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Percutaneous Approach in Pneumology

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Thoracic drainage

Chest drainage is an essential tool in the treatment of pneumothorax (PNX), spontaneous or post-traumatic, of pleural empyema, haemotorax, chylothorax, recurrent pleural effusion that is not responding to pleurodesis and, finally, after thoracoscopy or thoracic surgery (both traditional and video assisted) *(Level of evidence: IV*) **(Grade C)** [1-5].

In cases of PNX, observational approach is largely sufficient and needle aspiration can have decisive results. Drainage should always be placed in ventilated patients, if the PNX is bilateral, hypertensive, recurrent after fine needle aspiration or in the extensive secondary PNX (>2 cms). The "large" size of PNX (presence of a visible rim of more than 2 cm between the lung margin and the chest wall at the level of the hilum) is a relative indication for active intervention *(Level of evidence: IV)* **(Grade C)** [2, 3, 4, 6].

The positioning of the chest drainage is always indicated in cases of empyema (pH <7.2, glucose <40 mg / dl, LDH >1000 U / dl) and hemothorax. In malignant pleural effusions small bore chest tubes followed by pleurodesis are preferable to recurrent aspiration. After unsuccessful attempts to pleurodesis, drainage may be the only valid therapeutic approach for recurrent pleural effusions and chylothorax *(Level of evidence: IV)* **(Grade C)** [5, 7, 8]. Chest drainage is always required after thoracic surgery and thoracoscopy *(Level of evidence: IV)* **(Grade C)** [9].

The pleural symphysis is an absolute contraindication for thoracostomy through drainage, while bleeding disorders represent a relative contraindication. Possible complications include vagal-crisis, intercostal artery injury, lung injury, infection, re-expansion pulmonary oedema, malignant seeding in the site of drainage *(Level of evidence: IV)* **(Grade C)** [2, 3, 9].

The positioning of the chest drain needs the implementation of a small thoracotomy that is usually given in V-VI space on the mid-axillary line of the hemithorax or, in case of PNX, in II or III space on mid-clavicular line. The choice of the site for positioning the drainage tube can be made with greater accuracy under ultrasound guidance *(Level of evidence: III)* **(Grade B)** [9, 10].

The size of the drainage tube depends on the quantitative and qualitative characteristics of the fluid or air leaking to drain. In PNX it is possible to use a tube of small calibre (14 ch); the size of the tube should be greater when the air leaking is important, the patient is unstable and requires mechanical ventilation, or in presence of blood loss. In parapneumonic or neoplastic effusions it is possible to use a tube of small calibre (14 ch), but, if the viscosity of the liquid becomes higher (pus or blood loss), it is necessary to place a tube with bigger calibre *(Level of evidence: IV)* **(Grade C)** [2, 3, 5, 9].

The chest drainage requires daily checks, in PNX the tube can be removed at the cessation of air leaking (at least 48 hours) and in the pleural effusions when the daily loss of fluid is less than 150 mL *(Level of evidence: IV)* **(Grade C)** [2, 3, 9].

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Transthoracic fine needle aspiration

The transthoracic fine needle aspiration (TTNA) is used in the diagnosis of lung cancer and lymphoma. TTNAs are performed on pulmonary nodules and masses, masses of the anterior and middle mediastinum, pleura and chest wall injury *(Level of evidence: IIb)* **(Grade B)** [1-7].

The TTNA has an almost absolute diagnostic accuracy where positive for malignancy, but, where negative, it may lead to wider margins of uncertainty (high sensitivity with low negative predictive value). Used in the second instance, following bronchoscopy (biopsies, transbronchial fine needle aspiration and transbronchial biopsy), which alone leads to the diagnosis in the 75.4% of cases, TTNA contributes to cytological diagnosis in 95.2% of cases. The diagnostic accuracy increases to 100% by associating repeated TTNAs with the clinical observation and TC studies *(Level of evidence: IIb)* **(Grade B)** [3, 4, 8].

TTNA contraindications are related to the need to avoid potentially severe complications: pneumothorax and bleeding. The most critical factors that increase risks and require a more careful assessment of the methodology are: the inability of patients to collaborate on the TTNA execution, the mechanical ventilation, the results of pneumonectomy, the bleeding disorder, thrombocytopenia, severe chronic obstructive pulmonary disease and the presence of unavoidable lung bubbles *(Level of evidenceIV)* **(Grade C)** [9].

The method performed under fluoroscopic guidance enhances the speed of execution and allows a direct view of the needle insertion with mild sensitivity in the determination of injury, the vascular structures and the bubbles. The TC guide requires a longer execution time but is currently used more frequently because it allows fine needle aspiration in parenchymal lesions, hilar and mediastinal, also of small dimension, by avoiding bubbles and vascular structures *(Level of evidence: IV)* **(Grade C)** [10-12].

Ultrasonography can guide the TTNA pleural lesions, peripheral parenchymal and mediastinal masses with the advantage of rapid execution, low cost, no radiation, real-time viewing, chance of avoiding necrotic areas, but this method is limited to injuries that produce an acoustic window (masse peripheral or mediastinal lesions) *(Level of evidence: III)* **(Grade B)** [13].

The possibility of obtaining an immediate evaluation of cytopathologists reduces the number of inadequate samples and increases the diagnostic sensitivity, negative predictive value and accuracy of the procedure *(Level of evidence: III)* **(Grade B)** [14, 15].

A large clinical documentation (years 1980-2000) on TTNA with different forms of guidance, needle localisation of lesions, presence of cytopathologists during the exam, the prevalence of malignancy in the population studied, showed a diagnostic sensitivity between 72% and 100%, a specificity between 91% and 100%, positive predictive value between 95% and 100% with a negative predictive value between 48% and 98%. The negative predictive value and percentage of specific benign diagnosis is relatively low in this extensive case studies and this justifies the following use of TTNA with sharp needle *(Level of evidence: IIb)* **(Grade B)** [3, 4, 11, 13, 14, 15-18].

TTNA's common complications are PNX (between 2 and 56% of cases) and bleeding (5% of cases) while vaso-vagal reactions, torsion of the lung, gas embolism, implantation of tumour cells along the needle circuit, cardiac tamponade, aspiration of cyst echinococcus are rare. Bleeding and gas embolism can be fatal. The PNX is undoubtedly the most common complication, it usually appears within the first hour of the TTNA execution and the approach is conservative; the positioning of the chest drainage is described in the 0% and 18% of the case studies. The presence of COPD, small injuries or deep lesions located in the lung parenchyma as the use of a needle with larger calibre or more steps seem to increase the risk of PNX complications. The bleeds are the second most common complication of TTNA, are usually self-limiting but can lead to death *(Level of evidence: III)* **(Grade C)** [3, 4, 15, 16, 19-25].

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Radiofrequency ablation

Radiofrequency ablation (RFA) is a technique, used in humans since 2000, for the palliative treatment of primary or secondary malignant pulmonary lesions which are unable to be healed by medical or surgical therapy. The RFA uses a sinusoidal current of frequency between 400 and 500 kHz that, applied to the lesion using a needle-electrode through percutaneous fixture, mobilizes the ions of the tissues submitted to its action causing heat. The goal of the treatment is to obtain a thermo coagulation with permanent injury of the tissue near the electrode. After RFA treatment, a survival rate has been reported as follows: at 1, 2, 3, 4 and 5 years of 78%, 57%, 36%, 27% in patients who cannot have surgical indications; 27% in NSCLC patients with stage 1 and 87%, 78%, 57%, 57% and 57% in patients with pulmonary metastases of colorectal NPL. These survival rates results are more satisfying than those obtained with radiotherapy alone. The efficacy of treatment with RFA is higher with nodules smaller than 3 cm (irrespective of histological type), keeping the maximum healable size to 5 cm. The indication for RFA may be extended to the treatment of multiple pulmonary lesions (cut off indicative of 5) by repeated needle's placements if unilateral whether more sessions if bilateral. In a recent study, CT imaging-bronchoscopy-guided, internally cooled RFA results may be a potential therapeutic tool for local control in medically inoperable patients with stage I NSCLC *(Level of evidence: IV)* **(Grade C)** [1-9].

The most common complications of the RFA are represented by pain, cough and dyspnoea (76% of cases) followed by the onset of PNX (28-42.3%) which may occur later or become recurrent. Cases of sepsis, interstitial pneumonia and pleurisy have been decrypted after RFA. The FDA in December 2007 and September 2008, have reported deaths from complications arising after RFA treatment in patients with lung cancer so it is recommended to pay extreme attention to indications, selection of patients, modalities of treatment, and management of postoperative complications. Furthermore it have been reported that the RFA ablation devices have not been specifically approved for lung tumour ablation *(Level of evidence: IV)* **(Grade C)** [8, 10-13].

For the implementation of RFA, after CT-centring of the lesion a needle-electrode monopole, simple or coaxial, is positioned, connected to a device that delivers sinusoidal current. Unilateral multiple lesions may require one or more sessions of treatment. Bilateral lesions always require different sessions. Lesions larger than 3 cm require double needle's placement for a complete treatment. The RFA can be performed under local or general anaesthesia and ventilation with single or double lumen intubations depending on the site of the lesion and the patient's characteristics. During the CT-control after RFA it is observed the cockade aspect of the lesion with peripheral hyperaemia (framework for ground-glass), and moderate pleural effusion whether controls following 30 days from the operation and subsequent observed gradual loss of density until the formation of hyper dense scar tissue on the lesion core surrounded by a ring of hyper dense tissue *(Level of evidence: IV)* **(Grade C)** [2, 6, 7, 13].

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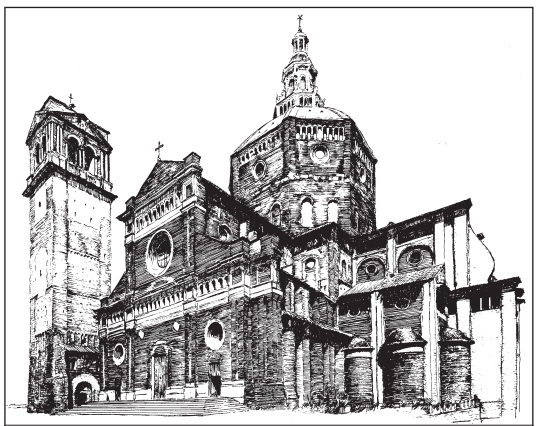

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