Lung Cancer 81 (2013) 382–387

Contents lists available at SciVerse ScienceDirect

Lung Cancer

journal homepage: www.elsevier.com/locate/lungcan

The format type has impact on the quality of pathology reports of oncological lung resection specimens

Konrad Aumann[a], Gian Kayser[a], Dominic Amann[a], Peter Bronsert[a], Dieter Hauschke[b], Emanuel Palade[c], Bernward Passlick[c], Martin Werner[a,*]

[a] Institute of Pathology, University Medical Center Freiburg, Germany
[b] Department of Medical Biometry and Medical Informatics, University Medical Center Freiburg, Germany
[c] Department of Thoracic Surgery, University Medical Center Freiburg, Germany

ARTICLE INFO

Article history:
Received 19 November 2012
Received in revised form 25 February 2013
Accepted 23 May 2013

Keywords:
Lung cancer
Pathology
Oncology
Quality
Synoptic reports
Standardization

ABSTRACT

Most pathology reports are in a narrative form without a given structure and occasionally lack important information. Here we show that the format of pathology reports of oncological lung resection specimens correlates with the quality of the reports. All pathology reports of oncological lung resection specimens between 01/02 and 04/11 ($N = 878$) were classified into descriptive reports (DR, $N = 249$), structured reports (SR, $N = 415$) as well as template based synoptic reports (TBSR, $N = 214$) and compared regarding the content of organ specific essential data (ED). The amount of recorded ED was summarized in an essential data score (EDS). Median EDS of DR was 8, of SR 9, and of TBSR 10. Only 28.7% of all reports had an EDS of 10; divided into the report types 2.6% of DR, 16.4% of SR and 88.4% of TBSR obtained an EDS of 10 (paired comparison: $P < 0.0001$). Traditional descriptive reports showed the lowest quality sometimes lacking important information and clarity of data layout whereas the template based synoptic reports reached the highest quality level. The broader use of structured reports is recommended for oncological lung resection specimens as they lead to a reduction of failed data transfer and therefore to an increase of quality.

1. Introduction

Most pathologists summarize their acquired data in a textual pathology report. However, permanent growing data volume and an increasing number of users of the reports (e.g. the federal cancer registry) demand a novel way of data acquisition, saving, and electronic transmitting. For these purposes, textual pathology reports are limited. Meanwhile, national associations of pathologists, e.g. the College of American Pathologists (CAP) or the Professional Association of German Pathologists (BDP) have developed and published regularly updated protocols and checklists of organ specific data that should be documented in oncological pathology reports [1–3]. In general, these data are relevant for therapy decisions and/or prognostication based on the requirements of the World Health Organization (WHO) and the Union for International Cancer Control (UICC) [4–6].

In particular, for oncological lung resection specimens those protocols and checklists are very helpful as the acquired data are very complex, reflected in the changes of the latest TNM-classification [5]. The essential data for lung resection specimens comprise the histological tumor type according to the WHO classification including histological grading, location and size of the tumor, specification of pleura visceralis infiltration, extra-pulmonary tumor spread, angio-invasion, complete surgical margin status, atelectasis or obstructive pneumonitis, and lymph node status. Finally, it is required to completely subsume the assessed data into the current UICC classification. These recommendations were incorporated into practice guidelines, e.g. of the American College of Chest Physicians [7].

However, not only the way of the data acquirement but also the design of the data visualization (i.e. the format of the report) has impact on the quality of pathological reports. In 1996 already Gephardt et al. investigated the correlation between amount of data transmission and the report format. They recommended reporting in a standard form or checklist [8]. Based on this insight we evaluated all pathology reports of oncological lung resection specimens of the Institute of Pathology, University Medical Center Freiburg, Germany, between January 2002 and April 2011 regarding their content of essential data. Our evaluation clearly showed a

* Corresponding author at: University Medical Center, Institute of Pathology, Breisacher Strasse 115a, 79106 Freiburg, Germany. Tel.: +49 76127080060; fax: +49 76127080040.
E-mail addresses: konrad.aumann@uniklinik-freiburg.de (K. Aumann), martin.werner@uniklinik-freiburg.de (M. Werner).

0169-5002/$ – see front matter
http://dx.doi.org/10.1016/j.lungcan.2013.05.017

Diagnosis:

8. Malignant neoplasia of the lung
Lower lobe, left (ICD-O-C34.3)
Surgical method: Lobectomy
WHO-type: Squamous cell carcinoma (ICD-O M-8070/3)
Grading: G3 (poorly differentiated)

Local tumor spread:
Maximal diameter: 4.5 cm
Extensive necrosis.
Lymph vessel invasion.
No blood vessel invasion.
No perineural invasion.

Surgical margin status:
No tumor infiltration of the following margins:
Parenchyma, bronchus, arteries, veins.

Lymph node status:
A total of 4 lymph node metastasis among 30 examined lymph nodes.
2: 3 positive lymph nodes among 6 examined lymph nodes (position10).
3: 0 positive lymph nodes among 3 examined lymph nodes (position11).
4: 1 positive lymph node among 2 examined lymph nodes (position7+8).
5: 0 positive lymph nodes among 1 examined lymph nodes (position10).
6: 0 positive lymph nodes among 3 examined lymph nodes (position 5).
7: 0 positive lymph nodes among 13 examined lymph nodes (position10).
8: 0 positive lymph nodes among 2 examined lymph nodes (peribronchial and intrapulmonal).

Additional findings:
1. Mature fatty tissue with blood vessels.
8. Obstructive, purulent pneumonitis distal of the tumour and fibrinous pleuritis.

UICC-Classification: pT2a, pN2 (4/30). L1. V0. Pn0
R-Classification: R0

Fig. 1. Example of a template based synoptic report of an oncological lung resection specimen.

correlation between the report format and the quality of the report: structured reports based on a checklist contained the most essential data and, therefore, reached the highest quality level, whereas descriptive reports in a narrative style occasionally lack important information.

2. Materials and methods

2.1. Establishing a novel report format: the template based synoptic report (TBSR)

The templates for the structured pathology reports were developed in rtf-format adapted to the current cancer protocols and checklists for lung resection specimens of the CAP [1] as well as to the instructions for pathological diagnosis of lung carcinoma of the BDP [3]. The templates were linked to a drop-down tumor module of our pathology information system (PIS), containing organ-specific and tumor-specific essential data (ED) with a database source. After the tumor module has been completed the report is created automatically. It is composed of structured text blocks arranged according to local tumor spread, lymph node status, distant metastases, and surgical margin status that contain the text boxes which get filled with the selected data of the tumor module. The result is a clearly arranged and easily readable report on a database source that we called template based synoptic report (TBSR, Fig. 1).

2.2. Evaluation of the content of essential data

The evaluation of the quality of pathology reports was conducted by reviewing all pathology reports of oncological lung resection specimens of the Institute of Pathology, University Medical Center Freiburg, Germany, between January 2002 and April 2011 and classifying them into the three distinct report formats: (1) Descriptive reports (DRs) with a free textual and formulated diagnosis without a specific structure; (2) Structured reports (SRs) arranged according to local tumor spread, lymph node status, distant metastases, and surgical margin status; and (3) template-based synoptic reports (TBSRs) as described above. Afterwards, the three groups of report formats were compared regarding the content of 11 organ-specific ED items. These EDs comprise the information that should be reported according to the recommendations of the Royal College of Pathologists (RCPath), the CAP, and the BDP [1–3]. In detail: tumor location (site, lobe, or segment), tumor size, involvement of the pleura visceralis, extrapulmonary tumor spread, exact histological tumor type according

Table 1
Data recommended for inclusion into histopathology reports of lung resection specimens (essential data, ED) with assessed values and the description for calculating the EDS (essential data score: the total number of essential data reported).

Essential data	Value	Description
Tumor location	0	Not acquired
	1	Specification of site, lobe, or segment
Tumor size	0	Not acquired
	1	Indication of tumor size
Pleura visceralis involvement	0	Information about tumor infiltration of the pleura visceralis is not acquired
	1	Infiltration status of the pleura visceralis is documented
Histological tumor type	0	Not acquired or incomplete (e.g. "carcinoma")
	1	Exact histological tumor type according to WHO classification (e.g. "adenocarcinoma")
Histological grading	0	Not acquired
	1	Histological tumor grading acquired
Surgical margin status	0	Not acquired or positive resection margins without exact specification of involved margins
	1	Negative or positive resection margins with exact specification of the involved margins or stated RX when the specimen was resected in many parts or larger tissue probes were removed
Lymph node status	Not evaluable	Lung resection without lymph nodes
	0	Not acquired
	1	Amount of resected and involved lymph nodes
UICC-classification	0	TNM classification not or only partly acquired
	1	TNM classification completely acquired
Angio-invasion	0	Not acquired
	1	L0/1 and/or V0/1 or verbal
Atelectasis/obstructive pneumonitis	0	Not acquired
	1	Information about tumor-associated atelectasis or obstructive pneumonitis is given

to the WHO, histological grading, surgical margins with specification if tumor positive, lymph node status, UICC-classification, vascular tumor infiltration, and atelectasis or obstructive pneumonitis. With respect to the 7th version of TNM, in the latest version of the RCPath's dataset for lung cancer histopathology the description of satellite nodules (versus synchronous tumors) is also recommended as a core data item. However, to maintain the comparability of the reports before and after the release of the 7th version of TNM we did not include description of satellite nodules as an ED in our evaluation. No statement could be made on lymph node status if lymph nodes were not resected ($N=30$; 3.4%). In these cases, the data were described as 'not evaluable' and did not contribute to statistical analysis. All pathology reports were reviewed for documentation of each of the evaluable ED items described above by recording the following values: 0, not acquired; 1, acquired (Table 1). After the reports had been reviewed by a first researcher, a second researcher checked 200 randomly chosen reports. Problematic cases were discussed until a consensus was reached. Thereafter another 200 reports were checked again with a 100% consensus of two researchers (D.A., K.A. and M.W.).

2.3. Statistical analyses

Statistical analyses were conducted with SPSS 18.0.2 (IBM Corporation, Somers, NY, USA). The frequency of each evaluable ED item per format type was calculated and compared between the three format types; statistical significance was calculated with the exact Fisher test. Additionally, an essential data score (EDS; the total number of ED reported) was derived for each report, with values from 0 to 10. The ED 'extrapulmonal spread' was disregarded, because only few cases ($N=41$) included extra-pulmonary tissue. The median EDS was used to compare the report types regarding the acquirement of the data and the statistical significance of the differences between the report formats was evaluated by use of the Wilcoxon test. A P-value of <0.05 was considered to be statistically significant.

3. Results

In total, 878 pathological reports of lung carcinoma operation specimens were reviewed; of these, 249 cases were classified as DRs, 415 as SRs, and 214 as TBSRs. In 2002, nearly all reports were DRs ($N=62$; 98.4%), only one report (1.6%) was a SR. From 2003 on the rate of SR increased and that of DR decreased continuously until in July 2009 the TBSR format was introduced. Since November 2009 the TBSR type has reached a proportion of 100% (Fig. 2).

In total, 28.7% of the reports had an EDS of 10 (median 9); with regard to the format type, an EDS of 10 was calculated for 2.6% of DRs, for 16.4% of SRs, and for 88.4% of TBSRs with a statistically highly significant difference (paired comparison: each $P<0.0001$). The first reports with an EDS of 10 appeared in 2004 (7.1% of all reports), when 70.5% of the reports were DRs and 29.5% were SRs. In 2010, when all reports were TBSRs, 82.8% had an EDS of 10. Of the DRs, 81.4% had an EDS of 8 or less (median EDS of 8), whereas 69.7% of SRs had an EDS of 9 or more (median EDS of 9). In comparison, 84.4% of the TBSRs had an EDS of 10 (median EDS of 10; Fig. 3a and Table 2).

Regarding the particular essential data the most remarkable, highly significant differences between DRs and SRs were seen in reporting on tumor size, pleura visceralis infiltration, histological tumor typing, angio-invasion, atelectasis or obstructive pneumonitis (for all $P<0.0001$), surgical margin status ($P=0.001$), and histological grading ($P=0.036$). Interestingly, DRs contained specification of the tumor location more often compared to SR ($P<0.0001$). However, by adopting the TBSRs tumor location was recorded in 100% of the reports. Comparing SR and TBSR, an additional improvement could be observed regarding the content of tumor size ($P=0.019$), pleura visceralis infiltration ($P<0.0001$), histological tumor typing according to the WHO classification ($P=0.032$), angio-invasion ($P<0.0001$), and atelectasis or obstructive pneumonitis ($P<0.0001$). All three format types contained information about extra-pulmonary tumor spread, the nodal status, and TNM-coding sufficiently (Fig. 3b and Table 2).

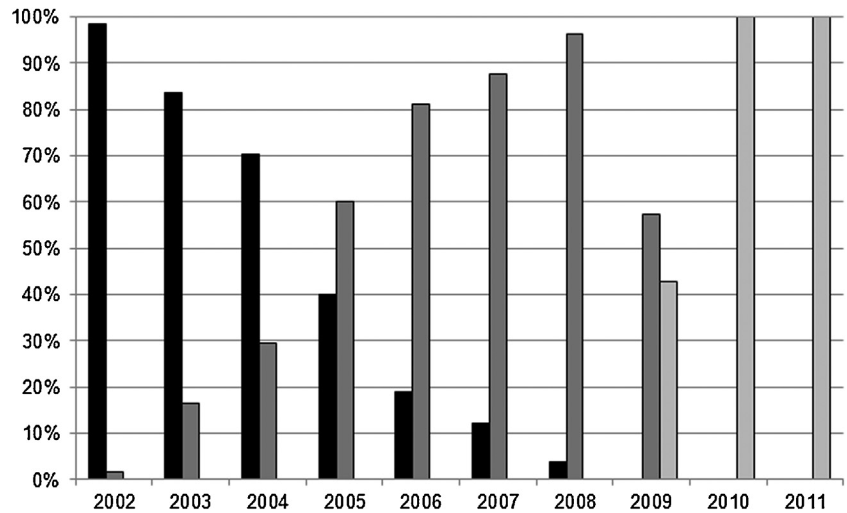

Fig. 2. Temporal changes of format types as percent of all oncological lung resection specimens: whereas in 2002 the vast majority of reports were DRs the proportion of SRs increased until 2009 when TBSRs were introduced. Since 2010 all reports were of TBSR-type (black bars: DRs, gray bars: SRs, light gray bars: TBSRs).

Table 2
Median EDS (maximum 10) and percentage of the reports containing the indicated essential data grouped according to the report format types (DR: descriptive report, SR: structured report, TBSR: template based synoptic report).

ED	DR	SR	TBSR
Median EDS	8	9	10
Tumor location	69.9%	51.1%	100.0%
Tumor size	80.7%	97.3%	100.0%
Involvement of the pleura visceralis	49.4%	75.7%	99.1%
Exact histological tumor type	87.1%	97.8%	100.0%
Histological grading	97.6%	99.5%	100.0%
Surgical margin status	96.2%	99.7%	100.0%
Nodal status	100.0%	99.8%	100.0%
UICC-classification	99.6%	99.5%	100.0%
Angio-invasion	24.9%	82.9%	96.7%
Atelectasis/obstructive pneumonitis	51.4%	70.1%	84.6%

4. Discussion

Pathology reports were traditionally drafted in a textual format by dictating or typing the findings, usually in a slightly sorted text without structure (so called descriptive reports, DRs). This procedure has some disadvantages: first, pathologists have to remember all data needed for a complete oncological report without any reminder; this can lead to missed data and, at worst, to a suboptimal therapy of the patient. Second, clinicians sometimes are confused by the huge amount of information, especially when these data are transmitted without a clear arrangement of the pathology report. Sometimes requests of clinicians appear although the requested data are described within the text – just because the clinician could not find the relevant information at the first glance. Third, beside clinicians there are so called second users of the reports (e.g. cancer registry, tumor bank, researchers) which are able to make use of pathology data only in an electronic format.

To address all these demands, some considerations for novel approaches have been made in the recent past: at our institute a given text structure for all oncological reports was introduced. This kind of report we called structured report (SR). Still, pathologists had to remember all data required for a complete oncological pathology report.

National associations of pathologists have developed checklists with all required tumor specific findings that were published online and updated regularly [1–3]. The usual practice with these protocols is that pathologists fill in the checklists and afterwards the report is typewritten. Thereby, a report with a high degree of completeness and clarity of design is created. Nevertheless, this leads to a redundant data acquisition with the possibility of transcription errors, the data are only stored in text form, and direct computerized processing is still not possible. To combine the clearly arranged output and the checklist based reporting we developed PIS (pathological information system)-integrated tumor specific checklists with data acquisition by drop down menus. By navigating through the drop down menus on the one hand pathologists are reminded of the required data; on the other hand a clearly arranged structured report is created automatically (template based report, TBSR, Fig. 1) and the selected data are stored in a data bank with the possibility of direct electronic data processing. In addition, TBSRs contain particular paragraphs in which pathologists can describe special features in a free text manner. To check if one report format has advantage over another we classified all reports of oncological lung resection specimens between January 2002 and April 2011 into DRs, SRs, and TBSRs and compared them regarding the content of essential data (ED), which are defined by national associations of pathologists [1–3]. For each report an essential data score (EDS, with a high score of 10) was calculated and the results were statistically evaluated. Our results show with a high statistical significance that by composing the pathological findings according to a given structured format the quality of reports increased already, displayed by an increase of the median EDS from 8 (DRs) to 9 (SRs). An additional gain in quality could be reached by adopting the TBSRs which had a median EDS of 10. That means that a given, clearly arranged report format in combination with a checklist-based automatic report generation leads to a complete data acquisition.

Comparing the report formats regarding the content of the single essential data in particular reporting on tumor location, tumor size, infiltration of the pleura visceralis, the histological tumor type, angio-invasion, and atelectasis or obstructive pneumonitis was different. TBSRs were advantageous over all other report formats. SRs were advantageous over DRs regarding all these data except for tumor location: in SRs we found less information about tumor location compared to DRs. The reason therefore may be that pathologists did not like to repeat information from clinicians within their report to avoid any transcription error. However, since tumor location is defined as an ED we included it into our checklists and due to adopting the TBSRs tumor location was completely acquired within our reports. This procedure can be taken as another advantage of TBSRs: with this format type it is possible to introduce important items into the reports quickly and to a large team of pathologists. Therefore, adoption of coding systems (e.g. ICD-O) which are

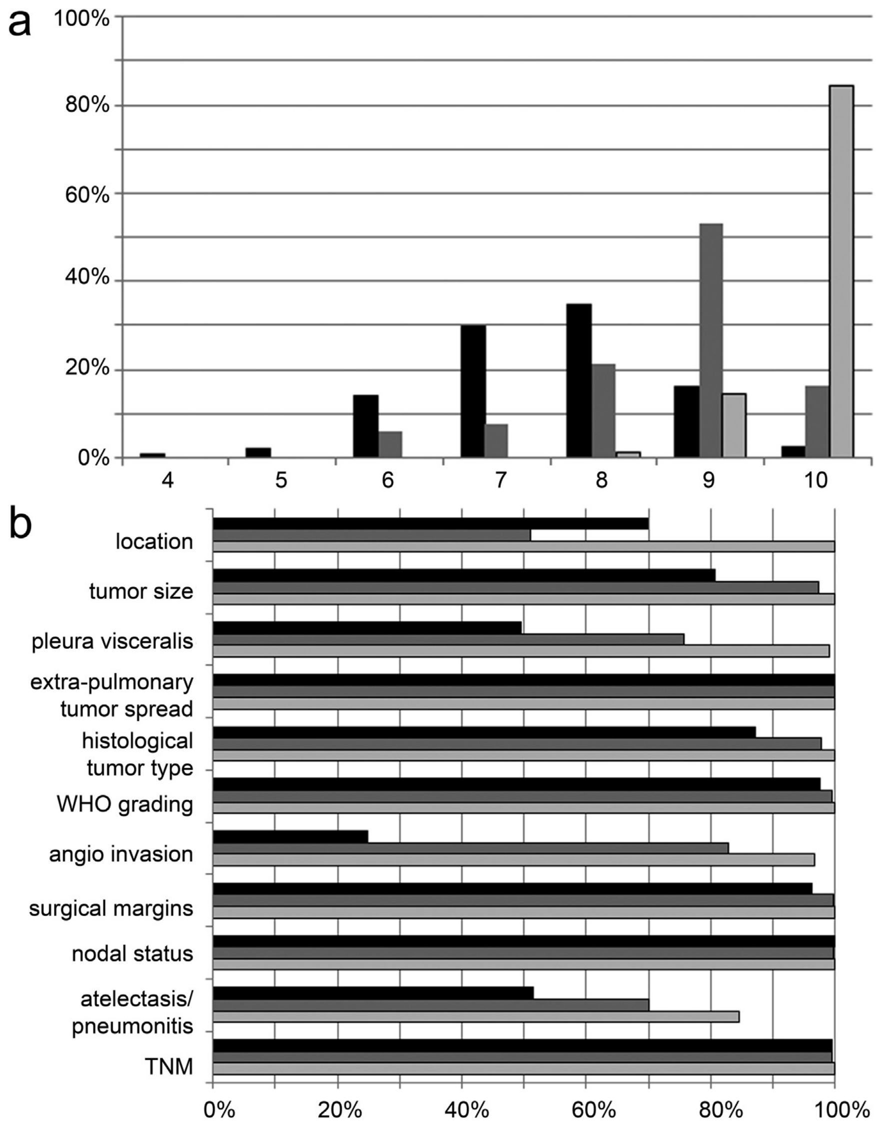

Fig. 3. (a) Essential data score (EDS) according to the format type: of the DRs, 81.4% had an EDS of 8 or less (range 4–10, median 8, mean 7.5), 69.7% of SRs had an EDS of 9 or 10 (range 6–10, median 9, mean 8.7) and 84.4% of TBSRs had an EDS of 10 (range 8–10, median 10, mean 9.8) (black bars: DRs, gray bars: SRs, light gray bars: TBSRs). (b) Percentage of reports containing the indicated ED arranged according to the format type: the most remarkably differences between the three format types were seen in reporting on tumor size and location, invasion of the pleura visceralis, histological tumor type according to the WHO classification, angio-invasion and atelectasis or obstructive pneumonitis (paired comparison between DRs, SRs, and TBSRs each $P < 0.0001$) (black bars: DRs, gray bars: SRs, light gray bars: TBSRs).

required for a complete cancer registry report (Cancer Registry Act of the Federal State of Baden-Wuerttemberg, 7th of March, 2006) is an additional advantage: the majority of reports did not contain the ICD-O-C code until the TBSR-format was adopted. Even more, the adoption of TBSRs enabled us to unify regression grading systems over all pathology reports according to international standards and in agreement with our clinicians.

Visceral pleural involvement is an important component of the lung cancer staging system [9,10]. Reporting on this ED could be significantly improved by using SRs and even more by TBSRs. Although, specification of positive or negative blood vessel and lymphatic vessel invasion is essential because they are important factors in assessing prognosis [11] and predictive of poor outcome [12], information about angio-invasion was given rarely in DRs (24.9%) and still insufficiently in SRs (82.9%). One reason therefore could be, that in TNM version 6 [5] angio-invasion was still a facultative data, in contrast, according to TNM version 7 [4] it is now obligate. The inclusion of angio-invasion into the TBSRs again led to an increase of the gathered data (96.7%).

To check if the improvement of reported ED is not due to a specialization of pathologists or staff changes we attributed the reports to the responsible pathologists. From January 2002 until April 2011 a total of twenty-five pathologists were responsible authors of reports of lung cancer resection specimens. All of them were general pathologists. On average, 7.6 pathologists per year were in duty and 1.4 colleagues left the institute whereas 1.6 new pathologists joined the team. There was not one single pathologist who was employed over the complete period of time. These data reveal a relatively high fluctuation rate (ratio of personnel leaving to the total number of employees) of 18.4%. Firstly, this is not unusual for an academic institute responsible for education of pathologists and it shows that it is unlikely that the marked improvement of acquired data is essentially determined by a training effect of the involved pathologists. Secondly, out of this high fluctuation the substantial need of standardized pathology reports arises to keep a high-leveled diagnostic quality.

There are still aspects where the quality even of TBSR can be improved: looking at the data given about atelectasis or obstructive pneumonitis it becomes obvious that pathologists seem to be pleased with their report when the tumor related data are recorded. However, tumor associated obstructive pneumonitis and atelectasis are important characteristics [13] and contribute to the UICC classification [4,5]. Although difficult to assess macroscopically, the RCPath recommend that atelectasis or obstructive pneumonitis should be described in the report, particularly if the changes extend to the hilum or the whole lung. According to the RCPath, this data should be recorded in the free-text as it may up-stage small central tumors [2]. Our data, however, show that pathologists reported on more findings when they were reminded, so recording of important data in a free-text section of the report may be suboptimal. Rather, it seems appropriate to define even more mandatory fields to improve the acquisition of the essential data.

The advantage of electronically stored tumor data is that they can be used for research purpose more easily. First, the retrieval of relevant tissue is facilitated. Second, the acquisition of structured data enables researcher to link every single tissue probe to periodically updated biological and epidemiological data resulting in a sustainable high quality tumor bank. Further on, these distinct data can also directly be sent to a cancer registry without processing by a documentation assistant and contribute therefore to a time and money saving epidemiological data collection without transcription errors.

Our results are consistent with previously published data and show that synoptic reports contain more information compared to traditional narrative reports [14–16]. In addition, they are characterized by a clearly arranged layout. However, all kinds of pathology reports are more or less a temporary excerpt of the clinical course of an oncological patient and for an optimal long-term care clinicians are forced to collect the needed data out of numerous reports. One solution would be a so called synthesis [17] in which all essential data of a patient are summarized and presented as an overview to the user. Therefore, it is necessary to record and store the findings electronically in a database which supplies the synthesis with the needed datasets. The synthesis can then be presented in a simple and attractive manner for example as a table-based or even figure-based overview to the clinicians. In addition to that Nakhleh put the idea forward to alert clinicians of important diagnoses that should not be overlooked by mobile devices [18].

Finally, it should be mentioned that the adoption of structured reports, like all novel processes, took some time and in a few instances it was a challenge to communicate that all participants – pathologists, clinicians, patients, researchers, and epidemiologists – benefit from structured reporting. At our institute some more experienced colleagues were not familiar with the structured reports in the beginning. However, in the course of time they realized their own benefits and clinicians appreciate the new format type very much.

In summary, structured oncological pathology reports of lung cancer specimens are advantageous compared to textual reports: first, because the format of the report correlates significantly with the completeness of the ED. Second, due to the uniform and clear layout of the report the key findings can be recognized at a first glance. Third, the so called second users can process the electronically stored data directly. The traditional textual pathology reports occasionally lack essential information and the data stored in written form only makes it more difficult to process the data.

Conflict of interest

The authors have declared no conflicts of interest.

Acknowledgements and funding

We would like to thank Manfred Kopp and Lioudmila Bogatyreva for their technical assistance. KA is supported by a fellowship of the medical faculty of the University of Freiburg (AUM843/11).

References

[1] Gal AA, Marchevsky A, Travis WD. Cancer protocol of lung cancer. In: Cancer Protocols. College of American Pathologists; 2005, http://www.cap.org, last access: June 2012.
[2] Nicholson AG, Gibbs A, Kerr K, Gosney J. Dataset for lung cancer histopathology reports. In: Pathologists TRCo, editor. Standards and Datasets for Reporting Cancers. The Royal College of Pathologists; 2011, http://www.rcpath.org, last access: June 2012.
[3] Müller KM, Wittekind C, Bohle R, Petersen I, Schäffer R. Empfehlungen zur pathologisch-anatomischen Diagnostik von Lungentumoren. In: Pathologie BDPuDGf, editor. Bundesverband Deutscher Pathologen und Deutsche Gesellschaft für Pathologie. 2005.
[4] Sobin LH, Gospodarowicz MK, Wittekind C. TNM classification of malignant tumours. Oxford, UK: Wiley-Blackwell; 2009.
[5] Sobin LH, Wittekind C. TNM classification of malignant tumours. Geneva: Wiley-Liss; 2002.
[6] Travis WD, Brambilla E, Müller-Hermelink HK, Harris CC. Pathology and genetics of tumours of the lung, pleura thymus and heart. Lyon: IARC; 2004.
[7] Schwartz AM, Henson DE. Diagnostic surgical pathology in lung cancer: ACCP evidence-based clinical practice guidelines (2nd edition). Chest 2007;132:78S–93S.
[8] Gephardt GN, Baker PB. Lung carcinoma surgical pathology report adequacy: a College of American Pathologists Q-Probes study of over 8300 cases from 464 institutions. Arch Pathol Lab Med 1996;120:922–7.
[9] Osaki T, Nagashima A, Yoshimatsu T, Yamada S, Yasumoto K. Visceral pleural involvement in nonsmall cell lung cancer: prognostic significance. Ann Thorac Surg 2004;77:1769–73 [discussion 1773].
[10] Bunker ML, Raab SS, Landreneau RJ, Silverman JF. The diagnosis and significance of visceral pleural invasion in lung carcinoma. Histologic predictors and the role of elastic stains. Am J Clin Pathol 1999;112:777–83.
[11] Fujisawa T, Yamaguchi Y, Saitoh Y, Hiroshima K, Ohwada H. Blood and lymphatic vessel invasion as prognostic factors for patients with primary resected nonsmall cell carcinoma of the lung with intrapulmonary metastases. Cancer 1995;76:2464–70.
[12] Brechot JM, Chevret S, Charpentier MC, Appere de Vecchi C, Capron F, Prudent J. Blood vessel and lymphatic vessel invasion in resected nonsmall cell lung carcinoma. Correlation with TNM stage and disease free and overall survival. Cancer 1996;78:2111–8.
[13] Goldstraw P, Crowley J, Chansky K, Giroux DJ, Groome PA, Rami-Porta R. The IASLC Lung Cancer Staging Project: proposals for the revision of the TNM stage groupings in the forthcoming (seventh) edition of the TNM Classification of malignant tumours. J Thorac Oncol 2007;2:706–14.
[14] Haydu LE, Holt PE, Karim RZ, Madronio CM, Thompson JF, Armstrong BK. Quality of histopathological reporting on melanoma and influence of use of a synoptic template. Histopathology 2010;56:768–74.
[15] Kahn C, Simonella L, Sywak M, Boyages S, Ung O O, O'Connell D. Postsurgical pathology reporting of thyroid cancer in New South Wales, Australia. Thyroid 2012;22:604–10.
[16] Aumann K, Amann D, Gumpp V, Hauschke D, Kayser G, May AM. Template-based synoptic reports improve the quality of pathology reports of prostatectomy specimens. Histopathology 2012;60:634–44.
[17] Ellis DW. Surgical pathology reporting at the crossroads: beyond synoptic reporting. Pathology 2011;43:404–9.
[18] Nakhleh RE. Quality in surgical pathology communication and reporting. Arch Pathol Lab Med 2011;135:1394–7.