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Investigating Frequency of Different Types of Spontaneous Pneumothorax Treatment Methods

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ABSTRACT

Introduction: *Pneumothorax is a relatively common respiratory disorder with a high level of incidence and recurrence and can happen in different clinical conditions and at any age. Due to the importance of treatment types in these patients, the present study was carried out in order to examine the frequency of different types of spontaneous pneumothorax treatment methods among patients admitted in Razi and Arya hospitals of Rasht over 2009-14.*
Materials and methods: *The present study was a cross-sectional descriptive investigation which was conducted on 204 (77.9%) of patients with spontaneous pneumothorax. The patients were diagnosed with pneumothorax and hospitalized according to the clinical symptoms (pleuritic chest pain, severe shortness of breath, hearing hyperresonance, decreased fremitus, and decreased breath sounds), chest x-ray, and CT scan. The patients' characteristics were recorded in a questionnaire and then analyzed using SPSS 22.0.*
Results: *Out of the participating patients, 163 (79.9%) were men and the rest were women (male to female ratio was about 4 to 1). The patients' mean age was 44.29±20.33 years, and the most common treatment methods were respectively chest tube in 41.7% of the cases and chest tube and thoracotomy in 29.9% of the cases. Moreover, recurrence was not observed in thoracotomy and VATS methods, while it was seen among patients who had been treated by chest tube method.*
Conclusion: *According to the results of the present study, it can be concluded that since inserting chest tube is associated with a high rate of recurrence and thoracotomy causes a high level of pain and long hospitalization. necessary facilities and equipment should be provided by hospitals in order to employ VATS because of its high reliability, fewer complications, and low costs compared to other methods including chest tube and thoracotomy.*

Keywords: *chest surgery methods, pneumothorax*

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INTRODUCTION

Pneumothorax refers to the collection of air or gas in the pleural cavity (Paolini R, 2007). Based on etiology, pneumothorax is classified into spontaneous, iatrogenic, and traumatic types (Henry M, Arnold T,Harvey Jon, 2003).
Although it is difficult to make sure about the incidence rate of spontaneous pneumothorax, its annual incidence is estimated to be 18-28 per 100,000 among men and 1.2-6 per 100,000 among women (Aguinagalde and et al, 2010). The annual hospital admission for primary and secondary spontaneous pneumothorax in England was reported to be 16.7 per 100,000 among men and 5.8 per 100,000 among women (Henry and et al, 2003). In the US, over 20,000 patients suffer pneumothorax every year with an economic cost of 130 million dollars (Noppen and De Keukeleire , 2008). Primary spontaneous pneumothorax occurs among tall young smoking men (Khan and et al, 2009). Smoking is associated with the relative risk of pneumothorax development (Jantz and Anthony, 2008). Pneumothorax can also be related with mechanical ventilation, previous history of pneumothorax, Valsalva manoeuvre, sexual activity, and changes in atmospheric pressure (Toro and et al, 2007). Invasive methods used for diagnostic and therapeutic purposes can be the causes of iatrogenic pneumothorax (Craig and et al, 2010). Pneumothorax symptoms include mostly one-sided pleuritic chest pain and intense shortness of breath, hearing hyperresonance, reduced tactile fremitus, and decrease or absence of breath sounds in the involved side (Noppen M, 2010).
Despite of the unknown pathophysiology of pneumothorax and various therapeutic methods, there is a remarkable debate on the best therapeutic method; however, there is consensus on achieving two therapeutic goals like drainage of air from the pleural cavity and prevention of recurrence (Chan J, 2007). Spontaneous pneumothorax treatments include observation of the patient, simple needle aspiration, percutaneous catheter, tube thoracostomy with or without chemical pleurodesis, video-assisted thoracoscopic surgery (VATS) and thoracotomy (Tschopp and etal, 2015). The primary therapeutic technique for spontaneous pneumothorax is different from one country to another, and it is very difficult to develop a standard protocol (Chen and etal , 2008).
In the first incidence of limited primary spontaneous pneumothorax, observation and simple aspiration carried out based on clinical trials are in the first line of treatment. In cases of resistant and recurrent primary spontaneous

pneumothorax, thoracoscopic talc pleurodesis is more efficient and associated with less pain compared to chest tube (Van Schil P, de Vos B, 2004). In secondary spontaneous pneumothorax in which breathing is weakened, it is necessary to seek effective and quick treatment (Chan J, nitasu W, 2009). In recent years particularly with the development of video-assisted thoracoscopic surgery (VATS) which has played an important role in such cases, surgical techniques have remarkably progressed [25]. Studies show that video-assisted surgery is more effective than chest tube drainage, and in case of lack of access to VATS, thoracotomy is replaced with chemical pleurodesis [26]. However, development of VATS which is a method of the minimum invasion has changed previous therapeutic strategies. Since the approach to pneumothorax treatment has changed with the passage of time, and quantitative studies have conducted in Iran on how the approach to pneumothorax treatment has changed, the present study was aimed at examining the frequency of different types of spontaneous pneumothorax treatment methods, the results of treatment methods and hospitalization time, the necessity of using modern devices and methods of endoscopic surgery particularly for secondary pneumothorax which is a therapeutic challenge among patients admitted in Razi and Arya hospitals of Rasht.

MATERIALS AND METHODS

The present study was a cross-sectional descriptive investigation. In the present study, the records of all patients who had referred to Arya and Razi hospitals over 2009-14. The patients were diagnosed with pneumothorax and hospitalized according to the clinical symptoms (pleuritic chest pain, severe shortness of breath, hearing hyperresonance, decreased fremitus, and decreased breath sounds), chest x-ray, and CT scan.

The patients' characteristics including age, gender, pneumothorax type, treatment type, time of hospitalization, and disease recurrence (recurrence of clinical symptoms, reference to medical centers, or radiologic confirmation of pneumothorax) were recorded in a questionnaire. The study exclusion criteria included incompleteness of the patients' records and association of other diseases of pleural space (pleural effusion, empyema, and hemothorax). Patients qualified to enter the study. It should be stated that the interventions carried out in Arya and Razi hospitals were conducted only by one surgeon and using the same technique in the mentioned hospitals.

Data analysis was carried out using SPSS 22.0. To describe the quantitative variables with normal distribution, mean and standard deviation were employed, median and interquartile range (IQR) were used for quantitative variables with non-normal distribution, and number and percentage were employed for qualitative variables. Normal distribution of the quantitative data was measured using Kolmogorov Smirnov Test.

RESULTS

Out of the 262 patients who had referred to Arya and Razi hospitals and been diagnosed with pneumothorax, 204 (77.9%) had spontaneous pneumothorax entered the study.

The mean age of the patients was 44.29±20.33 years and most frequently involved age group was 15-24 years, and 23.5% of the patients belonged to this group. Out of the participants, 163 (79.9%) were men and the rest were women.

With regard to spontaneous pneumothorax, 116 (56.9%) patients had primary pneumothorax and 88 (43.1%) had secondary pneumothorax. The therapeutic methods used for the patients are presented in Table 1.

Table 1. Clinical characteristics of the patients with spontaneous pneumothorax admitted in Razi and Arya hospitals, Rasht over 2009-14

Variable		N (%)
Gender	Male	163 (79.9)
	Female	41 (20.1)
Pneumothorax type	Primary	116 (56.9)
	Secondary	88 (43.1)
Recurrence in next references after treatment	40 (19.6)	
Death	4 (2)	
Therapeutic method	Aspiration	-
	Chest tube	190 (93.1)
	Conservation	10 (4.9)
	Thoracotomy	73 (35.8)
	VATS	4 (2)
	Pleurodesis	42 (20.6)
* For this variable, the sum of the related columns does not make 100, because more than one method was used for some patients.		

Table 2 presents the frequency of therapeutic methods in more details. As indicated in this table, the most common therapeutic method is chest tube alone with 41.7% and chest tube and thoracotomy together with 29.9%. Moreover, aspiration was not used as a treatment method in any cases. Furthermore, pleurodesis method was not used alone for treatment, and was used with other methods in 20.6% of the cases.

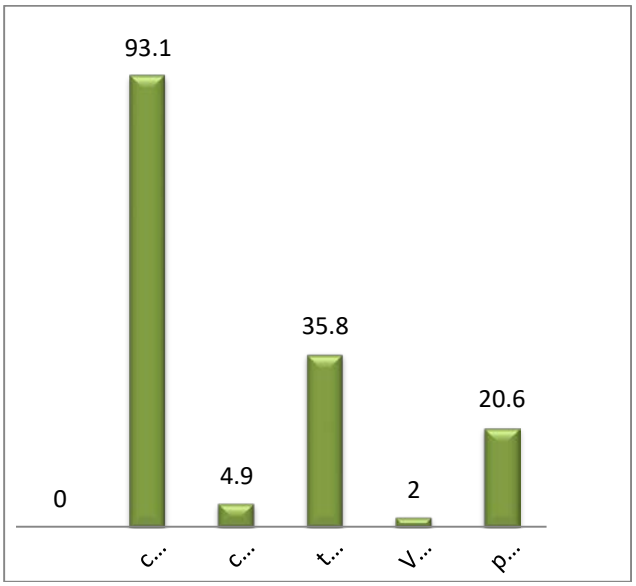

Diagram 1. The percentage of spontaneous pneumothorax therapeutic methods among the patients admitted in Razi and Arya hospitals of Rasht over 2009-14

Mean time of hospitalization was 7.86±4.95 days (with a median of 7 and a range of 1 to 42 days). Most of the patients were hospitalized 4 to 10 days (Diagram 2).

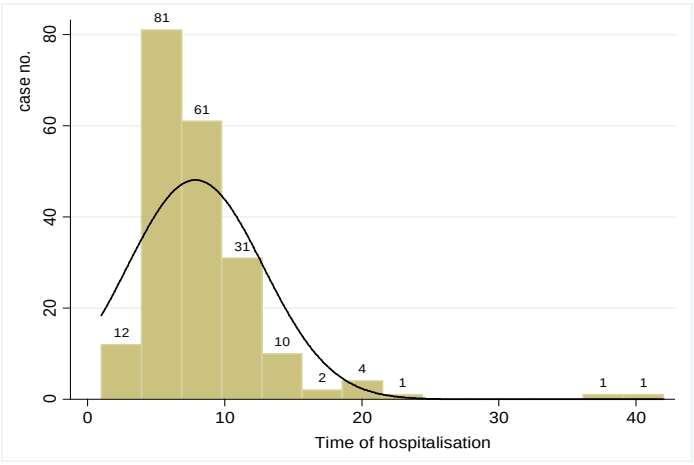

Diagram 2. Frequency distribution of hospitalization time among patients with spontaneous pneumothorax in Arya and Razi hospitals in Rasht over 2009-14

Frequency of different therapeutic methods according to the studied variables is presented in Tables 4.4 and 4.5. recurrence was not observed among patients who had undergone thoracotomy method and referred to the medical centers after a month again. Cases of recurrence were observed among patients who had treated by chest tube method.

Table 2. Frequency of therapeutic methods of spontaneous pneumothorax according to the studied qualitative variables (gender, reoccurrence, and type) among patients admitted to Arya and Razi hospitals over 2009-14

Therapeutic method type	Gender		Reoccurrence in next reference after the primary treatment	Disease type	
	Male	Female		Primary	Secondary
Chest tube (85)	70(42.9%)	15(36.6%)	11(27.5%)	52(44.8%)	33(37.5%)
Conservation (10)	7(4.3%)	3(7.3%)	5(12.5%)	9(7.8%)	1(1.1%)
Thoracotomy (30)	1(0.6%)	2(4.9%)	1(2.5%)	2(1.7%)	1(1.1%)
VATS (1)	1(0.6%)	0	0	1(0.9%)	0
Chest tube and Thoracotomy (61)	50(30.7%)	11(26.8%)	14(35%)	35(30.2%)	26(29.5%)
Chest tube and Pleurodesis (33)	26(16%)	7(17.1%)	6(15%)	12(10.3%)	21(23.9%)
VATS and Chest tube (2)	2(1.2%)	0	0	1(0.9%)	1(1.1%)
Chest tube, Thoracotomy and Pleurodesis (8)	5(2.1%)	3(7.3%)	3(7.5%)	4(3.4%)	4(3.4%)
Thoracotomy, Chest tube, Pleurodesis and VATS (1)	1(0.6%)	0	0	0	1(1.1%)
Total	163(100%)	41(100%)	40(100%)	116(100%)	88(100%)

Among the studied individuals, out of the 4 reported deaths, 3 were related to chest tube therapeutic method and 1 to conservation method in which the patient had tension pneumothorax. The most common therapeutic method for primary and secondary pneumothorax was chest tube alone (44.8% vs. 37.5%) and chest tube and thoracotomy together (30.2% vs. 29.5%). Moreover, there were more primary cases without treatment than the secondary ones (3.4% vs. 1.1%). Moreover, chest tube and pleurodesis methods together were used more in the secondary type of the disease than the primary type (23.9% vs. 10.3%) (See Table 2).

Table 3. Frequency of therapeutic methods of spontaneous pneumothorax according to the studied quantitative variables (age and time of hospitalization) among patients admitted to Arya and Razi hospitals over 2009-14

Therapeutic method	Age	Time of hospitalization
Chest tube	45.2±20.34	7.38±3.50
Conservation	30.90±18.72	4.50±4.22
Thoracotomy	39.67±7.51	5.67±3.79
VATS	17	5
Chest tubeandThoracotomy	40.79±19.68	9.64±6.98
Chest tubeandPleurodesis	57±9.90	6.70±2.53
VATS and Chest tube	50.03±24.51	7±0.00
Chest tube, ThoracotomyandPleurodesis	54.50±16.16	10.13±5.22
Thoracotomy, Chest tube, Pleurodesisand VATS	60	5
Total	44.29.20.33	7.86±4.95

The mean hospitalization days in methods of chest tube, thoracotomy, and pleurodesis together and chest tube and thoracotomy were respectively 10.13±5.22 and 9.64±6.98. Moreover, conservation method led to a lower hospitalization time than other methods (4.50±4.22).

DISCUSSION

In the present study, it was concluded that the patients' mean age was 44.29±20.33 years, and the most common involved age group was 15-24 years who accounted for 23.5% of the participants. These findings are in line with those of the study carried out by Mohebby et al who showed that the most common involved age group was 20-25 (Mohebby and et2003). Moreover, in a study conducted by RaufGorur (2007), the patients' mean age was reported to be 39.2±12.13, which is in agreement with the present study (Görür R, Kutlu A, Sönmez G, Yiğit N, Candaş F, Kunter E, TurgutIsıtmangil, 2007). Since age group are almost the same in all studies, it can be stated that the age group of below 45 is mor al, prone to pneumothorax, and most individuals of this age range are related with this disease.

In addition, in the present study, 163 (79.9%) patients were men and the rest were women, in other words, men to women ratio was 4 to 1, which is in agreement with the results of similar studies. In a study conducted by Chan et al in 2009, 66% of the patients were men and 34% were women (Chan and nitasu , 2009). Furthermore, Cristiana et al (2011) carried out a study in Portugal, men to women ratio was 3 to 1, which is in agreement with the present study (CRISTIANA and et al, 2011). The results of all these studies can show that pneumothorax usually occur among men, and women are less involved with this disease.

In the present study, regarding spontaneous pneumothorax, 116 (56.9%) had primary pneumothorax and 88 (43.15) had secondary pneumothorax. In a study entitled, "Treating patients with pneumothorax in Hong Kong" carried out by Chan et al (2009), 62% of the patients were diagnosed with primary spontaneous pneumothorax (Chan J, nitasu W, 2009). Furthermore, Cristiana et al (2011) conducted a study in which 55% of the patients had primary pneumothorax (CRISTIANA

and et al, 2011). Primary pneumothorax cases were more than secondary cases in most studies.

In therapeutic methods utilized for the patients with pneumothorax, the most common method was chest tube alone with 41.7% and chest tube and thoracotomy together with 29.9%. Moreover, aspiration method was not used to treat any cases. Furthermore, pleurodesis method was not used alone for treatment, and was used with other methods in 20.6% of the cases. Mohebby et al (2003) reported that the most frequently used method was chest tube alone [30] which is in line with the present study. According to the results of that study, simple aspiration was used as the first method to treat primary spontaneous pneumothorax, and thoracoscopy and VATS for secondary spontaneous pneumothorax (CRISTIANA and et al , 2011). Moreover, in their study, Ravari et al (2005) stated that the most frequent therapeutic method was thoracostomy tube insertion and that thoracoscopy was not utilized in any cases (Ravari and Mahjubi, 2005).

In their study carried out in 2007, RaufGorur et al reported that VATS was used more than other therapeutic methods and finally concluded that VATS is the best option with regard to pneumothorax reoccurrence (Görür and et al,2007). Reviewing most studies showed that difference in utilizing different therapeutic methods can be attributed to different causes. For instance, VATS is utilized more in developed countries but less in underdeveloped countries, which is directly related with hardware equipment. Moreover, presence or absence of skilled and trained experts in employing this method is one of the reasons for utilizing this method. According to extensive studies in industrialized countries, this method is introduced as a highly reliable, effective, and low-cost with short hospital stay.

In the present study, the mean time of hospitalization was 7.86±4.95 days, and the mean time of hospital stay in the methods of chest tube, thoracotomy, and pleurodesis together and chest tube and thoracotomy was respectively 10.13±5.22 and 9.64±6.98 days, which were more than that of VATS method with 5 days of hospital stay. This finding is in agreement with those of other reviewed studies.

Cristiana et al stated that VATS method led to the least time of hospitalization among all other methods (Ravari and Mahjubi , 2005). All of these studies indicated that there is a direct relationship between the therapeutic method and time of hospitalization, such that chest tube, thoracotomy, and pleurodesis methods cause a longer hospital stay than VATS method.

no recurrence was observed among patients who had undergone thoracotomy method and referred to the medical centers after a month again. Recurrence was observed in 11 (27.5%) patients who were treated by chest tube method, 5 (12.5%) patients who underwent conservation method, and 14 (35%) patients who were treated by chest tube and thoracotomy together, which is to a large extent in agreement with other studies. In their study carried out in 2007, RaufGorur et al reported that 25% recurrence was seen in chest tube method while no recurrence was seen in VATS method, which is in line with the present study.

Since the present study was a cross-sectional descriptive research, it is suggested that other types of study including cohort and prospective be conducted on patients with pneumothorax in order to improve and reduce complications, and provide more precise indices and criteria by examining different variables including the frequency of different types of therapeutic methods and their outcomes and recurrence.

CONCLUSION

According to the results of the present study, it can be concluded that chest tube insertion is used as the first therapeutic method for patients with pneumothorax. However, since chest tube insertion is associated with high recurrence and thoracotomy with high levels of pain and long hospital stay, VATS method can be utilized instead of other methods due to its high reliability, limited complications, low cost, and short time of hospitalization.

Because recurrence chances are high among pneumothorax patients who are treated with chest tube and pleurodesis alone, it is recommended that HRCT CT scan be run for these patients before discharge in order to diagnose underlying diseases like bleb or bullae and the patients can be hospitalized right away and undergo treatments like thoracoscopy or thoracotomy and the patient hospital stay and the medical costs decrease.

REFERENCES

1. AguinagaldeB,Zabaleta A, Fuentes A, Bazterargui N, Herna´ndez C, Miguel Izquierdo J, Pijuan J, EmparanzaJ.Percutaneous aspiration versus tube drainage for spontaneous pneumothorax: systematic review and meta-analysis, European Journal of Cardio-thoracic Surgery.2010;37: 1129—1136.
2. Chan J, nitasu W. Management of patients admitted with pneumothorax: a multi-centre study of the practice and outcomes in Hong Kong. Hong Kong Med J.2009; Vol 15 No 6 , December
3. Chan J. Management of Spontaneous Pneumothorax.the Hong Kong medical diary.2007, VOL.12 NO.1 January
4. Chen, J, HsuN H, Tsai k, Yuan A, Chen W.Salvage for unsuccessful aspiration of primary pneumothorax: thoracoscopic surgery or chest tubedrainage. 2008, Ann. Thorac. Surg. 85(6):1908-1913.
5. Craig E. Gordon,David Feller-KopmanL, Ethan M. Balk, Gerald W. Smetana.Pneumothorax Following Thoracentesis.Arch Intern Med. 2010;170(4):332-339
6. CRISTIANA SOUSA, JOAO NEVES, NUNO SA, FABIENNE GONCALVES, JULIO OLIVEIRA, AND ERNESTINA REIS. SPONTANEOUS PNEUMOTHORAX: A 5-YEAR EXPERIENCE, J CLIN MED RES • 2011;3(3):111-117
7. Görür R, Kutlu A, Sönmez G, Yiğit N, Candaş F, Kunter E, TurgutIsıtmangil. Retrospective analysis of treatment options in first recurrences of primary spontaneous pneumothorax in young adults. Eur J Gen Med. 2007; 4(4):172-175
8. Henry M, Arnold T,HarveyJon.behalf of the BTS Pleural Disease Group, a subgroup of the BTS Standards of Care Committee, BTS guidelines for the management of spontaneous pneumothorax.Thorax. 2003;58(Suppl II):ii39–ii52.
9. Jantz MA, Anthony VB. Pathophysiology of the pleur. Respiration 2008; 75: 121–133
10. Khan N, Jadoon H, Munawar Z, Subhani A, AbdurR,IhsanullahM.frequency and management outcome of pneumothorax patients.Journal of Ayub Med Coll Abbottabad. 2009;21(1).
11. Mohebby H, BannaZadeh ,Panahi F , Bahrami H . Spontaneous Pneumothorax Epidemiologic Characteristics And Treatment Methods In Iranian

Patients (1992 - 002). Tehran Univ Med J. 2003; 61 (1) :6-16
12. Noppen M, De Keukeleire T. Pneumothorax. Respiration. 2008;76(2):121—7.
13. Noppen M. Spontaneous pneumothorax: epidemiology,pathophysiology and cause.European respiratory review.2010,volume 19 number 117, 217–219
14. Paolini R. Management and outcome of spontaneous pneumothoraces at three urban EDs.Emerg Med Australas 2007; 19:449–457
15. Ravari D, Mahjubi B. Determining the Frequency of Different Kinds of Spontaneous Pneumothorax Treatment in Patients Admitted into Hazrat-e-Rasoul Hospital, 2000-2001 .RJMS. 2005; 12 (47):69-74
16. Toro J, Pautler S, Stewart L, Gladys M. Glenn,WeinreichM,TourelO,Ming-Hui Weil, Laura S. Schmidt,Lewis Davis, ZbarB,Choyke P, Seth M. Steinberg D, Nguyen M, and Marston L.Lung Cysts, Spontaneous Pneumothorax, and Genetic Associations in 89 Families with Birt-Hogg-Dube´ Syndrome.American journal of respiratory and critical care medicine.2007; VOL 175
17. Tschopp J, BintcliffeO ,Astoul P, Canalis E, Driesen P.ERS task force statement: diagnosis and treatment of primary spontaneous pneumothorax.EurRespir J. 2015; 46: 321–335