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Original Research Article

Developmental supportive care in preterm and low birth weight neonates

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ABSTRACT

Background: Developmental supportive care (DSC) focuses on evidence-based, family-centered practices designed to enhance neurodevelopment and reduce stress in neonates.
Method: A cross-sectional analytical study was conducted at SSG Hospital's NICU over 6 months. DSC interventions were done, and Outcomes were measured through growth, incidence of sepsis and ROP, duration of hospital stay, neurodevelopment at discharge, and outcome compared with the previous 6 months' data. The study aims to reduce neonatal mortality and morbidity, decrease hospital stays, and improve neurodevelopmental outcomes and maternal knowledge for preterm/LBW care. The objective is to assess the effectiveness of DSC in this population.
Results: The study demonstrated significantly improved neonatal growth parameters, with mean weight increased at 1st week from 157.84 grams to 947.16 grams and head circumference expanded at 1st week from 0.54 cm to 5.51 cm over eight weeks. A mean duration of MV of 0.93 days, CPAP of 1.47 days, and oxygen support (NP) of 0.99 days, an average of 14.09 days in room air, suggesting that DSC may reduce respiratory support duration and facilitate quicker weaning. The implementation of DSC means hospital stay of 17.3 days and a total hospital stay of 17.3 days, from the previous 6 month mean of 22.3 days. No one baby is discharged with neurological sequelae. The study demonstrated, with mean scores of mothers' knowledge for preterm/LBW care rising from 1.14 at birth to 8.45 at discharge, p value of <0.0001.
Conclusion: DSC significantly improved growth, reduced hospital stays and respiratory support needs, and enhanced maternal knowledge of preterm care.

Keyword: Developmental supportive care, Low birth weight neonates, Premature neonates

INTRODUCTION

Developmental supportive care (DSC) focuses on evidence-based, family-centered practices designed to enhance neurodevelopment and reduce stress in neonates. This study evaluates the impact of DSC on low birth weight (<2 kg) neonates in a tertiary care NICU. Also, developmental care is designed to minimize the stress of critical care settings and to support the development of parents and infant relationships.[1] Our study is based on 5 core measures, protected sleep, (nesting, swaddling, kangaroo mother care, minimal handling, minimize light and noise), Pain and stress assessment and management., Developmental activity of daily living. Family-centered care. The healing environment.[2] So, our goal is to reduce the mortality and morbidity of sick neonates and improve long term neurodevelopmental outcomes, and reduce hospital stays.[3]

Globally survival of preterm infants has increased due to advances in science and technology that impact the treatment and nursing care of premature infants. The task of premature care has also been expanded to ensure optimal growth and development as well as the survival of premature newborns. For the optimal growth and development of premature babies, developmental supportive care is an intervention that manages the NICU environment so that it is as much like the intrauterine environment as possible, and provides individual and integrated interventions with the help of health professionals and premature babies families.[4]

Advanced technologies in neonatal intensive care units have greatly reduced mortality rates for preterm infants. In the traditional multifaceted environment of the NICU, the process of implementing transformational change presents many challenges. The neonatal team is challenged not only to ensure infants' survival, but to also reduce stress levels for infants and families and to simultaneously optimize their developmental course and ultimately,

METHODS

A cross-sectional analytical study was conducted at SSG Hospital's NICU over 6 months, involving 150 neonates. Inclusion criteria were gestational age <37 weeks and/or birth weight <2000 grams requiring NICU admission. Minimum duration of NICU stay of 7 days. exclusion criteria are duration of hospital stay <7 days, neonate with major congenital malformation. sample size done by total enumeration sampling technique was used.

All eligible neonates admitted during study period met inclusion exclusion criteria were enrolled. the sample size 150 based on NICU admission trend over the previous 6 month. ethical approval was obtained from the institutional ethics committee of Baroda medical college, and SSG hospital ref no. IEC/BMC/2024/113.

After taking written consent from the parents of eligible new-born, face to face interview was taken regarding history. After enrolment, DSC interventions included protected sleep, pain and stress management, family-centered care, daily living activities, and a healing environment was provided.

Outcomes were measured through weight gain, head circumference, incidence of sepsis and retinopathy of prematurity (ROP), duration of respiratory support, and early up gradation of feeding methods, duration of stay in NICU and step down (duration of hospital stay), effectiveness of family centered care on family, neurodevelopment at time of discharge, and outcome of study population.

Compare this data with previous 6 months data. Data was compiled into a predesigned proforma and master chart in Microsoft excel sheet (version 16, 2024) and analysed using JAMOVI version 2.5. Percentage and person chi-square tests for categorical variables. Continuous variable was analysed using mean and SD of the Z score and students t test. A p value less than 0.05 was considered statistically significant.

RESULTS

The total number of admissions to the IMNICU in these six months was 1,830. Out of these 1830 patients, 150 fit into the study as per the inclusion and exclusion criteria (Figure 1).

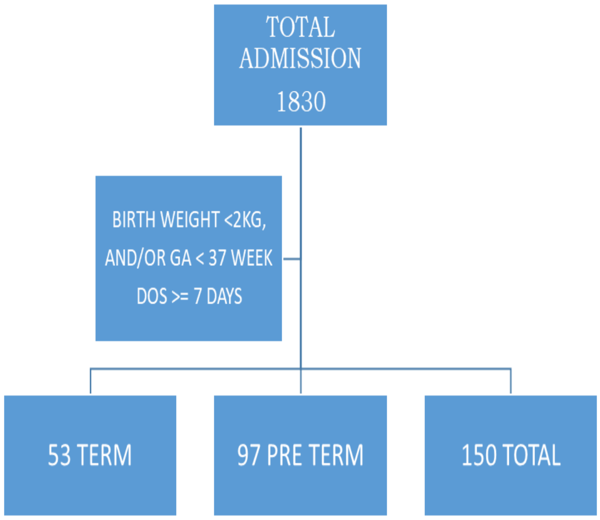

Figure 1: Admission of study population based on inclusion and exclusion criteria.

In our study, male: female ratio was 1.5: 1. The study population consisted of 91 (60.6%) males and 59 (39.33%) females. out of a total 150 patients, 55 (36.67%) were from urban areas and 95 (63.33) were from rural areas. according to birth weight they were divided into 3 group, <1000 gm (ELBW) group consisted total 9 (6%), between 1000-1499 gm (VLBW) group consisted total 45 (30%), in 1500-2000 gm (LBW) group consisted total 96 (64%).

According to gestation age at birth they were divided into 3 groups, <=28-week (extreme preterm) group consisted total 5 (3.33%) sick neonates, between 28–32-week (very preterm) group consisted total 31 (20.67%) sick neonates, in 32-34-week (moderately preterm) group consisted total 22 (14.67%) sick neonates, in 34–36-week (late preterm) group consisted 39 (26%) , in >36-week group 53 (35.33) sick neonates. out of total 150 study population 84 (56%) were delivered via NVD, 66 (44%) were delivered via LSCS.

The study demonstrated that DSC interventions significantly improved neonatal growth parameters, with mean weight increasing from 157.84 grams to 947.16 grams and head circumference expanding from 0.54 cm to 5.51 cm over eight weeks, highlighting DSC's role in promoting both physical and neurological development in NICU-admitted neonates. (Table 1 and 2).

Out of 150 neonates, 41% were diagnosed with sepsis, with Developmental Supportive Care (DSC) potentially reducing sepsis risk, although the trend was not statistically significant (p=0.0540), and DSC appeared to be associated with a shorter duration of antibiotic therapy, as most neonates received antibiotics for 8-14 days, indicating a possible benefit in minimizing infection risks and antibiotic use (Table 3). Only 5 (3.33%) neonates developing retinopathy of prematurity (ROP) and a highly significant p value of <0.0001, the study suggests that Developmental Supportive Care (DSC) may significantly reduce ROP incidence compared to a previous month's data with a higher incidence of 4.3%, indicating DSC's potential effectiveness in minimizing this risk (Table 4).

Among the 150 neonates, those requiring respiratory support had a mean duration of mechanical ventilation of 0.93 days, continuous positive airway pressure of 1.47 days, and oxygen support of 0.99 days, with an average of 14.09 days in room air, suggesting that DSC may reduce respiratory support duration and facilitate quicker weaning, supporting improved respiratory outcomes compared to a previous study (Table 5). Among 150 neonates, the mean duration for different feeding methods was 5.7 days for intragastric (IG), 5.9 days for KS, and 5.72 days for breastfeeding (BF), suggesting that DSC facilitates earlier transition to oral feeds and breastfeeding, leading to reduced hospital stays and quicker recovery (Table 6).

The data shows that none of the 144 neonates in the study experienced neurological sequelae, with 100% of the neonates having no such outcomes. The p value of <0.0001. The implementation of DSC led to a mean NICU stay of 7.89 days and a total hospital stay of 17.3 days, significantly reducing the overall length of stay from the previous 6 month mean of 22.3 days (Table 7).

The study demonstrated a significant increase in maternal knowledge about preterm or low birth weight neonate care, with mean scores rising from 1.14 at birth to 8.45 at discharge, and a p value of <0.0001 confirming the effectiveness of the family-centered care approach in enhancing maternal education for improved home-based neonatal care (Table 8). The majority (96%) of the new-born were discharged from the hospital, while 1.33% left against medical advice (DAMA), and 2.67% expired during the hospital stay (Table 9).

Table 1: Effectiveness of DSC intervention on weight gain of study population.

Week	Mean (gm)	SD
1	157.84	31.89
2	344.88	442.43
3	410.25	89.45
4	474.14	101.29
5	545.70	123.43
6	584.53	71.36
7	702.25	59.84
8	947.16	354.03

Table 2: Effectiveness of DSC intervention on head circumference gain of study population.

Weeks	Mean (cm)	SD
1	0.54	0.18
2	1.07	0.31
3	1.52	0.18
4	2.16	0.27
5	3.16	0.75
6	3.54	0.75
8	4.40	0.57
9	5.51	1.42

Table 3: Suspected or proven sepsis in study population and duration of antibiotic required in study population.

Suspected or proven sepsis	Frequency	%	P value
Yes	62	41.33	0.0540
No	88	58.67	
Total	150	100.00	
Antibiotics days			
<= 7	11	17.74	0.1927
8 – 14	42	67.74	
>= 15	9	14.52	
Total	62	100.00	

Table 4: ROP requiring treatment in study population.

ROP	Frequency	%	P value
Yes	5	3.33	<0.0001
No	145	96.67	
Total	150	100.00	

Table 5: Effectiveness of DSC on duration of requirement of respiratory support in study population.

	Invasive mode	Non-invasive group	Only O_2 by NP	Not required O_2 support
Mean duration of MV	0.93	0	0	0
Mean duration of CPAP	1.47	0.8	0	0
Mean duration of O_2	0.99	0.99	0.75	0
Mean duration of RA	14.09	14.16	12.77	12.31
Total neonates	45	42	8	55

Table 6: Effectiveness of DSC on early upgradation of method of feeding on study population.

	IG	KS	BF
Mean duration in days	5.7	5.8	5.7

Table 7: Effectiveness of DSC on duration of stay in NICU and step down.

Duration of stay	Mean	%
IN NICU	7.89	45.59
Step down	9.41	54.41
Total DOS	17.27	100

Table 8: Knowledge of mother about care of preterm or low birth weight neonate.

Effectiveness of FCC			P value
	Mean	**SD**	0.0001
At birth	1.14	0.68	
At discharge	8.45	0.67	

Table 9: Outcome of study population.

Outcome	Frequency	%	P value
Discharge	144	96.00	0.0068
DAMA	2	1.33	
Expired	4	2.67	
Total	150	100.00	

DISCUSSION

The results revealed significant insights into neonatal care. Gender distribution in the current study showed a higher proportion of males (60.67%), with a male-to-female ratio of 1.5:1. Geographically, most neonates (63.33%) came from rural areas, emphasizing the need for improved perinatal care in rural settings. Birth weight distribution remained comparable to the previous cohort, with the majority classified as low birth weight (64%). Similarly, gestational age showed a predominance of neonates born after 36 weeks (35.33%). These findings confirm the demographic consistency of the study population, allowing for reliable comparisons of outcomes between the two periods.

A study done for effectiveness of KMC, NIDCAP embeds the infant in the natural parent niche, avoids over-stimulation, stress, pain, and isolation while it supports self-regulation, competence, and goal orientation. Research demonstrates that NIDCAP improves brain development, functional competence, health, and life quality. It is cost effective, humane, and ethical, and promises to become the standard for all NICU care.[6] One of the key aspects of this study was the evaluation of the effectiveness of DSC on growth parameters. The data demonstrated a significant and consistent increase in both weight and head circumference among neonates exposed to DSC.

Weight gain increased from 157.84 grams in the first week to 947.16 grams by the eighth week, while head circumference increased from 0.54 cm to 5.51 cm by the eighth week. These outcomes suggest that DSC promotes catch-up growth, which is crucial for the overall development and recovery of neonates during their early stages of life. In the study conducted in Manipal, the repeated measures of ANOVA was performed to compare the growth parameters that are weight and head circumference between the groups at different points of time, at recruitment, repeated at 1st, 2nd and 3rd week, at discharge, at 40th week and 12th month of corrected age shown.

Comparison of growth parameters in terms of gain in the mean score of weight and head circumference at different points of time. The repeated measures of ANOVA showed there was no significant difference was found in the mean weight gain and head circumference of the preterm infant's recruitment till 12th months in different time point between intervention and control group, weight (F (6,1.65) =0.122, p=0.94), Head circumference: (F (6, 2.57) =0.668, p=<0.66). Thus, the null hypothesis was accepted, and the research hypothesis was rejected.[7]

Clinical outcomes such as the occurrence of sepsis, retinopathy of prematurity (ROP), and respiratory support were also analysed. Although 41.33% of neonates were diagnosed with suspected or proven sepsis, the data hinted at a possible reduction in the need for prolonged antibiotic therapy, as DSC appeared to help in minimizing infection risks. The low incidence of ROP (3.33%) and the reduction in the duration of respiratory support required further underscored the potential benefits of DSC in enhancing neonatal outcomes.

Additionally, DSC facilitated the early escalation of feeding methods, enabling neonates to transition to oral feeding and establish breastfeeding earlier, leading to quicker recovery and shorter hospital stays. In a study conducted in Manipal, the frequency and percentage of clinical outcomes of preterm infants in terms of incidence of infection and retinopathy of prematurity. No statistically significant difference was found in both groups in the incidence of infection: (x^2, 0.10, p=0.95) and in the occurrence of ROP: (×2 1.99, p= 0.19).[7] Decreasing ambient light exposure in neonatal intensive care units is not of benefit in reducing the incidence of ROP.[8]

Regarding the duration of hospital stay, neonates receiving DSC had a mean NICU stay of 7.89 days, with a total hospital stay of 17.3 days, compared to a longer stay of 22.3 days in the previous cohort. This significant reduction in hospital stays, particularly in the NICU, points to DSC's effectiveness in stabilizing neonates and accelerating recovery. In a study conducted in a Manipal collage of nursing neonates required invasive mode +Non-invasive mode intervention group 35 (43.75) and in the control group 32 (40), Non-invasive mode group in intervention group 22 (27.5), among control group16 (20). Without any respiratory support in intervention group 23 (28.75) and control group 32 (40). The mean duration of ventilation in days Invasive mode ventilation in the intervention group was 1.91 and control group was 4.83, mean duration of Non-invasive mode (CPAP/HFNC) in days in intervention group was 4.83 and in control group was 5.93.[7]

The study also examined the outcome of neonates based on gestational age and birth weight. It was observed that neonates with lower gestational ages and birth weights had higher mortality rates, whereas those with higher gestational ages and birth weights exhibited better survival outcomes. The mortality rate was significantly lower (2.67%) compared to the previous cohort (8.75%), indicating that DSC may contributed positively to improving survival rates and reducing mortality, especially among premature and low-birth-weight neonates.

The absence of neurological sequelae suggests that DSC interventions may have played a crucial role in safeguarding neonates from potential neurological complications. This significant result highlights the potential effectiveness of DSC in promoting optimal neurological health and development. Given the strong statistical support, the findings advocate for the continued use and integration of DSC protocols in neonatal care to enhance neurological outcomes and overall well-being in high-risk neonates.

Furthermore, the implementation of family-centered care was found to have a profound effect on maternal knowledge regarding neonatal care. Mothers demonstrated a substantial increase in their knowledge of preterm and low-birth-weight care, from a mean score of 1.14 at birth to 8.45 at discharge. This highlights the critical role of involving families in neonatal care and the importance of educating parents to improve post-discharge care and outcomes. Study conducted in Manipal collage of nursing, shows the analysis of the effectiveness of the DSCP among the mothers practicing DSC. It reveals that there exists a significant difference between the intervention (76.30±7.86) and the control group (40.79±5.16) (t1, 158= 33.77, p=<0.001).[7]

Consensus process results included articulation of standards, competencies and recommended best practices for (IFCDC), including components of systems thinking, positioning and touch, sleep and arousal, skin-to-skin contact, reduction of pain and stress for infants and families, and feeding.[9,12]

Newborns receiving KMC had lower mean respiratory rate and pain measures, and higher oxygen saturation, temperature, and head circumference growth.[10] This study demonstrates that given the appropriate knowledge, training, educational and quality improvement opportunities, supported with leadership skills, the usual complement of RNs in a NICU can improve their knowledge acquisition and successfully implement neuroprotective family-centered developmentally supportive care. In order to provide optimal care to babies and their families, hospitals with both level II and III NICUs should invest in a comprehensive training.[11]

This study confirms the effectiveness of developmental supportive care in improving key clinical outcomes for high-risk neonates. DSC interventions not only contributed to significant growth in terms of weight and head circumference but also reduced the duration of hospital stays, minimized infection risks, and enhanced survival rates. Additionally, family-centered care was instrumental in empowering parents, leading to improved neonatal care practices post-discharge. Based on these findings, integrating DSC into standard neonatal care protocols is strongly recommended to promote better health outcomes for neonates, particularly those born prematurely or with low birth weight.

The strength of the study was that, this study is a unique and the second leading clinical investigation in the country to evaluate the effectiveness of DSC and its impact on neonatal health outcomes in neonates. Additionally, it is the only study of its kind conducted within our state, highlighting its exceptional role in advancing local neonatal care practices and offering valuable insights into DSC’s benefits.

The study includes a larger number of preterm and low birth weight infants. This study lead to sensitization of preterm care among NICU staff, doctors and parents.

This study has some limitations like in this study, authors adapted half of our NICU to implement DSC practices, with focusing on improved noise and light control. Although this modification has yielded notable improvements, for achieving 100% effectiveness requires a dedicated DSC unit with specialized infrastructure for optimal environmental control. Follow-up assessment of growth and neurodevelopment was not assessed because it is time time-bound study also chance of lost to follow up is there.

CONCLUSION

This cross-sectional study at Baroda Medical College and Sayajirao general hospital assessed DSC interventions in 150 neonates, revealing significant improvements in weight gain, head circumference, and reduced hospital stays, alongside decreased incidence of sepsis, retinopathy of prematurity, and respiratory support needs, neurological outcome, compared to a previous cohort; DSC also enhanced maternal knowledge and promoted earlier feeding transitions, supporting its integration into standard neonatal care for better outcomes. The results highlight DSC's role in enhancing both immediate and long-term out come in the NICU setting.

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