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Short Communication

Rationale of Point-of-Care Ultrasound in Anesthesia

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Abstract: Point-of-Care Ultrasound is the use of ultrasound at patient's bedside, in real time, to help in the diagnosis, guide therapeutic interventions, monitoring of organ functions and their treatment. The acquisition of Point-of-Care Ultrasound images by anesthesiologists involves the evaluation of multiple organs in different perioperative situations. It can be used to improve clinical decision-making in a variety of perioperative cares, due to its ability to assess endotracheal tube placement, cardiac and lung functions, risk of aspiration, hemodynamics, vascular access, and visualization of nerves for regional procedures. The importance of clinical ultrasound in perioperative settings, its increasing affordability, and associated low risks have been used in many anesthesiology residency programs to increase the focus on perioperative ultrasound training. The purpose of this paper is to present current anesthesiologists and anesthesiologists in training with brief information on the utility and importance of Point-of-Care Ultrasound in perioperative settings.
Keywords: Point-of-Care-Ultrasound, Preoperative, Postoperative, Echography, Clinical echography, Anesthesiology.

Introduction

The first reports on diagnostic ultrasound in medicine were made in the 40s of the 20th century at the University of Vienna, by Dr. Dussik.[1] Since then, the development of this imaging technique has progressed rapidly due to the appearance of more modern, compact, easy-to-use, transportable, and lower-cost equipment, in addition to being used by different specialties and in any setting for healthcare. In the last decade, Point-of-Care-Ultrasound (POCUS), also called ultrasound or scanning ultrasound, clinical insonation, clinical ultrasound, echoscopy, 21st century stethoscope or anesthesiologist's third eye,[2] has advanced dramatically and it is successfully used by different specialties and in any scenario for health care.

POCUS is the ultrasonographic examination performed bedside the patient as an essential tool for diagnosis, therapy, procedure guidance, and evaluation of patients in multiple specialties, including the perioperative setting, since it can be quickly implemented in the pre-anesthesia room, operating room, postoperative or Intensive Care Unit. The primary advantages of POCUS are: expedited performance by the attending physician, the patient does not have to be transferred to another department, reproducible at any time, its result is immediate, avoids exposure to radiation, and its low cost.[3] Its main disadvantage is that its results depend on the experience of the operator who performs it.[3]

The objective of this paper is to present the opinions of the author in relation to the main indications of POCUS in perioperative anesthetic care, and which are carried out by the anesthesiologist. Those interested are referred to review the bibliographical citations for the description of the different techniques mentioned in the paper.

Perioperative medicine

Perioperative medicine is "a system of medical care that has a multidisciplinary, comprehensive and patient-centered approach; and that seeks to provide the best possible care to surgical patients from the moment surgery is indicated until their complete recovery, with the explicit objective of improving results and reducing complications".[4] The intervention is planned together with the patient, preoperative assessment, presence of associated diseases, standardization of care, individualization, and discharge or transfer planning. For these actions to be effective, the team must work in a coordinated, effective and responsible manner. The perioperative period is the time elapsed before, during and after surgery. It is divided into: preoperative; intraoperative and postoperative phases. The postoperative phase is divided in the immediate postoperative period (first 24 to 48 hours after surgery) and the mediate (72 hours and more).

Preoperative evaluation

Initially, multisystem ultrasound will be performed to evaluate functional or organic disorders that the patient may present that are not related to the reason for the operation:[5]

1) Lungs: presence of pneumonia; pleural effusion; pneumothorax; lung congestion.
2) Heart: identification of patients with structural or functional heart disease.
3) Abdominal: biliary pathologies; hepatic, pancreatic, splenic, kidneys, intestinal or vascular (aorta-inferior vena cava) affections.
4) Vascular: determine the presence of deep vein thrombosis.
5) Determination by ultrasound of difficult intubation criteria.[5]

✓ Evaluation of patients at risk of difficult intubation.
✓ Identification of the cricothyroid membrane for the possible realization of an invasive approach to the airway.
✓ Presence of vocal cord lesions or paralysis.

6) Estimation of the endotracheal tube size by measuring the tracheal diameter.[6, 7]
7) Verification of the correct position of the endotracheal tube.[8]
8) Demonstrate adequate mechanical ventilation of both lungs.[9]
9) Estimation of gastric content and correct placement of a nasogastric tube.[10]
10) Performing ultrasound-guided invasive procedures: vascular access insertion;[11] epidural puncture;[12] lumbar puncture:[13] nerve blocks.[14]

POCUS during the intraoperative period

1) Monitoring of mechanical artificial ventilation and cardiovascular function.[9]
2) Estimation of adequate blood volume by ultrasound of large veins (jugular, inferior vena cava, femoral vein, hepatic and portal veins).[15, 16]
3) Facilitate the evaluation of airways, ventilation and circulation (A B C) in the occasion of any event that the patient presents.[9]
4) Facilitate cardiopulmonary resuscitation maneuvers and determine the possible cause of cardiorespiratory arrest.[17]
5) Monitoring intracranial pressure.[18]

POCUS in the postoperative period

Period of time of variable duration, which averages from the moment the surgical intervention ends until the patient fully recovers from his operation.

Immediate postoperative period (24 to 48 hours)

1) Estimation of satisfactory extubation by assessing cardiorespiratory function, as well as the presence of complications (pneumothorax; pleural effusion; pulmonary atelectasis; pulmonary lesions).[9]
2) Structural lesion of vocal cords.[9]
3) Evaluation of intestinal motility and diagnosis of ileus.[19]
4) Control of "forgotten" objects in the operating field.[20]

POCUS in the mediate postoperative period (72 hours and more)

1) Assessment of functional or structural disorders that may appear in patients undergoing surgery.[5]
- ✓ Cardiovascular: cardiac dysfunction; pericardial effusion or cardiac tamponade.[9]
- ✓ Respiratory: pneumonia; atelectasis; lung congestion; abscesses; pulmonary thromboembolism.[9]
- ✓ Deep vein thrombosis.[21]
- ✓ Dehiscence of sutures.[19]
- ✓ Intracavitary collections.[19]
- ✓ Intracavitary bleeding.[19]
- ✓ Intestinal obstruction.[20]

Conclusions

POCUS is a valuable tool that is increasingly being used in perioperative settings due to its reliability, accuracy, immediacy, and ease of use. The application of POCUS by anesthesiologists to different organ systems and in a variety of perioperative settings offers its own advantages in improving clinical decision making. POCUS can be used to confirm proper endotracheal tube placement and in complex airway situations. The scan provides invaluable information that helps to appreciate challenging hemodynamically unstable situations. Lung ultrasound can identify conditions such as pneumothorax, pulmonary edema, pleural effusion, and lung consolidation. It facilitates the performance of invasive ultrasound-guided procedures. The diverse utility of POCUS by anesthesiologists enriches the quality of medical care that patients receive in perioperative settings. Therefore, the current and growing clinical evidence supporting the value of POCUS will increase its utility in this setting and its importance in aiding perioperative clinical decision-making.

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