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SASA REFRESHER COURSE ABSTRACTS

ALARM FATIGUE

Elethu Gwala

Studies have shown that most alarms generated by continuous bedside monitoring devices used in the critical care unit and operating room are non-actionable. This cascade of inaccurate signals can cause healthcare personnel to endure sensory overload when attempting to distinguish between true and false alarms, resulting in desensitisation and alarm fatigue. This often leads to adverse events when true instability is not identified or addressed despite the alarm.

A literature review indicates that the scope of the problem is vast. As the variety of healthcare alerts increases, alarm fatigue is increasingly becoming a significant safety concern for both patients and healthcare professionals. This presentation aims to delve into the widespread repercussions of alarm fatigue, including the diversity of factors that contribute to it, to further understand this phenomenon and find strategies to improve the safety of our patients and the well-being of healthcare providers.

This review sheds light on the current and prospective methods of identifying and responding to actionable and non-actionable alerts. It further highlights the obstacles to reducing alarm fatigue and adverse events by influencing alarm modes, sensitivity and specificity, and clinical activity. New modes sought to mitigate alarm fatigue will also be highlighted. Such modes include vibro-tactile units that can emit varying degrees of signals, as well as clinical monitoring capabilities incorporating artificial intelligence that can reflect and replicate human cognitive/decision-making processes.

In summary, this talk will clarify how addressing alarm fatigue can enhance safety. To ensure that clear mechanisms for safe alarm handling are in place, a multifaceted strategy combining clinicians, leaders of healthcare institutions, and industry and regulatory authorities will be required.

MINIMISING POSTOPERATIVE COGNITIVE DYSFUNCTION

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Postoperative delirium remains the most common postoperative complication worldwide, with the incidence ranging from 15% to 50%, depending on a multitude of risk factors and surgical scenario influences. Many risk factors are beyond our control and remain unmodifiable. However, anaesthesiologists remain an important component of the team approach in preventing delirium, where up to 40% may be preventable. Patients who experience postoperative delirium are more likely to manifest new-onset dementia and suffer cognitive decline. What simple interventions should form part of any anaesthesiologist's armamentarium when faced with a frail or vulnerable patient?

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SHOULDER SURGERY: ONE MONITOR FOR ALL

A Zeijlstra

An ideal monitor should be accessible, affordable, safe, and easy to use. It should also allow for real-time parameter modification, be reliable, and provide valid results.

Shoulder surgery presents the anaesthetist with a unique set of considerations and constraints. Successful surgery requires that the surgeon has good access and visibility, with a bloodless field. These provisions come at the cost of maintaining the blood pressure at hypotensive levels with the patient in a seated position. Consequent physiological changes become even more challenging in the presence of significant comorbidities, with the requirement of optimal cerebral oxygenation being paramount.

Consequently, the need for superior monitoring, including the need for cerebral oxygenation monitoring, is evident. With this in mind, the following monitors will be considered: cerebral oximetry, capnography, and invasive and non-invasive pressure monitors.

In conclusion, one perfect monitor is unavailable. Once standard monitoring has been used on a patient for a shoulder procedure, I would choose to use cerebral oximetry as my one additional monitor.

SAFE SURGERY PAEDIATRICS

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Children have little physiological reserves. When things go wrong, they can rapidly deteriorate, leading to increased morbidity and mortality. Ensuring safety in paediatric anaesthesia involves meticulous attention to detail and specialised care. It encompasses a comprehensive approach to minimise risks and ensure optimal outcomes for children undergoing surgical procedures. The risk of a critical incidence occurring during paediatric anaesthesia increases with decreasing age, the presence of underlying pathology, urgency of surgery, experience of anaesthetist, and hospital setting.

Anaesthesia morbidity in children is greater with age < 1 year, American Society of Anesthesiologists (ASA) > III, emergency surgery, inexperience of the anaesthetist, and specialised surgery, like cardiothoracic and neurosurgery. Complication rates in Africa are documented to be four-fold higher, and mortality rates are eleven-fold higher than in high-income countries.

Children are not "small adults". Their physiological differences in cardiovascular, respiratory, metabolic, medication response, and anatomy are unique. Their respiratory anatomy and physiology make respiratory incidents (laryngeal spam, hypoxia, hypoventilation, etc.) more likely. The presence of congenital anomalies and syndromes requires meticulous preoperative preparation. A good understanding of these differences is essential for safely conducting anaesthesia.

This narrative will review the contribution of preoperative assessment, appropriate anaesthetic planning, expert airway management, medication principles, temperature regulation, team communication, and handover to the safety of paediatric anaesthesia.

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HANDOVER IN RECOVERY

C Victory

Handover in recovery is a process of communicating important information between healthcare teams, and it states the patient's clinical status, risks, potential risks, and treatment to be performed. Patient safety in the operating theatre is a global concern, according to various research authors. Handover in the recovery room must be performed safely, effectively, and efficiently while respecting the patient's privacy and dignity. Staff in the recovery room must be competent and knowledgeable. A comprehensive handover from intra-op to recovery room staff should prevent the loss of important information. A qualitative research method was used to observe three hospitals. Staff responsibility and accountability is an important handover principle. Audits on handover processes should be conducted to verify the content and quality of the assessed clinical information. If the surgery content is not handed over properly, patient care is compromised. The study aims to promote a standard tool for safe patient recovery outcomes.

MULTIPLE PHYSIOLOGICAL DERANGEMENTS

R Hockman

Multiple physiological derangements follow brainstem death. Meticulous donor management is needed to ensure the best quality organs. Appropriate monitoring, fluid administration, and inotropic support are needed to ensure haemodynamic stability and optimal oxygenation of the organs. A conservative fluid strategy favours successful lung procurement, whereas a more liberal fluid administration favours the kidneys. Lung protective ventilation includes tidal volumes of 6–8 ml/kg and avoidance of high pressures and high oxygen concentrations. Diabetes insipidus is managed with DDAVP. Corticosteroids dampen the inflammatory response. Hyperglycaemia, hypothermia, and coagulopathy must be treated appropriately.

MUSIC IN THE PERIOPERATIVE PERIOD: HELP OR HINDRANCE?

S Kelber

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Introduction: Debasish Mridha states, "Music can heal the wounds which medicine cannot touch." If this is true, can music also influence the theatre environment where both the patient and surgical team experience ongoing stress? As a music-lover, amateur pianist, and wife to a professional guitarist, I have been conflicted by the pros and cons of music in theatre: I value the energy that music injects into my body and mind at 3 a.m. on a call, and I've also found myself annoyed at the added noise pollution music can cause.

Background music in theatre: A 2021 survey evaluating the opinions of theatre staff regarding background music in theatre found that most respondents (67%) felt background music had a positive effect on workers in the operating theatre, and 80% did not find it to be a distraction. A systematic review found classical music with a low-to-medium volume can improve surgical task performance by increasing accuracy and speed. However, the review cautions about the distracting effect of loud "high beat" type music that my orthopaedic colleagues seem to enjoy.

The role of music during anaesthesia: A randomised controlled trial found that patients with music of their choice played through headphones during general anaesthesia had more stable haemodynamics, a calmer recovery, and better patient satisfaction scores. Music may be used instead of midazolam to calm patients before a peripheral nerve block. Patients undergoing lower limb orthopaedic surgery under spinal, who listened to instrumental music during the case, had lower anxiety levels and reduced sedative requirements.

Conclusion: In this talk, I will evaluate the impact of music on the patient and theatre staff. Lailah Gifty Akita once said, "Music is a great healer." Maybe it is time to welcome music into our multidisciplinary team and thereby provide patients with a more enjoyable perioperative experience.

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CIRCI/CIRMI ADRENAL DYSFUNCTION IN CRITICAL ILLNESS

GD Nethathe

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Critical illness-related corticosteroid insufficiency (CIRCI) involves hypothalamic-pituitary axis dysfunction during critical illness, affecting cortisol metabolism and tissue corticosteroid resistance. Hyperreninaemic hypoaldosteronism describes impaired aldosterone response to increased levels of renin in critically ill patients.

Recently, mortality improvements associated with adjunctive glucocorticoid treatment in combination with fludrocortisone in septic shock, as well as the efficacy of angiotensin II in vasodilatory shock, have been demonstrated. This has prompted further exploration of the clinical relevance of mineralocorticoid dysfunction in critical illness.

Hyperreninaemic hypoaldosteronism is examined in this context, highlighting its pathophysiological and clinical characteristics alongside CIRCI and addressing gaps in the literature regarding assessment, diagnosis, and treatment limitations.

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MALIGNANT HYPERTHERMIA

AI Mamoojee

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Malignant hyperthermia presents when a susceptible person is exposed to volatile anaesthesia or suxamethonium, resulting in a hypermetabolic crisis that can be lethal if not managed swiftly. An anaesthetic emergency always requires preparedness, as it can occur with a patient's index exposure to anaesthesia. The cardinal clinical signs are masseter muscle spasms, high end-tidal carbon dioxide, a marked rise in temperature, tachycardia, tachypnoea, and arrhythmias. This may rapidly progress to the patient having widespread muscle rigidity and breakdown, hyperkalaemia, disseminated intravascular coagulation, multiorgan dysfunction, and death.

This talk focuses on a brief background of malignant hyperthermia, followed by crisis recognition and treatment according to the Malignant Hyperthermia Society of Australia and New Zealand (MHANZ). The algorithm and seven task cards emphasise a simplified approach to managing malignant hyperthermia by a team, employing dedicated task cards, which act as a memory aid, encourage teamwork, and avoid critical errors should this emergency arise. Malignant hyperthermia is treated using dantrolene, an orange powder that must be reconstituted before administration, in conjunction with supportive care, followed by transfer to the intensive care unit for ongoing management.

The talk also touches on the preparation for anaesthesia for a patient known to be at risk of developing malignant hyperthermia, including the preparation of the anaesthetic workstation. I completed a six-month fellowship in malignant hyperthermia in Australia. The insights presented in this talk are a culmination of a literature search and knowledge gained from my time there.

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CURRENT EVIDENCE ON THE SAFETY OF REGIONAL ANAESTHESIA

H Abrahams

A few discrete developments have contributed to the popularity of regional anaesthesia (RA) over the last 45 years. These include the discovery of spinal opioid receptors, outcome studies demonstrating the advantages of neuraxial anaesthesia, and the development of continuous neuraxial and peripheral catheter techniques. The introduction of ultrasound-guided nerve localisation, an emphasis on multimodal opioid-sparing analgesic techniques within an enhanced recovery after surgery (ERAS) paradigm in parallel with the introduction of fascial plane blocks (FPB) – where large volumes of local anaesthetic (LA) injected between fascial planes result in analgesia in a wide variety of settings – has resulted in a surge in novel FPB techniques with non-standardised nomenclature.

While using ultrasound (US) results in a rapid analgesic onset time and a lower required volume of perineural LA injectate, it has not reduced the incidence of peripheral nerve injury (PNI). In the case of FPB, the potential for LA systemic toxicity (LAST) is increased. The incidence of wrong site blocks (WSB) remains high despite being categorised as a "never-event". Procedural checklists and emergency protocols, equipment ranging from specialised block needle design, improved US technology, specific catheter, syringe and needle connectors, pressure monitoring devices (to signal potential intraneural injection), and electrostimulation as an adjunct to mitigate needle-nerve contact and injury are all suggested modalities to improve safety. The consideration that non-technical and human factors ultimately influence block performance (both success and failure) has resulted in strategies to improve work system design in implementing safe RA practices.

US-guided RA facilitates earlier postoperative mobilisation by siting motor-sparing peripheral nerve blockade and increased first-pass success rates in neuraxial RA. Gastric US facilitates the decision to perform a rapid sequence induction (RSI) versus a block with sedation. Newer technologies, such as artificial intelligence (AI), improve US image interpretation and, if incorporated into structured RA teaching, shows promise in improving anatomical target accuracy and earlier attainment of RA competence.

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AN EVALUATION OF ANAESTHETIC WASTE GENERATION AT A JOHANNESBURG ACADEMIC HOSPITAL

JM Meintjes, L Gilliland

Background: The healthcare sector contributes directly to global warming and environmental decline. This is partly due to disproportionately large waste generation compared to other sectors and the environmental consequences of medical waste incineration. Waste separation and recycling decrease the total waste generation of the theatre complex, decreasing the cost of waste disposal and, if properly implemented, can generate revenue. Waste separation is not performed uniformly, and no recycling programmes exist in the theatre complexes of the academic hospitals in Johannesburg. Potentially recyclable anaesthetic waste is not identified in our setting.

Methods: Recyclable anaesthetic waste items were identified. Anaesthetic waste was collected after every anaesthetic case. General and medical waste were weighed respectively and inspected for correct separation. Recyclable items were separated from general waste and weighed.

Results: A total of 107.6 kg of anaesthetic waste was evaluated. Per anaesthetic, 74.6% (65.0–84.2%) was medical waste, and 25.4% (15.8–35.0%) was general waste. Of the general waste, 68.8% (57.7–78.8%) was recyclable. Only 6.8% of medical and 61.4% of general waste bags inspected were correctly separated. Within each medical waste bag, 6.9% (2.3–15.5%) of waste was incorrectly placed general waste. Similarly, each general waste bag contained 6% (0–21.6%) of incorrectly placed medical waste. Waste generated per surgical discipline was significantly different.

Conclusion: Correct waste separation, a key step in decreasing the burden of healthcare waste, was poor. The study demonstrated that most general anaesthetic waste is recyclable.

ANAESTHESIA FOR THE PREGNANT PATIENT UNDERGOING NON-OBSTETRIC SURGERY

NY Fening

In the UK and USA, about 1% (ranging from 0.75% to 2%) of pregnant patients have surgery for non-obstetric reasons.[1,2] There is a paucity of published data indicating the rates in Africa.

Providing anaesthesia to a pregnant patient is undoubtedly stressful for all members of the theatre team; most clinicians try to delay surgery for as long as possible until the baby is delivered. There are two lives to consider.

Unfortunately, there are times when this is not possible. Concerns remain about the teratogenicity of anaesthetic agents, neurodevelopment, preterm delivery, low birth weight, and the loss of maternal or fetal life.[3,4] A good understanding of maternal physiology and pharmacology relating to the specific surgery is paramount in achieving a successful outcome.[4] Most surgeries take place in the first and second trimester.[1,4] Appendicitis remains the most common cause of non-obstetric surgery.[1,2,4-6] Other common causes are trauma-related, gallstones, and malignancies.[1,2,5]

This presentation aims to highlight the challenges faced by the anaesthetist when managing such patients with an overarching aim of ensuring safety and the best outcome for both mother and baby.

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ANALGESIA FOR BILATERAL MASTECTOMY

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According to the World Health Organization (WHO), breast cancer was the most prevalent cancer among women in 157 of 185 countries in 2022.[1] Encouragingly, survival rates continue to improve, likely due to earlier detection and advancements in individualised treatment.[2] Given that surgery remains the cornerstone of breast cancer management, many patients will require anaesthesia for their procedures.

Bilateral mastectomy, a common surgical intervention for breast cancer, either therapeutically or prophylactically, often results in significant acute and chronic postoperative pain, with a notable risk of developing postmastectomy pain syndrome (PMPS). Managing acute postoperative pain is one of the key modifiable risk factors in preventing PMPS.[3]

Effective analgesia for patients undergoing bilateral mastectomy is crucial for enhancing patient outcomes, reducing morbidity, and facilitating postoperative recovery. Advocating for a personalised approach, recent guidelines and evidence underscore the importance of considering patient-specific factors when selecting the optimal analgesic regimen. Notably, the use of multimodal analgesia, particularly incorporating regional anaesthesia, has been emphasised as essential for managing pain in bilateral mastectomies within the context of cancer surgery.[3-5]

Regional analgesia options for these patients include central blocks (including thoracic epidural and morphine spinal), bilateral nerve blocks (including paravertebral block), and bilateral fascial plane blocks (including erector spinae, serratus anterior, and pectoral nerve blocks). Each block presents unique advantages and disadvantages. When selecting a block, it is imperative to consider the risk profile of the block, the specifics of the surgery, the nerves requiring blockade, patient preference, surgeon concerns, and the anaesthesiologist's expertise.[5,6]

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ANAPHYLAXIS

O Fuzile

Anaphylaxis is a severe life-threatening systemic hypersensitivity reaction. The incidence of perioperative anaphylaxis is on the rise, possibly as a result of the more frequent use of anaesthesia and the associated increased drug complexity. It has been recognised that the causative agents vary between countries and over time. Recognition, diagnosis, and treatment of perioperative anaphylaxis should be included in training all anaesthesia and theatre personnel, including recovery personnel. One of the

NAP6 recommendations is that the Department of Anaesthesia should have protocols for detection, management, and referral for investigating perioperative anaphylaxis, which should be readily available in all areas where anaesthesia is administered.

ANAESTHESIA FOR CATHETER ABLATION OF ATRIAL FIBRILLATION

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Catheter ablation (CA) of atrial fibrillation (AF) is recommended as a class I indication for treatment in patients where AF contributes to the heart failure by the American College of Cardiologists. In 2024, the European Heart Rhythm Association Consensus Statement upgraded the use of CA as a first-line treatment for paroxysmal AF.

AF appears to result from an interaction between a focal initiator, usually arising from the muscular sleeves of the pulmonary veins, and abnormal atrial tissue capable of sustaining excitation. Electrical isolation of the pulmonary veins with radiofrequency or cryoablation remains the "gold standard" of CA.

Currently, CA is still evolving and is complex and lengthy, has periods of significant discomfort, and requires patient immobility. Access to the left atrium is almost always via a transseptal puncture performed under transoesophageal or intracardiac echographic control. Electroanatomical mapping systems (EAMS) are commonly used to locate foci for ablation.

Both general anaesthesia (GA) and deep sedation (DS) have been used for CA. A systematic review of retrospective studies revealed that the success rate with GA is higher than with DS. Complication rates for both are similar. Hypotension and coughing were common in the GA group, and pain and agitation were common in the DS group. A useful reference describing a protocol for GA is Osorio J, Rajendra A, Varley A, et al. General anesthesia during atrial fibrillation ablation: standardized protocol and experience. Pacing Clin Electrophysiol. 2020;43(6):602-88. https://doi.org/10.1111/pace.13928.

CARDIOVASCULAR DISEASE

C Alphonsus

Cardiovascular disease (CVD) is the leading cause of death globally. The majority of deaths occur in low- and middle-income countries, including African countries.[1] Africa is home to more than 1 billion people.[2] Demographic changes and increasing urbanisation on the continent are leading to an epidemiological shift in disease patterns.[3] From 1990 to 2015, deaths from noncommunicable diseases increased from 25% (1.7 million) to 34% (2.7 million) of total deaths in sub-Saharan Africa.[4] The majority of these deaths, about 38%, were caused by CVD.[5] Noncommunicable diseases are set to overtake communicable, maternal, neonatal, and nutritional diseases combined as the leading cause of mortality in sub-Saharan Africa by 2030.[6] The potential scenario is of a double burden of disease with the increase in noncommunicable diseases added to the already present disease burden on the continent.[7]

The Vascular Events in Noncardiac Surgery Patients Cohort Evaluation (VISION) Study demonstrated the impact of CVD on surgical outcomes in noncardiac surgery with a specific focus on myocardial injury after noncardiac surgery (MINS).[8] Silent postoperative troponin leak was shown to be as high as 8% with a mortality of 2%.[9] Patients with postoperative troponin leak are more likely to die within 30 days after surgery and, if still alive, will carry this morbidity up to one year after surgery.[10]

Preoperative risk stratification and identification of high-risk patients presenting for noncardiac surgery is an important step in mitigating postoperative complications. Risk stratification takes three factors into account that have a profound effect on surgical outcomes: age, patient comorbidities, and surgical risk (i.e. intermediate to high-risk surgery).[11] Patient comorbidities and surgical risk are modifiable and have a dynamic interaction over the course of the perioperative period. Thus, these two factors provide a potential means to improve postoperative outcomes.

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COLLOIDS – PREDICTING THE FUTURE

MFM James

Predicting the future requires an understanding of the past. Intravenous (IV) crystalloids were developed in the 19th century. Colloids have been part of fluid therapy since the exigencies of World War I led to the development of gelatins for volume replacement. In World War II, albumin was widely used. Subsequently, various artificial colloidal solutions were developed, including modified gelatins, dextrans, and hydroxyethyl starches (HES).[1] Despite these developments, crystalloids remained the most popular choice based on cost and the absence of perceived harm. The emergence of acute respiratory distress syndrome (ARDS) and the realisation that fluid overload was harmful to critically ill patients changed this perception. There was a consequent upswing in the use of colloids.

The gelatins had several issues, including a short duration of action, anaphylaxis risks, and later, possible prion transmission. The dextrans were highly effective plasma expanders but were associated with serious adverse reactions that resulted in their abandonment. HES, originally with high molecular weight molecules, was refined to the modern version of a smaller molecule in the plasma of similar size to albumin. For a while, this was a very popular colloid. However, concerns regarding renal injury began to emerge in intensive care unit (ICU) patients, particularly with sepsis. These concerns have not been supported in current perioperative studies.

Colloids, as plasma expanders, depend on the integrity of the capillary wall and the retention of the colloid particles within the vascular compartment. The discovery of the endothelial glycocalyx (EG) resulted in a revision of Starling principles and the realisation that oncotic forces were limited if the EG was damaged. The EG is fragile, and once it is injured (e.g. in sepsis), it rapidly loses its ability to retain large particles. Consequently, extravascular leakage of colloid particles into the interstitium can have adverse consequences, particularly regarding renal function and reduced efficacy.

Currently, colloids are generally limited to situations in which crystalloids alone are ineffective for volume replacement and in situations where the EG is relatively intact, such as in major surgery. In surgery, current fluid management strategies centre on goal-directed fluid therapy, in which colloids form a prime component. Recent research has demonstrated the efficacy of this strategy with virtually no effect on perioperative renal dysfunction or bleeding risks.

Future colloid development will probably focus on developing fluids that protect and repair the EG. Current evidence suggests that fresh frozen plasma (FFP) and albumin solutions exert some beneficial properties on the EG, but they are expensive and relatively unavailable in developing economies. The real target is colloid oncotic pressure (COP), and recent research promises to make the measurement of COP a reasonable bedside tool. If this becomes possible, it may provide a better clinical basis for the choice and timing of the administration of colloids. However, the current controversies surrounding colloids make major industrial development of a new colloid molecule that meets the requirements of safe plasma volume expansion without adverse effects at an affordable cost unlikely. It seems probable that blood-derived colloids and HES will remain the major colloid options in the developing world for the foreseeable future.

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CRITICAL ADVERSE EVENTS AND MANAGEMENT THEREOF

V November

Critical adverse events are defined as any preventable mishap associated with medical intervention, including the administration of anaesthesia. Critical adverse events in healthcare encompass both near-miss events and patient safety incidents (PSI). A near-miss event is an incident that has the potential to cause harm but does not reach the patient due to timely intervention. A PSI is preventable harm to a patient caused by medical intervention that is unrelated to the underlying disease or natural progression of the disease.

In the perioperative period, factors leading to critical adverse incidents can be attributed to the patient, surgery, anaesthesia, or theatre environment. The practice of anaesthesia is highly complex, where multiple factors interact and finally converge in the occurrence of adverse events. Airway mishaps and respiratory and cardiac complications are the leading causes of adverse outcomes during the administration of anaesthesia. It is well recognised that the induction period of anaesthesia and airway manipulation represent the highest risk for the occurrence of critical adverse events.

Close monitoring of physiological systems, clinical vigilance, and consultant supervision remain the cornerstones of prevention and early detection of adverse events. Institutional protocols, policies, and the implementation of voluntary reporting of critical incidents are encouraged. A robust PSI reporting system is essential in reducing the frequency of errors, fostering a culture of learning and improvement, and improving patient safety.

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DEATH ON THE TABLE: PREPARING FOR THE INEVITABLE

K van Rensburg

As anaesthesiologists, we are in the business of helping patients and saving lives. Anaesthesiologists, as perioperative physicians, are likely to experience death on the operating table at some point in their careers. Therefore, the perioperative death of a patient can be a harrowing experience and potentially a traumatic event. Whether the death on the table was expected or occurred when least expected, nothing in this world fully prepares one to face and manage these situations. Over the years, we have all developed various coping mechanisms that enable us to navigate through these stressful situations; however, each of us may be affected emotionally, physically, and professionally.

As defined by the Health Professions Act, Act no. 56 of 1974 (death from unnatural causes), a procedure-related death is a death of a person undergoing or as a result of a procedure of a therapeutic, diagnostic, or palliative nature or of which any aspect of such a procedure has been a contributary cause shall not be deemed to be a death from natural causes as contemplated in the Inquest Act, Act no. 58 of 1959, or the Births and Deaths Registration Act, Act no. 51 of 1992. There is no time limit to this definition, and it includes all deaths while the patient is under the influence of a local or general anaesthetic.

This talk will highlight what one's obligations are to the deceased, their family, the state, the medical team, and various third parties. The medicolegal implications related to the anaesthesiologist and how to complete the official documentation, including the GW7/24 form, will be discussed. The protocols to be followed will be explained, including notifying the South African Police and the Forensic Pathology services, keeping all medical paraphernalia intact, preserving and providing access to the full medical records, including all laboratory and other investigative reports, and to whom the body is to be handed over. Hopefully, this talk will promote discussion on this topic and assist those with the aftermath of a perioperative catastrophe.

CONTRAST MEDIA & RENAL PROTECTION

S Ramos

Contrast-induced nephropathy (CIN) remains a significant risk associated with administering iodinated contrast media in vulnerable populations. The American College of Radiology (ACR) Manual on Contrast Media has updated its guidelines to better protect renal function and reduce the incidence of CIN in patients undergoing contrast-enhanced imaging procedures.

This presentation aims to outline the recently updated ACR guidelines focused on renal protection, emphasising new recommendations, key insights from recent research, and practical strategies for implementation in clinical settings.

The presentation will review the mechanisms by which contrast media can affect renal function, identify patient populations at increased risk of CIN, and discuss the recommended pre- and post-procedure protocols aimed at mitigating this risk. A notable emphasis is placed on individualised patient assessment to guide contrast media choice and dosing.

The updated ACR guidelines reflect an evolving understanding of effectively balancing the diagnostic benefits of contrast-enhanced imaging with the imperative to minimise renal risk. By adhering to these guidelines, healthcare providers can significantly reduce the incidence of CIN, thereby improving patient outcomes.

DRUG ERRORS AND DRUG SAFETY

SP Erwee

Drug errors in anaesthesia remain a significant concern due to their potential to harm patients. This presentation explores the definition, causes, and prevention strategies for medication errors (MEs) and adverse drug reactions (ADRs). The presentation critiques traditional approaches such as the "naming, blaming, and shaming" culture and advocates for systemic changes to enhance safety, emphasising the role of human factors. It highlights findings from studies on the prevalence of medication errors in anaesthesia and the risk factors specific to anaesthetists. Additionally, the presentation outlines practical mechanisms to minimise MEs, including thorough preoperative preparation, careful drug administration, and post-administration documentation. The presentation aims to provide actionable insights for reducing drug errors and enhancing patient safety in anaesthetic practice by promoting a safety culture that encourages error reporting and continuous improvement.

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FAST TRACK TONSILLECTOMY

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Adenotonsillectomy is one of the most performed surgical procedures in children. Tonsillectomy presents particular challenges for the anaesthetist due to the shared airway nature of the procedure, the high frequency of obstructive sleep-disordered breathing (oSDB), and obstructive sleep apnoea (OSA), as well as an elevated risk of perioperative respiratory adverse events.

Indications for tonsillectomy are generally related to airway obstruction or recurrent infection. Accounting for over 75% of cases, oSDB and OSA are the most common surgical indications. Most tonsillectomies are performed as day-case procedures, and thorough preoperative screening is required to assess eligibility and feasibility for safe ambulatory surgery. Clinicians should

arrange for overnight, inpatient monitoring after tonsillectomy for patients under three years old or with significant medical conditions, American Society of Anesthesiologists (ASA) grade 3 or above, bleeding tendencies, moderate or severe sleep apnoea, emergency tonsillectomy for airway obstruction or infection, inappropriate home circumstances, non-availability of an adult escort, no access to telephones, no access to transport or long travelling times to the hospital.

Patients with features of oSDB or OSA, craniofacial abnormalities, neuromuscular disorders, Down syndrome, sickle cell disease, and mucopolysaccharidosis should be referred for polysomnography or overnight oximetry. Patients with severe OSA will require preoperative cardiac and pulmonary assessment and anaesthesia consultation and should be considered for postoperative inpatient monitoring in an intensive care setting.[1,2] Recent upper or lower respiratory tract infections (< 2 weeks) and a history of asthma or wheezing should be considered when evaluating perioperative risk.[3]

Preoperative fasting should be limited, and liberal access to clear fluids should be allowed 1–2 hours before anaesthesia. Preoperative anxiolytic agents should be individualised and used cautiously in patients with OSA. Non-pharmacological methods and parental presence at induction are considered safe and effective when compared to pharmacological anxiolysis.

The choice of anaesthetic induction technique should consider the degree of upper airway obstruction and the age and maturity of the patient. Both volatile and intravenous techniques are acceptable; a cuffed endotracheal tube is preferred to allow full surgical access while protecting the lower airways from blood and surgical debris. Due to anatomical and physiological changes, appropriate planning for difficult airway management should take place. Routine use of perioperative antibiotics should be avoided.[2,3]

Post-tonsillectomy pain is challenging and often undertreated. Caregivers and patients should be counselled on the importance of managing post-tonsillectomy pain. A multimodal, opiate-sparing analgesic technique should be employed to prevent the unwanted opiate side effects of respiratory depression, postoperative nausea and vomiting, and delayed return to enteral feeding. Paracetamol, in combination with nonsteroidal anti-inflammatory drugs (NSAIDs), reduces postoperative pain scores and is usually sufficient for postoperative analgesia. NSAIDs have not been shown to significantly increase the risk of post-tonsillectomy bleeding. Dexamethasone has analgesic and anti-inflammatory benefits and reduces nausea and vomiting; a single dose of 0.15 mg.kg^{-1} should be given intraoperatively.[4]

Opiates are not usually necessary for the management of postoperative pain and should be reserved for rescue only. Codeine has received a Food and Drug Administration (FDA) boxed warning as its use has been linked to life-threatening and fatal respiratory depression in children and should be avoided in children under 12 years. Ketamine, gabapentin, and dexmedetomidine reduce postoperative pain scores while avoiding the risks of respiratory depression and should be considered when first-line agents are contraindicated.

Local anaesthetic infiltration and glossopharyngeal nerve blocks show minor analgesic benefits in the early postoperative period but have been associated with intravascular injection, hypotension arrhythmias, and upper airway obstruction. Acupuncture and honey have been shown to reduce pain scores when used in conjunction with routine analgesic regimes.[5]

Extubation can be undertaken either awake or deeply anaesthetised, after accounting for the risk of bleeding and upper airway obstruction. The oropharynx and postnasal space should be thoroughly suctioned under direct vision, and haemostasis should be ensured before extubation.

Post-tonsillectomy complications include post-tonsillectomy haemorrhage, major respiratory adverse events (including laryngospasm, upper airway obstruction, post-obstructive pulmonary oedema, aspiration), pain, emergence delirium, nausea and vomiting, dehydration, delayed feeding, injury to hypoglossal, glossopharyngeal, or vagal nerve resulting in transient or permanent dysphagia.[1]

Patient and caregiver education and counselling on post-tonsillectomy care should include verbal and written information. Clinicians should reinforce postoperative instructions on the day of surgery as well as indications for readmission.

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HIGH NEURAXIAL BLOCK IN OBSTETRIC ANAESTHESIA

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A sensorimotor block at the fifth thoracic vertebra is required for adequate anaesthesia in caesarean delivery. A neuraxial (spinal or epidural) block is done in the lumbar area, and local anaesthetic (LA) will spread cephalad with the patient in the supine position. Block levels at or above the third thoracic vertebra are usually associated with respiratory and cardiovascular compromise. This complication is known as high neuraxial block (HNB). The exact

incidence of HNB is unknown but ranges between 1:2 383 and 1:54 000.[1]

Various factors influence block height.[2-4] A decreased cerebrospinal fluid (CSF) volume, increased intra-abdominal pressure, and increased lumbar lordosis are common factors in pregnancy. The dose and baricity of the LA are the most important drug-related factors, with concentration, temperature, and viscosity of lesser importance [2,5] Evidence regarding the effect of turbulence (speed of injection and barbotage) and needle type and orientation are conflicting.[3,6,7]

Difficulty breathing is an early sign of HNB.[1] The ascending block affects the intercostal nerves, but respiration is not impaired due to the intact diaphragm. The phrenic nerve (C3–C5) innervates the diaphragm, and respiratory difficulty occurs when this nerve is blocked. A cervical block affects the accessory muscles. High levels of LA in the CSF cause central apnoea by inhibiting the respiratory centre. Respiratory compromise causes hypoxia and hypercarbia.

Neuraxial anaesthesia (NA) causes an ascending sympathectomy with vascular dilatation.[1,2] Hypotension ensues and is proportional to the block height. A block above T4 causes bradycardia due to cardiac accelerator fibre denervation. The vagal nerve is affected in a very high block, resulting in a functionally denervated heart with a lack of heart rate variability and increased preload dependence.

HNB does not directly influence myocardial contractility, but cardiac depression occurs due to ongoing hypoxia and decreased coronary perfusion.[1] Other neurological features include a weak hand grip due to the involvement of C8/T1 nerve roots, followed by an inability to touch the nose (C5–C6).[8] Differentials in pregnancy include aortocaval compression, embolism, seizures, intracranial bleeding, and the Bezold–Jarisch reflex that can occur in hypovolaemia.[1]

HNB often occurs in epidural anaesthesia due to large volumes of LA. Catheter migration can cause excessive doses of LA to reach the intrathecal space. Before a top-up, the filter should be disconnected, and an aspiration test should be done with a small syringe to appreciate any volume change due to CSF aspiration. Careful monitoring is essential. The type of fluid appearing at the hub can be determined by measuring pH with a test strip. Saline has a pH of 7.0, while CSF pH is 7.3.

Single-shot spinal after a labour epidural has up to 50% risk of HNB.[9] With a poorly functioning labour epidural, it is safer to convert to general anaesthesia. If a single shot spinal is going to be done, the dose should be decreased. The exact dose reduction is not established, but values between 20% and 50% are quoted in the literature.[1,10]

Careful monitoring and a high index of suspicion are needed to detect HNB. Prompt respiratory and circulatory support is needed even before a definitive diagnosis of HNB is made.[8] Treat hypotension with intravenous fluids, and in the presence of bradycardia, add ephedrine boluses.[8] Most patients recover respiratory function quickly and can be extubated by the end of the procedure.

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IN-SERVICE TRAINING – WHOSE RESPONSIBILITY IS IT ANYWAY?

L Crous

The healthcare landscape is ever-changing, with new developments in technologies, availability of information, and general updates in medical knowledge. For a healthcare worker to stay relevant, staying current with these developments is important. Educational opportunities, of which in-service training is one, are a vehicle to ensure current practices are employed in the institution. But whose responsibility is it? Due to the multifaceted nature of in-service training, it can be viewed as two sides of the same coin: representing the perspectives and responsibilities of the nurse on one side and the needs and responsibilities of the institution (management) on the other.

This talk will highlight the various purposes of in-service training and the pros and cons of implementing an in-service training programme. Nursing is one of the last healthcare professions to introduce a continuous professional development (CPD) programme. To date, the onus of staying abreast of new developments was placed on the specific field nurses worked in, with no standardisation of information being shared. However, this is about to change with the introduction of the South African Nursing Council's (SANC) first phase of its CPD programme.

As nurse professionals, we are responsible for taking ownership of our learning needs to not only comply with the CPD

requirements but also contribute to advancing the field we as nurses work in. Moving beyond engaging with in-service training as a job requirement to being empowered to become a lifelong learner.

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BIOMARKERS OF CHRONIC PAIN

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Background: Biomarkers are used in most medical specialities to screen the risk of disease, objectively diagnose diseases, prognosticate, and evaluate treatment outcomes. However, biomarkers have not made significant inroads in the speciality of chronic pain. This is not surprising since chronic pain is a complex disease whose underlying mechanisms are still not fully understood. Moreover, due to multiple chronic pain phenotypes and complex interactions between different biopsychosocial mechanisms, there is currently no single adequate predictor of chronic pain via a single biomarker that has been identified. Some authors suggest that instead of searching for a single biomarker, a biomarker signature comprising composite biopsychosocial factors should rather be identified.[1]

Biomarkers: The biomarkers that measure pathological processes and therapeutic responses have been categorised into seven classes. The classes are susceptibility biomarkers, predictive biomarkers, diagnostic biomarkers, monitoring biomarkers, safety biomarkers, prognostic biomarkers, and pharmacodynamic biomarkers.[2] These include, but are not limited to, pro-inflammatory cytokines such as IL-1β, IL-2, IL-6, IL-33, CCL3, CXCL1, CCR5, and TNF-α, which are serum diagnostic biomarkers known to amplify chronic pain states.[3] This amplification is mitigated by the use of anti-inflammatory drugs.

Neuroimaging is intriguing since it allows us to directly "see" pain. Functional magnetic resonance imaging (fMRI) provides a clear picture of the deeper structures of the brain that are involved in chronic pain disease states and can be used as both a predictive and a prognostic biomarker.[1,2]

Epigenetics are changes in the function of genes without changes in the genetic sequence of the core structure. These changes result from three mechanisms: deoxyribonucleic acid (DNA) methylation, histone modifications, and micro-ribonucleic acid (RNA) interference caused by various factors such as drugs, toxins, diet, and psychological stressors. Identifying these susceptibility biomarkers presents chronic pain pre-emptive targets using epigenetic modifying drugs, such as histone deacetylase (HDAC) or DNA methyltransferase (DNMT) inhibitors.[4]

Conclusion: The patient's subjective account is currently relied upon in diagnosing chronic pain diseases and evaluating treatment outcomes. Therefore, developing biomarkers will provide invaluable indicators for the objective diagnosis and monitoring of treatment outcomes. Unfortunately, in most cases, there have been inconsistencies and a lack of replicability in subsequent validation studies for the clinical utility of these biomarkers. The jury is still out, so the biomarkers for chronic pain should be approached with caution in clinical practice.

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MONITORING OF TRAUMATIC BRAIN INJURY

S Nash

Traumatic brain injury (TBI) is the leading cause of death for all age groups, contributing to over 60% of trauma-related deaths. The primary goals of management in TBI are to minimise cerebral oedema and intracranial pressure (ICP) and optimise cerebral perfusion pressure (CPP), thereby decreasing the incidence of secondary brain injury.

TBI is divided into primary and secondary injury. The primary injury is induced by mechanical force and occurs at the moment of injury. Secondary injury may be delayed (hours to days) from the moment of impact, and may superimpose injury on a brain already affected by a mechanical injury. These include hypotension, hypoxaemia, hypercarbia, hyperthermia, hypo/hyperglycaemia, hyponatraemia, seizures, or infection.

Systemic monitoring includes electrocardiogram (ECG), invasive arterial blood pressure, pulse oximetry, central venous pressure, urinary catheter, NGT or OGT, frequent neurological examination, temperature and capnography.

Brain monitoring includes global or regional and local. Global monitoring looks at ICP (intraventricular, intraparenchymal, epidural or subdural monitors), CPP, electrical potentials, and venous oxygen saturation. Regional/local monitoring looks at cerebral blood flow (CBF), cerebral blood flow velocities, brain tissue metabolism, temperature, and oxygenation.

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CARDIAC RISK FACTORS

C Alphonsus

Over 300 million patients undergo surgery annually, and the prevalence of patients with cardiovascular disease for elective noncardiac surgery has increased.[1,2] Cardiac risk factors are associated with a higher incidence of postoperative mortality and morbidity, with a 30-day risk of mortality and adverse cardiovascular events above 5% in high-risk cardiac patients.[3]

One-third of major perioperative morbidity and mortality are due to cardiovascular complications. Myocardial injury after noncardiac surgery (MINS) is associated with an increased risk of 30-day mortality.[4] The incidence of MINS, defined by troponin leak, is 8–19% depending on the surgical population, with the highest incidence in vascular surgical patients.[5] Over 90% of patients with MINS are asymptomatic; most remain unnoticed.

To improve the detection of MINS, guidelines advise performing a routine postoperative assessment of serum cardiac troponin for 48–72 hours postoperatively.[6] Given the impact of MINS, identifying high-risk patients and implementing troponin screening would improve postoperative patient outcomes and reduce mortality.

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PHARMACOLOGICAL INTERVENTIONS THAT MAY IMPROVE OXYGENATION DURING ONE-LUNG VENTILATION

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Pharmacological interventions are used to alter and enhance inherent physiological protective and/or pathological mechanisms during one-lung ventilation (OLV). To understand hypoxia during OLV, basic respiratory physiology must be revisited. A summary of physiological concepts, as well as the measurement (mainly for research) of these parameters, can be seen in Table I.[1]

Table I: Parameters researched during OLV to minimise hypoxia

Research parameter	Implication for anaesthetist	Measurement
1. V/Q mismatch	Incidence of hypoxia during OLV = 5–10% May occur from V/Q mismatch	Transpulmonary shunting of blood occurs Gravity will cause the blood supply to divert to the non-dependent lung
2. Qs/Qt	Qs/Qt without GA = 2–5%, with GA and SLT = 10%, GA with DLT = 20–30%[2] ***HPV*** (see mechanism of action in Figure 1) is a protective autoregulatory mechanism that occurs when lung tissue becomes hypoxic Decreases Qs/Qt as blood in the pulmonary circulation is constricted around the area of hypoxia and so is diverted to areas of the lung that are not hypoxic Inhalational agents are known to attenuate this reflex	$Qs/Qt = \frac{CcO_2 - CaO_2}{CcO_2 - CvO_2}$ $CaO_2 = (1.34 \times Hb \times Sat) + (0.0031 \times [F_iO_2 \times P_{atm} - P_{H2O}) - Pa_{CO2} / RQ])$ Arterial and venous gas samples were collected
3. P/F ratio	Simple way to express the degree of hypoxia, less than 300 indicates acute respiratory failure	**Horowitz index** PaO_2 from the blood gas, normal is 75–100 mmHg FiO_2
4. Compliance (C')	Measures the ability of the lung to stretch and expand It is important to note the presence of ***hysteresis*** in the compliance curve (Figure 2) The slope of a line drawn through the inspiratory and expiratory limbs of the graph denotes C', which decreases in OLV	Dynamic compliance = (TV/PI–PE) Tidal volume/Pressure of lungs in full inspiration and full expiration. Therefore C' = volume/pressure
5. $DLCO_2$	This measures the ability of gas to cross the alveolar/capillary membrane Diffusing capacity of the lungs for CO	$DLCO_2$ see on ABG Patients with COPD have a lower $DLCO_2$
6. Alveolar dead space ventilation	Collapse of lung tissue with OLV and the possible destruction of alveolar septi may result in an increase of dead space alveolar ventilation	**Hardman and Aitkenhead equation** $(1.135 \times [PaCO_2 - Et\ CO_2] / PaCO_2 - 0.005)$ **Bohr equation** $V_D/V_T = P_ACO_2 - P_ECO_2 / P_ACO_2$

7. Capnography	New predictor appears to be ***capnography*** ET_{CO2} is strongly dependent on pulmonary blood flow, therefore close estimate of pulmonary perfusion Measure changes in ET_{CO2} between TLV and early stages of OLV and a large gradient meant lower PaO_2 during OLV Measure both bronchial end-tidal CO_2 (ET_{brCO2}) during TLV in a lateral position The difference, i.e. D - ET_{brCO2}, had a linear relationship with the P/F ratio at 15 min after starting OLV	Two lung ventilation ET_{CO2} - early stages of OLV ET_{CO2} Alveolar gas equation $P_AO_2 = PiO_2 - \frac{PaCO_2}{R}$ A high CO_2 will decrease P_AO_2 or the amount of oxygen available in the alveoli. Manipulation of ventilation, whether volume or pressure controlled, should be individualised[8]
8. Haemodynamic parameters		Systolic blood pressure, heart rate, and CVP

ABG – arterial blood gas, CAO_2 – arterial oxygen content, CcO_2 – pulmonary capillary blood oxygen content, CO – carbon monoxide, CO_2 – carbon dioxide, CvO_2 – venous oxygen content, CVP – central venous pressure, $DLCO_2$ – diffusion capacity for carbon monoxide, DLT – double lumen tube, FiO_2 – fraction of the inspired oxygen expressed as a decimal, GA – general anaesthesia, HPV – hypoxic pulmonary vasodilation, Patm – atmospheric pressure, PH_2O – water vapour pressure = 47 mmHg, Q – perfusion, Qs – blood flow through the shunt bypassing oxygenation in the lungs, Qs/Qt – intrapulmonary shunt equation, Qt – total blood flow or cardiac output, RQ – respiratory quotient = 0.8, SLT – single lumen tube, V – ventilation, VD – Volume of alveolar dead space, V_T = TV – tidal volume

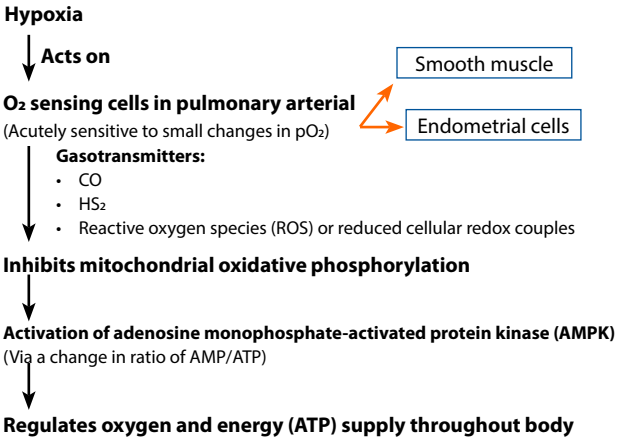

Figure 1: Hypoxic pulmonary vasoconstriction mechanism of action[3]

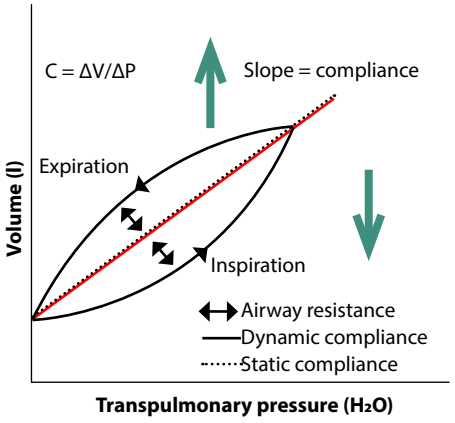

Figure 2: Lung compliance curve (courtesy Physiopedia)

Many drugs have been used in an attempt to pharmacologically improve oxygenation in OLV. Table II lists those most mentioned in the literature.

Table II: Pharmacological interventions to improve oxygenation during OLV

	Pharmacology	Assessment
Iloprost[2,5] Inhalation 2.5–20 µg/ml Affects **Qs/Qt** shunts blood to well-ventilated areas	**Synthetic prostacyclin PG12 that vasodilation of pulmonary arterioles and decreases vascular resistance**. • Onset within 5 min, offset 30–60 min	
Almitrine bimesylate[2] • IV infusion intraoperatively to improve **HPV** • 12 µg/kg/min for 10 min and then reduce to 4 µg/kg/min • Improves P/F ratio	• Said to stimulate the chemoreceptors in carotid bodies • IV during OLV, improves HPV by causing increased vasoconstriction of pulmonary vasculature in areas that are hypoxic[6] • Used for HPV effect in COVID-19 patients who had ARDS • PO; an old drug used for respiratory stimulation in COPD patients to decrease pCO_2, but chronic use resulted in peripheral neuropathy	Appears to be effective for OLV if combined with NO[2]
Nitric oxide (NO)[2] Inhalation used in 5–40 ppm	• Also known as endothelin relaxant factor (ERFD)	Appears to be effective when used with almitrine
Nitrous oxide (N_20)[2]	• Diffusion of air enhances airspace • Lung collapse is also increased • Lung protection from hyperoxia • Increased surfactant as N_2O is a NMDA antagonist	Results are not convincing High atmospheric pressure in Gauteng limits use on the Highveld
Penehycyclidine[6] Improved ventilation	• Developed in China • Has anti-muscarinic and anti-cholinergic effects • Used for organophosphate poisoning • Use in OLV for decrease in bronchial resistance; mechanism of action similar to ipratropium bromide (Atrovent®)	Not found to be effective
Dexmedetomidine[7] **Decreases Qs/Qt** **But increase P/F ratio** Inhalant Intravenous LD = 1 µg/kg over 10 min and then 0.4 µg/kg/hr	• α_2-agonist • Decreases central nervous system sympathetic outflow • Shown to improve oxygenation by decreasing intrapulmonary shunt and decreased flow to hypoxic non-ventilated areas • Also regulates the inflammatory process and limits oxidative stress	Small and not significant effect

Sevoflurane[2] Moderate increase in QS/Qt, but does have a protective effect Increases P/F ratio	• Protects lung from ischaemic reperfusion sequelae • Appears to preserve the epithelium glycocalyx as well as decrease inflammatory effects	Ongoing debate if propofol/ remifentanil TCI is not preferable to inhalational agent
Thoracic epidural May increase Qs/Qt	• If cardiac output is maintained, the effect on oxygenation is minimal	

ARDS – acute respiratory distress syndrome, HPV – hypoxic pulmonary vasodilation, IV – intravenous, OLV – one-lung ventilation, α = alpha, TCI = target controlled infusion

Non-pharmacological strategies to improve oxygenation during OLV

a. Increasing oxygen administration is an option, but in an editorial by Martin and Grocot, the dangers of excess oxygen administration with the formation of reactive oxygen species (ROS) from hyperoxic conditions are convincing.[4] The recommended *precise control of arterial oxygenation* (PCAO) may not be feasible in OLV, but the recommendation that: PaO_2 of 56–70 mmHg, SaO_2 of 88–92% are acceptable and compatible with good outcomes, is sensible.[4]

b. Permissive hypercarbia in OLV is also an acceptable practice, but the alveolar gas equation, as noted in Table I, explains how a high pCO_2 may in fact decrease the oxygenation of the patient. Permissive hypoxia, as explained in the editorial, is not an acceptable practice in thoracic anaesthesia.

c. Alveolar recruitment manoeuvre (ARM) to the dependent lung is another method, especially if a low tidal volume (TV) is used. However, the effect is transient, and ARM has side effects:

- Haemodynamic instability (decrease LV preload, CO, BP). Gradual recovery over two minutes, unless the patient is hypovolaemic. If DLT is in situ, only ARM one lung and vent the other to atmosphere.
- Barotrauma.
- Translocation of pro-inflammatory cytokines from the alveolar space into systemic circulation.

d. Ventilation of non-dependent lung:

- Traditionally, hypoxaemia was treated by applying CPAP or stopping the surgeon and ventilating both lungs. This manoeuvre is not possible with VATS or RATS.
- Oxygen insufflation into a specific pulmonary segment remote from the operative area via a flexible bronchoscope. Attach the catheter to the suction channel and give 5 L/ min oxygen. Attach the filter to the connector of DLT, attach O_2 tubing to capnograph port and intermittently occlude filter with a finger for two seconds, and then let go for eight seconds (should give 66 ml).
- Clamp pulmonary artery in dire situations.
- Tell the surgeon to stop compressing the lung, as this decreases cardiac output (CO), and therefore, systemic oxygen delivery. Or just give an inotrope to maintain CO.[9]

In conclusion, the study by Schorer et al.[2] using ***network meta-analysis*** appears to advocate that intravenous almitrine combined with inhaled nitrous oxide during propofol-based anaesthesia improves oxygenation during OLV as the Qs/Qt shunt is reduced. Dopexamine also appeared to improve the P/F ratio.[2]

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PHYSICS: RADIATION PROTECTING OURSELVES

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As anaesthesiologists, we face occupational exposure to ionising radiation in the form of X-ray fluoroscopy, often used in the clinical environment (e.g. theatre and catheter laboratories). This presentation will focus on physics in three areas: the basics of radiation, the clinical effects of exposure, and the protective measures to reduce the effects of ionising radiation exposure.

X-rays are a form of electromagnetic ionising radiation produced by fluoroscopy apparatus for clinical use (e.g. in visualising bony structures during orthopaedic surgical procedures). Anaesthesiologists in the clinical environment may routinely be exposed to the deterministic and stochastic effects of radiation.

Protective measures encompass the guidelines recommended by the International Commission on Radiological Protection (ICRP), which are based on justification for use, optimisation of

the occupational environment to ensure as low as reasonably achievable exposure (ALARA principle), and dose limitation. In the clinical environment, these principles hinge on a three-pronged approach of minimising ionising dose, adequate shielding against radiation, and ensuring maximal distance between the radiation source and the operator, patient, and other theatre staff.

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THE CHANGING CODING LANDSCAPE

SP Erwee

The healthcare industry is undergoing a significant transformation in how procedures and diagnoses are coded, impacting data accuracy, reporting, and reimbursement. This talk addresses the critical role of clinical coding, emphasising its importance in standardising patient care, improving communication among healthcare providers, and enhancing patient safety. In South Africa, the disparity between public and private healthcare systems is highlighted, with the public sector struggling with coding implementation and the private sector facing inconsistencies among practitioners, facilities, and funders.

The presentation will delve into the National Health Reference Price List (NHRPL), Current Procedural Terminology (CPT), and the World Health Organization's newly introduced ICD-11 and International Classification of Health Interventions (ICHI). These coding systems facilitate better resource allocation and health intervention tracking, enabling comprehensive data collection for public health analysis. By examining the integration and challenges of these systems within the South African context, the talk aims to provide insights into improving coding practices to enhance healthcare delivery and patient outcomes.

This presentation will offer practical solutions for adopting unified coding practices, thus bridging the gap between different healthcare sectors and promoting a more efficient and accurate healthcare system in South Africa.

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THE ELDERLY HEART

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Ageing is associated with changes in the heart that impact clinical practice. Normal ageing changes should not result in functional decline at rest or with mild to moderate activity. Common disease processes such as diabetes, smoking, hypertension, human immunodeficiency virus (HIV) infection, and hyperlipidaemia, if not well controlled, will accelerate ageing changes and overwhelm compensatory mechanisms.

Intracardiac ageing changes include the loss of cardiac myocytes, increased collagen deposition by fibroblasts, and senile amyloid deposition. These changes contribute to increased ventricular stiffness, which impairs early diastolic filling and increases end-diastolic filling pressure. Therefore, the older heart is hypertrophied and stiffer, resulting in diastolic impairment. To compensate, the older heart rate slows via reduced sinoatrial automaticity, reduced baroreceptor sensitivity, and diminished responsiveness to beta-adrenergic stimuli from catecholamine desensitisation.

Ageing aortic changes of reduced elastic tissue, increased collagen deposition, and smooth muscle hypertrophy result in a less compliant aorta, which increases pulse wave velocity. There is a loss of the late reflected aortic wave that impairs the augmentation of diastolic pressure. These changes increase the systolic load on the left ventricle, further contributing to cardiac hypertrophy. The lowered diastolic coronary perfusion increases the risk of ischaemia.

Senile amyloid deposition, an age-related decline in sinoatrial pacemaker cells, and the deposition of fat, fibrous tissue, and calcium in the conduction system all increase clinical risk of heart block, atrial fibrillation, and neurocardiogenic syncopal syndromes.

All is not lost. Regular aerobic exercise can reduce adverse effects by increasing early diastolic filling, increasing arterial capacity, and reducing both peripheral vascular resistance and the duration of myocardial relaxation.

Recommended reading

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WHO SURGICAL SAFETY CHECKLIST: ENHANCING SURGICAL SAFETY AND TEAMWORK

Z Valashiya

The World Health Organization (WHO) Surgical Safety Checklist, launched by the WHO in June 2008, marks a pivotal step in improving surgical outcomes globally. This initiative aims to eliminate complications and adverse events during surgical procedures while fostering teamwork and effective communication among healthcare professionals. By adhering to this meticulously designed checklist, healthcare providers

can systematically reduce risks, ensuring each step is followed consistently and safely in every surgical procedure. This adherence significantly decreases the incidence of adverse events, safeguarding patient outcomes.

In this presentation, I seek to underscore the critical importance of the checklist's initial step – **Sign In** – which involves a **thorough briefing before administering anaesthesia**. This foundational step is vital for setting the stage for a safe surgical experience.

Surgical complications and adverse events, though common in routine medical practice, can often be prevented through the implementation of robust safety measures. The WHO Surgical Safety Checklist, implemented globally in June 2008, has been instrumental in addressing these challenges. During the initial phase, eight hospitals worldwide demonstrated remarkable improvements:

- **Complication rates in inpatient surgical procedures decreased from 26% to 10%, while death rates decreased from 1.5% to 0.84%**.
- The initial implementation results highlighted a **significant reduction in surgical site infections (SSI) from 6.2% to 3.4% and a drop in death rates from 1.5% to 0.8%**.
- Furthermore, 78% of the involved staff found the checklist user-friendly, **74% reported enhanced patient care, 64% noted improved communication**, and **48% observed better overall services**.

Notably, the benefits of adopting the WHO Surgical Safety Checklist were especially pronounced in low- and middle-income countries, underscoring its value in diverse healthcare settings. As anaesthetic nurses, our foremost duty is to uphold the principle of "do no harm" by ensuring the highest standards of patient care. This ethical obligation is central to our role as patient advocates. Rigorous adherence to safe practices is not just a professional responsibility but a commitment to patient safety and quality care. By embedding the WHO Surgical Safety Checklist into our daily routines, we reinforce our dedication to excellence in anaesthesia and surgical care, ensuring that every patient receives the safest possible treatment.

Key points to remember include the importance of **consistency in daily practice**, such as administering antibiotics 30 minutes before incision time. This attention to detail at every step of the surgical process is crucial for minimising risks and enhancing patient outcomes. In conclusion, the WHO Surgical Safety Checklist is not merely a protocol but a vital tool that embodies our commitment to patient safety and high-quality care. Through its implementation, we can continue to improve surgical practices, reduce adverse events, and ultimately save lives.

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ORGAN PRESERVATION

F van der Schyff

Organ preservation refers to the techniques and procedures used to maintain solid organs ex vivo or in vivo after death has occurred, typically for transplantation or research purposes. The main goals are maintaining organ viability, reducing ischaemic reperfusion injury post transplantation, and reducing primary graft non-function. New techniques and technologies allow for organ resuscitation and therapeutics before implantation of the organ into the recipient.

Several evidence-based methods of organ preservation are currently in clinical use:

1. Static cold storage: This is the most common method, in which organs are cooled to typically around 4 degrees Celsius using specialised organ preservation solutions (like the University of Wisconsin solution or HTK solution). Cold storage slows down metabolic processes and reduces oxygen demand, extending the time organs can remain viable without oxygenated perfusion.
2. Hypothermic machine perfusion: This technique involves pumping a cold preservation solution, with or without an oxygen carrier, through the organ and monitoring its condition. It allows for better assessment and potentially longer preservation times than static cold storage.
3. Normothermic machine perfusion: In contrast to hypothermic machine perfusion, this method maintains organs at near-normal body temperature and provides a more physiological environment. It can help to assess and potentially rehabilitate organs that might otherwise be discarded.
4. Normothermic regional perfusion: This method re-establishes normothermic perfusion of organs after brain death or cardiac death has occurred within the organ donor, using an extra-corporeal pump. Care is taken to not reperfuse the brain, using aortic occlusion devices or carotid artery occlusion, in the case of thoracic organ procurement.

The choice of preservation method depends on factors such as the type of organ, transport distance, and the specific clinical situation. Advances in organ preservation have been crucial in expanding the pool of transplantable organs and improving outcomes for transplant recipients.

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OBSTRUCTIVE SLEEP APNOEA AND SEDATION

G Leballo

The rising worldwide prevalence of obstructive sleep apnoea (OSA) poses a challenge to the anaesthesiologist, particularly in non-operating room anaesthesia (NORA), where diagnostic

procedures are performed under conscious sedation. A global study utilising the American Academy of Sleep Medicine (AASM) scoring criteria of 2012 against the equivalent apnoea-hypopnoea index (AHI) reported that adult patients between the ages of 30 and 69 years had an OSA incidence of almost 1 billion cases.[1] An analysis of the South African adult population demonstrated a prevalence of 22.8%, with an AHI of more than 15 hours.[2]

OSA is defined as a "sleep-associated breathing disorder that is caused by partial or complete obstruction of the upper airway."[3] It is characterised by episodes of breathing cessation or upper airway flow obstruction, for a period of 10 seconds or more.[4] The pathogenesis can be explained by a variety of factors, including the anatomy of the upper airway, comorbid factors, gender differences, age, and lifestyle choices.[5] OSA severity is usually graded as mild (≥ 5–15), moderate (≥ 15–30), or severe (≥ 30) by the AHI, and it is calculated from the number of apnoea episodes against hypopnoea periods.[4]

Sedation guidelines by the South African Society of Anaesthesia (SASA) define sedation as a drug-induced reduction in the level of consciousness, ranging from minimal sedation to general anaesthesia.[6] Anaesthesiologists often employ advanced sedation techniques through a combination of pharmacological agents such as intravenous boluses or infusions. Agents such as propofol, ketamine, midazolam, fentanyl, remifentanil, and dexmedetomidine are often utilised, as well as inhalational agents such as sevoflurane. A combination of these agents can lead to respiratory events in patients with OSA, such as low oxygen saturation levels in the immediate postoperative period and unstable haemodynamics during procedures.[3] Patient assessment and selection become paramount in OSA patients undergoing procedures in a theatre setting and NORA when sedation techniques are employed.

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PHARMACOLOGY: MARIJUANA: FRIEND OR FOE

S Bechan

Cannabinoids are a family of psychoactive compounds which may be found endogenously within human physiological systems, produced synthetically specifically for pharmacological use, or derived from plants. Marijuana is a phytocannabinoid produced by the *Cannabis sativa* plant and has been reported to contain over 480 constituents. Delta-9-tetrahydrocannabinol (THC) is the ingredient that produces the psychoactive, sedation, analgesia, anti-emesis, and antispasmodic effects by its action on the CB_1 receptors, mainly in the central nervous system. It also stimulates the CB_2 and TRPV receptors. Cannabidiol (CBD) is the other main ingredient, which produces anxiolysis and has antipsychotic and anticonvulsant properties.

The combined pharmacodynamic effects include analgesia, anxiolysis, mood changes, disinhibition, increased sociability or, paradoxically, social withdrawal. An increased sense of happiness, heightened awareness of sensations, imagination and appreciation of art and music may occur. In short-term use, problems with memory and learning, distorted perception, difficulty in thinking and problem-solving, and s loss of coordination may occur. At higher doses, altered perceptions of space and time, cognitive impairment, and coordination and movement may be affected. Long-term regular use can lead to physical dependence and withdrawal following discontinuation, as well as psychological addiction or dependence.

This review will discuss the pharmacokinetic and pharmacodynamic effects of short and long-term cannabinoid and marijuana use and the potential beneficial and harmful effects.

PHYSICS: THE GREENHOUSE EFFECT

G Morgan

Our planet receives incoming shortwave solar radiation[1]. Some of this radiation is reflected into space by certain surfaces with high albedo, such as clouds, dust, snow, and ice. The earth absorbs the remainder of the incoming solar radiation, causing the planet to heat up. The earth then re-emits radiation at longer wavelengths in the infrared spectrum, called terrestrial radiation.[1,2]

Greenhouse gases are gases in the earth's atmosphere that absorb this longwave length infrared terrestrial radiation and then re-emit some of it back to earth as "back radiation".[3] The most important naturally occurring greenhouse gases are water vapour, carbon dioxide, methane, nitrous oxide, and ozone.[4] This so-called Greenhouse Effect keeps the troposphere warm, which is a natural and necessary process.[1]

However, since the industrial and agricultural revolutions, anthropogenic activities have led to an extremely rapid increase in atmospheric concentrations of greenhouse gases. Notably, current carbon dioxide, methane, and nitrous oxide have reached unprecedented atmospheric concentrations compared with the last 800 000 years.[5] As these greenhouse gas concentrations have risen since the pre-industrial era, so have average global surface temperatures through both the Greenhouse Effect and various positive feedback mechanisms that have been set in action.[3]

Since the 1980s, halogenated volatile anaesthetic agents and nitrous oxide have become increasingly recognised as potent greenhouse gases.[6-9] Among the volatile agents, desflurane has by far the highest greenhouse gas contribution and accounts for 0.005% of total anthropogenic radiative forcing.[10,11] Nitrous oxide is also a potent and important long-lived greenhouse gas.[10] The use of these gases should be limited as far as possible.

The Climate Crisis is upon us, and urgent action is required to decrease greenhouse gas emissions in our personal and professional lives.

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CLEARING THE AIR: NITROUS OXIDE AND THE ENVIRONMENT

G Morgan

In the face of accelerating global warming and climate change, a meaningful decrease in anthropogenic greenhouse gas emissions has become an emergency.[1] Global healthcare systems have been estimated to produce 4.6% of all such emissions.[2] Consequently, it is essential to decrease greenhouse gas emissions in the healthcare sector.

Nitrous oxide (N_2O) is a potent greenhouse gas with a long atmospheric lifetime.[3] Despite regulation through the Kyoto Protocol, atmospheric concentrations of N_2O continue to increase, making it the third most important atmospheric contributor to radiative forcing, after carbon dioxide and methane.[4,5] Owing to the formation of nitrogen oxide intermediates under the influence of ultraviolet radiation, N_2O also has the potential to destroy atmospheric ozone and, after the systematic phasing out of halocarbons with the Montreal Protocol, is currently the most important anthropogenic ozone-depleting substance.[6]

Whilst previously extensively used, enthusiasm for N_2O use in modern anaesthetic practice is waning. Clinical concerns with this agent include interference with vitamin B12 metabolism, association with postoperative nausea and vomiting, and potential for occupational reproductive toxicity.[7,8] However, the European Society Task Force recommends that the supply of N_2O in hospitals be maintained based on current evidence for its use.[8]

The adverse environmental impact of medical N_2O can be mitigated by reserving its use for select cases at the lowest possible fresh gas flow.[9] Previous studies have demonstrated that as much as 95% of piped N_2O may be lost through leaks in the pipe system.[10] Therefore, where possible, N_2O piping systems should be decommissioned and replaced with point-of-care cylinders, which should be closed when not in use to avoid wastage.[9] In the future, "nitrous cracking" may become a feasible option for eliminating exhaled N_2O.[11]

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M&M CONFIDENTIALITY

H Radford

Morbidity and mortality (M&M) meetings support a systematic approach to the review of patient care, complications, or deaths. These meetings enhance patient care, contribute to improved patient safety, and provide professional learning

and development, peer review, collective learning, and quality improvement. Currently, negative outcomes seem to be the driving force behind outcome improvement. Positive outcomes for a difficult problem are as important in enhancing care and patient safety. Discussing and analysing cases of good clinical care with positive outcomes provide opportunities to understand and learn from everyday clinical work.

Further, the meeting acts as an emotional release valve promoting physician wellness. The forum gives one a sense of not being alone and that others have had the same issue but have chosen not to discuss it. Interesting cases are revealed.

However, these meetings exist within a legal framework laid down by the Promotion of Access to Information Act [PAIA] 2000 and The Protection of Personal Information Act [POPIA] 2013. Currently, the contents of these meetings are confidential but not privileged, which means they can be used in a court of law. We need to lobby to make these discussions privileged.

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DIALYSIS AND ANAESTHESIA

B Mrara

Practising anaesthetists frequently encounter patients on dialysis in various perioperative settings, ranging from low to high-risk and emergency surgery. These patients are at risk of adverse perioperative outcomes stemming from the underlying disease, its impact on organ function, and the associated comorbidities. Cardiovascular complications remain the most frequent and life-threatening complication. Dialysis treatment itself presents significant perioperative risk and management challenges that anaesthetists need to be cognisant of. There is a general paucity of research in this area; most recommendations remain unchanged in literature from the past ten years, and clinicians rely on practical experience.

This presentation aims to provide an update on current discussions of aspects of the perioperative care of patients on dialysis. Regarding the preoperative assessment, there is an emphasis recognising diastolic dysfunction and coronary artery disease risk. Also, haemoglobin targets are discussed in relation to current blood conservation principles. The logistics of dialysis timing regarding the surgery and postoperative care are discussed: a 6–24-hour window is currently recommended, balancing the risks of uraemia and fluid overload with the risks of anticoagulation and intraoperative hypotension in this population at risk of cardiovascular complications. Current practices on anaesthetic agents, analgesics, monitoring, and fluid therapy are also discussed.

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SHOULDER SURGERY: ONE MONITOR FOR ALL

A Zeijlstra

An ideal monitor should be accessible, affordable, safe, and easy to use, allow for real-time modification of parameters, be reliable, and provide valid results. Shoulder surgery presents the anaesthetist with a unique set of considerations and constraints. Successful surgery requires that the surgeon has good access and visibility in a bloodless field. These provisions come at the cost of maintaining the blood pressure at hypotensive levels while the patient is seated. Consequent physiological changes become even more challenging in the presence of significant comorbidities, with the requirement of optimal cerebral oxygenation being essential. The need for superior monitoring, including cerebral oxygenation monitoring, is evident. Therefore, these monitors will be considered: cerebral oximetry, capnography, and invasive and non-invasive pressure monitors.

In conclusion, one perfect monitor is unavailable. Once standard monitoring has been used on a patient for a shoulder procedure, I would use cerebral oximetry as my one additional monitor.

ANAESTHESIA: MINIMISING THE HARM IN ANAESTHESIA

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Minimising harm in anaesthesia is vital in ensuring patient safety and improving clinical outcomes. Advances in anaesthetic techniques and medications, coupled with meticulous preoperative assessments, play a crucial role in mitigating risks. A comprehensive evaluation of patient history, current health status, and potential risk factors allows for preoperative optimisation and tailoring of anaesthetic plans to each patient's needs. This personalised approach helps identify potential complications and implement strategies to prevent adverse events, enhancing patient safety. This refresher course underscores the importance of evidence-based practices, technological advancements, and human factors in minimising anaesthetic harm.

Intraoperative monitoring is a critical component in minimising anaesthetic harm. The continuous monitoring of vital signs, oxygen levels, and anaesthetic depth enables the timely detection of physiological changes and immediate intervention. The use of advanced monitoring technologies,

such as capnography and bispectral index monitoring, further aids in maintaining optimal anaesthetic depth and preventing awareness during surgery. Postoperative care with effective pain management, vigilant monitoring for signs of complications, and prompt response to adverse events are integral to patient recovery. Multimodal analgesia and enhanced recovery protocols reduce postoperative pain and improve patient satisfaction. Additionally, patient education on postoperative care and potential warning signs ensures timely reporting and management of complications.

In addition, clinical risk management (CRM) offers a systematic approach to reducing harm. It involves identifying, analysing, and monitoring incidents. Although serious anaesthesia incidents are rare, routine checks of anaesthesia machines, proper syringe labelling, and trainee supervision help minimise risks. The use of cognitive aids, such as the World Health Organization's (WHO) Surgical Safety Checklist, the Anesthesia Patient Safety Foundation's (APSF) Pre-anesthetic Induction Patient Safety (PIPS) checklist, clinical guidelines, flowcharts, contingency planning, training courses, and simulator training all contribute to minimising harm. Having informed conversations with patients can contribute to their safety during anaesthesia. Integrating artificial intelligence in decision-support systems has promising approaches to reduce anaesthesia-related complications further.

Considering that anaesthesiologists have an incredibly stressful job, working long hours, dealing with emergencies, and having to make quick decisions, they are prone to burnout, depression, and anxiety. When mentally fatigued or distressed, their ability to make quick, accurate decisions can be impaired, thus increasing the risk of errors during critical moments. Compromised patient care, including medication administration or monitoring mistakes, may result in serious harm to the patient. Programmes that focus on resilience training, mental health support, and creating a work environment that supports relaxed alertness will benefit the clinicians and have a direct positive impact on patient outcomes.

In conclusion, adopting a multidisciplinary approach that encompasses patient optimisation, perioperative monitoring, and postoperative management, mental health support, CRM, and artificial intelligence integration, will significantly improve patient safety. While anaesthesia remains safe, continuous efforts are essential to minimise harm and improve patient outcomes.

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