Predictors of Survival time to Discharge Following Cardio-Pulmonary Resuscitation among Neonates admitted in NICU at Gandhi Memorial and Tikur Anbessa Specialized Hospital, Ethiopia: A Prospective Cohort Study (2025 GC).

A Research Thesis To be Submitted to Addis Ababa University, College of Health Science Tikur Anbessa Specialized Hospital for the requirement of Specialty certificate in Pediatrics and Child health

FEBRUARY 2025 G.C

ADDIS ABABA, ETHIOPIA

ADDIS ABABA UNIVERSITY COLLEGE OF HEALTH SCIENCE TIKUR ANBESSA SPECIALIZED HOSPITAL

Predictors of Survival time to Discharge Following Cardio-Pulmonary Resuscitation among Neonates admitted in the NICU in Gandhi Memorial Hospital and TASH Hospital, Ethiopia: A Prospective Cohort Study (2025 GC).

By: ABRARAW ADMASU (MD)

***Advisors*: Dr. Helen Mintesnot, (Assistant professor of pediatrics, pediatric cardiologist)**

A research A Research Paper Submitted to Addis Ababa University Tikur Anbessa Specialized Hospital College of Health Science; for the prerequisite of specialty in pediatrics and child health

FEBRUARY 2025 G.C

ADDIS ABABA, ETHIOPIA

To be approved by the examining board of Addis Ababa University Tikur Anbessa specialized Hospital College of health science department of pediatrics and child health

Principal Investigator Name	**Signature**	**Date**
Abraraw Admasu (MD)	_____	_____

Approve By the Examining Board

To be approved by

Advisor Name	**Signature**	**Date**
Dr.Helen Mintesnot (MD, Pediatrics cardiologist)		
_____	_____	_____

Examiners' Name	**signature**	**Date**
_____	_____	_____

ABSTRACT

Background:

Cardiopulmonary resuscitation (CPR) is a set of life-saving procedures that increase survival chances. An integrated series of coordinated actions symbolized by the links in the Chain of Survival are necessary for successful resuscitation after cardiac arrest. Cardiopulmonary arrest requiring CPR with chest compressions occurs in 0.25% to 1% of NICU admissions.

Objectives: To determine predictor and survival time to discharge following cardio pulmonary resuscitation among neonate admitted in NICU at Gahandi memorial hospital and TASH Hospital, Ethiopia, January 2025G.C.

Methods: Hospital based Prospective cohort study design were employed from October 2024 to February 2025. Total sample size were 92 patient who had a cardiorespiratory arrest during the period and neonates were followed from onset of arrest to discharge. Data were collected from patient profile, death audits and resuscitation registries data. Then entered to Epidata version 3.1 exported to SPSS 27 version for analysis .. Survival plot, bivariate and multivariate cox regression were used to assess predictor of survival following discharge.

Result: The incidence of CPR among neonate admitted to TASH and GMH were7.9% (99/1243) and survival (censored) to discharge following CPR was 8.6 (8/92) and 91.2 %(84/92) died.

Neonate with CPR duration ≤ 5 minute (AHR 1.501, 95% CI: 1.039-2.170) were 1.5 times more likely to survive to discharge than > five minute and those who had antibiotic revision treatment during admission time (AHR 1.898, 95% CI: 1.156-3.117) were 1.9 times more likely survive to discharge compared to who had no revision.

No significant association to birth weight, vasopressor use, MV, underlying disease

Conclusion: Incidence of CPR among neonate admitted to TASH and GMH NICU is high.

Low survival to discharge following treatment to CPR.

C PR duration, Antibiotic revision were associated to survival time following CPR.

Key words: CPR, Neonate, NICU, Survival

Acknowledgement

I would like to thank Addis Ababa University, Tikur Anbessa Specialized Hospital College Health Science, Department of Pediatrics and Child Health for providing this opportunity for me to do this research. I would like also to thank my advisor Dr. Helen Mintesnot, Assistant professor of pediatrics, pediatric cardiologist for her constructive comment and valuable suggestion throughout this proposal development. I also thank to anyone in the process of this thesis.

List of abbreviations/ acronyms

AOR- adjusted odds ratio

CI-Confidence Intervals

COR-Crude odds ratio

CPR- Cardio-Pulmonary Resuscitation

DC-Data Collectors

FMOH-Federal Ministry of Health

GMH- Gahndi Memorial Hospital

NB- Newborn

Neonatal Intensive Care Units (NICU)

PI - Principal Investigator

SPSS-Statistical Package for Social Science

SRS-Simple Random Sampling

TASH –Tikur Anbessa specialized Hospital

TEF- Tracheoesophageal Fistula

LIST OF CONTENTS

List of tables

LIST OF FIGURE

1. INTRODUCTION

1.1 Background

Cardiopulmonary resuscitation (CPR) is a set of life-saving procedures that increase survival chances. An integrated series of coordinated actions symbolized by the links in the Chain of Survival are necessary for successful resuscitation after cardiac arrest. (1). The Chain of Survival describes the interconnections of essential components needed to revive a patient experiencing cardiac arrest from the time of the arrest until they regain consciousness.(1)

It's crucial to optimize the cardiopulmonary resuscitation (CPR) strategy for hospitalized newborns and infants. A large number of newborns and infants in the intensive care unit suffer from cardiopulmonary instability or arrest. Between 0.25 and 1% of NICU admissions involve cardiopulmonary arrest that necessitates CPR with chest compressions. (2).

There are few long-term survivors and a high rate of severe mental and/or psychomotor disability in infants who do survive after cardiopulmonary resuscitation (CPR) in neonatal intensive care units (NICUs) according to studies conducted over the past ten years (3). With improvements in neonatal care the survival rate for preterm and critically ill term infants is still increasing however these infants frequently have serious morbidities and are at a higher risk of needing cardiopulmonary resuscitation (CPR) (4).

About 1 percent of admissions to the neonatal intensive care unit (NICU) 1–4% of pediatric intensive care unit (PICU) and 3–1% of pediatric cardiac intensive care unit (PCICU) involve cardiopulmonary resuscitation (CPR) with chest compressions. In these units neonates and infants under one year old account for the majority of CPR events. Compared to the 0–1% incidence of CPR at birth the incidence of CPR with chest compressions in the NICU is ten times higher. Fifth. Thus far the results had been dismal with extremely high rates of neurological morbidity and mortality. The reported survival rates range widely from 3 percent to 17 percent (6).

Since many of the studies are over 15 years old they might not accurately represent current practices in CPR or the results obtained from newborns. A lot of these early reports also only

included very preterm babies who were given cardiopulmonary resuscitation within the first few days of their birth (7).

1.2. Statement of the problem

In many regions of the world cardiac arrest is still a major cause of death and a significant public health concern despite significant advancements in prevention (8). For neonatal resuscitation efforts to be successful crucial steps must be taken quickly in order to increase the likelihood of survival (9).

In any subject, a timely and appropriate resuscitation can mean the difference between intact survival, survival with neurological squeals or death (10).

Though cardiopulmonary resuscitation (CPR) may be required for newborns after birth especially in high-risk groups of infants admitted to the NICU such as those born prematurely with congenital defects experiencing perinatal asphyxia undergoing major surgery relying on technological devices and so on resuscitation is actually required for approximately 1-2 percent of all newborns in their first few minutes of life (10).

Current cardiopulmonary resuscitation (CPR) procedures and results in the neonatal intensive care unit (NICU) are poorly understood. The reported incidence of CPR in historical studies varied from 1 to 6 percent of all infants admitted to the NICU and among extremely preterm infants it could reach 10 to 34 percent (7). Some authors questioned whether CPR is useless for extremely preterm infants in the NICU because between 49 and 100 percent of the infants who received it in these studies passed away before being released from the hospital (7).

Although there is little information on CPR risk factors and NICU survival small single-center studies have indicated poor survival after CPR (11). Due to these constraints little is known about the risk factors and related survival after NICU CPR. Because of this ignorance healthcare professionals are unable to recognize infants who are at risk for cardiopulmonary resuscitation (CPR) determine which infants require CPR how thorough it should be and how to best advise parents when CPR is required.

Researchers observes CPR outcome and survival to discharge among neonate admitted to NICU was poor but had no any study exactly what is the current incidence as well predictors of

survival to discharge This raised the question about Predictors of Survival to Discharge Following Cardio-Pulmonary Resuscitation among Neonates admitted in the NICU in this setting, and gave rise to the following research question: What are predictors of survival to discharge among neonate following CPR incident? This study was motivated by the researcher's clinical practice observing poor outcome following CPR with aim to improve critical care in neonate.

1.3. Significance of study

The study assesses the base line information regarding the outcome of cardiopulmonary resuscitation (CPR) and survival to discharge in current practice.

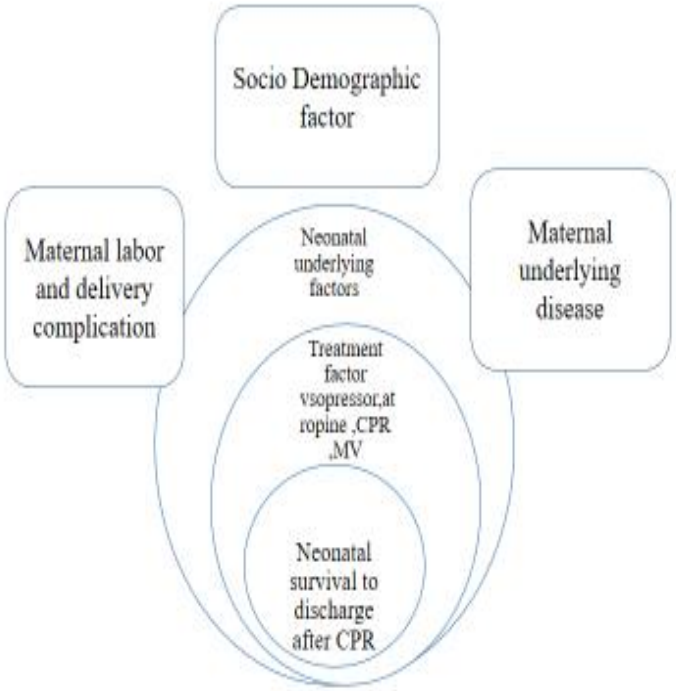
Result obtained from this study serve as to improve neonatal mortality by identified the specific predictor related to survival.

- Potential improvements in clinical practices and interventions.
- Researches can use this study for further study like survival after discharge, neurodevelopmental outcome and others

The finding of this survey will serve other researchers, educators, and policy makers, governmental and non-governmental organizations as a step point for initiation of activities and strengthen the utilization of available resources in order to decrease mortality after.

Moreover, it might provide some information that will help the planning and implementation of different activities that improve survival to discharge of neonate after CPR.

1.4 Conceptual frame work



Conceptual frame work of neonatal survival after CPR among neonate in NICU,2024GC

Figure 1 *Conceptual frame work of neonatal survival following CPR among neonate* admmited to NICU

2. LITERATURE REVIEW

A Cohort study done in North America on 2231 receiving CPR. Of these, 1127 (51%) survived to hospital discharge. Lower gestational age, postnatal age, 5-min APGAR, congenital anomaly, and markers of severity of illness were associated with higher mortality (11).

There were one to two CPR incidents for every 1000 patient days according to a Philadelphia study. During the study period 113 out of 5046 (2. 2%) infants admitted to the NICU had CPR performed. Chest compressions lasted an average of two minutes (interquartile range: one to six minutes). During 34 (30%) CPR events adrenaline was given. 69 (61 percent) of the 113 infants who experienced at least one CPR event lived to be discharged from the hospital (7).

Factors independently associated with decreased survival to hospital discharge were inotrope treatment prior to CPR (adjusted Odds Ratio [AOR] 0.14, 95% Confidence Interval [CI] 0.04, 0.54), and adrenaline administration during CPR (AOR 0.14, 95% CI 0.04, 0.50) (7).

According to a retrospective study conducted in Australia 35 (1 percent) out of 3624 infants admitted to the NICU over a six-year period received cardiopulmonary resuscitation due to a cardiac arrest. Eight (23 percent) of the infants responded to CPR but passed away prior to being released from the hospital (short-term responders) seven (20 percent) responded to CPR and were released from the hospital (long-term responders) and twenty (57 percent) did not respond to CPR and died within two to five hours (non-responders) (3).

The arterial pH was significantly lower in non-responders to CPR compared with responders. Non-responders to CPR were not significantly different from responders with regard to gestational age, birth weight, age at arrest, systolic blood pressure, blood gases, severity of respiratory failure, or renal function. In 24 infants (68%), the precipitating cause for the cardiac arrest was either irreversible (20), or not known (4) and all died prior to discharge from hospital. In 11 infants (32%), the cardiac arrest was considered to have been precipitated by an acute and reversible event, and seven (64%) survived to discharge from hospital. All six infants with septicemia shock were non-responders to CPR. Three of 15 infants with complex congenital heart disease were long-term responders to CPR but none survived without a major physical and psychomotor disability(3).

The final analysis included a systematic review of 25 publications with a total sample size of 28479 children. 46 percent was the pooled prevalence of survival to hospital discharge (95 percent CI = 43. 0–50. 0 percent I2 = 96. 7 percent p 0. 001). Asia had the lowest prevalence of pooled survival according to subgroup analysis by continent and income level (six studies pooled survival = 36. 0 percent with 95 percent CI = 19. 01–52. 15 percent I2 = 97. 4 percent p 0. 001) while low and middle income countries had the lowest prevalence with pooled survival = 34. 0 percent with 95 percent CI = 17. 0–51. 0 percent I2 = 97. 67 percent p 0. 001) (12).

In a study conducted at a children's hospital in Philadelphia 2080 (59 percent) of the 3521 infants who received CPR passed away prior to being released with a mortality rate of 25% during CPR and 40% within 24 hours. In the NICU mortality before discharge occurred in 65% of cases while in the PICU it was 47 percent. Vasoactive agents prior to CPR (adjusted odds ratio (AOR): 2. 77 95 percent confidence interval (CI) 2. 15-3. 58) and initial pulseless condition (AOR: 2. 38 95 percent CI 1. 463) were the factors most strongly independently associated with pre-discharge mortality. AOR: 2. 36 95 percent CI 1. 78-3. 12) or the onset of pulselessness and the location of the NICU in comparison to the PICU (AOR: 3. 85 95 percent CI 2. 86-5. 19). Lower odds of pre-discharge mortality were linked to endotracheal intubation during CPR (AOR: 0. 40 95 percent CI 0. 33-0. 49). (13).

3. OBJECTIVES

3.1 General Objectives

- To determine predictor and time survival to discharge following cardio pulmonary resuscitation among neonate admitted at NICU at Gahandi memorial and TASH Hospital, Ethiopia, Cohort study, February 2025G.C.

3.2. Specific Objectives

- To identify Predictor of survival to discharge following cardio pulmonary resuscitation among neonate admitted in NICU at Gahandi memorial and TASH Hospital, Ethiopia 2025 GC.
- To assess incidence of cardio pulmonary resuscitation among neonate admitted in NICU at Gahandi memorial and TASH Hospital, Ethiopia 2025 GC

4. METHODOLOGY

4.1. Study area and setting

Study were conducted in NICU Gandhi Memorial Hospital and TASH Hospital in Addis Ababa Ethiopia which are tertiary center for neonatal care. There are average of 47 bed available in GMH and 58 bed in TASH. Average of nearly 160 NICU admission in TASH and 150 GMH neonatal admission per month. The total number of CPR event is unknown and there is no receded data in settings.

4.2. Study design and period

Hospital based Prospective cohort study design were employed from October 2024 GC. To January 2025 GC

4.3. Source and study population

4.3.1. Source Population

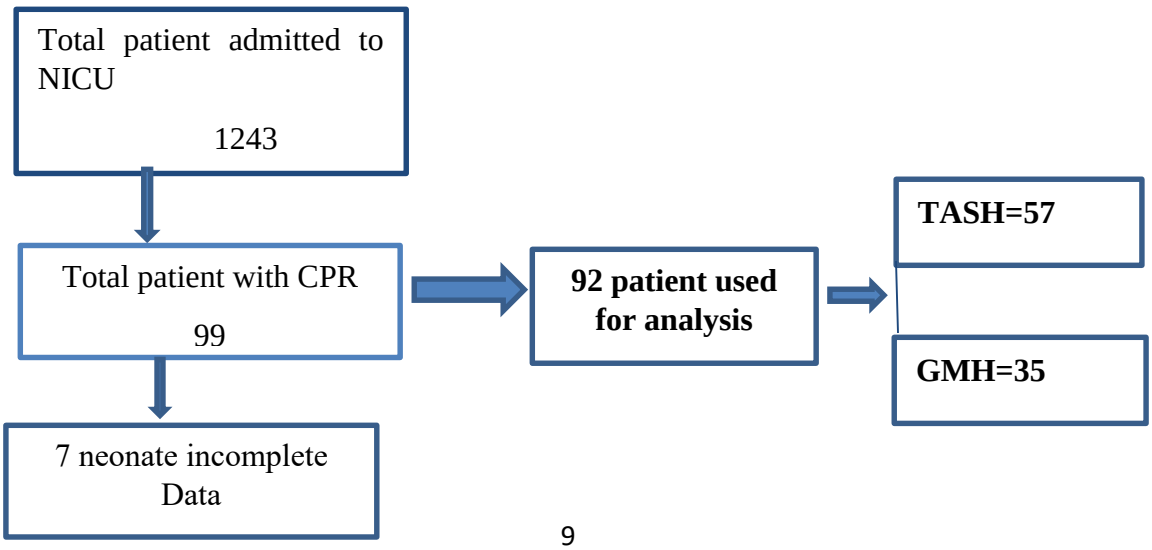
All Neonates admitted in Gandhi Memorial Hospital and TASH Hospital in Addis Ababa Ethiopia

4.3.2 Study Population

Study population were those neonate who had CPR done for cardiac arrest in Gandhi Memorial Hospital and TASH Hospital in Addis Ababa Ethiopia during study period.

4.4. Sample size determination and sampling procedure

But since study period is short I used census method and 92 case of CPR event used for analysis, all cases in study period.



4.5. Inclusion and Exclusion criteria

4.5.1. Inclusion criteria

i. Neonatal patient who had cardiac arrest with pulse rate less than 60 and CPR done defined by chest compression.

4.5.2. Exclusion criteria

i. Those who had cardiac arrest but no CPR done.

ii. Neonates with congenital anomalies incompatible with life

iii. First CPR done at delivery room

4.6. Study variables

4.6.1. Dependent variables

Survival to discharge following CPR.

4.6.2. Independent variables

- Socio demographic factor :
- Gestational age, Sex, Postnatal Age,
- Characteristics of neonate

  Birth weight, Gestational age, Birth Weight to Gestational age
- Underling disease:

  Surgical, cardiac, RDS, sepsis, congenital malformation, syndromic neonate
- Treatment factor:

  Vasopressor use, atropine, sodium bicarbonate, Antibiotic before cardiac arrest , Use of mechanical ventilation,
- CPR Event :

  Duration of CPR and Frequency of CPR

Maternal factors

- ✓ Socio demographic factor : maternal age, place of residency, parity
- ✓ Underlying chronic disease :cardiac, renal ,pulmonary ,vascular Diabetic Melitus
- ✓ Maternal complication during pregnancy and delivery

4.7. Operational Definitions and Definition of Terms

CPR: Defined as chest compression done after cardiac arrest of a neonate

Survival after CPR: Those neonate who will be discharged after CPR done in NICU setup

Non Survival after CPR: Those who will be died after CPR done in NICU set up before discharge

4.8. Data collection methods and tool

Structured questionnaires were used to collect data from primary and secondary sources. Patient files, death audits nurse registries resuscitation registries used to fill missed data. Data was collected primary as well as secondary from patient folder then follow up after CPR event until outcome of interest. The questionnaires adopted from previous research and standard tools to assess survival to discharge following CPR. The questionnaire developed through English language. The questionnaires contain socio- demographic factors, CPR event, underlying disease and treatment factor. Preliminary data were collected to know number of CPR event in NICU in each hospital hospitals.

4.9. Data quality control

Data was collected using a structured validated and reliable modified questionnaire. A half-day of training for supervisors and data collectors. To ensure high-quality data the completed questionnaires were examined for completeness. The recruited supervisor and the PI shared responsibility for finding a supportive supervisor immediately.

4.10. Data processing and analysis

Data were collected using structured questionaries' and entered in Epidata version 3.1 then raw data were transported to SPSS version 25 used for analysis.

Each participant outcome were divided into two categories: Death times (the event of interest), recorded as "1" and censorship (survival), coded as "0".

Median was calculated for time to die. Kaplan Meier survive curve was used to estimate the time to death during the follow up.

Cumulative survival time probabilities following CPR treatment were estimated using the life table. To compare statistical differences between groups of independent variables the log-rank test was utilized. The factors influencing survival time following CPR treatment were determined using the Cox proportional hazards regression model. The multivariable model included all covariates that had a p-value of 0 to 25 or less in the bivariate analysis. A 95 percent CI for the adjusted hazard ratio was displayed. Survival time and covariates were found to be statistically significantly correlated when the p-value was less than 0. 05. Each questionnaire was examined for consistency and completeness following data collection. The raw data was transferred to SPSS version 25 after being entered into Epidata version 3. 1. The study variables will be described using a variety of frequency tables graphs and descriptive summaries. The predictor of survival after CPR was evaluated using the survival curve life time table bivariate and multivariable Cox regression

4.11. Ethical consideration

Ethical approval were be obtain from College of Health Sciences, Addis Ababa Department University of pediatrics and Child, Research and ethical committee. Every research subject will be asked for their informed consent.

4.12. Dissemination result

The Department of Pediatrics and Child Health at Addis Ababa University College of Health Science will receive the study findings. The relevant medical facilities as well as other interested and concerned organizations will also receive it for potential action.

5. RESULTS

A total of 1243 patient were admitted in neonatal care intensive unit in a period of October 2024 G.C to January 2025 G.C from this 644 were from TASH and 599 were from GMH then patient are selected based on exposure status of first CPR event in which the incidence was 7.9 % (99/1243).

Among 99 patient who had CPR exposure 92 were studied for possible outcome of interest and the remaining (7/99) are incomplete data and excluded from study.

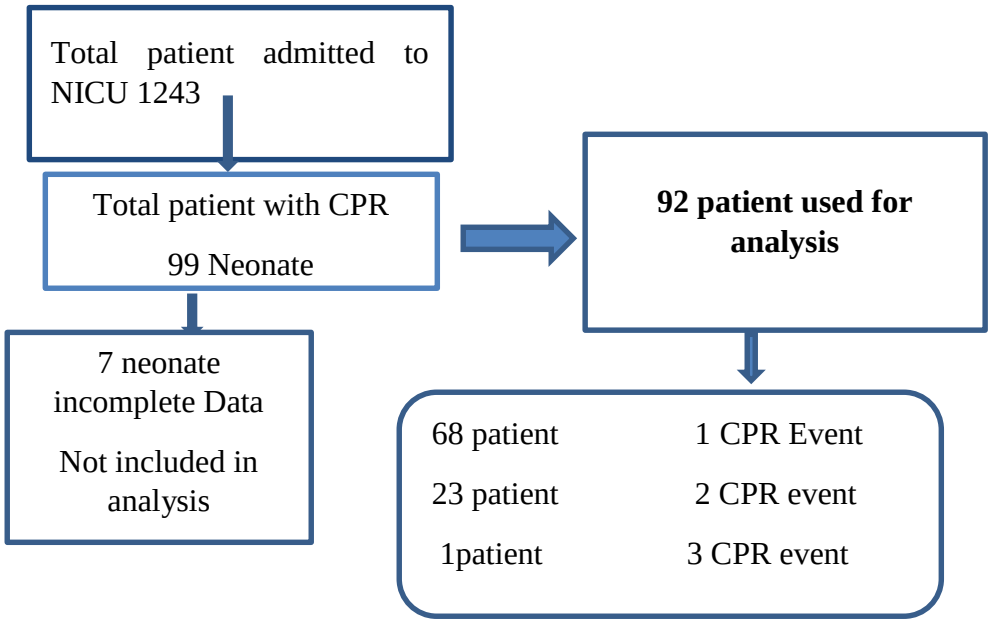


Figure 2 schematic diagram showing number of neonate *who were admitted from October 2024 to January 2025 at TASH and GMH NICU in Addis Ababa, Ethiopia, 2025 (n =92).*

5.1 Socio demographic Characteristics of neonate with CPR

Among 92 neonate who had CPR event 79/92(85.8%) were admitted in a period of less than 72hr.of postnatal age from this 8(8.6%) are survived. Late admission greater than 72 hr. end with death. Mode of delivery was SVD in 53/92 (57.6%) CPR cases from this 6 cases are survivor (*Table1*).

Table 1. *Socio demographic Characteristics of neonate with CPR who was admitted from October 2024 to January 2025 at TASH and GMH NICU, Addis Ababa, Ethiopia, 2025 (n =92).*

Variables	*Category*	*Frequency /percentage*	*Survival status at discharge*	
			Died/Event	Censored
Age of neonate at admission in days	< 72 hr.	79 (85.8%)	71	8
	>72 hr.	13 (14.2%)	13	0
Sex	Male	55 (59.7%)	51	4
	Female	37 (40.3%)	33	4
Mode of delivery	SVD	53 (57.6%)	47	6
	Cesarean section	38 (41.3%)	36	2
	Instrumental delivery	1 (1.1%)	0	1
Place of delivery	Health institution	89 (96.7%)	81	8
	Home	3 (3.2%)	3	0
Referral in status	Yes	46 (50%)	44	2
	No	46 (50%)	40	6
Maternal Age	Less than 35	79 (85.8%)	73	6
	Greater than 35	13 (14.2%)	11	2
Parity	Primipara	40 (43.4%)	35	5
	Multipara	52 (56.5%)	49	3

5.2 Birth characteristic of neonate

Among the study neonate with CPR 49/92 (53.2%) were low birth weight and 69/92 (75%) were AGA from this 7 of them were survivor *(Table 2).*

Table 2. *Characteristics of neonate with CPR who was admitted from October 2024 to January 2025 at TASH and GMH in NICU, Addis Ababa, Ethiopia, 2025 (n =92).*

Variables	*Category*	*Frequency /percentage*	*Survival status at discharge*	
			Died/Event	Censor
Birth weight in gram	Less than 2500	49 (53.2%)	45	4
	2500-4000	42 (45%)	38	4
	Greater than 4000	1 (1%)	0	0
Gestational age in weeks	Less than 37	40 (43.4%)	36	4
	37 to 42	48 (52.1%)	44	4
	Greater than 42	4 (4.3%)	0	0
Gestational age for birth weight	AGA	69 (75%)	62	7
	SGA	20 (21.7%)	19	1
	LGA	3 (3.2%)	3	0

5.3 Underlying disease of neonate with CPR

The study shows that the most common underlying disease among neonates who had CPR event 27/92(29.3%) are surgical cases and 27/92(29.3%) Respiratory distress syndrome for each. TEF accounts 20/92(21.7%) cases which is the most common cause from surgical. Three cases of survivor from PNA and surgical cases in each underling cause was noted. *(Table 3).*

Table 3.Underlying disease of neonate with CPR who was admitted from October 2024 to January 2025 at TASH and GMH NICU in Addis Ababa, Ethiopia, 2025 (n =92).

Variables	*Categories*		*Frequency*		*Survival status at discharge*	
					Died/Event	*Censored*
Major underlying disease of neonate	Surgical case	TEF	*20(21.7%)*	*27(29.3%)*	*24*	*3*
		Intestinal Obstruction	*4(4.3%)*			
		Abdominal defect	*3(3.2%)*			
	Respiratory distress syndrome		*27 (29.3%)*		*25*	*2*
	PNA		*13 (14.1%)*		*10*	*3*
	Sepsis		*9 (9.7%)*		*9*	*0*

Meconium aspiration syndrome	*4 (4.3%)*	*4*	*0*
Syndrome & other congenital malformation	*9 (9.7%)*	*9*	*0*
Other	*3 (3.2%)*	*3*	*0*

5.4 Characteristics of CPR

The study shows mean and SD of CPR in minute is 17.04±5.84 and mode is 20, maximum duration were 30 minute. The study shows mean age and SD at which CPR done was 5.5.04±5.91 days and mode is 2 days, maximum were 28days. The immediate cause of arrest among neonate with CPR was Pulmonary as a primary event leading to Cardiopulmonary arrest 63/92(68%) and also 68/92 (73%) of patient had one CPR event and 24 (26%) and two or more events (table 4).

Table 4. CPR event Characteristics of neonate with CPR who was admitted from October 2024 to January 2025 at TASH and GMH in Addis Ababa, Ethiopia, 2025 (n =92).

Variables	*Category*	*Frequency /percentage*	*Survival status at discharge*	
			Died/Event	Censored
CPR time	day	45 (48.9%)	41	4
	Night	47 (51.1%)	43	4
Training CPR	yes	35 (38%)	31	3
	No	57 (61.9%)	52	5
Profession of person doing CPR	Resident	87 (94.5%)	79	8
	Nurse	5 (2%)	5	0
Duration of CPR in minute	≤5minute	9 (9.7%)	6	3
	6 to 20	24 (26%)	19	3
	≥20 minute	5(64%)	57	2
Primary cause of arrest	Pulmonary	63(68%)	56	7
	cardiac	13 (14.1%)	13	0

	Other	16 (17.3%)	15	1
CPR frequency per arrest	one times	68 (73%)	63	5
	Two or more	24 (26%)	21	3
Age of neonate at first CPR	Within 1 hr.	5 (20.8%)	4	1
	2 to24 hr.	13 (14.1%)	11	2
	24 to 72 hr.	23 (25%)	22	1
	3 to 7 days	27 (29.3%)	25	2
	Greater than 7 days	24 (26%)	22	2

5.5 Treatment factor following CPR

According to this study main mode of oxygen administration were CPAP 77/92 (83.6%) and antibiotic revision 36/92 (39.1%) done 48 hr. before arrest.

Table 5.*Treatment factors of neonate survival following CPR who was admitted from October 2024 to January 2025 at TASH and GMH NICU in Addis Ababa, Ethiopia, 2025 (n =92).*

			Survival status at discharge	
Variables	*Categories*	*Frequency/percent*	*Died/Event*	*Censored*
Vasopressor use For resuscitation	Yes	83(90.2%)	76	7
	No	9(9.8%)	8	1
Antibiotic before arrest	Yes	84(91.3%)	78	6
	No	8(8.7%)	6	2
Mechanical ventilator use	Yes	14(15.2%)	11	3
	No	78 (84.7%)	73	5
Any surgical procedure done	Yes	19(20.6%)	16	3
	No	73(79.3%)	68	5
Atropine before	Yes	9(9.8%)	8	1
	No	83(90.2%)	76	7
Last Antibiotic revision arrest	Yes	36(39.1%)	28	8
	No	56(60.8%)	0	0

5.6 Life time table neonate following CPR

According to this study the probability of survival at time of CPR started were 1.00(100%), but decrease as time gone and within 24 hr.78/92 (85%) were died and survival to 24 hr. drop to 15% indicating most patient died immediately and within 24 hr. of CPR, then patient who were survived followed and lastly only 8 patient were stayed to 240 hr. (10days) then discharged which is the probability of 0.086 (8.6%) (Table 6).

Table 6.Over all life table of survival function (n = 92).

Total time in hr.	*Total patient*	*Died*	*survived*	*Lost*	*Survival*	*Standard error*	*Confidence interval*
0	92	0	92	0	1.00		
24	14	78	14	0	0.15		
48	12	2	12	0	0.13		
72	12	0	12	0	0,13		
96	12	0	12	0	0.13		
120	12	0	12	0	0.13		
144	12	0	12	0	0.12		
168	11	1	11	0	0.12		
192	11	0	11	0	0.1		
216	10	1	10	0	0.1		
240	8	2	8	0	0.086		

5.7 Incidence and treatment Outcome of neonate with CPR and overall survival function

In this study the incidence of CPR among neonate admitted to TASH and GMH were7.9% (99/1243) and survival (censored) to discharge following CPR was 8.6 (8/92)and 91.2 %(84/92)died following CPR before discharged.

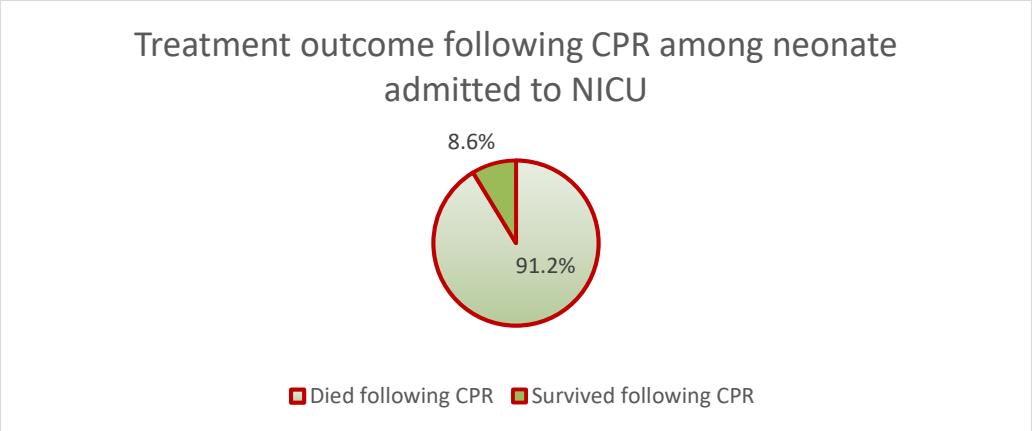


Figure 3. Treatment Outcome of neonate following CPR who was admitted from October 2024 to January 2025 at TASH and GMH NICU in Addis Ababa, Ethiopia, 2025 (n =92)

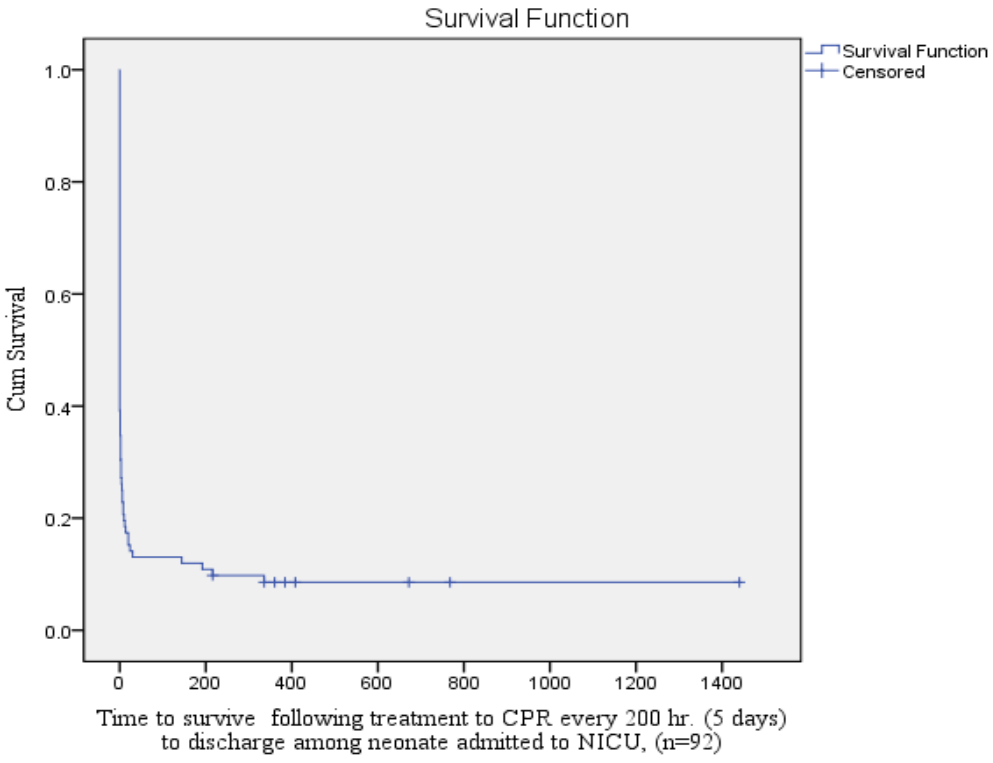


Figure 4. The overall Kaplan Meier estimate of Treatment Outcome survival of neonate following CPR who was admitted from October 2024 to January 2025 at TASH and GMH in Addis Ababa, Ethiopia, 2025 (n =92).

5.8 Predictors of survival time following CPR treatment

In a bi-variable Cox regression analysis shows determinants such as underling disease like PNA, mechanical ventilator use, CPR duration, surgical procedure done and antibiotic revision associated with time decrease survival to hospital discharge among neonate admitted to NICU but factors such as birth weight gestational age, vasopressor use, atropine referral status, mode of delivery were not associated to survival to hospital discharge among neonate.

In multivariable Cox regression duration of CPR < 5 minute versus > 5 minute, Antibiotic revision versus no revision were independently associated with decreased survival to hospital discharge.

The proportion hazard assumption was satisfied for the significantly associated variables, neonate with CPR duration less 5 minute (AHR 1.501, 95% CI: 1.039-2.170) with p value 0.031 were 1.5 times more likely to survive to discharge than greater than five minute.

And those neonate who had antibiotic revision treatment during admission time (AHR 1.898, 95% CI: 1.156-3.117) with p value 0.011 were 1.9 times more likely survive to discharge following CPR compared to who had no revision (see table 7).

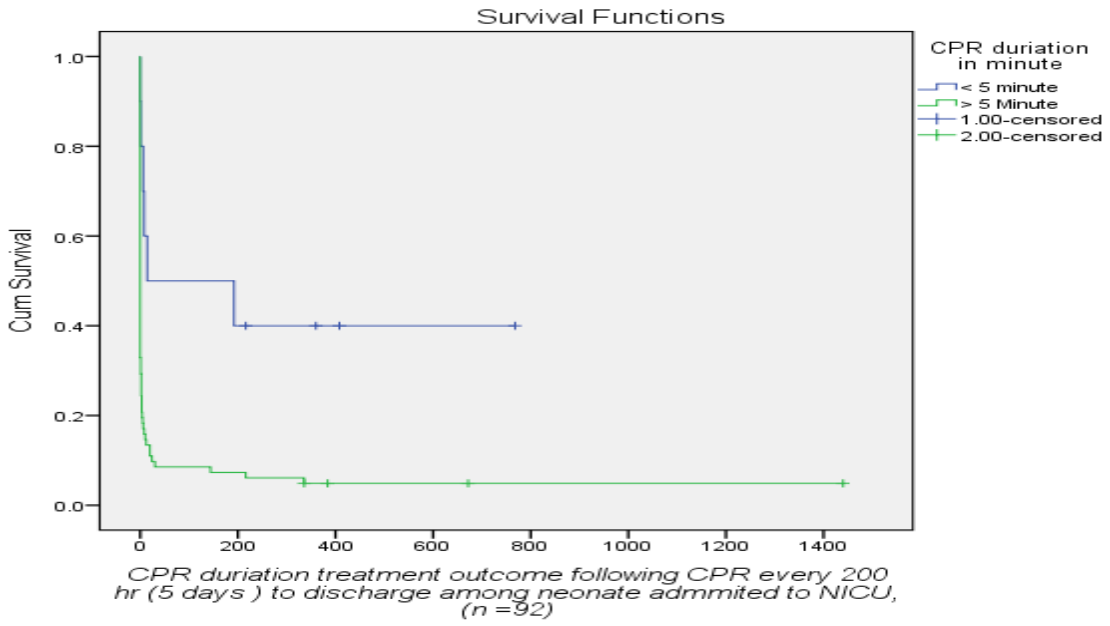


Figure 5.CPR duration Treatment Outcome survival of neonate following CPR who were admitted from October 2024 to January 2025 at TASH and GMH in Addis Ababa, Ethiopia, 2025 (n =92).

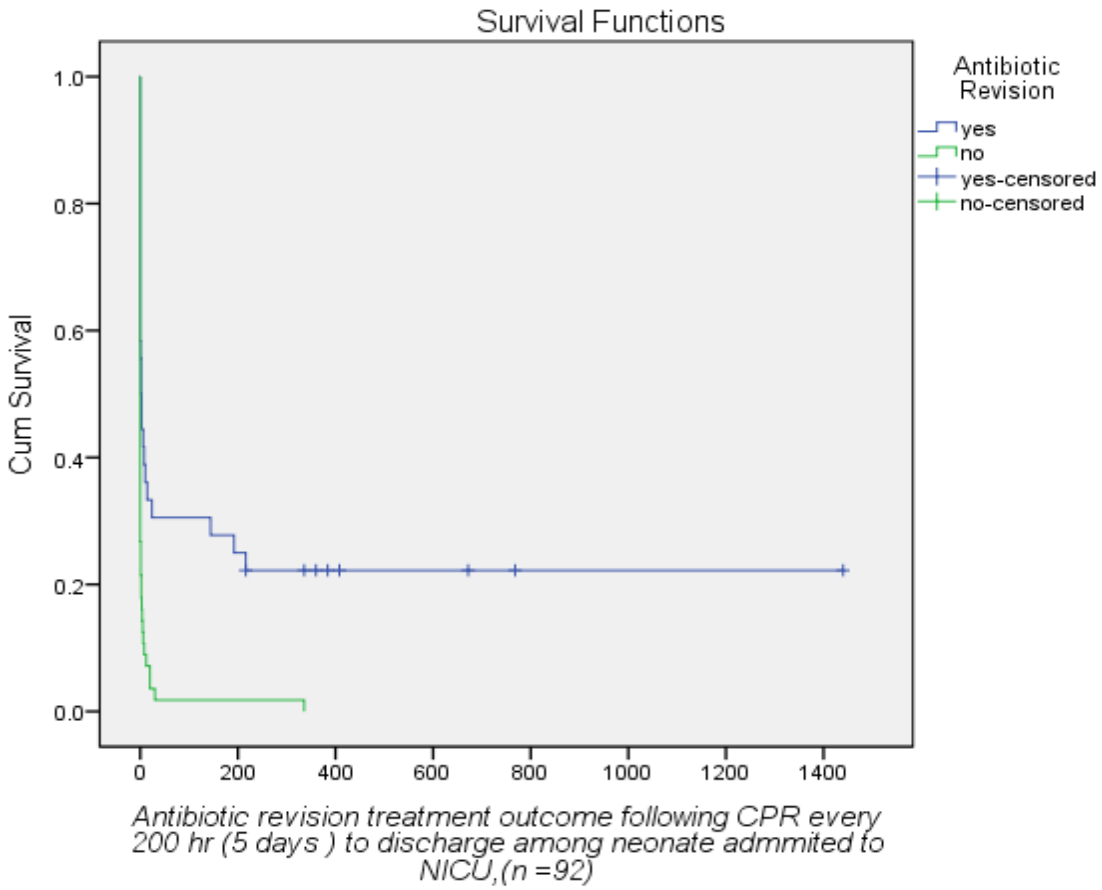


Figure 6 Antibiotic revision treatment Outcome survival of neonate following CPR who were admitted from October 2024 to January 2025 at TASH and GMH in Addis Ababa, Ethiopia, 2025 (n =92).

Table 7.Predictors factors associated to neonate survival following CPR who was admitted from October 2024 to January 2025 at TASH and GMH NICU in Addis Ababa, Ethiopia, 2025 (n =92).

Variables	Category	Frequency	Survival status		(95%CI)		
			Died	Censored	CHR	AHR	P value
CPR Duration	≤ 5minute	10(%)	6	4	2.992(1.284-6.972)	1..501(1.039-2.170)	0.031*
	>5 minute	82(%)	78	4	1	1	1
Mechanical ventilator use	Yes	14(%)	11	3	1.698(1.893-3.227	1.272(0.561-2.884)	0.565
	No	78(%)	73	5	1	1	1
Underlying disease	PNA	13(%)	10	3	2.131 (1.857-3.2790	1.827 (0.910-3.670)	0.090
	Other	79(%)	74	5	1	1	1
Surgical procedure done	Yes	19(%)	16	3	3.57(1.872,12.639)	1.374(.673-2.806)	0.383
	No	73(%)	68	5	1	1	1
Antibiotic revision	Yes	36(%)	28	8	2.175(1.338-3.535)	1.501(1.039-2.170)	0.011*
	No	56(%)	56	0	1	1	1

* P value less than 0.05

6. DISCUSSION

6.1 Incidence of CPR

In this study the incidence of CPR among neonate admitted to TASH and GMH were 7.9% (99/1243) a study done in children hospital of Philadelphia shows (2.2%) infants admitted to the NICU had CPR event (7) during the study period, in our study the incidence is higher this is possibly the difference in set up of NICU in pre resuscitation care in which preventable cases of cardiac arrest like PNA , RDS and surgical cause is prevalent in our set up. The same study done in Australia shows 1% of infant had CPR event but this study include infant still much lower than our study(3), Multicenter retrospective cohort study of four quaternary NICUs over six years Of 17,358 patients admitted to four NICUs, 200 (1.1%) experienced a CPR event(14) the higher incidence are more explainable the difference in health service disparities in the set up in developing versus developed countries.

6.2 Survival to discharge following CPR

According to this study survival (censored) to discharge following CPR was 8.6% (8/92), 15.2% (14/92) and 91.2 %(84/92) died following CPR before discharged CPR.

Twenty (80%) out of the 35 infants in the current case series who received cardiopulmonary resuscitation for a cardiac arrest while residing in a tertiary level NICU passed away before being released from the hospital according to a study conducted at Royal Childrens Hospital in Australia. Out of the 113 infants who received CPR in this study 69 (61 percent) survived to hospital discharge 103 (91 percent) achieved ROC and 92 (81 percent) survived for at least 24 hours after CPR (7). Fifteen (20 percent) of the infants survived to discharge but only four (11 percent) survived past three months of age (15).

A study done in children hospital of Philadelphia Among 3521 infants who received CPR, 2080 (59%) died before discharge, with 25% mortality during CPR and 40% within 24 h. Mortality prior to discharge occurred in 65% and 47% of cases in the NICU and PICU, respectively(13). , and

Multicenter retrospective cohort study of four quaternary NICUs over six years Of 17,358 patients admitted to four NICUs 45.5% of those survived to discharge.(14)

So as clearly stated in above sentence survival to discharge following CPR in neonate is low in our set up and 24 hr. survival is low this is because possible difference in resuscitation care and post resuscitation care in the set up as clearly there is low prevalence of mechanical ventilator use as well as absence of investigation modalities like ABG and preventable cause of arrest like early surgical intervention for trachea esophageal fistula and low survival following procedure warranted an increase in our set up as well as many causes are primary pulmonary cause leading to cardiopulmonary arrest which can be prevented by Mechanical ventilation .

6.3 Predictor of CPR Survival to discharge

In this study Factors independently associated with increased survival to hospital discharge were CPR duration less than or equal to 5 minute were (AHR 1.501, 95% CI: 1.039-2.170) with p value 0.031 were 1.5 times more likely to survive to discharge than greater than five minute.

After a pediatric cardiac arrest in a hospital pediatric cardiopulmonary resuscitation (CPR) for longer than 20 minutes has been deemed ineffective. According to recent research the rates of favorable neurological outcomes and survival decreased by 1 to 2 percent per minute and linearly respectively between 1 and 15 minutes of CPR. When performing CPR for 1 to 15 minutes the adjusted probability of survival was 41% and when performing CPR for more than 35 minutes it was 12%. Seventy percent of survivors had positive neurological outcomes after undergoing treatment. 15 minutes of CPR and 60 percent undergoing CPR 30 minutes. (16) A multicenter retrospective cohort study that was conducted between 2011 and 2016 and involved four quaternary NICUs. We looked at post-arrest results resuscitation event data and demographics. The main result was discharge survival. Survival to discharge was found to be lower for longer CPR durations (14).

The shorter derivation of CPR is scientifically associated to return of circulation with less end organ damage which result in continuity of life and associated to survival following CPRthe above study also shows the same result, regarding to derivation of CPR greater or equal to 20 minute

considered as futile exercise not regarded in this study because neonate were survived with CPR duration greater than 20 minute

Additionally according to a multicenter retrospective cohort study of four quaternary NICUs conducted over a six-year period (2011-2016) neonates who received antibiotic revision treatment during admission (AHR 1. 898 95 percent CI: 1. 156-3. 117) with a p value of 0. 011 had a 1. 9-fold higher chance of surviving to discharge after CPR than those who did not. Data on resuscitation events post-arrest outcomes and demographics were examined. Treatments at the time of the arrest that were linked to a lower survival rate until discharge were vasopressor therapy mechanical ventilation and antibiotics (p 0. 01). (2014). This could help to explain the setup variations and root causes of arrests in developed and developing nations. Sepsis is considered to be an additional diagnosis in almost all neonate with other underlying disease indicating high prevalence of sepsis in the set up and antibiotic treatment a means to survive in such neonate specially revision of potent antibiotics are main stay while patient are deteriorating, All this explain those neonate with antibiotic revision 1.9 times more likely to survive following CPR than not revised.

7. CONCLUSION

Incidence of CPR among neonate admitted to TASH and GMH NICU is high.

Low survival to discharge following treatment to CPR and most died during and within 24 hr. of post CPR time.

CPR duration and Antibiotic revision are independent predictor for survival following CPR treatment.

8. RECOMMENDATION

Study done with limitation of small sample size so I recommend to at large scale with appropriate sample size for researchers.

The Ethiopia FMOH in collaboration of health institution and health professional should have strategies to prevent preventable cause of arrest.

Most death were within 24 resuscitation and post resuscitation care should be strength.

Mechanical ventilator should be used as a post resuscitation care as well as before arrest.

Health care professional can be shortened CPR duration to return of circulation after arrest by providing effective CPR in early minute after CPR

9. STRENGTH AND LIMITATION OF STUDY

9.1. Limitation of study

Practice associated to quality of CPR were not assessed it would be better assessed by observation.

The Study was not triangulated with qualitative research.

Few research parallel to my study which make difficult to discuss in detail.

9.2. Strength of study

Study is cohort high casual to outcome relation

It is pioneer study in to show survival following CPR in neonate after admission to NICU and finding used to improve critical care in neonatal set up.

10. REFERENCES

1. Lee K. Cardiopulmonary Resuscitation : New Concept. 2012;3536:401–8.
2. Sawyer T, Mcbride ME, Ades A. Considerations on the Use of Neonatal and Pediatric Resuscitation Guidelines for Hospitalized Neonates and Infants : On Behalf of the American Heart Association Emergency Cardiovascular Care Committee and the American Academy of Pediatrics. 2024;153(1):1–15.
3. Barr P, Courtman SP. Cardiopulmonary resuscitation in the newborn intensive care unit. J Paediatr Child Health. 1998 Dec;34(6):503–7.
4. Haggerty M, Herrick H, Ades A. Post-cardiac arrest care in the neonatal intensive care unit. Resuscitation [Internet]. 2020;150:102–3. Available from: https://doi.org/10.1016/j.resuscitation.2020.03.012
5. Sawyer T, Mcbride ME. Article explores when to use neonatal vs . pediatric resuscitation guidelines. 2023;2023–4.
6. Tham LP, Chan I. Paediatric out-of-hospital cardiac arrests: Epidemiology and outcome. Singapore Med J. 2005;46(6):289–96.
7. Foglia EE, Langeveld R, Heimall L, Deveney A, Ades A, Jensen EA, et al. Incidence, characteristics, and survival following cardiopulmonary resuscitation in the quaternary neonatal intensive care unit. Resuscitation. 2017 Jan 1;110:32–6.
8. Travers AH, Rea TD, Bobrow BJ, Edelson DP, Berg RA, Sayre MR, et al. Part 4: CPR overview: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation. 2010;122(SUPPL. 3):676–84.
9. Aziz K, Lee HC, Escobedo MB, Hoover A V., Kamath-Rayne BD, Kapadia VS, et al. Part 5: Neonatal resuscitation 2020 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. Pediatrics. 2021;147(1):S160–90.
10. Biban P, Sof M, Santuz P. Early Human Development Neonatal resuscitation in the ward : The role of nurses. 2009;85:11–3.
11. Hornik CP, Graham EM, Hill K, Li JS, Ofori-amanfo G, Clark RH, et al. Early Human

Development Cardiopulmonary resuscitation in hospitalized infants. Early Hum Dev [Internet]. 2016;101:17–22. Available from: http://dx.doi.org/10.1016/j.earlhumdev.2016.03.015

12. Bimerew M, Wondmieneh A, Gedefaw G, Gebremeskel T, Demis A, Getie A. Survival of pediatric patients after cardiopulmonary resuscitation for in-hospital cardiac arrest: a systematic review and meta-analysis. Ital J Pediatr. 2021;47(1):1–11.

13. Handley SC, Passarella M, Raymond TT, Lorch SA, Ades A, Foglia EE. Epidemiology and outcomes of infants after cardiopulmonary resuscitation in the neonatal or pediatric intensive care unit from a national registry. Resuscitation. 2021 Aug;165:14–22.

14. Ali N, Lam T, Gray MM, Clausen D, Riley M, Grover TR, et al. Cardiopulmonary resuscitation in quaternary neonatal intensive care units: a multicenter study. Resuscitation. 2021 Feb;159:77–84.

15. Yoon SJ, Lim J, Han JH, Shin JE, Eun HS, Park MS, et al. Incidence, characteristics, and survival following cardiopulmonary resuscitation in the quaternary neonatal intensive care unit. Resuscitation [Internet]. 2021 Jan 1;110(6):32–6. Available from: https://dhsprogram.com/pubs/pdf/FR363/FR363.pdf

16. Matos RI, Watson RS, Nadkarni VM, Huang HH, Berg RA, Meaney PA, et al. Duration of cardiopulmonary resuscitation and illness category impact survival and neurologic outcomes for in-hospital pediatric cardiac arrests. Circulation. 2013;127(4):442–51.

11. ANNEXES

*11.1***.** Questionnaire English Version:

Consent form

College of health science

Instrument one; Questionnaire

Dear respondents my name is Abraraw Admasu The purpose of this questioner is to collect data for the research project entitled to Predictors of Survival to Discharge Following Cardio-Pulmonary Resuscitation Among Neonates admitted in the NICU in Gandhi Memorial Hospital and TASH Hospital ,Ethiopia: A Prospective Cohort Study (2024 GC) it is believed that your open and genuine response for each item will be highly valuable to design possible intervention strategies and to improve survival during admission time . Thus be honest and cooperative to provide relevant information to expedite effective remedies.

The information that will be obtained from this questionnaire is only used for the accomplishment of the purpose of research.

Thanks in advance

11.2: Questionnaire form: English version

Part I Neonatal demographic factor

1. What is the Gestational age at birth? ----------
2. What is Mode of delivery? 1. SVD 2. CS 3. Instrumental
3. The sex of neonate? 1. Female 2. Male 3. Undetermined
4. Postnatal age at admission …….
5. What is Birth weight of neonate?
6. Where is place of delivery? 1.Home 2.Hospital 3.Health center
7. Is neonate referred from other place 1. Yes 2.No
8. What is birth wt. with respect to GA? 1. AGA 2. SGA 3. LGA

Part II Neonatal underlying disease

9. What is Underling disease neonate :

   1. Surgical, A. TEF B. Anorectal malformation C. intestinal obstruction D. Abdominal wall defect E. other mention ……..

   2. Cardiac

      1. A..ASD B. VSD C. PDA
      2. Critical CHD mention

   3. RDS
   4. Sepsis
   5. Congenital malformation mention ……..
   6. Syndromic neonate mention ……
   7. Other mention …….

Part III CPR Event

10. **A**t what postnatal **Age** is the first CPR event?
11. At what Time CPR done 1.Day 2. Night
12. What is Duration of first CPR event in second or minutes …?
13. What is the cause of arrest? 1. Cardiac 2. Pulmonary 3.Other……..

14. How many CPR event done? 1. One times 2, two times 3. Three or more

Part IV Treatment factor associated to CPR event

15. Do you use Vasopressor before CPR? 1. Yes 2. No
16. Do you use Vasopressor after CPR? 1. Yes 2. No
17. Do you use atropine before CPR
18. Do you use atropine after CPR? 1. Yes 2. No
19. Do you use sodium bicarbonate before CPR? 1. Yes 2. No
20. Do you use sodium bicarbonate after CPR? 1. Yes 2. No
21. Do you use Antibiotic before cardiac arrest after CPR 1.yes 2. No
22. Do you revise Antibiotic after cardiac arrest after CPR 1.yes 2. No
23. Do you use of mechanical ventilation, before CPR 1.yes 2. No
24. Do you use of mechanical ventilation After CPR 1.yes 2. No

Part V Outcome after first CPR event

24 Is neonate Died during admission after CPR event 1.yes 2. No

25 If yes duration stay after CPR

Part V Maternal factors

I. Socio demographic factor :

1. Maternal age Educational status …… Income …….. Place of residency…….

II. Obstetric history

Parity …… Abortion …….. Number of Live birth …….

III. Underlying chronic disease :

1. cardiac
2. pulmonary

3. vascular
4. Diabetic Melitus
5. renal
6. NONE
7. Other mention

IV. Maternal complication during pregnancy and delivery :

1. Gestational hypertension ,
2. Antepartum hemorrhage ,
3. ANC follow up
4. Prolonged labor
5. Prolonged rapture of membrane
6. Meconium stained amniotic fluid

THANK YOU!!!

11.3. Declaration sheet

Principal Investigators assurance.

I the undersigned acknowledge that I am fully responsible for the research projects ethical and scientific execution. I give my advisor a progress report on time ask my primary advisors for guidance and approval when needed and promptly update my advisors on all study stakeholders including any funding sources. Investigator Name: Abraraw Admasu

Signature: ----------

Date ----------

Primary advisor name Dr. Helen Mintesnot, Assistant professor of pediatrics, pediatric cardiologist

Signature: _____

Date: _____