AIM OF THE WORK

To evaluate the efficiency of volume targeted versus pressure-limited ventilation for preterm infants with respiratory distress.

PATIENTS

This prospective comparative study was conducted in the neonatal intensive care (NICU) at Alexandria university children's hospital (AUCH) on 60 newborn infants with gestational age 28-34 weeks ventilated with either volume targeted ventilation or pressure limited time cycled ventilation as primary mode or secondary to failure of NCPAP.

Inclusion criteria:

Preterm infants with gestational age 28-34 weeks having respiratory distress requiring mechanical ventilation as primary mode or secondary to failure of NCPAP

Exclusion criteria:

- Multiple organ failure
- Major congenital anomalies
- Metabolic disorders
- Air leaks &/ or ETT leak >20%
- Hypoxic ischemic encephalopathy
- Intraventricular hemorrhage

The patients will be categorized in to 2 groups:

Group A:

- 30 preterm neonates were ventilated with pressure limited time cycled ventilation.

Group B:

- 30 preterm neonates were ventilated with volume-targeted ventilation.

METHODS

Study design

The study was a prospective interventional comparative randomized one. The randomization method used for blinding was closed envelopes. The study was conducted in the NICU of Alexandria university children's hospital on 60 newborn infants with gestational age 28-34 weeks ventilated with either volume targeted ventilation or pressure limited time cycled ventilation as primary mode or secondary to failure of NCPAP.

Patients enrolled in the study was subjected to the following

A) Data collection from records:

1. Prenatal, natal, and postnatal history.
2. Mode of delivery.
3. Maternal problems (e.g. infection (e.g. urinary tract infection (UTI), Chorioamnionitis (defined as the presence of fever with one or more of the following maternal leukocytes >15000, uterine tenderness, foul smelling amniotic fluid or fetal tachycardia) and *prolonged rupture of membrane > 18 hrs (PROM))*, bleeding, diabetes mellitus, maternal medication including corticosteroids and hypertensive disorders of pregnancy (HDP)… etc.).
4. Apgar score and delivery room management.
5. Full physical examination including:
   a) Vital signs and anthropometric measures.
   b) Gestational age using modified Ballard score.
   c) Systemic examination

Oxygen saturation and HR were continuously recorded using **Nellcor™ N-560 Pulse Oximetry from Covidien. OxiMax adhesive sensors with LoSat expanded accuracy were used.**

6. Clinical diagnosis on admission (e.g. RD, pneumonia and early onset sepsis (EOS)…etc.)
7. Laboratory investigations on admission.
   - CBC
   - CRP
   - Blood culture
   - Arterial blood gases

8. Indices of severity of respiratory distress include;
   A- Chest radiological findings on initial x-ray. The severity of RD on the initial chest x-ray was graded as mild, moderate, or severe according to standard classification. (116)

   B- The alveolar-arterial oxygen tension gradient (PAo2 -Pao2 or AaDO2). It is simply the difference between Alveolar concentration of oxygen, and Arterial concentration of oxygen. Alveolar Oxygen Concentration is calculated as follows: (Barometric Pressure – Water vapor Pressure) x FiO2]-[pCO2/0.8]. Essentially,

the A-a gradient is a measure of how effectively the lungs are moving vital oxygen from the exterior to the blood. It is expressed in millimeters of mercury, increases with worsening oxygenation. The alveolar arterial oxygen tension gradient was measured at the time of the first arterial blood gas.

C- Arterial blood gases

D- The dynamic lung compliance and the resistance measured by the ventilator.

E- Oxygenation and ventilation indices [117]

- The oxygenation index (OI) is used to assess the intensity of ventilatory support required to maintain oxygenation. It is used in neonatology and pediatrics to assess the outcome of the patient and the need for potential ECMO therapy. 0-25 index: Good outcome, 25-40 index: Chance of death > 40%, > 40 index: Consider ECMO (extracorporeal membrane oxygenation)
- The ventilation index (VI) is used to assess the severity of the ventilation disorder and predict the duration of the ventilation. VI values above 37 are associated with risk of prolonged IMV in this population, reflecting the severity of the ventilatory disorder and the need for support.

B) Ventilation protocol [96-114]

Ventilation was used as a primary mode or as a rescue after failure of NCPAP.

Criteria of failure of NCPAP:

- FiO2 exceeds 60% with PO2 less than 50 mmHg.
- Arterial pH drops below 7.25 or PCO_2 exceeds 65 mmHg
- Infants show clinical signs of severe respiratory distress.

The initial ventilation settings in group A:

Ventilator rate was 40 breaths/min, inspiratory time 0.35-0.4, and PEEP 5- 7 cmH20. The PIP and FIO2 were adjusted to obtain an adequate chest rise and the target Spo2 (86-94%) respectively. The ventilation parameters were subsequently adjusted according to the clinical judgment of the attending neonatologist as indicated by the blood gases.

The initial ventilator settings in group B:

Ventilator rate was 40 breaths/min, inspiratory time 0.3-0.45, and PEEP 5- 7 cmH20. The fio2 was adjusted to obtain the target spo2 (86%-94%). The PIP was set initially at a pressure about 5 cm H2O above that estimated by the ventilator to be sufficient to deliver a target tidal volume (4-6ml/kg). If the targeted V_T could not be reached with this setting, the PIP limit was increased until the desired V_T is achieved. Subsequent adjustment to targeted V_T was based on PaCO2.The usual increment of the targeted V_T is 0.5 ml/kg.

Ventilation was applied using SLE 4000 & 5000 having targeted tidal volume software (TTV) (Specialized Laboratory Equipment Ltd, South Croydon, UK)

Ventilator TTV algorithm:

The targeted tidal volume mode is a hybrid mode of ventilation available on the SLE 4000 and 5000 (Specialised Laboratory. Equipment Ltd, South Croydon, UK). When TTV^{plus} is on, the user sets the targeted inspiratory V_T that is appropriate for the patient, as well as the maximum PIP. The SLE 4000/5000 measures the inspiratory and expiratory V_T of every assisted breath and compares it to the target inspiratory V_T. If necessary, the algorithm adjusts the delivered PIP, only up to a maximum PIP setting. Therefore, even if there is a change to the lung mechanics, such as change in the resistance and compliance of the lung or a change in the respiratory effort of the patient, the ventilator will ensure that the appropriate PIP is used. . The inspiratory time is controlled by inspired V_T. Ti may vary, but is maintained within 75% to 100% of the set Ti. In Neonatal patients, it is very common to have gas leak around the ET tube, due to the use of un-cuffed ET tubes. It is therefore very important for the ventilator to be able to compensate for leakage. The SLE TTV software version 4.3 used in this study can manually compensate for leaks of up to 20%.

Ventilator settings recorded were:

- PIP and PEEP
- FIO_2.
- Expiratory and inspiratory tidal volume
- The set and measured rate, inspiratory time
- MAP (mean airway pressure)

C) Surfactant administration

Exogenous surfactant suspension (Survanta) (Abbott Laboratories, North Chicago, USA) was used. The dosage of the surfactant was 100mg/kg for one dose. It was administered in two bolus fractions of 50 mg/kg each, instilled through an endotracheal tube, with an interval of a few minutes. Manual ventilation was administered for 1 min after each dose. Administration of (Survanta) is rescue not routine with any modality of ventilatory support. The first dose of surfactant was always administered within 3 h of intubation if a homogeneous lung disease due to surfactant deficiency or inactivation was present and if the ventilator parameters during initial respiratory stabilization did not reach the following values within the 3h period after delivery: FIO2 was less than 0.35 and MAP<12.

D) Weaning protocol: [96-115]

In group A

Extubation was tried when the following ventilation settings were reached (PIP <10-12, PEEP 5, MAP <8, FIO2 <35) and good sustained respiratory effort was present.

In group B

Extubation was tried when the studied preterm infants consistently maintained tidal volume at or above the target value of 4ml/kg with delivered PIP < 10–12 cm H2O (<12–15 cm H2O in infants >1 kg) with FiO2 < 0.35 and good sustained respiratory effort.

Successful extubation is defined as not requiring reintubation within 48 hours after the extubation attempt. [118,119]

Criteria of failure of extubation and indications of reintubation: [118, 119]

1. FIO_2 exceeds 0.6.
2. Arterial pH drops below 7.20 and PCO_2 exceeds 65 mmHg.
3. Infants have recurrent apnea requiring repeated stimulation, or bag-and-mask ventilation.
4. Infants show clinical signs of severe respiratory distress.

E) The studied groups were evaluated as regards the occurrence of neonatal morbidities such as

- Duration of ventilation and duration of hospital stay
- Incidence of hypocarbia (any pCO_2 < 35 mmHg) and respiratory acidosis (pH <7.25 and pCO_2 > 65 mmHg)
- Incidence of CLD expressed as an oxygen requirement at a postconceptional age of 36 wks; chronic lung disease (CLD) was defined according to the new classification, which classifies CLD in preterm infant according to its severity into 3 groups (mild, moderate and severe). [15,16]

Assessment	**Gestational Age**	
	< 32 WK	**≥ 32 WK**
Time point of assessment	36 wk. PMA or discharge to home, whichever comes first	> 28 d but < 56 d postnatal age or discharge to home, whichever comes first
	Treatment with oxygen > 21% for at least 28 d plus	
Mild BPD	Breathing room air at 36 wk. PMA or discharge, whichever comes first	Breathing room air by 56 d postnatal age or discharge, whichever comes first
Moderate BPD	Need for < 30% oxygen at 36 wk. PMA or discharge, whichever comes first	Need for < 30% oxygen at 56 d postnatal age or discharge, whichever comes first
Severe BPD	Need for ≥ 30% oxygen or positive pressure (PPV or NCPAP), or both, at 36 wk. PMA or discharge, whichever comes first	Need for ≥ 30% oxygen or positive pressure (PPV or NCPAP), or both, at 56 d postnatal age or discharge, whichever comes first
PMA= post menstrual age, PPV= positive pressure ventilation, NCPAP= nasal continuous positive airway pressure		

- Incidence of patent ductus arteriosus through echocardiography examination using Sonoace 8000 Ex prime manufactured by Medison was done by using transducer probe P3-7AC of 5.5-7.5 MHz frequency.
- Incidence of VAP (ventilator associated pneumonia)

Diagnosis of VAP was based on the criteria recommended by the CDC for infants less than one year of age, as follows:

i) Pneumonia that develops later than 48 hr. after initiation of mechanical ventilation
ii) New or persistent infiltrates on CXR
iii) Worsening gas exchange

And at least three of the following criteria: temperature instability with no other recognized cause, new onset of purulent respiratory secretions, increase in respiratory secretions or increased need for suctioning, WBC < 4000/mm^3 or > 15000/mm^3), respiratory signs (nasal flaring, retractions, apnea and tachypnea) and bradycardia or tachycardia.

Tracheal aspirate cultures for pathogenic bacteria were obtained and the results interpreted according to CDC recommendations for infants less than one year of age, which were the presence of positive cultures of pathogenic bacteria with counts >100000 CFU/mL from bronchial secretions obtained by non-bronchoscopic bronchoalveolar lavage (NB-BAL).

- The incidence of Intraventricular hemorrhage (IVH): As part of the routine standard of care, sequential Cranial U/S scans were performed to all studied infants. Scanning was performed shortly after birth, on the third and seventh day of life and weekly thereafter until discharge or death and whenever clinically indicated. Scanning was done using Medison Sonoace SA 8000 system machine with (3 – 7) MHz multifrequency phased array sector probe (Medison Medical Systems, S Korea). Scanning was done through the anterior fontanel. IVH was classified according to Volpe. [120]

Statistical analysis of the data [121]

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. [122] 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 or Monte Carlo correction. The distributions of quantitative variables were tested for normality using Kolmogorov-Smirnov test, Shapiro-Wilk test and D'Agstino test; also Histogram and QQ plot were used for vision test. If it reveals normal data distribution, parametric tests were applied. If the data were abnormally distributed, non-parametric tests were used. For normally distributed data, comparison between the two studied groups were done using independent t-test while for abnormally distributed data, comparison was done using Mann Whitney test. Significance of the obtained results was judged at the 5% level.

RESULTS

Table 1 shows the demographic characteristics of the studied groups. There was no statistically significant difference as regards sex, weight, gestational age and mode of delivery among the studied groups.

Table 1: Demographic characteristics of the studied neonates

	GA "PLV" (n=30)		GB "VTV" (n=30)		Test of Sig.	p
	No.	%	No.	%		
Sex						
Male	15	50	18	60	χ^2=0.606	0.436
Female	15	50	12	40		
Mode of delivery						
NVD	8	26.7	4	13.3	χ^2=1.667	0.197
C.S.	22	73.3	26	86.7		
Weight (kg)						
Mean ± SD.	1.35 ± 0.45		1.58 ± 0.33		t=2.301	0.065
Gestational age (weeks)						
Median	32		33		z=335.5	0.08
Minimum-Maximum	28-34		28-34			

t: Student t-test.
χ^2: Chi square test.
Z: Mann-Whitney U test.
Statistically significant at $p \leq 0.05$

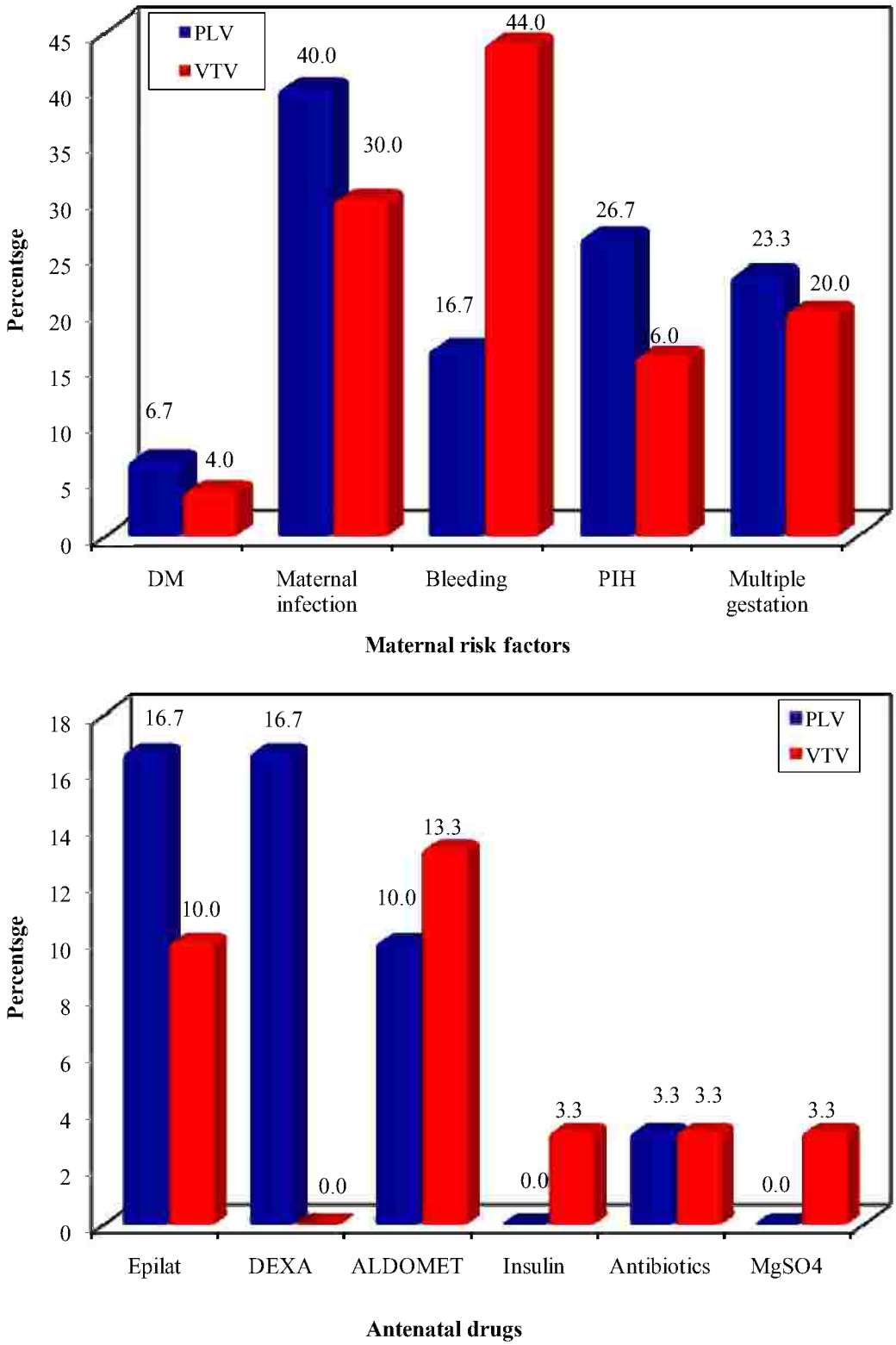

Figure (8): The percentage of the studied neonates in both PLV and VTV group who had maternal risk factors or received antenatal drugs.

Table 3 shows the resuscitation data of the studied groups. There was no significant statistical difference between the studied groups as regards Apgar score at 5 min and need for ambu bag during resuscitation.

Table 3: Resuscitation data of the studied groups.

	GA "PLV" (n=30)		GB "VTV" (n=30)		χ^2	p
	No.	%	No.	%		
APGAR at 5 min						
Low "<7"	6	20	10	33.3	1.364	0.243
Good ">7"	24	80	20	66.7		
Positive pr.vent. **	12	40	14	46.7	0.271	0.602

χ^2: Chi square test
Statistically significant at $p \leq 0.05$
** Positive pressure ventilation: Ambu bagging through facemask or ETT

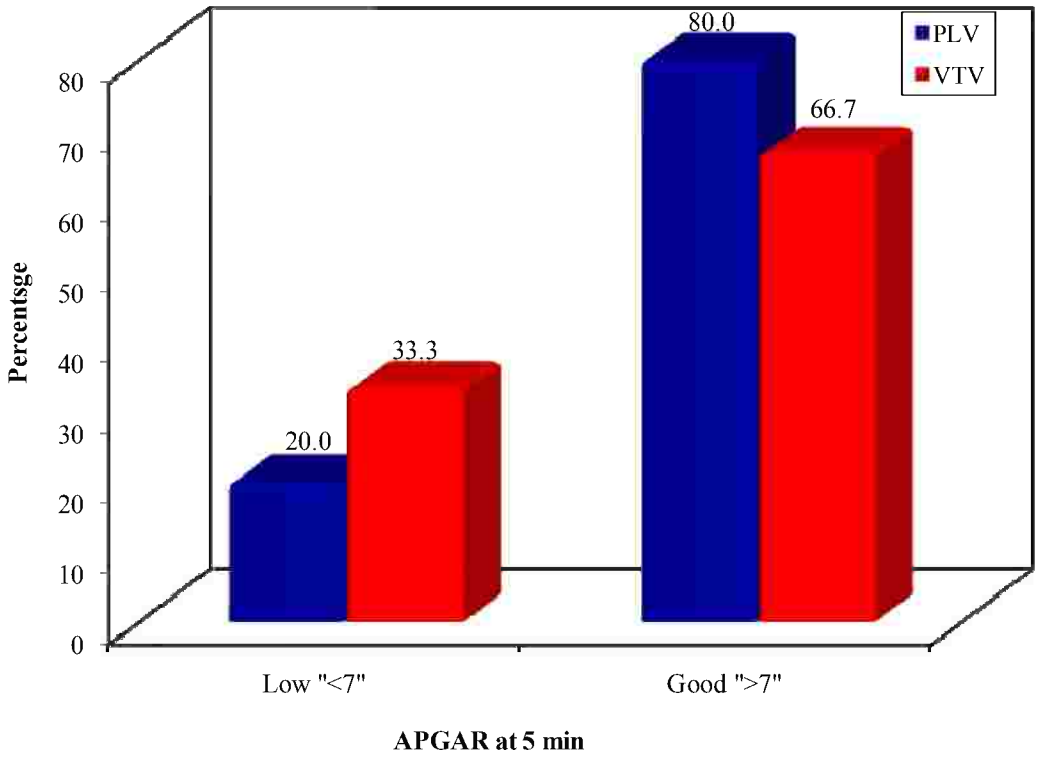

Figure (9): Apgar score at 5 min of the studied neonates.

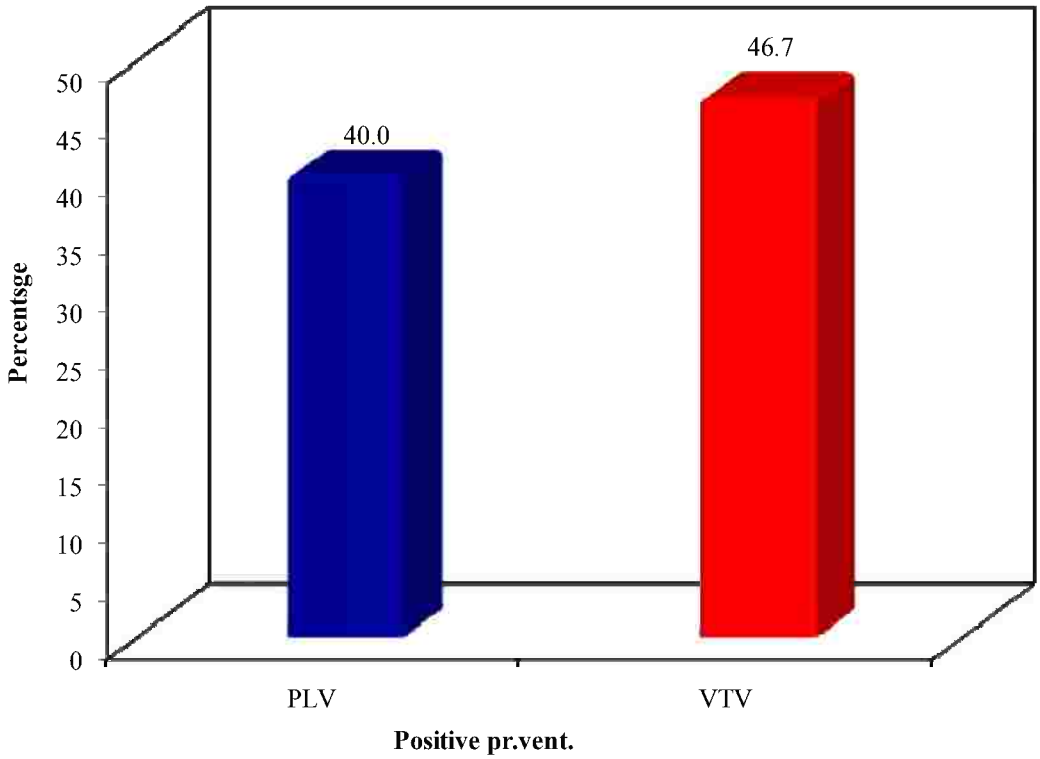

Figure (10): The distribution of the studied neonates who needed positive pressure ventilation in resuscitation.

Table 4 shows the clinical data of the studied group on admission. There was no statistically significant difference between the studied groups as regards vital signs, admission diagnosis or positive initial blood culture.

Table 4: The clinical data of the studied groups on admission

Clinical data of the studied groups	GA "PLV" (n=30)		GB "VTV" (n=30)		Test of sig.	p
	No.	%	No.	%		
Admission diagnosis						
Congenital pneumonia + EOS*	15	50	18	60	$\chi 2$ = 0.606	0.436
RDS*	15	50	12	40		
Vital signs						
Heart rate						
Mean ± SD.	150.03 ± 15.05		150.33 ± 12.59		t=0.683	0.861
Mean blood pressure						
Mean ± SD.	36.36±12.34		34.6±6.95		t=0.084	0.493
Temperature						
Mean ± SD.	36.76±0.33		36.82±0.43		t=0.607	0.326
Positive initial blood culture	1	3.3	0	0.0	χ^2 = 1.017	^{FE}p =1.000

χ^2: value for Chi Square test
FE: Fisher Exact test
t: Student t-test
Statistically significant at $p \leq 0.05$
*EOS= early onset sepsis RDS=respiratory distress syndrome

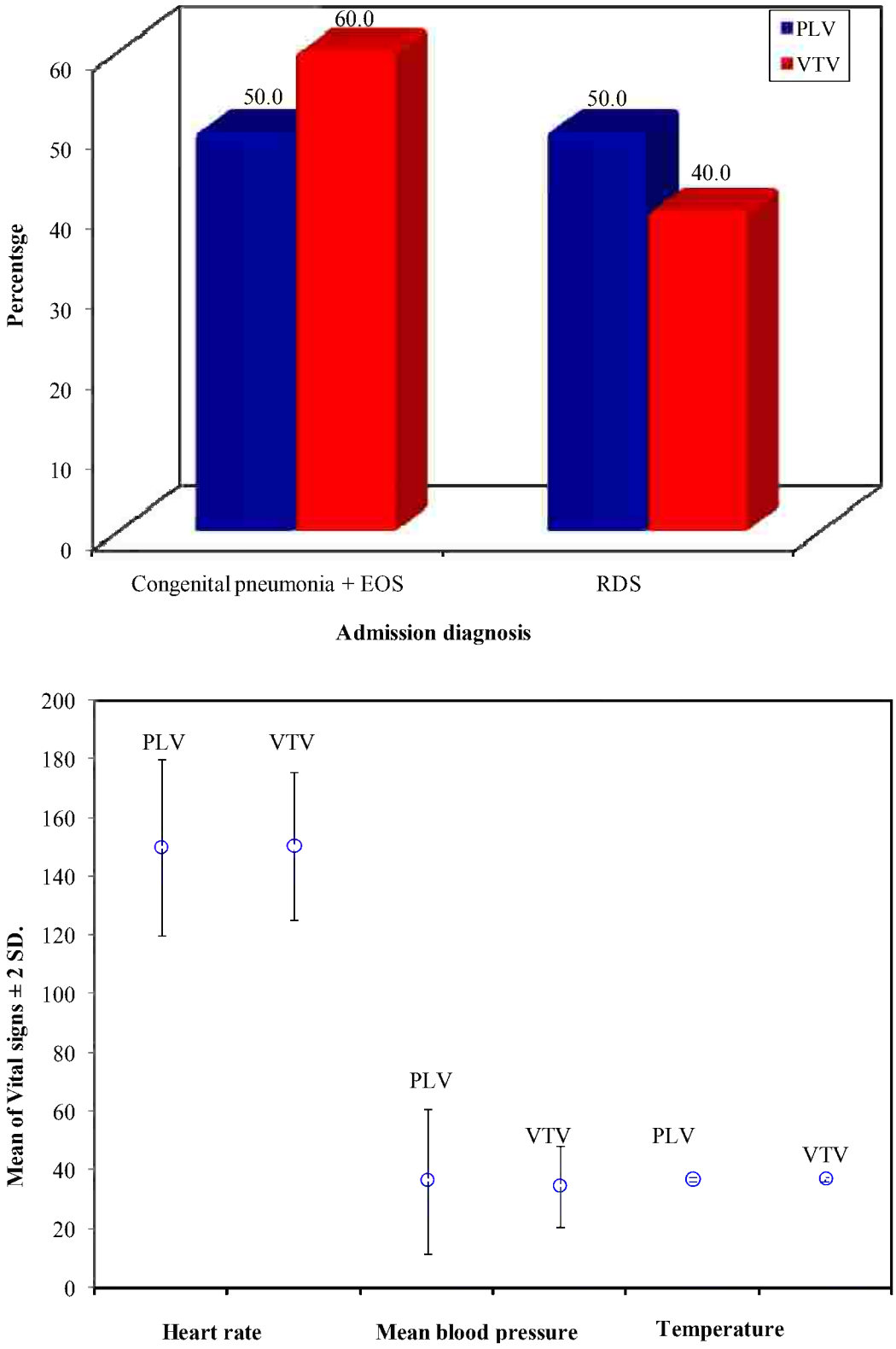

Figure (11): The clinical data of the studied groups

Table 5 shows the radiological diagnosis, the pulmonary status and the severity of the respiratory disorder of the studied groups on admission. There was no statistically significant difference between the 2 groups as regards radiological Dx, ABG, alveolar arterial gradient, need for surfactant therapy on admission and initial lung dynamics.

Table 5: The respiratory status of the studied groups on admission

	GA "PLV" (n=30)		GB "VTV" (n=30)		Test of Sig.	p
	No.	%	No.	%		
Radiological diagnosis						
Pneumonia	16	53.3	17	56.7	χ^2=0.0	1
RDS	**14**	**46.7**	**13**	**43.3**		
X ray staging of RDS						
2	1	7.1	1	7.7		
3	11	78.6	7	53.8	χ^2=2.283	^{MC}p=0.345
4	2	14.3	5	38.5		
ABG						
PH						
Mean ± SD.	7.25 ± 0.08		7.25 ± 0.08		t = 0.064	0.949
PCO_2						
Mean ± SD.	50.53 ± 11.26		51.53 ± 8.53		t = 0.390	0.698
PO_2						
Mean ± SD.	70.77 ± 15.20		65.46 ± 15.20		t = 1.351	0.182
A. a. O_2 gradient (mmHg)						
Median	539.5		513		Z=1.826	0.068
Min. – Max.	232.0 – 627.0		48.0 – 599.0			
Surfactant Rx	18	60	20	66.7	χ^2=0.287	0.592
COMPL (ml/cmH20)						
Min. – Max.	0.15 – 1.0		0.20 – 1.50		Z= 0.628	0.53
Median	0.5		0.5			
Resist (cmH20/l/sec)						
Min. – Max.	126.0 – 740.0		162.0 – 515.0		Z= 1.332	0.183
Median	185		229			
C20						
Mean ± SD.	1.51 ± 0.38		1.59 ± 0.55		t= 0.697	0.489

χ^2: value for Chi Square test
MC: Monte Carlo test
Z: Z for Mann Whitney test
FE: Fisher Exact test
t: Student t-test
Statistically significant at $p \leq 0.05$

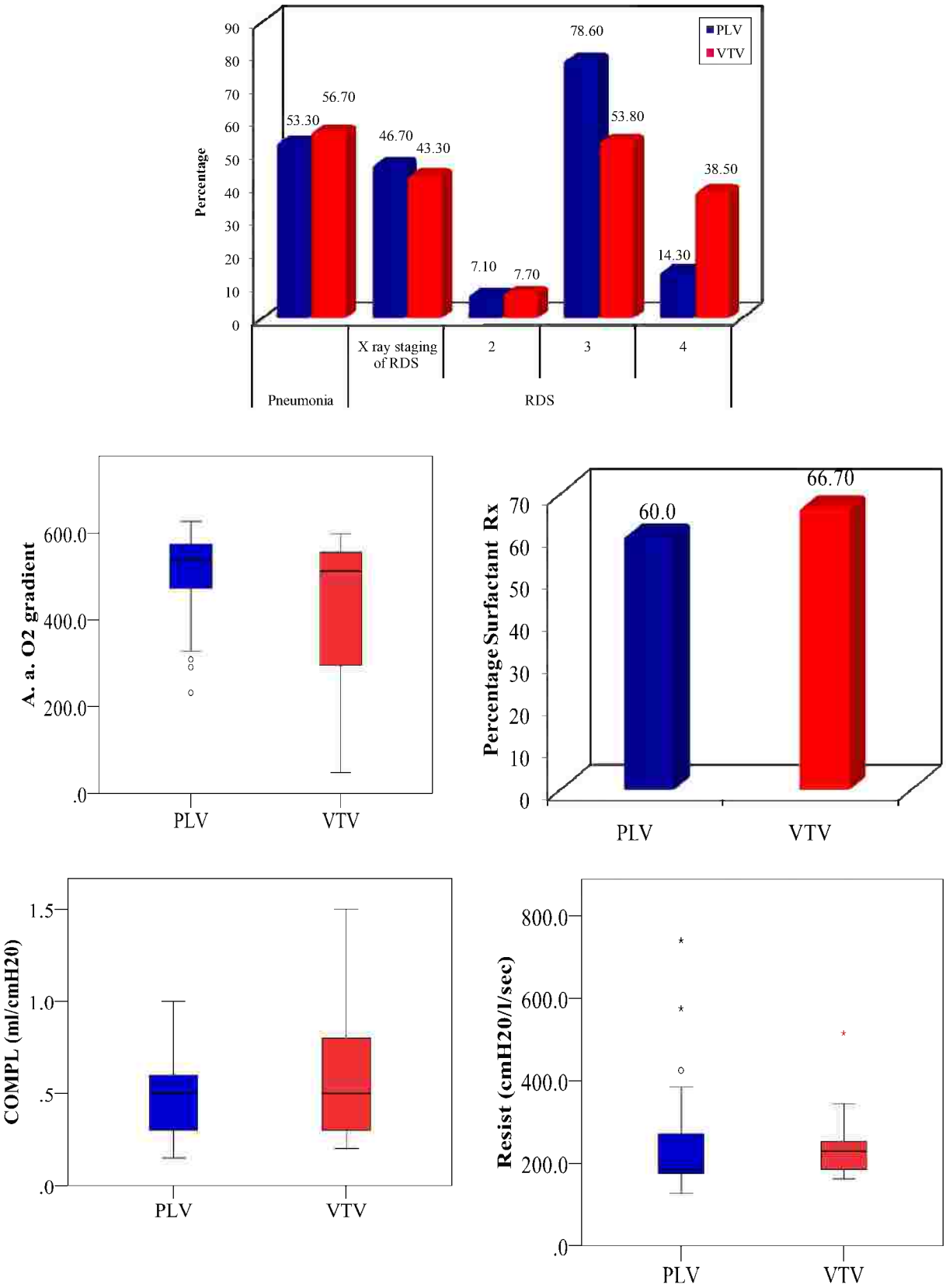

Figure (12): The respiratory status of the studied groups on admission

Table 6 shows the initial settings of ventilation among the studied groups. There was no statistically significant difference between the studied groups as regards all initial ventilatory parameter (PIP, PEEP, MAP, IT, measured RR, leak, ETV and FIO2)

Table 6: Initial settings of ventilation among the studied groups

Initial ventilatory setting	GA "PLV" (n=30)	GB "VTV" (n=30)	Test of Sig.	p
PIP (cmH20)				
Median	19	22	Z=1.724	0.085
Min. – Max.	17.0 – 29.0	17.0 – 29.0		
PEEP(cmH20)				
Median	6	6	Z=1.492	0.136
Min. – Max.	5.0 – 7.0	5.0 – 7.0		
IT(sec)				
Median	0.4	0.4	Z=1.157	0.247
Min. – Max.	0.35 – 0.40	0.30 – 0.45		
FIO_2 %				
Median	100	100	Z=1.145	0.252
Min. – Max.	60.0 – 100.0	30.0 – 100.0		
Leak %				
Median	4	4.5	Z=1.325	0.185
Min. – Max.	0.0 – 10.0	1.0 – 13.0		
ETV (ml/kg)				
Mean ± SD.	4.93 ± 1.16	4.63 ± 0.53	t=1.255	0.217
Meas. Rate				
Mean ± SD.	69.30 ± 12.16	69.87 ± 9.95	t=0.198	0.844
MAP (cmH20)				
Median	12	13	Z=1.661	0.097
Min. – Max.	10.0 – 17.0	9.0 – 19.0		

Z: Z for Mann Whitney test
t: Student t-test

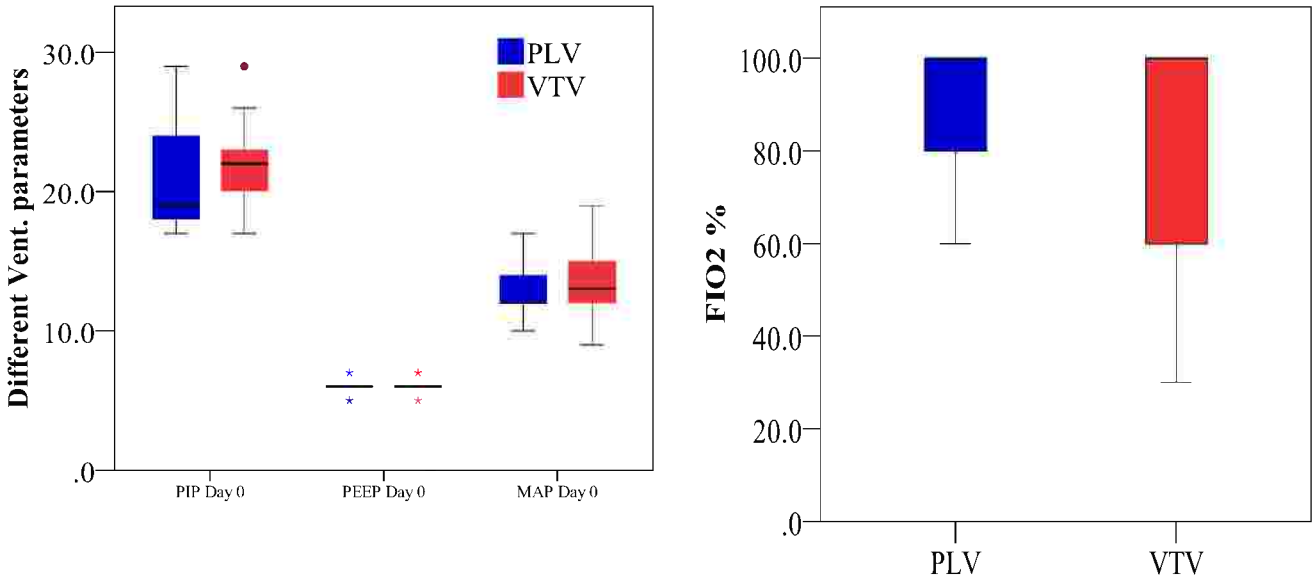

Figure (13): the median PIP, PEEP, MAP and FIO2 and its range on admission among the studied groups.

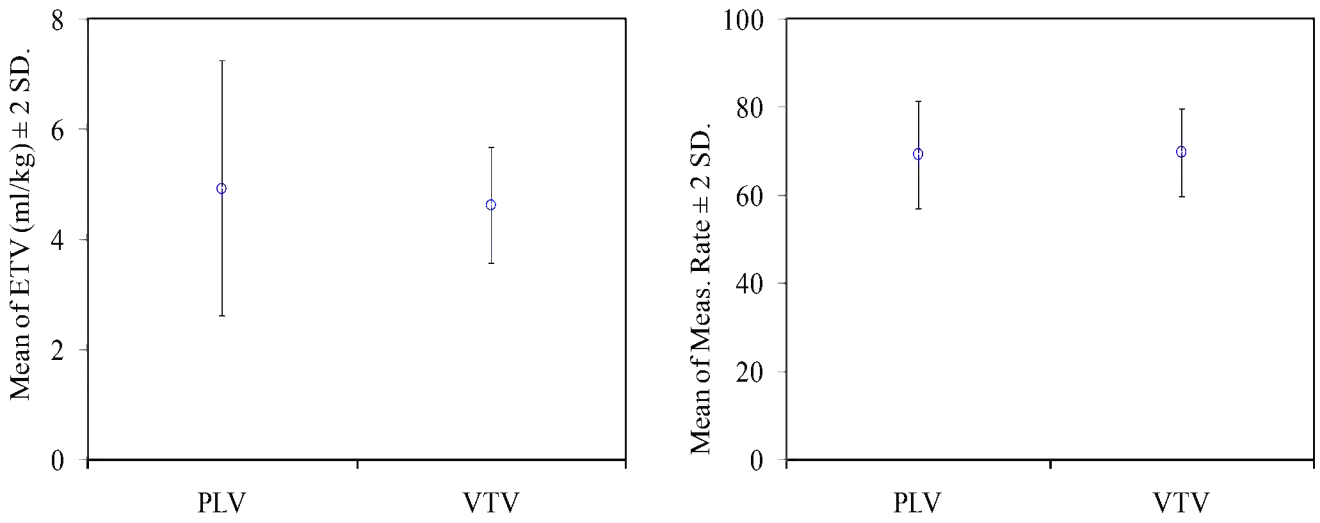

Figure (14): The mean ETV and measured RR and its standard deviation among the studied groups.

Table 7: shows Indices of oxygenation and ventilation on admission among the studied groups. There was no statistical significant difference in the mean ventilation index and oxygenation index between PLV and VTV group .

Table 7: Indices of oxygenation and ventilation on admission

	GA "PLV" (n=30)	GB "VTV" (n=30)	Test of sig.	p
Oxygenation index Mean ± SD.	12.93 ± 4.66	13.17 ± 5.14	t=0.184	0.854
Ventilation index Mean ± SD.	48.53 ± 19.25	59.0 ± 21.68	t=1.977	0.053

t: Student t-test
Statistically significant at $p \leq 0.05$

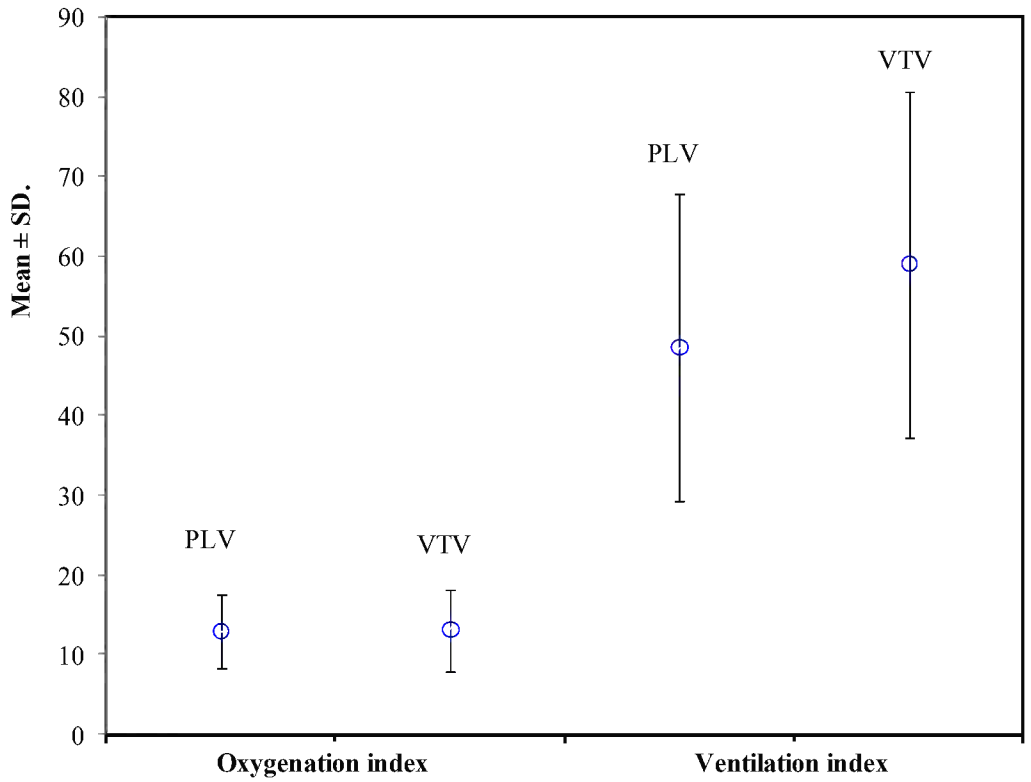

Figure (15): The mean indices of oxygenation and ventilation on admission and its SD among the studied groups .

Table 8: shows the Incidence of hypercarbic and hypocarbic episodes for each neonate during the course of the disease among the studied groups. Group B has statistically significant less hypocarbic and non-permissible hypercarbic episodes than group A.

Table 8: The Incidence of hypercarbic and hypocarbic episodes for each neonate during the course of the disease.

	GA "PLV" (n=30)	GB "VTV" (n=30)	Z	p
Non permissible Hypercarbia				
Mean rank	38.3	26.33		
Median	1	0	2.042*	0.041*
Min. – Max.	0.0 – 7.0	0.0 – 2.0		
Hypocarbia				
Mean rank	36.95	25.80		
Median	0.5	0	2.403*	0.016*
Min. – Max.	0.0 – 4.0	0.0 – 1.0		

Z: Z for Mann Whitney test
*: Statistically significant at $p \leq 0.05$

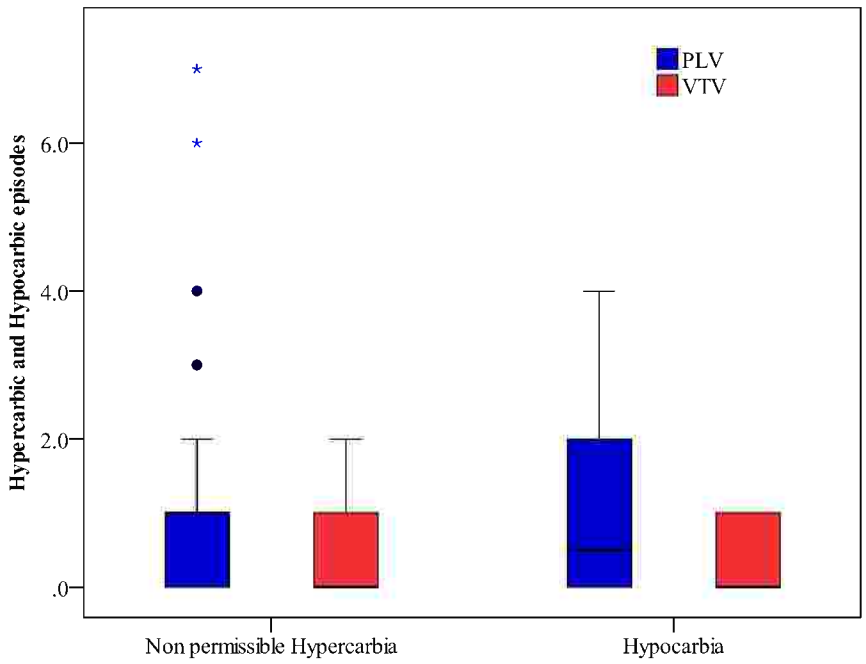

Figure (16): The number of the hypercarbic and hypocarbic episodes for each neonate during the course of the disease among the studied groups.

Table 9: shows Incidence of successful extubation among the studied groups. Group B had higher incidence of successful extubation (whether from 1st or 2nd trial) however that was not statistically significant.

Table 9: Incidence of successful extubation among the studied groups

	GA "PLV" (n=30)		GB "VTV" (n=30)		χ^2	p
	No.	%	No.	%		
Success. Extubation	21	70	27	90	3.75	0.053
1st Trial	20	66.7	23	76.7	1.279	MCp= 0.369
2nd Trial	1	3.3	4	13.3		

χ^2: value for Chi square test
MC: Monte Carlo Exact test
Statistically significant at $p \leq 0.05$

Table 10: shows Duration of Ventilation and hospital stay among the studied groups. Group B had a significantly shorter duration of ventilation than group A

Table 10: Duration of Ventilation and hospital stay among the studied groups

	GA "PLV" (n=30)	GB "VTV" (n=30)	Z	p
Duration of vent (hrs)				
Median	66	29	2.604*	0.009*
Min. – Max.	24.0 – 240.0	11.0 – 216.0		
Duration of hospital stay (days)				
Median	13	13	0.918	0.358
Min. – Max.	2.0 – 40.0	4.0 – 69.0		

Z: Z for Mann Whitney test
*: Statistically significant at $p \leq 0.05$

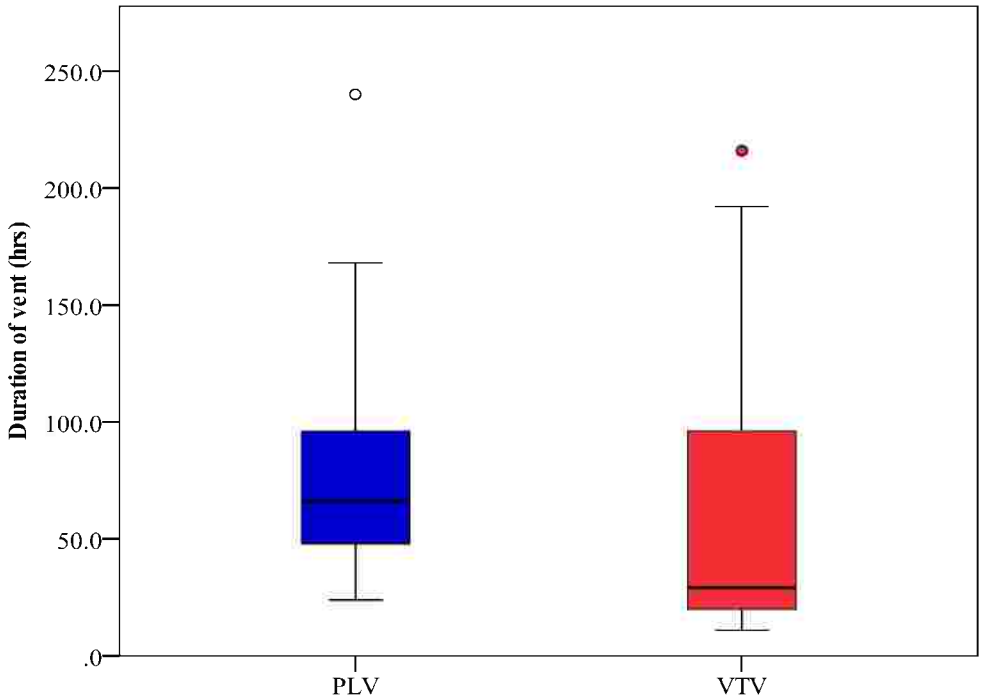

Figure (17): The median duration of Ventilation and its range among the studied groups

Table 11 shows comparison between the studied groups according to pulmonary, cardiac and neurological outcomes. No statistically significant difference was detected between both groups as regards complications. However, there was higher incidence of IVH grade 3 and 4 in group A and higher incidence of PDA in group B

Table 11: Pulmonary, cardiac and neurological complications of the studied groups

	GA "PLV" (n=30)		GB "VTV" (n=30)		χ^2	p
	No.	%	No.	%		
BPD	1	3.3	1	3.3	0	*FCp=1*
BPD needed CST	1	3.3	1	3.3	0	*FCp=1*
Air leaks	1	3.3	1	3.3	0	*FCp=1*
PDA	2	6.7	6	20	2.308	*FCp=1*
IVH						
No IVH	21	70	24	80	3.686	*MCp=0.308*
2	2	6.7	4	13.3		
3	6	20	2	6.7		
4	1	3.3	0	0		

χ^2: value for Chi square test FE: Fisher Exact test
MC: Monte Carlo test Statistically significant at $p \leq 0.05$

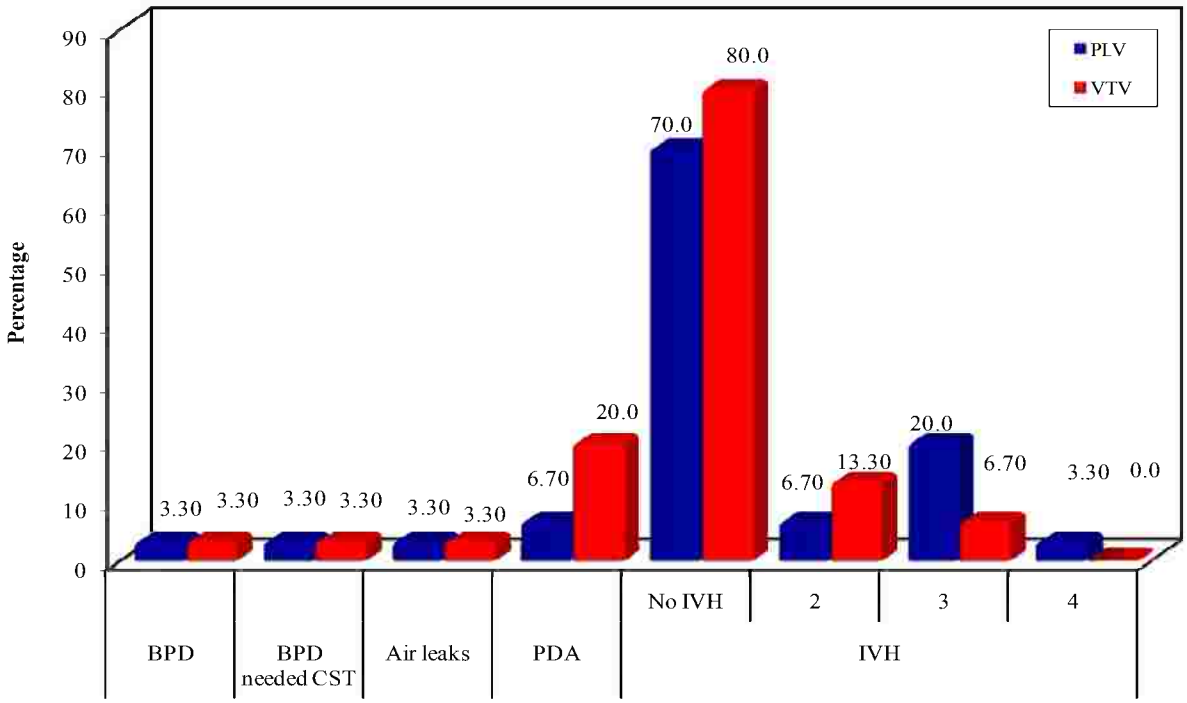

Figure (18): The Percentage Of Pulmonary, Cardiac And Neurological Complications Of The Studied Groups

Table 12 shows Comparison between the studied groups according to nosocomial infection. There was no statistically significant difference between group A and group B as blood stream infection, VAP, meningitis and gastroenteritis. However there is higher incidence of VAP and blood stream infection in the group A more than Group B.

Table 12: Comparison between the studied groups according to nosocomial infection.

	GA "PLV" (n=30)		GB "VTV" (n=30)		χ^2	p
	No.	%	No.	%		
Nosocomial Infection	21	70	21	70	0	^{FE}p=1.000
1. Blood stream infection	21	70	17	56.7	1.148	0.284
A. Lab diagnosis with –ve blood culture	17	81	16	94.1	0.067	0.795
B. Lab diagnosis with +ve blood culture						
Klebsiella	2	9.5	1	5.9	0.303	^{FE}p=1.000
Candida	1	4.8	0	0	0.783	^{FE}p=1.000
MRSA	1	4.8	0	0	0.783	^{FE}p=1.000
2. VAP	7	23.3	1	3.3	5.192	^{FE}p=0.052
A. Clinical VAP with –ve BAL	1	14.3	0	0	0.163	^{FE}p=1.000
B. Clinical VAP with +ve BAL						
VAP due to Klebsiella	5	71.4	0	0	2.917	^{FE}p=0.286
VAP due to Diphteria	1	14.3	0	0	0.163	^{FE}p=1.000
Acintobacter	0	0	1	5.9	1.017	^{FE}p=1.000
3. Meningitis	2	6.7	5	16.7	1.456	^{FE}p=0.424
4. Gastroenteritis	0	0	1	5.9	1.017	^{FE}p=1.000

χ^2: value for Chi square test FE: Fisher Exact test
*: Statistically significant at $p \leq 0.05$

Table 13 shows the median PIP , its range and the % of change of the PIP during the first 2 days of ventilation. There was statistically significant lower range of the PIP in day 2 and higher percentage of decrease in the pip from day 0 to day 2 in the VTV group. Moreover, there was lower median pip in day 1 and higher percentage of decrease in the pip from day 0 to day 1 in the vtv group although it was not statistically significant.

Table 13: The PIP changes during the first 2 days of ventilation among the studied groups.

PIP (cmH20)	GA "PLV" (n=30)	GB "VTV" (n=30)	Z	p
Day 0				
Median	19.0	22.0	1.724	0.085
Min. – Max.	17.0 – 29.0	17.0 – 29.0		
Day 1				
Median	14.0	13.50	0.232	0.816
Min. – Max.	9.0 – 18.0	9.0 – 21.0		
Day 2				
Median	12.0	12.0	2.397*	0.017*
Min. – Max.	10.0 – 18.0	9.0 – 15.0		
% Change from day 0 to day 1				
Median	-34.17	-36.84	1.198	0.231
Min. – Max.	-54.55 – 0.0	-65.38 – 5.88		
% Change from day 0 to day 2				
Median	-33.33	-47.91	3.049*	0.002*
Min. – Max.	-64.29 - 5.88	-65.38 - -17.65		

Z: Z for Mann Whitney test
*: Statistically significant at $p \leq 0.05$

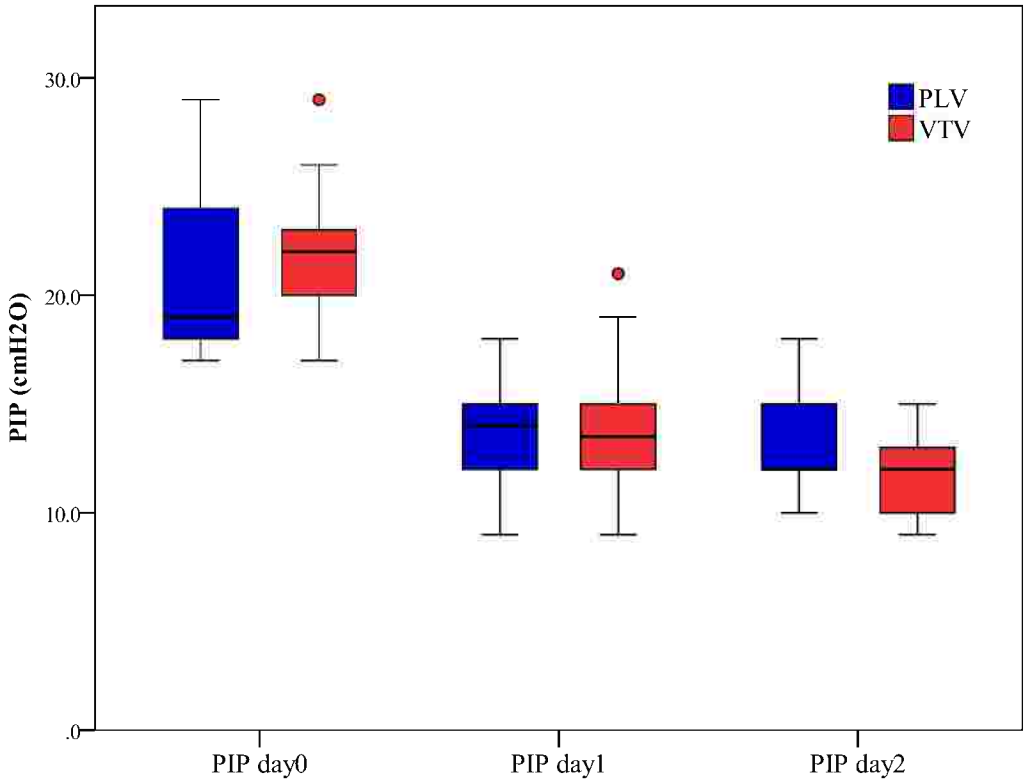

Figure (19): The PIP changes during the first 2 days of ventilation among the studied groups.

TABLE 14 shows the median FIO2 , its range and the % of change of the FIO2 during the first 2 days of ventilation. There was statistically significant lower median and range in the FIO2 in the first 2 days among the VTV group. Moreover, there was also non-significant higher percentage of decrease in the FIO2 during the first 2 days of ventilation in the VTV group

Table 14: The FIO2 changes during the first 2 days of ventilation among the studied groups.

FIO2	GA "PLV" (n=30)	GB "VTV" (n=30)	Z	p
Day 0				
Median	100.0	100.0	1.145	0.252
Min. – Max.	60.0 – 100.0	30.0 – 100.0		
Day 1				
Median	45.0	35.0	3.254*	0.001*
Min. – Max.	30.0 – 80.0	21.0 – 60.0		
Day 2				
Median	35.0	30.0	2.219*	0.027*
Min. – Max.	21.0 – 100.0	21.0 – 60.0		
% Change from day 0 to day 1				
Median	-50.0	-57.78	1.831	0.067
Min. – Max.	-70.0 – 14.29	-79.0 – 0.0		
% Change from day 0 to day 2				
Median	-53.13	-63.75	0.961	0.337
Min. – Max.	-79.0 – 66.67	-73.75 – -16.67		

Z: Z for Mann Whitney test
*: Statistically significant at $p \leq 0.05$

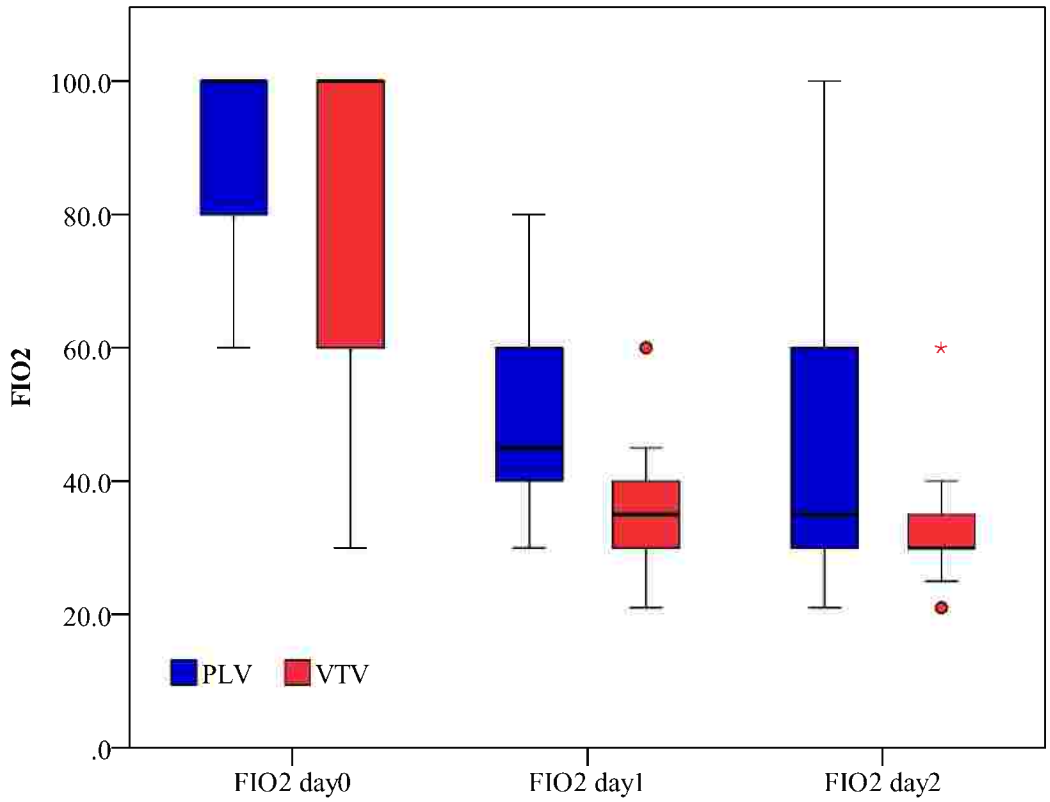

Figure (20): The FIO2 changes during the first 2 days of ventilation among the studied groups.

Table 15: shows the mean ETV, its standard deviation and the % of change of the ETV during the first 2 days of ventilation. There was statistically significant lower mean in the ETV in day 1 in the VTV compared to the PLV group. Moreover there was statistically significant percentage of decrease in the mean of the ETV from day 0 to day 1 among the VTV group and on the contrary an increase in the mean of the ETV from day 0 to day 1 among the PLV group.

Table 15: The ETV changes during the first 2 days of ventilation among the studied groups.

ETV (ml/kg)	GA "PLV" (n=30)	GB "VTV" (n=30)	t	p
Day 0 Mean ± SD.	4.9 ± 1.2	4.6 ± 0.5	1.255	0.217
Day 1 Mean ± SD.	5.6 ± 1.7	4.4 ± 0.5	3.370*	0.002*
Day 2 Mean ± SD.	4.6 ± 1.7	4.3 ± 1.0	0.675	0.503
% Change from day 0 to day 1 Mean ± SD.	17.21 ± 41.89	-3.67 ± 8.34	2.677*	0.012*
% Change from day 0 to day 2 Mean ± SD.	-1.44 ± 44.58	-6.72 ± 20.68	0.588	0.560

t: Student t-test
*: Statistically significant at $p \leq 0.05$

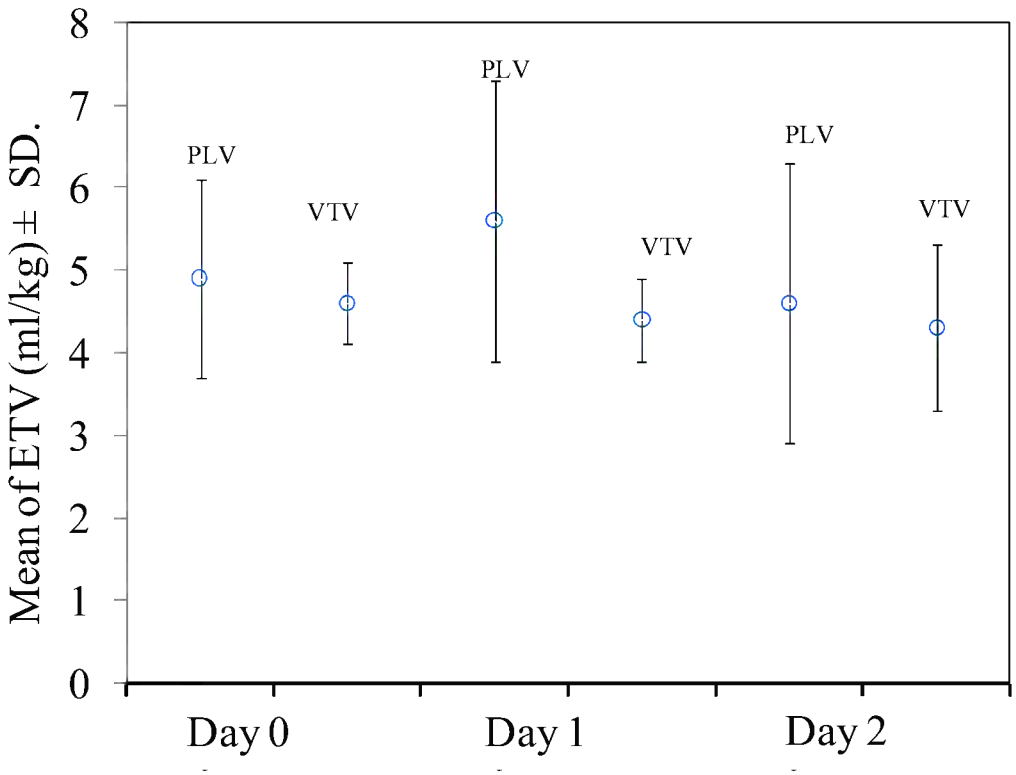

Figure (21): The ETV changes during the first 2 days of ventilation among the studied groups.

TABLE 16 shows the median MAP, its range and the % of change of the MAP during the first 2 days of ventilation. There was significantly lower median and range of the MAP in day 2 among the VTV group. Moreover there was statistically significant percentage of decrease from day 0 to day 2 in the VTV group.

Table 16: The MAP changes during the first 2 days of ventilation among the studied groups.

MAP (cmH20)	GA "PLV" (n=30)	GB "VTV" (n=30)	Z	p
Day 0				
Median	12.0	13.0	1.661	0.097
Min. – Max.	10.0 – 17.0	9.0 – 19.0		
Day 1				
Median	9.0	7.5	0.745	0.456
Min. – Max.	6.0 – 12.0	6.0 – 12.0		
Day 2				
Median	7.0	6.0	2.122*	0.034*
Min. – Max.	6.0 – 12.0	5.0 – 8.0		
% change from day 0 to day 1				
Median	-35.71	-42.73	1.406	0.160
Min. – Max.	-50.0 – 0.0	-60.0 – 0.0		
% change from day 0 to day 2				
Median	-45.83	-53.85	2.429*	0.015*
Min. – Max.	-58.82 - 9.09	-61.54 – -27.27		

Z: Z for Mann Whitney test
*: Statistically significant at $p \leq 0.05$

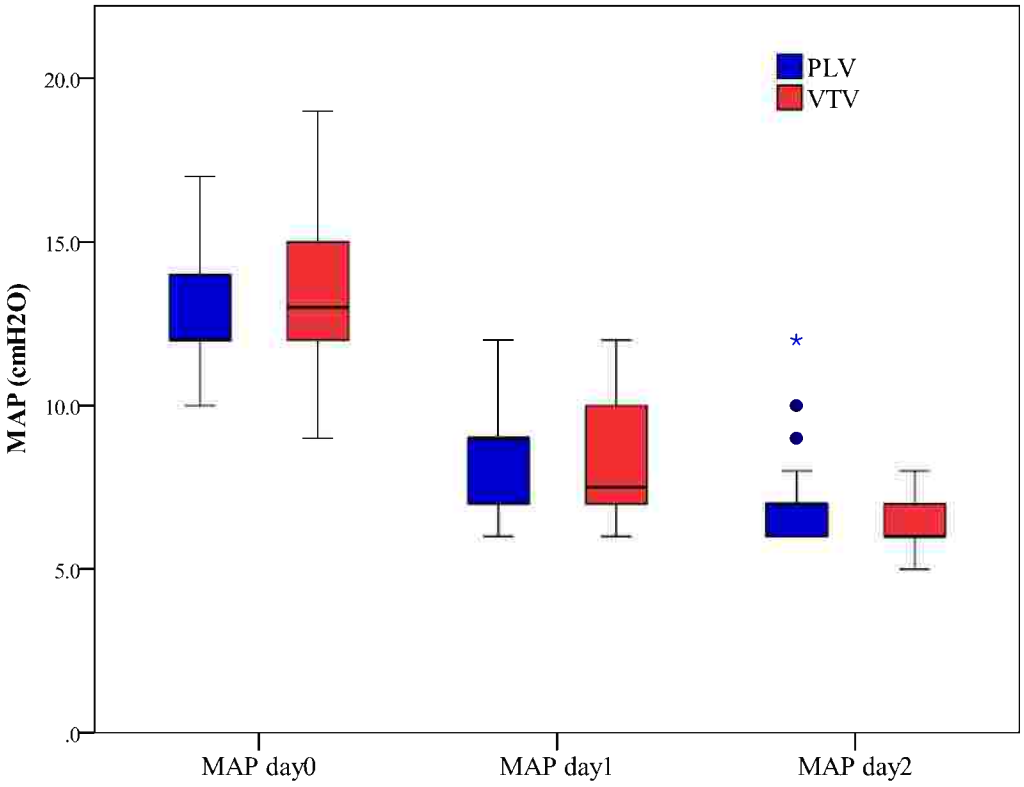

Figure (22): The MAP changes during the first 2 days of ventilation among the studied groups.

Table 17: shows the median dynamic lung compliance, its range and the % of change during the first 2 days of ventilation. There was statistically significant higher median compliance in the first 2 days among the VTV group. There was statistically significant higher percentage of increase in the compliance from day 0 to day 2 in the VTV group.

Table 17: The dynamic lung compliance changes during the first 2 days of ventilation among the studied groups.

COMPL (ml/cmH20)	GA "PLV" (n=30)	GB "VTV" (n=30)	Z	p
Day 0				
Median	0.5	0.5	0.628	0.530
Min. – Max.	0.2 – 1.0	0.2 – 1.5		
Day 1				
Median	0.6	1.1	3.511*	<0.001*
Min. – Max.	0.4 – 1.3	0.4 – 2.3		
Day 2				
Median	0.9	1.2	4.444*	<0.001*
Min. – Max.	0.2 – 1.3	0.5 – 2.3		
% change from day 0 to day 1				
Median	43.75	100.0	1.934	0.053
Min. – Max.	-55.56 – 500.0	-33.33 – 900.0		
% change from day 0 to day 2				
Median	60.0	163.33	2.382*	0.017*
Min. – Max.	-20.0 – 433.33	-37.50 – 900.0		

Z: Z for Mann Whitney test
*: Statistically significant at $p \leq 0.05$

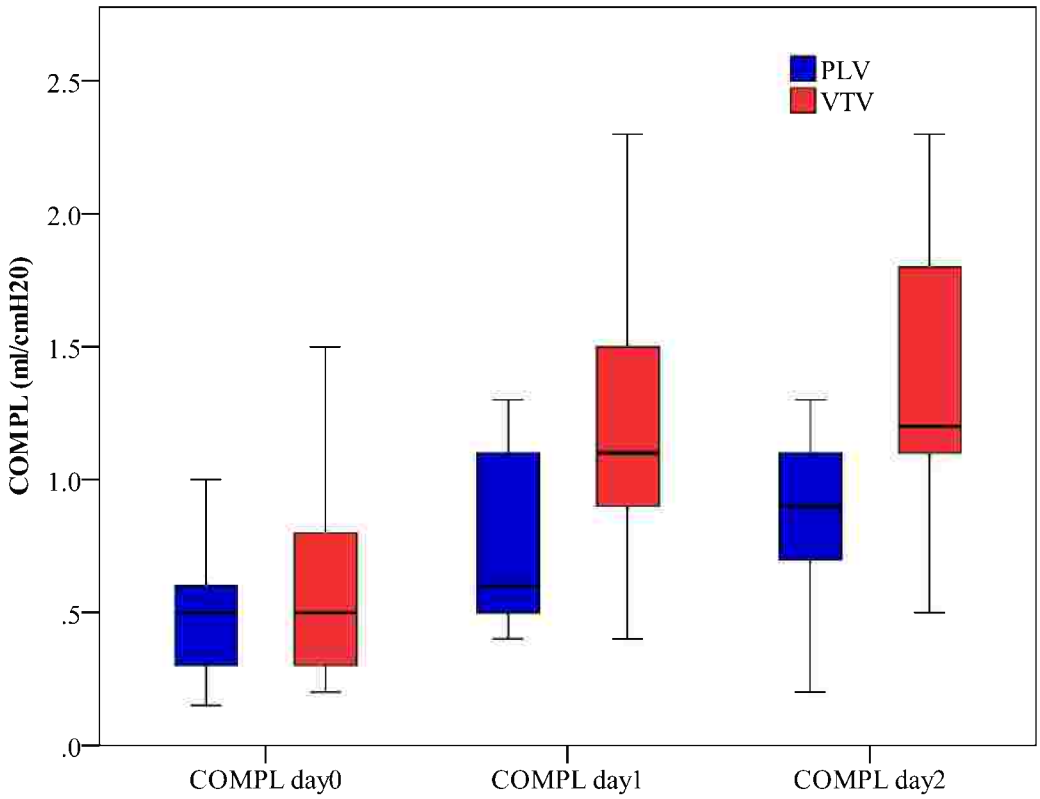

Figure (23): The dynamic lung compliance changes during the first 2 days of ventilation among the studied groups.

Table 18: shows the median lung resistance, its range and the % of change in the resistance during the first 2 days of ventilation. There was no statistically significant difference between both groups regarding the resistance in day 1 or day 2 or the percentage of change in the resistance from day 0 to day 1 and from day 0 to day 2.

Table 18: The lung resistance changes during the first 2 days of ventilation among the studied groups.

Resist (cmH20/l/sec)	GA "PLV" (n=30)	GB "VTV" (n=30)	Z	p
Day 0				
Median	185.0	299.0	1.332	0.183
Min. – Max.	126.0 – 740.0	162.0 – 515.0		
Day 1				
Median	188.0	197.5	0.451	0.652
Min. – Max.	113.0 - 740.0	141.0 – 643.0		
Day 2				
Median	179.0	195.0	1.146	0.252
Min. – Max.	91.0 – 66.0	92.0 – 389.0		
% change from day 0 to day 1				
Median	0.0	-8.31	0.762	0.446
Min. – Max.	-67.14 - 300.00	-52.43 - 154.15		
% change from day 0 to day 2				
Median	-9.43	-8.77	0.096	0.923
Min. – Max.	-78.09 - 260.0	-53.40 - 80.09		

Z: Z for Mann Whitney test
Statistically significant at $p \leq 0.05$

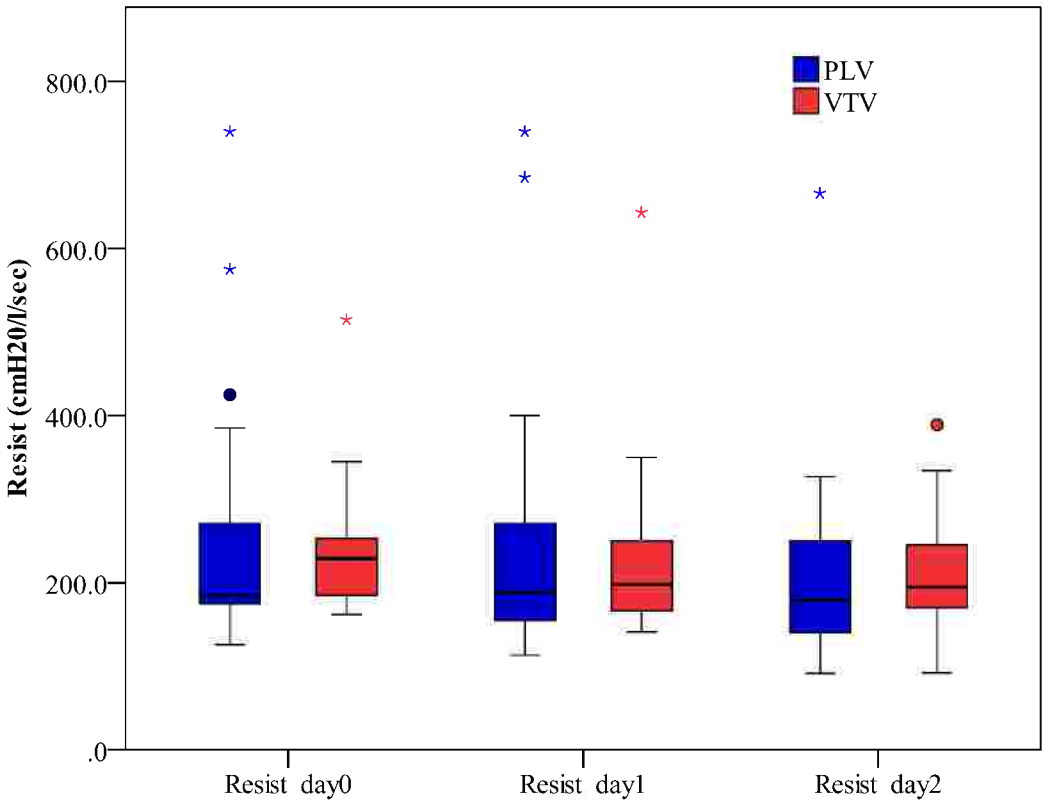

Figure (24): The lung resistance changes during the first 2 days of ventilation among the studied groups.