

Pneumothorax in the Emergency Room: personal caseload

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SUMMARY: Pneumothorax in the Emergency Room: personal caseload.

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The aim of this study was to collect information on the incidence, pathophysiology, treatment and mortality of pneumothorax in the Emergency Room. Pneumothorax is classified as spontaneous (primary, secondary or catamenial) or traumatic (iatrogenic or secondary to a blunt or penetrating chest injury).

Between January 2007 and December 2009, 102 patients with pneumothorax were seen in our Emergency Room. Their records were examined and their data collected retrospectively. The type and side of the pneumothorax and age, sex, incidence and mortality were analyzed. The cases, involving 93 males and 9 females, broke down as follows: 68 spontaneous (66.7%), 33 traumatic (32.3%) and one iatrogenic (0.98%). The mean age was 47.3 (range 12-99); the incidence was 0.10%. There were no deaths due to pneumothorax in the Emergency Room. Traumatic pneumothorax was associated with blunt chest trauma, pleural effusion, hemothorax, cranial trauma, fractured collarbone, upper and lower limb fracture, pelvic fracture, vertebral and spinal trauma, sternum fracture and abdominal trauma.

Pneumothorax is a common clinical problem. A multidisciplinary approach is essential to reduce the risk of morbidity and mortality. The incidence of pneumothorax in the Emergency Room was similar to that reported in the literature, while mortality data cannot be compared due to the lack of published studies.

RIASSUNTO: Pneumotorace in Pronto Soccorso: casistica personale.

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Lo scopo di questo studio è quello di reperire informazioni su incidenza, fisiopatologia, trattamento e mortalità per pneumotorace nel reparto di Pronto Soccorso. Lo pneumotorace si classifica in spontaneo (primario, secondario e catameniale) e traumatico (secondario a trauma toracico chiuso, a trauma penetrante e iatrogeno).

Tra gennaio 2007 e dicembre 2009, sono stati osservati nel nostro Pronto Soccorso 102 pazienti con pneumotorace. I dati di tutti i pazienti sono stati retrospettivamente raccolti: tipo di pneumotorace, lato, età, sesso, incidenza e mortalità. Abbiamo registrato 102 casi di pneumotorace (93M e 9F): 68 spontanei (66.7%), 33 traumatici (32.3%) e uno iatrogeno (0.98%). L'età media dei pazienti era di 47.3 (range 12-99); l'incidenza di pneumotorace è stata dello 0.10%. Nessun decesso si è verificato durante la permanenza in Pronto Soccorso. Lo pneumotorace traumatico era variamente associato a trauma toracico chiuso, versamento pleurico, emotorace, trauma cranico, frattura della clavicola, frattura degli arti inferiori e superiori, frattura del bacino, traumi vertebrali e spinali, fratture sternali e traumi addominali.

Lo pneumotorace rappresenta un comune problema clinico. L'approccio multidisciplinare è fondamentale per ridurre il rischio di morbilità e mortalità. I nostri dati relativi all'incidenza di pneumotorace in Pronto Soccorso sono sovrapponibili a quelli presenti in letteratura, mentre i dati sulla mortalità non sono comparabili per la scarsità di studi attualmente presenti in letteratura.

KEY WORDS: Pneumothorax - Incidence - Mortality.
Pneumotorace - Incidenza - Mortalità.

Introduction

Pneumothorax (PNX) is the presence of air (or gas) in the pleural space following an injury to the lung

parenchyma and causes the loss of the normal negative intrathoracic pressure, resulting in the total or partial collapse of the lung. It may be spontaneous or so-called acquired. Spontaneous pneumothorax is classified as primary (where there is no apparent lung disorder), secondary (in the presence of existing lung diseases, such as chronic obstructive pulmonary disease or COPD, cystic fibrosis, etc.) or catamenial, occurring in conjunction with menstrual periods. Acquired pneumothorax may be traumatic (secondary to a blunt or penetrating chest

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TABLE 1 - CLASSIFICATION OF PNEUMOTHORAX.

<p><i>Spontaneous pneumothorax</i></p> <ul style="list-style-type: none"> ➤ <i>Primary: no apparent underlying lung disease</i> ➤ <i>Secondary: clinically apparent underlying disease (COPD, cystic fibrosis, etc.)</i> ➤ <i>Catamenial</i> <p><i>Acquired pneumothorax</i></p> <ul style="list-style-type: none"> ➤ <i>Iatrogenic: secondary to transthoracic and transbronchial biopsy, central venous catheterization, pleural biopsy, thoracentesis</i> ➤ <i>Traumatic: secondary to blunt or penetrating chest injury</i>

injury) or iatrogenic (secondary to a transthoracic or transbronchial biopsy, central venous catheterization, pleural biopsy, thoracentesis, etc.) (Tab. 1).

The pathophysiological mechanism underlying its development is still subject to debate, however the distribution of air in the pleural space enables it to be classified as:

- *open*, if there is an open chest wall injury with continuous and constant passage of air;
- *closed*, if the passage of air through the visceral pleura is temporary;
- *tension pneumothorax*, if there is a continuous one-way flow of air which is unable to leave; this is an extremely dangerous condition which if not treated in time can cause mediastinal shift towards the unaffected lung, severely affecting respiratory function and with consequences for the circulation that may prove fatal.

Spontaneous pneumothorax (SP) is normally unilateral (right or left); bilateral cases are rare. It has a tendency to recur at a later date, usually within two years of the first episode. It is called spontaneous because most cases occur in subjects at rest, only rarely following physical effort. It normally affects males (7.4-18 cases per 100,000 people annually against 1.2-6 cases per 100,000 in females). While primary SP normally affects the young, the long-limbed and smokers, the incidence of secondary SP seems to increase with age.

The exact pathogenesis is still unclear. Most authors believe the main cause is a rupture of small subpleural bullae generally located in the lung apices (1,2). These arise through an infectious process and usually pass unobserved, but can cause fibrosis, increasing pleural porosity and enabling air loss into the pleural space. Other probable causes include genetic predisposition, anatomic changes to the bronchial tree, low Body Mass Index (BMI) and connective tissue diseases (3). Traumatic pneumothorax is almost always secondary to a blunt chest injury with fractured ribs or to a penetrating injury (knife or gun shot

wound), while iatrogenic pneumothorax is the result of invasive diagnostic procedures (transthoracic needle biopsy, central venous catheterization, thoracentesis, pleural biopsy or mechanical ventilation).

A recent Israeli study found an incidence of 60.3% for spontaneous pneumothorax (primary 30%, secondary 70%), 33.6% for traumatic, and 18.1% for iatrogenic (transthoracic needle biopsy 24%, central venous catheterization 22%, thoracentesis 20%, transbronchial lung biopsy 10%, pleural biopsy 8%, and positive pressure mechanical ventilation 7%) (1,3).

Diagnosis is based on clinical signs (sudden chest pain, dyspnea, reduced or absent tactile fremitus and abnormal breath, altered sounds, hypotension, tachypnea and tachycardia and, in severe cases, cyanosis) and instrumental procedures (standard chest X-ray and, for small or traumatic pneumothorax, chest CT).

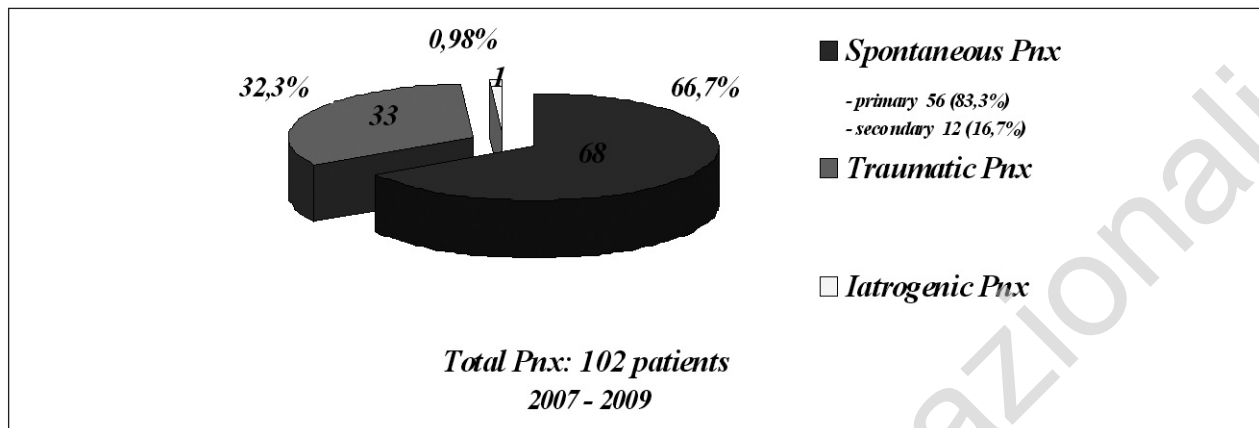
Management can be conservative (observation, oxygen therapy, simple manual aspiration, small catheter drainage), intermediate (chest tube drainage, talc pleurodesis, pleural abrasion), or invasive (VATS with bullectomy, pleural abrasion or partial pleurectomy, thoracotomy) (1,4).

The aim of our study was to evaluate the incidence of and mortality due to pneumothorax in the Emergency Room, discussing the processes enabling the suitable and modern treatment of this condition. This data review aimed to evaluate various parameters (incidence, mortality, aetiology, age, sex, location and recurrence) in a level II Emergency Department in a hospital in the South of Italy.

Patients and methods

We evaluated the cases of pneumothorax seen between January 2007 and December 2009 in the Admissions and Emergencies with Short-Term Observation Medicine and Surgery Unit, "G. Martino" University Hospital, Messina. In this period we saw 102 cases of pneumothorax, of which 33 were traumatic (32.3%), 1 iatrogenic (0.98%) and 68 spontaneous (66.7%).

TABLE 2 - PNEUMOTHORAX (PNX), PERCENTAGE BY ETIOLOGY: 102 CASES, OF WHICH 33 TRAUMATIC (32.3%), 1 IATROGENIC (0.98%) AND 68 SPONTANEOUS (66.7%), THE LATTER CONSISTING OF 56 PRIMARY (83.3%) AND 12 SECONDARY (16.7%).



Spontaneous pneumothorax

There were 56 (83.3%) primary and 12 (16.7%) secondary cases (Tab. 2). The age range was 18-99, with 64 cases in men and four in women. Only four cases were recurrences (Fig. 1), it being the first occurrence in all other patients. The symptoms were chest pain at rest or after physical exercise, dyspnea, tachycardia and tachypnea. Chest examination revealed reduced or absent tactile fremitus, altered sounds and no vesicular murmur in the affected hemithorax.

Traumatic pneumothorax

Twenty-nine cases were seen in males, and four in females. The age range was 12-89 years. Signs and symptoms depended on the type and severity of the trauma.

Instrumental examinations (chest X-ray, ECG, blood gas analysis) were used in cases of trauma or multiple trauma.

Iatrogenic pneumothorax

The one case involved a 62-year-old woman.

The pneumothorax was one-sided in all cases (right or left) (Figs. 2-3), except one bilateral case of traumatic pneumothorax. Five patients presented tension pneumothorax. The second level diagnostic investigation was multislice CT in all cases (5).

Our approach was as recommended in the *Advanced Trauma Life Support* (ATLS) guidelines for all patients, especially those with multiple trauma (6).

Results

During the study period 100,887 patients were treated in the Emergency Room: 34,284 in 2007, 33,895 in 2008 and 32,708 in 2009.

In 2007 there were 23 spontaneous (of which 20 primary [mean age 50.8 yrs] and 3 secondary [mean age 80.3 yrs]), 14 traumatic (mean age 48.6 yrs) and 1 iatrogenic cases of pneumothorax (total 38).

In 2008 there were 25 spontaneous (of which 20 primary [mean age 39.6 yrs] and 5 secondary [mean age 57.8 yrs]) and 10 traumatic (mean age 37.6 yrs) cases (total 35).

In 2009 there were 20 spontaneous (of which 16 pri-



Fig. 1 - Chest X-ray: recurrent right pneumothorax.

mary [mean age 29.5 yrs] and 4 secondary [mean age 43.2 yrs]) and 9 traumatic cases (mean age 33.1 yrs) (total 29).

These characteristics are summarized in Table 3.

Incidence as percentage on total Emergency Room visits

In 2007, pneumothorax accounted for 0.11% of all visits to the Emergency Room, breaking down to 0.07% for spontaneous pneumothorax (0.058% primary and 0.009% secondary), 0.04% for traumatic pneumothorax, and 0.003% for the single case of iatrogenic pneumothorax.

In 2008 pneumothorax accounted for 0.10% of all visits to the Emergency Room, breaking down to 0.07% for spontaneous pneumothorax (0.059% primary and 0.015% secondary), and 0.03% for traumatic pneumothorax.



Fig. 2 - Chest X-ray: left pneumothorax.



Fig. 3 - Chest X-ray: left pneumothorax.

In 2009 pneumothorax accounted for 0.09% of all visits to the Emergency Room, breaking down to 0.07% for spontaneous pneumothorax (0.049% primary

and 0.012% secondary), and 0.27% for traumatic pneumothorax.

These incidences are summarized in Table 4.

The 33 cases of traumatic pneumothorax were associated with: blunt chest trauma (25 patients), fractured ribs (20 patients), pleural effusion (14 patients), cranial trauma (9 patients), acromioclavicular joint trauma (4 patients), upper limb fracture (6 patients), pelvic fracture (2 patients), spinal injury (3 patients), lower limb fracture (2 patients), fractured sternum (1 patient) and abdominal trauma (6 patients). The latter presented a serious clinical picture requiring urgent surgery for liver segment V injury (1 case), ruptured spleen (3 cases), and hemoperitoneum following a mesenteric injury (2 cases).

No predominance of one side over the other was observed in the study period. However, the incidence of primary spontaneous pneumothorax was far greater than that of secondary.

Mortality for pneumothorax in our Emergency Room over the study period was zero.

Discussion

Patients with suspected spontaneous or traumatic pneumothorax are treated according to the ATLS guidelines: primary and secondary evaluations are carried out, followed by coordination of the diagnostic and therapeutic procedures. The primary evaluation is carried out according to ABCDE (A airway, B breathing, C circulation, D disability, E exposure) enabling fast (2-3 minutes) classification of the circulatory, respiratory and neurological condition of patients with multiple traumas, evaluation of their stability, and a decision on the diagnostic examinations to be performed immediately in the Emergency Room and subsequent therapeutic strategy. Just one altered clinical parameter (circulatory or respiratory) is sufficient to classify the patient as unstable.

The secondary evaluation consists of a short medical history (SAMPLE: (S symptoms/signs, A allergy, M medications, P past illness, L last meal, last tetanus, E events) and a quick head-to-toe physical examination.

This retrospective analysis of accesses to a II level Emergency Department in the South of Italy in 2007-2009 evaluated the incidence and mortality of patients with pneumothorax, calculated as a percentage of all patients attending the Emergency Room, and the percentages of patients with spontaneous, traumatic and iatrogenic pneumothorax were extrapolated. Age, sex, incidence, localization, recurrence and mortality were all evaluated. The incidence of total spontaneous and traumatic pneumothorax seen in this study was similar to literature reports, but differed in the proportions of

TABLE 3 - CHARACTERISTICS OF PNEUMOTHORAX (PNX) PATIENTS.

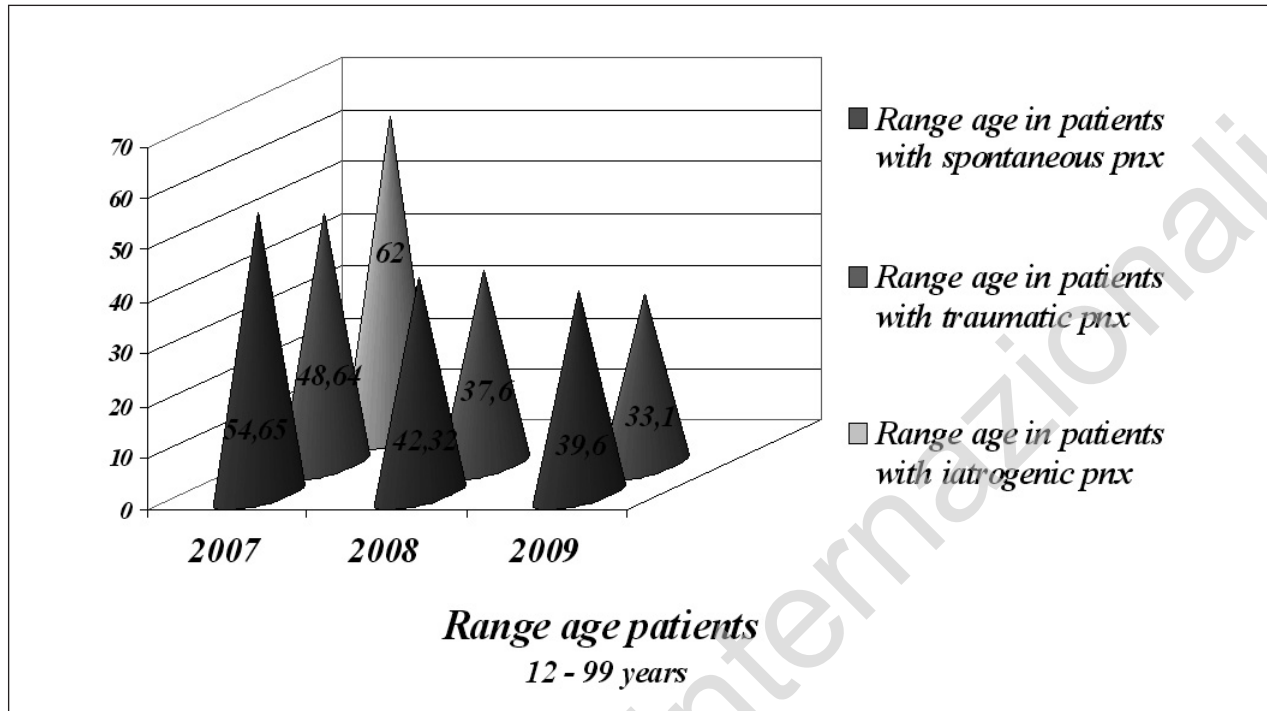
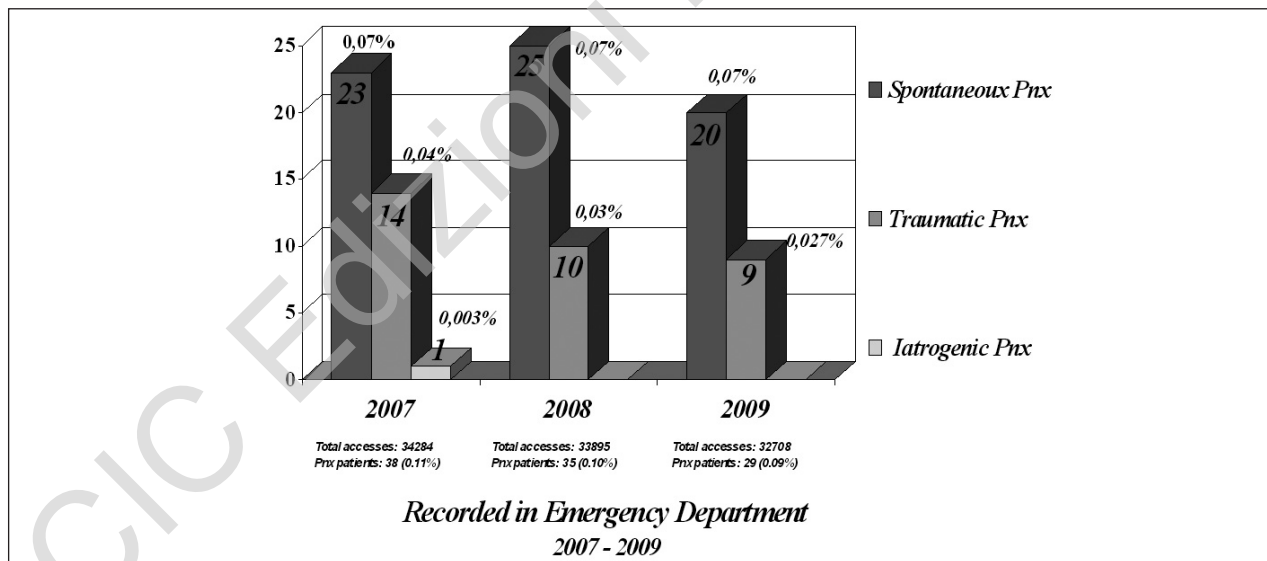


TABLE 4 - PERCENTAGE OF PATIENTS WITH PNEUMOTHORAX (PNX) AGAINST ALL EMERGENCY ROOM PATIENTS.



primary, secondary and iatrogenic cases. The mortality for this condition over the study period was zero, but this can not be compared against the literature due to the lack of data.

The incidence of primary spontaneous pneumothorax was constant over the three-year period, and was considerably higher than that of secondary spontaneous pneumothorax. Unsurprisingly, the mean

age for primary cases was lower than that for secondary cases. Cases in males were by far the most common (93 men versus 9 women), while there was no predominance of one side over the other. The incidence of traumatic pneumothorax decreased slightly over the study period. The most serious cases were chest traumas associated with abdominal, cranial and spinal traumas.

Conclusions

The various forms of pneumothorax represent a life-threatening medical-surgical emergency. The physician's and facility's ability to make an immediate diagnosis and put in place adequate procedures to reduce or elim-

inate mortality is fundamental.

While the approach is multidisciplinary, the first facility involved in the diagnosis and treatment of this condition is undoubtedly the Emergency Room, prompting us to evaluate its incidence and mortality.

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