Anesthetic Drugs Managed by Pulmonologists during Medical Thoracoscopy: One Size Does Not Fit All!

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Among pleural diseases, pleuritis represent a common medical dilemma with a high prevalence of malignancy in the case of exudates (42–77%), and the number of cases is expected to continue to rise with the incidence of cancers and increasing life expectancy [1]. The initial workup for a pleural effusion typically consists of thoracentesis, which may establish the diagnosis in 60% of malignant pleural effusions; contrary to common belief, a second sample will increase the diagnostic yield by around 15%, but a third sample is noncontributory [2]. The role of ‘blind’ pleural biopsy (non-image-guided pleural biopsy) is questionable at present because it is less sensitive than image-guided pleural biopsy (via computed tomography or ultrasonography) or thoracoscopy under local anesthesia. In the last pleural disease guideline of the British Thoracic Society dedicated to local anesthetic thoracoscopy, which was published in 2010, Rahman et al. [1] reported the pooled results of 22 case series showing a 92.6% diagnostic sensitivity for malignant pleural disease, establishing local anesthetic thoracoscopy (a misnomer as intravenous sedation is also typically used), also called medical thoracoscopy (MT) or pleuroscopy, as the cornerstone of the management of unexplained exudative pleural effusions. While no head-to-head comparisons have been performed to date, the diagnostic test perfor-

mance of MT is comparable to that of video-assisted thoracoscopic surgery, which is usually performed under general anesthesia by thoracic surgeons in an operating theater [3]. In contrast, MT is routinely performed by chest physicians under light sedation (or so-called ‘conscious sedation’) in spontaneously breathing patients in procedural facilities outside of the costly environment of operating rooms [4–6]. Besides being efficient, local anesthetic thoracoscopy is overall a safe procedure with major complications (empyema, hemorrhage, port site tumor growth, bronchopleural fistula, postoperative pneumothorax or air leak and pneumonia) and minor complications (subcutaneous emphysema, minor hemorrhage, operative skin site infection, hypotension during the procedure, fever or atrial fibrillation) reported in less than 2 and 7%, respectively [1]. Recently, semirigid pleuroscopies carried out by pulmonary fellows under the supervision of a pulmonologist showed a similarly high diagnostic accuracy, albeit with a slightly higher rate of complications when performed by fellows in training, especially in the early part of their learning curve; but interestingly these complications were not directly related to the procedure but due to an overuse of medications during conscious sedation (midazolam and fentanyl in this study) [7]. These findings are consistent with the litera-

ture, in particular from gastroenterology endoscopy, where most complications occurring during endoscopy, such as hypoxemia, hypoventilation, apnea and hypotension, are not related to the procedure itself but rather to sedation [8]. These observations raise concerns about the pertinence of sedation administered by non-anesthesiologists: which kind of sedation, if any, should pulmonologists be allowed to administer for MT?

Patients' fitness for the procedure as well as absolute and relative contraindications have been reported elsewhere [1]. Prerequisites for an optimal sedation drug administered by non-anesthesiologists include a predictable pharmacokinetic profile, a rapid onset of action, a short recovery time and overall minimal associated risks, thus making the presence of an anesthesiologist unnecessary. Midazolam remains the preferred sedative drug for all endoscopy procedures, but recently several teams have gained experience with the administration of propofol both during bronchoscopy and thoracoscopy, with clear potential advantages [9–11]. The rationale for considering the use of propofol by pulmonologists is justified by increasing patients' demand for sedation, the progressive shortage of anesthesiologists as well as an increase in workload and financial constraints. However, as pointed out by Werner et al. [12], this is a double-edged sword, and we have to be very careful not to extrapolate the results of gastrointestinal endoscopy and bronchoscopy under propofol sedation to the MT practice. Changes in PaCO_2 have been described during MT under local anesthesia, primarily related to the type of sedation used. Monitoring for hypoventilation by simultaneously measuring both pulse oximetry (SpO_2) and cutaneous carbon dioxide tension (PcCO_2) during thoracoscopy is therefore recommended, enhancing patient safety and guiding a safer administration of sedation [13]. Moreover, significant changes in hemodynamic parameters, similar to those reported for thoracotomy, may occur during the procedure, in particular after the patient is placed in the lateral decubitus position (significant decrease in systolic and diastolic blood pressure, oxygen saturation and systolic blood pressure in pulmonary artery) and 5 min after the pneumothorax is established (restoration of cardiac output to the initial value and significant decrease in total peripheral resistance) [14]. All these respiratory and hemodynamic changes related to the patient's position and pneumothorax induction need to be carefully considered during clinical trials assessing the safety of sedative regimens during MT.

In a recent issue of *Respiration*, Grendelmeier et al. [15] compared midazolam and propofol for sedation dur-

ing MT with the mean lowest oxygen saturation during the procedure chosen as the primary endpoint. Midazolam was titrated as previously described for its use for flexible bronchoscopy [16, 17] while the patients assigned to the propofol group received an initial bolus via the intravenous route followed by a continuous infusion (0.3 mg/kg/min) and, after adequate sedation, maintenance therapy at a reduced rate (from 0.2 to 0.05 mg/kg/min). Additional analgesia by intravenous pethidine was allowed in each group. Total doses of propofol and midazolam as well as hemodynamic parameters, duration of thoracoscopy and periprocedural complications, including uncontrollable cough, uncontrollable pain, oxygen desaturation ($\leq 90\%$), need for nasopharyngeal or oropharyngeal airway insertion, need for intubation, hypotension (systolic blood pressure ≤ 90 mm Hg), minor or major bleeding, intensive care unit admission, thoracoscopy abortion and patient death were all recorded. Analysis of the primary endpoint showed overall significantly lower mean oxygen saturation in the propofol group, in particular 3, 6 and 9 min after the initiation of sedation. Hypotension was also significantly more frequent in the propofol group compared to the midazolam group. Other complications, duration of the procedure, cough and discomfort scores did not differ significantly between the two groups. These results are consistent with prior literature showing hypoxemia and hypotension as major complications of various sedation protocols for thoracoscopy [10, 11, 13, 18]. However, in comparison to the sedation in bronchoscopy, for which propofol was shown to be a reasonable option [9, 17, 19, 20], the results of this study are quite different, suggesting that sedation protocols for bronchoscopy should not be extrapolated carelessly to the thoracoscopy practice. Indeed, if the so-called 'awake anesthesia' (nonintubated patient under sedation) avoids general anesthesia-related adverse effects, the 'between-lung' pendular ventilation resulting from the induced artificial pneumothorax can result in significant hypoxemia and hypercapnia. Pompeo and the Awake Thoracic Surgery Research Group [21] have shown that an intraoperative drop in the ratio of the arterial oxygen tension to the fraction of inspired oxygen may occur both in patients with normal lung and in patients with severe obstructive pulmonary disease; in the latter, it is caused by a reduction in intrinsic positive end-expiratory pressure in the peripheral alveolar region. These findings also suggest that positioning patients in the lateral decubitus position during the procedure rather than in the supine position might be preferred to reduce the perfusion of the nondependent lung and consequently the shunt fraction [21,

22]. The results reported by Grendelmeier et al. [15] highlight important messages. Knowledge of the respiratory and hemodynamic changes during thoracoscopy procedures is of paramount importance as well as an understanding of the pharmacology of the anesthetic drugs used. Clinical trials taking into account that each endoscopy procedure may require specific sedation protocols in order to reduce complications are urgently needed [23–26]. In comparison to video-assisted thoracoscopic surgery, MT does not necessarily require general anesthesia and is therefore increasingly performed by pulmonologists. Analgesia and sedation are crucial for the procedure to be effective and safe. We commend the authors for performing such an important study in a field that has received relatively little attention from proceduralists in the past. Sedation regimens need to be rigorously studied and carefully chosen based on specific procedure characteristics. As demonstrated in this study, ‘one size does not fit all’.

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The authors have no competing interests to disclose.

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