An evaluation of methods of inducing sputum production in patient with suspected lung cancer

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Summary:

Background *: the major focus of respiratory cytology is the diagnosis of lung cancer , carcinoma of the lung is now reported to be the most commonly diagnosed non- Cutaneous malignancy in the world. Iraq has faced the increase in incidence of this lethal type of cancer. Sputum cytology is a convenient method of screening and diagnosing primary epithelial tumor of the lung which is of many types include fresh smear ,Sacccomanno smear, and mailing container method.*

Methods *: Sputum cytological study was done on 50 patients suspected to have pulmonary carcinoma prepared by fresh smear method ,Saccomanno method ,and mailing container method.One, two,or three samples taken from each patient.Slides were prepared and stained by H and E stain and examined thoroughly .The accuracy specificity, and sensitivity was found for each method for comparison.*

Result and Conclusion *: A careful and sometimes frequent sputum samples is very essential in the diagnosis of lung cancer .Preservation and fixation methods are found to facilitate more accurate diagnosis especially in areas far from hospital.*

Key words *: Lung cancer, sputum cytology, accuracy.*

Introduction:

Sputum cytological study in experienced hands has been demonstrated

to be an accurate and convenient method of screening and diagnosing primary epithelial tumors of the lung (1-5) . Convenient sputum cytology in mass surveys has also become an essential method for the detection of x-ray negative central type early stage lung cancer (6). The most reliable method of processing sputum is the preparation of fresh smears from unfixed,selected material (7,8) .When fresh smears can not be processed , and when a significant time lapse between collection and processing is expected, the samples must be fixed. The best and widely used method of fixation and concentration of sputum has been describe by Saccomanno . Mailing container method is another method used for the fixation of the sputum for a maximum three days.This method can be applied in mass surveys (9).

Material & Methods

From the first of July 2002 to the end of December 2004, 50 sputum samples were collected from patients attending the outpatient, medical wards , and the cardiothoracic unit in the Al-Kadhimiya Teaching Hospital .

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These sputum samples were prepared by three different techniques (fresh smear technique, Saccomanno technique and mailing container method). For each patient a record no. had been given and a case report was prepared. Specimens were subjected to cytological examination

Early morning sputum specimens are recommended (8,10). The patient is instructed to gargle and rinse the mouth with normal saline to minimize contamination by food residues and bacteria. And asked to cough and expectorate sputum into three plastic tubes, the first used for the fresh smear preparation ,the second contain a mixture of 50% ethanol and 2% carbowax (used for the Saccommanno technique) ,and the third contain a mixture of 9.9 ml of methyl alcohol and 0.1 ml of thymol (used for mailing container method). The content of the second tube was blended thoroughly with food blender then centrifuged for 15 minutes at 1500 rpm and the sediment is smeared on three glass slides. The third container contents were poured on filter paper and the remaining materials accumulated by a spatula and smeared on a glass slides and fixed in 95% alcohol .All slides were stained by hematoxylin and eosin.

Cellular findings were classified as :

- Benign
- Dysplastic changes
- Malignant with identification of specific type of malignancy

For the purpose of statistical analysis suspicious results were considered negative.

Statistical analysis has been done using, sensitivity, specificity, accuracy, positive predictive value, and negative predictive value.

Results:

Table (1): Cytological diagnosis of sputum samples (prepared by , fresh smear , Saccomanno smear , and mailing container method)

	Saccomanno method		Mailing container method		Fresh smear	
	Number of patients	%	Number of patients	%	Number of patients	%
Benign	**17**	**34**	**17**	**34**	**18**	**36**
Squamous dysplasia	**14**	**28**	**14**	**28**	**15**	**30**
Suspicious	**7**	**14**	**7**	**14**	**6**	**12**
Malignant	**12**	**24**	**12**	**24**	**12**	**24**
Total	**50**	**100**	**50**	**100**	**50**	**100**

Table (2): Percentage of each type of lung cancer diagnosed by sputum cytology (by all methods) in 14 cases of lung cancer.

Tumor type	Number	percentage
Squamous cell carcinoma	**11**	**78.57**
Adenocarcinoma	**1**	**7.14**
Small cell carcinoma	**2**	**14.28**
Total	**14**	**100**

Table (3): Comparison between histopathological versus cytological diagnosis of lung cancer (all methods).

Type of malignancy	No. of cases diagnosed by histopathology	No. of cases diagnosed by cytology
Squamous cell carcinoma	**14**	**11**
Adenocarcinoma	**7**	**1**
Small cell carcinoma	**3**	**2**
Total	**24**	**14**

Table (4): Histopathological versus cytological diagnosis in 50 cases of sputum samples (prepared by mailing container method, Saccomanno method and fresh smear).

Methods	Benign	Suspicious for malignancy	Positive for malignancy
Mailing container method	**31**	**7**	**12**
Saccomanno method	**31**	**7**	**12**
Fresh smear method	**33**	**6**	**11**
Histopathological diagnosis	**25**	**1**	**24**

Table (5): Statistical analysis of lung cancer (Mailing container method).

Accuracy	**76%**
Sensitivity	**50%**
Specificity	**100%**
Positive predictive value	**100%**
Negative predictive value	**68.4%**

Table(6): Statistical analysis of lung cancer (Saccomanno method).

Accuracy	**76%**

Sensitivity	**50%**
Specificity	**100%**
Positive predictive value	**100%**
Negative predictive value	**68.4%**

Table(7): Statistical analysis of lung cancer(fresh smear).

Accuracy	**74%**
Sensitivity	**47%**
Specificity	**100%**
Positive predictive value	**100%**
Negative predictive value	**66.66%**

Table(8): Comparison of the cytological diagnosis using fresh smear method with Saccomanno and mailing container method.

No. of cases	Mailing container	Saccomanno method	Fresh smear diagnosis
1 case	**Squamous cell carcinoma**	**Squamous cell carcinoma**	**Suspicious**
1 case	**Squamous cell carcinoma**	**Squamous cell carcinoma**	**Squamous dysplasia**
1 case	**Suspicious**	**Suspicious**	**Small cell carcinoma**

Table(9): Number of sputum specimens in the diagnosis of 14 patients with lung cancer.

Specimen no. 1st diagnostic of cancer	No. patients	% of total patients with lung cancer
1	**3**	**21,42**
2	**3**	**21,42**
3	**8**	**57,16**

Discussion and conclusion:

Mailing container method is performed with specimens pooled over 3 days can be used in mass surveys, for example in high risk groups , with the subject pooling daily specimens and then mailing the material in the container provided to the examination center . In our work we have examine this procedure on the hospitalized patient , because patient return rate (for three days) was low for people attending the outpatient.

The Saccomanno technique remains as invaluable method of preserving and concentrating sputum samples that cannot be processed fresh (in outpatient cases , or sputum cytology done for research purposes when the time between the collection of sputum samples and making a smear is prolonged) so preservation of sputum samples by using Saccomanno technique is essential

The following table shows the difference between mailing container method and Saccomanno method .

Table (10) : comparison of mailing container method and Saccomanno .

	Mailing container	Saccomanno
Preservation	**50% methyl alcohol ,1% thymol**	**50% ethyl alcohol ,carbowax**
Mucin	**Remains**	**Disappear**
Cell adhesion	**Good**	**Poor**
Degree of degeneration	**Less degeneration**	**More degeneration**
No. of specimens examined per day/ examiner	**30**	**10**
Other features	**Suitable for mass survey**	**Not suitable for mass survey**

Regarding various histopathological types of lung cancer diagnosed by the three methods, the accuracy of the cytological diagnosis using Saccomanno smear was 76% , using mailing container method was 76% , and it was 74% by fresh smear method. So we can conclude that the accuracy of diagnosis of fresh smear is less than the other two methods,because the later two methods concentrate the material (in addition to preservation).

In this study from 24 cases of lung cancer proved by histopathology 14 cases were diagnosed by sputum cytology (by all methods) so the sensitivity of procedure was 58,33% and the specificity was 100% . This finding were comparable with other larger series which showed the sensitivity to rang from 27% to 69.1% and a specificity to rang from 89.7% to 99.99% (11-18).

Regarding various histological types of lung cancer diagnosed by the three methods, the number of cases of Squamous cell carcinoma diagnosed by mailing container method and Saccomanno smear were more than that diagnosed by fresh smear (11case diagnosed by mailing container and Saccomanno smears , while 10 cases diagnosed by fresh smear method).

The number of cases of adenocarcinoma diagnosed by all methods were similar from 7 cases diagnosed by histopathology , only one case diagnosed by all three methods).

The number of small cell carcinoma cases diagnosed by fresh smear is more than the number of cases diagnosed by the other two methods (1 case was diagnosed by mailing container method and Saccomanno method, while two cases were diagnosed by fresh smear) , which is consistent with the results obtained by others. The low diagnostic rate of small cell carcinoma using mailing container method and Saccomanno method related to the very fragile tumor cells having a recognizable tendency to deformity during blending and prolong preservation.

From the results of this study and those obtained by others, Saccomanno technique and mailing container method are provided to be useful in fixation and preservation of sputum samples when delay in processing of these samples is anticipated. They also provide a concentrated samples representative of the entire specimen.

Mailing container method produce less artifact than Saccomanno method (because the samples not blended) , so these two technique have a good sensitivity and specificity and in conjunction with fresh smear may contribute to the diagnoses of non-small cell carcinoma (especially Squamous cell carcinoma).

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