Cross-Sectional Survey on Bronchoscopy in Germany – The Current Status of Clinical Practice

Querschnittserhebung zum aktuellen Stand der Bronchoskopie in Deutschland

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received 1.11.2015
accepted after revision 27.11.2015

Bibliography
DOI http://dx.doi.org/10.1055/s-0041-110288
Pneumologie 2016; 70: 110–116

ISSN 0934-8387

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Abstract

Objectives: Bronchoscopy is an integral part of pulmonary medicine. In recent years, a series of new technologies have evolved. It is to assume that significant changes have also occurred in clinical practice. We conducted a nationwide survey to evaluate the current status of care and to compare it with earlier reports.

Methods: A standard questionnaire was sent to 1875 institutions to assess the clinical practice of bronchoscopy in Germany with respect to general issues, education, sedation/anaesthesia and technical aspects.

Results: The returned questionnaires cover 301,965 bronchoscopies, performed by 2158 physicians over 12 months, making it the largest survey to date. The proportion of rigid bronchoscopies has decreased and amounts to 7.3% at present. Atropine as a premedication is hardly used any more. Sedation is routinely applied in 88% of flexible bronchoscopies, for which a combination of propofol and midazolam is preferred by most institutions (41.3%), followed by propofol monotherapy (28.3%). 74.4% of institutions accept aspirin for transbronchial biopsy, 8.1% dual platelet inhibition. 62.4% of all institutions perform airway recanalisation, favouring cryotherapy and argon plasma coagulation. 9.1% of bronchoscopies are supported by endobronchial ultrasound.

Conclusion: Compared to preceding surveys, the experience of bronchoscopists, especially regarding interventional procedures, has increased. Endobronchial ultrasound has become a standard of care, as has patient sedation with propofol.

Zusammenfassung

Hintergrund: Die Bronchoskopie ist heute ein integraler Bestandteil pneumologischer Diagnostik und Therapie. In den letzten Jahren hat sich in diesem Bereich eine Reihe neuer Techniken und Methoden entwickelt, welche vermutlich einen signifikanten Einfluss auf die klinische Praxis hat. Wir führten deshalb eine nationale Umfrage durch, um den aktuellen Stand der bronchoskopischen Versorgung zu analysieren und um einen Vergleich mit früheren Umfragen durchzuführen.

Methodik: Ein Standardfragebogen wurde an 1875 bronchoskopierende Institutionen in Deutschland versendet, um die tägliche klinische Praxis der Bronchoskopie in Bezug auf allgemeine Aspekte, Untersuchungszahlen, Ausbildung, Technik und Sedierung zu untersuchen.

Ergebnisse: Die zurückgesandten Fragebögen erfassen insgesamt 301 965 Bronchoskopien, welche von 2158 Ärzten in einem Zeitraum von 12 Monaten durchgeführt wurden. Damit stellt diese Umfrage die bis heute zahlenmäßig größte Erhebung dar. Der Anteil an starren Bronchoskopien ist in den letzten 15 Jahren zurückgegangen und beträgt derzeit noch 7,8%. Atropin als Prämedikation wird kaum noch eingesetzt, wohingegen eine Sedierung mittlerweile bei 88% der flexiblen Bronchoskopien Standard ist. Hierfür wird von den meisten Untersuchern die Kombination aus Propofol und Midazolam bevorzugt (41,3%), gefolgt von einer Propofol-Monotherapie (28,3%). 74,4% der befragten Institutionen akzeptieren Acetylsalicylsäure bei der Durchführung transbronchialer Biopsien, 8,1% eine duale Plättcheninhibition. 62,4% aller Einrichtungen führen Atemwegsrekanalisationen durch, bevorzugt mittels Kryosonde bzw. Argon-Plasma-Koagulation. 9,1% aller Bronchoskopien erfolgen unter Zuhilfenahme des endobronchialen Ultraschalls. Hinsichtlich zukünftiger Entwicklungen wird von Seiten der Bronchoskopeure am häufigsten der

Wunsch nach besseren Möglichkeiten bei der Diagnostik peripherer Rundherde geäußert.

Schlussfolgerung: Im Vergleich zu vorausgegangenen Umfragen hat die Erfahrung der Untersucher, insbesondere in Bezug auf interventionelle Methoden, umfassend zugenommen. Der endobronchiale Ultraschall wird im Rahmen der Lymphknotendiagnostik mittlerweile flächendeckend als Standard eingesetzt, und der Einsatz von Propofol zur Sedierung hat sich bei fast allen Untersuchern durchgesetzt.

Abbreviations

ACCP	American College of Chest Physicians
APC	Argon Plasma Coagulation
BAL	Bronchoalveolar Lavage
EBB	Endobronchial Biopsy
EBUS	Endobronchial Ultrasound
EBUS MP	Endobronchial Ultrasound with Mini-Probe
ELVR	Endoscopic Lung Volume Reduction
TBB	Transbronchial Biopsy
TBNA	Transbronchial Needle Aspiration
TCI	Target-Controlled Infusion

Introduction

Bronchoscopy is a well-developed and essential technique to investigate bronchial and pulmonary structures and to treat its pathologies. Within the past decades, several surveys on methods, usage, medication and complication rates in different countries have been published [1–8]. The "ACCP Survey" 1991 in North America [1] and the German Survey in 2000 [3] were the largest collections of data, including 871 and 681 institutions respectively. Since its establishment by Killian in the late 19th century [9], bronchoscopy has developed immensely. Endobronchial ultrasound (EBUS), stent treatment or thermal recanalisation techniques are true examples of procedures that, in the recent past, have found their way into clinical routine [10]. Guidelines [10–12] summarise developments and recent study results to define standards and help bronchoscopists optimise their performance. However, guidelines do not necessarily reflect clinical practice and do not always meet the specific requests, demands and various traditions of the different institutions. Questions as to whether the rigid or the flexible approach is more favourable, or what is the best strategy for sedation and anaesthesia, are still under debate.

This survey is intended to describe the current situation of bronchoscopy in Germany, as well as to focus on the developments that have taken place within the past two decades, by considering previous polls. Furthermore, it investigates the allocation of modern interventional and diagnostic methods and takes a detailed look at the use of sedation strategies which have, so far, not been explored to this extent. In this way, we can better understand how research and development in the field of bronchoscopy are reflected in everyday clinical routine.

Methods

Data were obtained on the basis of a structured questionnaire that was sent to the heads of participating institutions nationwide by post and which consisted of 29 questions divided into three sections: 1) General information on the participant, such as training, experience and frequency of procedures: 2) Technical equipment, premedication and sedation strategies and 3) Methods of diagnostic and therapeutic techniques. The questionnaire consisted of six pages and was designed to take 20–30 minutes to complete. It was anonymous and no reminders were sent. The design was developed in collaboration with the Division of Endoscopy of the German Society for Pneumology. Participating institutions were identified by directories of medical associations and bronchoscope manufacturers, in order to cover all existing bronchoscopy units, both in hospitals and in private practice.

1875 institutions and physicians met the criteria of an independent bronchoscopy unit (277 in private practice and 1598 in hospitals). Hospitals were separated into two categories according to their professional classification: dedicated respiratory and internal medicine hospitals and departments. Data acquisition took place between August 2013 and February 2014. The responses were archived, processed and analysed using SPSS statistical software (version 22) to calculate standard statistical measures.

Results

Responses

In total, 472 hospitals (response-rate: 29.5%) and 155 private practitioners (response-rate: 56.0%) returned 627 questionnaires (overall response-rate: 33.4%). 92.8% of the questions in the questionnaire were answered. 28 institutions (nine hospitals, 19 private practices) stated that they did not conduct bronchoscopies. The response rate was significantly higher in hospitals with more than 600 beds (57.3%). On average, bronchoscopies are performed by 4.2 physicians per hospital and 1.6 physicians per private practice respectively. The survey covers a total number of 2158 physicians.

Bronchoscopy in hospitals

Frequencies

54.7% of respiratory clinics use dedicated bronchoscopy labs, whereas internal clinics prefer to participate in interdisciplinary facilities (94.9%). Both equally often serve in-house intensive care units (74.7% vs. 73.5%). The frequency of all the examinations are shown in **Table 1**. 7.5% of all bronchoscopies are done in outpatients. 46.3% of hospitals do not perform outpatient bronchoscopies.

Fig. 1 displays the proportion of rigid bronchoscopies in reference to the total number of bronchoscopies, today, and in 2000 [3], respectively. The proportion of hospitals performing rigid bronchoscopies has increased over time (35.0% vs. 22.7%). In 2000, almost three-quarters of these hospitals performed less than 50 rigid bronchoscopies per year. Today, nearly 50% perform more than 50 rigid bronchoscopies per year. However, the proportion of rigid bronchoscopies as a whole decreased from 10.2% to 7.3%. Respiratory clinics perform rigid bronchoscopies more often (8.5%) than internal clinics (2.1%).

Table 1 Frequencies and distribution of bronchoscopies/year.

Institution	Total bronchoscopies			Flexible bronchoscopies			Rigid bronchoscopies			Outpatient bronchoscopies		
	n	N	n/N	n	N	n/N	n	N	n/N	n	N	n/N
all hospitals	289 310	451	641	267 222	443	603	20 633	155	133	21 603	195	111
respiratory clinics	231 028	167	1383	210 538	166	1268	19 440	124	157	17 732	121	147
internal clinics	53 892	265	203	52 426	259	202	1131	26	44	3125	69	45

n: number of bronchoscopies, N: number of institutions, n/N: mean number of bronchoscopies per institution.

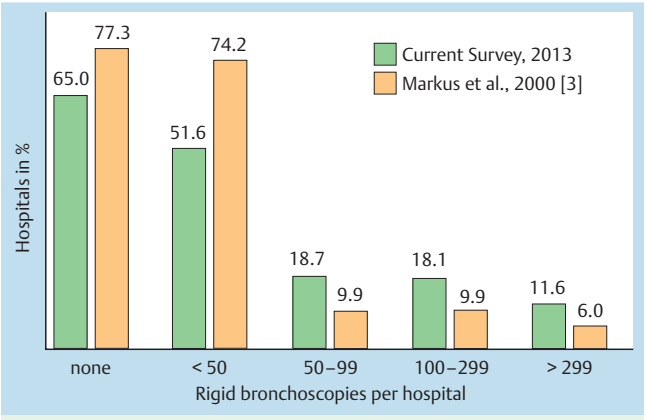

Fig. 1 Distribution of rigid bronchoscopy frequencies comparing the current survey with the German survey from 2000.

Similar to the distribution of rigid bronchoscopies, the number of flexible bronchoscopies per institution has increased. **Table 2** gives an overview of the frequencies in comparison with previous surveys.

Training and experience

71.3% of the responding physicians have been performing bronchoscopies for more than 10 years. Training is most commonly conducted in-hospital by experienced colleagues. 62.5% of physicians attended an additional training course. **Table 3** displays the experience of bronchoscopists in dedicated skills and techniques.

On-call service

On-call services for emergencies overnight or on weekends are provided by 56.0% of all departments (respiratory 73.2%, internal 46.1%).

Premedication, local anaesthesia

Atropine as a premedication is applied in 15.4% of the institutions; opioids (e.g. codeine) in 20.1%. 15.3% of the hospitals state that they do not use any premedication. Local anaesthetics are used in 79.4%.

Sedation

Sedation is nowadays routine during bronchoscopy (88.0%). General anaesthesia is used in 5.4% of cases. No sedatives are applied in 6.6%. When sedation is applied, propofol and midazolam are the preferred drugs (**Table 4**). The most common regimen is the combination of propofol and midazolam (41.3%), followed by the sole application of propofol (28.3%) or of midazolam (20.8%) respectively. The use of the opioid-combinations, fentanyl/alfentanil (4.9%), or other sedative drugs (e.g. diazepam, pethidine) (4.7%) is rare. The combination of propofol and midazolam has the highest acceptance among bronchoscopists. 73.1% of them are satisfied with the sedation quality. Satisfaction with propofol or with midazolam as a mono-sedative is slightly less (72.6% and 65.4%). Only 31.7% of those using a propofol/midazolam combination declare that occasionally they would wish to have a "deeper, but equally safe sedation", especially for interventional procedures.

Infusion systems are used by 7.3% of the institutions, in 1.6% with target-controlled infusion (TCI) modes. For special indications (e.g. critical patients, complicated interventions, TBB, EBUS), 48.8% of institutions make use of dedicated endobronchial tubes.

Table 2 Comparison of flexible bronchoscopy frequencies across different surveys.

Number of flexible bronchoscopies per institution per year	This survey (%)	Markus et al. [3] (%)	Smyth et al. [5] (%)
1–99	29.2	57.7	12
100–299	26.4	23.1	76
>299	44.4	19.2	12

Numbers are given as percentage of all institutions.

Table 3 Experience in diagnostic and interventional techniques.

	Proportion of bronchoscopists with experience in:			
	Cryotherapy, APC or laser (%)	EBUS (%)	Stent implantation (%)	ELVR (%)
all hospitals	35.4	24.8	18.7	12.5
respiratory clinics	45.4	41.8	31.2	22.7
internal clinics	25.9	6.9	5.8	2.0

APC: argon plasma coagulation, EBUS: endobronchial ultrasound, ELVR: endoscopic lung volume reduction.

Table 4 Preferred sedation regimen.

Sedation regimen	Preferred by % of institutions
propofol + midazolam	41.3
propofol mono	28.3
midazolam mono	20.8
combination with fentanyl/alfentanil	4.9
combination with other sedatives[1]	4.7

[1] other sedatives contain: diazepam, pethidine, etomidate.

Table 5 Implementation of different bronchoscopic techniques within institutions. Impact of hospital size and specialisation.

		Specialisation		Hospital size		Bronchoscopies/year	
Technique	**All hospitals (%)**	**Respiratory (%)**	**Internal (%)**	**≤600 beds (%)**	**>600 beds (%)**	**≤300 (%)**	**>300 (%)**
BAL	98.7	100.0	98.1	98.3	100.0	98.4	99.5
EBB	89.3	93.5	88.8	87.3	96.6	84.7	96.8
TBB	71.8	96.4	59.9	65.6	95.5	52.2	98.4
TBNA	57.8	91.2	38.2	50.4	85.4	33.3	91.6
EBUS	36.3	79.2	11.2	25.3	77.5	4.7	79.5
EBUS MP	10.1	25.0	1.1	8.0	16.9	0.4	23.7
electromagnetic navigation	2.6	6.5	0.4	2.2	4.5	0	6.3
laser	16.8	36.3	5.9	9.6	44.9	2.4	36.8
APC	59.3	82.7	47.6	53.2	82.0	37.6	88.9
cryotherapy	28.2	63.7	8.2	19.8	60.7	4.3	61.1
cryobiopsy	17.3	38.7	5.2	12.1	37.1	0.8	40.0
stent implantation	34.8	75.6	11.9	24.2	74.2	6.7	73.2
brachytherapy	14.4	35.1	2.6	6.9	44.9	0.4	34.2
foreign-body	79.6	94.6	72.1	76.0	93.3	68.6	96.3
thoracoscopy	20.1	42.3	7.1	16.0	37.1	4.7	41.1

Numbers represent the application of the described technique in percent. BAL: bronchoalveolar lavage, EBB: endobronchial biopsy, TBB: transbronchial biopsy, TBNA: transbronchial needle aspiration, EBUS: endobronchial ultrasound, EBUS MP: endobronchial ultrasound with miniprobe, APC: argon plasma coagulation, foreign-body: foreign-body removal.

Indications and techniques

The most frequent indication for a bronchoscopy is the diagnostic evaluation of a suspected tumour or its follow-up. It is followed by 2) microbiological diagnostics, 3) chronic cough or haemoptysis, 4) bronchial washing and cleaning and 5) interstitial alterations. The practice of the different diagnostic and therapeutic techniques among the respondent institutions are shown in **Table 5**.

When sedation is considered to be inadequate for specific procedures, general anaesthesia is used. Examples for interventions that mainly take place under general anaesthesia are stent implantation (79.4%), laser therapy (69.9%) and ELVR (65.2%) (**Table 6**). For some procedures, the use of general anaesthesia is more or less balanced: cryotherapy, which includes cryorecanalisation (57.1%), EBUS (50.3%), cryobiopsy (49.4%). APC (38.1%) and brachytherapy (19.8%) are carried out less frequently under general anaesthesia. For all other bronchoscopic methods, general anaesthesia is rarely used (BAL: 4.4%, EBB: 4.1%, TBB: 7.9%, TBNA: 12.4%). It can be observed that, for numerous interventional methods (e.g. TBNA, EBUS, laser therapy, cryotherapy, stent implantation), the percentage of general anaesthesia increases, the more bronchoscopies the hospital does. This especially applies to APC, as hospitals with more than 999 bronchoscopies use general anaesthesia in 54.9% and hospitals with 300 or less bronchoscopies use it in 18.7% of the cases. Respiratory clinics, compared to internal clinics, often have significantly higher numbers of general anaesthesia usage which applies to the following procedures: TBNA (respiratory: 15.3%, internal: 8.1%), laser (respiratory: 75.0%, internal: 50.0%), APC (respiratory: 53.8%, internal: 20.2%), cryotherapy (respiratory: 61.1%, internal: 39.1%) and stent implantation (respiratory: 84.6%, internal: 60.3%). Sometimes, the size of the hospital is relevant when considering the usage of general anaesthesia. For example, during EBUS, cryobiopsy and ELVR bronchoscopies, hospitals with more than 600 beds use notably less general anaesthesia than hospitals with less than 600 beds. For APC, the opposite relationship applies.

Table 6 Use of general anesthesia within diagnostic and therapeutic modalities.

Modality	General anesthesia applied in (%)
stent implantation	79.4
laser therapy	69.9
ELVR	65.2
cryotherapy	57.1
EBUS	50.3
cryobiopsy	49.4
APC	38.1
brachytherapy	19.8
TBNA	12.4
TBB	7.9
BAL	4.4
EBB	4.1

BAL: broncho alveolar lavage, EBB: endobronchial biopsy, TBB: transbronchial biopsy, TBNA: transbronchial needle aspiration, EBUS: endobronchial ultrasound, ELVR: endoscopic lung volume reduction, APC: argon plasma coagulation.

TBB and anti-platelet therapy

In some situations, TBBs under anti-platelet therapy are rejected to prevent bleeding. However, 74.4% of the institutions perform TBB despite aspirin therapy. 8.1% accept dual anti-platelet therapy. 25.1% refuse TBB under any type of anti-platelet therapy.

EBUS and ELVR

This survey counts 23,125 EBUS bronchoscopies and 4008 EBUS with mini-probes conducted by 158 hospitals, which represents a mean of 171 EBUS bronchoscopies/year. Together, this adds up to 9.4% of all bronchoscopies. It can also be observed that the more bronchoscopies a hospital performs, the higher the relative proportion of EBUS procedures. In hospitals with less than 300 bronchoscopies/year, the percentage of EBUS is 0.7%; in hospitals with 300 to 999 bronchoscopies/year, it is 8.2% and in hospitals with more than 999 bronchoscopies/year, 10.2%. Furthermore, 72.7% of EBUS is performed in institutions with 999 bronchosco-

Table 7 Popularity of different recanalisation methods in numerical order among institutions performing airway recanalisation.

	All institutions	Institutions w/bronchoscopies/year	
method		<300	>=300
APC	1	1	2
cryotherapy	2	3	1
mechanical debulking	3	2	3
laser therapy	4	4	4
brachytherapy	5	5	5

1: most popular and 5: least popular, APC: argon plasma coagulation,

Table 8 The five most frequent comments regarding requests for future developments in the field of bronchoscopy.

1.	improved diagnostic possibilities in solitary pulmonary nodules
2.	implementation of biopsy forceps for EBUS
3.	improved EBUS TBNA-needles
4.	less acquisition cost for navigation systems
5.	improvement in sedation strategies

pies/year. Respiratory clinics perform more EBUS (195 per year) than other clinics (58 per year).

ELVR is conducted by 23.5% of institutions. The preferred method for ELVR is the implantation of airway valves (84.7%) followed by coils (14.4%). In contrast, steam or tissue glue is rarely used. This order is evenly distributed across institutions, irrespective of specialty, hospital size or examination frequency.

Airway recanalisation

62.4% of institutions declare their performance of airway recanalisation. The ranking of the preferred methods is displayed in **Table 7**. High frequency units favour cryotherapy, whereas smaller units prefer APC. Stent implantation and balloon-dilatation is also mentioned, but are performed less frequently.

Patient monitoring and surveillance

All bronchoscopists measure oxygen-saturation by means of pulse oximetry; 95.2% use oxygen supplementation during examinations and 93.9% institute an IV line. Intermittent non-invasive blood pressure monitoring is conducted in 84.1%, and ECG monitoring in 76.3% of cases. Capnography is applied by 15.9% of institutions on selected patients. In outpatients, the average monitoring time before discharge is 132 minutes. Respiratory clinics observe patients longer than internal clinics (difference 11 minutes).

Personal comments

Institutions were asked to specify the next desirable development in the field of bronchoscopy. 135 respondents made additional comments. Advancements in diagnostic instruments and techniques are the major requests, next to improvements in sedation strategies and questions of cost. The five most frequent comments are displayed in **Table 8**.

Bronchoscopy by private practitioners

Private practitioners performed 12,655 flexible bronchoscopies, which results in an average of 97 bronchoscopies per private practice. 31.5% of the responding practitioners do less than 25 flexible bronchoscopies/year and 50.8% do less than 50 bronchoscopies. However, private practitioners have longer bronchoscopy experience than hospital physicians. 63.0% of the bronchoscopies are performed in private practice, and 37.0% in hospitals respectively. 84.1% of bronchoscopies are outpatient procedures. 91.1% of private practitioners use local anaesthetics, 21.5% use Atropine and 11.1% use opioids (e.g. codeine), whereas only 4.4% state that they do not use any premedication. 71.3% of the bronchoscopies are performed with sedation. Midazolam as a monotherapy is preferred by 50.6% of private practitioners. 19.8% use propofol only, 13.6% use propofol and midazolam in combination and 8.6% use combinations with diazepam. The majority of physicians are satisfied with the combination of propofol and midazolam (90.9%), while physicians using monotherapies are satisfied to a lesser extent (propofol-only: 57.1%, midazolam-only 51.2%).

Endotracheal tubes are rarely used (14.5%). Chronic cough or haemoptysis are the most common indications, followed by suspected tumour or tumour follow-up. Private practitioners mostly perform BAL (97.0%) or EBB (83.3%). TBB (38.6%), foreign body removal (37.1%) or TBNA (25.8%) are done less frequently. APC (6.8%), EBUS (4.5%) and stent implantations (3.0%) are rare. 50.9% of all private practitioners do TBB under aspirin, 5.7% accept dual platelet inhibition. 49.1% of them avoid TBB under any kind of anti-platelet therapy. Private practitioners use less monitoring measures than hospitals. The average surveillance time before discharge is 92 minutes. A major concern for private practitioners is the inadequate reimbursement of bronchoscopic activity.

Discussion

This survey addresses the current situation of bronchoscopy in Germany. It covers more than 300,000 examinations, which makes it numerically the largest investigation on this subject [1–5]. It was also designed to identify changes in clinical practice when compared to the preceding German survey which had been completed in 2000 by Markus et al. [3].

The response rate was lower than in the previous surveys. In contrast to Markus et al. [3], we addressed a considerably higher number of institutions, whereas the number of returned questionnaires was identical. The most likely reason for this is, that in our mailing list, we frequently addressed different institutions within the same hospital, (e.g. anaesthesiologic and pulmonary clinics), and only one of these institutions responded. In addition, our database covered a large number of very small institutions, suggesting that some of these institutions did not respond because they presently do not perform bronchoscopy or did not feel significant enough to complete such a complex questionnaire. Nevertheless, the absolute number of responses can be interpreted as an indication for a representative cross-section of bronchoscopy in Germany.

Compared to 2000, the number of flexible bronchoscopies per institution increased by 80.6% to 484. Even if the number of examinations cannot be directly compared between the two studies, as we do not know what proportion of institutions participated in both surveys, a growing number of indications and growing technical possibilities may explain the increase. Previous surveys in the UK [2], and in the United States [1], counted 171 and 115 bronchoscopies per institution respectively. In contrast, the number of rigid bronchoscopies decreased slightly (**Fig. 1**). It is particularly interesting to see that the proportion of institutions

with a low number of rigid bronchoscopies has declined, indicating that more invasive procedures are concentrated in larger centres.

Guidelines promote a structured education [10,11]. However, most bronchoscopists are still trained exclusively within their institution. Today, two-thirds of institution heads have more than 10 years of experience in bronchoscopy. In the US study from 1991, this proportion was 58% [1]. Interventional skills among bronchoscopists are now widely scattered. In respiratory clinics, nearly half of the examiners are able to perform, e.g. airway recanalisation or EBUS, whilst one-third are able to place bronchial stents. Even recent and complex developments, like ELVR, are already applied by every fourth institution. This reflects the high technical standards and capabilities, as well as the constant desire to quickly offer new and innovative therapies to patients – and, not least, the ambition to obtain the generally attractive reimbursements for the most recent devices.

Premedication and sedation regimen have changed noticeably over time [13]. Atropine has always been widely used; in 83% of patients [1,2,14] in 1991. In this survey, it was only applied in one of six institutions, recognising the fact that atropine has few beneficial effects to justify routine use [15]. The same applies to opioids as antitussive agents. It is now generally accepted that sedation is beneficial during bronchoscopic procedures, both for the patient and for the bronchoscopist [10,12]. In Germany, only 7% of examinations are performed without sedatives or intravenous anaesthetics. In the past decades, the application of general anaesthesia dropped significantly from 16.5% (US survey, 1991) and 12% (UK survey, 1986) to 5.4%, which corresponds well with a recent Japanese survey [4]. Most interventional procedures today can be performed under sedation, only a few techniques require general anaesthesia [16]. The most popular regimen for sedation is now a combination of midazolam and propofol, followed by propofol alone (**Table 4**). The increasing acceptance of propofol results from the fact that a growing number of studies have proven the feasibility and safety of the drug when administered by the bronchoscopist [17,18], which had been a major concern when propofol was first introduced. In particular the significantly faster sedation, as well as the shorter recovery time, are often very advantageous for patient-handling, when compared to midazolam or other benzodiazepines [19] which, in former surveys, have been the most commonly used substances. A few institutions additionally use perfusors for propofol administration (7.3%). Opioids, however, are rarely given for sedation purposes (4.9%).

Transbronchial biopsy and transbronchial needle aspiration is now very widely used and its application has further increased over time. Currently, 75% of institutions even perform TBB under aspirin, which recognises and supports results from a clinical trial on this issue [20]. However, in patients with dual platelet inhibition, bronchoscopists are much more cautious, which is also backed up by clinical studies [21,22]. Only 8% perform TBB in such circumstances. Endobronchial ultrasound (EBUS) has now become a standard for diagnosing mediastinal lymph nodes. It is recommended by various guidelines [23,24] which have clearly led to the wide diffusion of this method. For obstructed airways, the classic method of laser therapy has been mostly replaced by APC and the cryoprobe which have since become the most popular means of airway recanalisation. The reasons for that may vary, but we assume that APC and cryotherapy are relatively uncomplicated to use and more cost-effective [25]. Cryobiopsy, a novel diagnostic modality, especially for diffuse lung disease [26], is already utilised by a significant number of institutions. Navigation technology, such as electromagnetic navigation [27], is effective and wanted by many bronchoscopists, but it has been expressed that the financial cost is a critical issue – this may be one of the factors why it has still not been widely adopted.

To summarise; bronchoscopy has developed in many respects within the past 20 years. When compared with previous surveys, new achievements containing dedicated interventional techniques, as well as a set of diagnostic innovations, have been introduced into clinical practice. Endobronchial ultrasound is certainly one of the most important developments which is now implemented in many institutions. Furthermore, a number of new guidelines and recommendations provide precise instructions and directives for the bronchoscopist, e.g. on how to manage sedation, which have found their way into the daily routine.

Conflict of interest

H. Hautmann, R. Eberhardt, F. Stanzel, M. Wagner, A. Schneider, R. Dirschinger and A. Poszler declare no conflict of interest.

J. Hetzel reports personal fees from Erbe Medizintechnik, Tuebingen, Germany, personal fees from Superdimension/Covidien, during the conduct of the study.

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