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Spontaneous Pneumothorax: Experience from a Peripheral Tertiary Care Teaching Hospital Of West Bengal, India

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Abstract:
Background: *Spontaneous pneumothorax (SP) is one of the common acute chest problems encountered in day to day clinical practice. Clinico-epidemiological profile of SP is less well studied in Indian scenario.*
Objective: *to describe sociodemographic correates of pneumothorax, to study the clinical profile and medical causes of SP.*
Method And Materials: *a cross sectional descriptive study involving seventy six SP patients treated in in-patient-department of Pulmonary and General Medicine of Bankura Sammilani Medical College & Hospital, West Bengal, India during January 2011 to December 2013 was carried out. Information pertaining to socio-demographics, previous morbidity etc. was gathered by interview using a predesigned and pretested questionnaire. Cinical features of the present morbidity (SP) and its medical causes were established by clinical examination including anthropometry as well as relevant laboratory investigations. Data regarding the treatment modality and the final outcome were also collected.*
Results: *A bimodal age distribution was found with 1st peak between 21 – 30 years and 2nd peak in the age group of 61 years and above. Overall male to female ratio was 6.6:1. Among 76 patients, 16 (21.05 percent) had primary spontaneous pneumothorax (PSP) and 60 (79.95 percent) patients had secondary spontaneous pneumothorax (SSP). Majority (46.6percent) of SSP cases had COPD as underlying cause. TB was found to contribute 40.0 percent of SSP cases. PSP occurs more in tall, thin young male smokers and amongst the individuals engaged skilled jobs with comparatively less strenous occupations.*
Conclusion: *SP is more common among men with marked predominance of SSP. PSP occurs more in tall, thin young male smokers. The most frequent underlying causes of SSP were COPD and TB.*
Keywords: *spontaneous pneumothorax; primary spontaneous pneumothorax; secondary spontaneous pneumothorax; epidemiology.*

I. Introduction

Pneumothorax is defined as the presence of air within the pleural cavity. The term pneumothorax was first coined in 1803 by Itard and its clinical features were described by Laennec in 1819. [1] Spontaneous Pneumothorax (SP) is defined as the presence of air in the pleural cavity with the consequent collapse of the respective lung without an identified precipitating cause, namely a direct or indirect trauma, or iatrogenesis. The SP is said primary (PSP) in the absence of a chronic or acute pulmonary disease. The secondary (SSP) occurs more frequently related to chronic obstructive pulmonary disease (COPD),tuberculosis, AIDS, cystic fibrosis or pneumocystosis.[2, 3] In simultaneous bilateral spontaneous pneumothorax (SBSP), the presence of an underlying lung disease is greater than in the patients with unilateral SP. [4] The proportion of SBSP is approximately 1.3% among all the cases of pneumothorax.[5] Tension pneumothorax is another common term, often used in literature by physicians. Leigh-Smith et al. defined tension pneumothorax as "pneumothorax with significant respiratory or hemodynamic compromise that reverses on decompression (needle or finger) alone" [6] i.e., the improvement occurs before one way valve drainage is established. Thus, two distinct epidemiological types of SP are evident: PSP and SSP. PSP shows a peak incidence in young individuals contray to SSP having peak incidence at ages of 55 years.[7] PSP remains an important health problem with an annual incidence of 18-28 per 100,000 populations in males [8] and 1.2-6.0 per 100,000 populations in females. [4] A well-known risk factor for PSP incidence regarding both genders is smoking. [9]

Limited data related to disease burden, epidemiology and clinical profile of SP from India especially from the rural area necessitates more study. This study was aimed to describe the sociodemographic correlates, medical aetiology and clinical profile of patients admitted with SP to a peripheral tertiary care teaching hospital of West Bengal, India.

II. Materials And Method

A descriptive cross-sectional study was conducted between January 2011 and December 2013 in the In-Patient-Department (IPD) of Pulmonary and General Medicine of Bankura Sammillani Medical College & Hospital, a peripheral tertiary care teaching Institution in West Bengal, India.The study protocol was approved by the Institutional Ethics Committee. All cases of SP aged 15 years and above were considered for the study excepting the hydro-pneumothorax. Data were collected prospectively from consecutive patients got admitted in the IPD. After obtaining informed consent the patients were interviewed with a predesigned and pretested questionnaire for gathering information pertaining to the socio-demographics (age, sex, occupation, residence), past morbidity etc. Then thorough clinical examination including the anthropometry [e.g. measuring height, weight as per standard guidelines and determining body mass index (BMI)] was carried out for each and every patient. Moreover, the relevant information in connection with addiction including smoking habit, exposure to biomass fuel smoke, and activity during the onset of symptoms etc. were also explored.The opinion of the surgical specialist was also sought for the treatment of patients. Chest radiography and other relevant investigations like sputum for acid fast bacilli (AFB), culture and sensitivity for pyogenic organism,staining for fungal element; blood for HIV1&2, CT scan of thorax, CT guided FNAC, Fibre optic bronchoscopy etc. as done during routine investigation for treatment was recorded. Medical records were scrutinised for any relevant morbidity like confirmed case of COPD. Chemical pleurodesis had been done in patients with recurrent SP with 2percent 100 ml Providone Iodine. [10]

Data compiled in MS excell sheets were analysed using statitical methods e.g. tables, charts, mean, standard deviation (sd), percentage, and inferential statistical tests like Chi-square test, unpaired t test etc.. For the purpose of analysis the SPSS-16 free version was utilised. P value of ≤ 0.05 with 95 percent confidence interval (CI) was considered for statistical inference.

III. Results

Analysis revealed that among 76 patients included in this study 16 (21.05 percent) had PSP while 60 (78.95 percent) had SSP. Majority (68.42 percent) patients had right sided pneumothorax. The overall average age was 43.16± 17.65 (mean±sd) with median 43.5 and a range of 15-72 years. However, no significance difference in age could be demonstrated across the gender (independent $t_{74}=1.581$, p=0.118). It was also revealed that the PSP patients was significantly younger than the SSP patients (unpaired $t_{74}=5.685$, p=0.000). [Table-1] Age of the female patients seemed to be higher in SSP group but like the overall age distribution, significant difference wasn't estabished statistically across the gender (mean±sd= 53.44±18.13 versus 47.22±16.12, unpaired $t_{58}=1.050$, p=0.298). Moreover, the age of the patients with SSP of infective origin was found to be lower than that of the other causes and the difference was revealed to be statistically significant (mean±sd=35.38±14.00 versus 57.91±10.36, independent $t_{58}=7.168$, p=0.000). Similarly age of the COPD patients was also significantly higher than the patients of other causes (mean±sd= 58.93±9.72 versus 38.72±15.31, independent $t_{58}=6.003$, p=0.000). On the whole 86.84 and 13.16 percent cases belonged to male and female genders. Overall male to female ratio was 6.6: 1. [Table 2] The male predominance was seen in SSP group also (M: F=5.66:1).

Bimodality in age distribution was noticed during analysis. [Table 3] The first peak occurred between 21 and 30 years of age and was contributed predominantly by PSP in a ratio of 1.27:1 with SSP while the second peak occurred in the age group of 61 years and above and was contributed solely by SSP. [Fig.1] The average height was found to be higher among the PSP patients contrary to the BMI which revealed to be lower and the differences were statistically robust enough in each case to conclude that the PSP was more common among the tall and thin individuals. [Table 1]

On the whole 53.94 percent SP cases and further 68.75 percent and 50 percent of PSP and SSP patients, respectively had reported smoking. Regarding occupation, cultivation was revealed to rank first (26.31percent). However, one fifth (21.05 percent) were reported to be unemployed. Proportion of SSP cases was found significantly higher in unskilled workers e.g. daily labpourers, fisherman, rickshaw pullers, cultivators, home makers etc. compared to the group comprising of skilled workers like electrician, driver, factory workers; businessman including vendors and shopowners, clerk as well as students and few unemployed etc. [Table-4]

The COPD was shown to be on the top of the list (46.6 percent) as the medical cause for SSP closely followed by pulmonary tuberculosis (40.0 percent). Other causes for SSP were asthma, lung cancer, diffuse parenchymal lung diseases (DPLD), staphylococcal and klebsiella pneumonia. [Fig. 2] The distribution of SSP had no variation between the gender when analysed as per the cause e.g. infective versus other causes (p=1.00, Fisher exact test) and COPD versus other causes (p=0.482, Fisher exact test). [Fig-3] This statistically comparable gender distribution in COPD might be due to higher COPDs among the female caused by inhalation of smoke arising out of biomass fuel burning during cooking in rural India.

The clinical presentation was more or less similar irrespective of the category of SP. The most common symptom at onset was acute ipsilateral chest pain complained by 38 (50.0 percent) patients followed by sudden

onset dyspnea in 30 (39.47 percent) patients. Moreover, 11 (14.47 percent) patients reported dry cough at the beginning.

Most (52.63 percent) of the patients reportedly had the onset of symptom while taking rest. Physical activity at the onset of pneumothorax was explored only in 3.95 percent of patients.

Out of the 76 patients, five (6.58 percent) had recurrent SP of which 2 (40.0 percent) were PSP and 3 (60.0 percent) were SSP. Patients having recurrent PSP showed pneumothorax on contralateral side and patients with SSP had both ipsilateral (one) and contralateral pneumothorax (two).

Simple aspiration was done initially in 12 (15.79 percent) patients of whom 8 (66.67 percent) had responded. Sixty eight (89.47 percent) patients had been managed by tube thoracostomy including those four who didn't respond to simple aspiration. For the patients of recurrent SP chemical pleurodesis had been done in 4 (80.0 percent) patients. One (20 percent) patient did not consent for that procedure.

Out of the sixty eight patients managed by tube thoracostomy complains and or complications were reported and or detected in 56 i.e. 82.35 percent. Out of these, pain at the insertion site was found to be the most common complication of intercostal tube drainage (ICTD) reported by 89.28 percent of patients followed by malfunctioning of drain in 17.85 percent, subcutaneous emphysema in 12.5 percent and re-expansion of pulmonary edema in 3.57 percent patients with SSP. However, one patient with SSP developed empyema after intercostal tube drainage. [Table-5]

IV. Discussion

In the present study, 21.05 percent patient had PSP while the underlying medical cause was found in 78.95 percent patients with SP. The proportion of PSP and SSP among all SP patients varied widely in Indian studies from i.e. 12.5 percent and 87.5 percent from Jaipur, [11] 20 percent and 80 percent from Chandigarh, [12] 25 percent and 75 percent from Rohtak, [13] respectively. Sousa C et al. in a retrospective study on SP carried out in the Internal Medicine Service of the Santo Antonio Hospital reported PSP and SSP to be 63.6 percent and 36.4 percent, respectively. [14] Higher percentage of SSP in the present study, like that of the Chandigarh study, could partly be due to the higher incidence of COPD including those amongst the female caused by inhalation of smoke from burning of biomass fuel during cooking in rural as well as slum areas and pulmonary tuberculosis in India.

As per the study on SP in India conducted by Gupta D et al, the SP showed a bimodal age distribution, the 1st peak being in the age group of 20 – 30 years and the 2nd peak occurring in the age group of 40 – 50 years. [12] The present study also showed similar pattern in respect of the 1st peak occurring in the age group of 21 – 30 years but the 2nd peak occurring in the age group of 61 years and above corresponding to that reported by a study conducted by Gupta D et al. in England. [15] Most of the cases of PSP in this study were found to occur in the 1st age peak i.e. 21-30 years as the predominance of PSP was observed amongst the younger men. On the contrary, the SSP occurred mostly in the second age peak.

Predominance of SP among male (Male: Female = 6.6: 1) in this study corresponds to that reported by other investigators. [12-15] On the whole male was found to be almost 7 times more vulnerable to SP. The male predilection was 15 times for PSP and about six times for SSP. The higher rate of occurrence of SP in men has been attributed to higher rates of smoking, body habitus and different mechanical properties of the lungs. [16]

Though there is no published data regarding the relationship between the occurrence of SP and occupation of patients, one worth mentioning finding of this study was that PSP occurred even among the patients engaged in less strenous/laborious work (e.g. student, shopkeeper, clerk, hawker, driver, electrician, home maker, even amongst unemployed individuals). It is contrary to the popular belief that SP occurs in people with more strenuous jobs. In his review Professor Shi-ping L mentioned that PSP might be associated with some congenital disorders such as Marfan's syndrome, or some environmental factors such as smoking. He also added that there are some precipitating factors, such as change in atmospheric pressure or emotional change, examination seasons for students; sexual activity (woman on top position), hearing loud music etc. [17]

Family history i.e. genetic predisposition to PSP was explored for no case in the present study. But in one study, Graham et al found 10 percent of patients with PSP had a positive family history. [18] Abolnik I Z et al. also reported a positive family history for 11.5% of PSP cases. [19]

In their study Gupta D et al. found that patients affected by PSP had higher mean height (171 cms) in contrast to the lower weight and BMI among the SSP patients. [12] In this study more PSP patients were taller than to SSP patients. This might be due to the higher chances of subpleural bleb formation in the lung apex subjected to a greater mean distending pressure for long period in taller individuals. [19] Moreover, in the current study PSP patients were also found thinner disimilar to the observation made by Gupta D et al. [12] But this finding had concurrence with what was infered by Shi-ping L in his review. [17]

Smoking is known to be strongly associated with the development of PSP probably due to the formation of subpleural bleb contributed by smoking related small airway inflammation. [20] In present study, 68.75 percent of the patient with PSP was smoker as compared to 50 percent of patients with SSP. Professor

Shi-ping L regarded smoking as a precipitating factor for PSP. He quoted the observation made by Bense et al. in 1987 "that the relative risk of pneumothorax ranged from 7 to 100 times higher in light to heavy smokers". [17]

In a series of 505 patients with SSP from Israel, the etiologies were as follows: COPD (348), Tumor (93), Sarcoidosis (26), Tuberculosis (9), other pulmonary infections (16) and miscellaneous (13). [21] Though tuberculosis was the dominant cause for SSP in adults as per the studies from India [12-14], it was found, in the present study, that COPD was the leading cause of SSP (46.6 percent) very closely followed by tuberculosis accounting for 40.0 percent cases of SSP. This might partly be due to difference in study setting or to higher prevalence of COPD as the underlying medical cause reflecting enormous exposure to tobacco smoke in the form of bidi/cigarette for male as well as to the smoke emitted from use of biomass fuel during cooking for female, specially in rural India. [22] Tuberculosis was also not much less than COPD as the underlying cause of SSP because of higher incidence of tuberculosis in India. None of the SP patients was found positive for HIV in this study unlike the observation made by Gupta D et al where AIDS was revealed to be responsible for 12.5 percent of cases of SSP. [12] Higher proportion of SSP among the unskilled workers might be contributed to their lower SES vulnerable to high PTB and COPD due to smoking and other causes.

A tendency to overestimate the recurrence rate of SP exists in the published series. The recurrence rate for the PSP ranges from 16 to 52 percent and for the SSP from 39 to 47 percent, mostly taking place between six months to two years after the first episode. [23] The present study reported low recurrence rate i.e. only in 5 (6.57 percent) cases and out of which 40.0 percent were PSP and 60.0 percent were SSP.

The beginning of the SP is generally characterized by acute ipsilateral pleuritic chest pain, sudden dyspnea or dry cough. [15] The present research witnessed that the most common symptom at the onset was ipsilateral chest pain explored in 35 (46.05 percent) patients followed by dyspnea in 28 (36.84 percent) patients.

Though strenous physical effort is presumed to cause SP, physical activity at the time of onset of pneumothorax was reported in only 3.94 percent patients of this study. Most of the patients had the onset while taking rest (52.63 percent). It is with concurrence of the finding reported by Sousa C et al. who observed that most (64.4 percent) patients with SP were at rest while physical activity was not described in a considerable number of episodes at the onset of the symptoms. [14] In a study carried out by Weissberg's only 10 percent of the episodes took place with relation to physical effort. [21] Professor Shi-ping L also reported that PSP usually occurs at rest. [17]

In their study Gupta D et al reported that all the SPs were unilateral and more patients (60%) had a right sided pneumothorax. [12] Similarly, the present study explored all the SPs as unilateral with predominance (68.42 percent) of right sided pneumothorax.

The therapeutic options range from simple observation, simple needle aspiration, placement of the chest tube, chemical pleurodesis, thoracoscopy, video assisted thoracoscopic surgery and thoracotomy. The chest tube is recommended whenever the simple aspiration fails and also for most of the SSP. [10] In this study it was found that 68 (89.47 percent) patients were managed by tube thoracostomy. Simple aspiration was done initially in 12 (15.79 percent) patients of PSP of whom 4 (33.33 percent) had failed aspiration and required tube thoracostomy. This high rate of tube thoracostomy management was attributed to higher percentages of SSP in our study.

Chest tube related complications were almost similar that found in other studies. In the study conducted by Sousa C et al. [14] 45 percent of the patients had complications related to the chest tube. The present study had witnessed ICTD related complications in 73.68 percent of patients mostly (89.0 percent) being pain at the insertion site followed by malfunction of drain (17.85 percent) and subcutaneous emphysema (12.5 percent).

Few limitations of this study need discussion. Thoracoscopy, video assisted thoracoscopic surgery and thoracotomy were not done due to non-availability. For that reason subpleural blebs were not detected though they are said to be the most common cause of PSP. Single institution based cross-sectional study with small arbitrary sample size was another limitation. As it was a hospital based study, incidence of SP couldn't be estimated and risk factors exploration wasn't made confidently for which a case control or community based study with larger sample would have been a better option.

V. Conclusion

The findings of the present study such as COPD is rising fast to be on the top followed still by pulmonary tuberculosis as the leading cause of SSP, PSP occurs more commonly in tall thin young male smoker and SP may also occur among individuals with occupation of less strenous jobs and event at rest etc. can be a portrait of the concerned morbidity and may help the care providers diagnosing victims for prompt appropriate management.The observations may also help programme planner and managers to initiate different promotive and preventive measures to curb this health problem. Various measures like tobacco cessation, early diagnosis and treament of PTB, motivate and empower the people for installation and continue use of smokeless chula etc. may be thought of in this connection.

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Table 1: Distribution of patients according to few attributes (N=76).

Attributes	Types of SP		Total (N=76)	Unpaired 't', P at df 74
	PSP(n_1=16)	SSP (n_2=60)		
Age (yrs.)				
Range	16-32	15-72	15-72	----------
Mean±sd	24.44±4.79	48.15±16.43	43.16± 17.65	5.685, 0.000
Height (cm)				
Range	165 - 176	152 - 176	152 – 176	-------
Mean±sd	170.5±3.14	161.28±4.92	163.22±5.94	7.102, 0.000
Weight (kg)				
Range	48-62	43 - 68	43 – 70	-------
Mean±sd	52.75±4.17	52.75±5.43	55.60±7.51	1.086, 0.281
BMI (kg/m^2)				
Range	16.9 - 20.8	18.13 - 23.24	18.13– 23.93	-------
Mean±sd	18.71± 1.10	20.23±1.28	20.77±1.57	4.359,0.000

Table 2: Distribution of participants according to gender (N=76)

Gender	Frequency and type of SP		Total, No. (%)	χ2 at df 1, p	OR (95% CI)
	PSP, No. (%)	SSP, No. (%)			
Male	15(22.73)	51(77.27)	66(100.0)	0.678$^{@}$	2.65(0.30-60.23)
Female	1(10.00)	9(90.00)	10(100.0)		
Total	16(21.05)	60(78.95)	76(100.0)	----------	-------

@=Fisher exact test,

Table 3: Distribution of the study subjects as per their age and type of SPs (N=76)

Age group(yr.)	SP		Total, No. (%)	$\chi 2$, p at df 1*	OR (95% CI)
	PSP, No. (%)	SSP, No. (%)			
≤20	03(3.95)	02(2.63)	05(06.57)	19.92, 0.0000	NA
21 – 30	11(14.47)	10(13.16)	21(27.63)		
31 – 40	02(2.63)	08(10.53)	10(13.15)		
41 – 50	-	14(18.42)	14(18.42)		
51 – 60	-	07(9.21)	07(09.21)		
>60	-	19(25.00)	19(25.00)		
Total	16(21.05)	60(78.95)	76(100.0)	----------	--------

* Between group (SP) comparison by clubbing initial three and last three age groups, OR=Odds ratio, CI=confidence interval, NA=not applicable.

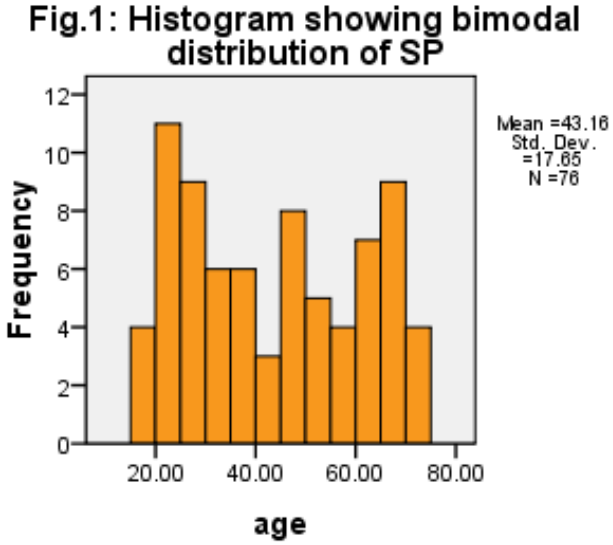
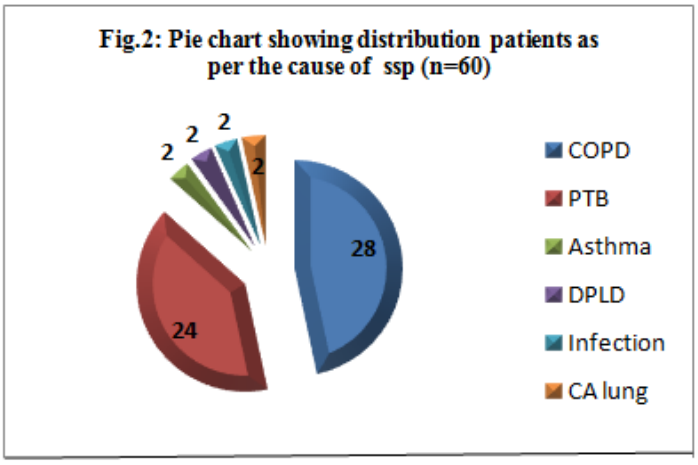


Table 4: Distribution of patients as per occupation (N=76)

Occupation	SP		Total(N=76) No. (%)	$\chi 2$, p at df 1	OR (95% CI)
	PSP (n_1=16) No. (%)	SSP(n_2=60) No. (%)			
Unskilled workers	01(2.00)	49(98.00)	50(100.0)	28.66, 0.0000	66.82 (7.65-1505.77)
Skilled workers	15(51.69)	11(42.31)	26(100.0)		
Total	16(21.05)	60(78.95)	76 (100.0)	---------	----------

Unskilled worker- Daily labourer, Fisherman, Rickshaw puller, Cultivator, home maker Skilled worker- Student, Unemployed, Electrician, Driver, Factory workerClerk, Hawker,Businessman, Shopowner, Vendor,



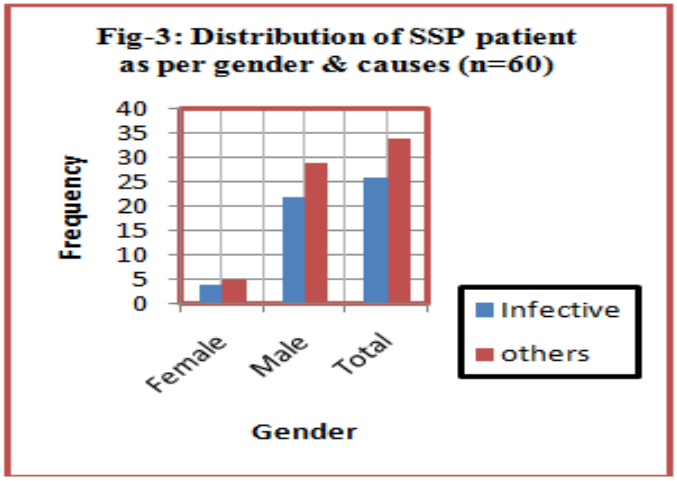


Table 5: Distribution of participants as per complications of ICTD (n=56)

Complications	Number*	Percentages
Pain at the insertion site	50	89.28
Infection at the insertion site	03	05.35
Hemorrhage	02	03.57
Subcutaneous emphysema	07	12.50
Malfunction of drain	10	17.85
Re-expansion pulmonary edema	02	03.57
Empyema	01	01.78

* Multiple responses.