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SPIROMETRIC INVESTIGATION OF RESPIRATORY ILLNESS IN A HOSPITAL POPULATION

by

Yoshihiko Fujii, M.D.

Chief, Department of Medicine
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ABSTRACT

Continuing the previous study, we have done spirograms on 82 cases on 88 occasions. Their ages were distributed from 19 years to 78 years. The subjects came to the O.P.D. or came into the hospital for complete physical check-ups, pre-operative evaluation, evaluation of airway obstruction, spirometric study of cardiac patients and so on.

About half of the subjects showed normal spirograms. Two-thirds of the remainder had obstructive lung pattern on the spirograms. The rest showed restrictive type of abnormality. FEV_1, $FEV_1\%$ of FVC, MMF, and PFR corresponded fairly well to the functional diagnosis but MVV did not.

Also blood gas analysis showed a good correlation with the clinical and functional diagnosis. It should be the guide for diagnosis and treatment in association with spirometric studies.

Spirograms done before and after bronchodilator can be frequently used for the diagnosis of irreversibility of airway obstruction.

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I

INTRODUCTION

Since September, 1967, we have examined spirographically a fair number of subjects of the hospital population.[1]

We have noted that, although the hospital population had limited tendency, we could get some information about respiratory illness in the hospital in certain areas.

Thus, we have continued the similar study though feeling it to be insufficient, using only the spirometer for assessment of pulmonary function of the subject with various conditions.

II

METHOD

From February 15, 1969, to February 14, 1970, we tested spirographically or by using Wright peak flow meter, patients and subjects for complete physical check-ups, pre-operative evaluation, evaluation of airway obstruction and pulmonary function study of cardiac patients and several other reasons.

The tests have been done in the pulmonary function laboratory in the afternoons by a special technician. The test was done in the standing position, with the subject sitting in the pause.

Vital capacity, (VC), forced vital capacity (FVC), maximal voluntary ventilation (MVV) equivalent to MBC, were performed three times each, and the best result was taken for the record. Forced expiratory volume in one second (FEV_1), maximal mid-expiratory flow (MMF), same as $FEF_{25-75\%}$, were calculated from the FVC curve.

For predicted values, we have used Baldwin's formula from the age, sex and height.

Peak flow rates were obtained using Wright's flow meter. Three blowings were recorded and the best one was taken.

[1] Spirometric investigation of Respiratory illness in a Hospital Population. May 1969 (Unpublished)

III

RESULT

Table I. The total number of patients was 82 and tests were done on 88 occasions on these patients. There was no child case this year. About three-fourths of the patients were older than 40 years. The number of female patients was less than the male patients. During this period no patient died.

Table II. Ten persons were tested as a part of physical check-ups in so-called "human dock". Twenty-three cases were examined as pre-operative general evaluation. Almost all of them were to have abdominal surgery. Patients with respiratory disease were frequently tested. There were four cases of acute or chronic simple non-purulent, non-obstructive bronchitis. Pneumonia, bronchogenic carcinoma, metastatic lung cancer, pulmonary fibrosis, bronchiectasis were grouped as "other pulmonary diseases".

Table III. About two-thirds of the subjects showed normal vital capacity. Only less than 20% of the cases showed moderately to severely restrictive pattern.

Table IV. FEV_1 and $FEV_1\%$ of FVC were normal in about 60% of the cases. Only about 5% of the cases showed severely obstructive spirograms.

Table V. Normal MVV and severely reduced MVV groups each contained just over one-third of the cases.

Table VI. More than three-fourths of the cases showed normal MMF. Moderately and severely reduced MMF were not many.

Table VII. About two-thirds of the cases showed more than 300 l/min. on peak flow rate. The cases of poor value in peak flow rate were small in number.

Table VIII. At the time of spirography we made the functional diagnosis on the basis of the spirogram as well as the clinical signs and symptoms. About half of the cases showed normal spirograms. Some cases had mixed abnormality, both restrictive and obstructive patterns. Consequently the number in the table was more than the cases done.

Severely obstructive cases were not so many. There was no severely restrictive case.

Table IX. We made the table for distribution by age and sex of obstructive lung disease patients. We saw no patient under 20 with obstructive lung disease. Among the twelve cases with moderate to severe obstructive lung disease ten (83%) were male and only two (17%)

female. Nine (75%) of the twelve were in the age sixty and over group. Ratios in mild cases were reversed in distribution: only five (36%) of fourteen were male and eight (57%) were under sixty.

IV

DISCUSSION

We tested 82 cases during one year period, though for about two months the equipment was out of order. Comparing with the previous year, the number was fairly well increased because the cases in the previous report were 86 during one and a half year period.

Although the cases of respiratory disease, such as asthma in the pediatric service were not so rare, none were referred to the pulmonary function laboratory because of questionable cooperation, reliability and reproducibility in children for spirograms.

In comparison with the previous year, the cases more than 60 years old were more than the cases aged 40 to 59 years. The male cases were about the same in number, but the female cases decreased from last year. This was mainly due to the reduction in number of patients with bronchial asthma this year.

All the cases of the complete physical check-ups, so-called "human dock" showed completely normal spirograms. Most cases were in their fourth decade. Thus, such normal spirogram is understandable as active working age.

The pre-operative evaluation by spirogram increased this year. They showed normal spirograms in all but five cases (22%). Pre-operative case number 5 showed moderately restrictive lung disease and the chest x-ray disclosed a space occupying lesion. So we considered that the restriction was caused by this lesion, then the operation was done. The postoperative course was uneventful. The pathology was leiomyoma of the lung.

Pre-operative case number 10, once showed mild obstructive type of spirogram. The oral treatment for airway obstruction was done and the repeated test turned out to be normal.

Pre-operative case number 11 had advanced breast cancer, who showed moderate restrictive and mild obstructive type of abnormality repeatedly, but the operation under careful anesthesia was performed with success.

Pre-operative case number 16 was a patient with subdural haematoma retrospectively, who showed mild restriction on spirogram. The operation was done without any trouble.

Pre-operative case number 17 had cancer of the stomach, and her spirogram showed mild airway obstruction, then the pre-operative cleaning and bronchodilation was done. After this treatment, the operation was performed successfully. Thus, the spirogram shows us an airway obstruction which may lead to postoperative pulmonary infection process if special care is not taken early. Thus, a careful evaluation of pulmonary function should be done especially before general anesthesia on cases which have the possibility of mucous retension and inadequate inflation of lung and development of ventilation/perfusion abnormality.

Most patients with acute bronchitis or with history of non-purulent productive cough showed normal spirograms. This is compatible with so-called Fletchers' criteria[2] or with definition by the American Thoracic Society[3].

In contrast with simple bronchitis, the patients with chronic obstructive lung disease showed five with mild, six with moderate, three with severe obstructive spirograms. We could not follow most patients with C.O.L.D. of those examined last year in spite of our suggestion that close observation would be necessary for their disease, because most of the patients (except three cases) did not return or some had moved to other institutions. Consequently the patients with C.O.L.D. in this study were almost entirely different from the previous series.

This year the overall number of asthmatic patients who came to our clinic were somewhat decreased. This resulted in reduced number of asthma patients in the present study.

As we expected from Table II, which showed non-pulmonary subjects were more than half of the cases, 64.6% of all cases showed normal vital capacity on the basis of % predicted. This figure was not much different from the previous one, though in this year's there were less number of subjects with normal vital capacity and more cases with reduced VC% predicted than the previous report. This resulted partly because of the increased number of the aged group who have some disease process in addition to their age. Classification by FEV_1 and

[2]Lancet i 776, 1965

[3]American Review Respiratory Disease, 85.762 1962

and FEV_1% of FVC disclosed quite similar results as the last year's report. For some subjects we did spirogramophy before and after bronchodilator. Asthma cases or those with a mild degree of C.O.L.D. showed good improvement in pulmonary function after the administration of bronchodilator, but not in severe C.O.L.D.

Unfortunately this year, again, the technicians were changed twice during this period. Their training was probably insufficient or inadequate and cooperation by the subjects was poor. Thus, MVV resulted in very unreliable value. Although MMF and peak flow rate have been said to be very variable, our results of MMF and peak flow rate corresponded fairly well with FEV_1 and with the functional diagnosis. When we take those with a normal or obstructive deficit of function abnormality, their number becomes about the same as the number of those with more than 1.5 l in MMF. This is understandable because every parameter, FEV_1, MMF, PFR express whether or not airway obstruction is present.

We have analysed blood gas for a fair number of cases with several conditions in respect to PO_2, PCO_2 and PH. On each condition the result of blood gas analysis and/or with the functional condition. The most interesting and typical value was seen on the acute excerbation of C.O.L.D., on which we saw hypercapnia, hypoxemia and respiratory acidosis. We have gained good guide for treatment by blood gas analysis. We will continue this procedure from now for several clinical conditions.

V

CONCLUSION

1. Eighty-two cases were tested on 86 occasions. Forty-nine cases were interpreted to have normal spirogram. Twenty-five cases were obstructive lung disease, more than half of them were mild obstruction. Eleven cases were interpreted as restrictive type of abnormality.

2. This functional spirometric diagnosis corresponded fairly well with the clinical diagnosis and comparing it with the previous report, it showed similar tendency.

3. For some cases of airway obstruction, spirometric study was done before and after the administration of bronchodilator; and in mild chronic obstructive lung disease and in asthmatic patients (pulmonary function dilating effect was improved) in some degree.

4. Blood gas analyses were performed on some patients. The results were compatible with the clinical and functional diagnosis, especially in chronic obstructive lung disease.

TABLE I

Distribution by Age, Sex

Age	Male		Female		Total	
- 19	1		1		2	
20 - 39	8		12	(13)	20	(21)
40 - 59	18	(19)	9	(12)	27	(31)
60 -	24	(25)	9		33	(34)
Total	51	(53)	31	(35)	82	(88)

( ) = Actual number of tests done

TABLE II

Classification by reason for Examination

Diagnosis or Examination		
Routine Physical Examination of Human Dock	10	33
Preoperative Evaluation	23	
Pulmonary Tuberculosis	2	33
Simple or Acute Bronchitis	4	
Chronic Obstructive Lung Disease	14	
Bronchial Asthma	7	
Other Pulmonary Diseases	6	
Heart Disease	6	
Miscellaneous Diseases	10	
Total		82

TABLE III

Classification by Vital Capacity % of Predicted Value

VC %	Number		% in Total Cases
> 80	53	(55)	64.6%
79 - 65	13	(13)	15.9%
64 - 50	14	(17)	17.1%
49 >	2	(3)	2.4%
Total	82	(88)	100.0%

TABLE IV

Classification by FEV_1 and FEV_1% of VC

FEV_1	Cases (Tests)	% in cases	FEV_1 %	Cases (Tests)	% in cases
≥ 1.75	51 (52)	62.2%	> 71%	49 (50)	59.8%
$1.75 \geq 1.25$	18 (18)	22.0%	70 - 56%	17 (19)	20.7%
$1.25 \geq 0.75$	9 (14)	11.0	55 - 41%	11 (14)	13.4%
0.75 >	4 (4)	4.8	40 >	5 (5)	6.1
Total	82 (88)	100.0	Total	82 (88)	100.0

TABLE V

Classification by MVV% Predicted

%	Cases	(Tests)	% in cases
80	28	30	34.1
79 - 65	9	10	11.0
64 - 50	14	14	17.1
49	31	34	37.8
Total	82	88	100.0

TABLE VI

Classification by MMF

Volume	Cases	(Tests)	% in cases
$\geq$ 1.5	64	(69)	78.0
1.5> $\geq$ 0.85	13	(14)	15.9
0.85> $\geq$ 0.35	3	(3)	3.7
0.35 >	2	(2)	2.4
Total	82	(88)	100.0

TABLE VII

Classification by Peak Flow Rate

Volume	Cases	(Tests)	% in cases
500	11	(11)	13.4
499 - 400	14	(14)	17.1
399 - 300	26	(28)	31.7
299 - 200	15	(17)	18.3
199 - 100	14	(15)	17.1
99	2	(3)	2.4
Total	82	(88)	100.0

TABLE VIII

Classification by Functional Diagnosis

		Cases	(Tests)
Normal		49	(51)
Obstructive	Mild	14	(18)
	Moderate	7	(9)
	Severe	4	(4)
Restrictive	Mild	5	(8)
	Moderate	6	(8)

TABLE IX

Distribution of Subjects by Age, Sex of Obstructive Type

Grade	Age	Male		Female		Total	
Mild	- 19	0	5	0	9	0	14
	20 - 39	1		2		3	
	40 - 59	2		3		5	
	60 -	2		4		6	
Moderate	- 19	0	6	0	1	0	7
	20 - 39	0		0		0	
	40 - 59	0		0		0	
	60 -	6		1		7	
Severe	- 19	0	4	0	1	0	5
	20 - 39	1		1		2	
	40 - 59	1		0		1	
	60 -	2		0		2	
Total		15		11		26	

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