UNIL | Université de Lausanne
Faculté de biologie et de médecine

CHUV

CAN YOU DO REGIONAL BLOCKS IN THE DIABETIC PATIENT ?

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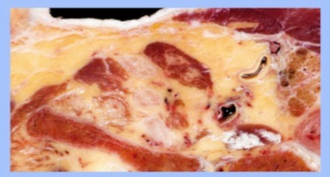
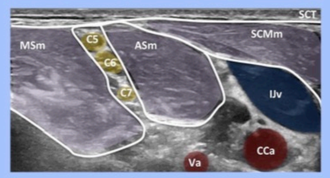
COMPETING INTERESTS

- Board Member, ESRA
- Member of the PROSPECT working group
- Associate Editor I ANAESTHESIA I REGIONAL ANESTHESIA & PAIN MEDICINE
- Recipient of a grant from the Swiss National Science Foundation
- Honorarium for lectures & consultancy in the last 5 years:
    - None

THE BOOK OF

ULTRASOUND-GUIDED REGIONAL ANESTHESIA



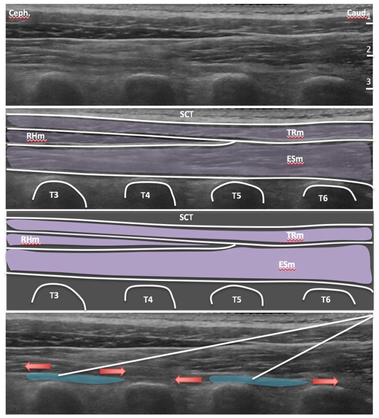


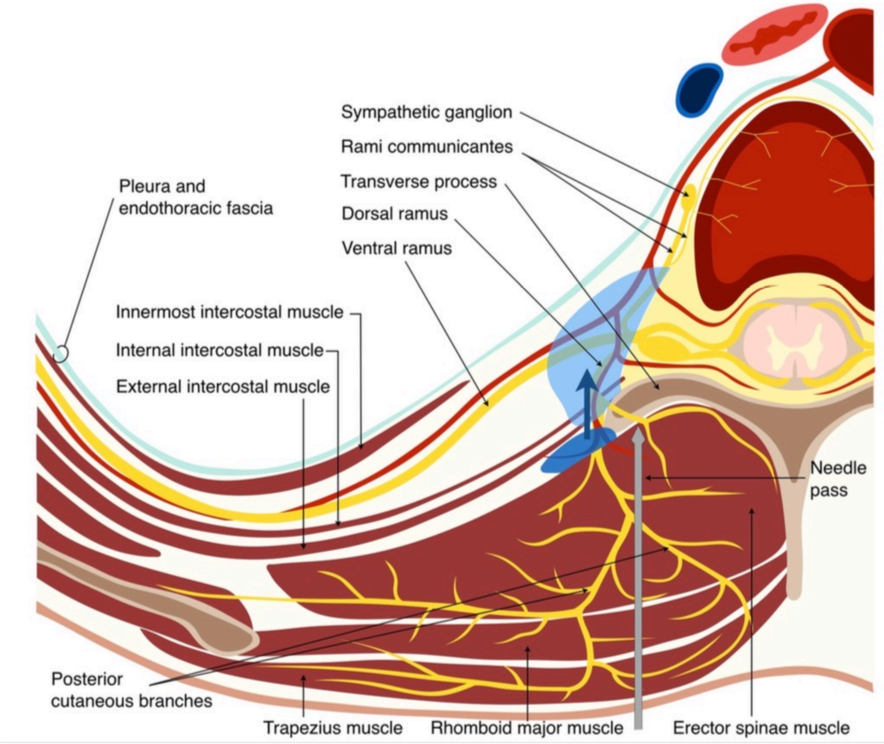
- More than 40 procedures described
- Chronic pain medicine blocks included
- Anatomic reminders
- Clinical tips and tricks
- Literature review

Éric Albrecht

Sébastien Bloc - Hughes Cadas - Sina Grape

& Kyle Robert Kirkham





19.00 EUROS

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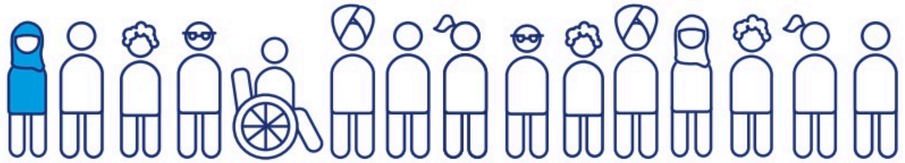
Available at amazon

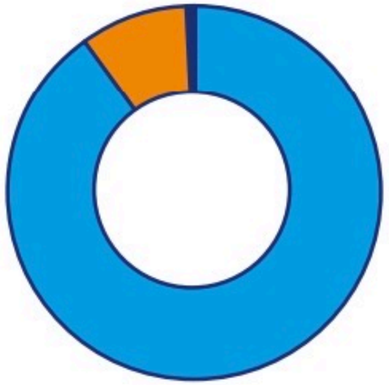
GET IT ON Google Play

EPIDEMIOLOGY

4.7 million
people in the UK
have diabetes.



One in 15 people have diabetes in the UK.



About **90%** of people with diabetes have **Type 2.**

About **8%** of people with diabetes have **Type 1.**

About **2%** of people have **rarer types** of diabetes.

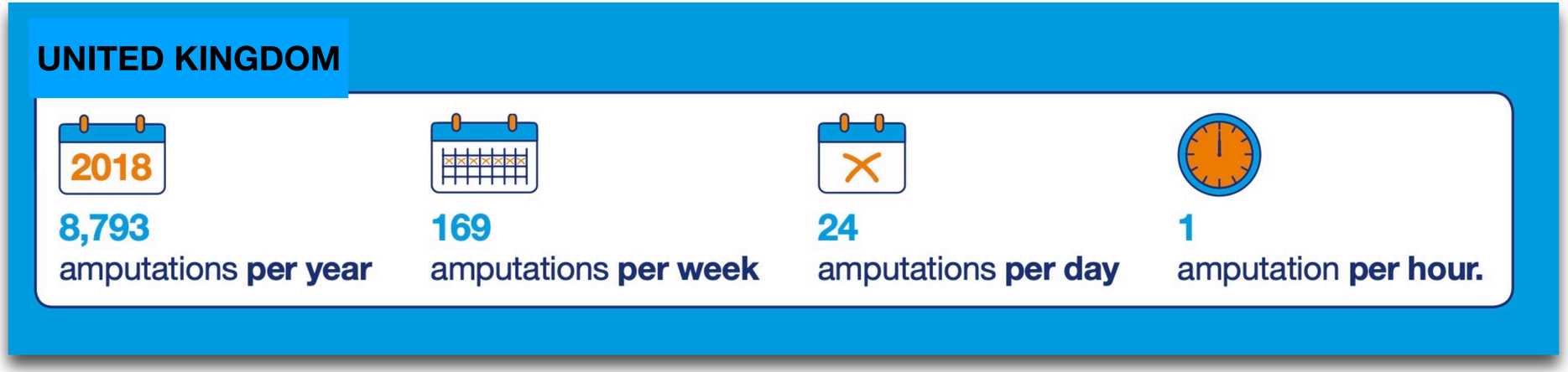
Obesity is responsible for
80 to 85%
of someone's risk of developing Type 2 diabetes.

The number of people diagnosed with diabetes has
more than doubled in 20 years.

https://www.diabetes.org. uk
https://www.diabetesschweiz.ch

EPIDEMIOLOGY

- Prevalence of neuropathy: up to 30%
- Foot ulceration: 8%
- Amputation: 2%



Around half
of all people who experience a major amputation will die within two years.

- Life expectancy reduced by
  - 20 years in type-1 diabetes
  - 10 years in type-2 diabetes

https://www.diabetes.org. uk

PATHOPHYSIOLOGY OF DIABETIC POLYNEUROPATHY

- Early symptoms: numbness, pain, and autonomic dysfunction
- Damage to small nerve fibers before damage to large fibers
- Histologic abnormalities in neural blood vessels => multifocal fiber loss
- Axonal degeneration (most prominent feature) due to reduced delivery of nutrients and oxygen
- Proposed mechanisms include:
    - Sorbitol deposition in the nerve because of glucose accumulation
    - Local tissue ischemia secondary to endoneurial hypoxia
    - Abnormal tissue repair mechanisms caused by excess glucose
    - Mitochondrial dysfunction within the dorsal root ganglia

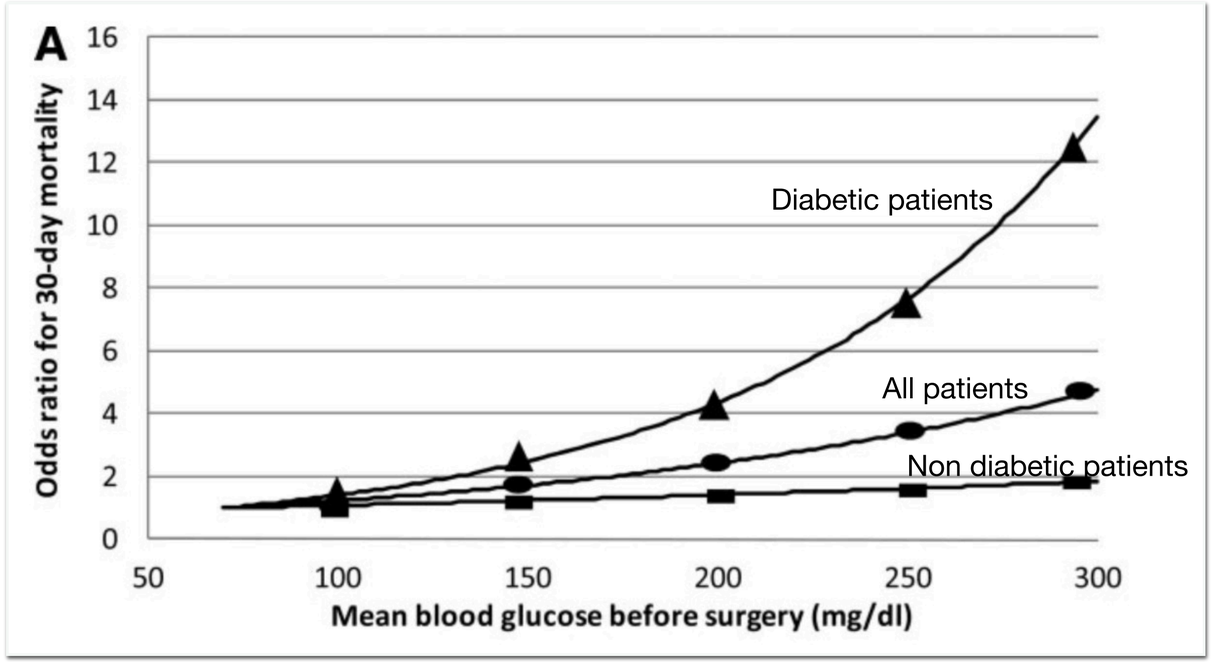
Kopp et al, Reg Anesth Pain Med, 2015

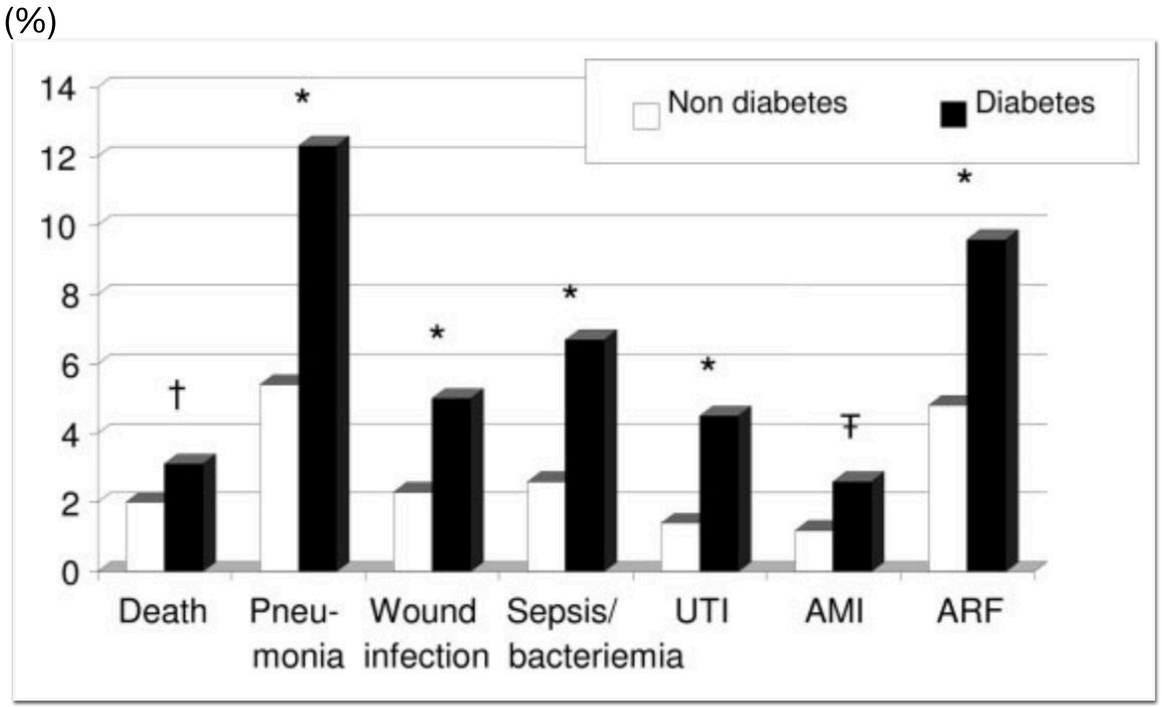
Prevalence and Clinical Outcome of Hyperglycemia in the Perioperative Period in Noncardiac Surgery

ANNA FRISCH, PHD, MD[1]
PRAKASH CHANDRA, MD, MS[1]
DAWN SMILEY, MD[1]
LIMIN PENG, PHD[2]
MONICA RIZZO, MD[3]
CHELSEA GATCLIFFE, BS[1]
MEGAN HUDSON, BS[1]
JOSE MENDOZA, BS[1]
RACHEL JOHNSON, BS[1]
ERICA LIN, BS[1]
GUILLERMO E. UMPIERREZ, MD[1]

Diabetes Care **33:1783–1788, 2010**

- Observational study
- 3,184 consecutive noncardiac surgery patients
- **Overall 30-day mortality : 2.3%**





Surg Endosc (2013) 27:1772–1777
DOI 10.1007/s00464-012-2678-5

Perioperative risk factors for 30-day mortality after bariatric surgery: is functional status important?

Muhammad Asad Khan · Roman Grinberg ·
Stelin Johnson · John N. Afthinos · Karen E. Gibbs

- Retrospective study
- 44,400 bariatric patients between 2007 and 2009
- Multivariate analysis - risk factor for 30-day mortality
- **Diabetes mellitus : AOR = 2.88, $p < 0.01$**

Anaesthesia 2015, 70, 1427–1440 doi:10.1111/anae.13233

Guidelines

Peri-operative management of the surgical patient with diabetes 2015

Association of Anaesthetists of Great Britain and Ireland

Membership of the Working Party: P. Barker, P. E. Creasey, K. Dhatariya,[1] N. Levy, A. Lipp,[2] M. H. Nathanson (Chair), N. Penfold,[3] B. Watson and T. Woodcock

- Glycated haemoglobin (HbA1c) < 69 mmol/mol (8.5%) within 3 months before surgery
- Day-surgery should be promoted
- Patients with diabetes should be scheduled at the beginning of the list
- 20–50% reduction in insulin daily dose
- Iv insulin infusion in case of poorly controlled diabetes, emergency surgery
- Capillary blood glucose at 6–10 mmol/l
- Check of ketones in blood or urine in case of glycaemia > 12 mmol/l

Anaesthesia 2019 doi:10.1111/anae.14604

Editorial

Peri-operative management of diabetes: the need for a lead

E. Albrecht[1] and **M. D. Wiles**[2]

1 Program Director of Regional Anaesthesia, Department of Anaesthesia, Lausanne University Hospital, Lausanne, Switzerland
2 Consultant, Department of Anaesthetics, Sheffield Teaching Hospitals NHS Foundation Trust, Sheffield, UK

« An alternative strategy to prevent occult intra-operative hypo- and hyperglycaemic episodes, would be to provide regional anaesthesia. »

« Not only does the patient remains conscious and able to manifest any symptoms, but pain will be better controlled without opioid adverse-effects, such as PONV, that may worsen the condition. »

Anaesthesia 2013, 68, 612–620 doi:10.1111/anae.12182

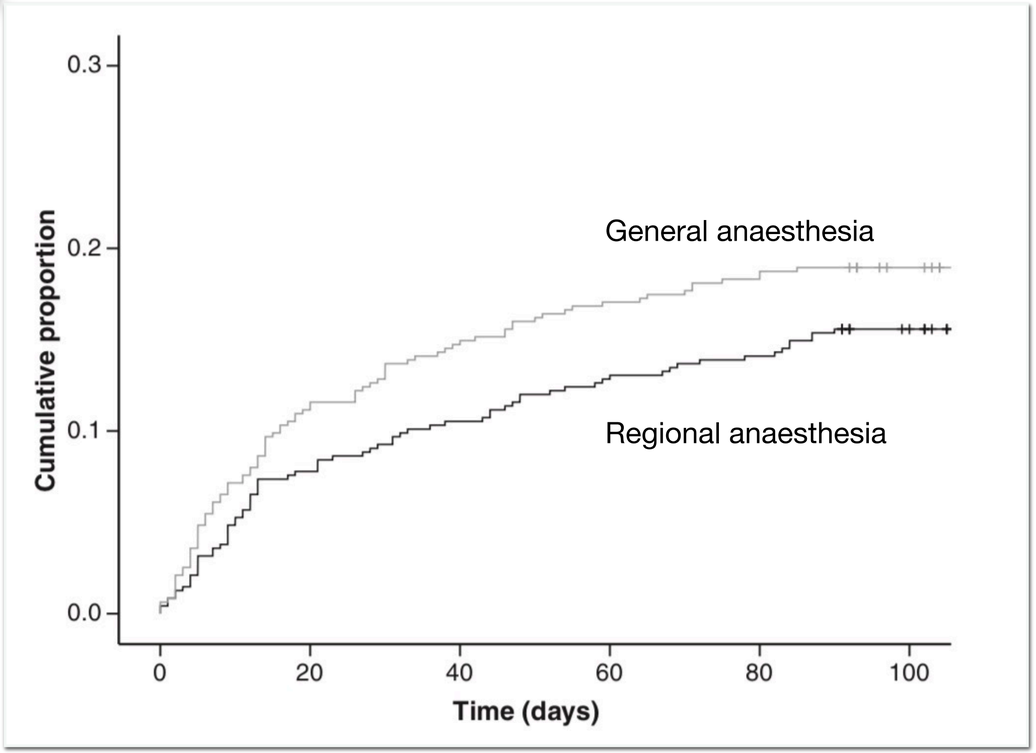
Original Article

Effect of anaesthetic technique on mortality following major lower extremity amputation: a propensity score-matched observational study

S. A. Khan,[1] R. L. Qianyi,[2] C. Liu,[3] E. L. Ng,[4] S. Fook-Chong[5] and M. G. E. Tan[6]

- 1365 diabetic patients
- Major amputation of the lower limb

- 30-day mortality
  - General anaesthesia:13.7%
  - Regional anaesthesia: 9.3%
  - p = 0.04



Neurologic Complications After Neuraxial Anesthesia or Analgesia in Patients with Preexisting Peripheral Sensorimotor Neuropathy or Diabetic Polyneuropathy

James R. Hebl, MD*
Sandra L. Kopp, MD*
Darrell R. Schroeder, MS†
Terese T. Horlocker, MD*

Anesth Analg 2006;103:1294–9

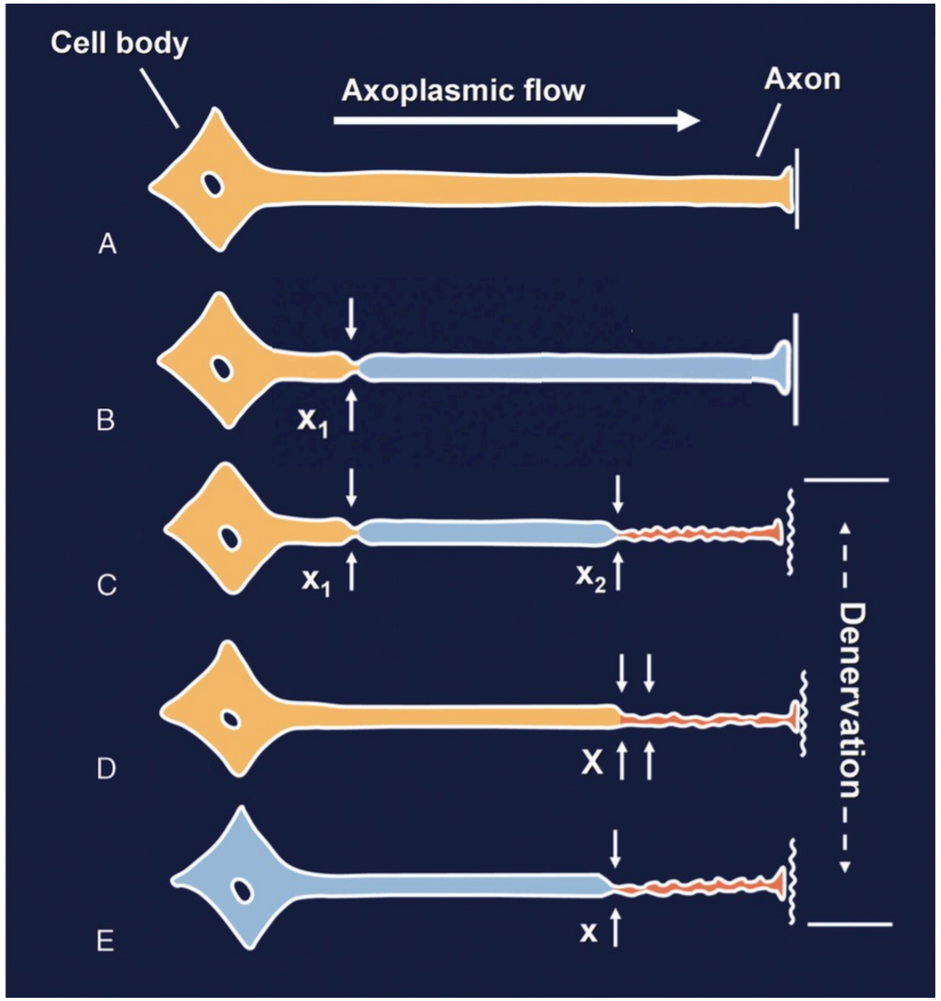
- Retrospective study
- 567 patients with peripheral sensorimotor neuropathy
- Rate of neurologic dysfunction after neuraxial anesthesia: 0.4%

Incidence of nerve injury after regional anaesthesia: 0.04 %

Barrington et al, Reg Anesth Pain Med, 2009

Rohrbaugh et al, Reg Anesth Pain Med, 2013

Double-crush theory



Upton and McComas, Lancet, 1973

British Journal of Anaesthesia **114** (2): 319–26 (2015)
Advance Access publication 21 August 2014 · doi:10.1093/bja/aeu270

BJA

Effects of early and late diabetic neuropathy on sciatic nerve block duration and neurotoxicity in Zucker diabetic fatty rats

P. Lirk[1], C. Verhamme[2], R. Boeckh[3], M. F. Stevens[1], W. ten Hoope[1], P. Gerner[4], S. Blumenthal[5], U. de Girolami[6], I. N. van Schaik[2], M. W. Hollmann[1*] and S. Picardi[1,3]

- Animal study: Zucker diabetic fatty rats
- SNB with lidocaïne 2%, 0.2 ml
- Electrophysiologic & neurohistopathologic studies

Conclusions.

Our results do not support the hypothesis that neuropathy due to type II DM increases the risk of nerve injury after nerve block.

PATIENTS WITH DIABETES

REGIONAL ANAESTHESIA		GENERAL ANAESTHESIA
Theoretical increased risk of nerve injury	vs	Increased rate of 30-day mortality

BLOCK CHARACTERISTICS

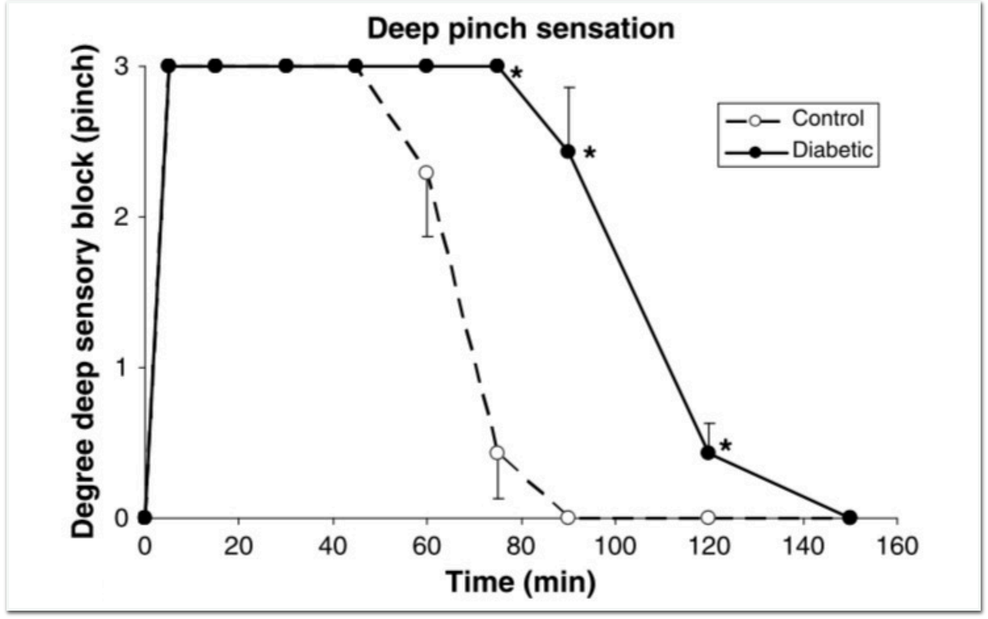
IN DIABETIC PATIENTS ?

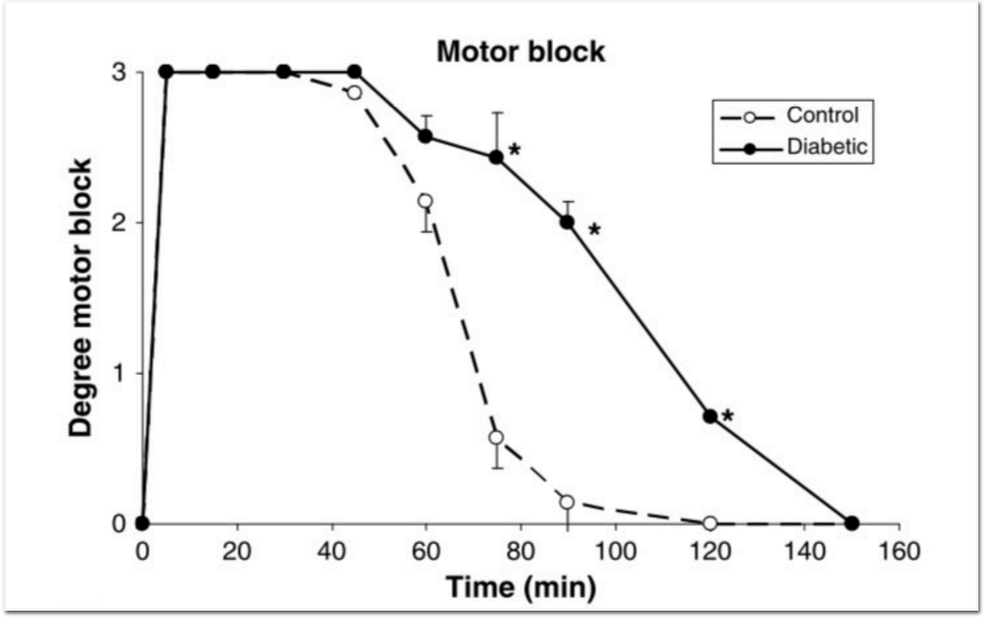
Regional Anesthesia and Pain Medicine • Volume 37, Number 6, November-December 2012

In Zucker Diabetic Fatty Rats, Subclinical Diabetic Neuropathy Increases In Vivo Lidocaine Block Duration But Not In Vitro Neurotoxicity

Philipp Lirk, MD, MSc,† Magdalena Flatz, MD,† Ingrid Haller, MD,† Barbara Hausott, PhD,‡ Stephan Blumenthal, MD,§ Markus F. Stevens, MD,* Suzuko Suzuki, MD,|| Lars Klimaschewski, MD,‡ and Peter Gerner, MD||¶*

- Animal study: Zucker diabetic fatty rats
- SNB with lidocaïne 2%, 0.2 ml
- Sensory and motor block duration





Anaesthesia 2018, 73, 1110-1117 doi:10.1111/anae.14347

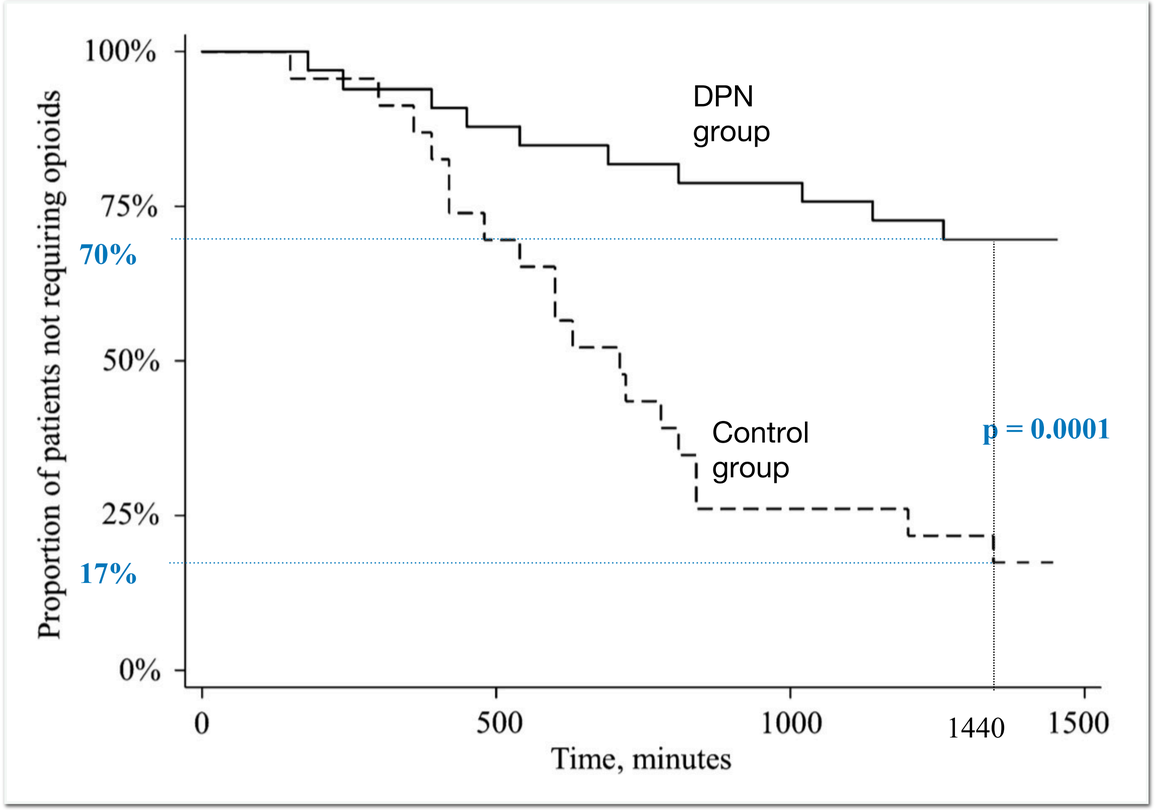
Original Article

Comparison of peripheral nerve blockade characteristics between non-diabetic patients and patients suffering from diabetic neuropathy: a prospective cohort study

M. Baeriswyl,[1] P. Taffé,[2] K. R. Kirkham,[3] I. Bathory,[1] V. Rancati,[1] X. Crevoisier,[4] S. Cherix[5] and E. Albrecht[6]

- Prospective cohort study
- 56 patients with or without diabetic peripheral neuropathy
- Forefoot surgery - popliteal sciatic nerve block

	Control group	DPN group	p
Time to first opioid request	710 (420 - 1200)	1440 (1140 - 1440)	0,0004
Pain score at rest at 24 PO h	3 (0 - 5)	0 (0 - 1)	0,001
Pain score on movement at 24 PO h	5 (0 - 6)	0 (0 - 2)	0,0003
i.v. morphine consumption at 24 PO h	7.5 (2.5 - 12.5)	0.0 (0.0 - 2.5)	0,0002



- Patients with DPN developed a
  - 150% longer time to first opioid request
  - 50% shorter sensory and motor onset time

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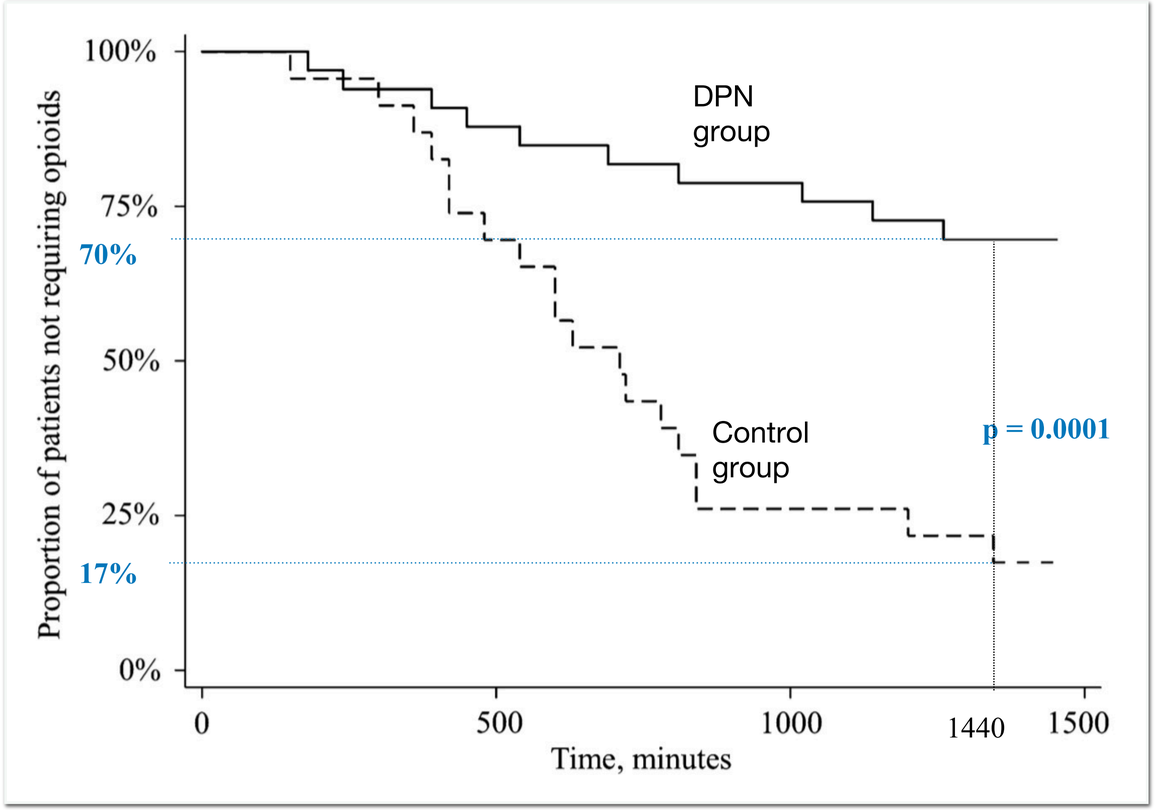
- No worsened neuropathy at 1 and 4 PO weeks.

- **Prolonged block duration [analgesia] secondary to:**
  - **impaired sensation** at the surgical site due to the neuropathy itself
  - **increased neural sensitivity to the local anaesthetics** because of chronic ischemic hypoxia
  - presence of concurrent microangiopathy => decreased perineural blood flow => **delayed local anaesthetic uptake** => exposure to larger concentrations of local anesthetics



DPN & LOCAL ANAESTHETICS

« Eliminating epinephrine additives should also be considered given that diabetic nerves are already at risk of neural ischemia and infarction because of changes within the endoneural microvasculature »

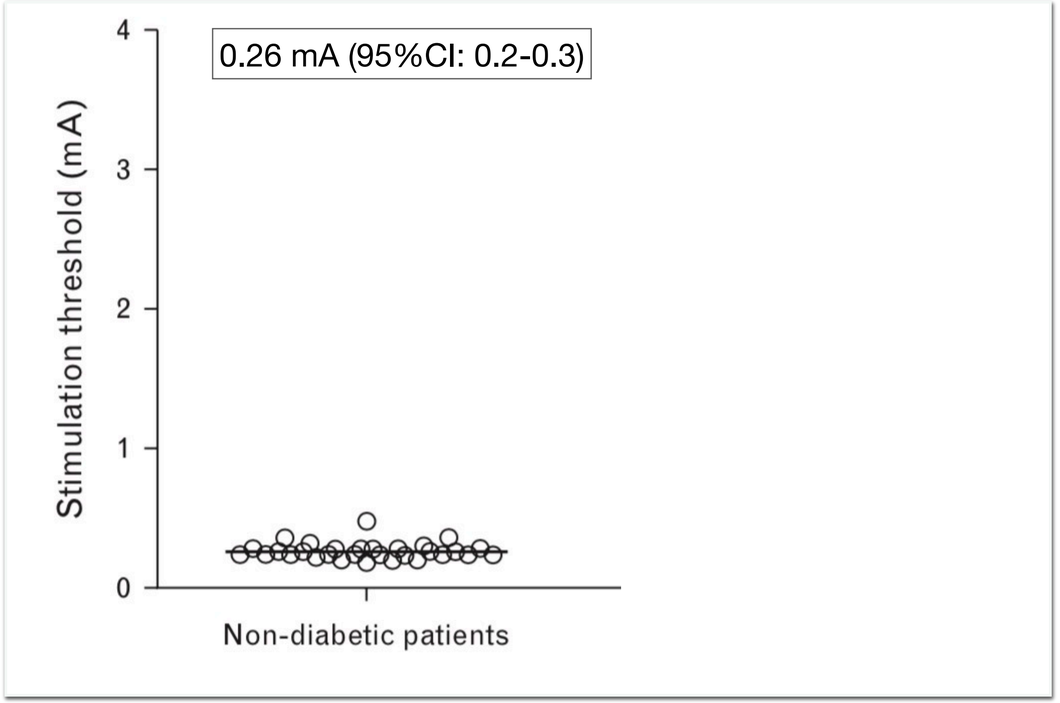
Kopp et al, Reg Anesth Pain Med, 2015

Increased electrical nerve stimulation threshold of the sciatic nerve in patients with diabetic foot gangrene

A prospective parallel cohort study *Eur J Anaesthesiol* 2013; **30:**435–440

Cornelius Keyl, Tanja Held, Georg Albiez, Astrid Schmack and Christoph Wiesenack

- 60 diabetic and non-diabetic patients for foot surgery
- Sciatic nerve block with nerve stimulator & US-guidance



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- 60 diabetic and non-diabetic patients for foot surgery
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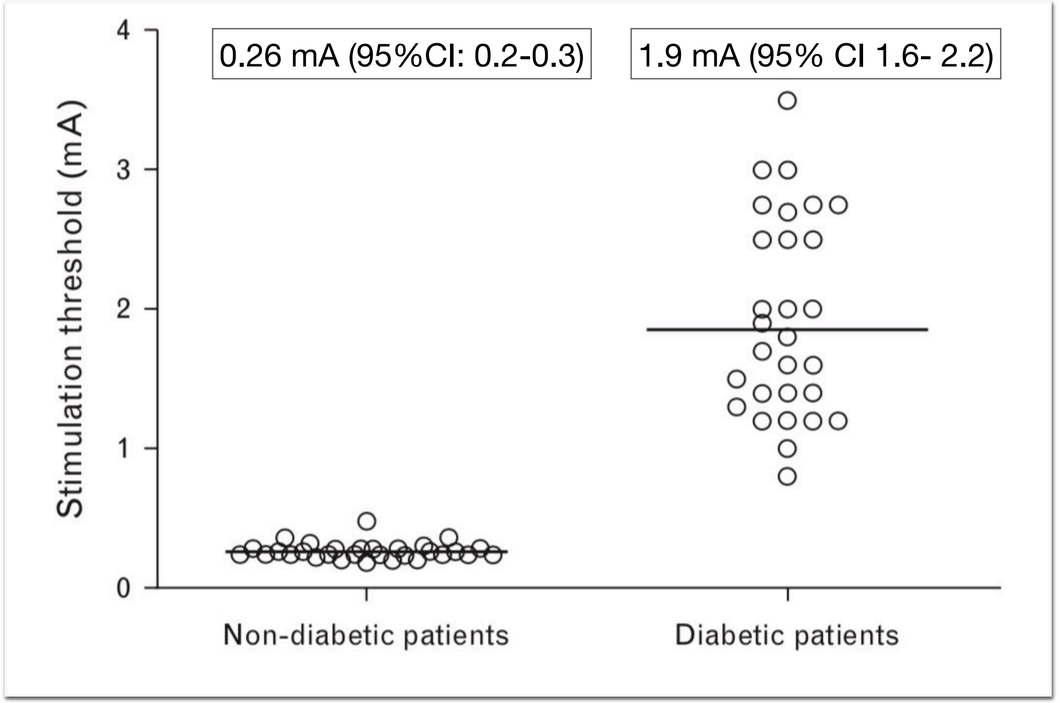
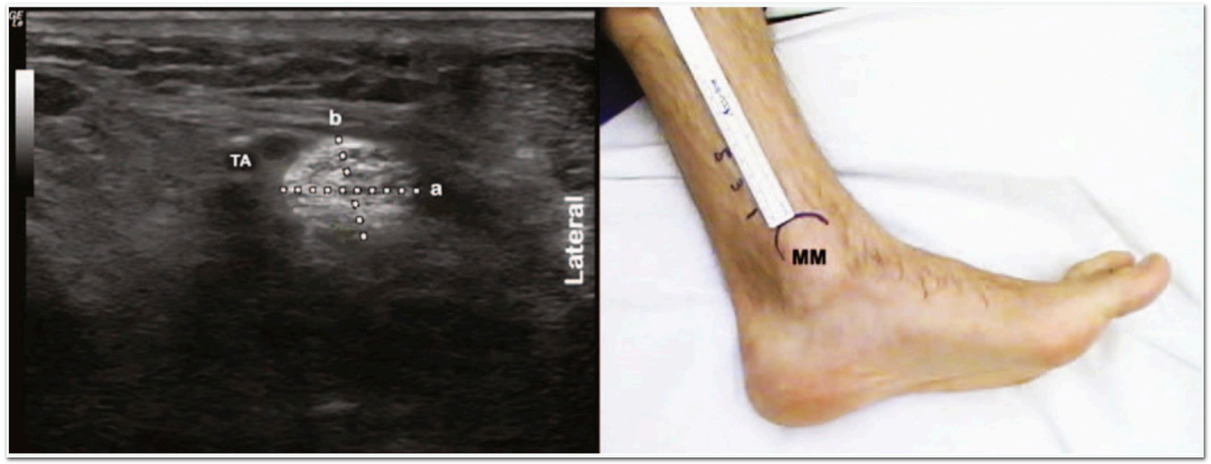
« The electrical stimulation threshold for a motor response of the sciatic nerve is increased by a factor of 7.2 in patients with diabetic foot gangrene, which might hamper nerve identification. »



DPN DIAGNOSIS WITH US



Cross sectional area = a x b x 3.14 x 1/4

Cut - off value: 19.01 mm2

Riazi et al, Diabetes Care, 2012

Anaesthesia 2016, 71, 1037–1043 doi:10.1111/anae.13544

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The effect of anti-emetic doses of dexamethasone on postoperative blood glucose levels in non-diabetic and diabetic patients: a prospective randomised controlled study*

M. Tien,[1] T. J. Gan,[2] I. Dhakal,[3] W. D. White,[4] A. J. Olufolabi,[5] R. Fink,[6] B. M. Mishriky,[7] H. J. Lacassie[8] and A. S. Habib[9]

DEXAMETHASONE

- Randomised controlled trial
- 85 diabetic and non diabetic patients
- Dexamethasone 8 mg vs Ondansetron 4 mg
- Blood glucose measured at 2, 4 and 24 PO hours

	Non-diabetic patients			Type-2 diabetes patients		
	Dexamethasone n = 20	Ondansetron n = 21	p value	Dexamethasone n = 20	Ondansetron n = 24	p value
Baseline blood glucose; mmol.l^{-1}	5.3 (0.9)	5.1 (0.8)	0.62	6.9 (1.6)	7.2 (1.9)	0.59
2-h blood glucose; mmol.l^{-1}						
4-h blood glucose; mmol.l^{-1}						
24-h blood glucose; mmol.l^{-1}						
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4-h blood glucose; mmol.l^{-1}						
24-h blood glucose; mmol.l^{-1}						
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4-h blood glucose; mmol.l^{-1}	8.5 (1.6)	7.3 (1.6)	0.02	10.4 (3.0)	8.6 (2.1)	0.08
24-h blood glucose; mmol.l^{-1}						
Maximum 24-h blood glucose; mmol.l^{-1}						
Maximum 4-h blood glucose change; mmol.l^{-1}						

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24-h blood glucose; mmol.l^{-1}	7.0 (2.5)	6.5 (1.0)	0.99	9.8 (2.5)	8.3 (2.3)	0.05
Maximum 24-h blood glucose; mmol.l^{-1}						
Maximum 4-h blood glucose change; mmol.l^{-1}						

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4-h blood glucose; mmol.l^{-1}	8.5 (1.6)	7.3 (1.6)	0.02	10.4 (3.0)	8.6 (2.1)	0.08
24-h blood glucose; mmol.l^{-1}	7.0 (2.5)	6.5 (1.0)	0.99	9.8 (2.5)	8.3 (2.3)	0.05
Maximum 24-h blood glucose; mmol.l^{-1}	9.1 (2.2)	7.8 (1.4)	0.04	14.0 (2.5)	10.7 (2.4)	< 0.01
Maximum 4-h blood glucose change; mmol.l^{-1}						

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- Blood glucose measured at 2, 4 and 24 PO hours

	Non-diabetic patients			Type-2 diabetes patients		
	Dexamethasone n = 20	Ondansetron n = 21	p value	Dexamethasone n = 20	Ondansetron n = 24	p value
Baseline blood glucose; mmol.l^{-1}	5.3 (0.9)	5.1 (0.8)	0.62	6.9 (1.6)	7.2 (1.9)	0.59
2-h blood glucose; mmol.l^{-1}	6.4 (1.0)	6.6 (1.3)	0.65	9.4 (2.8)	8.1 (2.2)	0.10
4-h blood glucose; mmol.l^{-1}	8.5 (1.6)	7.3 (1.6)	0.02	10.4 (3.0)	8.6 (2.1)	0.08
24-h blood glucose; mmol.l^{-1}	7.0 (2.5)	6.5 (1.0)	0.99	9.8 (2.5)	8.3 (2.3)	0.05
Maximum 24-h blood glucose; mmol.l^{-1}	9.1 (2.2)	7.8 (1.4)	0.04	14.0 (2.5)	10.7 (2.4)	< 0.01
Maximum 4-h blood glucose change; mmol.l^{-1}	3.2 (1.7)	2.3 (1.7)	0.10	3.7 (2.7)	1.6 (2.1)	< 0.01

DEXAMETHASONE

- Glycaemic level increased by an average of 1-3 mmol/l
- Dose-dependant response with a peak effect 4h after administration
- No increased risk of postoperative wound or systemic infection

Tien et al, Anaesthesia, 2016
Polderman et al, Cochrane, 2018
Low et al, J Clin Anesth, 2015

CONCLUSION

- 7% of the population suffers from DM
- DM = risk factor for increased perioperative mortality
- RA (vs GA) reduces 30-day mortality for lower limb amputation in diabetic patients
- RA helps preventing perioperative hypo/hyperglycaemic episodes
- PNB and DM:
    - Reduced onset time of action by 50%,
    - Incresed duration of action by 150%,
    - Increased stimulation threshold by a factor 7
- Dexamethasone 0.1 - 0.2 mg => peak effect 4h after administration

QUESTIONS ?

Photo by Bryan Minear