

How to reduce pleural drainage complications using an ultrasound-guided technique.

Como reduzir complicações relacionadas à drenagem pleural utilizando uma técnica guiada por ultrassom.

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LETTER TO THE EDITOR

The article by Mendes and Hirano¹ addresses a relevant issue in the context of emergency surgery. In fact, complications related to emergency pleural drainage occur in 14% to 25%^{2,3} and may range from drain misplacement to lethal iatrogenic lesions^{4,5}. Faced with this scenario, the understanding of factors related to the incidence of complications leads to the development of measures and techniques that can reduce this rate. One of the techniques is the ultrasound-guided pleural drainage, which has been standardized by our group and recently published⁶.

Regarding the origin of the complications reported in the article, we consider that anatomical variations and pathological alterations can also result in drainage failure. Although the authors did not observe intercostal artery lesions, this is a common complication reported in literature⁷. The presence of vulnerable vessels in the intercostal space can be excluded, using ultrasound Doppler mode⁸. Some conditions favor iatrogenic lesions during pleural drainage. Atelectasis may result in diaphragmatic dome elevation and diaphragmatic hernias increase the risk of abdominal viscera lesions during drainage⁴. By using ultrasound, it is possible to identify the diaphragmatic excursion and define the safest intercostal space to perform the procedure^{6,9}. Thus, drain insertion into the abdominal cavity, observed in two cases¹, could have been avoided using the echo-guided technique.

Since there is no detailed description of the malpositioning in the article by Mendes and Hirano¹, we identified three more cases in which the use of ultrasound could have avoided complications. In the case in which there was a gastric perforation, a diaphragmatic hernia, often not observed by digital exploration of the cavity, could have been visualized by ultrasound during an echo-guided pleural drainage. Regarding the two cases of drain placed in the subcutaneous, ultrasound could have prevented complication. With ultrasound, malpositionings quickly identified¹⁰. Instead of waiting for results of chest X-ray or tomography to confirm positioning, ultrasound allows the physician to promptly identify the necessity of re-drainage.

Obviously, the ultrasound-guided pleural drainage technique has two important limitations. The first is related to resources and lack of training. The other limitation refers to drainage time. Although there are not yet prospective studies comparing the echo-guided technique with the traditional one, it is assumed that the first should take longer.

The medical community is increasingly using ultrasound in emergencies and as an adjunct to invasive procedures. It is necessary that professionals understand the benefits of this tool and the importance of specific training. There are several point-of-care courses in Brazil. To our knowledge, the Discipline of General Surgery and Trauma of Hospital das Clínicas

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- Universidade de São Paulo (HC-FMUSP) offers the only course that teaches the step-by-step ultrasound-guided pleural drainage, developed by our group⁶, in addition to other important topics of ultrasound in emergency medicine.

Thus, we consider that the incorporation of the ultrasound-guided pleural drainage technique may avoid complications currently observed in our medical centers. For this, physicians need to be adequately trained and hospitals must provide the necessary resources to perform the procedure. Similar to other procedures such as thoracentesis and central venous access, in which the echo-guided technique became the gold standard, we believe that the same positive results can be obtained with echo-guided pleural drainage.

REFERENCES

1. Mendes CA, Hirano ES. Predictors of chest drainage complications in trauma patients. *Rev Col Bras Cir.* 2018;45(2):e1543.
2. Aylwin CJ, Brohi K, Davies GD, Walsh MS. Pre-hospital and in-hospital thoracostomy: indications and complications. *Ann R Coll Surg Engl.* 2008;90(1):54-7.
3. Deneuille M. Morbidity of percutaneous tube thoracostomy in trauma patients. *Eur J Cardiothorac Surg.* 2002;22(5):673-8.
4. Wrightson JM, Helm EJ, Rahman NM, Gleeson FV, Davies RJ. Pleural procedures and pleuroscopy. *Respirology.* 2009;14(6):796-807.
5. Hooper C, Maskell N; BTS audit team. British Thoracic Society national pleural procedures audit 2010. *Thorax.* 2011;66(7):636-7.
6. Menegozzo CAM, Utiyama EM. Steering the wheel towards the standard of care: proposal of a step-by-step ultrasound-guided emergency chest tube drainage and literature review. *Int J Surg.* 2018;56:315-9.
7. Kong VY, Clarke DL. The spectrum of visceral injuries secondary to misplaced intercostal chest drains: experience from a high volume trauma service in South Africa. *Injury.* 2014;45(9):1435-9.
8. Salamonsen M, Dobeli K, McGrath D, Readdy C, Ware R, Steinke K, Fielding D. Physician-performed ultrasound can accurately screen for a vulnerable intercostal artery prior to chest drainage procedures. *Respirology.* 2013;18(6):942-7.
9. Bowness JS, Nicholls K, Kilgour PM, Ferris J, Whiten S, Parkin I, et al. Finding the fifth intercostal space for chest drain insertion: guidelines and ultrasound. *Emerg Med J.* 2015;32(12):951-4.
10. Jenkins JA, Gharahbaghian L, Doniger SJ, Bradley S, Crandall S, Spain DA, et al. Sonographic Identification of Tube Thoracostomy Study (SITTS): confirmation of intrathoracic placement. *West J Emerg Med.* 2012;13(4):305-11.

Replication (letter to the editor)

Réplica à carta ao editor.

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REPLICATION

In their Letter to the Editor, "How to reduce pleural drainage complications using an ultrasound-guided technique", the authors attest that the method has demonstrated benefits in the fields of medical urgency and emergency.

The study carried out by Mendes and Hirano¹ aimed to identify post-trauma thoracic drainage complications treated at HC Unicamp (Discipline of General Surgery and Trauma) and sent from other sites. ATLS² guidelines were applied to those traumatized patients who had their first initial care conducted there.

In a study³ in which most patients (85%) were referred from low-complexity hospitals with post-trauma thoracic drainage to a Reference Center, intercostal artery injury was described as one of the complications, and the authors found that, in these cases, the technique for traumatized patients recommended in ATLS² protocol was not followed. A trocar was used for insertion of the drain.

Salamonsen *et al.*⁴ carried out a study in non-traumatized patients using ultrasound Doppler mode to locate vessels in the intercostal space, which should be avoided during thoracentesis. But the method was described in prone position, performed by medical specialists and the examined sites were in the back from the posterior axillary line. This study identified the presence of the posterior intercostal artery (PIA)

in 86% of the evaluations. Therefore, the study is not related to the recommended site for thoracic drainage in traumatized patients, which is the fifth intercostal space between the mid and anterior axillary line². PIA is around 3mm in diameter near its origin in the aorta and, as located before, it becomes closer to the lower costal border of the intercostal space⁵, being more protected.

Authors^{6,7} demonstrate that the ultrasound examination helps to determine the intercostal space favorable for thoracic drainage, reducing the occurrence of complications in the intra-hospital care. However, on a day-to-day basis, trauma referral centers receive patients through Pre-Hospital Care or less complex units (such as UPAs in Brazil), where ultrasound equipment may not be available, a scenario that may contribute to iatrogenic complications.

Concerning thoracic drainage after trauma, Mendes and Hirano¹ demonstrated a general complication rate of 26.5%. And when they analyzed those performed at the Reference Center, the rate was 17.9%. Patients who had the first initial care at this center followed the protocols² and were submitted to eFAST, followed by multislice computed tomography (CT) evaluation. In this study, major complications were diagnosed/suspected by CT, since they had already been referred with previous thoracic drainage.

Jenkins *et al.*⁸ evaluated the use of ultrasound to confirm drain placement within

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the pleural space. This study defines the correct drain placement when it is seen transposing the parietal pleura, but it does not state in the method if this evaluation is done during the procedure. Another detail, if the ultrasound evaluation occurred simultaneously during the drain introduction through the chest wall, the associated identification with the used surgical material could be described in the results. The metal forceps can be shown in the ultrasound examination image⁹.

There is no doubt that ultrasound has gained space both in diagnostic aid and in medical procedures, contributing to a better prognosis and less occurrence of complications. Compared to simple chest X-ray, ultrasound provides better confirmation of the drain in the intercostal space after the procedure.

But there are two limitations to the method: equipment availability and learning curve. Regardless of this, the technology added to the new knowledge (researched or shared) aims to provide a quality service, which makes important the knowledge of global and local epidemiology for the elaboration of institutional protocols. Medical procedures can cause a number of complications which must be prevented, and, for this, it is necessary to know them.

REFERENCES

- Mendes CA, Hirano ES. Predictors of chest drainage complications in trauma patients. *Rev Col Bras Cir.* 2018;45(2):e1543.
- Advanced Trauma Life Support-ATLS®. Student Course Manual. The Committee on Trauma. 10th ed. Chicago: American College of Surgeons; 2018.
- Kong VY, Clarke DL. The spectrum of visceral injuries secondary to misplaced intercostal chest drains: Experience from a high volume trauma service in South Africa. *Injury.* 2014;45(9):1435-9.
- Salamonsen M, Dobeli K, McGrath D, Readdy C, Ware R, Steinke K, Fielding D. Physician-performed ultrasound can accurately screen for a vulnerable intercostal artery prior to chest drainage procedures. *Respirology.* 2013;18(6):942-7.
- Choi S, Trieu J, Ridley L. Radiological review of intercostal artery: anatomical considerations when performing procedures via intercostal space. *J Med Imaging Radiat Oncol.* 2010;54(4):302-6.
- Menegozzo CAM, Utiyama EM. Steering the wheel towards the standard of care: proposal of a step-by-step ultrasound-guided emergency chest tube drainage and literature review. *Int J Surg.* 2018;56:315-9.
- Bowness JS, Nicholls K, Kilgour PM, Ferris J, Whiten S, Parkin I, et al. Finding the fifth intercostal space for chest drain insertion: guidelines and ultrasound. *Emerg Med J.* 2015;32(12):951-4.
- Jenkins JA, Gharahbaghian L, Doniger SJ, Bradley S, Crandall S, Spain DA, et al. Sonographic Identification of Tube Thoracostomy Study (SITTS): confirmation of intrathoracic placement. *West J Emerg Med.* 2012;13(4):305-11.
- Tahmasebi M, Zareizadeh H, Motamedfar A. Accuracy of ultrasonography in detecting radiolucent soft-tissue foreign bodies. *Indian J Radiol Imaging.* 2014;24(2):196-200.

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