

Efficacy and Safety of Sedation in Cardiac Imaging

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Nowadays, cardiac imaging is provided via numerous modalities such as echocardiography [transesophageal echocardiography (TEE) and transthoracic echocardiography (TTE)], magnetic resonance imaging of the heart (cardiac MRI), cardiac nuclear study, cardiovascular computed tomography (CT) scan-angiography, carotid artery imaging, and general radiography. Also, an increasing number of adult or pediatric patients currently undergo minimally invasive cardiovascular diagnostic or interventional procedures in catheterization and electrophysiology laboratories. These diagnostic imaging modalities are time-consuming and cooperation-dependent, and the creation of the best examination environment along with adherence to the best "patient safety" standards necessitates the application of most recent sedation guidelines and patient monitoring protocols (1).

TEE is a valuable diagnostic method performed for an increasing number of patients in echocardiography laboratories, operating rooms, and intensive care units. Although generally a safe procedure, TEE is regarded as a semi-invasive modality due to its potential for some minor and rarely major complications (1). It is, therefore, essential that TEE be conducted by a highly skilled operator. This imaging technique often requires light degrees of sedation and analgesia. The European Society of Cardiology (ESC) provides clear-cut guidelines for the appropriate premedication and establishment of a standard monitoring system prior to a TEE examination (2). These guidelines are, however, proposed only for TEE in adults and there are other protocols for pediatric patients. The majority of patients need only conscious sedation, which has the benefit of speedy post-procedural recovery and early discharge from the echocardiography laboratory. A large number of patients who receive conscious sedation, must be informed that they will not get a complete anesthetic (3). The personnel in charge of TEE must know

that every drug, which depresses the central nervous system, could impair ventilation, circulation system, or both. Therefore, it is necessary that non-anesthesiologist sedation practitioners managing intravenous sedation regularly pass relevant training courses (4). Electrocardiography (ECG) and oxygenation monitoring must be available throughout the procedure, and support must be provided by an assistant for the observation of vital signs and management of the airway (3, 5). This assistant can be an anesthesiologist, a well-trained anesthesia nurse, or any physician familiar with the pharmacology and clinical use of sedative/analgesic drugs and able to manage the patient's airway and lung ventilation as necessary (3). TEE should not be a painful procedure, and it is essential to remember that tranquilizers do not alleviate pain. Pain in a TEE examination can be a sign of a possible complication (i.e. esophageal erosion) (1, 2, 6).

Cardiac (CT Angiography, MRI, and Nuclear) Imaging and Other Modalities

These are noninvasive diagnostic modalities that provide a detailed picture of the tissues and organs in the body.

CT angiography images are used to aid in the detection of coronary artery lesions or peripheral artery obstruction and in any potential threat of a major cardiac event (7). This imaging technique focuses on the cardiac structures and their adjacent vascular bed and can, thus, obviate the need for more invasive procedures.

Cardiac MRI is a helpful modality that can create full images of the beating heart. This entirely noninvasive technique helps the physician study the configuration and performance of the cardiac muscle (8) and is, as such, considered the "gold standard technique" for the assessment of cardiac function. This technique does not use radiation or X-ray, but has a large magnet effect (9).

Implication for health policy/practice/research/medical education:

It is vital that non-anesthesiologist sedation practitioners responsible for intravenous sedation management have appropriate training and skills. A suitable monitoring system must be available during the procedure, and necessary support must be provided by an assistant for the observation of vital signs and management of the airway.

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Nuclear imaging of the heart assesses not only the blood flow in the cardiac muscle but also myocardial function via specific radionuclide dyes. Throughout this method, the physician administers a small quantity of dye into the vein of the patient in order to obtain nuclear images of the blood flow in the cardiac muscle (10).

Carotid imaging is both safe and painless. This imaging modality is FDA-approved and can effectively screen atherosclerosis and risk of myocardial infarction and stroke.

And last but not least among these imaging modalities is the carotid intima-media thickness (CIMT) technique, which is capable of diagnosing the extent of carotid atherosclerotic vascular disease (11).

The majority of these imaging techniques are generally noninvasive; be that as it may, they require the patient's complete immobility to guarantee optimal image quality. Sometimes the patient is restless or is not cooperative due to neurologic problems and, as a result, needs some degree of sedation. Diagnostic procedures such as TTE, electroencephalogram (EEG), and general radiography in some nervous and uncooperative children may require non-pharmacologic interventions, including relaxation and behavioral interventions. These methods are somewhat similar to pharmacologic approaches and may preclude the use of sedation in some children. Nevertheless, some children with significant distress or anxiety who are undergoing these procedures, especially CT and MRI, must receive sedation (6). In settings where the intravenous (IV) infusion of dexmedetomidine, propofol, etomidate, ketamine, or midazolam is not available, other agents (e.g. oral pentobarbital or oral or rectal chloral hydrate) may be safely used (10). Deep sedation is desirable during cardiac imaging, not only in agitated patients, but also to immobility of patients and obtain high-quality images. What is of paramount importance in this regard is excellent interdisciplinary cooperation with a skilled anesthetist and availability of standard hemodynamic monitoring (ECG, pulse oximetry, capnography, and noninvasive blood pressure measurement) as well as intubation and ventilation equipment (7).

In conclusion, the available guidelines on cardiac imaging modalities recommend suitable sedation administered by well-qualified sedation practitioners (1, 3, 11, 12).

Authors' contributions

Dr. Ziyaeifard made literature review and primary struc-

ture of the paper. Dr. Azarfarin introduced the idea and completed the paper writing and submitted to the journal.

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