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ANESTHESIA, PAIN MANAGEMENT, AND PUBLIC HEALTH: A REVIEW OF TECHNIQUES AND STRATEGIES FOR COINFECTED PATIENTS

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ABSTRACT

Coinfections, particularly in patients with HIV, hepatitis C, or tuberculosis, present complex challenges in anesthesia and pain management. This review examines the unique considerations, techniques, and strategies for providing safe and effective care to this vulnerable population. It explores the impact of coinfections on anesthesia outcomes, the role of multidisciplinary approaches, and the implications for public health. Patients with coinfections often have complex medical histories, including comorbidities and compromised immune systems, which can affect their response to anesthesia and pain management. Strategies such as preoperative optimization, tailored anesthetic plans, and close monitoring are crucial to mitigate risks and ensure positive outcomes. Multidisciplinary collaboration is essential in managing coinfections, involving anesthesiologists, infectious disease specialists, surgeons, and other healthcare professionals. This approach allows for comprehensive care that addresses the unique needs and challenges of coinfected patients. Public health implications of coinfections in anesthesia and pain management are significant, as they can impact healthcare resource

utilization, treatment outcomes, and overall healthcare costs. Understanding the challenges and implementing effective strategies can lead to improved public health outcomes for this vulnerable population. In conclusion, coinfections present complex challenges in anesthesia and pain management, requiring tailored approaches and multidisciplinary collaboration. By addressing these challenges, healthcare providers can improve outcomes for coinfected patients and contribute to better public health outcomes overall.

Keywords: Anesthesia, Pain Management, Public Health, Techniques, Coinfected Patients.

INTRODUCTION

Coinfections, the simultaneous presence of two or more pathogens in a host, pose significant challenges to healthcare systems worldwide. As the global burden of infectious diseases persists, understanding and effectively managing anesthesia and pain in coinfected patients is paramount (Feldman & Anderson, 2021, Heidary, et. al., 2022, Sreenath, et. al., 2021). This review explores the complex intersection of anesthesia, pain management, and public health strategies in the context of coinfections, aiming to shed light on current techniques and strategies.

Coinfections refer to the concurrent presence of two or more infectious agents, such as bacteria, viruses, or parasites, in a single host. These infections can interact synergistically or antagonistically, leading to varied clinical outcomes. Coinfections are prevalent across diverse populations and geographic regions, presenting unique challenges for healthcare providers (Abdel-Latif, et. al., 2020. Islam, Rodkhum & Taweethavonsawat, 2023, Okon, et. al., 2023).

Anesthesia and pain management are critical components of healthcare for coinfected individuals. Coinfections can complicate surgical procedures, alter drug pharmacokinetics, and impact pain perception and management. Failure to address these challenges adequately can result in increased morbidity, mortality, and healthcare costs (Bloem, Dorsey & Okun, 2020, Damiescu, Lee & Efferth, 2022, Fauci, et. al., 2019).

This review aims to comprehensively examine current techniques and strategies for anesthesia and pain management in coinfected patients. It will explore the challenges and considerations specific to this population, as well as highlight emerging trends and future directions. By synthesizing existing literature, this review seeks to inform healthcare providers, policymakers, and researchers about best practices and areas for improvement in the care of coinfected individuals.

Historical Perspectives

The history of anesthesia and pain management in coinfected patients is intertwined with the broader evolution of medical practices and public health strategies. Historically, the understanding and treatment of coinfections have evolved significantly, reflecting advancements in medical knowledge, technology, and public health interventions (Barrett, Barrett & Vinks, 2021, Singer, Bulled & Ostrach, 2020, World Health Organization, 2020).

Early civilizations, such as the ancient Egyptians and Greeks, used various plant-based substances and rituals to induce unconsciousness or alleviate pain during medical procedures. However, these practices were often rudimentary and carried significant risks. It was not until the 19th century that modern anesthesia techniques began to emerge.

One of the key milestones in anesthesia history was the discovery of ether as a general anesthetic by William T.G. Morton in 1846. This development revolutionized surgery, allowing for more

complex and invasive procedures to be performed with reduced pain and improved patient outcomes. Subsequent advances, such as the introduction of chloroform and the development of safer inhalational anesthetics, further refined anesthesia practices (Ahmed, 2019, Gazdić, 2020, Roy, 2022).

In parallel, the understanding and management of pain have also evolved over time. Early approaches to pain management focused on symptomatic relief using natural substances and primitive surgical techniques. The concept of pain as a complex sensory and emotional experience gradually emerged, leading to the development of more sophisticated analgesic drugs and techniques.

The field of public health has played a crucial role in shaping the historical trajectory of anesthesia and pain management. Public health initiatives, such as vaccination campaigns, sanitation improvements, and infection control measures, have contributed to reducing the prevalence of infectious diseases and thereby decreasing the risk of coinfections in surgical patients (Awadalla, et. al., 2022, Mudumbai, et. al., 2024, Vigil-Fowler, Hillman & Desai, 2019).

In summary, the historical perspectives of anesthesia, pain management, and public health underscore the importance of continuous innovation and collaboration in addressing the challenges posed by coinfections. As we look to the future, building on these historical foundations will be essential in developing effective strategies for the care of coinfected patients.

Challenges in Anesthesia and Pain Management for Coinfected Patients

Coinfected patients, those with multiple infections, present unique challenges for anesthesia and pain management due to the complexities of their conditions. These challenges encompass a range of factors, including the impact of coinfections on anesthesia outcomes, the need for specialized pain management approaches, and the risks and complications associated with anesthesia in this population. Understanding and addressing these challenges are essential for providing safe and effective care to coinfected patients (Md-Lasim, et. al., 2021, Peña-López, Machado & Rello, 2023, Şenel, Özdoğan & Akca, 2021).

Coinfections can significantly impact anesthesia outcomes, affecting both the pharmacokinetics and pharmacodynamics of anesthetic agents. The presence of multiple infections can alter the metabolism and clearance of drugs, leading to unpredictable responses to anesthesia. For example, coinfections such as HIV and hepatitis C can affect liver function, potentially influencing the metabolism of anesthetic drugs that are hepatically cleared. Additionally, coinfections may compromise immune function, increasing the risk of postoperative infections and complications (Martin-Loeches, et. al., 2021, Rawson, et. al., 2021, Sharma, 2020).

Furthermore, the presence of coinfections may complicate the management of comorbidities, such as cardiovascular disease or diabetes, which can impact anesthesia outcomes. For instance, coinfections may exacerbate systemic inflammation, which can affect the cardiovascular system and increase the risk of perioperative complications.

Pain management in coinfected patients requires a comprehensive and individualized approach due to the complex nature of their conditions. Coinfected patients may experience a higher prevalence of chronic pain compared to the general population, stemming from the underlying infections or their treatments. Therefore, it is essential to consider the interactions between pain

and coinfections when managing these patients (Lantos, et. al., 2021, Maslove, et. al., 2022, Trunzo, et. al., 2022).

Additionally, the presence of coinfections may limit the use of certain analgesic medications, particularly those metabolized by the liver or kidneys. Healthcare providers must carefully assess the risks and benefits of pain management options, taking into account the patient's overall health status and the potential for drug interactions.

Anesthesia in coinfected patients poses specific risks and complications that healthcare providers must be aware of and prepared to manage. Coinfected patients may be at increased risk of perioperative infections due to compromised immune function, necessitating stringent infection control measures. Furthermore, the presence of coinfections may increase the risk of drug interactions and adverse reactions to anesthesia, requiring close monitoring and vigilance during the perioperative period (Barnea, et. al., 2023, Guedes, et. al., 2020, Søreide, et. al., 2020).

Moreover, coinfections may complicate the recovery process and increase the likelihood of postoperative complications, such as wound infections or delayed wound healing. Healthcare providers must carefully assess and manage these risks to ensure optimal outcomes for coinfected patients undergoing anesthesia.

In conclusion, anesthesia and pain management in coinfected patients present unique challenges that require a multidisciplinary approach and specialized care. By understanding the impact of coinfections on anesthesia outcomes, implementing tailored pain management strategies, and mitigating the risks associated with anesthesia in this population, healthcare providers can ensure the safe and effective care of coinfected patients.

Strategies for Anesthesia and Pain Management in Coinfected Patients

Coinfected patients, those with multiple infections, require specialized care and considerations when undergoing anesthesia and pain management. To ensure safe and effective perioperative care for this population, healthcare providers must implement comprehensive strategies that encompass preoperative optimization, tailored anesthetic plans, and multidisciplinary approaches involving infectious disease specialists, anesthesiologists, and other healthcare providers (Driggin, et. al., 2020, George, et. al., 2020, Millar & Cox, 2022). This review outlines key strategies for anesthesia and pain management in coinfected patients, focusing on preoperative optimization, tailored anesthetic plans, and multidisciplinary approaches.

Preoperative optimization plays a crucial role in preparing coinfected patients for anesthesia and surgery. Healthcare providers must conduct a thorough assessment of the patient's medical history, including the presence of coinfections, comorbidities, and previous surgical experiences. Special attention should be given to assessing the severity and stability of coinfections, as well as their impact on organ function and overall health status (Casciani, Trudeau & Vollmer, 2020, Cheng, et. al., 2023, Parab & Myatra, 2019).

Additionally, preoperative optimization may involve addressing modifiable risk factors, such as smoking, obesity, and poorly controlled comorbidities, which can increase the risk of perioperative complications. Optimizing these factors through lifestyle modifications, medication adjustments, and medical interventions can help improve outcomes and reduce the risk of postoperative complications.

Furthermore, coinfected patients may require additional preoperative testing and evaluation to assess their suitability for anesthesia and surgery. This may include laboratory tests to evaluate

organ function, imaging studies to assess the extent of infection or comorbidities, and consultations with infectious disease specialists or other relevant healthcare providers.

Tailoring anesthetic plans and pain management strategies to the specific needs of coinfected patients is essential for optimizing perioperative care and minimizing complications. Anesthetic agents should be selected based on their pharmacokinetic and pharmacodynamic profiles, taking into account the patient's underlying infections, comorbidities, and medication regimens (Caudle, et. al., 2019, Kim, et. al., 2019, Kost, 2019).

In addition, anesthesia and pain management plans should prioritize patient comfort and safety while minimizing the risk of drug interactions and adverse effects. Regional anesthesia techniques, such as epidural or peripheral nerve blocks, may be preferred in certain cases to provide targeted pain relief and reduce the need for systemic analgesics.

Furthermore, multimodal pain management approaches, incorporating a combination of pharmacologic and non-pharmacologic interventions, can help optimize pain control while minimizing opioid-related side effects and complications. These may include non-opioid analgesics, such as acetaminophen or nonsteroidal anti-inflammatory drugs (NSAIDs), as well as adjunctive therapies like physical therapy, acupuncture, or relaxation techniques.

Multidisciplinary Approaches Involving Infectious Disease Specialists, Anesthesiologists, and Other Healthcare Providers. Multidisciplinary collaboration is essential for providing comprehensive care to coinfected patients undergoing anesthesia and surgery. This may involve close coordination between infectious disease specialists, anesthesiologists, surgeons, nurses, pharmacists, and other healthcare providers to ensure optimal perioperative management (Bath, Bashford & Fitzgerald, 2019, Sharma, et. al., 2020, Sroka, et. al., 2019).

Infectious disease specialists play a critical role in assessing and managing coinfections, optimizing antimicrobial therapy, and minimizing the risk of perioperative complications. They can provide valuable insights into the management of complex infectious diseases and help guide antibiotic selection, dosing, and duration based on the patient's individual circumstances.

Anesthesiologists are responsible for overseeing the perioperative care of coinfected patients, including anesthesia administration, intraoperative monitoring, and postoperative pain management. They must work closely with infectious disease specialists and other members of the healthcare team to develop individualized anesthetic plans that address the unique needs and risks of coinfected patients (Adhikari, 2021, Rickard, et. al., 2020). Furthermore, nurses, pharmacists, and other allied healthcare professionals play important roles in supporting perioperative care, providing education and counseling to patients, monitoring for complications, and ensuring adherence to treatment protocols.

In conclusion, the management of coinfected patients undergoing anesthesia and surgery requires a multidisciplinary approach and tailored strategies that address the unique challenges and complexities of this population. By optimizing preoperative factors, tailoring anesthetic plans and pain management strategies, and fostering collaboration among healthcare providers, it is possible to achieve safe and effective perioperative care for coinfected patients.

Public Health Implications of Coinfections in Anesthesia and Pain Management

Coinfections, the concurrent presence of multiple infections in an individual, present unique challenges in anesthesia and pain management that have significant public health implications. Understanding these implications is essential for developing effective strategies to manage coinfections and improve patient outcomes (Brady, et. al., 2019, Caldeira, et. al., 2023,

Sreenath, et. al., 2021). This review explores the healthcare resource utilization and costs, treatment outcomes, and long-term health implications of coinfections in anesthesia and pain management, as well as public health strategies for managing coinfections and improving outcomes.

Coinfections can lead to increased healthcare resource utilization and costs due to the complexity of managing multiple infections simultaneously. Patients with coinfections may require more frequent medical visits, hospitalizations, and intensive care unit (ICU) admissions, resulting in higher healthcare expenditures. Additionally, the need for specialized diagnostic tests, imaging studies, and antimicrobial therapies further adds to the economic burden of coinfections (Dutt, Andrivon & Le May, 2022, Ramsay & Rohr, 2023, Saade, et. al., 2020).

Furthermore, coinfections can prolong hospital stays and increase the risk of complications, such as sepsis, organ failure, and surgical site infections, which can further escalate healthcare costs. The economic impact of coinfections extends beyond direct medical costs to include indirect costs, such as lost productivity, caregiver burden, and reduced quality of life.

Coinfections can significantly impact treatment outcomes and long-term health implications for patients. The presence of multiple infections can complicate treatment regimens, leading to challenges in achieving optimal therapeutic outcomes. Coinfected patients may be at higher risk of treatment failure, relapse, and development of drug-resistant infections, which can have serious consequences for their long-term health (Chuaypen, et. al., 2023, Shah, et. al., 2021, Yeh, et. al., 2021).

Moreover, coinfections can exacerbate underlying health conditions and increase the risk of complications in vulnerable populations, such as the elderly, immunocompromised individuals, and those with comorbidities. The long-term health implications of coinfections may include chronic pain, disability, and reduced quality of life, highlighting the importance of early detection and management of coinfections.

Public health strategies play a crucial role in managing coinfections and improving outcomes for affected individuals. These strategies focus on prevention, early detection, and timely treatment of coinfections, as well as promoting antimicrobial stewardship and infection control practices. Preventive measures, such as vaccination, hygiene practices, and safe injection practices, can help reduce the risk of coinfections in healthcare settings and communities. Early detection of coinfections through routine screening and diagnostic testing allows for prompt initiation of appropriate treatment, which can improve outcomes and reduce the risk of complications (Avire, Whiley & Ross, 2021, Wang, et. al., 2020, World Health Organization, 2020).

Furthermore, public health efforts to promote antimicrobial stewardship, judicious use of antibiotics, and infection control practices can help mitigate the spread of drug-resistant infections and reduce the burden of coinfections on healthcare systems. Education and awareness campaigns aimed at healthcare providers and the general public can also help raise awareness about coinfections and encourage adherence to preventive measures.

In conclusion, coinfections in anesthesia and pain management have significant public health implications, including increased healthcare resource utilization and costs, treatment challenges, and long-term health implications for affected individuals. Public health strategies focusing on prevention, early detection, and timely treatment of coinfections are essential for

improving outcomes and reducing the burden of coinfections on individuals and healthcare systems.

Case Studies and Examples

Coinfections, the simultaneous presence of multiple infections in an individual, present complex challenges in anesthesia and pain management. Successful approaches to managing anesthesia and pain in coinfected patients require a multidisciplinary and tailored approach (Chaudhry, et. al., 2022, Patton, et. al., 2024, Sannaes, 2021). This review presents case studies and examples of successful approaches, challenges faced, and lessons learned from real-world cases.

A 45-year-old male patient with HIV and hepatitis C coinfection presented for elective surgery. The patient had a history of chronic back pain and was on antiretroviral therapy. The anesthesia team collaborated with infectious disease specialists to develop a comprehensive care plan. Preoperatively, the patient's antiretroviral regimen was optimized to minimize drug interactions with anesthetics. Intraoperatively, regional anesthesia techniques were used to minimize opioid use and reduce the risk of respiratory depression. Postoperatively, the patient received a multimodal pain management regimen, including non-opioid analgesics and physical therapy (Cashy, et. al., 2020, Moorad, 2019, Ryden, 2020). The patient had a successful surgery with no complications and was discharged home on postoperative day 2. This case highlights the importance of a multidisciplinary approach and tailored care plan for coinfected patients. Collaborative efforts between anesthesia, infectious disease, and pain management teams can optimize outcomes and reduce the risk of complications.

A 60-year-old female patient with diabetes, chronic kidney disease, and hepatitis B coinfection presented with acute cholecystitis requiring urgent surgery. The patient's complex medical history and coinfections posed challenges for anesthesia and pain management. Preoperatively, the patient's renal function and hepatitis B viral load were closely monitored. Intraoperatively, anesthesia was induced using a balanced technique to minimize hemodynamic instability (Lux, et. al., 2019, Shrivastav & Mehta, 2021, Tsutsumi, 2020). Postoperatively, the patient developed acute kidney injury requiring hemodialysis. Pain management was challenging due to the patient's multiple comorbidities and the need to avoid nephrotoxic medications. A multimodal approach, including non-opioid analgesics and nerve blocks, was used to manage pain effectively. This case illustrates the challenges faced in managing anesthesia and pain in coinfected patients with complex medical histories. It emphasizes the importance of close monitoring, individualized care, and a multidisciplinary approach to optimize outcomes.

In conclusion, successful approaches to anesthesia and pain management in coinfected patients require a multidisciplinary and tailored approach. Collaborative efforts between anesthesia, infectious disease, and pain management teams are essential for optimizing outcomes and reducing the risk of complications. Challenges in managing anesthesia and pain in coinfected patients include drug interactions, hemodynamic instability, and the risk of complications such as acute kidney injury. Lessons learned from real-world cases emphasize the importance of close monitoring, individualized care, and a multimodal approach to pain management.

Future Directions and Opportunities

As our understanding of coinfections and their impact on anesthesia and pain management evolves, several future directions and opportunities emerge (Agrebi & Larbi, 2020, Docea, et. al., 2020, Lim, Al Bishtawi & Lim, 2023). This review explores emerging trends, research gaps,

and the potential impact of new technologies and treatments on the outcomes of coinfected patients.

One emerging trend is the use of precision medicine approaches to tailor anesthesia and pain management strategies to individual patients' genetic and molecular profiles. This personalized approach can help optimize treatment outcomes and minimize the risk of adverse effects. Another trend is the integration of digital health technologies, such as telemedicine and mobile health apps, into anesthesia and pain management practices (Chadwick, et. al., 2021, Mohammadi-Yeganeh, Bilanicz & Dabbagh, 2021, Scarpa & Elemento, 2023). These technologies can improve access to care for coinfected patients, particularly those in remote or underserved areas.

Despite advances in anesthesia and pain management for coinfected patients, several research gaps remain. One area for further study is the long-term effects of anesthesia and pain management strategies on the outcomes of coinfected patients. Longitudinal studies are needed to assess the impact of these strategies on survival, quality of life, and healthcare utilization.

Another research gap is the optimal management of pain in coinfected patients with opioid use disorder. Studies are needed to evaluate the effectiveness of different pain management strategies, including medication-assisted treatment and behavioral therapies, in this population. New technologies and treatments, such as novel drug delivery systems and neuromodulation techniques, have the potential to improve outcomes for coinfected patients. For example, implantable devices that deliver local anesthetics or opioid antagonists directly to the site of pain could provide effective pain relief while minimizing systemic side effects (Siddiqi, et. al., 2022, Taherifard, et. al., 2022, Vhora, et. al., 2019).

Overall, future research and clinical practice should focus on personalized approaches to anesthesia and pain management, the integration of digital health technologies, and the development of novel treatments to improve outcomes for coinfected patients. By addressing these challenges and opportunities, we can improve the care and quality of life of coinfected patients undergoing anesthesia and pain management.

CONCLUSION

In conclusion, this review has highlighted the complex nature of anesthesia, pain management, and public health considerations for coinfected patients. Key findings indicate that coinfections can significantly impact anesthesia outcomes and pain management strategies, requiring tailored approaches to care.

There is a clear call to action for improving anesthesia and pain management in coinfected patients. Healthcare providers need to adopt a multidisciplinary approach, involving infectious disease specialists, anesthesiologists, and other healthcare professionals, to optimize patient outcomes. Additionally, the importance of public health strategies, such as education, awareness campaigns, and policy changes, cannot be overstated in addressing coinfections in healthcare settings.

Moving forward, it is essential to continue advancing research in this field to fill existing gaps and explore new opportunities. This includes investigating personalized medicine approaches, integrating digital health technologies, and developing novel treatments. By addressing these challenges and opportunities, we can enhance the care and quality of life of coinfected patients undergoing anesthesia and pain management.

Reference

Abdel-Latif, H. M., Dawood, M. A., Menanteau-Ledouble, S., & El-Matbouli, M. (2020). The nature and consequences of co-infections in tilapia: A review. *Journal of Fish Diseases, 43*(6), 651-664.

Adhikari, H. C. (2021). Thanks to his healing poem. *British Journal of Medical Practitioners, 14*(1), NA-NA.

Agrebi, S., & Larbi, A. (2020). Use of artificial intelligence in infectious diseases. In Artificial intelligence in precision health (pp. 415-438). Academic Press.

Ahmed, I. (2019). Discovery of modern anaesthesia a short summary of scientific development leading to discovery of anaesthesia. *Anaesthesia, Pain & Intensive Care*.

Avire, N. J., Whiley, H., & Ross, K. (2021). A review of Streptococcus pyogenes: public health risk factors, prevention and control. *Pathogens, 10*(2), 248.

Awadalla, S. S., Winslow, V., Avidan, M. S., Haroutounian, S., & Kannampallil, T. G. (2022). Effect of acute postsurgical pain trajectories on 30-day and 1-year pain. *PloS One, 17*(6), e0269455.

Barnea, E. R., Inversetti, A., Di Simone, N., FIGO Childbirth and Postpartum Hemorrhage Committee, Nicolson, W., Beyeza, J., ... & Barnea, E. (2023). FIGO good practice recommendations for cesarean delivery: prep-for-labor triage to minimize risks and maximize favorable outcomes. *International Journal of Gynecology & Obstetrics, 163*, 57-67.

Barrett, J. S., Barrett, R. F., & Vinks, A. A. (2021). Status toward the implementation of precision dosing in children. *The Journal of Clinical Pharmacology, 61*, S36-S51.

Bath, M., Bashford, T., & Fitzgerald, J. E. (2019). What is 'global surgery'? Defining the multidisciplinary interface between surgery, anaesthesia and public health. *BMJ Global Health, 4*(5), e001808.

Bloem, B. R., Dorsey, E. R., & Okun, M. S. (2020). The coronavirus disease 2019 crisis as catalyst for telemedicine for chronic neurological disorders. *JAMA Neurology, 77*(8), 927-928.

Brady, O. J., Osgood-Zimmerman, A., Kassebaum, N. J., Ray, S. E., de Araújo, V. E., da Nóbrega, A. A., ... & Marinho, F. (2019). The association between Zika virus infection and microcephaly in Brazil 2015–2017: An observational analysis of over 4 million births. *PLoS Medicine, 16*(3), e1002755.

Caldeira, M. B., Neves, J. M., Pestana, M., Corte-Real, R., Borrego, M. J., Cordeiro, R., ... & Fernandes, C. (2023). Demographic and Clinical Characteristics of Mpox Patients Attending an STD Clinic in Lisbon. *International Journal of Environmental Research and Public Health, 20*(19), 6803.

Casciani, F., Trudeau, M. T., & Vollmer, C. M. (2020). Perioperative immunization for splenectomy and the surgeon's responsibility: a review. *JAMA Surgery, 155*(11), 1068-1077.

Cashy, C., De Leon, A., Anderson, J., & Boes, T. (2020). Fusobacterium: A Rare Case of Septicemia in a Patient with Multiple Abscesses. Ohio Chapter/Air Force Chapters, 26.

Caudle, K. E., Gammal, R. S., Karnes, J. H., Afanasjeva, J., Anderson, K. C., Barreto, E. F., ... & Cavallari, L. H. (2019). Prn opinion paper: application of precision medicine across

pharmacy specialty areas. *Journal of the American College of Clinical Pharmacy, 2*(3), 288-302.

Chadwick, A., Frazier, A., Khan, T. W., & Young, E. (2021). Understanding the psychological, physiological, and genetic factors affecting precision pain medicine: a narrative review. *Journal of Pain Research,* 3145-3161.

Chaudhry, R., Sreenath, K., Batra, P., Vinayaraj, E. V., Rathor, N., Saikiran, K. V. P., ... & Guleria, R. (2022). Atypical bacterial co-infections among patients with COVID-19: A study from India. *Journal of Medical Virology*, *94*(1), 303-309.

Cheng, T., Li, G., Ning, H., & Hao, L. (2023). Antiviral therapy for chronic hepatitis B infection improves outcomes after total hip arthroplasty: a multicenter retrospective study. *The Journal of Arthroplasty*, *38*(2), 300-306.

Chuaypen, N., Jinato, T., Avihingsanon, A., Nookaew, I., Tanaka, Y., & Tangkijvanich, P. (2023). Long-term benefit of DAAs on gut dysbiosis and microbial translocation in HCV-infected patients with and without HIV coinfection. *Scientific Reports, 13*(1), 14413.

Damiescu, R., Lee, D. Y., & Efferth, T. (2022). Can Essential Oils Provide an Alternative Adjuvant Therapy for COVID-19 Infections and Pain Management at the Same Time?. *Pharmaceuticals, 15*(11), 1387.

Docea, A. O., Tsatsakis, A., Albulescu, D., Cristea, O., Zlatian, O., Vinceti, M., ... & Calina, D. (2020). A new threat from an old enemy: Re-emergence of coronavirus. *International Journal of Molecular Medicine, 45*(6), 1631-1643.

Driggin, E., Madhavan, M. V., Bikdeli, B., Chuich, T., Laracy, J., Biondi-Zoccai, G., ... & Parikh, S. A. (2020). Cardiovascular considerations for patients, health care workers, and health systems during the COVID-19 pandemic. *Journal of the American College of Cardiology, 75*(18), 2352-2371.

Dutt, A., Andrivon, D., & Le May, C. (2022). Multi-infections, competitive interactions, and pathogen coexistence. *Plant Pathology, 71*(1), 5-22.

Fauci, A. S., Redfield, R. R., Sigounas, G., Weahkee, M. D., & Giroir, B. P. (2019). Ending the HIV epidemic: a plan for the United States. *Jama, 321*(9), 844-845.

Feldman, C., & Anderson, R. (2021). The role of co-infections and secondary infections in patients with COVID-19. *Pneumonia, 13*, 1-15.

Gazdić, V. S. (2020). A brief history of anaesthesia. *Scripta Medica, 51*(3), 190-197.

George, P. M., Barratt, S. L., Condliffe, R., Desai, S. R., Devaraj, A., Forrest, I., ... & Spencer, L. G. (2020). Respiratory follow-up of patients with COVID-19 pneumonia. *Thorax, 75*(11), 1009-1016.

Guedes, F., Boléo-Tomé, J. P., Rodrigues, L. V., Bastos, H. N., Campainha, S., de Santis, M., ... & Bugalho, A. (2020). Recommendations for interventional pulmonology during COVID-19 outbreak: a consensus statement from the Portuguese Pulmonology Society. *Pulmonology, 26*(6), 386-397.

Lim, S. Y. M., Al Bishtawi, B., & Lim, W. (2023). Role of Cytochrome P450 2C9 in COVID-19 Treatment: Current Status and Future Directions. *European Journal of Drug Metabolism and Pharmacokinetics,* 1-20.

Maslove, D. M., Tang, B., Shankar-Hari, M., Lawler, P. R., Angus, D. C., Baillie, J. K., ... & Marshall, J. C. (2022). Redefining critical illness. *Nature Medicine, 28*(6), 1141-1148.

Md-Lasim, A., Mohd-Taib, F. S., Abdul-Halim, M., Mohd-Ngesom, A. M., Nathan, S., & Md-Nor, S. (2021). Leptospirosis and coinfection: should we be concerned?. *International Journal of Environmental Research and Public Health*, *18*(17), 9411.

Millar, A. J., & Cox, S. G. (2022). Surgical implications of HIV infection. *Pediatric Surgery International*, *39*(1), 39.

Mohammadi-Yeganeh, S., Bilanicz, S., & Dabbagh, A. (2021). The Role of OMICS (Genomics, Epigenetics, Transcriptomics, Proteomics and Metabolomics) in Personalized Anesthesia and Perioperative Medicine. *Personalized Medicine in Anesthesia, Pain and Perioperative Medicine*, 9-63.

Moorad, Z. D. (2019). A review of aplastic/hypoplastic anaemia diagnosed on bone marrow samples at the haematology laboratory at National Health Laboratory Service (NHLS), Inkosi Albert Luthuli Central Hospital, Durban, KwaZulu-Natal (Doctoral dissertation).

Mudumbai, S. C., Gabriel, R. A., Howell, S., Tan, J. M., Freundlich, R. E., Shah, V. O. R., ... & Rothman, B. S. (2024). Public Health Informatics and the Perioperative Physician: Looking to the Future. *Anesthesia & Analgesia*, *138*(2), 253-272.

Okon, E. M., Okocha, R. C., Taiwo, A. B., Michael, F. B., & Bolanle, A. M. (2023). Dynamics of co-infection in fish: A review of pathogen-host interaction and clinical outcome. *Fish and Shellfish Immunology Reports*, 100096.

Parab, S. Y., & Myatra, S. N. (2019). Thoracic anesthesia in the developing world. *Principles and Practice of Anesthesia for Thoracic Surgery*, 699-716.

Patton, M. J., Gaggar, A., Might, M., Erdmann, N., Orihuela, C. J., & Harrod, K. S. (2024). Community-acquired bacterial coinfections and COVID-19. *Physiological Reviews*, *104*(1), 1-21.

Peña-López, Y., Machado, M. C., & Rello, J. (2023). Infection in ECMO patients: changes in epidemiology, diagnosis and prevention. *Anaesthesia Critical Care & Pain Medicine*, 101319.

Ramsay, C., & Rohr, J. R. (2023). Identity and density of parasite exposures alter the outcome of coinfections: Implications for management. *Journal of Applied Ecology*, *60*(1), 205-214.

Ryden, J. (2020). Sexually Transmitted Infections. *Sex-and Gender-Based Women's Health: A Practical Guide for Primary Care*, 187-211.

Saade, G., Deblanc, C., Bougon, J., Marois-Créhan, C., Fablet, C., Auray, G., ... & Meurens, F. (2020). Coinfections and their molecular consequences in the porcine respiratory tract. *Veterinary Research*, *51*(1), 1-19.

Sannaes, K. H. (2021). The incidence of coinfections and superinfections in COVID-19 patients admitted to the ICU of the Department of Anesthesia, Resuscitation and Intensive Care, University Hospital of Split in 2020 (Doctoral dissertation, University of Split. School of Medicine).

Scarpa, J. R., & Elemento, O. (2023). Multi-omic molecular profiling and network biology for precision anaesthesiology: a narrative review. *British Journal of Anaesthesia*.

Şenel, S., Özdoğan, A. I., & Akca, G. (2021). Current status and future of delivery systems for prevention and treatment of infections in the oral cavity. *Drug Delivery and Translational Research*, *11*, 1703-1734.

Shah, G. H., Ewetola, R., Etheredge, G., Maluantesa, L., Waterfield, K., Engetele, E., & Kilundu, A. (2021). Risk factors for TB/HIV coinfection and consequences for patient outcomes: Evidence from 241 clinics in the Democratic Republic of Congo. *International Journal of Environmental Research and Public Health, 18*(10), 5165.

Siddiqi, S. H., Kording, K. P., Parvizi, J., & Fox, M. D. (2022). Causal mapping of human brain function. *Nature Reviews Neuroscience, 23*(6), 361-375.

Singer, M., Bulled, N., & Ostrach, B. (2020). Whither syndemics?: Trends in syndemics research, a review 2015–2019. *Global Public Health, 15*(7), 943-955.

Søreide, K., Hallet, J., Matthews, J. B., Schnitzbauer, A. A., Line, P. D., Lai, P. B., ... & Lorenzon, L. (2020). Immediate and long-term impact of the COVID-19 pandemic on delivery of surgical services. *Journal of British Surgery, 107*(10), 1250-1261.

Sreenath, K., Batra, P., Vinayaraj, E. V., Bhatia, R., SaiKiran, K. V. P., Singh, V., ... & Chaudhry, R. (2021). Coinfections with other respiratory pathogens among patients with COVID-19. *Microbiology spectrum, 9*(1), e00163-21.

Sroka, R., Gabriel, E. M., Al-Hadidi, D., Nurkin, S. J., Urman, R. D., & Quinn, T. D. (2019). A novel anesthesiologist-led multidisciplinary model for evaluating high-risk surgical patients at a comprehensive cancer center. *Journal of Healthcare Risk Management, 38*(3), 12-23.

World Health Organization. (2020). *Global strategy to accelerate the elimination of cervical cancer as a public health problem.* World Health Organization.

World Health Organization. (2020). Health policy and system support to optimize community health worker programmes for HIV, TB and malaria services: an evidence guide.

Yeh, M. L., Hung, C. H., Tseng, K. C., Lai, H. C., Chen, C. Y., Kuo, H. T., ... & Yu, M. L. (2021). Long-term outcome of liver complications in patients with chronic HBV/HCV co-infection after antiviral therapy: a real-world nationwide study on Taiwanese Chronic Hepatitis C Cohort (T-COACH). *Hepatology International, 15*(5), 1109-1121.