ACUTE COMPARTMENT SYNDROME

& REGIONAL ANAESTHESIA



Peter Merjavy
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University of East Anglia, Norwich, UK
European Society of Regional Anaesthesia
Slovak Association of Regional Anaesthesia

Use of regional anaesthesia in patients with high risk of acute compartment syndrome



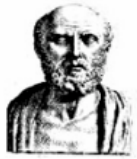
ANAESTHESIOLOGIST

- ☑ RA is the **most effective** pain relief
- ☑ RA is **safe**
- ☑ RA **does not mask or delay** ACS

SURGEON

- ☒ RA **masks** the pain
- ☒ RA **masks** the ACS
- ☒ RA **delays** the diagnosis of ACS
- ☒ RA **delays** the fasciotomy

EVIDENCE-BASED, SAFE AND TIMELY CARE



Acute compartment syndrome as an imbalance of humors by the body by Hippocrates

5th century BC

1881

Richard von Volkmann launched the 5 P's clinical signs





1949

Carters' et al modern definition of acute compartment syndrome

1975

First identification of increased compartment pressure (Madsen) and a method of tissue pressure measurement (Whitesides)





1996

Introduction of pain as the 5th vital sign by Campbell

Soulioti, E. et al: Trauma Patients and Acute Compartment Syndrome: Is There an Ariadne's Thread That Can Safely Guide the Anesthesiologist/ Emergency Physician Out of the Labyrinth? Medicina 2024, 60, 1279.

Acute Compartment Syndrome

TRAUMA / BLEEDING → **COMPARTMENT PRESSURE ↑** → **MICROPERFUSION ↓** → **ISCHAEMIA / NECROSIS**

Fracture, crush, reperfusion or external constriction

Non-compliant fascia restricts expansion

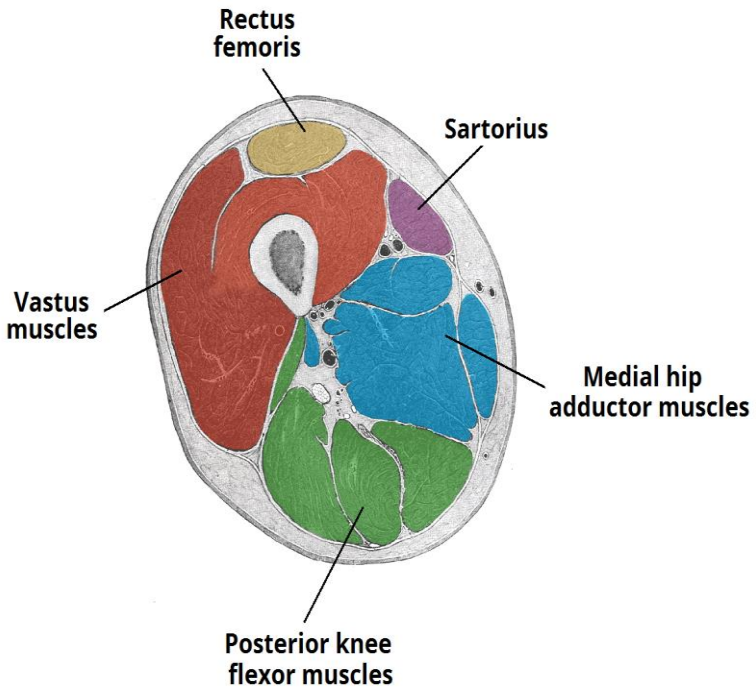
Capillary flow falls; venous congestion worsens

Muscle and nerve injury becomes irreversible

A self-amplifying cycle: hypoxia → endothelial leakage → oedema → further pressure rise

Nathanson et al. 2021; Hilber et al. 2024

Who is at risk?



LOWER-LIMB ANATOMY

Injury pattern

Tibial shaft / plateau fracture; high-energy or crush injury; severe soft-tissue damage.

Vascular / bleeding

Vascular injury, reperfusion, anticoagulation or bleeding disorder.

Treatment factors

Intramedullary nailing, tight casts or dressings, prolonged positioning.

Remember

ACS can occur with open fractures and without a fracture.

Association of Anaesthetists 2021; BOAST 2025

THE JOURNAL OF BONE & JOINT SURGERY

Focus On
Diagnosis of acute compartment syndrome

Andrew D. Duckworth MSc, MRCS Ed Specialty Registrar and Clinical Research Fellow
Margaret M. McQueen MD, FRCSEd(Orth) Professor of Orthopaedic Trauma

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Table I. Conditions associated with the development of acute compartment syndrome[15]

Cause	% of cases
Fracture	
Tibial diaphyseal fracture	36
Distal radius fracture	9.8
Diaphyseal forearm fracture	7.9
Femoral diaphyseal fracture	3.0
Tibial plateau fracture	3.0
Soft tissue	
Soft-tissue injury	23.2
Crush syndrome	7.9

Average annual incidence
3.1/100.000 people

- 7.3/100.000 men
- 0.7/100.000 women

Shadgan et al. *Can J Surg* 2010, 53, 329-34
Shadgan et al. *J Ortop Trauma* 2008,22,581-7

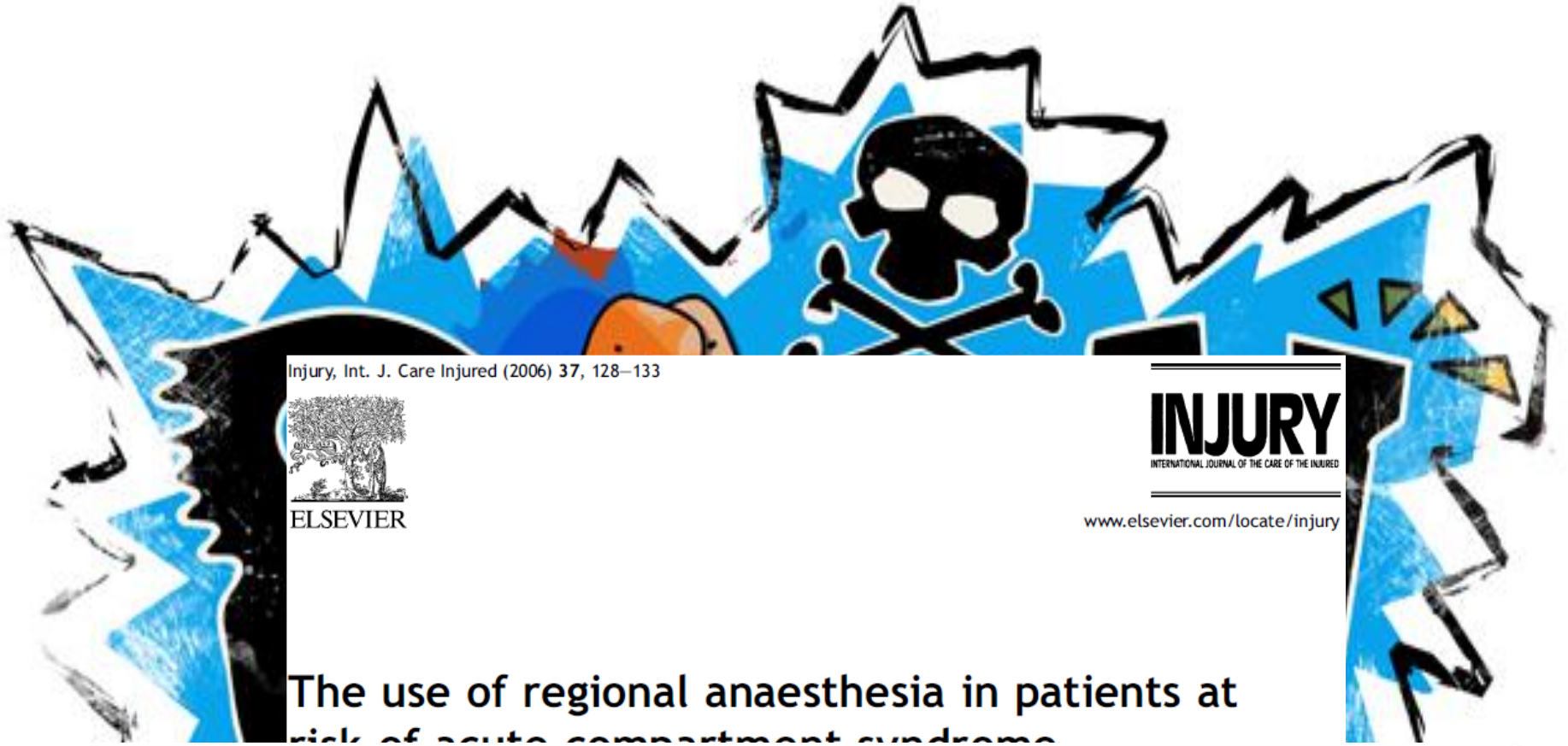
Age < 35 is a risk factor increasing the incidence of ACS following tibial fracture by 30 fold

Gadsden J. *Regional Anaesthesia in Trauma*, 2012,28

Clinical symptoms of ACS – 6 P's

- **P**ain (out of proportion to injury)
- **P**ain on passive movement
- (forced dorsiflexion of ankle or wrist of affected limb)
- **P**ressure/**P**alpation (tense, hard muscle compartment)
- **P**aresthesia („pins and needles")
- **P**aralysis (late sign)
- **P**ulselessness (late sign)





Injury, Int. J. Care Injured (2006) 37, 128–133

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The use of regional anaesthesia in patients at risk of acute compartment syndrome

	Pain	Pain on passive stretch	Paraesthesia	Paresis
Sensitivity (%)	19	19	13	13
Specificity (%)	97	97	98	97
PPV (%)	14	14	15	11
NPV (%)	98	98	98	98

6 P´s – Clinical symptoms of ACS

- **P**ain (out of proportion to injury)
- **P**ain on passive movement
- (forced dorsiflexion of ankle or wrist of affected limb)
- **P**ressure/**P**alpation (tense, hard muscle compartment)
- **P**aresthesia („pins and needles“)
- **P**aralysis (late sign)
- **P**ulselessness (late sign)

The “6 Ps” are not six early signs

Earlier warning features

- Pain disproportionate / increasing
- Pain on passive stretch
- Escalating analgesic requirement
- Tense, swollen compartment
- Evolving altered sensation / motor block

Late / unreliable to exclude ACS

- Pulselessness (late; pulses usually persist)
- Paralysis (late)
- Pallor (variable)

A normal pulse DOES NOT rule out ACS.

Serial trends and the overall clinical picture matter more than a single normal examination.

Hilber et al. 2024; BOAST 2025

Clinical evaluation and monitoring

Manual palpation:

Sensitivity 24%

Specificity 55%

Orthopaedic residents to detect „normal“ (20-40mmHg) and elevated (60-80 mmHg) pressure in fresh cadaver leg specimens.

Cascio et al. J Bone Joint Surg Am 2005, 85, 346-50

Physical examination considered inaccurate and subsequently withdrawn from screening protocol for dg of lower extremity ACS in critically ill trauma patients

Kosir R, Moore FA, Selby JH et al: Acute lower extremity compartment syndrome (ALECS) screening protocol in critically ill trauma patients. J Trauma 2007, 63, 268-75

Measuring intracompartmental pressure (ICP)

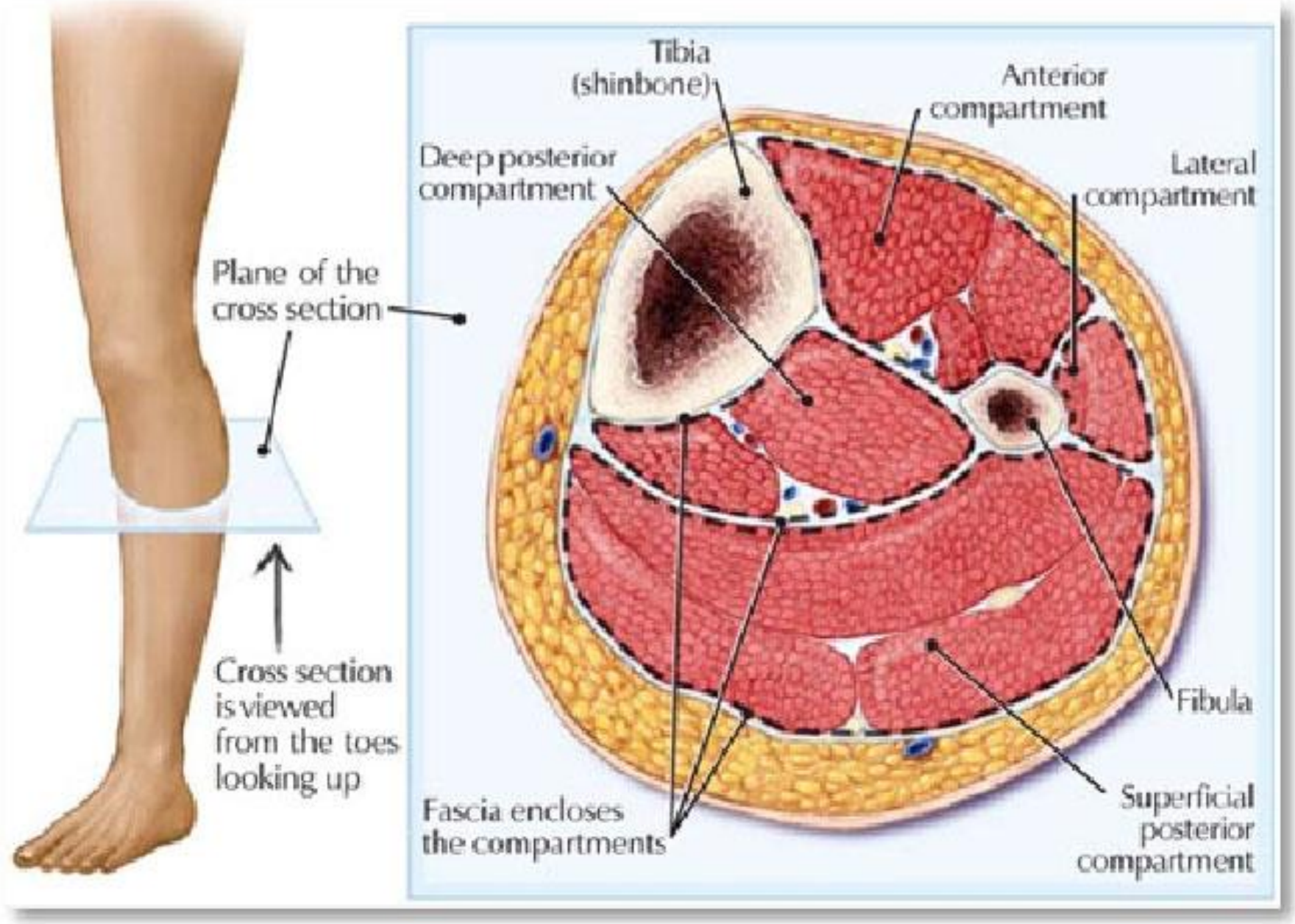
Interpret the number in context

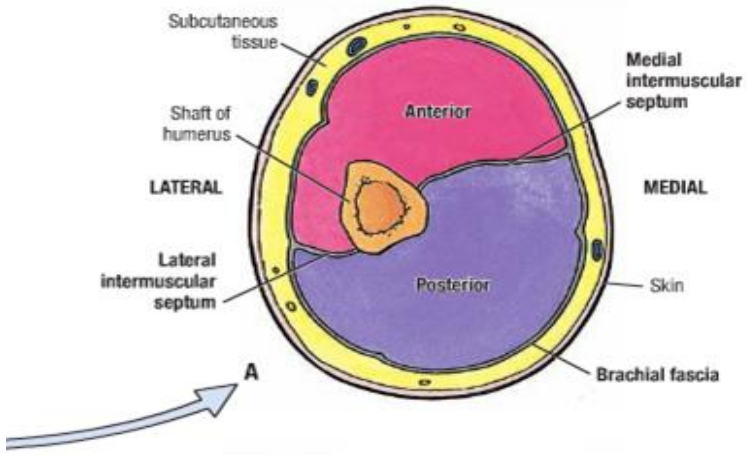
A threshold of either
- ICP >30 (45) mmHg or
- ΔP = diastolic pressure − ICP ≤30 mmHg

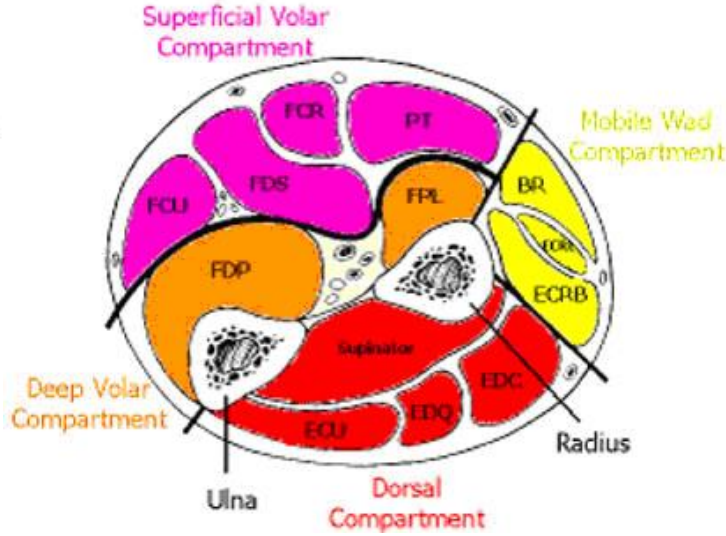
indicates increased ACS risk.

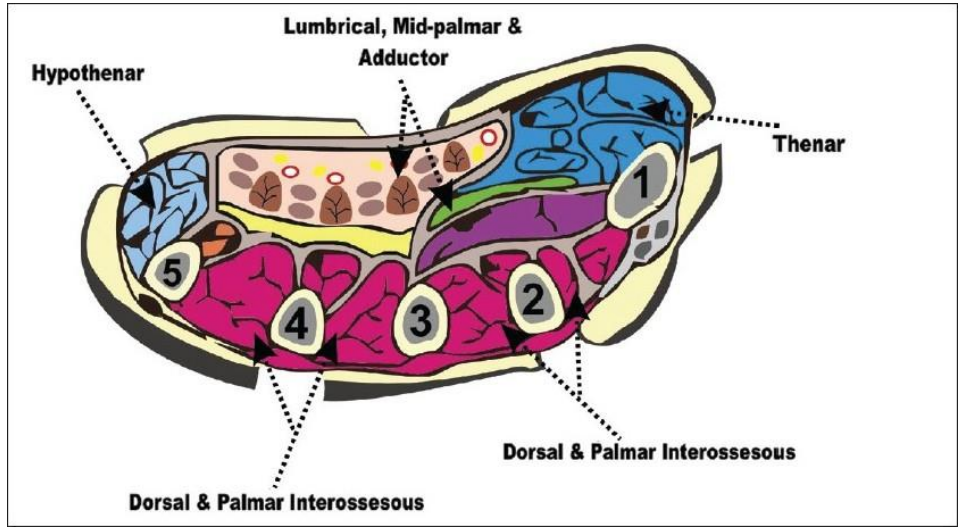


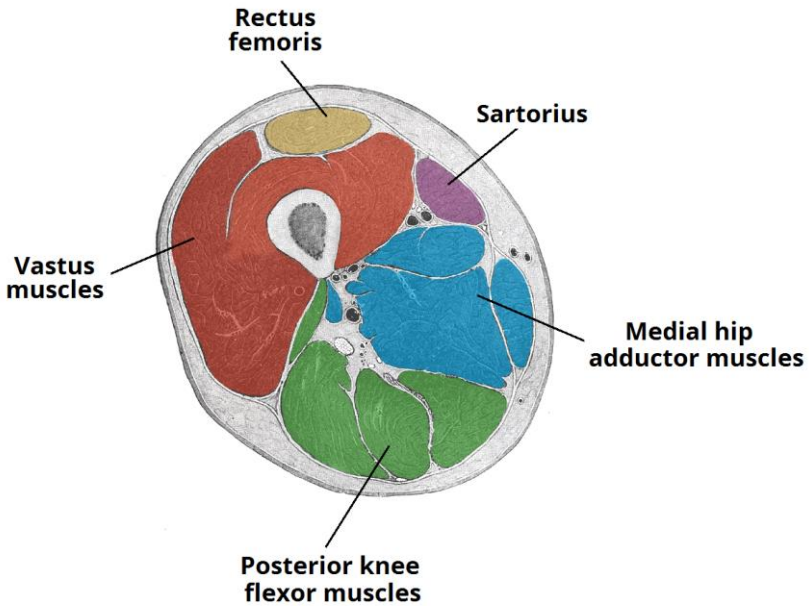


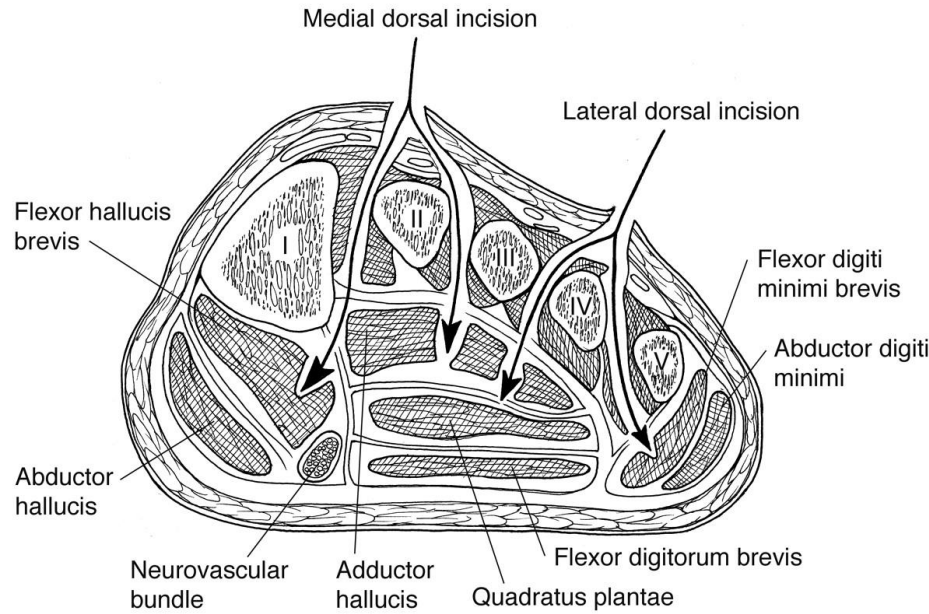

Tibia
(shinbone)
Anterior
compartment
Deep posterior
compartment
Lateral
compartment
Plane of the
cross section
Cross section
is viewed
from the toes
looking up
Fibula
Fascia encloses
the compartments
Superficial
posterior
compartment


Subcutaneous tissue
Shaft of humerus
LATERAL
Lateral intermuscular septum
Anterior
Posterior
Medial intermuscular septum
MEDIAL
Skin
Brachial fascia
A


Superficial Volar Compartment
FCR
PT
FCU
FDS
FPL
BR
Mobile Wad Compartment
ECRL
FDP
ECRB
Supinator
EDC
Deep Volar Compartment
EDQ
ECU
Radius
Ulna
Dorsal Compartment


Lumbrical, Mid-palmar & Adductor
Hypothenar
Thenar
1
2
3
4
5
Dorsal & Palmar Interossesous
Dorsal & Palmar Interossesous


Rectus femoris
Sartorius
Vastus muscles
Medial hip adductor muscles
Posterior knee flexor muscles


Medial dorsal incision
Lateral dorsal incision
Flexor hallucis brevis
I
II
III
IV
V
Flexor digiti minimi brevis
Abductor digiti minimi
Abductor hallucis
Neurovascular bundle
Adductor hallucis
Quadratus plantae
Flexor digitorum brevis









Fasciotomy is the definitive treatment



Confirmed ACS

Immediate surgical decompression of the affected compartments.

When ACS is suspected

Escalate urgently; remove circumferential constraint and reassess. Do not wait for pulselessness.

Caution: the “6-hour rule” is not a substitute for case-specific urgent clinical decisions.

Fasciotomy

Delaying for more than 12hr associated with significantly worse outcome

Fasciotomy	Early (< 6hr.)	Late (> 12 hr.)
Acceptable outcome	88%	15%
Amputation rate	3.2%	14%
Death rate	2%	4.3%

Hayakawa H et al. Trauma 2009,11,5-35


11.3.4 Tendinosis calcarea



Volume 5 • Issue 2 • 2026 ISSN 2046-1049

Bone and Hammer

Journal of surgeons who like to hit something

„… I've had a patient, who developed a compartment syndrome and didn't do well. He had an epidural, so it must be an anaesthetists fault …"

Drill U. et al.

Bone & Hammer 2026; 5: 104–108



Volume 1 • Issue 1 • 2024 ISSN 2046-1049

Bone and Hammer

Journal of surgeons, who like to hit something

> „... I've had a patient, who developed a compartment syndrome and didn't do well. He had nerve block, so it must be an anaesthetists fault ...“

Gamma A., Nail P.:
Bone & Hammer 2024; 1: 10–17



Volume 9 • Issue 1 • 2025 ISSN 2046-1049

Bone and Hammer

Journal of surgeons, who like to hit something

„... I've had a patient, who developed a compartment syndrome and didn't do well. He had some sort of anaesthetic (not sure which one), but it must be an anaesthetists fault ...“

Screw M. Et al.
Bone & Hammer 2025; 9: 75–81



Injury, Int. J. Care Injured (2006) 37, 128–133



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The use of regional anaesthesia in patients at risk of acute compartment syndrome

E.T. Davis*, A. Harris, D. Keene, K. Porter, M. Manji

Departme

tice. This finding is in keeping with that of Thonse et al.[17] In their study of orthopaedic surgeons, they found that 32% stated they had seen a delay in the diag-nosis of an acute compartment syndrome due to the anaesthetic regimen used. This study high-lighted that the delay was due to regional anaes-thesia in 75% of cases.

Injury, Int. J. Care Injured (2006) 37, 128–133



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The use of regional anaesthesia has been highlighted as a cause of delay in the diagnosis and treatment of compartment syndrome in a number of case reports.[5,13,22] The increasing usage of regio-

5. Dunwoody JM, Reichert CC, Brown KL. Compartment Syndrome Associated with Bupivacaine and Fentanyl Epidural Analgesia in Paediatric Orthopaedics. J Paediatr Orthop 1997; 17:285–8.

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J Pediatr Orthop. 1997 May-Jun;17(3):285-8.

Compartment syndrome associated with bupivacaine and fentanyl epidural analgesia in pediatric orthopaedics.

Dunwoody JM[1], Reichert CC, Brown KL.

Author information

Abstract

Two patients had a compartment syndrome after surgery at a remote site performed under a continuous lumbar infusion of a mixture of narcotic (fentanyl) and local anesthetic (bupivacaine 0.1%). Each patient had inadvertent excessive pressure applied to the limb distally and had no perception of pain in the presence of this analgesic combination. After the relief of this pressure from a sling or traction apparatus, each child had signs of a compartment syndrome, and this sensation of pathologic pain was not masked by the epidural infusion. A discussion of the literature questions the benefits of bupivacaine local anesthetic as a routine addition to epidural analgesia for orthopaedic surgery.

Comment in

Compartment syndromes and epidural analgesia. [J Pediatr Orthop. 1997]

PMID: 9150012 [PubMed - indexed for MEDLINE]

Publication Types, MeSH Terms, Substances

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analgesia. [J Pedia
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arrests associated with epic [Anes

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Pediatric Anesthesia 2007 **17**: 520–533 doi:10.1111/j.1460-9592.2007.02230.x

The National Pediatric Epidural Audit

N. LLEWELLYN, RN, RSCN, BA* AND A. MORIARTY FRCA†

**Acute Pain Service and †Department of Anaesthesia, Birmingham Children's Hospital NHS Trust, Birmingham, UK*

Ninety six incidents were reported in 10 633 epidurals performed.

the development of pressures sores. Four incidents of compartment syndrome were reported, in each of these cases the presence of EIA did not mask the condition.

British Journal of Anaesthesia **102 (1):** 3–11 (2009)
doi:10.1093/bja/aen330 Advance Access publication November 19, 2008

BJA

REVIEW ARTICLES

Acute compartment syndrome of the lower limb and the effect of postoperative analgesia on diagnosis†

G. J. Mar*, M. J. Barrington and B. R. McGuirk

Department of Anaesthesia, St Vincent's Hospital, Melbourne, PO Box 2900, Fitzroy, 3065 VIC, Australia

**Corresponding author. E-mail: gjpmar@yahoo.com.au*

Report	Patient age/gender	Surgery	Anaesthetic	Postop analgesia	Drug	Significant other issues	Signs/symptoms	Classic CS symptoms despite Epi	Time to fasciotomy (h)*		Pressure monitoring utilized	Outcome
									From initial surgery	From symptoms of CS		
Beerle and Rose[2]	76F	Radical cystectomy	Epi/GA	Epi till fasciotomy	B5 and fentanyl intraop, B125 and fentanyl postop	7.5 h lithotomy	Pain, tenseness, swelling, pulselessness	Yes	1.5	No delay	Yes	No injury
Iwasaka and colleagues[24]	15F	Repair genitourinary fistula	Epi/GA	Epi till fasciotomy	M2 intraop, lidocaine in recovery	11 h lithotomy	Pain, tenseness, swelling, paraesthesia, paralysis in ankle and great toe	Yes	23	23	Yes	Slight limp
Montgomery and Ready[38]	52F	Radical cystectomy	Epi/GA	Epi till fasciotomy	L2 intraop and morphine after	10.5 h lithotomy	Numbness and muscle spasm, tightness, swelling	Yes	18.5	6	Yes	Sensory, motor deficit
	17F	Urological reconstruction	Epi/GA	Epi	B0625 intraop, morphine and fentanyl postop	11.5 h lithotomy	Numbness, swelling, pain, pain on passive stretch	Yes	16	16	Yes	Slight limp
Strecker and colleagues[59]	45M	Osteocutaneous-free fibular transfer	Epi	Epi 4 days	B125	Infected non-union tibia	Swelling, pain once Epi ceased	Yes	8 days	4 days	No	Not clear due to other injuries

Acute compartment syndrome and the role of regional anesthesia

Stephen Mannion[1] M.D. F.C.A.R.C.S.I., M.R.C.P.I., Xavier Capdevila[2] Ph.D., M.D.
[1]Department of Anaesthesiology, South Infirmary-Victoria University Hospital, Cork, Ireland
[2]Department of Anaesthesia and Intensive Care, Hôpital Lapeyronie, Montpellier, France

Corresponding author: Dr. Stephen Mannion, Department of Anaesthesiology, South Infirmary-Victoria University Hospital, Cork, Ireland.
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Introduction

Compartment syndrome is a condition in which increased pressure within a closed compartment compromises the circulation and function of the tissues within that space (1). The condition can be acute, subacute or chronic (1, 2). This chapter will provide an overview of the pathology, clinical presentation and management of acute compartment syndrome (ACS). The difficulties and pitfalls in the diagnosis of ACS will be presented followed by discussion on the role of regional anesthesia (RA) in the context of ACS.

Reference	Surgery	Technique used	Comments
Hyder[18]	Intramedullary nail for a tibial fracture	Femoral "3-in-1" block; bupivacaine 0.5%	**Pain** in the calf and anterior part of the leg; anterior tibial compartment necrosis (peroneal nerve territory). **3-in-1 block held responsible for delayed diagnosis.**

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Noorpuri[19]	Forefoot revision arthroplasty	Ankle block; bupivacaine 0.25%	**Severe pain** unrelieved by pain killers within 12 hours. Fascitomy without sequelae.

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Cometa[8]	Distal femoral and proximal tibial osteotomy	**Continuous** sciatic and femoral nerve blocks with ropivacaine 0.2%	**Severe leg pain** without other symptoms on second post-operative day. Tense calf on the operative side. Fasciotomy with sequelae.

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Walker[21]	Left calcaneal osteotomy and Achilles tendon lengthening	**Continuous** popliteal block; initial bolus of 15 mL of bupivacaine 0.5% with epinephrine then ropivacaine 0.2% at 8 mL/hr	**Increasing pain** in the foot on day one. Cast removal and infusion stopped.

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Aguirre[7]	Complex distal humerus fracture	**Continuous** infraclavicular block; bolus 30 mL ropivacaine 0.5% then ropivacaine 0.3% at 6 mL/h plus an additional bolus of 5 mL.	**Severe forearm pain** 14 hours after surgery; compartment pressure measured at 40 mmHg; Fasciotomy without sequelae.

No evidence found that a femoral nerve block in cases of femoral shaft fractures can delay the diagnosis of compartment syndrome of the thigh

George Karagiannis and Richard Hardern

Emerg Med J 2005,22,814

Relevant paper (s)

No relevant papers found

Clinical bottom line

There is no evidence of an association between a femoral nerve block with a delayed or missed diagnosis of compartment syndrome in femoral fractures.

Compartment syndrome and regional anaesthesia: Critical review

Jozef Klucka[a], Petr Stourac[a], Alena Stouracova[b], Michal Masek[c], Martin Repko[d]

Acute compartment syndrome (ACS) is a potential orthopaedic/traumatology emergency. Without prompt, precise diagnosis and immediate treatment with surgical decompressive fasciotomy it can lead to neurological dysfunction and disability. The role of regional anaesthesia (RA) in patients at risk for ACS/ and in those with developed ACS is controversial. The aim of this critical review was to answer the question, whether regional anaesthesia can delay the diagnosis. The authors use an evidence-based approach to discuss these high risk patients in considering RA as a method of choice for effective analgesia.

Summary of evidence

We found no prospective RCT dedicated to this theme and the reviewed data can be considered as low-EBM quality (case reports, case series). Currently clinical practice is based on several reported cases and the theme is considered controversial.

- 3 reports decribin
- All tibial fractures
- 1st – 4th Patient: c uffer from severe pain
- 5th Patient: No pa osure 36h later
- 6th Patient: i.v. Mc ıpting dg of CS



ıgton P et al. Injury 2000, 31, 387-9
last Reconstr Surg 1996, 97, 1087-8
ards H et al. Injury 2004, 35, 296-8

Contents lists available at ScienceDirect

JCA Advances

journal homepage: www.elsevier.com/locate/jcadva



Does regional anesthesia impact the frequency and timing of fasciotomy following surgical repair of lower leg fracture; A National Database Analysis

Alexander B. Stone, MD [a,*], Alex Illescas, MPH [b], Haoyan Zhong, MPA [b], Jashvant Poeran, MD PhD [b], Jeremy T. Smith, MD [c], Stavros G. Memtsoudis, MD PhD MBA [b,d,e], Jiabin Liu, MD PhD [b,d]

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[b] *Department of Anesthesiology, Critical Care & Pain Management, Hospital for Special Surgery, New York, NY, USA*
[c] *Department of Orthopedic Surgery, Brigham and Women's Hospital, Boston, MA, USA*
[d] *Department of Anesthesiology, Weill Cornell Medicine, New York, NY, USA*
[e] *Department of Health Policy and Research, Weill Cornell Medical College, New York, NY, USA*

Stone et al. 2024: 77,685 lower-leg fracture operations

77,685

Tibia / fibula fracture repairs

6.7%

Received peripheral nerve block

3.9%

Overall ACS diagnosis (coded)

OBSERVED UNADJUSTED RATES

ACS diagnosis

4.0% no block vs 2.3% block

Fasciotomy

3.3% no block vs 1.7% block

Stone et al. JCA Advances 2024; DOI 10.1016/j.jcadva.2024.100066

Kakalecik et al. 2025 • tibia fracture cohort



ANESTHESIA & ANALGESIA

RESEARCH ARTICLE • 2025

Relationship Between Perioperative Regional Anesthesia and the Risk of Missing Acute Compartment Syndrome Following Tibia Fractures

AUTHOR(S)

Jaquelyn Kakalecik and colleagues

SOURCE

Anesth Analg. 2025;140(6):1290–1296

SOURCE IDENTIFIER

doi:10.1213/ANE.0000000000007084

Retrospective single-centre chart review; selected patients with tibia fractures. ACS outcome based on residual motor deficit at three months.

Missing ACS after tibial fracture repair

Single-centre retrospective study with a proxy for missed ACS; limited numbers and confounding prevent a definitive safety claim.

PAPER IDENTIFIER • doi:10.1213/ANE.0000000000007084

Kakalecik et al. 2025: tibial fractures

791

Patients with tibial shaft / plateau fractures

0.7%

Missed ACS proxy in PNB group (4/610)

1.7%

Missed ACS proxy without PNB (3/176)

Interpret with caution

p = 0.19; “missed ACS” was defined using persistent motor deficit at 3 months. All 4 affected blocked patients had catheters. Not powered to exclude uncommon harm.

Kakalecik et al. Anesth Analg 2025;140:1290–1296



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REVIEW

Pain Cor at Risk o of the Li Patients : Review

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Table 3 Summary Table of World Society Guidelines on Use of Regional Anesthesia and Its Effect on Compartment Syndrome

Specialty	Society	Statement
Anesthesia	Association of Anaesthetists of Great Britain and Ireland[3]	"Use of neuraxial or peripheral regional techniques that result in dense blocks of long duration that significantly exceed the duration of surgery should be avoided.single-shot or continuous peripheral nerve blocks using lower concentrations of local anaesthetic drugs without adjuncts are not associated with delays in diagnosis provided post-injury and postoperative surveillance is appropriate and effective"
	American Society of Anesthesia	No consensus statement
	American Society of Regional Anesthesia	No consensus statement in adults
	European Society of Regional Anaesthesia & Pain Therapy	No consensus statement in adults
	European Society of Regional Anaesthesia and Pain Therapy and the American Society of Regional Anesthesia and Pain Medicine (joint statement)[26]	"There is no current evidence that the use of regional anesthetics increases the risk for ACS or delays its diagnosis in children"
	French Physical and Rehabilitation Medicine (SOFMER) and Anesthesia and Intensive care (SFAR) societies[71]	"Consider the risk of the consequences of the occurrence of a hematoma: minimal in the case of a superficial hematoma, more significant in the case of a deep hematoma threatening a compartment syndrome"
	Asian & Oceanic Society of Regional Anaesthesia and Pain Medicine	No consensus statement
	African Society of Regional Anesthesia	No consensus statement
Surgery	International Orthopaedic Trauma Association	No consensus statement
	American Academy Of Orthopedic Surgeons[72]	"Risk of neuraxial anesthesia delaying and/or masking signs/ symptoms associated with impending compartment syndrome. outweighs the potential benefits of this treatment modality in high risk patient populations.regional anesthesia may delay diagnosis of acute compartment syndrome and that regional anesthesia does not mask timely diagnosis. If neuraxial anesthesia is administered, we recommend that more emphasis is placed on intra-compartmental pressure monitoring as well as break through pain despite regional anesthesia".
	European Orthopaedic Research Society	No consensus statement
	Asia Pacific Orthopaedic Association	No consensus statement

Guidelines

Regional analgesia for lower leg trauma and the risk of acute compartment syndrome

Association of Anaesthetists

June 2021

Recommendations for patients at risk of acute compartment syndrome (ACS)

Summary of key recommendations



1 Early identification & protocol



Identify patients at risk of ACS on admission or at surgery, and manage them using agreed multidisciplinary protocols.

2 Regular surveillance



Ward observations should detect signs and symptoms of ACS at set frequencies, by trained staff, using objective scoring charts.

3 Pressure measurement



Equipment for intracompartmental pressure measurement should be available. Staff must be trained, with SOPs for measurement and urgent escalation when abnormal.

4 Effective analgesia for all



All trauma and postoperative patients should be offered effective analgesia.

5 Explanation, choice & consent



Patients at risk of ACS should, where possible, receive a full explanation of analgesic options and provide documented verbal consent for their chosen technique.

6 Joint decision-making



Neither surgeon nor anaesthetist should veto the other's recommended treatment. Aim for consensus; if not possible, the anaesthetist's expertise in pain relief should be respected, while explaining the surgeon's concerns to the patient.

7 Avoid dense prolonged blocks



Avoid neuraxial or peripheral regional techniques that produce dense blocks lasting significantly longer than the surgery.

8 Low-dose peripheral RA may be used



Single-shot or continuous peripheral nerve blocks with low concentrations of local anaesthetic, without adjuncts, are not associated with delayed diagnosis when surveillance is appropriate and effective.

9 Need for more evidence



Urgent studies and prospective audit are recommended on low-dose regional analgesia, spinal opioid analgesia, and wound infusion with local anaesthetic for tibial fracture surgery.

Key message: *effective analgesia, vigilant surveillance, multidisciplinary working, and cautious use of low-dose regional techniques.*

Shared decision-making for analgesia

Patient autonomy, multidisciplinary discussion, and respect for expertise

Patient choice

The patient has the right to accept or refuse treatment.

No veto

Neither the surgeon nor the anaesthetist should veto the other's recommended treatment.



Aim for consensus

Consensus should be sought whenever possible.

Respect expertise

If consensus is not achievable, the anaesthetist's expertise in pain relief should be respected.

Offer acceptable options

The anaesthetist may offer the patient acceptable analgesic techniques while explaining the surgeon's concerns.

Key message: the patient remains central, consensus is preferred, and the anaesthetist leads on acceptable analgesic options while acknowledging surgical concerns.

Practical clinical decision: when to consider PNB

Lower risk

- Document baseline
- Choose effective analgesia
- Continue routine observations
- Explain warning symptoms

Elevated risk

- Surgeon–anaesthetist plan
- Prefer titratable / less dense block
- Hourly ACS observations
- Clear rescue escalation

Unreliable examination

- Dense block may obstruct exam
- Senior surgical assessment
- Objective pressure measurement
- Consider alternative strategy

Illustrative pathway, not a validated ACS prediction score.

Synthesis of AOA 2021, BOAST 2025 and supplied 2024 reviews

PNB, neuraxial analgesia and opioids: balanced view

Peripheral nerve blocks

Excellent targeted analgesia; often less opioid exposure. Dense / prolonged block could hinder assessment.

Neuraxial techniques

Can provide profound analgesia and sensorimotor effects; caution especially with prolonged dense blockade.

Systemic opioids / PCA

Avoid technical block concerns but sedation and analgesia can also impair detection; record doses and trends.

No analgesic modality replaces a diagnostic plan.

Nathanson et al. 2021; AAOS 2025; Stone et al. 2024

After the block: ward observation bundle

Document hourly in high-risk patients

- Pain score and trajectory
- Analgesic demand (opioids and catheter boluses)
- Sensory / motor changes vs expected block
- Compartment tension, swelling, passive stretch
- Perfusion / vital signs; limb observations

Ensure an action plan

- A named owner of serial assessment
- Explicit thresholds for urgent escalation
- ICP measurement immediately available
- Senior orthopaedic review 24/7

Clinical escalation algorithm

TRIGGER	Rising pain, breakthrough pain, tense limb, new deficit or unreliable examination
↓	
IMMEDIATE ACTION	Urgent surgical assessment; release circumferential dressings; reassess promptly
↓	
UNCERTAIN?	Serial documented exam + ICP and concurrent diastolic BP; senior decision
↓	
CONFIRMED ACS	Urgent decompressive fasciotomy; do not delay for additional analgesic trials

BOAST 2025; AAOS 2025

Scenario: tibial shaft fracture + nerve catheter

Four hours after surgery, pain escalates despite an apparently effective catheter.

Option A

Increase local anaesthetic bolus and review later.

Option B

Escalate immediately: examine, release constriction, urgent surgical review.

Option C

Assume the block is wearing off; increase PCA opioid.

Preferred: B + objective assessment when needed

Five practical safety commitments

1 Identify ACS risk before planning the block.

2 Avoid unnecessarily dense, prolonged regional blockade.

3 Arrange documented, trained, repeated surveillance.

4 Treat breakthrough pain as a red flag, not block failure.

5 Escalate early: senior review + pressure measurement + surgery.

BOAST 2025; Association of Anaesthetists 2021

Journal of
Clinical Medicine

MDPI

Review

The Impact of Regional Anesthesia in Masking Acute Compartment Syndrome after Limb Trauma

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Table 5. Suggestions for anesthesia and postoperative analgesia in patients at high-risk of postoperative ACS.

Anesthesia Techniques	Drugs to Be Used	Duration of Action	Recommendation for Trauma
Single shot PNB (SPNB)	Lidocaine 1.5% Mepivacaine 1% Chloroprocaine 2–3%	Lidocaine: 2.5–3 h Mepivacaine: 2–4 h Chloroprocaine: 1–2 h	For low postoperative pain, adapted local anesthetics to surgery time. Consider low-dose CPNB.
Continuous PNB (CPNB)	Ropivacaine: bolus with 10–20 mL of 0.1–0.2% PCRA: ropivacaine 0.1–0.2% (0.3%) 4–6 mL/h, bolus 3–4 mL, lock out 20–30 min	While infused and 30–60 min after stopping the infusion. No motor function impairment at low dosages.	Consider if catheter placement possible without previous block (or the block is performed with short-acting LA or low-concentration LA to avoid a long-lasting, dense block)
CWI/IAI/(C)FPB	Ropivacaine 0.2–0.3% Bupivacaine 0.25%. Dexamethasone I.V. 8–12 mg for FPB	Covers pain only during infusion.	Use whenever possible: good analgesia, no case report blaming this technique for masking ACS.
Single shot spinal (SSPA)	Bupivacaine 0.5% hyperbaric/isobaric low-dose (7.5 mg–max 10 mg); if needed add fentanyl/clonidine Mepivacaine 1% (30 mg) Chloroprocaine 1% 50 mg Prilocaine 2% hyper/isobaric 30–60 mg	Bupivacaine: 3–4 h Mepivacaine: 2–3 h Chloroprocaine: 1–2 h Prilocaine: 1.5–2.5 h	Use for lower limb trauma if possible to adapt duration to surgery time. No case report blaming SSPA for masking ACS.
Continuous spinal (CSPA)	Surgery: Bupivacaine (isobaric or) hyperbaric 0.5% during surgery 0.5–2 mL initial bolus, thereafter adaptation to surgery time and sensory level. Analgesia: Bupivacaine isobaric 0.125–0.2% for 0.5–1 mL/h	Bupivacaine: 2–3.5 h	No published case blaming CSPA for masking ACS. However, dense, long-lasting motor block possible if used also after surgery. Therefore, use CSPA for longer lasting surgery and in cases GA is not the optimal choice. Avoid using CSPA for analgesia after surgery if risk of ACS due to possible dense block.
Single shot epidural (EDA)	Lidocaine 1.5% Chloroporcaine 3% (Ropivacaine 0.75%–1%)	Lidocaine: 3.5 h Chloroprocaine: 2.5 h Ropivacaine: 3–6 h	No published case blaming EDA for masking ACS. However, a dense motor block is possible. Use EDA in cases GA is not the optimal choice.
Continuous epidural (CEDA)	Ropivacaine 0.1% (−0.2%) Levobupivacaine 0.125%; if needed add sufentanil 1 µ/mL, fentanyl 1–3 µ/mL	While infused and 2–4 h after stopping the infusion. A block resolution within 60 min achieved after wash out with 30 mL saline.	Avoid if GA, SPA or CPNB possible. Different case reports blaming CEDA for masking ACS.
General anesthesia (GA)	Propofol/volatile anesthetics Low-dose long-acting opioids (fentanyl); remifentanil TCI until low-concentration CPNB start possible.	Remifentanil: 5 min after TCI is stopped.	Avoid ideally for high-risk patients. If GA, combine with CPNB for postoperative analgesia.

Abbreviations: ACS: Acute compartment syndrome, (c) FPB: (continuous) fascia plane block, CWI: continuous wound infusion, EDA: epidural anesthesia, IAI: intra-articular infusion, LA: local anesthetic, PNB: peripheral nerve block, SPA: spinal anesthesia.

Use of regional anaesthesia for patients with high risk of acute compartment syndrome



CONCLUSION

Do not deny effective analgesia because ACS is possible.

Do not let effective analgesia replace vigilant ACS surveillance.

The patient needs BOTH.