Original Article

Agreement between Cytological and Surgicopathological Diagnoses of Respiratory Specimens in Rajavithi Hospital, Thailand

Kuakpaetoon T, MD[1]

[1] Department of Pathology, Rajavithi Hospital, College of Medicine, Rangsit University, Bangkok, Thailand

Background: In current medical diagnostic processes, pathological examination, including surgicopathological study, is the gold standard, especially for neoplasia or oncology. Recently, there has been a developmental trend towards minimally-or less-invasive investigation techniques, and one of these modalities is cytological (or cytopathological) examination. This study aimed to examine the level of agreement between the conventional and less invasive methods, in terms of their usefulness and limitations, in order to determine the most appropriate diagnostic method for individual cases in the future. The selection of respiratory system specimens for this study was made because of the large number of cytological tests that are available, and we wanted to be able to check the results of each test with surgicopathological ones. There are various tests, such as bronchial washing (BW), bronchoalveolar lavage (BAL), pleural effusion (PE) and transbronchial needle aspiration (TBNA). In surgical pathology, the specimen type used is a transbronchial lung biopsy (TBLB). This study was conducted in Rajavithi Hospital, which is a super tertiary hospital.

Objective: To study the agreement between cytological and surgicopathological diagnoses in patients with respiratory disorders in Rajavithi Hospital from 2015 to 2017.

Materials and Methods: Diagnoses of respiratory specimens of Rajavithi Hospital from 2015 to 2017, obtained from both cytology and surgical pathology, were retrospectively collected and analyzed.

Results: In surgicopathological diagnoses, 53 (46.1%), 9 (7.8%) and 53 (46.1%) were in the malignancy, borderline and benign categories respectively compared with 28 (24.3%), 18 (15.7%) and 69 (60.0%), respectively from cytological tests. The overall concordance between the cytological and surgicopathological diagnoses in benignity was 65.2% and in malignancy 82.1%.

Conclusion: The agreement between the cytological and surgicopathological diagnoses in respiratory specimens in Rajavithi Hospital from 2015 to 2017 was statistically significant at a low level. The agreement was higher in some subtypes of cytological diagnoses than in others, with 84.61%, 83.72% and 68.29% from TBNA, PE and BAL, respectively. In terms of validity of diagnosis, cytology had other benefits over surgical pathology which need to be considered in each clinical situation. However, both methods should be used to complement each other in order to reach more definite diagnoses.

Keywords: Agreement, Correlation, Rajavithi Hospital, RJVH, Cytology, Cytopathology, Histopathology, Pathology, Surgical pathology

In the medical diagnostic process, pathological examination (surgical pathology or tissue study) is an important investigation, and it is the gold standard in medical diagnosis, especially in neoplasia or oncology. Recently, there has been a developmental trend towards minimally- or less-invasive investigation, and one such technique is cytological (or cytopathological) examination. The present study aimed to examine the level of agreement between diagnoses reached using the conventional test and the less invasive methods, in order to determine the appropriate diagnostic technique for individual cases in the future. The authors chose specimens from the respiratory system for this study because of the large number of cytological tests that are available, and we wanted to be able to check the results of each test with surgicopathological ones. The various tests available include bronchial washing (BW), bronchoalveolar lavage (BAL), pleural effusion (PE) and transbronchial needle aspiration (TBNA). In surgical pathology, the specimen type most often used is transbronchial lung biopsy (TBLB). It was appropriate that this study was performed in Rajavithi Hospital (RJVH) which is a super tertiary hospital at the top level of hospital networking in the national referral system and which handles consultations and patient transfer from primary, secondary and even other tertiary hospitals.

Studying the agreement or consistency between cytological and surgicopathological diagnoses is beneficial to both specialties and also to improve quality assurance and

Correspondence to:

Kuakpaetoon T.

Department of Pathology, Rajavithi Hospital, 2, Phyathai Road, Ratchathewi, Bangkok 10400, Thailand.

Phone: +66-2-3548108 ext. 3848, **Fax:** +66-2-3548079

E-mail: thiti@rajavithi.go.th, thiti.k@rsu.ac.th

standards of medical practice used in diagnosis[1,2]. The results of such research should lead to the adoption of a variety of technique revisions in individual institutions or contexts. This study focused on patients treated in the past 3 years who had respiratory system problems, for which a variety of cytological investigative methods are performed[2,5]. Cytological examination is available for immediate initial evaluation, and this is superior to the conventional surgicopathological in that it takes much less time to process[3]. There is also a test which is common to both methods called Fine Needle Aspiration Biopsy (FNAB)[4] and Fine Needle Cytology[6]. In the future, both pathological examinations will be moving in the direction of molecular testing which should lead to more agreement between the two approaches[7]. In addition, there is a new extension to cytology examination techniques in the form of the cell block method which augments diagnostic facility[8]. The consistency of the two tests is greater in peripheral lung lesions[9]. In general, cytology tests yield 90% specificity and 87% sensitivity[10].

Materials and Methods

All diagnoses of respiratory specimens in RJVH from 2015 to 2017, obtained from both cytology and surgical pathology, were retrospectively collected and analyzed to assess their levels of agreement using Chi-square tests (McNemar-Bowker test) and Kappa co-efficient.

The cytological specimens included those obtained from bronchial washing (BW), bronchoalveolar lavage (BAL), pleural effusion (PE) and transbronchial needle aspiration (TBNA). In surgical pathology, the specimen type most often used is transbronchial lung biopsy (TBLB). The cytology techniques of BW, BAL and TBNA were performed in accordance with the international standard guidelines[2]. In the case of PE, specimens were aspirated and immediately sent to the cytology laboratory where cytotechnologists span or centrifuged them before smearing and staining them. In the next stage, the specimens were examined via microscope to check whether there were any abnormal cells. After screening, the case slides were sent to the pathologists who made the final cytological diagnosis and report.

For tissue studies, the specimens were obtained via bronchoscopy. The tissue biopsy specimens were placed in a fixative agent, 10% neutral formalin, and sent to the pathological laboratory where they were put through an automatic tissue processor, emerging as processed tissue blocks. A technician embedded the tissue into paraffin blocks and cut the 2 to 4-micron sections via a microtome. The thin sections were then stained using hematoxylin-eosin stain before being examined by pathologists who recorded diagnoses in the pathological reports.

In this study, we collected the cytological reports of four types of cytology tests, BW, BAL PE and TBNA, as well as the pathological reports of TBLB in all cases of respiratory system problems in RJVH in the study period. Not every case had all four types of cytological specimen, but all had tissue biopsy, the gold standard. We analyzed the agreement between cytological and surgicopathological

diagnoses of respiratory system problems using the IBM SPSS version 22.0. The data from the computerized reports are held securely in the RHIS (Rajavithi Hospital Information System) with information access layer or class; results are shown anonymously. This study was approved by the Rajavithi Hospital Ethics Committee (reference number 074/2561).

Results

The results of the study consist of a total of 116 records; however, one case (No. 03) had to be excluded due to inappropriate surgicopathological diagnosis (the surgicopathological diagnosis was performed 2 years after the cytological diagnosis of the ascites). The majority (56%) of the population was female, with ages ranging from 22 to 85 years old, with an average of 61.00 ± 12.75. Demographic factors, together with types and numbers of cytological tests, are summarized in Table 1. The results of cytological and surgicopathological diagnoses are shown in Table 2. In surgicopathological tests, there were 53 (46.1%), 9 (7.8%) and 53 (46.1%) diagnoses in the malignancy, borderline and benign categories respectively compared with 28 (24.3%), 18 (15.7%) and 69 (60.0%) diagnoses in the cytology tests (43 PE, 41 BAL, 18 BW and 13 TBNA diagnoses).

The sensitivity and specificity of cytological diagnoses were calculated and compared with those of surgicopathological ones, as shown in Table 3.

A summary of the level of agreement between cytological and surgicopathological diagnoses with their subtypes is shown in Table 4.

Discussion

The cytological and surgicopathological diagnosis results were checked using Chi-square tests (McNemar-Bowker test), with significance set at a p-value of less than 0.05. Kappa showed that agreement was at a low level, as shown in Table 2. This overall level of agreement was lower than that found in the literature review[2,10]; however, in the literature, studies were performed by specific types of cytology and surgical pathology; for example, BAL and tissue biopsy. Four cytology tests are analyzed individually in Table 4.

As shown in Table 4, the overall concordance (C)

Table 1. Results

Demographic factors	n (%)
Sex	
Female	65 (56.0)
Male	51 (44.0)
Age (years), mean ± SD	61.00±12.75
Type of Cytological tests	
PE	43 (37.4)
BAL	41 (35.7)
BW	18 (15.7)
TBNA	13 (11.3)

Table 2. Summary from the results

	Surgicopathological diagnosis, n (%)			Total
	Benign	Borderline	Malignancy	
Cytological diagnosis				
Benign	45 (65.2)	3 (4.3)	21 (30.4)	69 (100.0)
Borderline	6 (33.3)	3 (16.7)	9 (50.0)	18 (100.0)
Malignancy	2 (7.1)	3 (10.7)	23 (82.1)	28 (100.0)
Total	53 (46.1)	9 (7.8)	53 (46.1)	115 (100.0)

Kappa = 0.361, *p*-value <0.001

Table 3. Sensitivity and specificity for cytological and surgicopathological diagnoses

Cytological diagnosis	n	Sensitivity % (95% CI)	n	Specificity % (95% CI)
Borderline/malignancy	39	61.9 (56.0 to 67.8)	8	15.1 (11.6 to 18.6)
Benign	24	38.1 (32.2 to 44.0)	45	84.9 (81.4 to 88.4)

Sensitivity and specificity were calculated versus surgicopathological diagnosis

Table 4. The summary of agreement of cytological diagnosis and surgicopathological diagnosis with their subtypes

		%		%		%		%		%
All	C = 67	58.26	C-1 = 10	8.69	C+1 = 6	5.22			83	72.17
	D-2 = 19	16.52	D-1 = 6	5.22	D+1 = 5	4.35	D+2 = 2	1.74	32	27.83
TBNA	C = 9	69.23	C-1 = 1	7.69	C+1 = 1	7.69			11	84.61
					D+1 = 2	15.38			2	15.38
PE	C = 29	67.44	C-1 = 3	6.98	C+1 = 4	9.30			36	83.72
	D-2 = 3	6.98	D-1 = 3	6.98	D+1 = 1	2.32			7	16.28
BAL	C = 25	60.97	C-1 = 3	7.32	C+1 = 0	0			28	68.29
	D-2 = 8	19.51	D-1 = 2	4.76	D+1 = 1	2.44	D+2 = 2	4.88	13	31.71
BW	C = 4	22.22	C-1 = 3	16.67	C+1 = 1	5.56			8	44.44
	D-2 = 8	44.44	D-1 = 1	5.56	D+1 = 1	5.56			10	55.56

C = concordance; D = discordance

was 58.26%. C-1 indicates concordance but with cytological diagnosis one step milder than surgicopathological diagnosis and yields 8.69%. C+1 means concordance but with cytological diagnosis one step more severe than surgicopathological diagnosis and yields 5.21%. When we averaged all 3 types of concordance, there was an overall level of 72.17%.

Analysis of each type of cytology test revealed that C of TBNA, PE, BAL and BW were 84.61%, 83.72%, 68.29% and 44.44% respectively, so that their discordance (D) levels were 15.39%, 16.28%, 31.71% and 55.56%, respectively. BW was clearly the weak link which accounted for the low level of agreement in the present study, while the C of the other types of cytological tests was acceptable and similar to those in the literature. The category C+1 also showed the superiority of cytology testing over surgicopathological diagnosis.

Even though validity of diagnosis is most important, in medical practice, other factors should also be considered. The beneficial aspects of cytology compared to those of surgical pathology are as follows: it is simpler, cheaper, less time-consuming and less invasive. Cytology cannot replace tissue biopsy, but the two should be complementary diagnostic procedures. Nowadays, developments in cytology techniques are making it more complex and costly but also more reliable, with the advent of such new techniques as liquid-based cytology, involving new laboratory machines and higher costs. The megatrend is probably toward whatever is able to improve the reliability of cytological diagnosis, even if it has to be at the loss of some former strong points. It will be difficult to restore the previous strengths of cytological tests in terms of their low price and simplicity while maintaining the present high quality of diagnosis, and this could be the next target; however, it will require substantial supportive research in the academic profession of pathology.

Conclusion

The overall agreement between cytological and surgicopathological diagnoses in respiratory specimens in RJVH from 2015 to 2017 was significant, but unfortunately at a low level. Analysis of individual cytology tests and tissue biopsy, however, revealed that three of the four test types showed satisfactory levels of agreement. The validity of current cytological diagnosis has been greatly improved in recent years, and the next aim of academic and professional development may be how to maintain the current high diagnostic reliability and somehow regain the original strong points of cytology in terms of its low cost and simplicity. Essentially, cytology and surgical pathology are complementary diagnostic procedures.

What is already known on this topic?

Agreement between cytological and surgicopathological diagnoses is accepted but with some reservations.

What this study adds?

The results of this study in RJVH are partly compatible with the conclusion in the literature in the lower level. Some types of cytology yield more satisfactory levels. This adds to the decision to choose the suitable specific type of examination in each case within the context of the referral system of the country.

Potential conflicts of interest

The authors declare no conflict of interest.

References

1. Raab SS, Grzybicki DM. Cytologic-histologic correlation. Cancer Cytopathol 2011;119:293-309.
2. Guidelines of the Papanicolaou Society of Cytopathology for the examination of cytologic specimens obtained from the respiratory tract. Papanicolaou Society of Cytopathology Task Force on Standards of Practice. Diagn Cytopathol 1999;21:61-9.
3. Chandra S, Chandra H, Sindhwani G. Role of rapid on-site evaluation with cyto-histopathological correlation in diagnosis of lung lesion. J Cytol 2014;31:189-93.
4. Lieberman RP, Hafez GR, Crummy AB. Histology from aspiration biopsy: Turner needle experience. AJR Am J Roentgenol 1982;138:561-4.
5. Johnston WW, Frable WJ. The cytopathology of the respiratory tract. A review. Am J Pathol 1976;84:372-424.
6. Dahlstrom JE, Langdale-Smith GM, James DT. Fine needle aspiration cytology of pulmonary lesions: a reliable diagnostic test. Pathology 2001;33:13-6.
7. Shukla S, Malhotra KP, Husain N, Gupta A, Anand N. The utility of cytology in the diagnosis of adenocarcinoma lung: A tertiary care center study. J Cytol 2015;32:159-64.
8. Assawasaksakul T, Boonsarngsuk V, Incharoen P. A comparative study of conventional cytology and cell block method in the diagnosis of pleural effusion. J Thorac Dis 2017;9:3161-7.
9. Tanaka T, Yamamoto M, Tamura T, Moritani Y, Miyai M, Hiraki S, et al. Cytological and histological correlation of primary lung cancer: a preliminary study of 106 cases with resectable tumors. Acta Med Okayama 1983;37:11-9.
10. Jay SJ, Wehr K, Nicholson DP, Smith AL. Diagnostic sensitivity and specificity of pulmonary cytology: comparison of techniques used in conjunction with flexible fiber optic bronchoscopy. Acta Cytol 1980;24:304-12.