Overview of Pain and Pain techniques for Major Surgery

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international centre of excellence for telesurgery

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MATTU

Minimal Access Therapy Training Unit

University of Surrey

Pain – It's Important!

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It Hurts!

Good pain relief:

- Can restore function
- Can reduce function

Effects Outcome:

1. Complications
2. ? Life expectancy

Recent Developments

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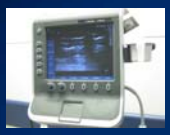

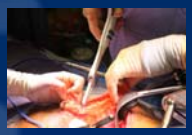

Pain – It's Complex

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Wound Pain

- Incision / inflammation

Visceral / Organ

- Surgical injury
- Drains

Pain at Rest

Dynamic Pain - Important for mobility and function

Inflammatory Response

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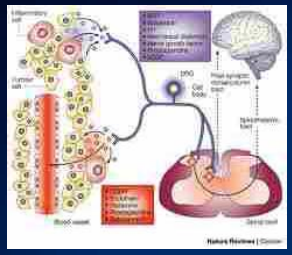
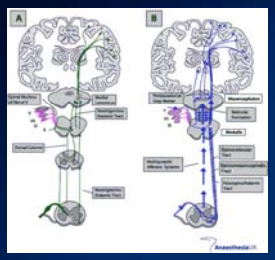


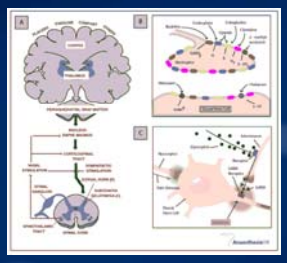
- Local
- General

- Normally proportional to injury
- Organ specific

The larger the SIRS Response the worse the patient feels / longer recovery

Pain Pathways



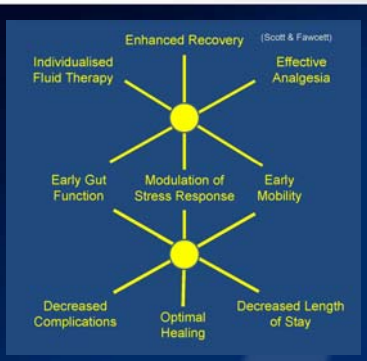


VIDEO

Video to show the phases of Nociceptive Pain:

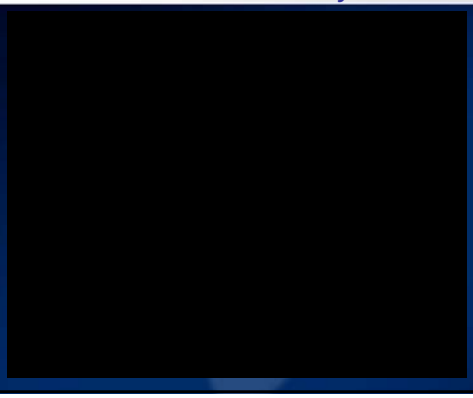
Transduction
Conduction
Transmission
Perception
Modulation

The Trimodal Approach



Manual of Fast Track Recovery for Colorectal Surgery , Chapter 4 , Mythen M Scott M

Pancreatectomy



The Perfect Analgesic

- Simple to give and cheap
- Effective lasting pain relief
- Allows movement of limbs and mobilisation
- No drowsiness
- No nausea and vomiting
- No effects on blood pressure
- No effects on GUT function
- No need for high care area

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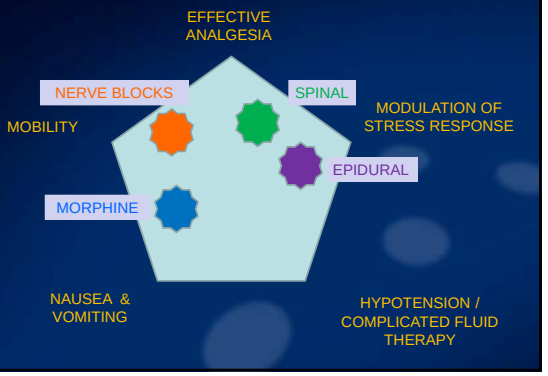
Analgesia – always a compromise?

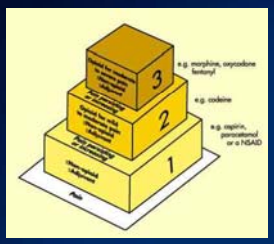


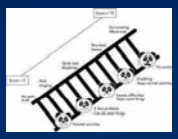
Patients Are All Different

- Response to injury varies
- Response to treatment varies

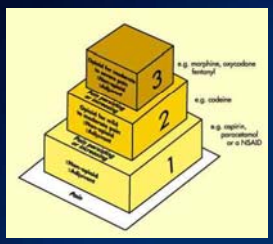
McQuay BMJ1997

Pain Scales





WHO Pain Ladder



1 Mild
- Paracetamol, NSAID

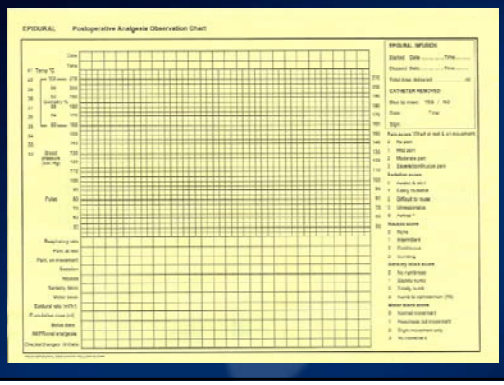
2 Moderate
- Codeine, Tramadol

3 Severe
- Morphine

Pain Teams

- Ensure analgesic method is effective
- Troubleshoot epidurals and PCAs
- Reduce complications
- Improves function after surgery
- If failure – change of analgesic option

Efficacy and Safety



Where to target pain control

Nerve Blocks
- Peripheral
- Wound infiltration
- Major nerves
- TAP Blocks
- Rectus Sheath
- Plexus
- Epidural
- Spinal

Drugs
- Paracetamol
- NSAIDS
- Tramadol
- Codeine
- Morphine
- Diamorphine

Balanced or Multimodal analgesia

Kehlet H et al Anesthesia and Analgesia 1993;77:1048-56

Variety of approaches to reduce opioid consumption including:

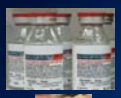
Local anaesthetics including wound infusions
Paracetamol
NSAIDs
Others including gabapentin, clonidine and ketamine, lignocaine

What are the sites of action of Drugs?

- Site of Injury and decrease the inflammatory reaction
- non steroidal anti- inflammatory drugs
- Alter nerve conduction
- local anaesthetics
- Modify transmission in the dorsal horn of spinal cord
- opioids (other)
- Central component and emotional aspects of pain
- Opioids (antidepressents)

Problems with analgesia

NSAIDs: renal, bleeding, perforation, anastomotic leakage



Paracetamol - liver

Opioids: sedation, constipation, PONV

Local anaesthetics – toxicity

Paracetamol

- Old drug – new delivery ensures plasma levels
- COX 2 - CNS
- COX 3 – CNS
- ? Cannabinoid

Bertolini CNS Drug Rev 2006
Anderson Paed.Anaes 2008

Drug Delivery - Patches

- Fentanyl - Not licensed in post operative care due to unpredictable respiratory depression
- Buprenorphine - New matrix patches may be different

Morphine

- Effective
- Still
- PONV
- Gut function
- Central / Respiratory depression

- Immunological effect

New Forms of Drug Delivery

- Depo Dur
- Morphine sulphate pentahydrate
- Long acting morphine for epidural use
- Analgesia for upto 48hrs

Other Agents

- Ketamine
- Gabapentin
- Clonidine
- Lignocaine infusions

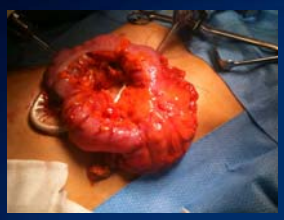
Surgery is Changing!

Traditional Open Surgery

- Incision is through muscle and skin
- Pain can effect mobility and function

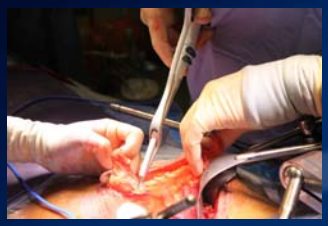
Blood loss more common
Higher overall blood loss

Traditional Open Surgery



- Bowel can be kept outside abdominal cavity
- Ileus
- Fluid Shift
- SIRS

Modern Open Surgery



- In open surgical procedures new instruments (eg harmonic scalpel) reduce blood loss and tissue injury
- More use of transverse incisions

Minimally Invasive Surgery

- Smaller incisions – less wound pain
- Not just the outside – on the inside
- Open surgery – more tissue destruction / blood loss *(collateral damage)*
- Harmonic Scalpel
- Plains for dissection
- DaVinci Robot
- Less SIRS
- Gut not externalised – early gut function
- Analgesic Requirements usually met by oral analgesia around 24 hours

Laparoscopic Surgery

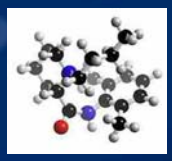
- The specimen still needs to be delivered
- Small low transverse incision

Impact of Enhanced Recovery on Pain

- Improved Anaesthesia
- Less Post operative Nausea and Vomiting
- Fluid Optimisation
- Early Gut function, patient feels better
- Early eating – ABLE to take ORAL ANALGESIA

Local Anaesthetics

- Ropivacaine
- Bupivacaine
- 2 isomers – levo and dextro
- Dose related cardiac toxicity
- Levobupivacaine now widely used – safer - can use more volume or higher concentration – length of duration of analgesia



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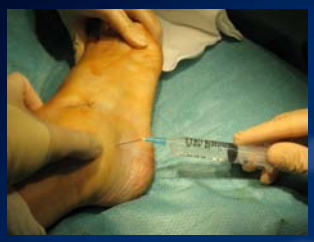
Peripheral Surgery



- Nerve Blocks
- Motor function not effected peripherally

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Multibeam Ultrasound

- Accurate targeting of nerves
- Less failure
- Enables lower volumes / doses
- ?higher concentration
- Longer duration
- Catheter placement

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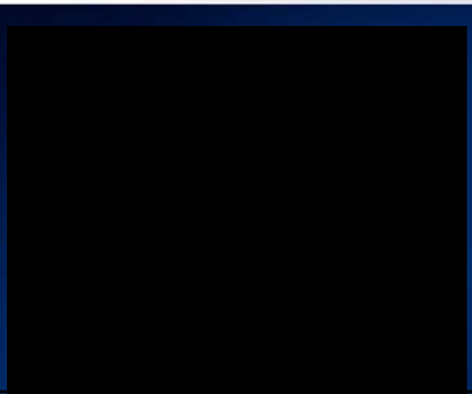
Multibeam Ultrasound



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Upper Limb Surgery

- Brachial Plexus Blocks
- Ultrasound
- Catheter can be inserted for postoperative infusion

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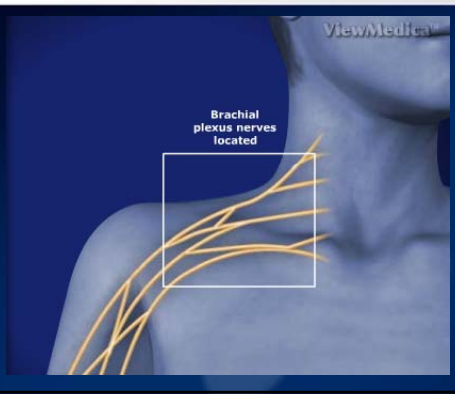

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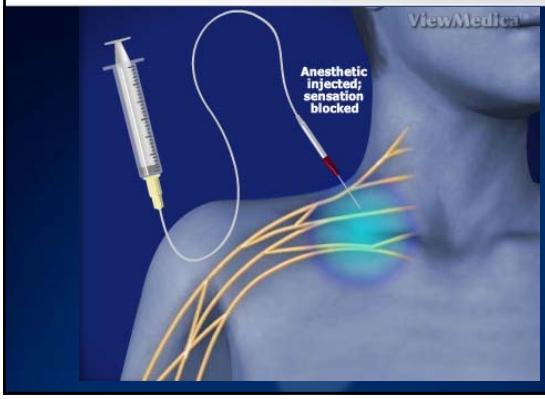

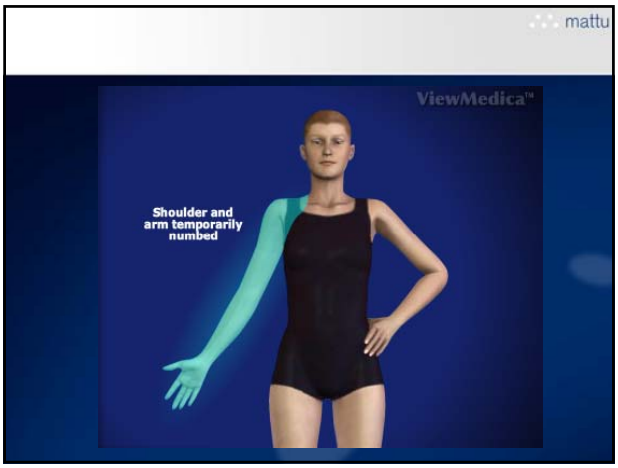
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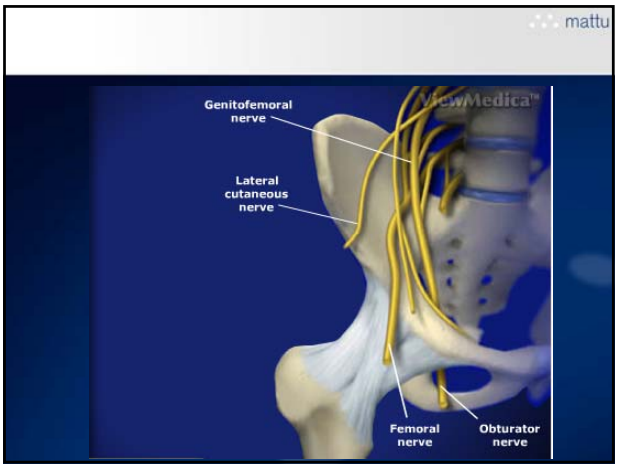
ViewMedica™
Shoulder and arm temporarily numbed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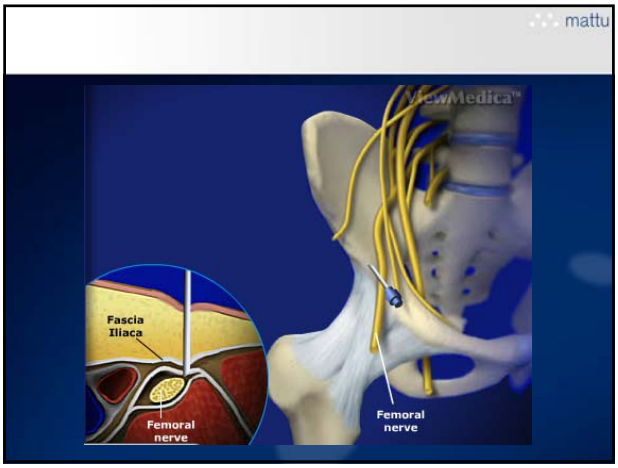
ViewMedica™
Genitofemoral nerve
Lateral cutaneous nerve
Femoral nerve
Obturator nerve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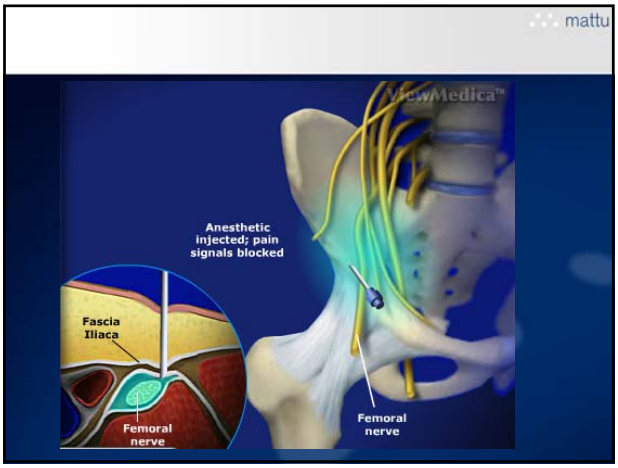
ViewMedica™
Fascia Iliaca
Femoral nerve
Femoral nerve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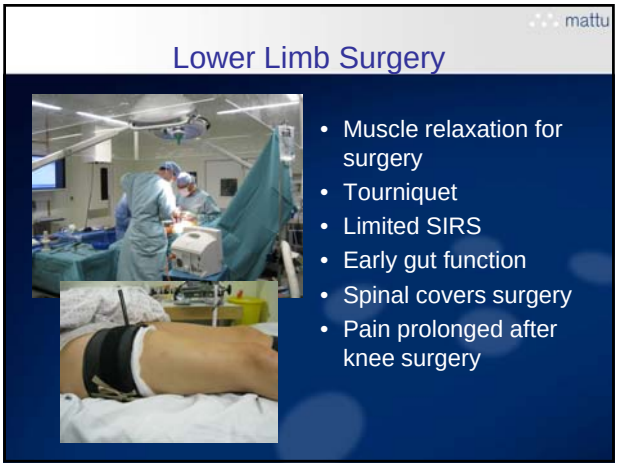
ViewMedica™
Anesthetic injected; pain signals blocked
Fascia Iliaca
Femoral nerve
Femoral nerve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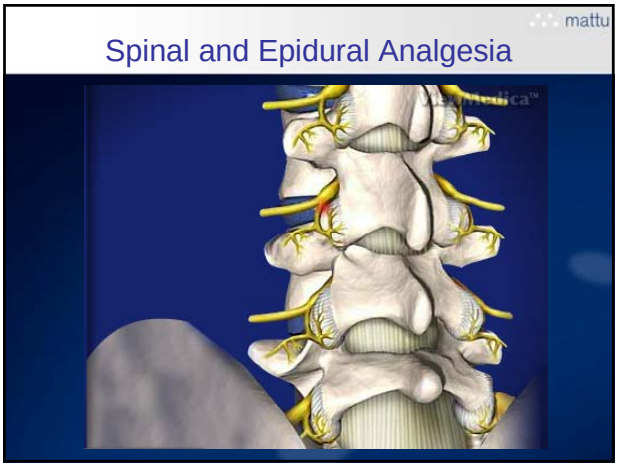
Lower Limb Surgery
• Muscle relaxation for surgery
• Tourniquet
• Limited SIRS
• Early gut function
• Spinal covers surgery
• Pain prolonged after knee surgery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Spinal and Epidural Analgesia

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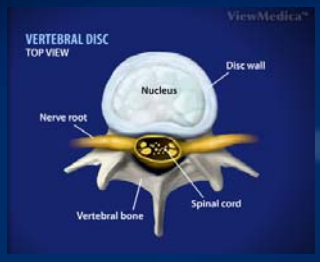
Spinal

- Single Shot in CSF
- Local Anaesthetic
- Last upto 3-4 hours
- Dense Motor and sensory block
- Sympathetic block
- Can add Opioid to increase length of analgesia (other)



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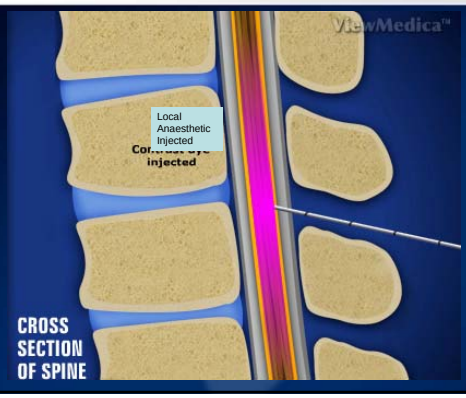

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Epidural

- Catheter placed in epidural space at appropriate level
- Continuous Infusion of local anaesthetic and low concentration opioid
- Nerve roots blocked
- Opioids act on spinal cord
- Usually maintained for 48-72hours

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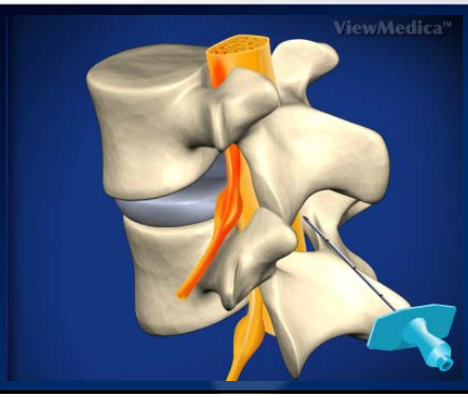

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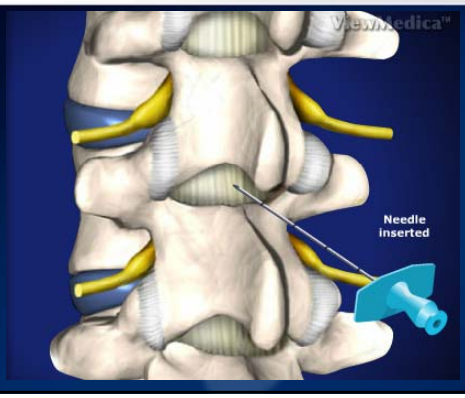

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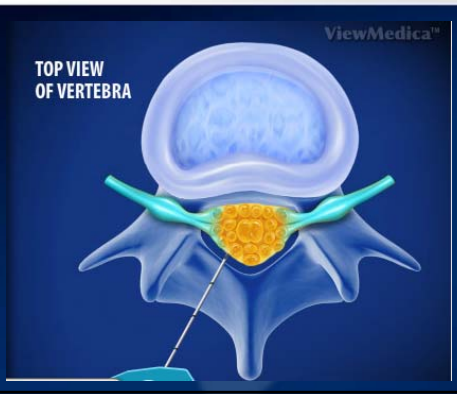

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Epidural Loss of Resistance Syringe

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Epidural Catheter fed into space

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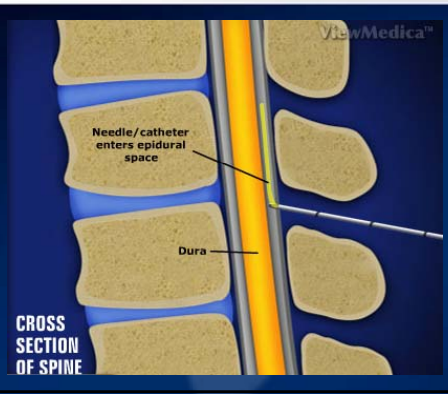

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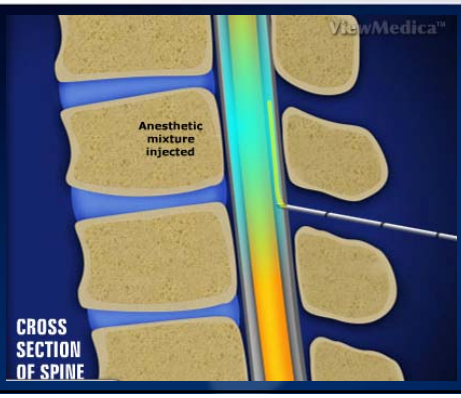

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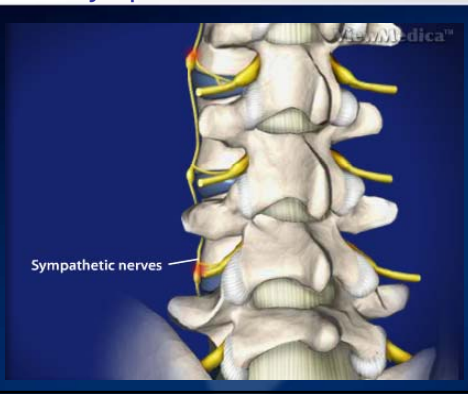
Sympathetic Nerve Block



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Epidural

- Used to be 'gold standard'
- Analgesia
- Sympathetic Block - hypotension
- Motor Block – if high concentration local anaesthetic but also if high infusion rate leads of accumulation – usually lumbar causing quads weakness and immobility
- Failure rate (upto 50%)

MASTER trial Rigg JRA et al. Lancet 2002;359:1276-82
"Epidural analgesia: first do no harm" Low J et al Anaesthesia 2008;63:1-3

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Epidural

- Outcome papers - no fluid optimisation
- Is it still needed in Laparoscopic Surgery?
- Difficult time when epidural comes out!
- High level of care post operatively
- Stress Response
- Vasodilation causes increased cardiac output and increased O2 delivery

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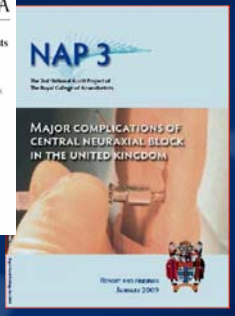
Safety of Epidurals and Spinal


BJA

Major complications of central neuraxial block: report on the Third National Audit Project of the Royal College of Anaesthetists



Cases with Permanent harm

Pessimistic 30

Optimistic 14

'pessimistic'

4.2 per 100 000 (95% CI 2.9–6.1)

1 in 23 500

'optimistic'

2.0 per 100 000 (95% CI 1.1–3.3)

1 in 50 500

Paraplegia and death

Pessimistic 13

Optimistic 5

'pessimistically'

1.8 per 100 000 (95% CI 1.0–3.1)

1 in 54 500

'optimistically'

0.7 in 100 000 (95% CI 0–1.6)

1 in 141 500

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Epidurals and CVS

Hypotension and its effects on

- Splanchnic and anastomotic perfusion
- Other organs eg heart, brain, kidneys

Treatment of hypotension

- Fluids
- Vasopressors
- Pressure more important than flow

Gould TH. BJA 2002:89;446-51

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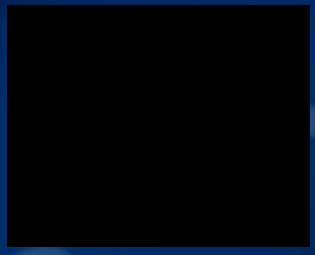
Analgesia effects fluid administration

- Sympathetic block leads to hypotension
- Increased fluid administration
- Vasopressors
- High care area



Analgesia in open surgery

Multimodal analgesia

- Paracetamol, NSAIDs, local anaesthetics
- Opiate sparing
- Epidurals: level 1-2 care for optimum treatment
- Continuous local anaesthetic infusions

Pain teams

Excellent pain control ≠ reduction in morbidity, mortality and hospital stay

Laparoscopic surgery

How much is transferable from open surgery?

Little data for optimum analgesic technique in laparoscopic colorectal surgery

Which Analgesia for Laparoscopic Surgery?

Evidence in laparoscopic surgery

Epidurals

- "..thoracic epidural analgesia superior to PCA in accelerating the return of bowel function and dietary intake, while providing better pain relief".

  Taqi A et al. Surgical Endoscopy 2007;21:247-52

- Thoracic epidurals improved early analgesia.

  Senagore AJ et al. BJS. 2003;90:1195-9

48 Hours Post-Op

Which is the optimal stress response?

Epidural group in hospital

Spinal group at home

23 Hour Stay Laparoscopic Colectomy

Levy BF, Scott MJ, Fawcett WJ, Rockall T

23-hour-stay laparoscopic colectomy. [Controlled Clinical Trial, Journal Article]

Dis Colon Rectum 2009 Jul; 52(7):1239-43.

Laparoscopic surgery

Simple analgesics often all that is required at 24 hours:

- Paracetamol
- NSAIDs
- Tramadol/codeine

Intense analgesia for first 12-24 hours only

Do you need an epidural?

Spinals – emerging data

– Well tolerated
– Need for vasoconstrictors less than epidurals
– Better preservation of respiratory function
– Good opioid sparing effects
– Reduced length of stay

Levy B et al BJS 2008; 95(S3):57
Levy B, Fawcett WJ, Scott MJP et al Anaesthesia 2009;64:810
Levy BF, Fawcett WJ, Scott MJP et al BJS 2009;96(S4):2-3

Laparoscopic surgery – first 24 hours

RCT - Enhanced Recovery
Oesophageal Doppler to optimise fluids

–Epidural
–Spinal
–iv morphine (PCA)

- Randomized clinical trial of epidural, spinal or patient-controlled analgesia for patients undergoing laparoscopic colorectal surgery

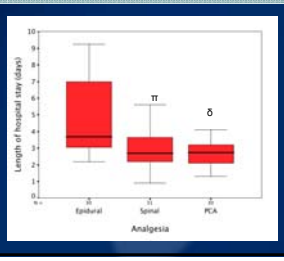
Levy, B. F., Scott, M. J, Fawcett, W.,Fry, C., Rockall, T. A.
Br J Surg 98:8 1068-78 2011

Randomised trial - Epidural versus Spinal versus PCA

(In fluid optimised patients undergoing lap colorectal resection)

Levy B, Scott M et al BJS 98:8 2011

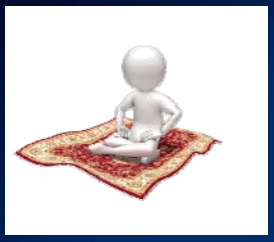
	Epidural	Spinal	PCA
Age	69	69	71
CR Possum	26	27	29
Hospital stay	3.7	2.6	2.3



π p=0.002

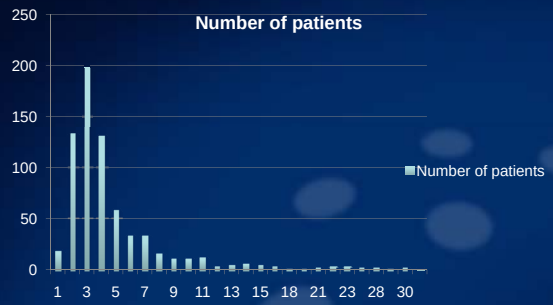
δ p<0.001

What is the Reality for all our patients?



- 25% patients are discharged the day after surgery
- Remainder within 3-4 days depending on age and co-morbidities

736 Consecutive Patients



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N= 736

- Readmission = 39 (5.3%)
- Anastomotic Leak = 26 (3.5%)

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How safe is home compared to hospital?

Home

- Sleep
- Favourite Food
- Carer
- Comfortable
- TV – distraction from pain
- 1 hour away from seeing a consultant if problem during day or A&E at night – immediate review

Hospital

- Intravenous Salt poisoning
- Bugs – MRSA
- Immobility
- No food!
- Noise - poor sleep
- Uncomfortable
- Ignored!
- At least 30 mins-1 hour from seeing a surgical registrar

Hospital is a dangerous place!

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What have we learned through this process?

Haemodynamic / Fluids

Analgesia

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Minimally Invasive Surgery

Maximum cardiopulmonary stress

Head down and Pneumoperitoneum

1. High Intra-abdominal pressure
2. High Mean intra-thoracic pressure
3. Heart is ejecting uphill against resistance

•Increased aortic after load – reduced oxygen delivery
•Prolonged head down can cause pulmonary atelectasis and cerebral venous congestion
•Prolonged CO_2 loading can lead to acute acidosis due to respiratory acidosis

Even more reason to optimise fluid therapy, cardiac output and oxygen delivery!

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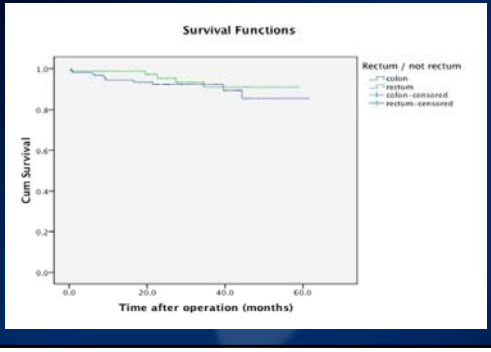
Survival After Cancer



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Does enhanced recovery and laparoscopic surgery have the potential to improve the outcome from cancer?

Hypothetical Reasons

- Early review of our series demonstrates patients receive chemotherapy at least 22 days earlier than open surgery
- Laparoscopic surgery / Enhanced Recovery may effect the immune system differently
- ?Improved post op NK cell function
- ?Improved post op Lymphocytic function
- ?Decreased risk of micrometastasis

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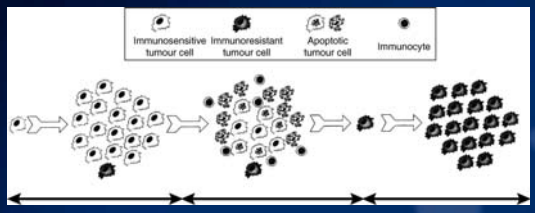
Tumour cells and the immune response.



Snyder G L , Greenberg S Br. J. Anaesth. 2010;105:106-115

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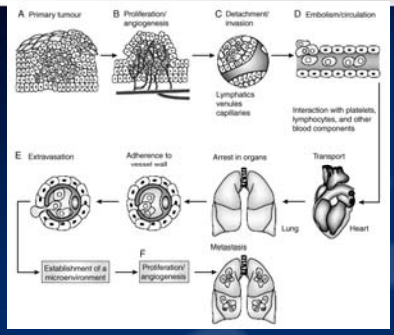
The main steps in formation of a metastasis.6 (a) Cellular transformation and growth, a period during which nutrient supply is met by diffusion.



Snyder G L , Greenberg S Br. J. Anaesth. 2010;105:106-115

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Conclusion

- Laparoscopic surgery stimulates a stress response
- There is currently no detectable difference in the stress response with either spinal or PCA
- Cytokine and Lymphocyte function analysis data to follow

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Analgesia - Getting the Right Balance

- Effective static and dynamic pain relief
- Restores Function
- Does not increase complications or complexity of care
- Allows early Gut function
- Does not impact the immune system

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Conclusion

- Choose the right technique for the operation and the patient
- If all staff are familiar with the technique it has more chance of succeeding – protocols appear to be the way forward
- Pain team / ensuring effectiveness is important
- Blocks before recovery reduce opiate requirements
- Epidurals may not be needed for laparoscopic surgery

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