Analgesia in Major Abdominal Surgery

Anton Krige
Michael J. P. Scott
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Editors
Anton Krige
Department of Anaesthetics
and Critical Care
Royal Blackburn Hospital
Blackburn, Lancashire
United Kingdom

Michael J. P. Scott
Department of Anesthesiology
and Critical Care
Virginia Commonwealth University
Hospital
Richmond, VA
USA

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Foreword

Enhanced post-operative recovery programmes were developed about 20 years ago, initially in minor abdominal procedures but rapidly followed by major abdominal procedures. The clinical and economic benefits of these programmes have been repeatedly confirmed by centres around the world and later including programmes from all other surgical specialties.

A prerequisite for enhanced recovery is provision of "dynamic pain relief", meaning that patients are comfortable and able to mobilize. During the last decade, several developments of new analgesic techniques and drugs have been available, making it difficult for the practical clinician to make evidence-based procedure-specific choices. Consequently, this book which reviews the many different possibilities to optimize analgesia in major surgery is an important step forward to help clinicians to achieve further improvement in their enhanced recovery pathways. The authors are to be congratulated for their efforts to put this knowledge together, which deserves widespread interest and distribution.

Henrik Kehlet
Section for Surgical Pathophysiology 7621
Rigshospitalet
Copenhagen, Denmark

Introduction

This millennium has seen dramatic changes in how major abdominal surgery is performed with rapid increases in the use of minimally invasive surgical techniques, utilizing laparoscopic or robotic assistance. The result is a reduction in abdominal wound site and visceral injury, which has in turn led to a different approach to analgesia management as pain is often controlled with oral multimodal analgesia within 24–36 h post-operatively.

Surgical technique and newer surgical instruments (such as the harmonic scalpel) have also led to a reduction in the amount of tissue damage and blood loss during surgery, regardless of whether a minimally invasive or open approach is used. The result has been surgery with less primary injury and reduction in blood loss enabling patients to recover more rapidly after surgery.

The development of accelerated peri-operative care pathways (so-called enhanced recovery programmes), originally described by Kehlet in the 1990s, which enable patients to recover faster after open colorectal surgery, has also changed the approach to analgesia in patients undergoing all major abdominal surgery globally. This emphasizes early mobilization after surgery to reduce complications and insulin resistance, in order to improve outcomes, and dynamic analgesic techniques are pivotal in achieving these goals.

Analgesic techniques that reduce mobilization, or encumber the patient, are therefore problematic even before they have been commenced. The avoidance of high doses of opiates is also imperative to reduce their unwanted side effects, which include nausea, vomiting, sedation, lethargy, confusion and delirium. There is also an increased risk of ileus and constipation with opiate use. The recognition that early oral feeding is beneficial and without risk, compared to long periods of starvation with a nasogastric tube in situ, has led to the acceptance of early feeding as a standard clinical practice in both upper and lower GI surgery across Europe. Although the timing, initial quantity and increase in buildup of feeds differ between specialties, the era of not feeding the gut for many days after surgery is over. This has presented the opportunity for administering medication orally, thereby reducing the need for complex pumps, which in turn reduce mobility and create psychological dependence. These changes jointly lead to greater simplicity in delivering effective analgesia.

The development and availability of new technology has not been limited to surgery. The advent of highly sophisticated portable ultrasound machines has enabled anaesthetists to perform ultrasound-guided nerve blocks at the bedside or in the

operating room environment. Ultrasound is useful for both single-shot and catheter placement for paravertebral blocks and abdominal wall blocks, e.g. TAP, QLB and rectus sheath blocks, as well as increasingly used in difficult spinal or epidural catheter placement in patients with high body mass index. The result has been the increased safety and efficacy of nerve blocks as anatomy can be accurately targeted and vascular structures identified and avoided. Chapters 9–12 comprehensively cover this range of nerve blocks with continuous wound infusions covered in Chap. 13.

Whilst all these newer techniques are challenging the position long held by thoracic epidural analgesia, Dr. Antrobus devotes Chap. 8 to the discussion of what is still considered the gold standard by many. The other neuraxial block, the spinal blockade using intrathecal opiate, has found a new niche as an effective postoperative analgesic option and is ably discussed by Dr. Dhillon.

It is imperative that surgeons and anaesthetists have knowledge of anatomy of the abdominal wall and nerve distribution to ensure appropriate selection, safety and efficacy of these techniques depending on the surgical approach and patient factors. In Chap. 1, Professor Timothy Rockall outlines the anatomy and approach of different techniques that provide a solid foundation for the regional techniques that follow.

This era has also seen advancements in pharmacology and the introduction of newer analgesic drugs. The release of older drugs in newer formulations has also improved efficacy of analgesia during the peri-operative period when there is gut dysfunction or when the patient is not able to ingest enteral medication.

Paracetamol (acetaminophen) is one such drug. It is now available in intravenous form enabling delivery of up to 4 g a day providing good blood concentrations of the drug as the backbone to peri-operative multimodal opioid-sparing analgesia. Many NSAIDs (including COX2) are available in intravenous form as another addition to paracetamol in multimodal analgesia. Dr. Baldini in Chap. 2 covers simple multimodal analgesia as well as systemic opiate in Chap. 3, which although minimized is still frequently required at lower dosage for control of visceral pain or as a step down from the more potent regional techniques.

Although gabapentinoids (gabapentin, pregabalin) have been used for many years for chronic pain, these drugs are being increasingly used as an adjunct to multimodal opioid-sparing analgesia, and they are expertly dissected by Dr. Jeremy Cashman in Chap. 4.

Other exciting non-opioid adjuvants discussed in detail are ketamine and intravenous lidocaine infusions by Dr. Naveen Eipe in Chaps. 5 and 6. Both drugs have been in use for many decades but have only recently been identified as safe and useful opioid-sparing options, along with other benefits involving inflammation in the case of ketamine and inflammation and gut function in the case of lidocaine. Although a plethora of other non-opioid molecules with varying degrees of analgesic effect has been identified and is used in research settings or by pain experts, for example, beta adrenergic blockers, glucocorticoids, alpha-2 agonists, magnesium, epinephrine, antidepressants, cholinomimetics, antihistamines, nitroglycerine and calcium channel blockers, we have chosen to confine this book to the aforementioned agents as these have the greatest evidence of efficacy and safety and have already been incorporated as standard items in the analgesic package of many enhanced recovery programmes.

Pain is multifactorial in nature and has large inter-individual variation. Indeed the final chapter by Dr. Searle deals with the challenging task of managing of acute pain in patients with pre-existing chronic pain. There is increased awareness that treating the pain score alone, without addressing the consequences of the analgesic method, can worsen outcomes after surgery. Examples are the patient who is rendered immobile with a thoracic epidural due to motor block or a patient who is obtunded or confused as a result of liberal opioid use.

Therefore, the concept of "effective analgesia" is a key principle to keep in mind when reading this book and choosing combinations of techniques to suit your practice and institution.

Multimodal analgesia, including simple analgesia (Chap. 2) along with non-opioid adjuvants (Chaps. 4–6) delivered in a standardized package to reduce the need for opiates and their related side effects, is the backbone of analgesia for enhanced recovery pathways. A major analgesic modality, the so-called primary technique (usually one of regional techniques described in Chaps. 7–13), is needed to achieve this during surgery and the immediate post-operative period. The duration of this depends on the type of surgery, surgical approach and patient factors. The role of systemic opiates ideally remains low dose as rescue.

The primary technique should provide adequate pain relief for early mobilization, enable early return of gut function and have minimal adverse effects (in particular hypotension and excessive motor block which prohibit mobilization). Importantly, the techniques that fulfil all of these attributes, and are therefore the most effective choices, are not always the option with the best pain scores initially. The key to success of any analgesic strategy is patient education and setting of appropriate goals and expectations. Dr. Rockett in Chap. 14 highlights fascinating emerging research surrounding such non-pharmacological adjuncts to analgesia.

It is important for hospitals to have several different approaches for analgesia in case one is inappropriate, contraindicated or in the case of failure. Other factors to consider in choice of technique are the healthcare time involved in managing the interventions, the skill set required for insertion (ideally use interventions with rapid learning curves or already existing skill sets thus enabling rapid system-wide implementation), and portability of infusion devices (ideally use techniques that are single shot thus not requiring infusions or long-acting transdermal patches which do not rely on administration compliance). Finally, many analgesic methods need troubleshooting to ensure efficacy so constant monitoring of pain scores, patient function and vital signs are necessary.

The emphasis for optimal analgesia in modern surgery is therefore multifaceted:

1. A basis of patient education with realistic setting of their expectations and psychological preparation which improves analgesia throughout the peri-operative pathway including after discharge to home. This is an often overlooked component.
2. An overall aim to reduce opioid use and their associated side effects of sedation, nausea and vomiting, pruritus, confusion and ileus.

3. Some form of local anaesthetic block, either central neuraxial, truncal or wound infusions, to reduce opiate consumption in the immediate peri-operative period.
4. Early commencement of multimodal analgesia.
5. Reduction of opiates using other pharmacological methods (gabapentinoids, ketamine, lidocaine). This may include non-pharmacological techniques.
6. Recognition of the chronic pain patient presenting for surgery and those at risk of developing chronic postsurgical pain and developing a robust peri-operative analgesic plan incorporating acute pain team involvement proactively.

The selection of analgesic techniques used in many hospitals around the world is still often based on that which was used during a physician's period in training or what has been historically used in a hospital based on studies from 10 to 20 years ago. This book aims to give the reader an up-to-date evidence-based guide of the analgesic choices available for patients undergoing major abdominal surgery, along with the practical knowledge and tips of the experts to enable you to implement these interventions into your practice and across your wider institutions.

When compiling the chapter list, we engaged some of the world's most eminent authority on each subject. We hope you enjoy reading it and find the contents relevant to your clinical practice.

Blackburn, UK Anton Krige, MBChB, DIMC, FRCA, FFICM
Guildford, UK Michael J. P. Scott, MBChB, FRCP, FRCA, FFICM

Abbreviations

ACC	Anterior cingulate cortex
AMPA	α-Amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid
AMPAR	α-Amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid receptor
ASIS	Anterior superior iliac spine
BD	Bilateral dual
CBT	Cognitive behavioural therapy
CI	Confidence interval
CNB	Central neuraxial blockade
CNCP	Chronic non-cancer pain
CNS	Central nervous system
COX	Cyclooxygenase
CT	Computed tomography
CTL	Costotransverse ligament
CWI	Continuous wound infusion
CWIC	Continuous wound infusion catheter
DNIC	Diffuse noxious inhibitory control
DRG	Dorsal root ganglion
EO	External oblique
ER	Extended release
ERAS	Enhanced recovery after surgery
EREM	Extended-release epidural morphine
ES	Erector spinae muscles
ESRA	European Society of Regional Anaesthesia & Pain Therapy
FDA	United States Food and Drug Administration
FLK	FentaKetaCaine
fMRI	Functional magnetic resonance imaging
GABA	γ-Aminobutyric acid
GI	Gastrointestinal
GP	General practitioner
IASP	International Association for the Study of Pain
IBW	Ideal body weight
ICB	Intercostal block
ICBG	Iliac crest bone grafting
IHN	Iliohypogastric nerve

IIN	Ilioinguinal nerve
IO	Internal oblique
IL	Interleukin
ILO	Ivor-Lewis oesophagectomy
IM	Intramuscular
IV	Intravenous
L4	Vertebral body of L4
LA	Local anaesthetic
LAST	Local anaesthetic systemic toxicity
LAT	L-Amino acid transporter
LOS	Length of stay
MAC	Minimum alveolar concentration
MCID	Minimal clinically important difference
MCT-1	Monocarboxylate transporter-1
MIO	Minimally invasive oesophagectomy
NAP	National Audit Project
NF-κB	Nuclear factor-kappa B
NMDA	N-methyl-D-aspartate
NNH	Number needed to harm
NNT	Number needed to treat
NSAID	Nonsteroidal anti-inflammatory drug
OFA	Opioid-free anaesthesia
OIH	Opioid-induced hyperalgesia
OR	Odds ratio
PACU	Post-anaesthetic care unit
PAG	Periaqueductal grey
PCA	Patient-controlled analgesia
PCEA	Patient-controlled epidural analgesia
PCP	Phencyclidine
PCTS	Patient-controlled transdermal fentanyl
PO	Per os
POCD	Post-operative cognitive dysfunction
PONV	Post-operative nausea and vomiting
PVB	Paravertebral blockade
RSB	Rectus sheath block
RSC	Rectus sheath catheter
QL	Quadratus lumborum
QLB	Quadratus lumborum block
QST	Quantitative sensory testing
PSU	Presurgical unit
PVS	Paravertebral space
RA	Rectus abdominis
RCT	Randomized controlled trial
RFA	Radiofrequency ablation
RSB	Rectus sheath block

RSC	Rectus sheath catheter
RSS	Rectus sheath space
SC	Subcutaneous
SD	Standard deviation
TA	Transversus abdominis
TAP	Transversus abdominis plane
TCI	Target-controlled infusion
TEA	Thoracic epidural analgesia
TERSC	Thoracic Epidural versus Rectus Sheath Catheter study
TFP	Transversalis fascia plane
TLO	Thoracoscopic-laparoscopic oesophagectomy
TP	Transverse process
TPBV	Thoracic paravertebral block
TQL	Transmuscular quadratus lumborum block
UA	Ultrasound assisted
USG	Ultrasound guided
VDCC	Voltage-dependent calcium channel
VPL	Ventral posterolateral
VR	Virtual reality
WHO	World Health Organization
WMD	Weighted mean difference

Contents

Contributors

Jonathan Antrobus, MD Department of Anesthesia, Borders General Hospital, Melrose, Roxburgshire, UK

Gabriele Baldini, MD, MSc Department of Anesthesiology, McGill University Health Centre, Montreal General Hospital, Montreal, QC, Canada

Rafael Blanco, MB, BS, FRCA, DEAA Department of Anaesthesia & Intensive Care Medicine, King's College Hospital, Dubai, UAE

Jens Børglum, MD, PhD Department of Anesthesiology & Intensive Care Medicine, Zealand University Hospital, University of Copenhagen, Roskilde, Denmark

Jeremy Cashman, BSc, MB, BS, BA, MD, FRCA Department of Anaesthetics, St. George's Hospital, London, UK

Mark Daugherty, MBChB, FRCA Department of Anaesthesia, Royal Devon and Exeter Hospitals, Exeter, UK

Sabrina Dhillon, MD Virginia Commonwealth University Health System, Richmond, VA, USA

Naveen Eipe, MD Department of Anesthesiology and Pain Medicine, The Ottawa Hospital, University of Ottawa, Ottawa, ON, Canada

Kevin King, DO Department of Anesthesiology, University of Pittsburgh Medical Center, Passavant Hospital, Pittsburgh, PA, USA

Anton Krige, MBChB, DIMC, FRCA, FFICM Department of Anaesthesia & Critical Care, Royal Blackburn Teaching Hospital, East Lancashire Hospitals NHS Trust, Blackburn, UK

Nicholas Marshall, MBBS, FRCA Department of Anaesthesia, Royal Cornwall Hospital, Truro, Cornwall, UK

Aisling McMahon, FCAI, FJFICMI Department of Anesthesia, Clinical Sciences Institute, National University of Ireland, Galway, Ireland