

Outcome of spontaneous pneumothorax patients admitted to thoracic division at King Hussein Medical Center

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ABSTRACT

Objectives: To show the outcome and management modalities of patients diagnosed with spontaneous pneumothorax admitted within a 5 years period to thoracic division ward at King Hussein Medical Center (K.H.M.C) Amman. Jordan.

Methods: This is retrospective descriptive study conducted at King Hussein Medical Center. Patients admitted to the thoracic division ward with the diagnosis of spontaneous pneumothorax in a 5 years period between 2007 and 2012 were included in this study. Traumatic and post interventional pneumothorax cases as well as patients below age of (14) were excluded from analysis. Data were retrieved from prospective data base and imaging studies retrieved from the PACS imaging system. Data analysis included age, gender, side and type of spontaneous pneumothorax, outcome and treatment modalities. Outpatient follow up was available up to 36 months for all patients.

Results: A total of (89) patients (8) females and (81) males median age was (50) years) were admitted to King Hussein Medical Center with the diagnosis of primary spontaneous pneumothorax (n=73, 82.1%, median age 24years) or secondary spontaneous pneumothorax (n=16, 17.9%, median age 57years). There was a predominance of right-side spontaneous pneumothorax (n=51, 57.3%) and (2) patients were identified with bilateral spontaneous pneumothorax .All patients received chest tube management as the initial intervention, which was the definitive therapy for (50) patients, while at (39) patients required further operative treatment. Patients with primary spontaneous pneumothorax required hospitalization for (3-12) days in contrast to (5-32) days with secondary spontaneous pneumothorax .There was no mortality observed in patients in this study.

Conclusion: In accordance with international guidelines, tube thoracostomy conservative management of spontaneous pneumothorax patients represents the first line of treatment. In case of persistence or recurrence, minimally invasive surgical treatment of spontaneous pneumothorax offers excellent success rates.

Key words: Spontaneous pneumothorax, Tube thoracostomy, Video-assisted thoracoscopic surgery.

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Introduction:

Pneumothorax has been noticed as clinical issue since the 15th century when the Islamic physician Serefeddin Sabuncuoglu (1385-1470) reported Pneumothorax and management in his book (Cerrahyye Ul Haniyye) later on it was fully described by

Rene Laennec in 1819. ⁽¹⁻²⁾ Pneumothorax is leakage of air in the space between the lung and the chest wall more specifically in the pleural cavity. ⁽³⁾ Pneumothorax is divided into two main categories spontaneous pneumothorax where no precipitating factor

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could be blamed and nonspontaneous pneumothorax. ^(4, 5) Primary spontaneous pneumothorax is pneumothorax which occurs in patients without lung disease where lung bleb or bulla formation is found, while secondary spontaneous pneumothorax occurs in patients with underlying lung disease, mostly chronic obstructive pulmonary disease. ⁽³⁾ For primary spontaneous pneumothorax the incidence is 18 per 100,000 per year among men and 1.2 per 100,000 per year among women and the incidence of secondary spontaneous pneumothorax is 6.3 per 100,000 per year for men and 2.0 per 100,000 per year for women. ⁽⁶⁾ Diagnosis of spontaneous pneumothorax is always by clinical assessment of the patient where chest posteroanterior radiography view (PA) with lateral decubitus radiography and chest CT scan is to confirm it and to help in proper treatment decision. ⁽³⁾ Chest CT scan is the most accurate tool for estimation of pneumothorax size and provide good information of underlying lung pathology. ⁽⁶⁾ The corner stone of Pneumothorax treatment is to drain the intrapleural air collection, encourage pleural recovery, and prevention of recurrence. ⁽³⁾ Management of pneumothorax depends on type, size of pneumothorax and patient's symptom as well as condition. ⁽⁷⁾ Identification of any lung pathologies in patients considered having primary spontaneous pneumothorax define a group at higher risk of persisting or recurrent pneumothorax who would benefit from early surgical intervention. The most widely used guidelines for the treatment of spontaneous pneumothorax have been published by the American College of Chest Physicians (ACCP) and the British Thoracic Society (BTS). ⁽⁸⁾ Different guidelines and recommendations were populated for treatment of pneumothorax but most accepted is the American Collage of Chest Physician (ACCP) guidelines and the British Thoracic Society (BTS) recommendations. ^(9, 10, 11)

Methods:

Retrospective descriptive study conducted over period of 5 years from Jan. 2007 to Jan.2012. Eighty nine cases were admitted to

the thoracic division ward all patients were complaining of shortness of breath ,chest pain and tachycardia initially evaluated in the emergency department by clinical examination and chest x ray (P-A) and found to have pneumothorax rim >2cm using the Axel method* or pneumothorax >30% depending on Collins formula*. All cases were treated initially in the emergency department by chest thoracostomy tube size >24 F placed in the safe triangle using open method technique without trocar and covered by intravenous antibiotic ceftazidime 1gm x2 in addition to oxygen mask 4 l/mint as long as the chest tube was inserted. All cases received pain killer started by morphine 2-4 mg x4 subcutaneous injection then shifted to Revacod tablets (paracetamol 300mg+ codeine phosphate15mg) x3 per os. in the 2nd day of insertion. All cases started on incentive spirometer and respiratory physiotherapy after chest tube insertion and after surgery. Computed tomography of the chest was offered to all patients after clinical stabilization. Clinical follow-up included daily chest x-ray and inspection of the chest drainage system for air leakage. Air leak was defined in our study as persistent air bubbling in chest bottle more than 48 hours after chest tube drain insertion. After initial placement chest tube were connected to under water seal drainage system and negative pressure of -20 cm H₂O was administered using portable suction device for 4-5 days for primary spontaneous pneumothorax and up to 7-14 days for secondary spontaneous pneumothorax. Thoracoscopic bullectomy and apical pleurectomy was offered to patients with persisting air leakage for primary spontaneous pneumothorax despite proper chest tube management exceeding 5 days. In case of persisting secondary spontaneous pneumothorax exceeding 14 days of drainage chemical pleurodesis using 10% of iodopovidone or doxycycline was preferred and repeated twice. At failure of chemical pleurodesis surgery was also offered to patients suffering from secondary spontaneous pneumothorax. Recurrent pneumothorax was defined in our study as second occurrence of pneumothorax at the

same side after discharge of the patient from the hospital.

***Axel Method:** ⁽¹²⁾

Identification of 2 cm or more between lung margin and chest wall on roentgenogram

***Collins Formula:** ⁽¹³⁾

$$Y = 4.2 + (4.7 \times (A+B+C))$$

Y= pneumothorax size percentage

A= distance between lung apex and the uppermost point of the pleural cavity

B= distance between the midpoint of the upper half of collapsed lung to the hemi thorax

C= distance between the midpoint of the lower half of collapsed lung to the hemi thorax

Chest drain was managed as follow:

Chest tube sized >24F placed in the safe triangle in the affected side with tube tip directed to chest apex tube is fixed to skin by silk 0 stitch wound secured by gentleman knot ,tube is then connected to under water seal bottle. During admission chest drain was inspected daily for underwater seal level, intrathoracic tube placement, security of the draining system, type of discharge and signs of air leak. After complete lung expansion at plain chest x-ray and no air leakage or surgical emphysema was observed the chest tube was clamped for a period of 24 hours while observing clinical signs of recurrence followed by plain chest x-ray to ensure full expansion of the lung, before the chest tube was removed. The indication for surgical intervention in addition to the above mentioned conditions was extended to patients with recurrent ipsilateral pneumothorax, bilateral pneumothorax, first incidence of contralateral pneumothorax and social or occupational factors like for patients living in remote areas, pilots and divers. VATS was carried out during single lung ventilation using double-lumen endobronchial tube. Surgical resection of abnormal lung tissue like blebs or bullae was performed using staples with green cartridges and apical pleurectomy was routinely added to ensure apical pleurodesis. Chest tubes were managed as mentioned above. Open thoracotomy through an axillary approach was indicated in patients with huge or

multiple bullae and excessive adhesions following previous surgery or when excessive bleeding was anticipated together with poor visualization of operative field. Patients unfit for single lung ventilation were offered open surgery with spontaneous breathing. All surgical interventions were carried out as elective procedures.

Results:

A total of 89 patients (81 males and 8 females ,median age 50 years ,range 14-85years) were admitted to this ward between January 2007 and January 2012.All patients initially presented to the emergency department with clinical signs of chest pain ,shortness of breath and tachycardia.73 patients (82.1%)were classified as primary spontaneous pneumothorax and the remaining 16 cases(17.9%)had secondary spontaneous pneumothorax. smoking history was found in 77 cases,13patients with secondary spontaneous pneumothorax suffered from COPD and 3 patients of this group from lung fibrosis .See Table I and Table II 51 of 89 patients (57.3%) presented with right-sided spontaneous pneumothorax, 36 patients (40.5%) had left- sided spontaneous pneumothorax and 2 patients had bilateral spontaneous pneumothorax. 27 patients received chest tube drainage connected to under water seal as a stand-alone intervention without the need for any further intervention. 19 patients required negative suction as a part of their chest tube management, 9of these patients were classified as primary spontaneous pneumothorax .Chemical pleurodesis was successfully administrated in 4 patients with persisting secondary spontaneous pneumothorax. 39 patients underwent operative treatment. 15pateints where indicated for persisting primary spontaneous pneumothorax despite negative suction , 16 patients were indicated due to recurrent primary spontaneous pneumothorax and 3 patients underwent surgery after failed chemical pleurodesis for secondary spontaneous pneumothorax. The remaining 5 patients were operated on for bilateral primary spontaneous pneumothorax or due to remote residence without excess to medical service. 37 of 39 patients under went minimally invasive bullectomy and epical

pleurectomy and open procedure were offered to 2 patients using posterolateral thoracotomy for bullectomy and apical pleurectomy. Algorithm of treatment in relation to method, conservative or operative is shown in Figure (1), Figure (2) shows treatment in relation to clinical type of spontaneous pneumothorax. Hospital stay varied from 3-12 days for primary spontaneous pneumothorax and from 5-32

days for secondary spontaneous pneumothorax. Recurrence for conservative chest tube only treatment was noticed in 18 cases (36%) out of (50) cases and for operative treatment showed recurrence in single case (2.5%) out of (39) cases. Recurrence in spontaneous pneumothorax was noticed in 19 cases (21.3%) out of (89) cases. No intraoperative or in ward mortality occurred in our study.

Table I: Demographic Data.

Age	from (14) years to (85) years	median (50) years
	Median age for Primary spontaneous pneumothorax (24)years	
	Median age for Secondary spontaneous pneumothorax (56) years	
Gender	(81) males	(8) females
Smoking history	(77) cases	
COPD	(13) cases presented with Secondary spontaneous pneumothorax	
Lung fibrosis	(3)cases presented with Secondary spontaneous pneumothorax	

Table II: Types of spontaneous pneumothorax with gender recognition.

	total	male	Female
Spontaneous pneumothorax	89	81	8
Primary spontaneous pneumothorax	73	66	7
Secondary spontaneous pneumothorax	16	15	1

Fig (1): Treatment pathway of Spontaneous pneumothorax in relation to management method

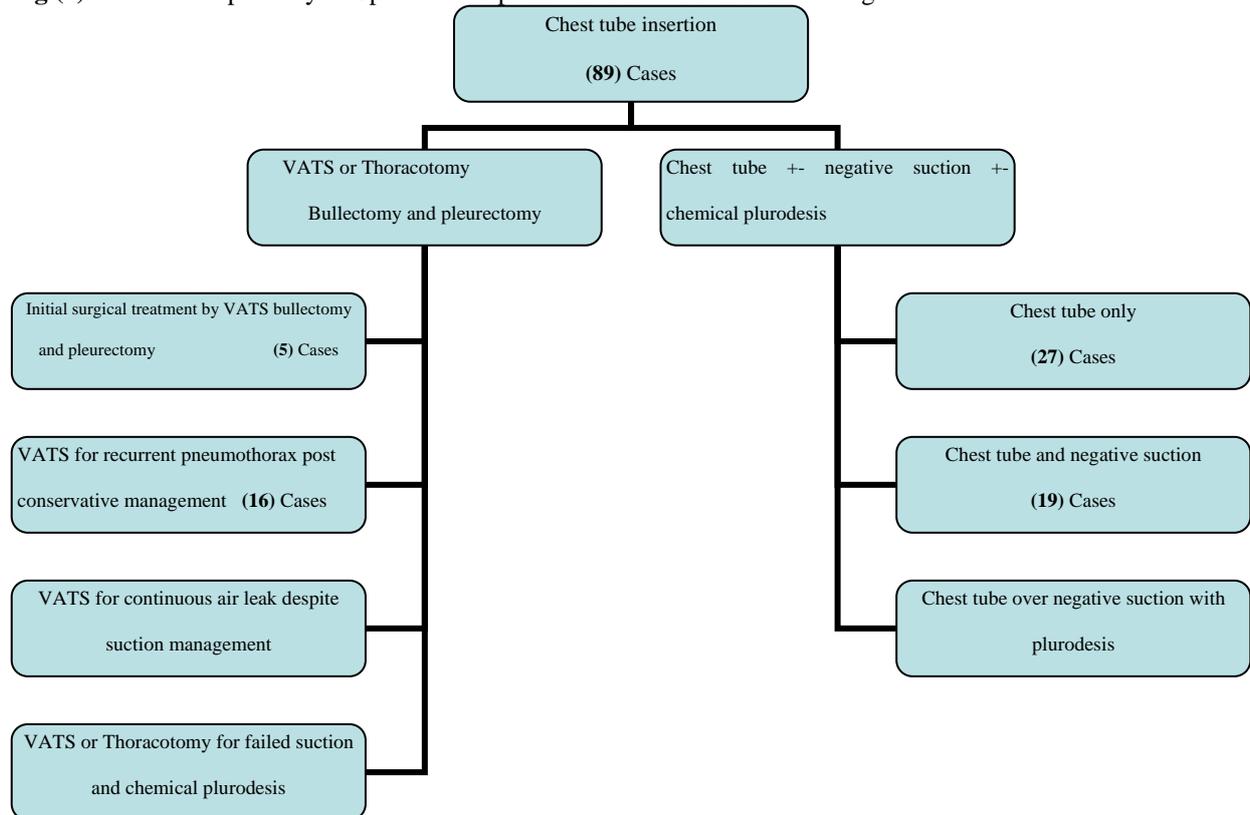
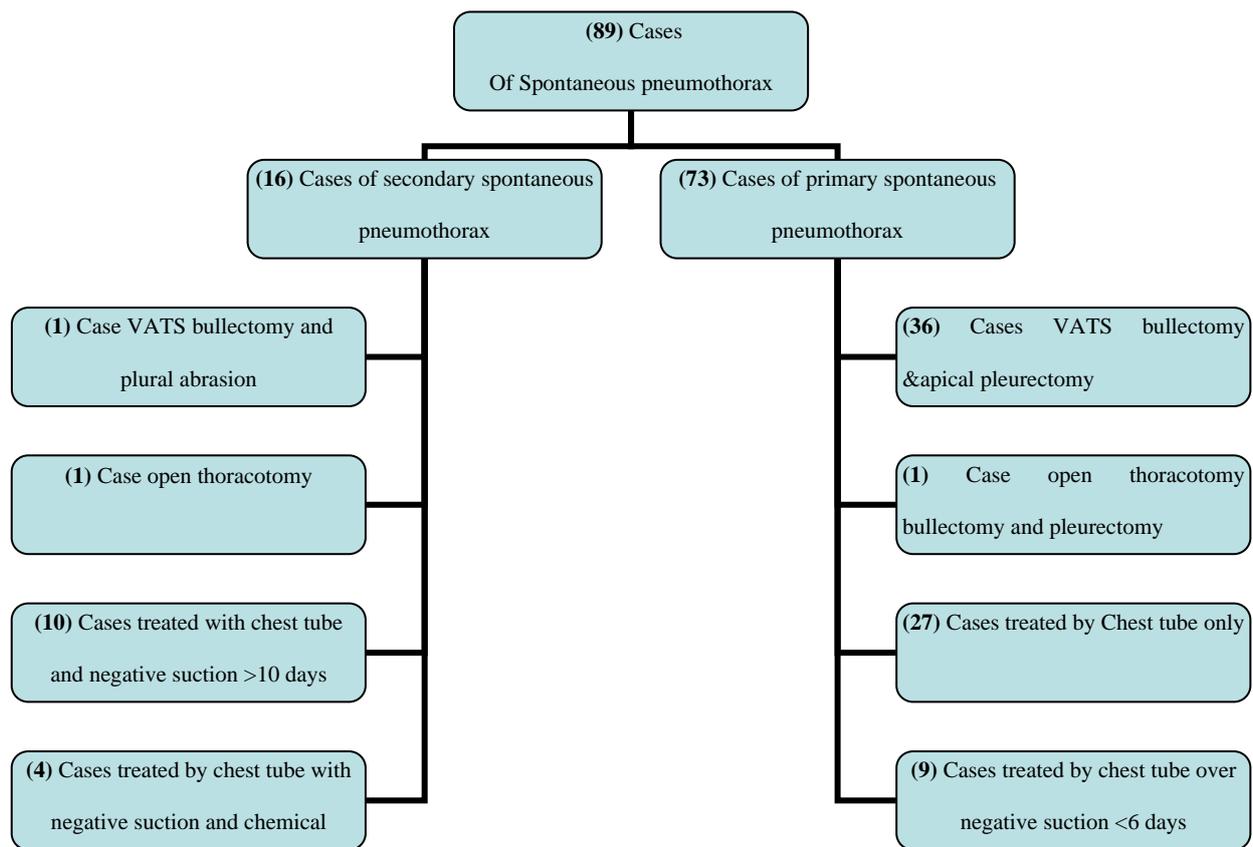


Fig (2): Treatment pathway of Spontaneous pneumothorax in relation to clinical type.



Discussion:

Spontaneous pneumothorax is a well-recognized medical condition with a variety of treatment options according to type, size and predisposing factors. Gupta et al. have analyzed the incidence of spontaneous pneumothorax in the United Kingdom and demonstrated a higher incidence of primary spontaneous pneumothorax as compared to secondary spontaneous pneumothorax and clear predominance of male gender. ⁽¹⁴⁾ In accordance with these figures 82% of patients in our study presented with primary spontaneous pneumothorax with a predominance of the male gender of 91%. Like in other studies (Bense) ⁽¹⁵⁾ smoking history was found in 86.5% of patients in our study. As the results found by Chan et al. also our study showed that the right side chest was affected in 57.3% of cases and the left side in 40.5% of cases. ⁽¹⁶⁾ The age of patients suffering from spontaneous pneumothorax is different in primary and secondary disease. In our study the mean age of all patients was 50 years with a median

age of 24 years with the diagnosis of primary spontaneous pneumothorax and 57 years with secondary spontaneous pneumothorax. This observation was also noticed by Takuya Onuki et al. in a recent publication. ⁽¹⁷⁾ As a matter of fact COPD was presented in 13 of 16 patients (81.2%) of our patients with secondary spontaneous pneumothorax, which is in accordance with reports by Light et al. ⁽¹⁸⁾ All patients included in our study were treated by chest tube drainage as needle aspiration was not practiced in our institute which was also not popular method in similar published studies. ^(16, 19, 20) Although the guidelines of the British Thoracic Society recommend the use of small bore tubes for first episode spontaneous pneumothorax, a large bore chest tube of 24F was used in all patients in our study. This approach was established following the philosophy, that the degree of air leakage cannot be anticipated before chest tube placement, particularly without detailed information regarding the classification of the disease and potential lung abnormalities in the presence of secondary spontaneous pneumothorax

.Anyway, based on the age of the patient at first presentation primary spontaneous pneumothorax may be anticipated in patients under age of 30 years and small bore tubes may be used in these patients in order to be less invasive. ^(9, 10) Treatment strategies of spontaneous pneumothorax in our study were based on recommendations from different international guidelines. The use of suction to the closed chest drainage system was influenced by BTS guidelines, however the strategy of clamping the chest tube before its removal is recommended controversially in the literature. ^(8, 9, 10, 21, 22) The quite long hospital stay of more than 3 week in patients treated for secondary spontaneous pneumothorax may be explained by our intention to achieve full lung expansion and avoid surgical intervention in these patients. Similar results were noticed by Lee et al. in their study. ⁽²³⁾ Recurrence in patients diagnosed with primary spontaneous pneumothorax in our study treated with chest tube drainage was (36%) resembling different international publications mentioned by Al-Qudah et al. ⁽²⁴⁾ Notwithstanding the nil recurrence in case of secondary spontaneous pneumothorax this explained by more aggressive treatment either by using doxycyclin or iodopovidone solution till the surgical option implicated as mentioned by JWM Chan et al. ⁽²⁵⁾ Following ACCP guidelines we indicated surgery in 39 of 89 patients (43.8%) offering minimally invasive surgical management to 37 of these patients. Early conversion to open thoracotomy in presence of excessive adhesions or obscure anatomy saves operation time is in accordance with other authors. (Passlick and Cole et al). ^(10, 26, 27) Recurrences after surgical intervention within the follow-up period of 2 years are very rare and refer to only one patient after VATS approach similar to result found by Yim et al. ⁽²⁸⁾ Limitations of our study are the retrospective in nature, the absence of national prospective randomized trials and the limited number of cases.

Conclusion:

Despite the availability of different international guidelines for the management

of primary and secondary spontaneous pneumothorax the information from different established sources may be used in order to define institutional algorithms. Chest Tube drainage still represents the first line measure of spontaneous pneumothorax and may be used as definitive conservative treatment, however balancing about one third of recurrence after conservative against high success rates after surgical management should be considered.

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