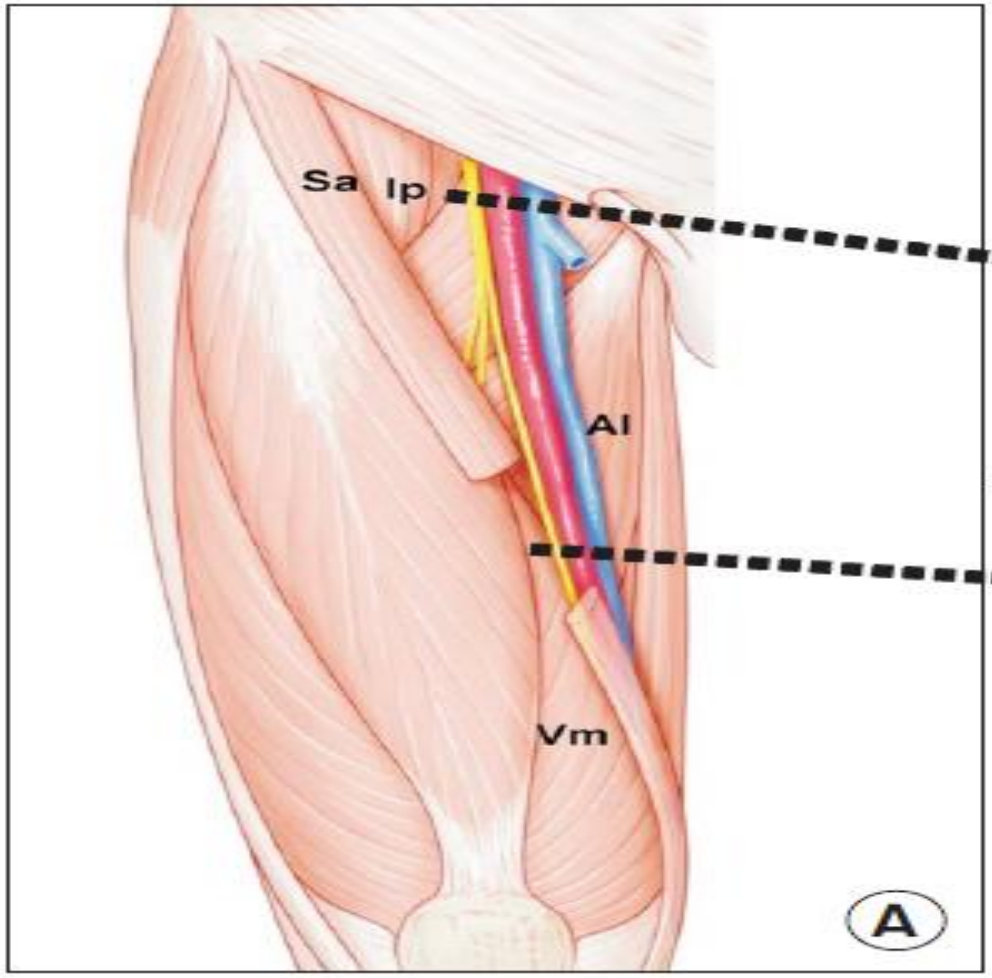
Knee Surg Relat Res 2017;29(2):87-95
https://doi.org/10.5792/ksrr.16.039
pISSN 2234-0726 · eISSN 2234-2451

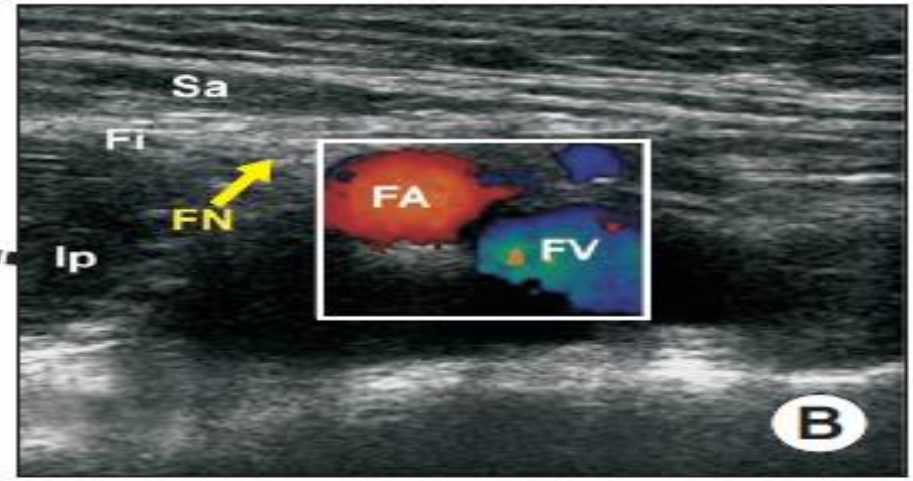
KSRR
Knee Surgery & Related Research

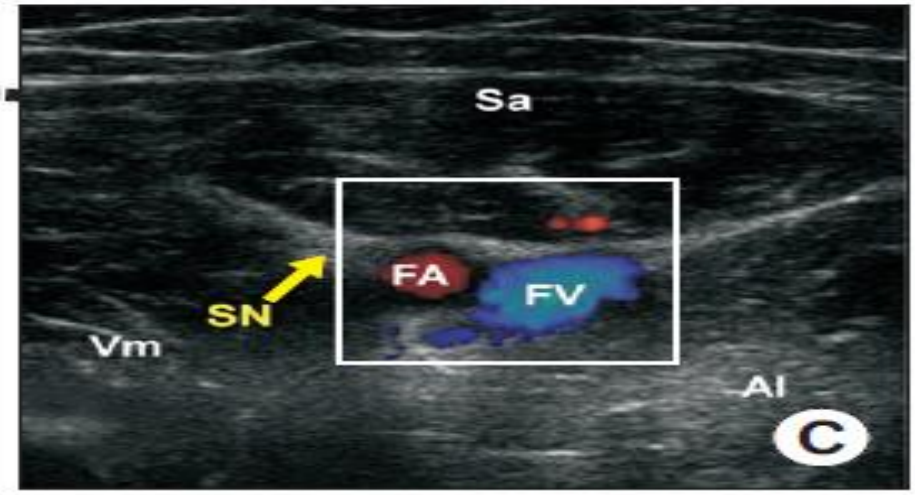
Femoral Nerve Block versus Adductor Canal Block for Analgesia after Total Knee Arthroplasty

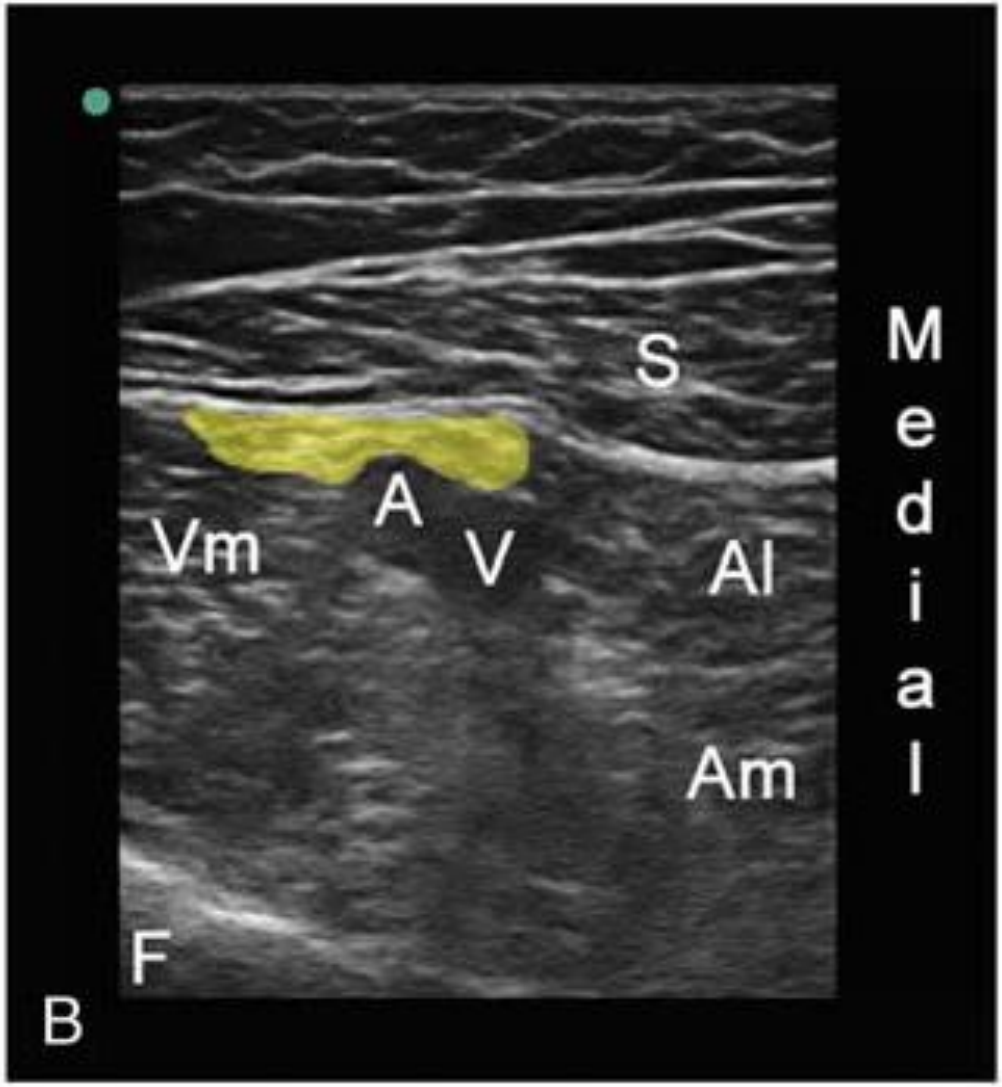
In Jun Koh, MD[1,2], Young Jun Choi, MD[1,2], Man Soo Kim, MD[1,2], Hyun Jung Koh, MD[3], Min Sung Kang, MD[1], and Yong In, MD[1,2]

[1]Department of Orthopaedic Surgery, Seoul St. Mary's Hospital, Seoul; [2]Department of Orthopaedic Surgery, College of Medicine, The Catholic University of Korea, Seoul; [3]Department of Anesthesia and Pain Medicine, Seoul St. Mary's Hospital, Seoul, Korea





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Adductor Canal Block *versus* Femoral Nerve Block for Total Knee Arthroplasty

A Prospective, Randomized, Controlled Trial

David H. Kim, M.D., Yi Lin, M.D., Ph.D., Enrique A. Goytizolo, M.D., Richard L. Kahn, M.D., Daniel B. Maalouf, M.D., M.P.H., Asha Manohar, M.D., Minda L. Patt, M.D., Amanda K. Goon, B.A., Yuo-yu Lee, M.S., Yan Ma, Ph.D., Jacques T. YaDeau, M.D., Ph.D.

What We Already Know about This Topic

- Despite the improved analgesia and shortened hospital stays provided by the use of femoral nerve blockade after total knee arthroplasty, these blocks can cause significant motor weakness, delaying mobilization and increasing the risk of falls

What This Article Tells Us That Is New

- The results of this randomized, blinded trial suggest that adductor canal block results in less motor impairment after surgery, but provides a comparable level of pain relief

SCIENTIFIC REPORTS

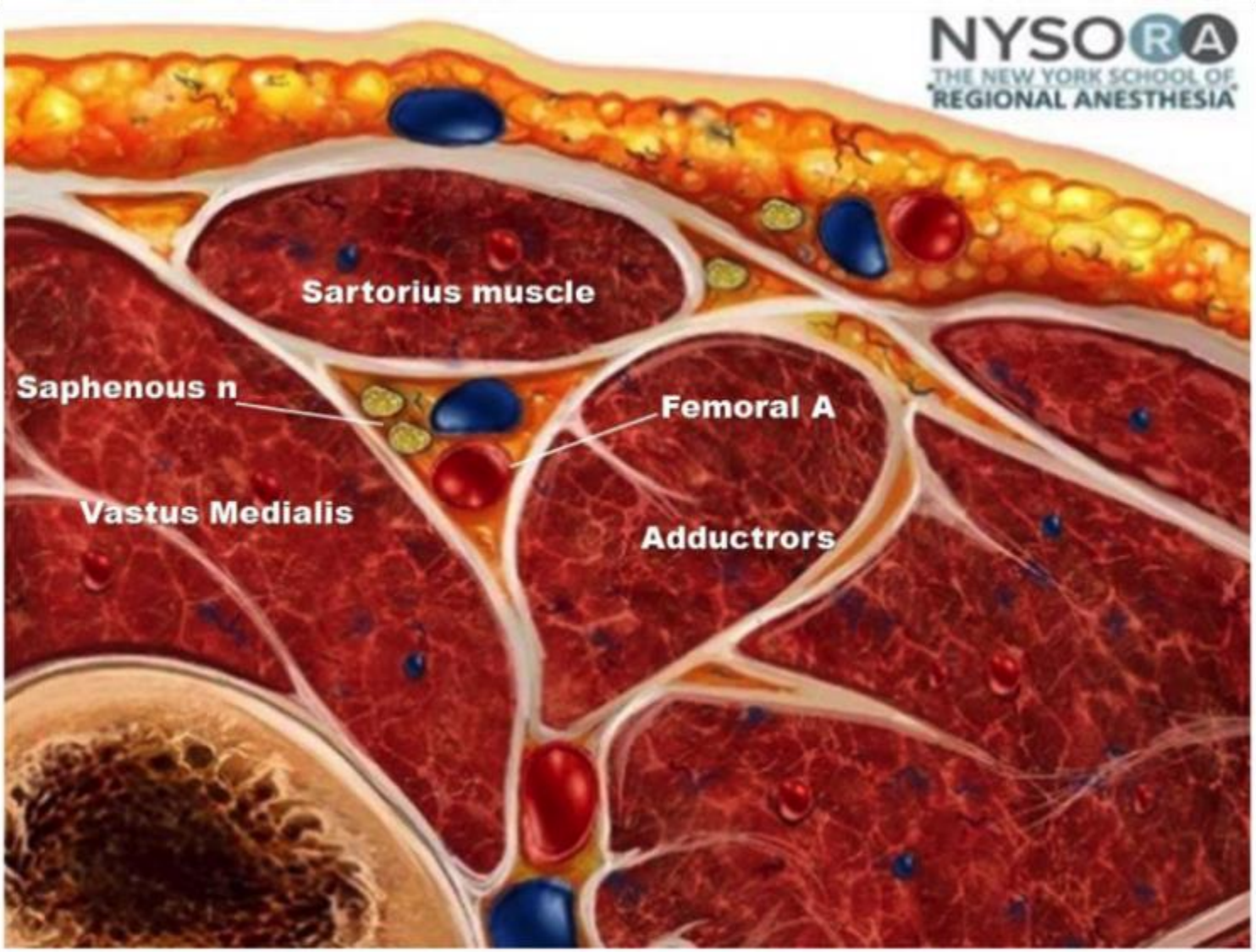
OPEN

Adductor canal block versus femoral nerve block for total knee arthroplasty: a meta-analysis of randomized controlled trials

Received: 08 July 2016
Accepted: 09 December 2016
Published: 12 January 2017

Duan Wang[1,*], Yang Yang[2,*], Qi Li[1,*], Shen-Li Tang[3], Wei-Nan Zeng[4], Jin Xu[5], Tian-Hang Xie[1], Fu-Xing Pei[1], Liu Yang[4], Ling-Li Li[1] & Zong-Ke Zhou[1]

falling versus FNB. At any follow-up time, ACB was not inferior to FNB regarding pain control or opioid consumption, and showed better range of motion in comparison with FNB. ACB is superior to the FNB regarding sparing of quadriceps strength and faster knee function recovery. It provides pain relief and opioid consumption comparable to FNB and is associated with decreased risk of falls.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THE NEW YORK SCHOOL OF REGIONAL ANESTHESIA
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Nottingham University Hospitals NHS

NUH LOWER LIMB ERAS[1] ANALGESIA GUIDELINE

Better for you
caring • safe • thoughtful

	Total Hip/Knee Replacement	Notes
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Local infiltration analgesia: a technique for the control of acute postoperative pain following knee and hip surgery

A case study of 325 patients

Dennis R Kerr and Lawrence Kohan

Table 3. Morphine usage over the first 48 h postoperatively by patients presenting between Jan 1, 2005 and Dec 31, 2006. Proportion of patients in each category. Dose in parentheses is average total dose in mg over 48 h for each category

	HRA n = 185	TKR n = 86	THR n = 54
No morphine	122/185	49/86	43/54
Morphine	63/185 (10 mg)	37/86 (11 mg)	11/54 (8 mg)
Morphine after 24 h	0/185	0/86	0/54

Reduced morphine consumption and pain intensity with local infiltration analgesia (LIA) following total knee arthroplasty

A randomized double-blind study involving 48 patients

Per Essving[1], Kjell Axelsson[2], Jill Kjellberg[2], Örjan Wallgren[3], Anil Gupta[2,4], and Anders Lundin[1]

Table 2. Consumption of analgesics

	Group A median (range)	Group P median (range)	p-value
Morphine i.v. (mg)			
0–24 h	17 (1–74)	65 (36–131)	< 0.001
24–48 h	0.5 (0–17)	22 (0–52)	< 0.001
0–48 h	18 (1–74)	87 (36–160)	< 0.001
Tramadol orally (mg)			
0–24 h	0 (0–200)	0 (0–100)	0.01
24–48 h	375 (0–400)	200 (0–400)	0.04
0–48 h	400 (0–500)	200 (0–500)	0.008
Total analgesics [a] (mg)			
0–48 h	54 (4–114)	109 (37–211)	< 0.001

[a] Total analgesic consumption was calculated by converting oral tramadol to the equivalent dose of intravenous morphine (100 mg tramadol orally = 10 mg morphine intravenously).

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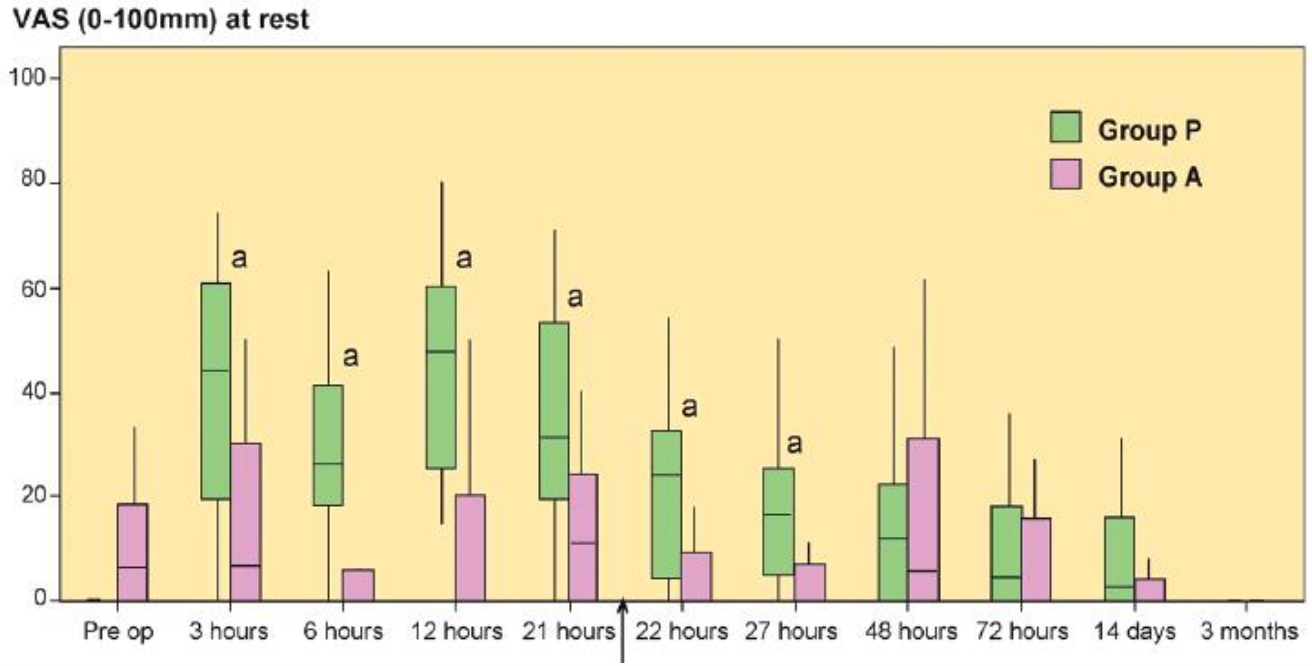

Nottingham University Hospitals NHS Trust

B.S.O.A British Society of Orthopaedic Anaesthetists

neos Nottingham Elective Orthopaedic Services

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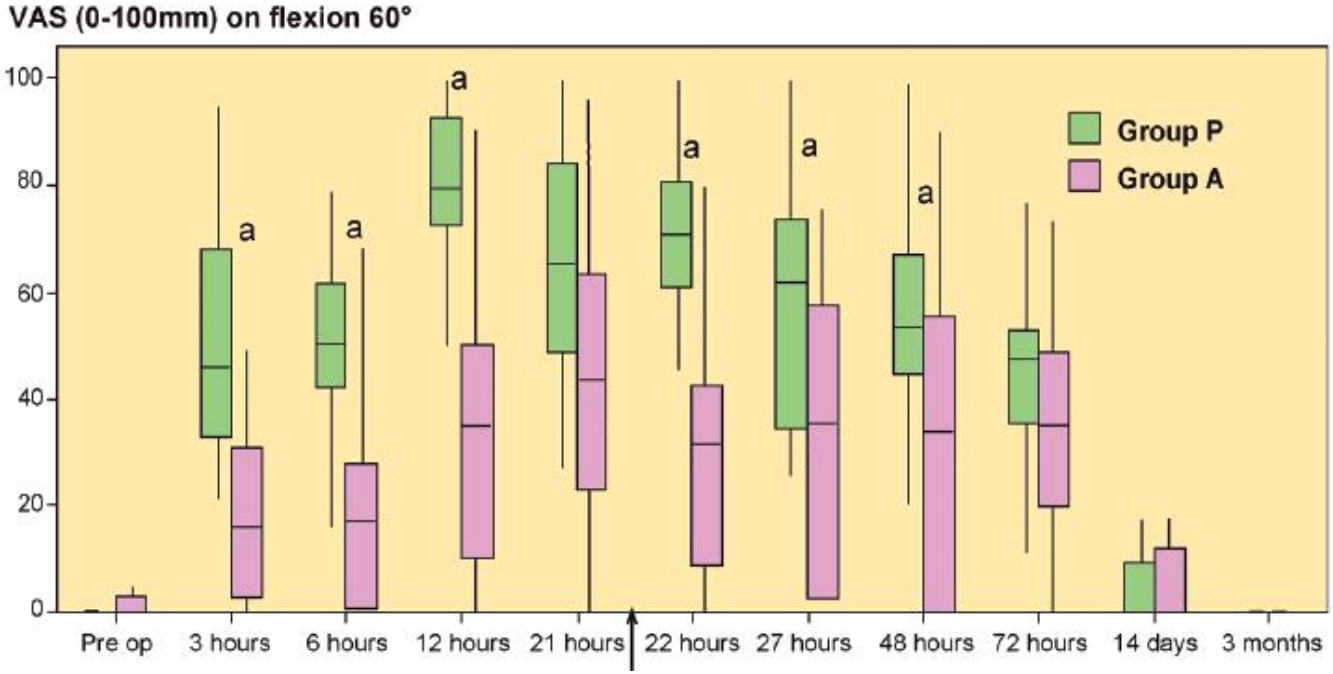

Reduced morphine consumption and pain intensity with local infiltration analgesia (LIA) following total knee arthroplasty

A randomized double-blind study involving 48 patients

Per Essving[1], Kjell Axelsson[2], Jill Kjellberg[2], Örjan Wallgren[3], Anil Gupta[2,4], and Anders Lundin[1]

Interpretation The local infiltration analgesia (LIA) technique provides excellent pain relief and lower morphine consumption following TKA, resulting in shorter time to home readiness and higher patient satisfaction. There were few side effects and systemic LA concentrations were low.

Orthopaedics & Traumatology: Surgery & Research xxx (2015) xxx–xxx

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Original article

Local infiltration analgesia versus femoral nerve block in total knee arthroplasty: A meta-analysis

X.-D. Yun [1], X.-L. Yin, J. Jiang [1], Y.-J. Teng [1], H.-T. Dong, L.-P. An, Y.-Y. Xia *

Department of Orthopaedics, Orthopaedics Key Laboratory of Gansu Province, Second Hospital of Lanzhou University, No. 82 Cuiyingmen, Chengguan District, Lanzhou, Gansu, PR China

A B S T R A C T

Introduction: Local infiltration analgesia (LIA) and femoral nerve block (FNB) are both used for the pain management after total knee arthroplasty (TKA). Controversy still remains regarding the optimal technique for pain relief in patients undergoing TKA. The purpose of this meta-analysis was to compare the analgesia achieved with LIA and the one from FNB following TKA.

Hypothesis: LIA achieves better pain control than FNB in patients with TKA.

Methods: Databases, including Pubmed, EMBASE, the Cochrane Library and Web of Science were comprehensively searched to identify studies comparing LIA with FNB for patients with TKA. Two reviewers independently selected trials, extracted data, and assessed the methodological qualities of included studies. Data were analyzed by RevMan 5.2.

Results: Nine RCTs involving 782 patients were included. LIA achieved more rapid pain relief (VAS) at 6 h postoperatively [$SMD_{6h} = -0.92$, 95% CI (−1.38, −0.47)] than FNB. There were no significant differences at 24 h and 48 h [$SMD_{24h} = -0.03$, 95% CI (−0.46, 0.40); $SMD_{48h} = 0.28$, 95% CI (−0.35, 0.91)], VAS with activity at 24 h and 48 h [$SMD_{6h} = -0.54$, 95% CI (−1.62, 0.54); $SMD_{24h} = -0.22$, 95% CI (−1.41, 0.96); $SMD_{48h} = -0.08$, 95% CI (−0.52, 0.69)], opioid consumption at 24 h and 48 h [$SMD_{24h} = -0.24$, 95% CI (−0.82, 0.34); $SMD_{48h} = 0.15$, 95% CI (0.25, 0.54)] and length of hospital stay [MD = −0.52, 95% CI (−1.13, 0.09)].

Discussion: LIA may be the better choice in the pain management of TKA for it could achieve fast pain relief and is easier to perform than FNB for patients with TKA.

Level of evidence: Level II, meta-analysis and systematic review.

Femoral nerve blocks for acute postoperative pain after knee replacement surgery (Review)

47 RCTs

- **29 FNB vs PCA**
  - **FNB > PCA**
  - **FNB + PCA > PCA**
- **10 FNB vs Epidural**
  - **FNB = Epidural**
- **5 FNB vs LAI**
  - **FNB = LAI**
- **1 FNB vs PO Analgesia**
  - **???**
- **4 Continuous FNB vs Single Shot FNB**
  - **Continuous > Single Shot**

Local Infiltration Analgesia Versus Intrathecal Morphine for Postoperative Pain Management After Total Knee Arthroplasty: A Randomized Controlled Trial

Per Essving, MD,*† Kjell Axelsson, MD, PhD,†‡ Elisabeth Åberg, BSc,‡ Henrik Spännar, BSc,§ Anil Gupta, MD, PhD,†‡¶ and Anders Lundin, MD, PhD*†

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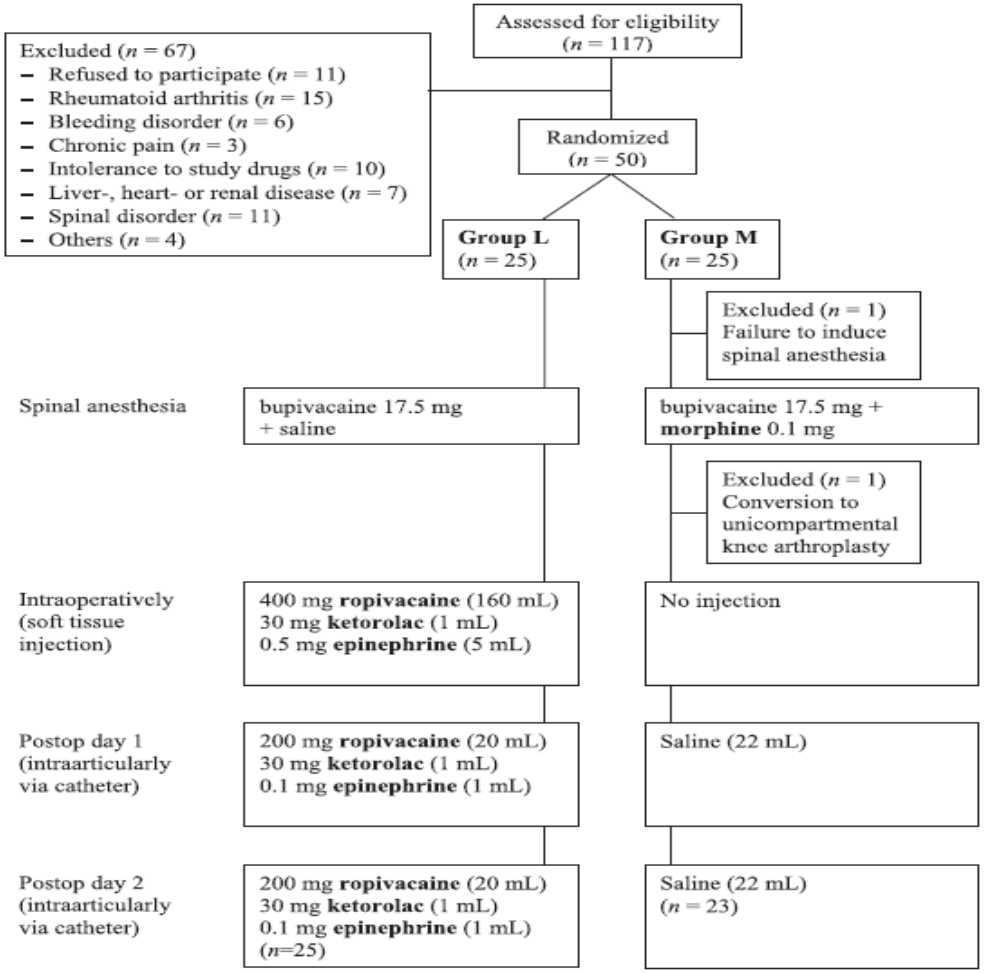


Figure 1. Flow chart for the study. Group L = local infiltration analgesia; group M = intrathecal morphine.

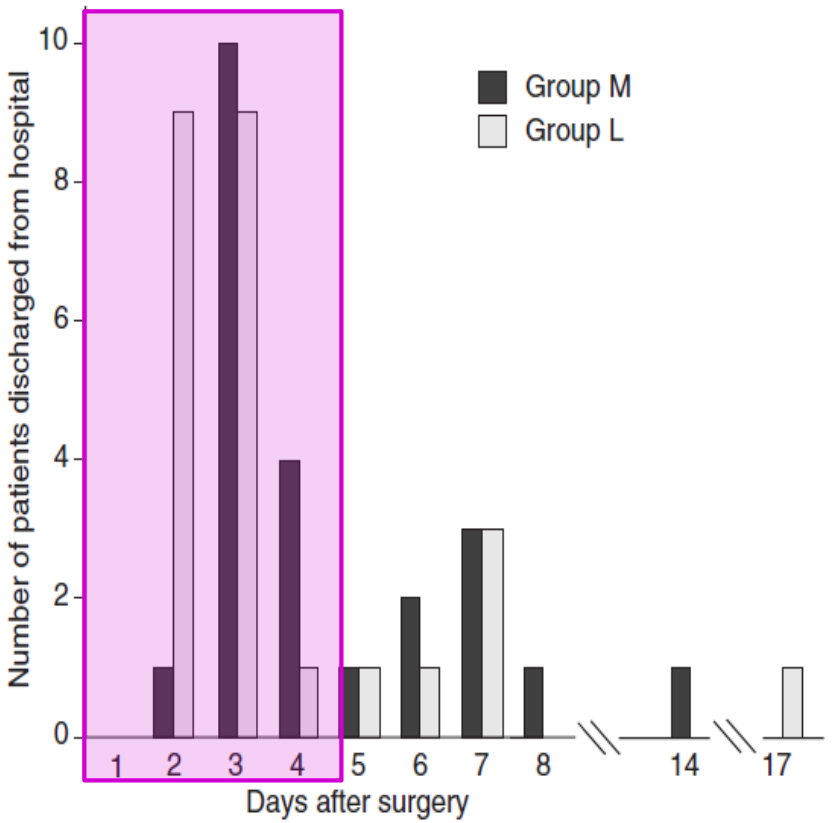


Figure 4. Length of hospital stay. Group L = local infiltration analgesia; group M = intrathecal morphine; day 0 = the day of operation.

Local Infiltration Analgesia Versus Intrathecal Morphine for Postoperative Pain Management After Total Knee Arthroplasty: A Randomized Controlled Trial

Per Essving, MD,*† Kjell Axelsson, MD, PhD,†‡ Elisabeth Åberg, BSc,‡ Henrik Spännar, BSc,§ Anil Gupta, MD, PhD,†‡¶ and Anders Lundin, MD, PhD*†

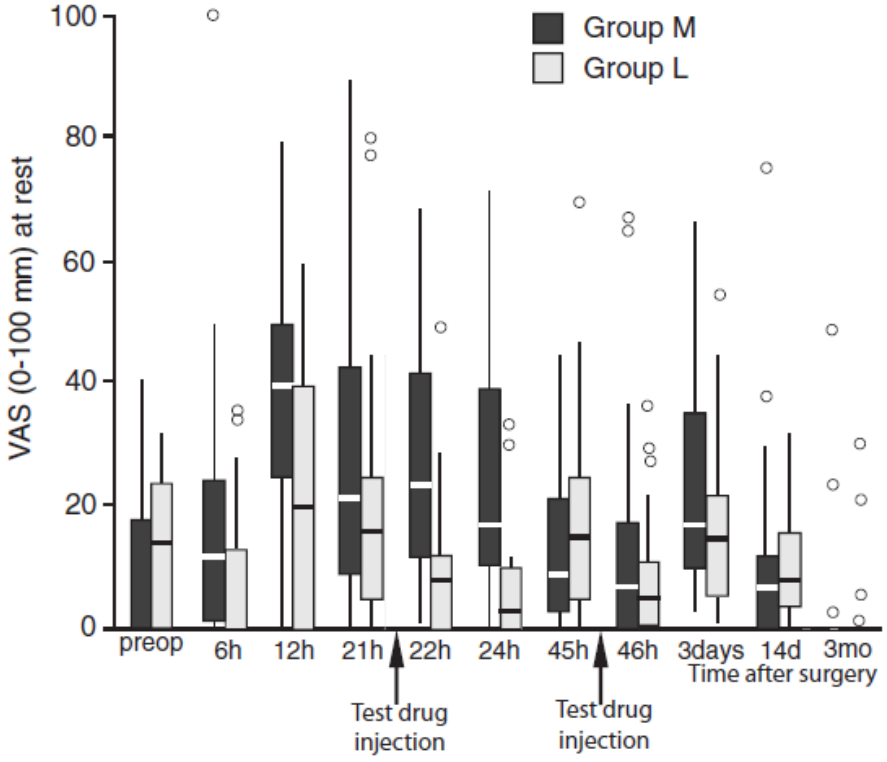


Figure 2. Pain at rest. Visual analog scale (VAS) scores are presented as median and interquartile range. Group L = local infiltration analgesia; group M = intrathecal morphine.

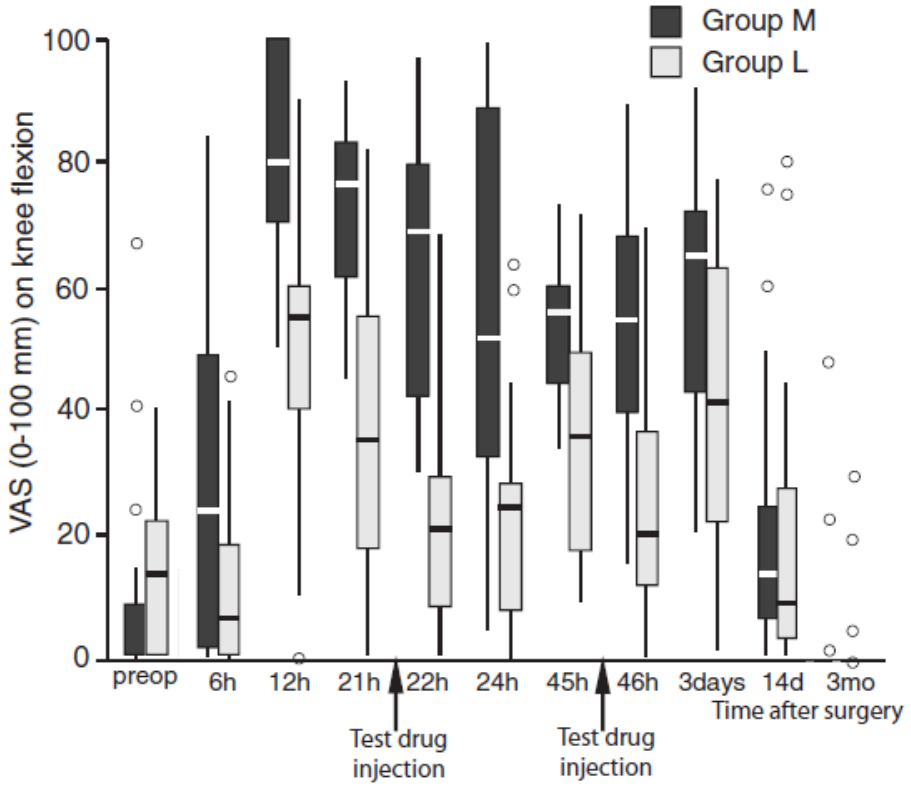


Figure 3. Pain on movement. Visual analog scale (VAS) scores are presented as median and interquartile range. Group L = local infiltration analgesia; group M = intrathecal morphine.

British Journal of Anaesthesia **113** (3): 360–74 (2014)
Advance Access publication 17 June 2014 · doi:10.1093/bja/aeu155

BJA

Analgesic efficacy of local infiltration analgesia in hip and knee

Editor's key points

- Growing interest in local infiltration pain relief has led to novel management of patients in hip and knee arthroplasty.
- The authors examined the evidence base for this practice, finding better support for its use in knee surgery than in hip surgery.
- Wound infusion catheters were not shown to provide additional benefit, and length of hospital stay appeared unaffected by local infiltration protocols.

In recent years, there has been an increasing interest in local infiltration analgesia (LIA) as a technique to control postoperative pain. We conducted a systematic review of randomized clinical trials investigating LIA for total knee arthroplasty (TKA) and total hip arthroplasty (THA) to evaluate the analgesic efficacy of LIA for early postoperative pain treatment. In addition, the analgesic efficacy of wound catheters and implications for length of hospital stay (LOS) were evaluated. Twenty-seven randomized controlled trials in 756 patients operated on with THA and 888 patients operated on with TKA were selected for inclusion in the review. In THA, no additional analgesic effect of LIA compared with placebo was reported in trials with low risk of bias when a multimodal analgesic regimen was administered perioperatively. Compared with intrathecal morphine and epidural analgesia, LIA was reported to have similar or improved analgesic efficacy. In TKA, most trials reported reduced pain and reduced opioid requirements with LIA compared with a control group treated with placebo/no injection. Compared with femoral nerve block, epidural or intrathecal morphine LIA provided similar or improved analgesia in the early postoperative period but most trials had a high risk of bias due to different systemic analgesia between groups. Overall, the use of wound catheters for postoperative administration of local anaesthetic was not supported in the included trials, and LOS was not related to analgesic efficacy. Despite the many studies of LIA, final interpretation is hindered by methodological insufficiencies in most studies, especially because of differences in use of systemic analgesia between groups. However, LIA provides effective analgesia in the initial postoperative period after TKA in most randomized clinical trials even when combined with multimodal systemic analgesia. In contrast, LIA may have limited additional analgesic efficacy in THA when combined with a multimodal analgesic regimen. Postoperative administration of local anaesthetic in wound catheters did not provide additional analgesia when systemic analgesia was similar and LOS was not related to use of LIA with a fast-track set-up.

Keywords: anaesthesia, local; arthroplasty; pain, postoperative

Marques et al. BMC Musculoskeletal Disorders 2014, 15:220
http://www.biomedcentral.com/1471-2474/15/220

BMC Musculoskeletal Disorders

RESEARCH ARTICLE Open Access

Local anaesthetic infiltration for peri-operative pain control in total hip and knee replacement: systematic review and meta-analyses of short- and long-term effectiveness

Elsa MR Marques[1*], Hayley E Jones[1], Karen T Elvers[2], Mark Pyke[3], Ashley W Blom[2] and Andrew D Beswick[2]

Results: In 13 studies including 909 patients undergoing THR, patients receiving local anaesthetic infiltration experienced a greater reduction in pain at 24 hours at rest by standardised mean difference (SMD) −0.61 (95% CI −1.05, −0.16; p = 0.008) and by SMD −0.43 (95% CI −0.78 −0.09; p = 0.014) at 48 hours during activity. In TKR, diverse multi-modal regimens were reported. In 23 studies including 1439 patients undergoing TKR, local anaesthetic infiltration reduced pain on average by SMD −0.40 (95% CI −0.58, −0.22; p < 0.001) at 24 hours at rest and by SMD −0.27 (95% CI −0.50, −0.05; p = 0.018) at 48 hours during activity, compared with patients receiving no infiltration or placebo. There was evidence of a larger reduction in studies delivering additional local anaesthetic after wound closure. There was no evidence of pain control additional to that provided by femoral nerve block.

Patients receiving local anaesthetic infiltration spent on average an estimated 0.83 (95% CI 1.54, 0.12; p = 0.022) and 0.87 (95% CI 1.62, 0.11; p = 0.025) fewer days in hospital after THR and TKR respectively, had reduced opioid consumption, earlier mobilisation, and lower incidence of vomiting.
Few studies reported long-term outcomes.

Research Paper

PAIN

OPEN

Effect of local anaesthetic infiltration on chronic postsurgical pain after total hip and knee replacement: the APEX randomised controlled trials

Vikki Wylde[a,*], Erik Lenguerrand[a], Rachael Gooberman-Hill[a], Andrew D. Beswick[a], Elsa Marques[b], Sian Noble[b], Jeremy Horwood[b], Mark Pyke[c], Paul Dieppe[d], Ashley W. Blom[a]

Abstract

Total hip replacement (THR) and total knee replacement (TKR) are usually effective at relieving pain; however, 7% to 23% of patients experience chronic postsurgical pain. These trials aimed to investigate the effect of local anaesthetic wound infiltration on pain severity at 12 months after primary THR or TKR for osteoarthritis. Between November 2009 and February 2012, 322 patients listed for THR and 316 listed for TKR were recruited into a single-centre double-blind randomised controlled trial. Participants were randomly assigned (1:1) to receive local anaesthetic infiltration and standard care or standard care alone. Participants and outcomes assessors were masked to group allocation. The primary outcome was pain severity on the WOMAC Pain Scale at 12 months after surgery. Analyses were conducted using intention-to-treat and per-protocol approaches. In the hip trial, patients in the intervention group had significantly less pain at 12 months postoperative than patients in the standard care group (differences in means: 4.74; 95% confidence interval [CI]: 0.95-8.54; $P = 0.015$), although the difference was not clinically significant. Post hoc analysis found that patients in the intervention group were more likely to have none to moderate pain than severe pain at 12 months than those in the standard care group (odds ratio: 10.19; 95% CI: 2.10-49.55; $P = 0.004$). In the knee trial, there was no strong evidence that the intervention influenced pain severity at 12 months postoperative (difference in means: 3.83; 95% CI: −0.83 to 8.49; $P = 0.107$). In conclusion, routine use of infiltration could be beneficial in improving long-term pain relief for some patients after THR.

Keywords: Hip, Knee, Arthroplasty, Pain, Randomised controlled trial

British Journal of Anaesthesia **111** (2): 242–8 (2013)
Advance Access publication 20 March 2013 · doi:10.1093/bja/aet030

BJA

PAIN

Local infiltration analgesia for total knee arthroplasty: should ketorolac be added?

K. V. Andersen[1], L. Nikolajsen[3*], V. Haraldsted[2], A. Odgaard[1] and K. Søballe[1,4]

Methods. Sixty patients undergoing TKA were randomized to receive intraoperative LIA (ropivacaine 300 mg and epinephrine 0.5 mg) combined with either ketorolac 30 mg (ketorolac group) or saline (control group). After surgery, eight bolus doses of ropivacaine 100 mg combined with either ketorolac 15 mg (ketorolac group) or saline (control group) were administered every 6 h via an intra-articular catheter. The primary outcome was postoperative consumption of i.v. morphine patient-controlled analgesia (PCA). Secondary outcomes were time to first request of i.v. morphine PCA, pain intensity, side-effects, and readiness for hospital discharge.

Results. Consumption of i.v. morphine PCA was lower in the ketorolac group *vs* control group {0–6 h: 0 (0–0) *vs* 5 (0–10) mg, $P<0.0001$; 0–48 h: 10 (0–22.5) *vs* 48.75 (30–82.5) mg, $P<0.0001$ [median (inter-quartile range, IQR)]}. Time to first request of i.v. morphine PCA was longer in the ketorolac group *vs* the control group [490 (248–617) *vs* 223 (115–319) min, $P=0.02$, median (IQR)]. Early postoperative pain (<48 h) and readiness for hospital discharge were also significantly reduced in the ketorolac group.

Conclusions. LIA with ketorolac results in reduced morphine consumption, reduced pain intensity, and earlier readiness for hospital discharge.

Perret et al. Journal of Orthopaedic Surgery and Research (2015) 10:119
DOI 10.1186/s13018-015-0249-x

JOURNAL OF ORTHOPAEDIC SURGERY AND RESEARCH

RESEARCH ARTICLE Open Access

Comparison of patient outcomes in periarticular and intraarticular local anaesthetic infiltration techniques in total knee arthroplasty

Michael Perret[1*], Philip Fletcher[2], Laura Firth[3] and Piers Yates[1,4,5]

Abstract

Background: The use of local infiltration analgesia in the setting of knee arthroplasty is well established. There are no studies to date which have directly compared differences in infiltration techniques. The purpose of this study is to establish if a difference in patient outcomes exists when the infiltrate is injected into the periarticular tissues or directly into the joint.

Methods: One hundred and forty-two consecutive patients waitlisted for primary total knee arthroplasty were enrolled after primary exclusion criteria were applied. These included the following: allergy to study drugs, inability to receive spinal anaesthesia, and planned bilateral surgery. Patients were divided into two groups, a periarticular infiltration group (group A) and an intraarticular infiltration group (group B). Secondary exclusion criteria of regular opioid use, psychiatric illness, and serious medical comorbidity left a total of 47 patients in group A and 54 patients in group B. Both groups received a combination of 30 mg ketorolac, 500 μg of adrenaline, and 300 mg of ropivacaine, and normal saline. This was either injected into the periarticular tissues during surgery (group A) or intraarticularly after closure of the wound (group B).
Primary outcome measures included opioid consumption during the first 24 h postoperatively and over the total admission, and visual analogue scales (VAS) on postoperative day 1 and at discharge. Secondary measures included Oxford Knee Score, knee flexion, length of stay, haemoglobin drop, and transfusion requirement.
Ethics approval was granted by the hospital review board. The trial is registered in the Australian New Zealand Clinical Trials Registry, registration ACTRN12615000488505.

Results: No statistically significant differences in postoperative analgesic use were observed between the two groups. However, there was a trend toward decreased postoperative patient-controlled analgesia use in the periarticular group (mean 53.1 vs 68.3 mg morphine equivalents; $p = 0.093$), as well as a statistically significant reduction in postoperative visual analogue pain scores. No statistically significant differences were observed for haemoglobin drop, range of motion, or pre- to 6-week postoperative Oxford Score difference.

Conclusions: Our study is the first we are aware of to directly compare a periarticular to intraarticular injection technique when using local infiltration analgesia for total knee arthroplasty. Our results show no clear statistically significant benefit with either technique. The periarticular group showed a statistically significant reduction in postoperative VAS pain scores alongside a trend in that group toward reduced overall opioid use.

Keywords: Local infiltration analgesia, Local anaesthetic, Total knee arthroplasty, Total knee replacement

Guideline for Administration of Local Anaesthetic Infiltration (LAI) for Total Hip and Total Knee Replacements

Ropivacaine 2mg/ml 200ml bags

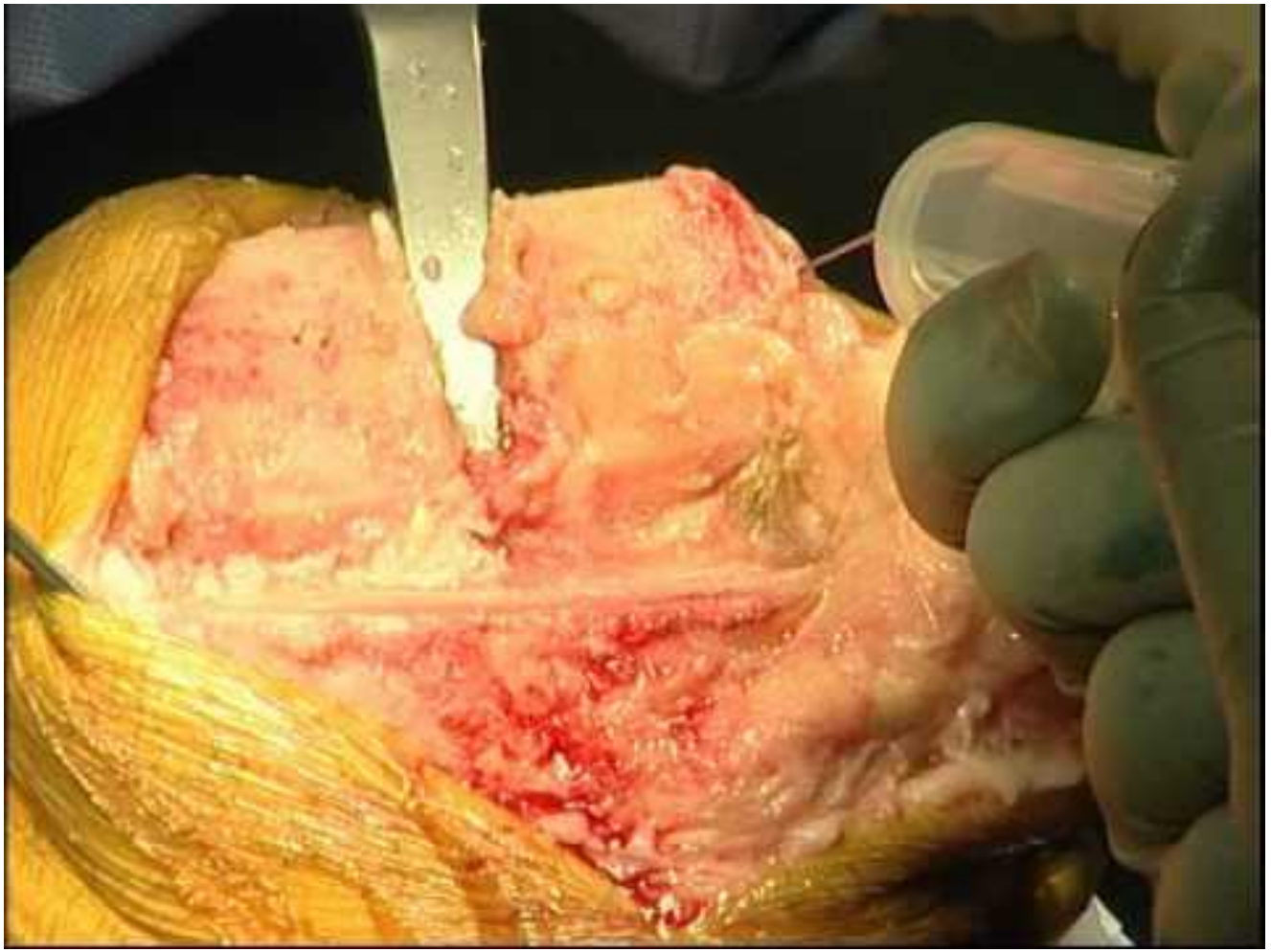
BNF maximum dose for Ropivacaine 3 mg/kg

In the absence of peripheral nerve blocks, the following are the maximum safe doses of Ropivacaine for LAI:

50kg = 75ml
60 kg = 90ml
70kg = 105ml
80 kg = 120ml
90 kg = 135ml
100 kg = 150ml

Please check with anaesthetist to confirm maximum safe dose before injecting.

Guidelines from BNF adapted by Mr T Westbrook and Dr Adam Carney. June 2014. Annual Review.



Systematic Review And Meta-Analysis

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Adductor canal block with local infiltrative analgesia compared with local infiltrate analgesia for pain control after total knee arthroplasty

A meta-analysis of randomized controlled trials

Qiujuan Xing, MD, PhD[a,*], Weiwei Dai, PhD[b], Dongfeng Zhao, PhD[c], Ji Wu, MD[a], Chunshui Huang, MD[a], Yun Zhao, MD[a]

Abstract

Background: This meta-analysis aimed to evaluate the efficiency and safety of the combined adductor canal block with peri-articular infiltration versus periarticular infiltration alone for pain control after total knee arthroplasty (TKA).

Methods: PubMed, Medline, Embase, Web of Science, and the Cochrane Library were searched to identify articles comparing the combined adductor canal block with peri-articular infiltration and periarticular infiltration alone for pain control after TKA. Main outcomes were numeric rating scale (NRS) at postoperative day (POD) 0–2 and opioid consumption. Meta-analysis was performed using Stata 11.0 software.

Results: Four randomized controlled trial (RCTs) including 297 patients met the inclusion criteria. The present meta-analysis indicated that there were significant differences between the groups regarding NRS score at POD 0 (weighted mean difference [WMD] = −0.849, 95% confidence interval [CI]: −1.345 to −0.353, P = .001), POD 1 (WMD = −0.960, 95% CI: −1.474 to −0.446, P = .000), and POD 2 (WMD = −0.672, 95% CI: −1.163 to −0.181, P = .007) after TKA. Significant differences were found in terms of opioid consumption at POD 0 (WMD = −3.761, 95% CI: −6.192 to −1.329, P = .002), POD 1 (WMD = −4.795, 95% CI: −8.181 to −1.409, P = .006), and POD 2 (WMD = −2.867, 95% CI: −4.907 to −0.827, P = .006).

Conclusion: Combined adductor canal block with peri-articular infiltration could significantly reduce NRS scores and opioid consumption in comparison with periarticular infiltration alone following TKA. Additionally, there is a lower incidence of nausea and vomiting in the combined groups.

Abbreviations: LOS= length of stay, NRS = numeric rating scale, RCT= randomized controlled trials, TKA =total knee arthroplasty.

Keywords: adductor canal block, meta-analysis, pain control, peri-articular infiltration, total knee arthroplasty

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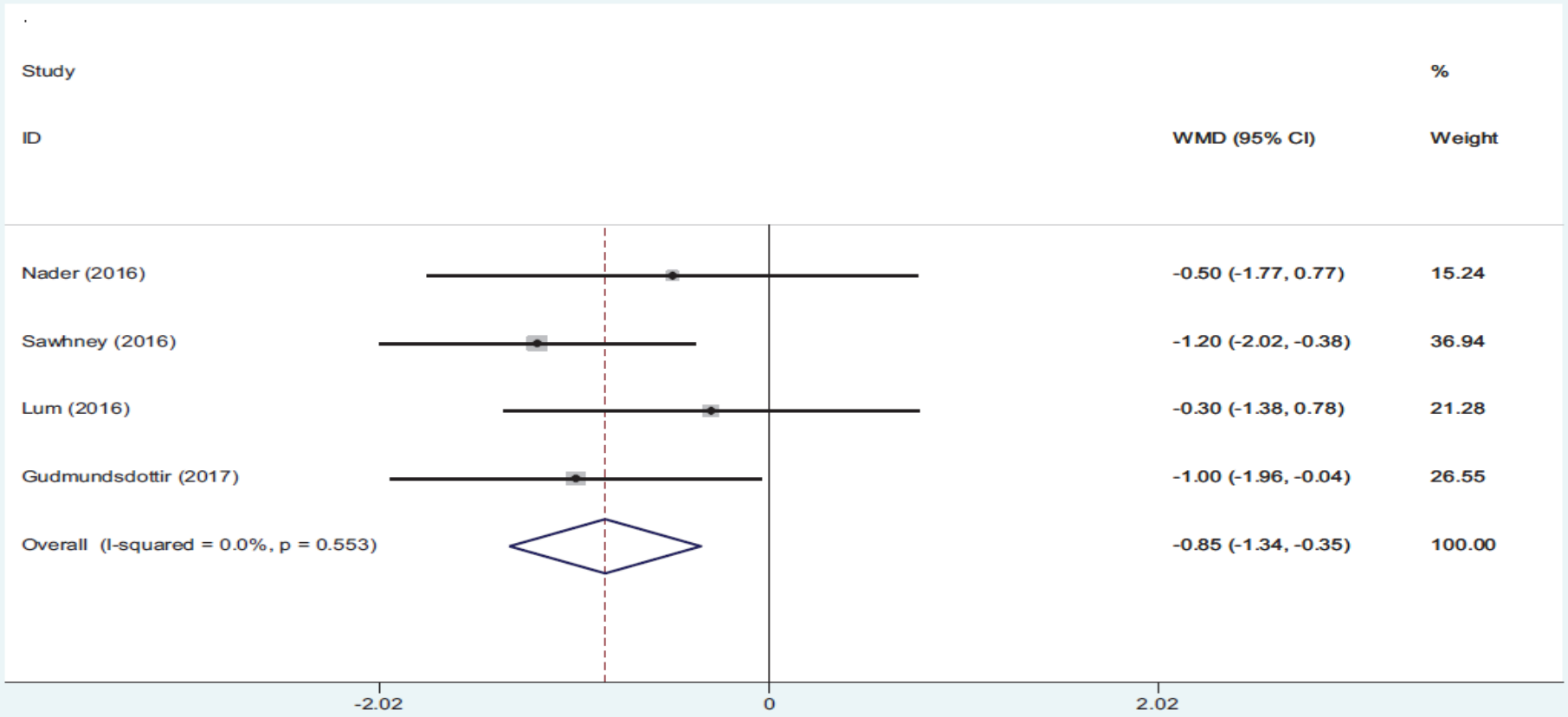

Figure 2. Forest plot diagram showing NRS scores at POD 0 after TKA. NRS = numeric rating scale, TKA = total knee arthroplasty.

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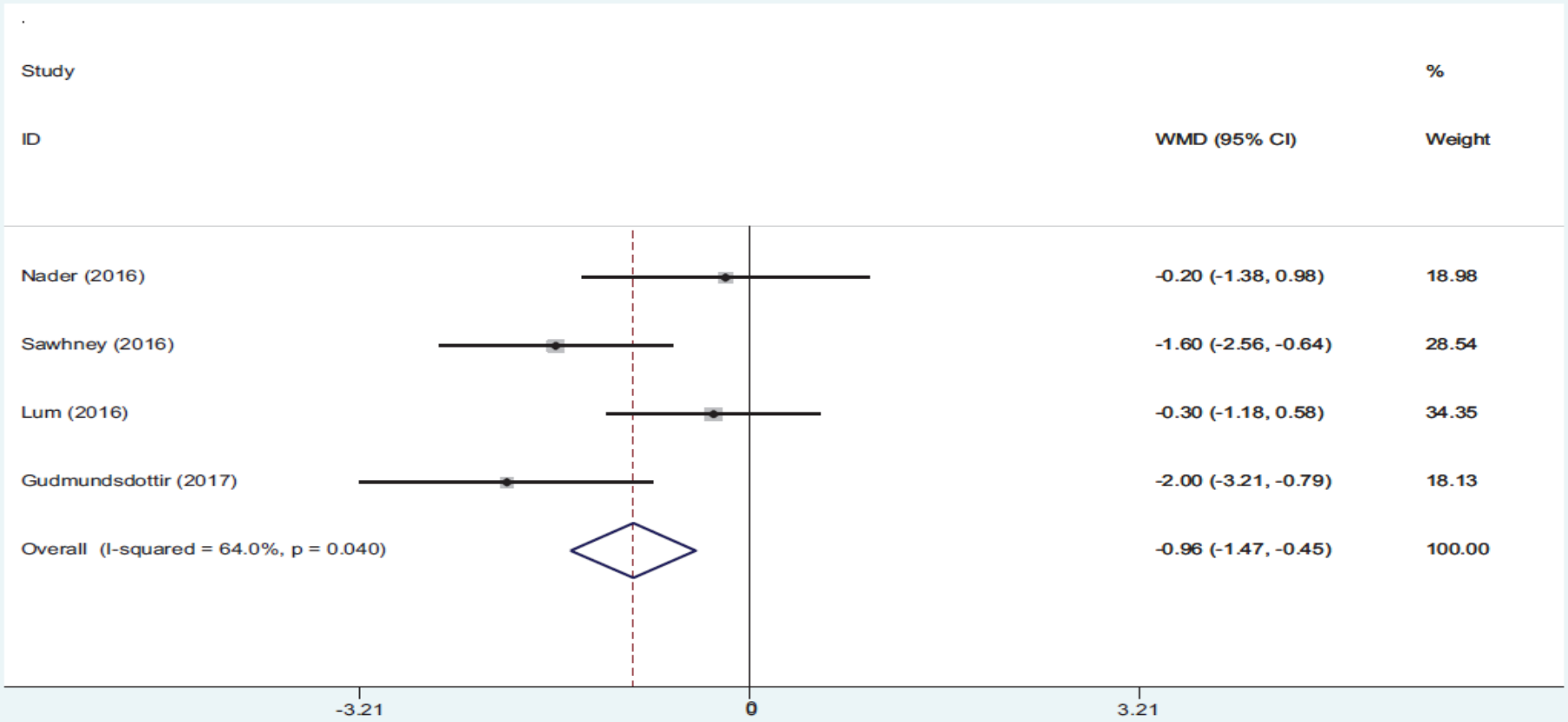

Figure 3. Forest plot diagram showing NRS scores at POD 1 after TKA. NRS = numeric rating scale, TKA = total knee arthroplasty.

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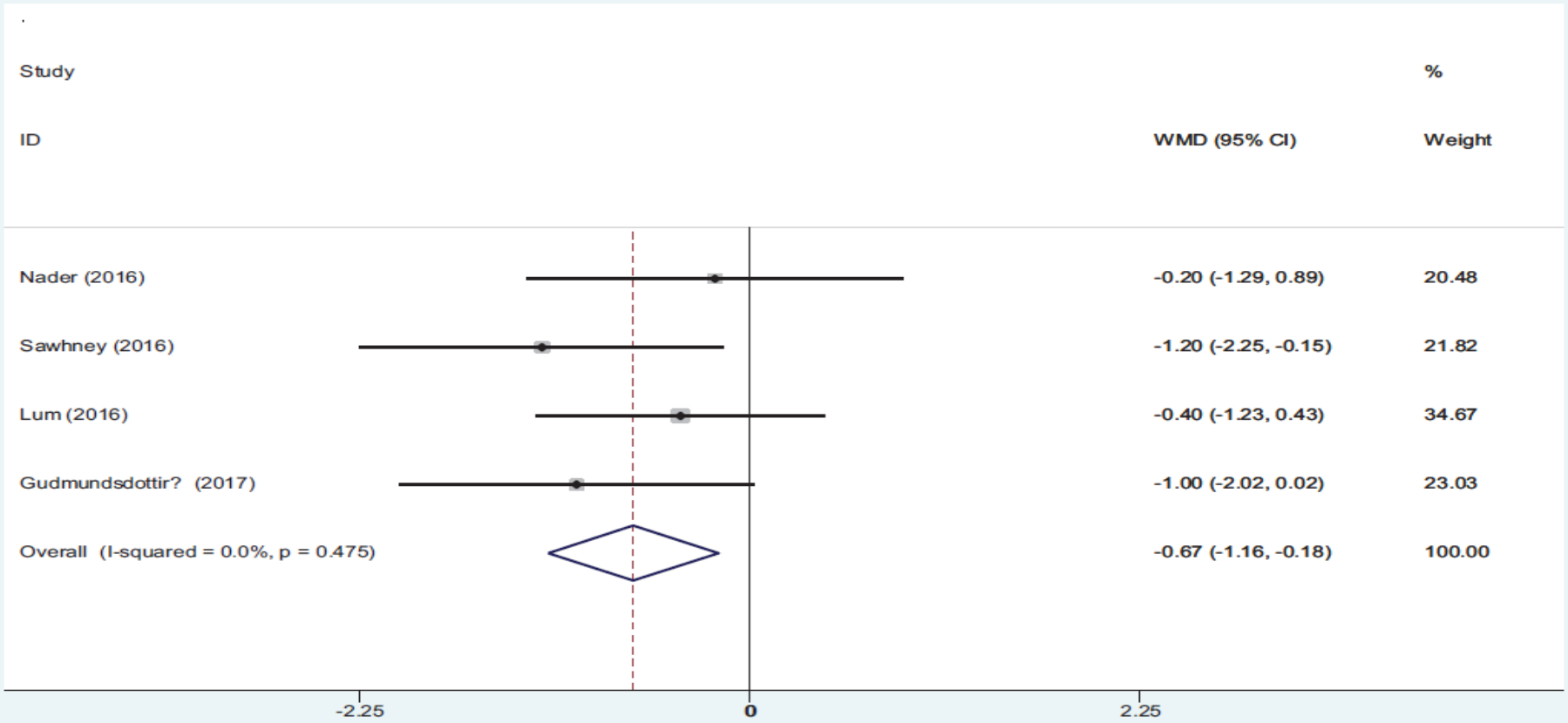


Figure 4. Forest plot diagram showing NRS scores at POD 2 after TKA. NRS = numeric rating scale, TKA = total knee arthroplasty.

ORIGINAL ARTICLE

Single-Dose Adductor Canal Block With Local Infiltrative Analgesia Compared With Local Infiltrate Analgesia After Total Knee Arthroplasty

A Randomized, Double-Blind, Placebo-Controlled Trial

Antoun Nader, MD, Mark C. Kendall, MD,* David W. Manning, MD,† Matthew Beal, MD,† Rohit Rahangdale, MD,* Robert Dekker, MD,† Gildasio S. De Oliveira Jr, MD, MSCI,* Eric Kamenetsky, MD,* and Robert J. McCarthy, PharmD**

DISCUSSION

The most important finding of the current study is that a single-dose ultrasound-guided adductor canal block with 10 mL of bupivacaine 0.25% with epinephrine 1:300,000 placed preoperatively in combination with local infiltrative analgesia reduces opioid consumption and pain burden during the first 36 hours after TKA without impeding physical function and independence required for hospital discharge when compared with local infiltrative analgesia alone. Patients in the active group met discharge criteria sooner and had shortened length of hospital stay. Taken together, our study demonstrates that a single-dose adductor canal blockade placed preoperatively to periarticular infiltrative analgesia provides enhanced analgesia and does not hinder "fast track" rehabilitation after TKA.

In summary, our finding suggests that a single-dose adductor canal block in addition to local infiltrative analgesia can be an integral part of "fast track" TKA because it positively impacted pain burden, reduced opioid consumption, and facilitated early discharge compared with local infiltration analgesia alone.

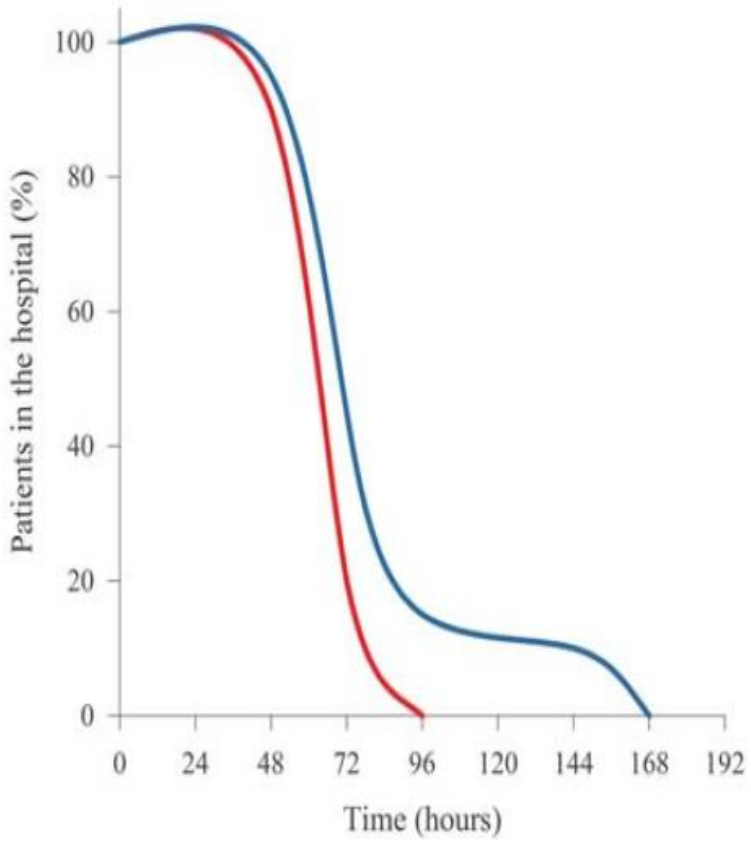


FIGURE 2. Percentage of patients remaining in hospital as a function of time after surgery. The mean (95% CI) time to discharge based on the log-normal transformed data was 73 (64–83) hours in the active group compared with 92 (76–111) hours in the control group ($P = 0.007$).

The Impact of Analgesic Modality on Early Ambulation Following Total Knee Arthroplasty

Anahi Perlas, MD, FRCPC,† Kyle R. Kirkham, MD, FRCPC,*† Rajeev Billing, MD,*† Cyrus Tse, BSc,* Richard Brull, MD, FRCPC,* Rajeev Gandhi, MD, FRCSC,‡ and Vincent W. S. Chan, MD, FRCPC*†*

(*Reg Anesth Pain Med* 2013;38: 334–339)

TABLE 2. Early Ambulation, LOS, and Discharge Destination

	CFNB (n = 100)	LIA (n = 97)	LIA + ACB (n = 101)	*P*
Ambulation POD1 (m), median (IQR)	0 (0–0)	20 (6–50)*	30 (7–50)*†	<0.001
Ambulation POD2 (m), median (IQR)	40 (18–60)	50 (26–60)	50 (27–62)	0.103
Ambulation POD3 (m), median (IQR)	55 (45–80)	50 (40–70)	60 (40–80)	0.410

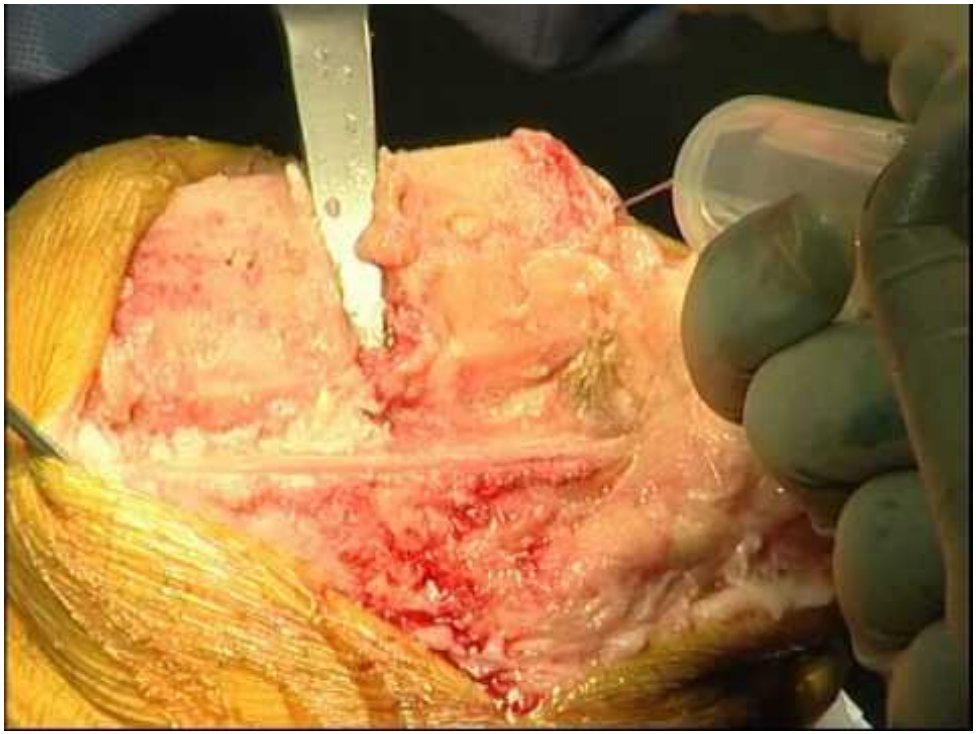
TABLE 3. Pain Scores According to a Numeric Rating Scale (0 = No Pain to 10 = Maximal Pain)

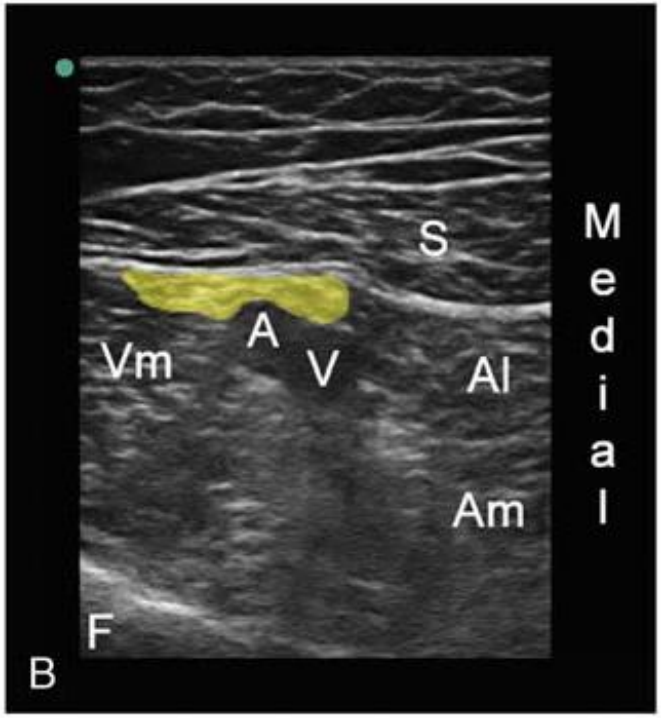
	CFNB (n = 100)	LIA (n = 97)	LIA + ACB (n = 101)	*P*
POD0 at rest	1.9 ± 3.3	0.4 ± 1.4*	0.5 ± 1.6*	<0.001
POD0 on movement	1.7 ± 3.3	0.4 ± 1.7*	0.5 ± 1.6*	0.005
POD1 at rest	4.1 ± 2.7	3.8 ± 2.7	4.1 ± 2.9	0.752
POD1 on movement	6.7 ± 2.5	5.4 ± 2.9*	6.1 ± 2.9	0.008
POD2 at rest	3.6 ± 2.7	3.3 ± 2.5	3.9 ± 2.4	0.243
POD2 on movement	6.2 ± 2.6	5.1 ± 2.7*	5.9 ± 2.4	0.013
POD3 at rest	2.3 ± 2.5	2.7 ± 2.2	3.3 ± 2.6	0.064
POD3 on movement	4.9 ± 2.9	4.2 ± 2.4	5.1 ± 2.8	0.165

CONCLUSIONS

This retrospective study of 298 patients undergoing TKA suggests that LIA is associated with greater early ambulation (longer distance walked on POD1) and improved analgesia compared with low-dose CFNB. The addition of ACB was associated with further increases in early ambulation, a more rapid transition to use of a standard low walker, and a higher incidence of discharge to home. Further prospective comparative studies are warranted to better define the role of these new analgesic modalities, especially in the setting of spinal anesthesia and intrathecal morphine.

Nottingham University Hospitals NHS
NHS Trust

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Nottingham University Hospitals NHS

NUH LOWER LIMB ERAS[1] ANALGESIA GUIDELINE

Better for you
caring • safe • thoughtful

	Total Hip/Knee Replacement	Notes
***pre**operative:*	Consider Paracetamol NSAID [2] Zomorph™ [3] 10mg or 20mg	**Check when patient last took analgesia** **Do not use NSAIDS if GFR < 60**
***peri**operative:*	Spinal anaesthesia, +/- intrathecal diamorphine [4] Encourage surgical peri-articular local anaesthetic infiltration (LAI) or, in selected patients, use nerve block(s) **Use Ropivacaine 0.2% for LAI in weight - related volume** Consider tranexamic acid 10mg/kg (max 1g) at induction and at release of tourniquet / end of surgery	**All patients with intra-thecal opoids must have a urinary catheter** **Use low concentration LA in nerve blocks. Modify LAI if using nerve blocks (Be aware maximum safe dose LA)** **Tranexamic acid- caution in patients at risk of thromboses, DIC, seizures**
***post**operative analgesia:*	Paracetamol 1g qds po/IV Use NSAID unless contraindicated / GFR <60 Zomorph™ (10-20mg)or Longtec ™ (5-10mg) 12 hourly **Three post-op doses initially**[5] If no opoid in spinal / preoperatively, prescribe Zomorph™ / Longtec ™ for Recovery. Oramorph™ (10-20mg) / Shortec ™ (5-10mg) 2 hourly prn Consider Gabapentin [6]	**IV paracetamol: <50kg 15mg/kg qds >50kg with risk factors for liver damage 1g tds** **Limit Zomorph™ / Longtec ™ doses by crossing off further doses on chart** **If recovery room dose of opoid after 12pm, prescribe half usual dose OR prescribe short acting opoid (on front of chart) to allow full dose later that evening** **Nurses to ensure patients receive long-acting opoid at prescribed timing points**

RCS
ADVANCING SURGICAL STANDARDS

LOWER LIMB

Ann R Coll Surg Engl 2014; **96:** 302–306
doi 10.1308/003588414X13946184900525

Postoperative pain following primary lower limb arthroplasty and enhanced recovery pathway

KP Robinson, KJ Wagstaff, S Sanghera, RM Kerry

Sheffield Teaching Hospitals NHS Foundation Trust, UK

ABSTRACT

INTRODUCTION Enhanced recovery is a concept that has become increasingly popular for arthroplasty surgery over the last ten years. This study was designed to assess the analgesia requirements, pain levels and time to discharge for patients having primary arthroplasty in the enhanced recovery pathway.

METHODS A multidisciplinary prospective cohort study was carried out between January 2012 and March 2012. Data were collected for patients undergoing primary arthroplasty in one hospital during this time. Details of anaesthesia, local infiltration, additional medications and analgesia were recorded. A visual analogue scale pain score was obtained from each patient at time of mobilisation on days 0, 1, 2 and 3 postoperatively.

RESULTS Ninety-six patients were included in the study. Of these, 34 underwent total hip arthroplasty and 62 total knee arthroplasty (TKA). Pain was the greatest contributor for delayed discharge in TKA patients. The patients who had TKA and did not receive non-steroidal anti-inflammatory drugs (NSAIDs) had significantly higher pain scores (day 0, $p<0.01$; day 1, $p<0.001$; day 2, $p<0.01$) and significantly increased opiate demands compared with those patients who did receive NSAIDs.

CONCLUSIONS There are unacceptably high pain scores in patients undergoing TKA without the use of NSAIDs. There should be focused intervention with this group of patients to improve their pain scores and reduce their length of stay.

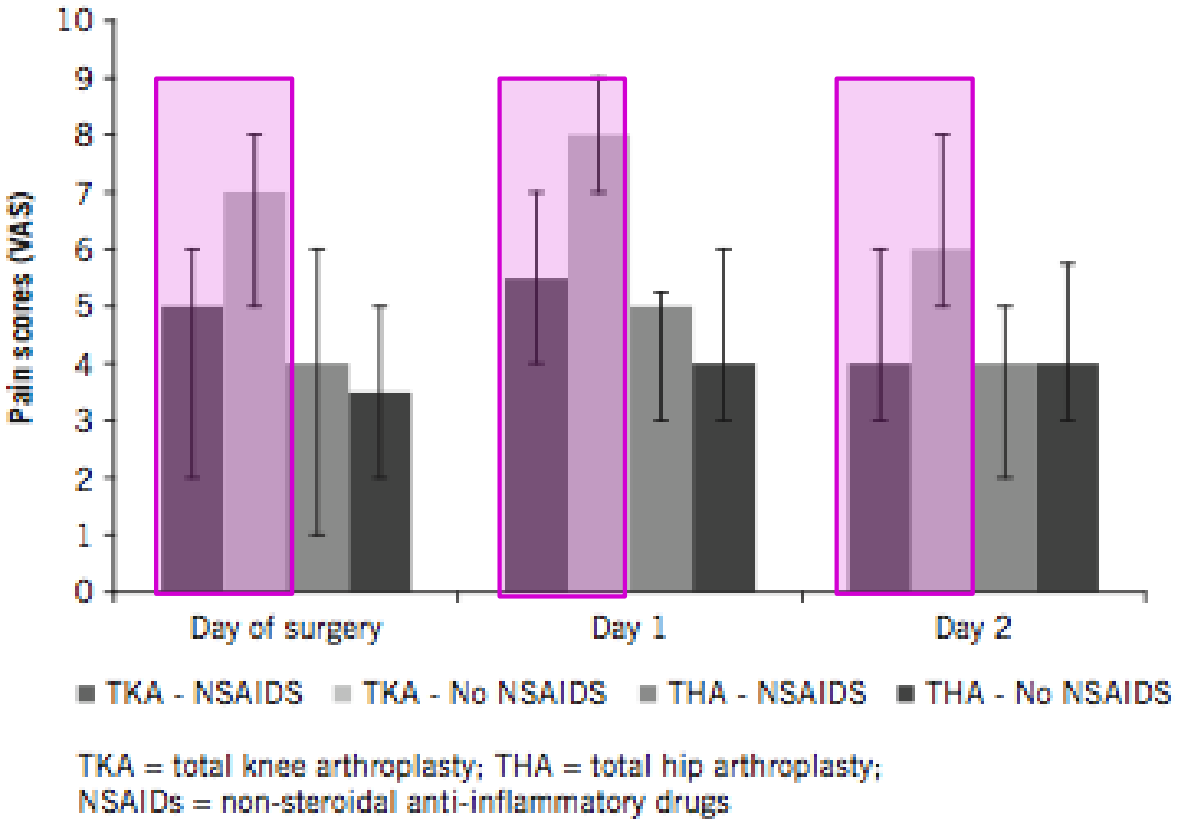


Figure 1 Median postoperative visual analogue scale pain scores for primary arthroplasty patients.

Perioperative Celecoxib Administration for Pain Management After Total Knee Arthroplasty – A Randomized, Controlled Study

Yu-Min Huang[1]*, Chiu-Meng Wang[2]*, Chen-Ti Wang[1], Wei-Peng Lin[3],
Lih-Ching Horng[4], Ching-Chuan Jiang[1§]

Results

Groups were comparable for age, pre-operative ROM, operation duration and intraoperative blood loss. Resting VAS pain scores improved significantly in the celecoxib group, compared with controls, at 48 hrs (2.13 ± 1.68 vs. 3.43 ± 1.50, p=0.03) and 72 hrs (1.78 ± 1.66 vs. 3.17 ± 2.01, p=0.02) after surgery. Active ROM also increased significantly in the patients that received celecoxib, especially in the first 72 hrs [40.8° ± 17.3° vs. 25.8° ± 11.5°, p=0.01 (day 1); 60.7° ± 18.1° vs. 45.0° ± 17.3°, p=0.004 (day 2); 77.7° ± 15.1° vs. 64.3° ± 16.9°, p=0.004 (day 3)]. Opioid requirements decreased about 40% (p=0.03) in the celecoxib group. Although patients suffering from post-operative nausea/vomiting decreased from 43% in control group

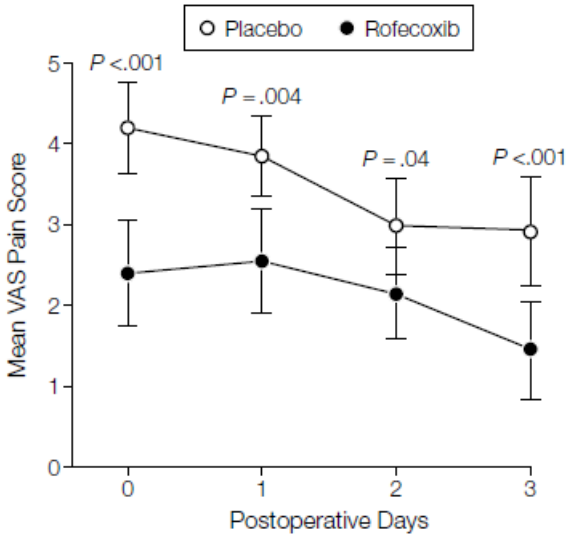
Effects of Perioperative Administration of a Selective Cyclooxygenase 2 Inhibitor on Pain Management and Recovery of Function After Knee Replacement

A Randomized Controlled Trial

JAMA. 2003;290:2411-2418

Conclusion Perioperative use of an inhibitor of cyclooxygenase 2 is an effective component of multimodal analgesia that reduces opioid consumption, pain, vomiting, and sleep disturbance, with improved knee range of motion after TKA.

Figure 3. Postoperative Pain Score During Hospitalization After Total Knee Arthroplasty



VAS indicates visual analog scale (0-10). Error bars indicate SD.

Nottingham University Hospitals NHS
NHS Trust

Acute Kidney Injury:

An Audit of Lower Limb Arthroplasty Patients

S Chillistone, R Phillips, A Carney

Nottingham University Hospitals NHS Trust

BACKGROUND

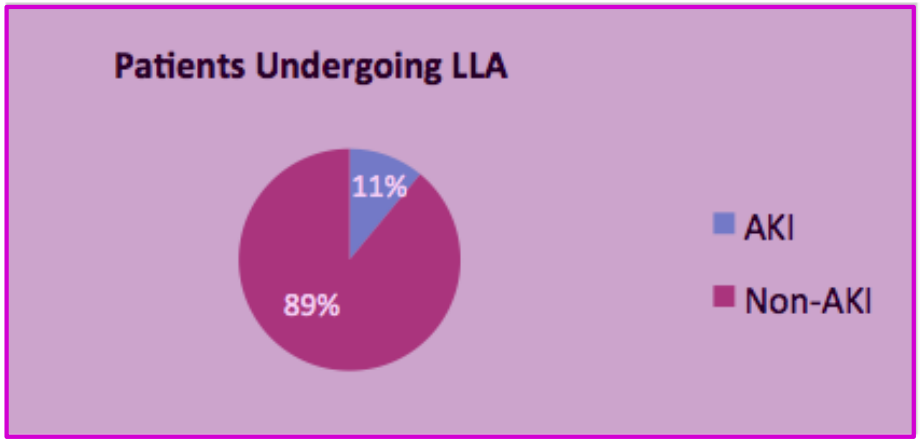
Enhanced recovery (ERAS) programmes improve patient safety, reduce length of stay and save money.[1] Many ERAS protocols for lower limb arthroplasty (LLA) include non-steroidal anti-inflammatory drugs (NSAIDS).[2] Recently, the National Institute for Health and Care Excellence (NICE) highlighted NSAIDS as a risk factor for Acute Kidney Injury (AKI).[3] AKI is defined as rise in creatinine of ≥26 micromol/L over 48 hours, and is seen in 13-18% of all people admitted to hospital. This audit sought to establish the incidence of AKI in our patients undergoing LLA, all of whom are prescribed Celecoxib as part of our ERAS protocol.

METHODS

We reviewed the pre- and post operative renal function of LLA patients operated on over a one year period, all of whom received Celecoxib post operatively.

RESULTS

- We identified 202 patients over the study period.
- 23 (11%) had a post operative creatinine rise of ≥26micromol/L (Median rise 51, range 26-239).



Nottingham University Hospitals NHS
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B.S.O.A
British Society of Orthopaedic Anaesthetists

neos
Nottingham Elective Orthopaedic Services

- This AKI group had a higher pre-operative mean creatinine of 97micromol/L, vs 85 micromol/L in the non-AKI group (P=0.004).
- The AKI group had a lower pre-operative mean GFR of 61ml/min/1.73m^2 vs 69ml/min/1.73m^2 in the non-AKI group (P=0.002).
- 17 of the 23 patients developing AKI had one or more pre-operative risk factors of age ≥65 years or GFR <60ml/min/1.73m^2.
- 51 patients had a pre-operative GFR <60ml/min/1.73m^2. 11 (22%) of those developed AKI compared to 12 (8%) of those with a GFR ≥60ml/min/1.73m^2 (P<0.01).
- 113 patients were aged ≥65 years. 15 (13%) of those developed AKI compared to 8 (9%) of those <65 years. This association, however, was not significant (P>0.20).

Figure 1. Proportion of patients undergoing LLA who developed AKI

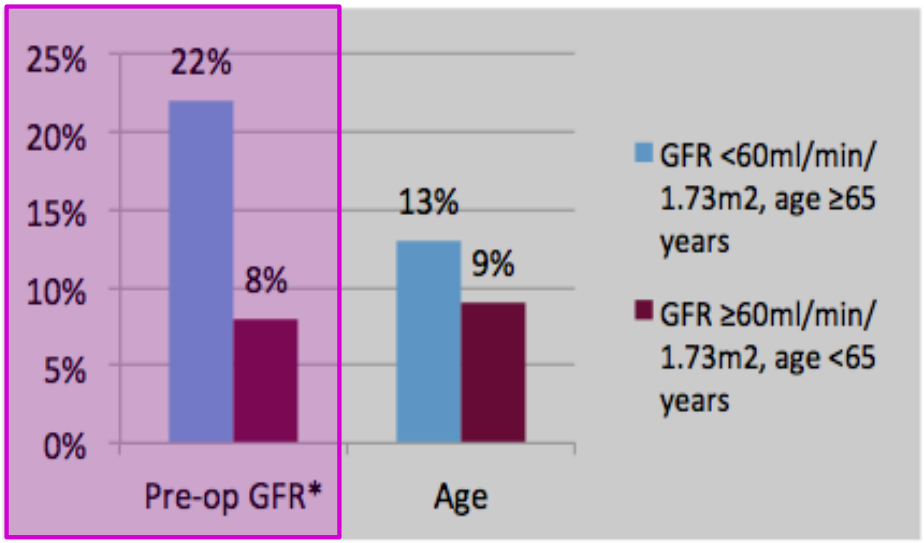

Figure 2. Percentage of patients developing AKI, stratified by pre-operative GFR and age
*Significant association (P<0.01)

DISCUSSION

The incidence of AKI in elective patients undergoing LLA on the ERAS pathway at our Centre is 11%. A pre-operative GFR of <60ml/min/1.73m^2 was significantly associated with development of AKI. All patients currently receive Celecoxib. It is likely that this may increase the incidence of AKI in this high risk group. We will now modify our ERAS based Celecoxib presription accordingly and re-audit.

Anesthesiology. 2011 Sep;115(3):575-88. doi: 10.1097/ALN.0b013e31822a24c2.

Perioperative single dose systemic dexamethasone for postoperative pain: a meta-analysis of randomized controlled trials.

De Oliveira GS Jr[1], Almeida MD, Benzon HT, McCarthy RJ.

Author information

Abstract

BACKGROUND: Dexamethasone is frequently administered in the perioperative period to reduce postoperative nausea and vomiting. In contrast, the analgesic effects of dexamethasone are not well defined. The authors performed a meta-analysis to evaluate the dose-dependent analgesic effects of perioperative dexamethasone.

METHODS: We followed the PRISMA statement guidelines. A wide search was performed to identify randomized controlled trials that evaluated the effects of a single dose systemic dexamethasone on postoperative pain and opioid consumption. Meta-analysis was performed using a random-effect model. Effects of dexamethasone dose were evaluated by pooling studies into three dosage groups: low (less than 0.1 mg/kg), intermediate (0.11-0.2 mg/kg) and high (≥ 0.21 mg/kg).

RESULTS: Twenty-four randomized clinical trials with 2,751 subjects were included. The mean (95% CI) combined effects favored dexamethasone over placebo for pain at rest (≤ 4 h, -0.32 [0.47 to -0.18], 24 h, -0.49 [-0.67 to -0.31]) and with movement (≤ 4 h, -0.64 [-0.86 to -0.41], 24 h, -0.47 [-0.71 to -0.24]). Opioid consumption was decreased to a similar extent with moderate -0.82 (-1.30 to -0.42) and high -0.85 (-1.24 to -0.46) dexamethasone, but not decreased with low-dose dexamethasone -0.18 (-0.39-0.03). No increase in analgesic effectiveness or reduction in opioid use could be demonstrated between the high- and intermediate-dose dexamethasone. Preoperative administration of dexamethasone appears to produce a more consistent analgesic effect compared with intraoperative administration.

CONCLUSION: Dexamethasone at doses more than 0.1 mg/kg is an effective adjunct in multimodal strategies to reduce postoperative pain and opioid consumption after surgery. The preoperative administration of the drug produces less variation of effects on pain outcomes.

British Journal of Anaesthesia **106** (2): 230–8 (2011)
Advance Access publication 3 December 2010 · doi:10.1093/bja/aeq333

BJA

PAIN

Effect of high-dose preoperative methylprednisolone on pain and recovery after total knee arthroplasty: a randomized, placebo-controlled trial

T. H. Lunn[1,2*], B. B. Kristensen[1,2], L. Ø. Andersen[1,2], H. Husted[2,3], K. S. Otte[2,3], L. Gaarn-Larsen[1,2] and H. Kehlet[2,4]

Results. Pain during walking was significantly lower in the MP group up to 32 h after operation. Overall pain and cumulative pain scores (2–48 h) were lower for all pain assessments ($P<0.04$). Consumption of rescue oxycodone was lower from 0 to 24 h ($P=0.02$) and PONV, consumption of ondansetron reduced ($P<0.05$), and CRP concentrations were lower at 24 h ($P<0.000001$). Fatigue throughout the day of surgery was lower ($P=0.02$), but sleep quality was worse on the first night ($P=0.002$). No side-effects or complications were observed in other respects.

Conclusions. MP 125 mg before surgery improves analgesia and immediate recovery after TKA, even when combined with a multimodal analgesic regime. These findings call for further studies on safety aspects.

Editor's key points

- Low-dose steroids reduce PONV and inflammatory responses and may improve analgesia.
- A single preoperative high-dose of methylprednisolone (MP) (125 mg i.v.) reduced pain in the first 2 days after knee replacement.
- PONV, plasma C-reactive protein, and postoperative fatigue were also lower in the first 24 h.
- There were no differences in pain at 30 days after surgery.
- Further studies on the effects of high-dose steroids are required.

J Obstet Gynaecol Res. 2011 Dec;37(12):1807-12. doi: 10.1111/j.1447-0756.2011.01616.x. Epub 2011 Jul 27.

Impact of a single perioperative dose of dexamethasone on the incidence of surgical site infections: a case-control study.

Eberhart LH[1], Holdorf S, Albert US, Kalder M, Kerwat K, Kranke P, Morin AM.

⊕ Author information

Abstract

AIMS: Dexamethasone is recommended in several international guidelines to prevent postoperative nausea and vomiting, a problem especially frequent in gynecological patients. Despite the increasing use of dexamethasone for this indication there are limited data concerning potential harmful effects of corticosteroids in surgical patients, especially the potential negative impact on wound healing and surgical site infection (SSI). This case-control study was conducted to look for potentially harmful effects of a single perioperative dose of dexamethasone with respect to the occurrence of SSI in gynecological and obstetric surgery patients.

MATERIALS AND METHODS: We retrospectively analyzed 3449 patients undergoing inpatient gynecological or obstetric surgical procedures for the occurrence of deep SSI requiring surgical intervention or prolonged antibiotic treatment. These case patients were matched to control patients according to the surgeon performing the procedure, the type of surgery, biometric data, and known risk factors for SSI. Furthermore, timely linearity of dexamethasone use and SSI rate was exploratorily analyzed using several auto-regressive, integrated, moving-average models.

RESULTS: Forty patients with deep SSI were matched to 158 controls. The risk profile for wound infections of both groups was comparable. Forty-five percent (95% confidence interval: 29-62%) of the case patients were treated with dexamethasone and 49% (95% confidence interval: 41-57%) of the control group received the drug. An increasing use of dexamethasone over time was not followed by an increased SSI rate. There were no timely correlations between dexamethasone usage and the occurrence of SSI.

CONCLUSION: In this case-control study we could not detect any evidence for an increased risk for SSI after a single-dose of dexamethasone (4-8 mg) in gynecological patients.

British Journal of Anaesthesia **113** (5): 855–64 (2014)
Advance Access publication 30 June 2014 · doi:10.1093/bja/aeu202

BJA

PAIN

Perioperative gabapentin reduces 24 h opioid consumption and improves in-hospital rehabilitation but not post-discharge outcomes after total knee arthroplasty with peripheral nerve block

H. A. Clarke[1,2,4*], J. Katz[1,4,5], C. J. L. McCartney[2,4], P. Stratford[6,7], D. Kennedy[6], M. G. Pagé[5], I. T. Awad[2,4], J. Gollish[3] and J. Kay[8]

Conclusions. In the context of celecoxib, spinal anaesthesia, femoral and sciatic nerve blocks, a dose of gabapentin 600 mg before operation followed by 4 days of gabapentin 200 mg TID decreased postoperative analgesic requirements and improved knee range of motion after TKA. Gabapentin provided no improvement in pain or physical function on POD4 and 6 weeks or 3 months after surgery.

Pregabalin and pain after total knee arthroplasty: a double-blind, randomized, placebo-controlled, multidose trial†

British Journal of Anaesthesia 115 (2): 285–93 (2015)

J. T. YaDeau[1,*], Y. Lin[1], D. J. Mayman[2], E. A. Goytizolo[1], M. M. Alexiades[2], D. E. Padgett[2], R. L. Kahn[1], K. M. Jules-Elysee[1], A. S. Ranawat[2], D. D. Bhagat[1], K. G. Fields[3], A. K. Goon[1], J. Curren[1] and G. H. Westrich[2]

Abstract

Background: Pregabalin may reduce postoperative pain and opioid use. Higher doses may be more effective, but may cause sedation and confusion. This prospective, randomized, blinded, placebo-controlled study tested the hypothesis that pregabalin reduces pain at 2 weeks after total knee arthroplasty, but increases drowsiness and confusion.

Methods: Patients (30 per group) received capsules containing pregabalin (0, 50, 100, or 150 mg); two capsules before surgery, one capsule twice a day until postoperative day (POD) 14, one on POD15, and one on POD16. Multimodal analgesia included femoral nerve block, epidural analgesia, oxycodone–paracetamol, and meloxicam. The primary outcome was pain with flexion (POD14).

Results: Pregabalin did not reduce pain at rest, with ambulation, or with flexion at 2 weeks (P=0.69, 0.23, and 0.90, respectively). Pregabalin increased POD1 drowsiness (34.5, 37.9, 55.2, and 58.6% in the 0, 50, 100, and 150 mg arms, respectively; P=0.030), but did not increase confusion (0, 3.5, 0, and 3.5%, respectively; P=0.75). Pregabalin had no effect on acute or chronic pain, opioid consumption, or analgesic side-effects. Pregabalin reduced POD14 patient satisfaction [1–10 scale, median (first quartile, third quartile): 9 (8, 10), 8 (7, 10), 8 (5, 9), and 8 (6, 9.3), respectively; P=0.023). Protocol compliance was 63% by POD14 (50.0, 70.0, 76.7, and 56.7% compliance, respectively), with no effect of dose on compliance. Per-protocol analysis of compliant patients showed no effect of pregabalin on pain scores.

Conclusions: Pregabalin had no beneficial effects, but increased sedation and decreased patient satisfaction. This study does not support routine perioperative pregabalin for total knee arthroplasty patients.

Pregabalin and pain after total knee arthroplasty: a double-blind, randomized, placebo-controlled, multidose trial†

J. T. YaDeau[1,*], Y. Lin[1], D. J. Mayman[2], E. A. Goytizolo[1], M. M. Alexiades[2], D. E. Padgett[2], R. L. Kahn[1], K. M. Jules-Elysee[1], A. S. Ranawat[2], D. D. Bhagat[1], K. G. Fields[3], A. K. Goon[1], J. Curren[1] and G. H. Westrich[2] *British Journal of Anaesthesia* 115 (2): 285–93 (2015)

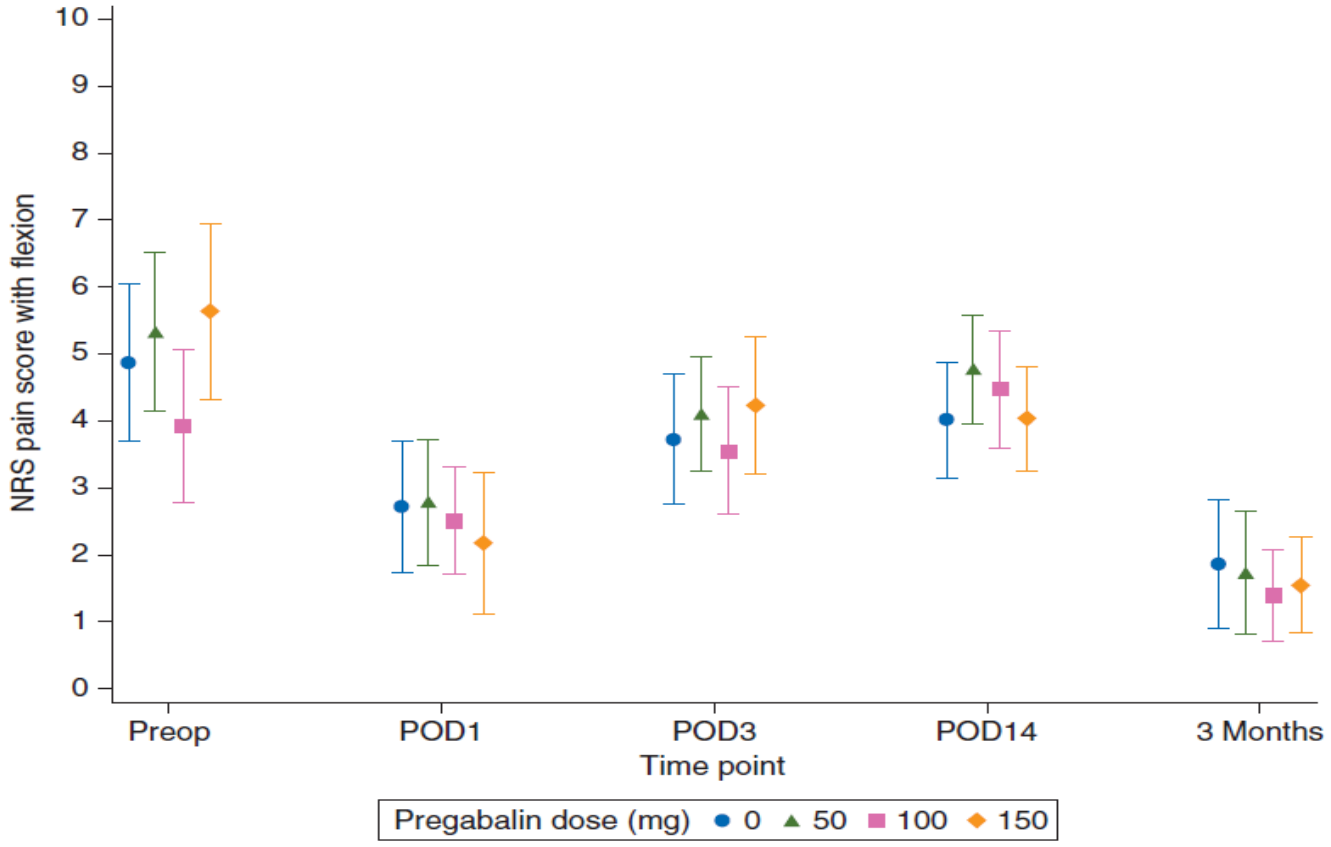

Fig 2 Pain scores with flexion over time. Data are plotted as means with 95% confidence intervals. POD, postoperative day; NRS, Numeric Rating Scale pain score.

CME Perioperative Oral Pregabalin Reduces Chronic Pain After Total Knee Arthroplasty: A Prospective, Randomized, Controlled Trial

METHODS: We performed a randomized, placebo-controlled, double-blind trial of pregabalin (300 mg) administered before TKA and for 14 days after TKA (150–50 mg twice daily). Patients were screened for the presence of neuropathic pain at 3 and 6 mo postoperatively using the Leeds Assessment of Neuropathic Symptoms and Signs scale. Secondary outcomes included postsurgical recovery and rehabilitation measures, including knee range of motion, opioid consumption, postoperative pain scores, sleep disturbance, and time to discharge as well as the occurrence of postoperative systemic complications.

RESULTS: Of the 240 patients randomly assigned to the 2 treatment groups (120 in each), data for the primary outcome were obtained from 113 pregabalin patients and 115 placebo patients. At both 3 and 6 mo postoperatively, the incidence of neuropathic pain was less frequent in the pregabalin group (0%) compared with the placebo group (8.7% and 5.2% at 3 and 6 mo, respectively; $P = 0.001$ and $P = 0.014$). Patients receiving

CONCLUSION: Perioperative pregabalin administration reduces the incidence of chronic neuropathic pain after TKA, with less opioid consumption and better range of motion during the first 30 days of rehabilitation. However, in the doses tested, it is associated with a higher risk of early postoperative sedation and confusion.
(Anesth Analg 2010;110:199–207)

CME Perioperative Oral Pregabalin Reduces Chronic Pain After Total Knee Arthroplasty: A Prospective, Randomized, Controlled Trial

Table 2. Incidence of Adverse Events on Day of Surgery (Day 0), Postoperative Days 1 and 2

	Day 0		Day 1		Day 2	
	Pregabalin $n = 120$	Placebo $n = 120$	Pregabalin $n = 106$	Placebo $n = 110$	Pregabalin $n = 100$	Placebo $n = 106$
Sedation	16 (13%)	4 (3%)	28 (26%)	15 (14%)	15 (15%)	8 (8%)
P		0.005*		0.019*		0.0906
Confusion	6 (5%)	0 (0%)	14 (13%)	4 (4%)	9 (9%)	4 (4%)
P		0.013*		0.011*		0.123
Dizziness	1 (1%)	1 (1%)	18 (17%)	12 (11%)	10 (10%)	8 (8%)
P		1.00		0.197		0.533
Headache	1 (1%)	0 (0%)	3 (3%)	0 (0%)	1 (1%)	0 (0%)
P		0.316		0.076		0.302
Dry mouth	3 (3%)	0 (0%)	7 (7%)	1 (1%)	5 (5%)	3 (3%)
P		0.081		0.027*		0.421
Nausea	9 (8%)	10 (8%)	13 (12%)	16 (15%)	6 (6%)	8 (8%)
P		0.811		0.642		0.659
Vomiting	3 (3%)	3 (3%)	4 (4%)	6 (6%)	1 (1%)	3 (3%)
P		1.00		0.479		0.341
Pruritus	1 (1%)	6 (5%)	4 (4%)	8 (7%)	1 (1%)	3 (3%)
P		0.055		0.262		0.341
Peripheral edema	0 (0%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)	0 (0%)
P		1.00		0.316		1.00
Diplopia	1 (1%)	0 (0%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)
P		0.316		0.323		1.00

* There was a statistically significant difference ($P < 0.05$) between groups.

International Journal of Surgery 34 (2016) 148–160

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Review

The effect of pregabalin on acute postoperative pain in patients undergoing total knee arthroplasty: A meta-analysis

Jian Dong [a], Wenmin Li [b], Yuling Wang [c, *]

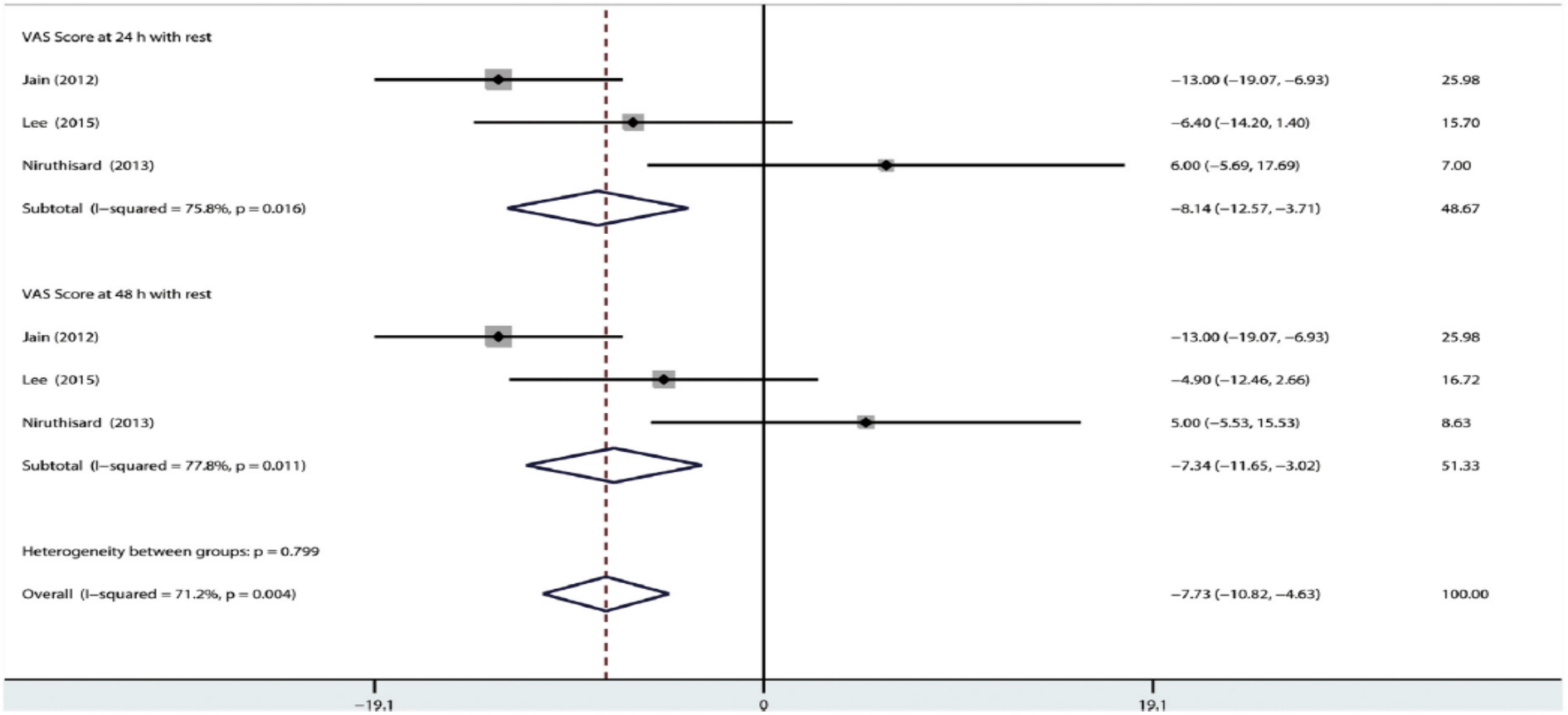

Fig. 4. Forest plots comparing VAS at 24 h and 48 h with rest. An Inverse-Variance Fixed-effects model was used. Mean difference with 95% CIs.

International Journal of Surgery 34 (2016) 148–160

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Review

The effect of pregabalin on acute postoperative pain in patients undergoing total knee arthroplasty: A meta-analysis

Jian Dong [a], Wenmin Li [b], Yuling Wang [c, *]

Dose of gabapentin preoperatively	Time to administrated preoperatively	Time to use the pregablin postoperatively
75 mg twice a day	2 h before surgery	150 mg at 6:00 a.m. and 6:00 p.m. on the first and second postoperative days
no dose administrated	no	300 mg 1–2 h before surgery, and 150 mg twice daily on the first 10 postoperative days, 75 mg twice daily on day 11 and 12 and 50 mg twice daily on 13 and day 14
100 mg/200 mg/300 mg	30 min before transfer to the operating room	received one capsule (50, 100, 150 mg) twice a day until POD14 (total daily dose of 100, 200, or 300 mg pregabalin), then one capsule at bedtime on POD15 and POD16
one dose (150 mg or 300 mg) at 12 h and one dose (150 mg or 300 mg)	2 h before surgery	12 h and 2 h before surgery and continued treatment (bid dosing) for 6 weeks post-TKA
150 mg	1 h before starting anesthesia	
150 mg	1 h prior to operation	

International Journal of Surgery 34 (2016) 148–160

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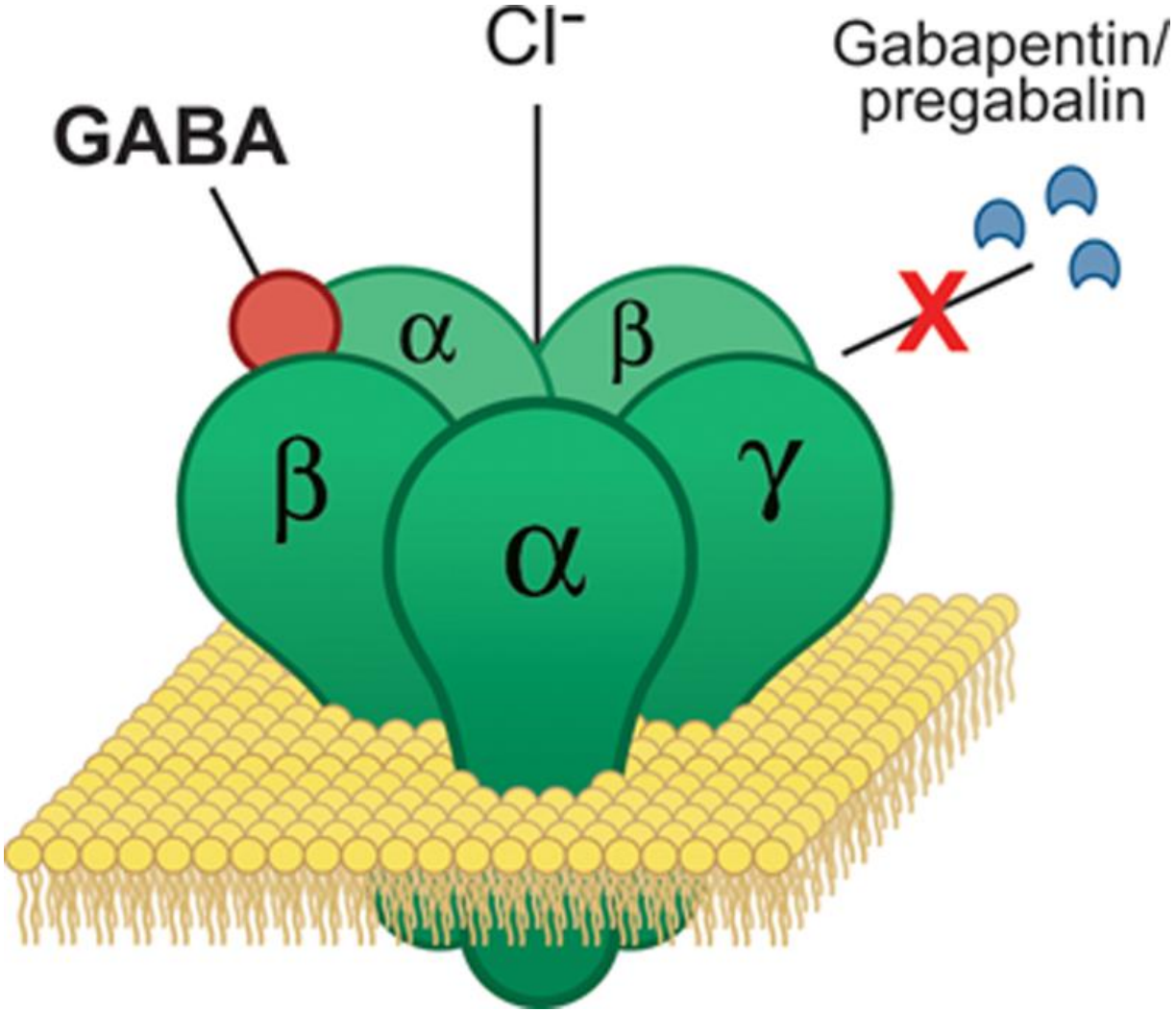
Review

The effect of pregabalin on acute postoperative pain in patients undergoing total knee arthroplasty: A meta-analysis

Jian Dong [a], Wenmin Li [b], Yuling Wang [c, *]

In conclusion, though the number of studies and sample in each paper is limited, this is the first meta-analysis that compared pregabalin with placebo in the management of pain after TKA. Based on the current meta-analysis, pregabalin has an analgesic and opioid-sparing effect in acute postoperative pain management without an increase in the rate of nausea and vomiting. However, the preoperative administration of pregabalin may increase the occurrence of dizziness and sedation. Since the sample and number of the included studies is limited, a multiple centre randomised controlled trial is still needed to identify the effect and the optimal dose of pregabalin in order to reduce the pain after TKA.


Cl⁻
GABA
Gabapentin/
pregabalin
α
β
β
α
γ

Anaesth Intensive Care 2009; **37:** 248-253

Intraoperative ketamine may influence persistent pain following knee arthroplasty under combined general and spinal anaesthesia: a pilot study

S. B. PERRIN*, A. N. PURCELL†

Department of Anaesthesia, Acute Campus, Bendigo Health, Hospital Campus, Bendigo, Victoria, Australia

SUMMARY

We report the findings of a randomised controlled triple-blind pilot study of intraoperative ketamine infusion combined with spinal anaesthesia on the prevalence of persisting post surgical pain following total knee arthroplasty surgery. Twelve patients were randomised to receive either ketamine or placebo in association with spinal anaesthesia for total knee arthroplasty. All patients also received general anaesthesia. More patients were pain-free at six months in the ketamine group (three of five) compared to the control group (two of seven). Perioperative data collected during the study suggested that the addition of intraoperative ketamine might also improve the quality of recovery. Although no statistical analysis was undertaken due to the small numbers, these preliminary findings suggest that the use of intraoperative systemic ketamine in association with spinal anaesthesia for the reduction of persisting post surgical pain deserves further study.

Ketamine

- NMDA blockade
- Analgesia
- Anaesthesia
- Anti-inflammatory
- 0.4mg/kg
  - ↓ PAR
  - ↓ MEP
  - ↓ 30-55% Opioid requirements
- +/- Infusion 60-120 mcg/kg/hr

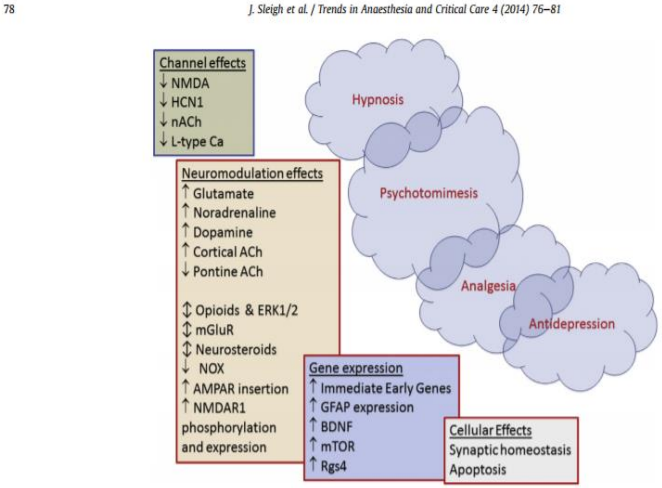


Fig. 1. Summary diagram of the neuropharmacological actions of ketamine, and the resultant clinical effects. The rapid effects and actions are represented at the top left, and the more delayed and prolonged effects and actions represented towards the bottom right. [NMDA = N-methyl-D aspartate, HCN1 = hyperpolarisation-activated cyclic nucleotide channels, ACh = acetyl choline, nACh = nicotinic acetyl-choline receptors, AMPA = α-amino-3-hydroxy-5-methylisoxazole-4-propionic acid, mGluR = metabotropic glutamate receptors, ERK1/2 = extracellular signal-regulated kinases, NOX = NADPH oxidase, BDNF = brain-derived neurotrophic factor, mTOR = mammalian target of rapamycin, Rgs4 = regulator of G protein signalling 4, L-type Ca2 = L-type calcium channels, GFAP = glial fibrillary acidic protein].


Ketamine
$C_{13}H_{16}ClNO$
Cl
O
NH

Original Article

Knee Surg Relat Res 2014;26(4):207-213
http://dx.doi.org/10.5792/ksrr.2014.26.4.207
pISSN 2234-0726 · eISSN 2234-2451

KSRR
Knee Surgery & Related Research

Effects of Tourniquet Use on Quadriceps Function and Pain in Total Knee Arthroplasty

David Liu, FRACS[1], David Graham, MBBS[2], Kim Gillies, M Hlth.Sc[3], and R. Mark Gillies, PhD[4]

[1]Gold Coast Centre for Bone and Joint Surgery, John Flynn Private Hospital, Gold Coast; [2]Department of Orthopedic Surgery, Gold Coast and Robina Hospitals, Gold Coast; [3]Clinical Data Solutions, Sydney; [4]University of Sydney, Kolling Institute, Murray Maxwell Biomechanics Laboratory, Royal North Shore Hospital, Sydney, Australia

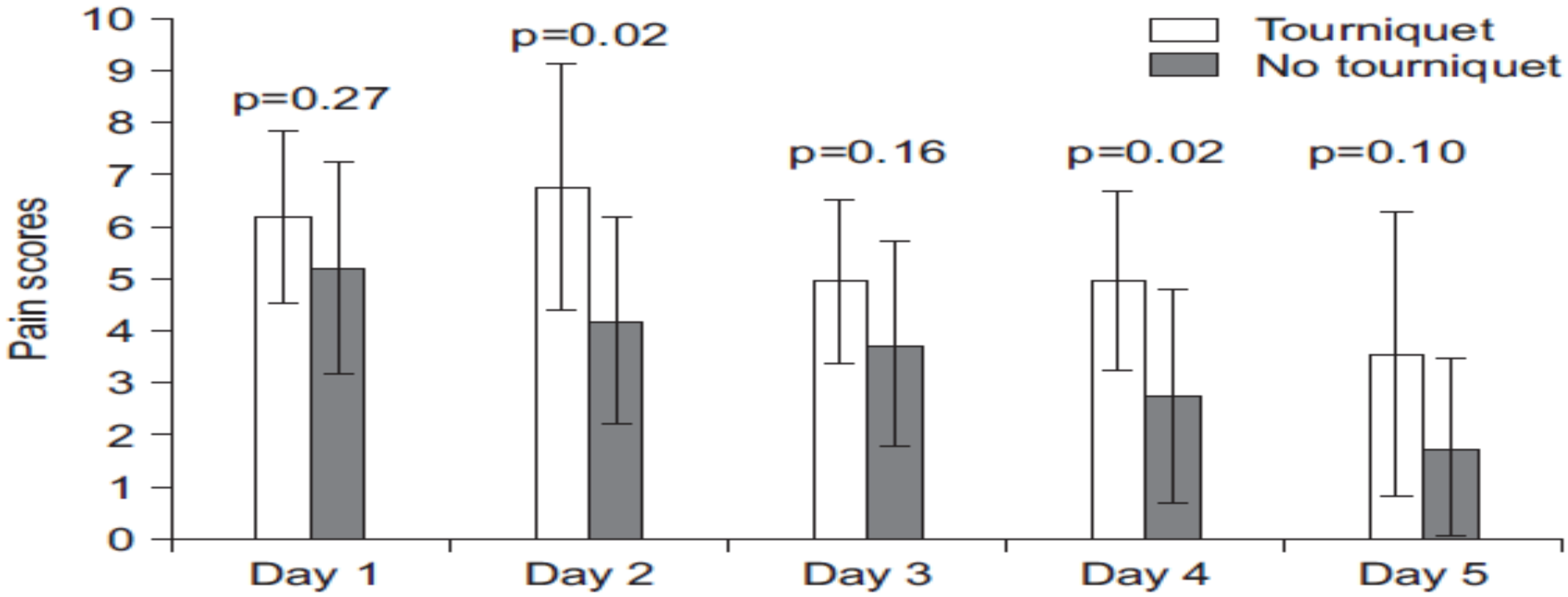


Fig. 2. Average pain scores for the first 5 days post-operatively in the tourniquet and no tourniquet groups.

Original Article

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Table 2. Inpatient Outcomes for the Tourniquet and No Tourniquet Patient Groups

Parameter	Tourniquet	No tourniquet	p-value
Total drainage post-operatively (mL)	457.1	436.2	0.670
Transfusion requirements	3 patients	0 patients	0.050
Morphine equivalents using patient controlled analgesia (mL)	870	914	0.815
Days to discharge	7.3	5.3	0.230

Faster recovery without the use of a tourniquet in total knee arthroplasty

A randomized study of 70 patients

Ashir Ejaz[1,2,3], Anders C Laursen[1,2,3], Andreas Kappel[1], Mogens B Laursen[1,2,3], Thomas Jakobsen[1,3], Sten Rasmussen[1,2,3], and Poul Torben Nielsen[1]

[1]Department of Orthopedic Surgery and [2]Orthopedic Surgery Research Unit, Aalborg University Hospital; [3]Department of Clinical Medicine, Aalborg University, Aalborg, Denmark.
Correspondence: asej@rn.dk
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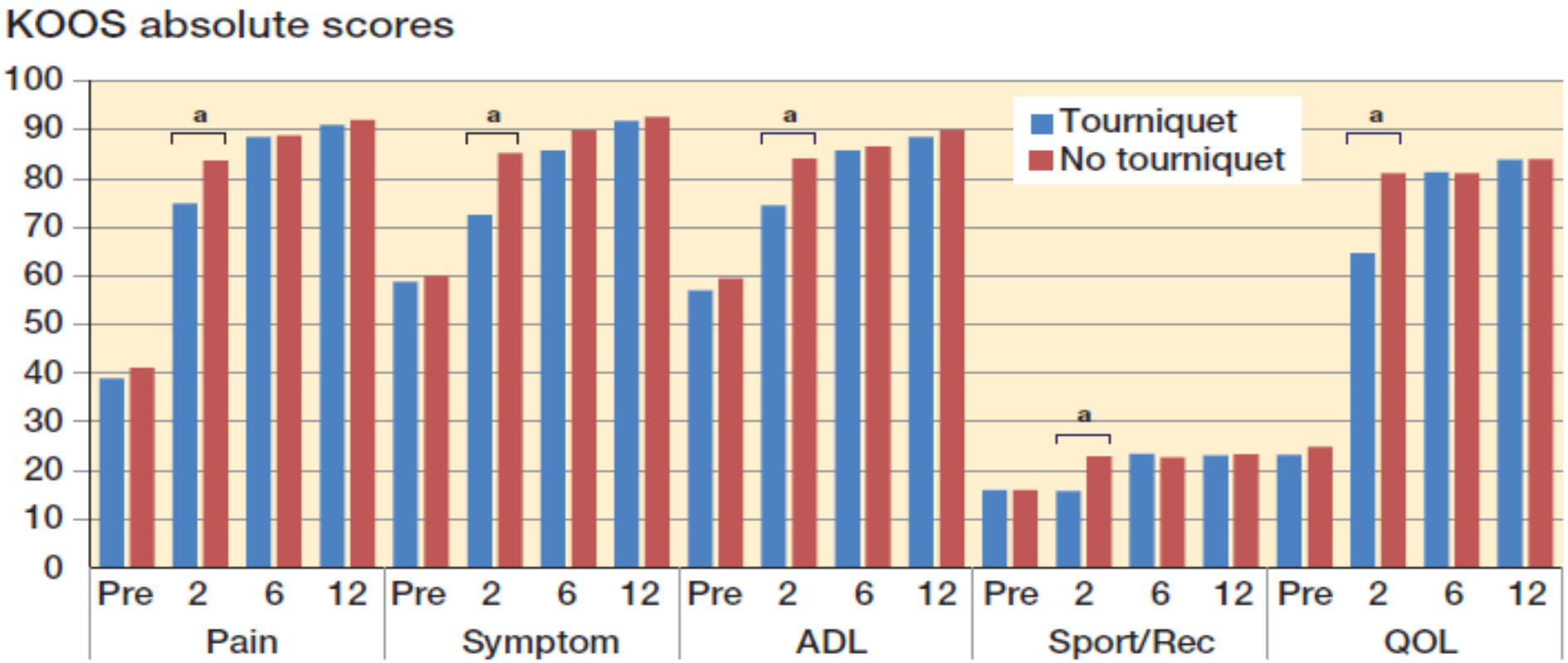


250
60

NUH LOWER LIMB ERAS[1] ANALGESIA GUIDELINE

Better for you
caring • safe • thoughtful

	Total Hip/Knee Replacement	Notes
***pre**operative:*	Consider Paracetamol NSAID [2] Zomorph™ [3] 10mg or 20mg	**Check when patient last took analgesia** **Do not use NSAIDS if GFR < 60**
***peri**operative:*	Spinal anaesthesia, +/- intrathecal diamorphine [4] Encourage surgical peri-articular local anaesthetic infiltration (LAI) or, in selected patients, use nerve block(s) **Use Ropivacaine 0.2% for LAI in weight - related volume** Consider tranexamic acid 10mg/kg (max 1g) at induction and at release of tourniquet / end of surgery	**All patients with intra-thecal opoids must have a urinary catheter** **Use low concentration LA in nerve blocks. Modify LAI if using nerve blocks (Be aware maximum safe dose LA)** **Tranexamic acid- caution in patients at risk of thromboses, DIC, seizures**
***post**operative analgesia:*	Paracetamol 1g qds po/IV Use NSAID unless contraindicated / GFR <60 Zomorph™ (10-20mg)or Longtec ™ (5-10mg) 12 hourly **Three post-op doses initially**[5] If no opoid in spinal / preoperatively, prescribe Zomorph™ / Longtec ™ for Recovery. Oramorph™ (10-20mg) / Shortec ™ (5-10mg) 2 hourly prn Consider Gabapentin [6]	**IV paracetamol: <50kg 15mg/kg qds >50kg with risk factors for liver damage 1g tds** **Limit Zomorph™ / Longtec ™ doses by crossing off further doses on chart** **If recovery room dose of opoid after 12pm, prescribe half usual dose OR prescribe short acting opoid (on front of chart) to allow full dose later that evening** **Nurses to ensure patients receive long-acting opoid at prescribed timing points**

This is The Line

The Line between winning and losing

Between failure and success

Between good and great

Between dreaming and believing

Between convention and innovation

Between head and heart

It's a fine line

It challenges everything we do

And we ride it every day

"WE ARE ALWAYS STRIVING FOR IMPROVEMENT, FOR THOSE 1% GAINS, IN ABSOLUTELY EVERY SINGLE THING WE DO."

Dave Brailsford

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