

Anesthesia And Analgesics For Patients During Diagnostic X-Ray Imaging

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1. Introduction

goal of this document is to list the pharmaceutical products and the necessary safety parameters for evaluating the anesthetic, sedative, and analgesic techniques in patients subjected to diagnostic imaging studies under a controlled environment. It is emphasized to control the environment where the patient is imaged, to treat early, and to prevent complications. The resources for anesthetic, sedative, and analgesic therapy, and the possibility of overseeing an experienced anesthetist are to obtain quality diagnostic images and minimize adverse events with the patient. The technical and professional team are the premises for starting and organizing this protocol. Non-invasive high-quality images provide new diagnostic information, define surgical planning, and open new avenues for early and precision treatments. The following statement is the basis of the document: 'It is recommended to perform diagnostic imaging tests under controlled environmental situations... patients are placed under the action of appropriate anesthesia and analgesia at the time for diagnostic imaging procedures that require support for maintenance.' The following points are discussed in dealing with anesthetized patients immobilized in sternal or dorsal recumbence for diagnostic imaging purposes: anesthesia depth and how to assess it, the necessary equipment, complications during anesthesia and how to prevent them, possible consequences in fetuses. Premedication or another support must be discussed by the anesthetist and the imaging personnel in order to define the procedure and environmental adaptation to receive the patient for imaging detection. (Romagnoli et al.2020)(Wong et al.2020)(Ana et al.2020)(Artunduaga et al.2021)

2. Types of Anesthesia and Analgesics Used in Diagnostic X-ray Imaging

Anesthesia and analgesia are used during imaging research not only for the amelioration of pain but also to prevent stress, discomfort, and distress that may occur during Patient restraint

and manipulation. Many agents that are used in the management of pain can also be combined with anesthetics to provide balanced analgesia for procedures that are likely to be painful. Treatments can range from a local anesthetic with ketamine to an injectable general anesthetic supplemented by opioids or serotonergic agonists for postprocedural pain relief. Agents that are chosen for use depend on factors such as the species, experimental needs, Patient health, and suitability for MRI investigations. Techniques to administer agents for more frequent or continuous pain relief are also commonly used. As inhalants, volatile anesthetics are well suited for use in a variety of species because they are safe and effective over a wide range of doses, providing rapid induction and recovery from anesthesia. Isoflurane is the most commonly used anesthetic for both inhalation and injectable anesthetic methods in X-ray imaging. It can be administered through induction and maintenance of anesthesia, without exsanguination effects. Some additional injectable drugs, including dissociatives, alpha-2 adrenergic agonists, opioids, and other analgesic medications, can also be used for pain management, and xylazine is the most commonly used drug in injectable anesthetic protocols. The alpha-2 adrenergic agonists administration is used in Patient undergoing X-ray imaging and plays a key role in managing Patient who need to be controlled but cannot be handled. Other analgesic medications can be associated with better outcomes and a smoother anesthetic protocol. These drugs are included in monitored anesthesia protocols using alpha-2 adrenergic agonists administration. (Schooler et al., 2022)(Chaudhari2021)(Ferrini et al.2021)

2.1. Local Anesthesia

The use of local anesthetics (LA) is essential for many of the interventional radiologic procedures. During most radiologic vascular or non-vascular types of interventional procedures, an advanced practice nurse anesthetist, anesthesiologist, or an anesthetist provides moderate sedation analgesia for the patient. In procedures requiring completely anesthetized patients, an anesthesiologist or an advanced practice nurse anesthetist is needed with anesthesia experience in taking care of critically ill patients. Used in high enough volumes, contrast media have local anesthetic properties. Lidocaine 1% or 2% solution for IV or SQ injection is commonly used; however, other agents from the amide-ester groups of LA can also be used. The onset of action of Lidocaine on IV is usually 30 seconds. (Hayek & Kastler, 2020)(Balkaya et al.2023)(Arrigoni et al.2021)(Schwartz and Routman2023)

Topical anesthesia: As mentioned previously, it is estimated that using elastic tourniquets can reduce the pain of phlebotomies by

at least 50-70%. In my experience, phlebotomies hurt less when you use the right size needle, a large diameter butterfly needle, at a slow rate of withdrawal to be sure the tip does not penetrate deep into the tissue. A eutectic mixture of local anesthetics, a 1:1 mixture of lidocaine and prilocaine, has been introduced as a eutectic mixture of local anesthetics that is liquid at room temperature. Eutectic mixtures have a melting point lower than the components. When applied to intact skin, the eutectic mixture provides a local anesthesia effect approximately 60 minutes after application and peak effect within 2 hours.

2.2. General Anesthesia

Use of general anesthesia is indicated for pediatric or uncooperative patients who need sedation and immobilization during diagnostic X-ray imaging. Anesthesia is also indicated for patients who need imaging with immobilization of keloids, other non-bound neoplasms, and other conditions under ultrasound or MRI control. Before entering the examination room, the anesthesiologist (in the presence of the doctor, nurse, and other medical personnel who came with the patient) should inquire about the history, the results of a physical examination, especially in terms of changes in airway patency, previous clinical and anesthetic experiences, complications, and precautions in administering anesthesia, emergency resuscitation measures, and other important points in caring for the patient. Standard monitoring includes pulse oximetry, non-invasive blood pressure, temperature, end-tidal exhalation, and respiratory rate. The anesthesiologist should have access to ultrasound and/or ECG monitoring, as well as to a gauge of intravenous pressure and other necessary equipment in case of complications. The presence of these indicators of body functions allows continuous monitoring of vital signs, which is especially important for the safety of patients when they are under the influence of anesthetics, as well as for maintaining body temperature. Without a tight connection with the breathing system, hypothermia can occur, so before the examination, it is recommended to connect the patient to an air heating blanket. This will help maintain body temperature and reduce the risk of hypothermia.

2.3. Analgesics

In small Patient, when there is a disadvantage to administering NSAIDs, analgesics such as opioids, ketamine, or tramadol are used to relieve pain. It is especially important to effectively relieve pain in lightly anesthetized or awake Patient. Furthermore, it is desirable that the administered analgesics have both analgesic and sedative effects in small Patient because they often become excitable when a sedative is administered. In small Patient, tramadol may be a good choice because it has a greater analgesic

effect with a smaller dose. However, tramadol has disadvantages and may induce truncal swaying, head bobbing, salivation, vomiting, systemic edema, and bradycardia. It should be sparingly used or not administered depending on the patient's condition.

For instillation of contrast medium into the nasolacrimal duct or liver, analgesics with a weak analgesic effect are administered without an NSAID. After the diagnostic X-ray imaging has been completed, a week of follow-up observation is performed. If an analog is structurally similar to an NSAID, it may have a problem similar to that of the NSAID. Administration of an NSAID should be performed 3-4 days after instillation, or the follow-up observation should continue for 3-4 days before NSAID administration in order to reduce the risk of inflammation. Make a choice with consideration of the risk for the individual patient.

3. Benefits and Risks of Anesthesia and Analgesics in Diagnostic X-ray Imaging

There are clear benefits for anxiolysis, analgesia, or anesthesia of pediatric, geriatric, or Patient patients in the specific context of diagnostic X-ray imaging. The primary goal of using multifactorial anesthesia care is to produce a state of calm with controlled responsiveness that protects the patient from an awareness of physical or psychological distress and pain, while ensuring maximal diagnostic imaging methods and quality. So, when is anesthesia or analgesia appropriate? The basic criteria for using anesthetic and analgesic techniques are: 1) minimizing physical or psychological stress in the patient; 2) minimizing handling and contact with the team; 3) cooperation of the patient to ensure appropriate positioning for the imaging technique and minimize movement during the appointment; 4) ensuring the medico-legal obligations of the need to protect the patient, owner, and members of staff authorized to operate and work in the radiology room; and 5) minimizing the exposure and the number of people exposed to low doses of X-rays.

The anxiolysis, analgesia, or anesthesia principles and protocols used in diagnostic X-ray techniques reduce handling stress and the exposure of bone, brain tissues, and gonads in the dose area product of patients and teams. This reduces potential negative consequences related to the avoidance of appointments. However, whenever possible, both the Patient and owner should be safely shielded. The use of a minimum amount of anesthetic or analgesic protocol to obtain a good result is a further basic criterion for defining the advantages over disadvantages. For patients usually treated awake, the use of short-acting drugs to minimize recovery time and allow discharge as early as possible is the ultimate goal regarding patient recovery.

4. Considerations for Anesthesia Administration in Different Patient Populations

A discussion of the differences in pediatric, geriatric, and pregnant patients, and the implications of these differences in anesthesia-related care during diagnostic imaging procedures, is presented below.

1) Anesthesia in Pediatric Patients: Pediatric patients, in particular, often are the ones who will not cooperate with diagnostic studies without assistance. They are generally more uncooperative, more frightened, and more difficult to explain the procedures to than an adult patient. The most common reason for the employment of anesthesia or sedation during diagnostic imaging procedures in young pediatric patients is to alleviate the fear and anxiety they may feel. This population often requires sedation or even general anesthesia to facilitate the performance of the imaging study. Age can be a limiting factor in the performance of certain imaging procedures. For example, a patient in pain may not lie still for a scan such as a computerized tomography or a magnetic resonance imaging series. Denial of an anesthetic would prolong the study duration and necessitate the need to repeat the examination.

2) Anesthesia for Geriatric Patients: While they are difficult to generalize, geriatric patients are at increased risk for adverse effects from their reduction in homeostatic reserve. It requires the most astute and able management in the administration of anesthesia. They have three unique factors that result in not receiving the same type of anesthetic as a pediatric or other adult patient. a. An increased use of medications, b. An average number of medical problems, c. A decreased baseline organ function (along with changes in both lung and liver capacity).

3) Anesthesia for Pregnant Patients: Before anesthetics can be safely administered to patients undergoing diagnostic examinations, the patient's pregnancy status must be known and appropriately handled. It is common for females of childbearing age to have diagnostic imaging studies performed both prior to and after missing the first period, and pregnancy may be unknown to them. A valuable pregnant patient is a two-patient unit, and each unit must be treated with respect and consideration for the other. Magnetic resonance imaging is generally regarded as a useful examination in pregnancy. It does carry, however, occasions where the administration of an anesthetic is necessary, but when and to what extent is this necessary? The maternal and fetal responses to different anesthetics, methods of administration, and how their effects can be lessened?

5. Future Developments and Research in Anesthesia and Analgesics for Diagnostic X-ray Imaging

Reducing the number of Patient that are anesthetized for radiologic imaging will also reduce the need for analgesia associated with anesthetic procedures. The need for and impact of anesthesia for diagnostic procedures is not as well understood as for interventional procedures, and it is also not as well documented. Anesthesia for imaging does not require the full or even part of the stereotypically hypnotic plane that is often targeted and reached for many experimental procedures; therefore, non-immobilizing drug combinations that allow conscious anesthetic effects should be explored. Alternative methods may benefit both the Patient and the laboratory personnel who work with the anesthetics.

Using equipment that has already been tested and validated reduces the need for research in this area. It is important for any type of anesthetic technique that it does not obscure the view or the interpretation of the diagnostic images. The combination of anesthesia, analgesia, procedures, and imaging is still considered a form of welfare condition in Patient -based research, which is strange since the purpose of the anesthesia is to reduce pain and distress, the main welfare considerations for the Patient. Alternative methods and techniques should be developed for procedures where anesthesia, analgesia, and imaging are necessary. Essential welfare requirements, justified by Patient needs, should only be assessed in the most reliable way possible for the benefit of all parties involved.

6. References

1. Romagnoli, S., Fanelli, F., Barbani, F., Uberoi, R., Esteban, E., Lee, M. J., ... & Morgan, R. (2020). CIRSE standards of practice on analgesia and sedation for interventional radiology in adults. *CardioVascular and Interventional Radiology*, 43, 1251-1260. sgul.ac.uk
2. Wong, T., Georgiadis, P. L., Urman, R. D., & Tsai, M. H. (2020). Non-operating room anesthesia: patient selection and special considerations. *Local and regional anesthesia*, 1-9. tandfonline.com
3. Ana, S., Peng, P., Antunez, M. M., Paola, A., Gonzalez, X., & Mauricio, F. (2020). A magnetic resonance imaging study of local anesthetic spread in patients receiving an erector spinae plane block. *Canadian Journal of Anesthesia*, 67(8), 942-948. academia.edu
4. Artunduaga, M., Liu, C. A., Morin, C. E., Serai, S. D., Udayasankar, U., Greer, M. L. C., & Gee, M. S. (2021). Safety challenges related to the use of sedation and general

- anesthesia in pediatric patients undergoing magnetic resonance imaging examinations. *Pediatric radiology*, 51, 724-735. [springer.com](https://www.springer.com)
5. Schooler, G. R., Cravero, J. P., & Callahan, M. J. (2022). Assessing and conveying risks and benefits of imaging in neonates using ionizing radiation and sedation/anesthesia. *Pediatric radiology*. [\[HTML\]](#)
6. Chaudhari, P. (2021). Preclinical Imaging for Laboratory Rodents. *Essentials of Laboratory Patient Science: Principles and Practices*, 607-630. [\[HTML\]](#)
7. Ferrini, E., Leo, L., Corsi, L., Catozzi, C., Salomone, F., Ragionieri, L., ... & Stellari, F. F. (2021). A new anesthesia protocol enabling longitudinal lung-function measurements in neonatal rabbits by micro-CT. *American Journal of Physiology-Lung Cellular and Molecular Physiology*, 321(6), L1206-L1214. [physiology.org](https://www.physiology.org)
8. Hayek, G. & Kastler, B. (2020). Interventional radiology for treatment of bone metastases. *Cancer/Radiothérapie*. [sciencedirect.com](https://www.sciencedirect.com)
9. Balkaya, A. N., Yilmaz, C., Kurtarangil, A., Ata, F., Karaca, İ., Eminoğlu, Ş., & Setayeshi, T. (2023). Anesthesia Approaches in the Interventional Radiology Unit: A Retrospective Single-Center Study. *Medical Science and Discovery*, 10(2), 45-51. [medscidiscovery.com](https://www.medscidiscovery.com)
10. Arrigoni, F., Izzo, A., Bruno, F., Zugaro, L., Arrigoni, G., Vacca, F., ... & Masciocchi, C. (2021). Could anaesthesia be a key factor for the good outcome of bone ablation procedures? A retrospective analysis of a musculoskeletal interventional centre. *The British Journal of Radiology*, 94(1118), 20200937. [nih.gov](https://www.nih.gov)
11. Schwartz, Z. L., & Routman, J. S. (2023, April). Sedation and Analgesia for the Interventional Radiologist. In *Seminars in Interventional Radiology* (Vol. 40, No. 02, pp. 240-246). Thieme Medical Publishers, Inc.. [nih.gov](https://www.nih.gov)