AIM OF THE WORK

The aim of this work is to conduct a five year (1st of January 2008-31st December 2012) retrospective study of the cases of pneumothorax among pediatric intensive care unit admissions in Alexandria University Children's Hospital .

SUBJECTS AND METHODS

This retrospective study was conducted in Alexandria University Pediatric Intensive care unit (PICU) which is located in a tertiary care teaching hospital (El-shatby Children`s Hospital belonging to Alexandria University Hospitals).

The pediatric hospital is 220 beds with a 9 bedded intensive care unit. The range of yearly admissions to PICU is 200-300 cases. Five yearly admission ranging 1200-1300 cases. The study was conducted after the approval of the study by Alexandria University Ethical Committee.

An informed consent was obtained from the patient`s parents or legal guardians concerning all the procedures applied in PICU and publishing data.

All files of patients admitted to Alexandria University Pediatric Intensive Care unit from 1st of January 2008 to 31st December 2012 were reviewed (n=1298) and the following data were collected:

- Personal characteristics:
  1. Age of the patient in months
  2. Sex of the patient
  3. Date of admission
  4. Weight of the patient
  5. Site of referral (emergency or ward)
  6. Final diagnosis
  7. Fate
- Pediatric Index of Mortality (PIM2 score) on admission
- Pediatric Logistic Organ Dysfunction score (PELOD score) on day 1
- Length of stay (LOS) in days
- Mechanical ventilation:
  1. Need for mechanical ventilation
  2. Mode of ventilation
  3. Duration of mechanical ventilation
  4. Mean ventilator settings

- Daily recorded laboratory investigations:
  1. C- reactive protein (CRP).
  2. White blood cell count (WBC).
  3. Percentage of neutrophils.
  4. Presence of left shift.
  5. Arterial blood gases (ABG).

Files of patients who developed pneumothorax were reviewed and the following data were collected:

- Etiology of pneumothorax
- Mechanical ventilation: in ventilator associated pneumothorax
  1. Mode of mechanical ventilation just before diagnosis of pneumothorax
  2. Ventilator setting at the time of development of pneumothorax

- Pediatric Logistic Organ Dysfunction score (PELOD score) on pneumothorax day.
- Laboratory investigations recorded on pneumothorax day:
  1. C- reactive protein (CRP)
  2. White blood cell count (WBC)
  3. Percentage of neutrophils
  4. Presence of left shift
  5. Arterial blood gases (ABG)
- First tool used for diagnosis of pneumothorax when first suspected
- Procedures and results of pneumothorax management.

Diagnosis of pneumothorax:

1- Clinical diagnosis:

Pneumothorax can be difficult to be recognized in a critically ill patient. Physical examination and clinical signs and symptoms are unreliable and nonspecific, but may raise clinical suspicion for pneumothorax:

- Decreased breath sounds on one affected side.
- Pulsus paradoxus.
- Hemodynamic instability with tachycardia, hypotension and cyanosis.
- Contralateral tracheal deviation.
- Sudden increase in airway pressures (peak and plateau) in a mechanically ventilated patient.[57]

2- Radiological diagnosis:

The first-line imaging modalities used to identify a pneumothorax are chest radiography and computed tomography (CT). While some investigators have reported using ultrasound to diagnose pneumothorax, particularly in bedridden patients, ultrasound is not a preferred modality for imaging the chest.

- **Chest radiographs**:

The main feature of a pneumothorax on a chest radiograph is a white visceral pleural line, which is separated from the parietal pleura by a collection of gas. In most cases, no pulmonary vessels are visible beyond the visceral pleural line (the collection of pleural gas is avascular). A pneumothorax may be identified on an upright, supine, or lateral decubitus chest radiograph. The lateral decubitus view tends to be the most sensitive, while the supine view is the least sensitive.[58]

- **Upright** – In an upright patient with a pneumothorax, most pleural gas accumulates in an apico-lateral location. The visceral pleural line appears either straight or convex towards the chest wall. As little as 50 mL of pleural gas may be visible on a chest radiograph. Although a pneumothorax is generally accompanied by a considerable loss of lung volume, the collapsed lung preserves its transradiancy because hypoxic vasoconstriction diminishes the blood flow to the collapsed lung.[58]

- **Supine** – In a supine patient with a pneumothorax, most pleural gas accumulates in a sub-pulmonic location. Gas in this location outlines the anterior pleural reflection, the costo-phrenic sulcus (creating the "deep sulcus" sign), and the anterolateral border of the mediastinum . In rare instances, pleural gas can also accumulate in the phrenico-vertebral sulcus. The visceral pleural line may be seen at the lung base and has a concave contour. Approximately 500 mL of pleural gas are needed for definitive diagnosis of a pneumothorax on a supine chest radiograph. The transradiancy and size of the entire hemithorax may be increased on the side of a pneumothorax.(58)

- **Lateral decubitus** – A pneumothorax can be most easily detected with a lateral decubitus view. In this position, most pleural gas accumulates in the non-dependent lateral location. The visceral pleural line appears either straight or convex towards the chest wall. As little as 5 mL of pleural gas may be visible on a lateral decubitus chest radiograph. (58)

- **Computed tomography of the chest (CT chest)**:

Pneumothorax is identified by nondependent lucency over the lower anterior thorax.(59) It is indicated for differentiating pneumothorax from complex bullous lung diseases and when plain chest radiograph is obscured by surgical emphysema. It allows definitive diagnosis of other pleural and lung pathologies and should be considered early when doubt exists. Overall, it is the gold standard for such imaging but is difficult and potentially dangerous in the critically ill patient. (39)

Pneumothorax can be classified into tension and non- tension pneumothorax where, **Tension pneumothorax** is a critical condition that most often results from iatrogenic trauma in mechanically ventilated patients. Tension pneumothorax results from check – valve pleural defect that allows air to enter but not to exit the pleural space. This leads to pleural air collection that has a pressure exceeding atmospheric pressure, during at least a portion of the respiratory cycle, causing complete collapse of the underlying lung and impairing venous return to the heart. Clinically patients present with tachypnea, tachycardia, cyanosis and hypotension. Radiologically, the involved hemi-thorax is expanded and hyper-lucent, with a medially retracted lung, ipsilateral diaphragmatic depression or inversion and contra-lateral mediastinal shift. Contra-lateral mediastinal shift from pneumothorax does not invariably indicate tension, since a relative inequality in the degree of negative intra-pleural pressure can produce shift in the absence of tension. Therefore, tension pneumothorax remains a clinical diagnosis. (59)

Statistical Analysis of Data

Data were analyzed using the Statistical Package for Social Sciences (SPSS ver.20 Chicago, IL, USA). The distributions of quantitative variables were tested for normality using Kolmogorov-Smirnov test. If it reveals normal data distribution, parametric tests was applied. If the data were abnormally distributed, non-parametric tests were used.

Qualitative data were described using number and percent. Quantitative data were described using Range (minimum and maximum), mean, standard deviation and median.

Comparison between different groups regarding categorical variables was tested using Chi-square test. When more than 20% of the cells have expected count less than 5, correction for chi-square was conducted using Fisher's Exact test.

For normally distributed data, comparison between two quantitative variables were done using independent t-test. For abnormally distributed data, comparison between two quantitative variables were done using Mann Whitney test.

Logistic regression was done to detect the individual contribution of various significant predictors on occurrence of pneumothorax . Logistic regression model was built with adjusted odds ratio for predicting occurrence of pneumothorax.

Survival analysis was done for the studied groups (group 1,2) using length of survival till the end of study and the fate as an outcome. The **Kaplan Meier survival curve** was performed to demonstrate if there is a significant difference in the cumulative freedom from death between the two groups.

In all statistical tests, $p \leq 0.05$ was adapted as a level of statistical significance.

RESULTS

This study is a retrospective study including 1298 patients admitted to Alexandria University Pediatric Intensive Care unit in 5 years starting from 1st of January 2008 to 31st of December 2012.

This study included 1298 cases, 135 (10.4%) patients developed 151 episodes of pneumothorax (group 1) and 1163 (89.6%) patients did not develop pneumothorax (group 2).

Table (2) showed yearly admission and mortality in Alexandria University Pediatric Intensive Care Unit from 1st of January to 31st December 2012.

Table (3) showed the comparison of personal and clinical criteria between cases with and without pneumothorax on admission. The results showed a significant statistical difference between the two groups as follows: younger age, lower weight, higher PIM2 Score and PELOD Score on admission, longer LOS, diagnostic criteria and higher mortality rate among pneumothorax group (p <0.001, <0.001,<0.001,0.001,<0.001, <0.001,<0.001 respectively).While both groups showed no significant statistical differences regarding sex and referral site (p 0.100, 0.841 respectively).

Table (4) showed the clinical characters of pneumothorax episodes as regards etiology, site, severity, first diagnostic tool on suspicion, management and any associated air leak syndromes.

Table (5) showed the comparison between cases with and without pneumothorax as regards being mechanically ventilated, duration of mechanical ventilation, mode and mean settings of ventilator. The results showed a significant statistical difference between the two groups as regards being mechanically ventilated, longer duration of ventilation ,higher ventilator settings (PEEP , PIP, rate , FiO_2, mean and delta P) and SIMV/PS as most common mode of ventilation associated with pneumothorax (p <0.001, <0.001, <0.001, <0.001,0, <0.001, <0.001, 0.020, 0.017, <0.001 respectively).

Table (6) showed the comparison between cases with and without pneumothorax as regards laboratory investigations (CRP, ABG, WBC count and percentage of neutrophils) on admission. The results showed statistically significant difference between the two groups as regards pH, $PaCO_2$, PaO_2,and HCO_3 (p 0.005, 0.006, 0.007, <0.001, respectively) .While both groups showed no significant statistical difference regarding CRP, WBC count, % of neutrophils and , SaO_2 (p 0.504, 0.839, 0.946, 0.466 respectively).

Table (7) showed comparison between PELOD score and laboratory investigations (CRP, ABG WBC count and percentage of neutrophils) on admission and on diagnosis of pneumothorax in cases with pneumothorax (group1). The results showed significant statistical difference as regards PELOD score, pH, $PaCO_2$, PaO_2, SaO_2 (p <0.001, <0.001, <0.001, 0.001respectively).While there was no statistically significant difference as regards CRP, WBC count, percentage of neutrophils and HCO_3 (p 0.064, 0.074, 0.946, 0.507 respectively).

Table (8) showed the personal and clinical characteristics of cases with respiratory and non-respiratory diseases on admission. The results showed significant statistical difference between the two groups as regards age, weight, PIM2 score, PELOD score, being mechanically ventilation, and occurrence of pneumothorax (P <0.001, 0.005, 0.004, <0.001, <0.001, <0.001, respectively). While there was no statistically significant difference as regards sex, LOS, fate and duration of mechanical ventilation (P 0.126, 0.151, 0.336, 0.061, respectively).

Table (9) showed comparison between cases with respiratory and non-respiratory diseases as regards laboratory investigations on admission. The results showed significant statistical difference as regards pH, $PaCO_2$, PaO_2 and HCO_3 (P<0.001, <0.001, 0.005, <0.001, respectively). The results showed no significant statistical difference as regards CRP, WBC count and SaO_2 (P 0.813, 0.933, 0.218, respectively)

Table (10) revealed the predictors of pneumothorax using multiple logistic regression analysis. The following variables were found to be significantly predicting the occurrence of pneumothorax: PIP (Exponent B=0.360, CI 1.284-1.602), P_aCO_2 on admission (Exponent B = 0.081, CI 0.864-0.984) HCo_3 on admission (Exponent B=0.129, CI 1.002-1.291 and FiO_2 (Exponent B = 0.044, CI 1.003-1.088).

Figure (3) showed the Kaplan Meier survival curve of cases with and without pneumothorax regarding the cumulative hazard of mortality with length of hospital stay (mortality in sense to time). By testing the equality of survival distributions for both groups using Log Rank test, a higher survival probability was found among the group which did not develop pneumothorax than those with pneumothorax (p< 0.001).

Table (2): Yearly admissions and mortality rate of cases admitted to Alexandria University Pediatric Intensive Care unit from 1st of January 2008-31st December 2012

Year	No of admitted cases	Mortality n(%)
2008	273	49 (17.94%)
2009	203	52 (25.6%)
2010	265	38 (14.34%)
2011	275	22 (8.00%)
2012	282	39 (13.82%)
Total	1298	200(15.40%)

Table (3): Personal and clinical characteristics on admission of cases with and without pneumothorax

	With pneumothorax (n=135)	Without pneumothorax (n=1163)	Test of significance	P
Age (month)				
Min. – Max.	1.0 – 144.0	1.0 – 180.0	Z= 5.439	<0.001*
Mean ± SD.	12.29 ± 22.59	25.75 ± 37.02		
Median	3.50	9.0		
Sex n (%)				
Female	71(52.6%)	525(45.1%)	$\chi2$= 2.704	0.100
Male	64(47.4%)	638(54.9%)		
Weight (Kg)				
Min. – Max.	2.3 – 37.0	2.5 – 50.0	Z= 5.693	<0.001*
Mean ± SD.	6.88 ± 5.29	10.14 ± 7.87		
Median	5.0	8.0		
PIM2 score				
Min. – Max.	15 – 90	10 – 90	Z= 4.711	<0.001*
Mean ± SD.	39.82 ± 29.61	27.88 ± 25.64		
Median	28.5	21.6		
PELOD score Day1				
Min. – Max.	1.0 –42	1– 42	Z= 5.058	<0.001*
Mean ± SD.	11.89 ± 9.78	9.22 ± 8.93		
Median	12	10		
Legnth of stay (LOS) (Days)				
Min. – Max.	2 – 81	1 – 84	Z= 4.711	<0.001*
Mean ± SD.	13.48 ± 12.39	6.44 ± 8.95		
Median	10	3		
Referral Site n(%)				
Casualty	94(69.6%)	800(68.8%)	χ^2= 0.040	0.841
Ward	41(30.4%)	363(31.2%)		
Diagnostic category n(%)				
Respiratory	53(39.4%)	278(23.9%)	$\chi2$= 15.013	0.001*
Cardiac	11(8.1%)	113(9.7%)	$\chi2$= 0.344	<0.557
Neuromuscular	11(8.1%)	106(9.1%)	$\chi2$= 0.138	0.711
Sepsis and septic shock	47(34.8%)	280(24.1%)	$\chi2$= 7.402	0.007*
Renal	3(2.2%)	13(1.1%)	$\chi2$= 1.212	FEp= 0.227
Post-operative	5(3.7%)	58(5.0%)	$\chi2$= 0.431	0.511
Metabolic and endocrinal	0(0%)	180(15.5%)	$\chi2$= 24.258	<0.001*
Others	5(3.7%)	135(11.6%)	$\chi2$= 7.854	0.005
Fate n (%)				
Discharged	55(40.75%)	1043(89.7%)	χ^2=158.449	<0.001*
Deceased	80(59.25%)	120(10.3%)		

PIM2score= pediatric index of mortality
PELOD score= pediatric logistic organ dysfunction score
χ^2: value for Chi square
Z: Z for Mann Whitney test
FE: Fisher Exact test
*: Statistically significant $p \leq 0.05$

Table (4): Characteristics of episodes of pneumothorax (n=151)

	Frequency	Percentage
Etiology		
Iatrogenic		
• Barotrauma related to mechanical ventilation	105	69.6%
• CVC insertion	20	13.2%
• Post-bronchoscope	1	0.67%
• Others	18	11.9%
Spontaneous(primary and secondary)	7	4.63%
Site of pneumothorax		
Right	83	55%
Left	44	29.1%
Bilateral	24	15.9%
Severity of pneumothorax		
Non tension pneumothorax	89	58.9%
Tension pneumothorax	62	41.1%
Management:		
Conservative	5	3.3%
Needle aspiration	2	1.3%
Chest tube insertion	144	95.4%
First diagnostic tool on suspicion:		
Clinical	41	27.2%
Radiological plain X ray	106	70.2%
Computerized tomography of chest(CT chest)	4	2.6%
Other associated air leak syndromes		
No	105	69.5%
Surgical emphysema	44	29.1%
Pneumomediastinum	2	1.4%

CVC=central venous catheter

NB: 135 patients had 151 episodes of pneumothorax.

Table (5): Comparison of cases with and without pneumothorax as regards mechanical ventilation and ventilator setting on admission

	With pneumothorax (n=135)	Without pneumothorax (n=1163)	Test of significance	P
Mechanical ventilation				
Yes n(%)	125(92.6%)	614(52.8%)	χ^2=78.109	**<0**.001*
No n(%)	10(7.4%)	549(47.2%)		
Days of mechanical ventilation;	(n=125)	(n=614)		
Min. – Max.	2.0 – 81.0	1 – 60.0	Z= 8.261	<0.001*
Mean ± SD.	12.24 ± 11.73	4.46 ± 8.19		
Median	9.0	4.0		
Starting mode of ventilation	(n=125)	(n=614)		
SIMV/PS	66(52.8%)	403(65.7%)		
SIMV/VC	6(4.8%)	10(1.6%)		
PC	32(25.6%)	83(13.5%)	χ^2= 50.755	<0.001*
VC	3 (2.4%)	6 (1.0%)		
HFOV	18(14.4%)	39(6.3%)		
CPAP/PS	0 (0%)	73(11.9%)		
Mean ventilator settings of conventional ventilation	(n=107)	(n=575)		
PEEP(cmH_2O)				
Min. – Max.	3.0 – 24.0	2.0 – 18.0		
Mean ± SD.	6.92 ± 3.93	5.31 ± 1.79	Z = 5.529	<0.001*
Median	5.50	5.0		
PIP (cmH_2O)				
Min. – Max.	18.0 – 48.0	15.0– 40.0	t= 14.591	<0.001*
Mean ± SD.	28.29 ± 6.32	19.56 ± 5.22		
Median	27.0	20.0		
Rate(cycle/minute)				
Min. – Max.	25.0 – 70.0	25.0 – 60.0		
Mean ± SD.	39.85 ± 10.89	33.35 ± 7.34	Z= 5.860	<0.001*
Median	40.0	30.0		
FiO_2 (%)				
Min. – Max.	40.0 – 100.0	21.0 – 100.0		
Mean ± SD.	67.95 ± 18.83	52.03 ± 12.82	Z= 8.064	<0.001*
Median	60.0	50.0		
Mean ventilator settings for HFOV	(n=18)	(n=39)		
Mean airway pressure (cmH_2O				
Min. – Max.	20.0 – 40.0	10.0 – 42.0		
Mean ± SD.	30.11 ± 5.80	25.33 ± 7.71	t=2.385	0.020*
Median	32.0	27.0		
Delta P(amplitude)				
Min. – Max.	45.0 – 70.0	25.0 – 70.0		
Mean ± SD.	59.32 ± 7.61	53.15 ± 9.14	Z= 2.380	0.017*
Median	60.0	55.0		
Frequency(hertz)				
Min. – Max.	5.0 – 10.0	5.0 – 8.0		
Mean ± SD.	6.59 ± 1.50	5.95 ± 0.94	Z= 1.459	0.145
Median	6.0	6.0		
FiO_2 (%)				
Min. – Max.	40.0 – 100.0	50.0 – 100.0		
Mean ± SD.	72.45 ± 19.41	53.70 ± 14.82	Z= 9.057	<0.001*
Median	70.0	60.0		

SIMV/PS=synchronized intermittent mandatory ventilation/pressure support
SIMV/VC=synchronized intermittent mandatory ventilation/volume control
PC=pressure control VC=volume control χ^2: value for Chi square
HFOV=high frequency oscillatory ventilation CPAP/PS=continuous positive airway pressure/pressure support
PEEP= positive end expiratory pressure PIP= peak inspiratory pressure Fio_2= fraction of inspired oxygen
Z: Z for Mann Whitney test *: Statistically significant $p \leq 0.05$

Table (6): Comparison between cases with and without pneumothorax as regards laboratory investigations on admission

	With pneumothorax (n=135)	Without pneumothorax (n=1163)	Test of significance	T test
CRP(mg/L)				
Min. – Max.	14.7–287.0	12.4 –362.0	Z= 0.668	0.504
Mean ± SD.	59.23 ± 69.18	41.16 ± 55.55		
Median	24.40	18.70		
WBC ($\times 10^3$/cmm)				
Min. – Max.	1.80 –38.50	0.10 –75.0	Z= 0.203	0.839
Mean ± SD.	14.36 ± 7.86	15.10 ± 9.45		
Median	13.30	13.30		
% of neutrophils				
Min. – Max.	20.0 – 96.0	57.0 – 96.0	t= 0.068	**0**.946
Mean ± SD.	69.81 ± 13.46	66.42 ± 16.34		
Median	70.0	70.0		
pH				
Min. – Max.	7.04 – 7.60	6.80 – 7.70	Z= 8.382	0.005*
Mean ± SD.	7.39 ± 0.09	7.28 ± 0.16		
Median	7.40	7.30		
$PaCO_2$ (torr)				
Min. – Max.	15.0 – 79.0	10.0 – 136.0	Z= 4.459	0.006*
Mean ± SD.	42.56 ± 10.53	38.83 ± 19.96		
Median	43.0	36.0		
PaO_2(torr)				
Min. – Max.	31.50 – 156.0	30.0 – 160.0	Z= 2.679	0.007*
Mean ± SD.	74.45 ± 22.77	83. ± 31.77		
Median	70.0	75.0		
HCO_3 (mmol/L)				
Min. – Max.	10.0 – 50.0	5.30 – 49.90	Z= 8.581	<.0001*
Mean ± SD.	26.43 ± 7.40	19.02 ± 9.58		
Median	26.0	19.70		
SaO_2 (%)				
Min. – Max.	60.0 – 99.0	55.0 – 100.0	t= = 0.729	0.466
Mean ± SD.	91.16 ± 7.23	91.67 ± 7.81		
Median	93.0	94.0		

CRP= C –reactive protein
WBC count= white blood cell count
$PaCO_2$= partial arterial carbon dioxide tension
PaO_2= partial arterial oxygen tension
HCo_3= bicarbonate buffer content
SaO_2= arterial oxygen saturation
χ^2: value for Chi square
t: Student t-test
Z: Z for Mann Whitney test *Statistically significant $p \leq 0.05$

Table (7): Comparison between PELOD score and laboratory results on admission and on diagnosis of pneumothorax in cases with pneumothorax

	On admission	On day of occurrence of pneumothorax	Test of significance	P
PELOD score				
Min. – Max.	1.0 – 42.0	2.0 – 52.0	Z=4.017	<0.001*
Mean ± SD.	12.08 ± 9.50	15.66 ± 9.58		
Median	12.0	12.0		
CRP (mg/L)				
Min. – Max.	14.7 – 287.0	15.4 – 289.0	Z= 1.849	0.064
Mean ± SD.	59.23 ± 69.18	65.61 ± 60.91		
Median	24.40	49.50		
WBC(×10^3/cmm)				
Min. – Max.	1.80 – 38.50	0.12 – 30.30	Z= 1.787	0.074
Mean ± SD.	14.36 ± 7.86	15.30 ± 7.32		
Median	13.30	15.10		
Percentage of neutrophils				
Min. – Max.	20.0 – 96.0	2.0 – 98.0	t= 0.068	0.946
Mean ± SD.	69.81 ± 13.46	69.64 ± 15.48		
Median	70.0	70.0		
pH				
Min. – Max.	7.04 – 7.60	6.90 – 7.50	Z= 8.488	<0.001*
Mean ± SD.	7.39 ± 0.09	7.24 ± 0.15		
Median	7.40	07.26		
$PaCO_2$ (torr)				
Min. – Max.	15.0 – 79.0	28.0 – 130.0	Z= 8.503	<0.001*
Mean ± SD.	42.56 ± 10.53	63.80 ± 20.81		
Median	43.0	60.0		
PaO_2(torr)				
Min. – Max.	31.50 – 156.0	30.0 – 111.0	Z= 6.770	<0.001*
Mean ± SD.	74.45 ± 22.77	59.52 ± 17.39		
Median	70.0	55.50		
HCO_3(mmol/L)				
Min. – Max.	10.0 – 50.0	10.0 – 41.0	Z=0.663	0.507
Mean ± SD.	26.43 ± 7.40	25.99 ± 6.66		
Median	26.0	26.0		
SaO_2(%)				
Min. – Max.	60.0 – 99.0	40.0 – 98.0	t=9.361	<0.001*
Mean ± SD.	91.16 ± 7.23	81.40 ± 12.71		
Median	93.0	83.50		

CRP=C- reactive protein
WBC count=white blood cell count
$PaCO_2$= partial arterial carbon dioxide tension
PaO_2= partial arterial oxygen tension
t: Paired t-test
HCO3= bicarbonate buffer content
SaO2= arterial oxygen saturation
Z: Z for Wilcoxon signed ranks test
*Statistically significant p≤0.05

Table (8): Personal and clinical characteristics of cases with and without respiratory diseases on admission

	Respiratory diseases (n=331)	Non-respiratory diseases (n=967)	Test of significances	P
Age (month)				
Min. – Max.	1.0 – 144.0	1.0 – 180.0	Z=3.719	<0.001*
Mean ± SD.	13.06 ± 17.99	28.21 ± 39.66		
Median	7.0	9.0		
Sex				
Male	191(57.7%)	511(52.8%)	χ^2= 2.345	0.126
Female	140(42.3%)	456(47.2%)		
Weight(Kg)				
Min. – Max.	2.30 – 37.0	2.50 – 50.0	Z=2.828	0.005*
Mean ± SD.	7.92 ± 4.53	10.45 ± 8.43		
Median	6.50	8.0		
Length of stay(days)				
Min. – Max.	1.0 – 81.0	2.0– 84.0	Z=1.435	0.151
Mean ± SD.	6.90 ± 8.01	7.27 ± 10.10		
Median	4.0	4.0		
PIM 2 score				
Min. – Max.	15 – 90	10 – 90	Z=2.855	0.004*
Mean ± SD.	25.10 ± 23.12	30.50 ± 27.21		
Median	21.30	23.30		
PELOD score				
Min. – Max.	1.0 – 23.0	1.0 – 42.0	Z=8.046	<0.001*
Mean ± SD.	6.38 ± 6.06	10.57 ± 9.65		
Median	10.0	10.0		
Mechanical ventilation				
Yes	234(70.7%)	505(52.2%)	χ2=34.281	<0.001*
No	97(29.3%)	462(47.8%)		
Day of mechanical ventilation				
Min. – Max.	2.0 – 81.0	1.0 – 60.0	Z=1.872	0.061
Mean ± SD.	6.54 ± 8.12	7.87 ± 9.56		
Median	4.0	5.0		
Pneumothorax				
Yes	53(16%)	82(8.5%)	χ^2= 15.013	<0.001*
No	278(84%)	885(91.5%)		
Fate				
Improved	270(81.6%)	828(85.6%)	$\chi^{2=}$0.924	0.336
Death	61(18.4%)	139(14.4%)		

PIM2score= pediatric index of mortality PELOD score= pediatric logistic organ dysfunction score
χ^2: Chi square test Z: Z for Mann Whitney test
*: Statistically significant at $p \leq 0.05$

Table (9): Comparison between cases with respiratory and without -respiratory diseases as regards laboratory data on admission

	Respiratory diseases (n=331)	Non-respiratory diseases (n=967)	Test of significance	P
CRP(mg/L)				
Min. – Max.	12.40 – 287.0	18.30 – 362.0	Z=0.237	0.813
Mean ± SD.	45.56 ± 52.48	46.56 ± 55.45		
Median	19.30	18.90		
WBC($\times10^3$/cmm)				
Min. – Max.	1.70 – 75.0	0.10 – 38.50	Z=0.084	0.933
Mean ± SD.	15.72 ± 11.18	14.79 ± 8.58		
Median	12.60	13.50		
pH				
Min. – Max.	6.81 – 7.70	6.80 – 7.70	Z=5.400	<0.001*
Mean ± SD.	7.34 ± 0.13	7.28 ± 0.17		
Median	7.36	7.30		
PCO_2 (torr)				
Min. – Max.	15.0 – 136.0	10.0– 120.0	Z=11.642	<0.001*
Mean ± SD.	49.75 ± 19.81	35.63 ± 17.80		
Median	44.0	34.0		
PaO2(torr)				
Min. – Max.	31.0 – 159.0	30.0 – 160.0	Z=2.823	0.005*
Mean ± SD.	80.17 ± 33.13	83.0 ± 30.45		
Median	70.0	75.0		
HCO_3 (mmol/L)				
Min. – Max.	8.10 – 49.90	6.0– 50.0	Z=13.008	<0.001*
Mean ± SD.	25.69 ± 6.98	17.74 ± 9.55		
Median	25.40	18.20		
SaO_2 (%)				
Min. – Max.	55.0 – 100.0	55.0 – 100.0	t=1.232	0.218
Mean ± SD.	91.20 ± 7.88	91.81 ± 7.68		
Median	93.0	94.0		

χ^2: Chi square test
Z: Z for Mann Whitney test
WBC count=white blood cell count
$PaCO_2$= partial arterial carbon dioxide tension
PaO_2= partial arterial oxygen tension
t: Student t-test
CRP=C- reactive protein
HCO3= bicarbonate buffer content
SaO2= arterial oxygen saturation
*: Statistically significant at $p \leq 0.05$

Table (10): Multiple logistic regression model for risk factors that predict pneumothorax

	B	S.E.	Sig.	OR	95% CI	
					LL	UL
PIP	0.360	0.056	<0.001*	1.434	1.284	1.602
FiO_2	0.044	0.021	0.035*	1.045	1.003	1.088
$PaCO_2$	-0.081	0.033	0.014*	0.922	0.864	0.984
HCO_3	0.129	0.065	0.047*	1.137	1.002	1.291

PIP= peak inspiratory pressure
Fio_2= fraction of inspired oxygen
$PaCO_2$= partial arterial carbon dioxide tension
HCO_3= bicarbonate buffer content
Predictors ; only significant factors included.
*Statistically significant $p \leq 0.05$

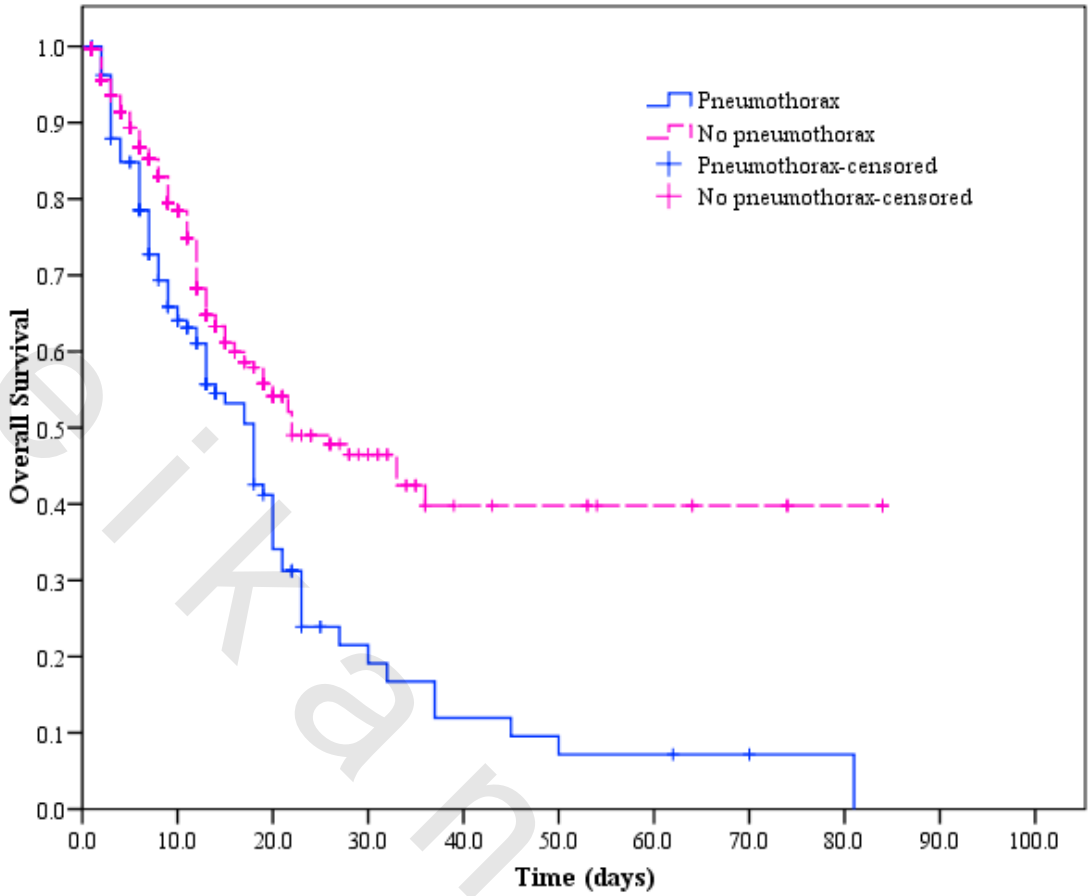

Figure (3): Kaplan- Meier survival curve Log Rank test comparing survival in cases with and without pneumothorax

Overall Comparisons		
	Chi-Square	**Sig.**
Log Rank (Mantel-Cox)	18.135	.001