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CORRELATION OF FUNCTIONAL ECHOCARDIOGRAPHIC PARAMETERS WITH CKMB AND TROPONIN I

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ABSTRACT

Introduction: Perinatal asphyxia is an important cause of admission to neonatal intensive care units (NICU) with multi organ dysfunction.**Aim**: Determine the change in functional echocardiographic parameters with CKMB and Troponin I and time. **Methodology:**The study, conducted at the Division of Pediatric Cardiology in M.D.M Hospital under the Department of Paediatrics, Dr. S. N. Medical College, Jodhpur, focused on perinatal asphyxia and hypoxic ischemic encephalopathy (HIE)**.**Functional echocardiographic parameters were studied with time. **Result:** Both left atrial and aortic diameters did not significantly change over time. However, La/Ao showed a significant decrease over time. LVED and LVES remained relatively stable over the measured time intervals. EF and FS increased significantly over time, indicating improvement in cardiac function. Parameters such as LVMPI, mvcf, MAPSE, and TAPSE did not show significant changes over time. Mitral E/A ratio, mitral E/e' medial, mitral E/e' lateral, tricuspid E/A ratio, tricuspid E/e' medial, and tricuspid E/e' lateral also remained relatively stable over the measured time intervals.

Conclusion: It shows a complex interplay between structural and functional aspects of cardiac performance over time. While certain parameters remained stable, others demonstrated dynamic changes, underscoring the importance of comprehensive echocardiographic assessment in evaluating cardiac function and guiding clinical management.

Keywords: Perinatal asphyxia, CKMB, Troponin I

INTRODUCTION:

Perinatal asphyxia is an important cause of admission to neonatal intensive care units (NICU) with multi organ dysfunction[1.]Cardiovascular complications (25-60%)[2,3]manifests as an abnormal clinical features like RDS, abnormal electrocardiogram (11%) and abnormal echocardiogram (25%) like transient myocardial systolic or diastolic dysfunction, tricuspid and mitral regurgitation and PPHN. The reduced myocardial performance and cardiac output following perinatal asphyxia may significantly complicate perinatal management and may contribute to increase end-organ damage and mortality. Even though this is generally a transient effect it can result in cardiogenic shock and death. Detecting them early will help in management and probably good long term outcome.Cardiac enzymes have long been used as frontline diagnostic tools in the detection of myocardial injury caused by myocardial ischemia[4,5,6]. However, the most commonly used enzymes, including CK and its myocardial fraction (CK-MB), have a limited role in detecting myocardial injury because of their short diagnostic windows, limited sensitivity, and a lack of specificity[7].Functional echocardiography (Fn Echo) is the bedside diagnostic tool to longitudinally assess myocardial function, systemic and pulmonary blood flow, intra and extra cardiac shunts. It

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can provide detailed real time information concerning physiology and hemo-dynamics leading to rapid identification of the mechanics of circulatory failure in critically ill patients, thus allowing targeted therapy[8].The clinical evaluation, cardiac enzymes – LDH, CPK-MB and troponin, electrocardiography (ECG), echocardiogram- M mode, 2D ECHO, Doppler and tissue doppler are means for cardiac function evaluation are the different modalities to evaluate neonate with birth asphyxia.

Aim:

To determine the change in functional echocardiographic parameters with CKMB and Troponin I and time within 24 hours of life, 90-96 hours and 162-168 hours of life in neonates with Perinatal Asphyxia.

METHODOLOGY:

The study, conducted at the Division of Pediatric Cardiology in M.D.M Hospital under the Department of Paediatrics, Dr. S. N. Medical College, Jodhpur, focused on perinatal asphyxia and hypoxic ischemic encephalopathy (HIE). Ethical approval was obtained from the Institutional Ethical Committee prior to commencement. Perinatal asphyxia was diagnosed according to guidelines from the NNPD[9] network, where moderate cases were identified by slow or gasping breathing or an APGAR score of 4 to 6 at 1 minute, while severe cases were characterized by no breathing or an APGAR score of 0-3 at 1 minute. Diagnosis of HIE involved a comprehensive physical examination assessing various parameters including level of consciousness, neuromuscular control, reflexes, pupil reaction, heart rate, secretion levels, gastrointestinal motility, and presence of seizures or myoclonus. The severity of HIE was classified using the Modified Sarnat & Sarnat staging system, a method proposed in 1976 for categorizing the extent of encephalopathy.

RESULT:

Table 1: Weight wise distribution of cohort:

Weight (in kg)	**Control group (n=65)**	**Study group (n=45)**
< 2.5 kg	03	06
≥2.5	62	39
Total	**65 (2.98±0.32)**	**45 (2.82±0.31)**

The mean birth weight of the neonates in control group and study group were 2.98 ± 0.32 kg and 2.82±0.31 kg respectively.

Table2: Left ventricular systolic functions of study group with time:

Parameters	**<24 Hours(Mean)**	**90-96 Hours(Mean)**	**162-168 Hours**	**ANOVA**
La	10.99±2.19	10.12±1.90	10.28±1.30	0.092
Ao	8.93±1.03	8.97±0.95	9.12±0.73	0.663
La/Ao	1.23±0.27	1.11±0.20	1.11±0.18	0.029

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LVDd	14.99±2.89	14.83±2.77	14.34-2.41	0.570
LVDs	11.14±2.59	10.53±3.18	10.23±2.11	0.238
EF	45.24±13.14	53.42±11.07	55.51±11.20	0.0005
Fs	24.93±7.57	28.31±6.79	28.48±6.48	0.041
LVMPi	0.83±0.51	0.87±0.55	0.81±0.27	0.857
MVCf	1.50±0.68	1.85±0.65	1.74±0.49	0.042
MAPSE	5.76±1.32	5.55±1.41	5.63±1.63	0.804

While most parameters remained relatively stable over time, the La/Ao ratio, EF, and FS showed statistically significant changes. These changes may indicate alterations in cardiac function or geometry during the observed time intervals.

Table3:Left Ventricular Diastolic dysfunction in study group with time:

	18-24hr (mean)	**90-96 hr(mean)**	**162-168 hr(mean)**	**ANOVA**
Mitral E/A	1.14±0.33	1.04±0.26	1.13±0.27	0.287
E/e'Medial	9.18±2.10	9.65±2.29	9.15±2.17	0.674
E/e'Lateral	9.34±1.50	8.95±1.79	7.98±1.83	0.894
Mitral annulus	9.26±1.37	8.90±0.96	9.02±1.27	0.415

None of the parameters related to mitral valve function and dynamics showed statistically significant changes over the observed time intervals. This suggests relative stability in these parameters within the study group across different time points.

Table 4 :Right ventricular functions in study group with time:

	18-24hr	**90-96hr**	**162-168 hr**	
Parameters	**Mean**	**Mean**	**Mean**	**ANOVA**
RVDd	9.49±1.73	8.91±1.91	9.08±1.63	0.320
RVDs	5.36±1.73	4.85±1.39	5.23±1.62	0.363
TAPSE	4.56±0.92	4.32±0.90	4.42±1.05	0.544
Tricuspid annulus	11.20±2.06	10.82±2.17	10.65±1.96	0.473
Tricuspid E/A	1.09±0.41	0.99±0.33	1.03±0.25	0.438
E/e'medial	9.70±1.37	9.06±1.48	8.65±1.95	0.715

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E/e'Lateral	9.28±1.18	7.84±1.68	9.67±2.08	0.789

The findings indicate that there were no statistically significant differences observed for any of the parameters across the different time points, as all p-values were greater than 0.05.This suggests that these parameters did not change significantly over the time intervals studied.

Table 5:Biochemical parameters in Expired vs Survived cases:

Biochemical parameter	**Expired**	**Survived**	**P value**
CPKMB	451.83±170.26	254.11±153.45	0.0006
LDH	1347.25±370.59	713.57±397.67	<0.0001
Troponin I (+)	11(91.66%)	04(12.12%)	<0.0001

Mean values of CPKMB and LDH were provided for both survived and expired cases.A statistically significant increase was observed in the levels of CPKMB and LDH in expired cases compared to survived cases (p-value < 0.001).The difference in Troponin I positivity between the two groups was statistically significant (p-value < 0.001).These findings suggest that elevated levels of CPKMB, LDH, and Troponin I may be associated with a higher likelihood of mortality in the context of the medical condition or event being studied.

Table 6: Regurgitation across AV and semilunar valve in Expired and survived cases:

Parameter	**Expired (n=12)**	**Survived (n=33)**	**P value**	**LR Ratio**	**likelihood ratios (95% C.I)**	
					Positive	Negative
MR	6	07	0.075	2.29	2.36 (0.99-5.61)	0.63 (0.35-1.15)
TR	10	27	0.906	1.01	1.02 (0.75-1.37)	0.92 (0.21-3.94)
PR	02	01	0.169	5.50	5.50 (0.55-55.28)	0.86 (0.66-1.11)
AR	05	06	0.130	2.29	2.29 (0.86-6.14)	0.71 (0.43-1.18)
PAH	12	21	0.019	1.57	1.57 (1.15-2.01)	0.00 (0.01-1.64)

Tricuspid regurgitation was the most common valvular lesion, present in 82.20% of cases within 24 hours, and this prevalence was statistically significant (p-value < 0.0001). The second most common finding was mitral regurgitation, present in 28.90% of cases within 24 hours. However, this prevalence was not statistically significant. Pulmonary regurgitation was present in 24.40% of cases within 24 hours, but this was not statistically significant. Among cases with pulmonary regurgitation, 45.45% resulted in mortality.Aortic regurgitation

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was present in 6.70% of cases within 24 hours, also not statistically significant. While tricuspid regurgitation was the most prevalent lesion and significantly associated with survival outcomes, mitral, pulmonary, and aortic regurgitation were also present, with varying degrees of impact on mortality, though not statistically significant in this study.

DISCUSSION

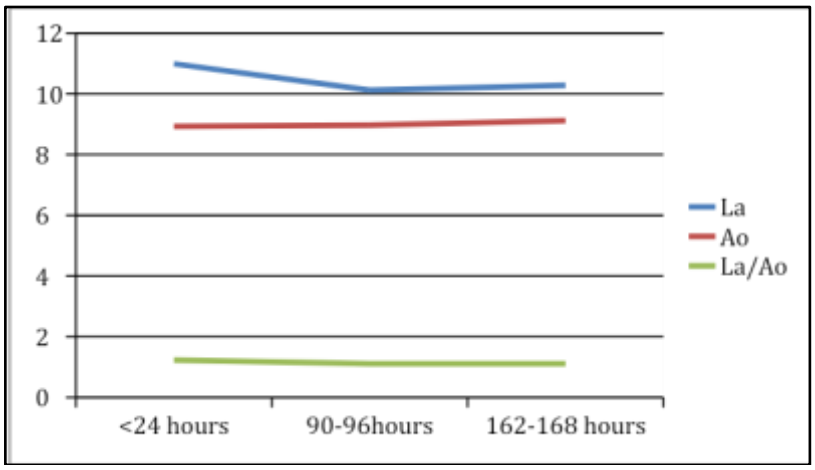

Fig1:La,Ao and La/Ao in Study group with time:

La with mean values of 10.99±2.19mm within 24 hours, 10.12±1.90mm at 90-96 hours, and 10.28±1.30mm at 162-168 hours. Aowith mean values of 8.93±1.03mm within 24 hours, 8.97±0.95mm at 90-96 hours, and 9.12±0.73mm at 162-168 hour.La/Ao showed a statistically significant change over time. Mean values were 1.23±0.27 within 24 hours, 1.11±0.20 at 90-96 hours, and 1.11±0.18 at 162-168 hours, with a p-value less than 0.05.
while left atrial diameter and aortic diameter did not significantly change over time, the ratio of left atrial diameter to aortic diameter did show a significant difference across the measured time points.

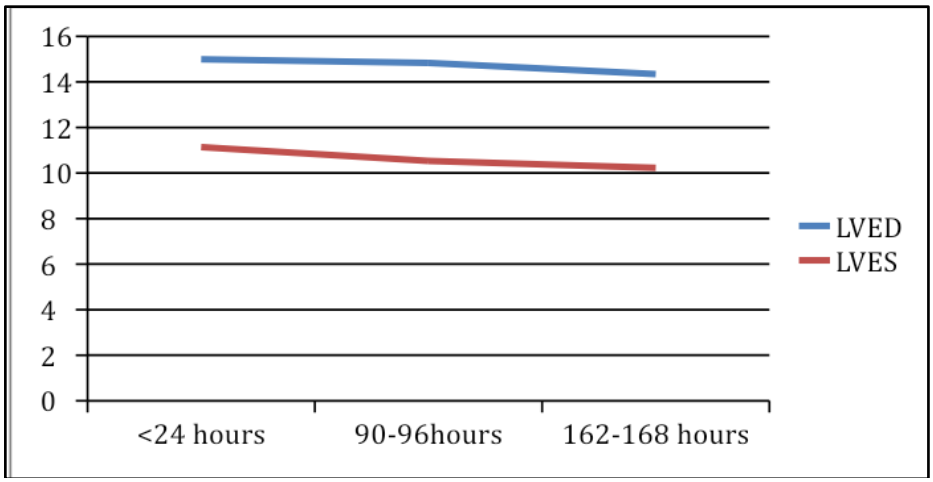

Fig2:LVED and LVES in study group with time:

LVED did not show statistically significant changes over time, with mean values of 14.99±2.89mm within 24 hours, 14.83±2.77mm at 90-96 hours, and 14.34±2.41mm at 162-168 hours (p-value > 0.05).Similarly, LVES did not exhibit statistically significant variations over time, with mean values of 11.14±2.59mm within 24 hours, 10.53±3.18mm at 90-96 hours, and 10.23±2.11mm at 162-168 hours (p-value > 0.05).

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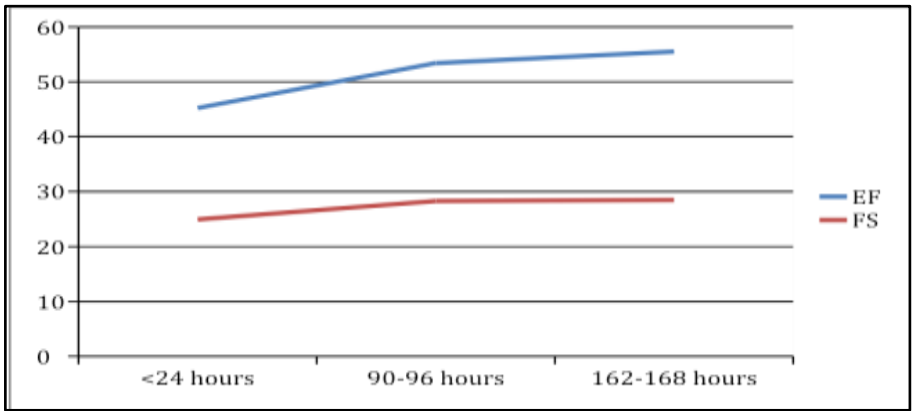

Fig3:EF and FS in study group with time

EF increased over time, with mean values of 45.24±13.14% within 24 hours, 53.42±1.07% at 90-96 hours, and 55.51±11.20% at 162-168 hours.FS also increased over time, with mean values of 24.93±7.57% within 24 hours, 28.31±6.79% at 90-96 hours, and 28.48±6.48% at 162-168 hours. These changes were statistically significant (p-value < 0.05).The findings suggest that when impaired cardiac function was detected initially and inotropic support was administered promptly, subsequent echocardiography at 90-96 and 162-168 hours showed significant improvement in both EF and FS (p-value < 0.0005).

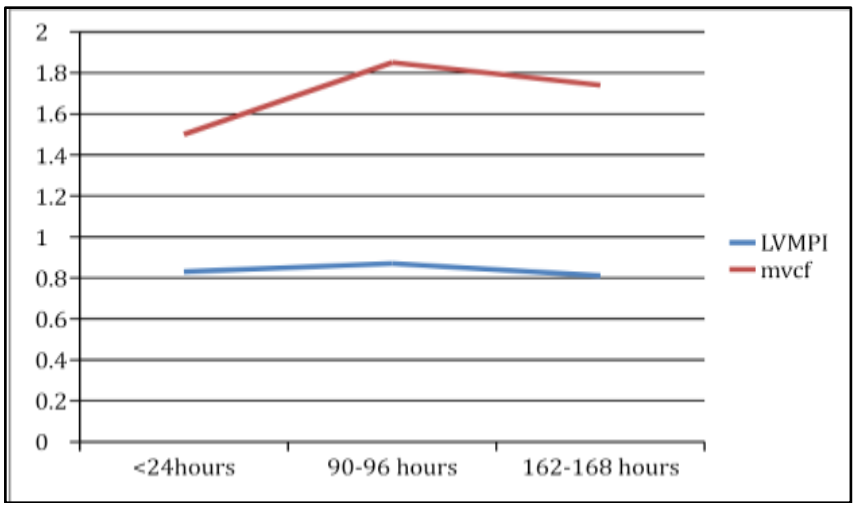

Fig4:LVMPI and mvcf in study group with time:

The mean value of LVMPI within 24 hours,90-96 hours ,162-168 hours were 0.83±0.51,0.87±0.5 and 0.81±0.27 respectively which were not statically significant as P value >0.05.The mean value of mvcf within 24 hours,90-96 hours ,162-168 hours were 1.50±0.68cicrcle/sec,1.85±0.65circle/sec and 1.74±0.49circle/sec respectively which were not statically significant as P value <0.05.

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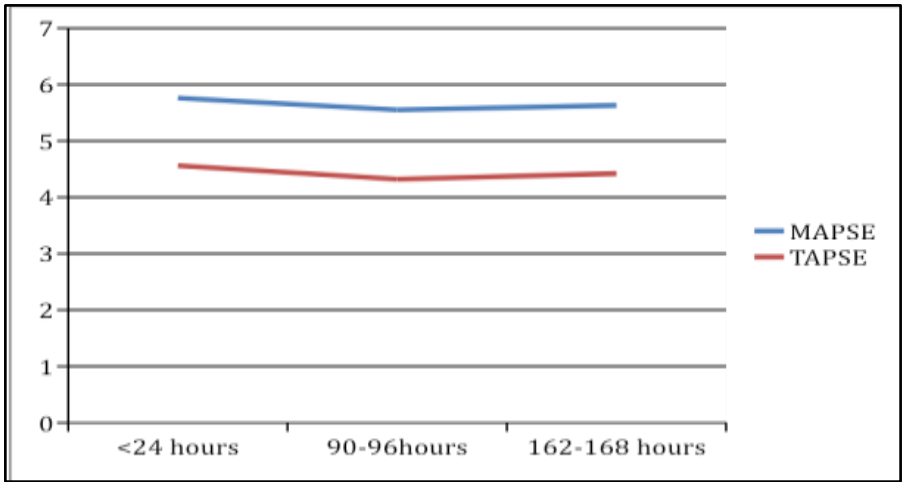

Fig5:MAPSE and TAPSE in study group with time:

The mean value of MAPSE within 24 hours,90-96 hours ,162-168 hours were 5.76±1.32mm, 5.55±1.4mm and 5.63±1.63mm respectively which were not statically significant as P value >0.05.The mean value of TAPSE within 24 hours,90-96 hours ,162-168 hours were 4.56±0.92mm,4.32±0.90mm and 4.42±1.05mm respectively which were not statically significant as P value >0.05.

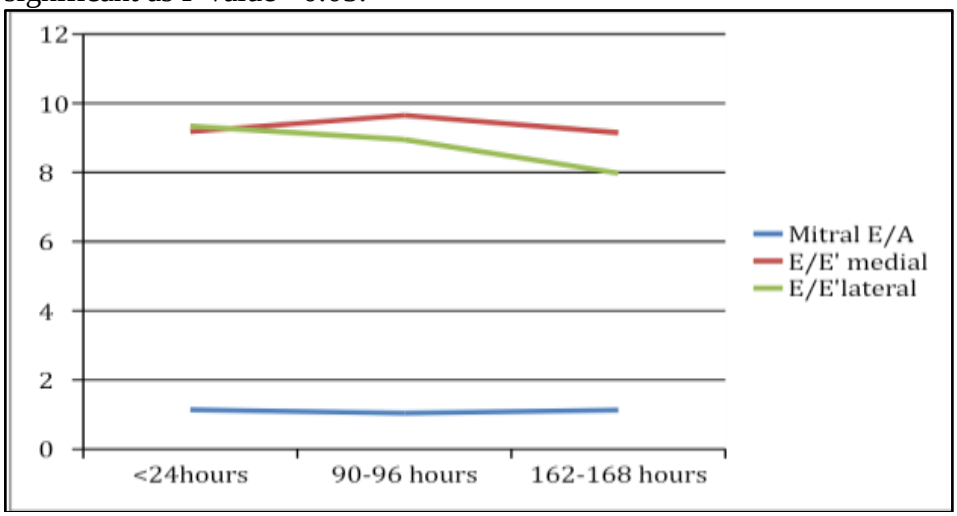

Fig6:Left ventricular diastolic dysfunctions in study group with time:

The mean values of mitral E/A ratio within 24 hours, 90-96 hours, and 162-168 hours were 1.14±0.33, 1.04±0.26, and 1.13±0.27, respectively. (p-value > 0.05).Similarly, the mean values of mitral E/e' medial within 24 hours, 90-96 hours, and 162-168 hours were 9.18±2.10 cm/sec, 9.65±2.29 cm/sec, and 9.15±2.17 cm/sec, respectively. (p-value > 0.05).Additionally, the mean values of mitral E/e' lateral within 24 hours, 90-96 hours, and 162-168 hours were 9.34±1.50 cm/sec, 8.95±1.79 cm/sec, and 7.98±1.83 cm/sec, respectively. Again, no statistically significant differences (p-value > 0.05)

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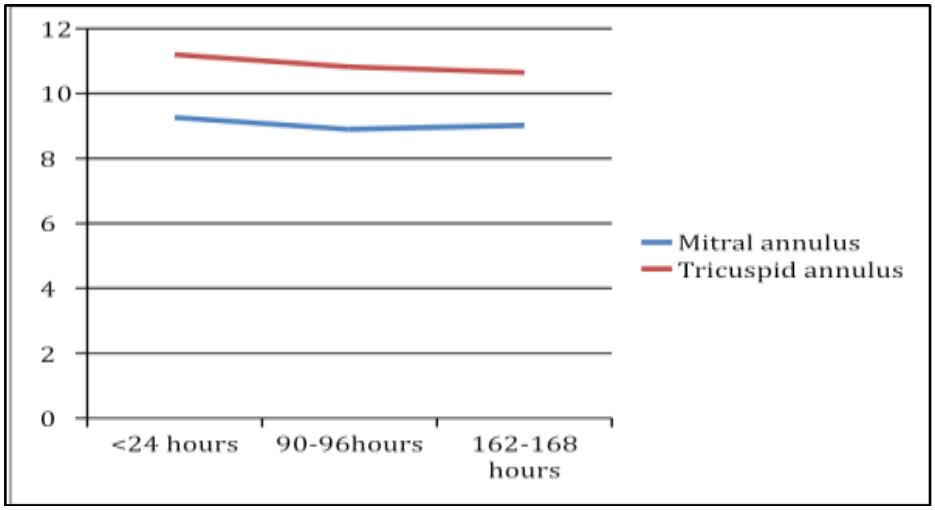

Fig7:AV valve diastolic diameter in study group with time:

The mean value of tricuspid annulus within 24 hours,90-96 hours ,162-168 hours were 11.20±2.06mm,10.82±2.17mm and 10.65±1.96mm respectively (P value >0.05).The mean value of mitral annulus within 24 hours,90-96 hours ,162-168 hours were 9.26±1.37mm,8.90±0.96mm and 9.02±1.27mm respectively (P value >0.05).

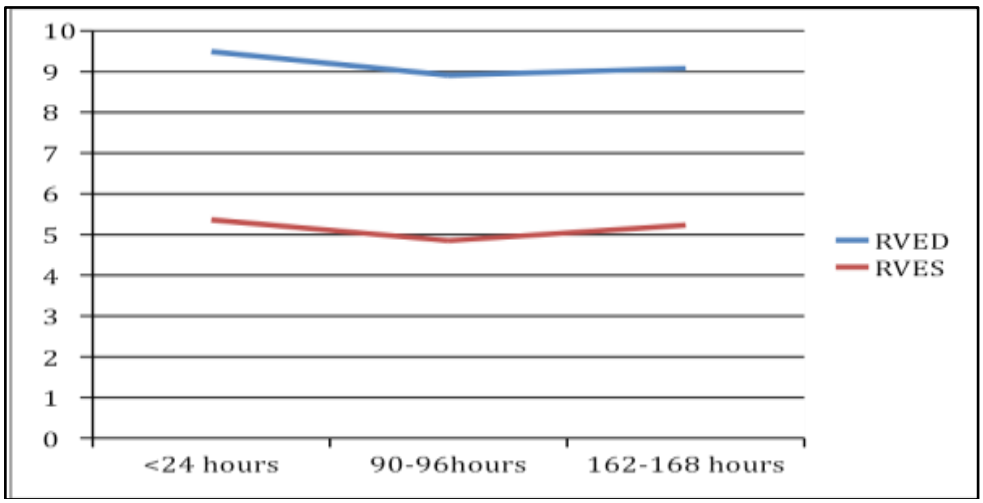

Fig8:RVED and RVES in study group with time:

The mean value of RVED within 24 hours,90-96 hours ,162-168 hours were 9.49±1.73mm,8.91±1.91mm and 9.08±1.63mm respectively(P value >0.05).The mean value of RVES within 24 hours,90-96 hours ,162-168 hours were 5.36±1.73mm,4.85±1.39mm and 5.23±1.62mm respectively (P value >0.05).

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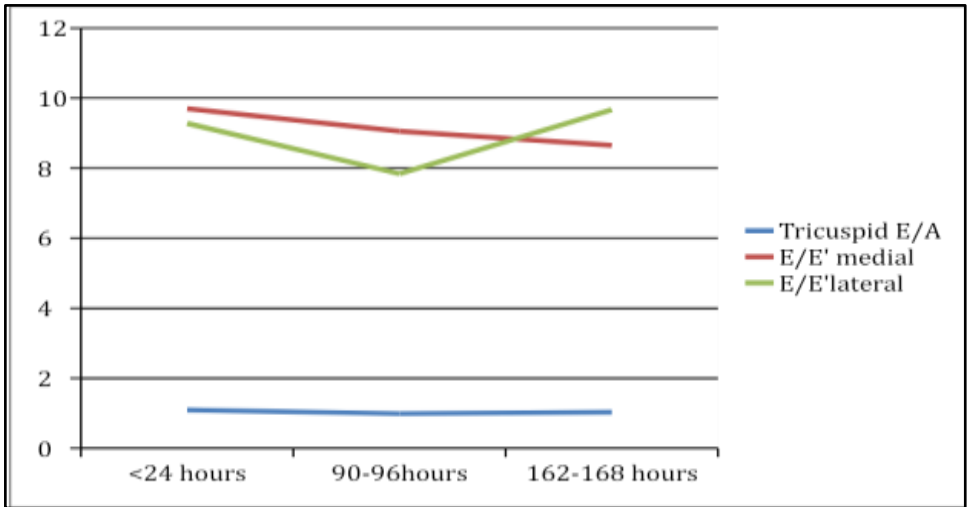

Fig9:Right ventricular diastolic functions in study group with time:

The mean value of tricuspid E/A within 24 hours,90-96 hours ,162-168 hours were 1.09±0.41,0.99±0.33 and 1.03±0.25 respectively which were not statically significant as P value >0.05.The mean value of tricuspid E/e' medial within 24 hours,90-96 hours ,162-168 hours were 9.70±1.37cm/sec,9.06±1.48cm/sec and 8.65±1.95cm/sec respectively which were not statically significant as P value >0.05.The mean value of tricuspid E/e' lateral within 24 hours,90-96 hours ,162-168 hours were 9.28±1.18cm/sec,7.84±1.68cm/sec and 9.67±2.08cm/sec respectively which were not statically significant as P value >0.05.

Conclusion

In the study group, various functional echocardiographic parameters were measured over different time intervals. The study findings highlight the importance of monitoring functional echocardiographic parameters over time to assess cardiac function dynamics and guide clinical management. Timely interventions can lead to significant improvements in cardiac function, while certain parameters may remain stable, reflecting consistent structural and functional aspects of the heart.

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