Suctioning First or Drying First During Delivery Room Resuscitation: *A Randomized Controlled Trial*

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Objective: To compare the effect of suctioning first or drying first on the composite outcome of hypothermia or respiratory distress in depressed newborns requiring delivery room resuscitation.

Design: Open-label, randomized, parallel-group, controlled trial.

Setting: Delivery room and neonatal intensive care unit of a tertiary-care teaching hospital.

Patients: Depressed newborns (*n*=154) requiring initial steps of resuscitation at birth.

Intervention: During delivery room resuscitation eligible newborns were randomly allocated to receive either suctioning first or drying first (77 newborns in each group).

Main outcome measure: Composite incidence of hypothermia at admission or respiratory distress at 6 hours of age.

Results: Both groups were comparable with regard to maternal and neonatal characteristics. Composite outcome was similar in both the groups [46 (59.7%) *vs* 55 (71.4%)] in suctioning first and drying first, respectively [RR (95% CI), 0.84 (0.66–1.05); *P*=0.13]. Incidence of hypothermia, respiratory distress at admission and oxygen saturation at 6 hours were also similar. On admission to NICU, hypothermia was observed in 26 (33.8%) neonates in suctioning first group and 33 (42.8%) neonates in drying first group but by one hour of age the proportion of hypothermic neonates was 13 (16.9%) and 14 (18.1%), respectively.

Conclusion: In newborns depressed at birth, the **s**equence of performing initial steps, whether suctioning first or drying first, had comparable effect on composite outcome of hypothermia at admission or respiratory distress at 6 hours of age.

Key words: *Hypothermia, Initial steps, Mortality, Newborn, Outcome, Respiratory distress.*

Approximately 10% of newborns require some assistance to initiate and sustain effective breathing at birth [1], and perinatal asphyxia accounts for 23% of 4 million neonatal deaths each year globally [2]. Skilled delivery room resuscitation can prevent many of these deaths and neurodevelop-mental handicaps in survivors.

All depressed newborns requiring delivery room resuscitation should receive 'initial steps' before initiating positive pressure ventilation. These essentially constitute temperature maintenance, positioning, suctioning, drying and tactile stimulation. Suctioning is done to clear the airway and drying is done to prevent heat loss. Though the sequence of suctioning followed by drying has been endorsed as the part of initial steps in neonatal resuscitation program (NRP) of the American Academy of Pediatrics (AAP) [3], it is based on expert opinion rather than evidence. It is not clear whether the same sequence should be followed in a resource-limited settings of lower and middle income countries, where the danger of hypo-thermia constitutes a bigger threat [4-6]. Due to this dilemma, the Indian NRP (first edition) [7],

advocated for the sequence of drying followed by suctioning as initial steps in Indian scenario. However, in neonatal resus-citation module of Facility-based newborn care [8], the sequence has been changed to suctioning first, followed by drying. Contradictory recommen-dations have led to confusion among health professionals, with variations in practice and training. The objective of the present study was to compare the effect of suctioning versus drying as a first procedure during delivery room resuscitation on the composite outcome of hypothermia at admission or respiratory distress at 6 hours of age.

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METHODS

This open-label, randomized controlled trial was conducted in the delivery room and neonatal intensive care unit (NICU) of a tertiary care teaching hospital of central India from March, 2016 to August, 2017. The study protocol was approved by the Institutional Ethics Committee. Written informed consent was obtained from

the parents before delivery. The cases was excluded, if there was insufficient time to obtain informed consent.

Consecutively delivered inborn neonates who were depressed at birth and required initial steps of resuscitation were included. Depression at birth was defined as presence of apnea or gasping and/or limp or poor muscle tone. Neonates delivered through meconium stained liquor, major congenital anomalies and cases where there was insufficient time to obtain consent were excluded. Antenatal details of the mothers including maternal age, gravida, parity, receipt of antenatal care, complications of pregnancy, evidence of fatal distress, mode of delivery, and relevant investigations done in the pregnant mother, including ultrasonography were noted.

Eligible newborns were randomized into one of two groups (suctioning first or drying first) using random permuted blocks of 4, 6 or 8. The randomization sequence was prepared by an independent person not involved in the conduct of study. Allocation of newborns to different groups was done using serially numbered, opaque and sealed envelopes.

All deliveries were attended by two pediatric residents who were trained in neonatal resuscitation as per AAP guidelines. After delivery, if a newborn was found to be apneic or limp, the umbilical cord was clamped immediately and baby was placed under radiant warmer with neck slightly extended. By this time, one member of the team or a staff nurse opened the sealed envelope and further sequence of initial steps was performed as per randomization. During resuscitation, oxygen saturation was recorded from right hand or wrist, using hand-held Masimo pulse oximeter. For suctioning, wall mounted suction was used with a pressure not exceeding 100 mm of Hg. Each attempt at suctioning was limited to no more than 3 to 5 seconds, and care was taken to avoid vigorous or deep suctioning. We used a pre-warmed towel to dry the baby and removed wet towel to prevent further heat loss. After completing initial steps including tactile stimulation, if the baby continued to have apnea/gasping breathing or bradycardia (heart rate 100/minute), positive pressure ventilation was initiated. The remaining steps of resuscitation were similar in the two groups.

All neonates were admitted to NICU and were monitored and managed as per unit protocol. Babies were kept under radiant warmer with temperature set at 36.5ºC. Babies were monitored using a predesigned proforma for heart rate, oxygen saturation, temperature, capillary refill time, respiratory rate, and other signs of respiratory distress (chest wall retractions, grunting and bilateral air entry into the chest). Investigations included blood glucose, serum electrolytes, chest X-ray, sepsis workup (complete blood count, absolute neutrophil count, C-reactive protein and blood culture), if needed, arterial blood gas analysis and renal function tests. Other tests included echocardiography and cranial ultrasonography, as and when necessary. Respiratory support was given via oxygen hood, continuous positive airway pressure (CPAP), high flow nasal cannula (HFNC) or mechanical ventilation as per need. Intravenous fluids, parenteral nutrition, and feeding were provided. Complications were managed as per our unit protocol.

Primary outcome variable was composite outcome of admission hypothermia or respiratory distress at 6 hours of age. Hypothermia was defined as rectal temperature <36.5ºC. Rectal temperature was recorded using a low-reading rectal thermometer. Respiratory distress was defined as presence of at least one of the following: respiratory rate >60/minute, chest wall retractions and grunting. Secondary outcome variables included the need and duration of positive pressure ventilation, chest compressions and medication use during delivery room resuscitation, oxygen saturations during first 10 minutes of age, incidence of hypothermia and respiratory distress within 24 hours, development of complications and duration of hospital stay and outcome.

Assuming an expected incidence of the need for delivery room resuscitation of 10% [3], a precision (d) of 0.05 and level of confidence of 95%, the sample size calculated was 138. Considering 10 % attrition rate, the total sample size was 154 newborns, 77 in each group *(www.kck.usm.my/ppsg/statistical_resources/SSCPS version1001.xls)*.

Statistical analyses: The statistical program SPSS version 16.0 was used for analysis. Independent samples t test/Mann Whitney U test and Fisher exact test were used as applicable to compare parametric and non-parametric variables. Risk ratios (RR) with 95% CI were calculated for outcome variables. The data were analyzed on intention to treat basis. A *P* value of <0.05 was considered statistically significant.

RESULTS

Each group included 77 neonates, and all neonates received their allocated intervention (**Fig. 1**). Both the groups were similar with respect to maternal and neonatal characteristics, except the incidence of eclampsia, which was significantly higher in suctioning first group (**Table I**).

The composite outcome of hypothermia at admission or respiratory distress at 6 hours of age was similar in suctioning first and drying first, respectively [46 (59.7%) vs. 55 (71.4%); RR (95% CI), 0.84 (0.66-1.05); *P* = 0.13]
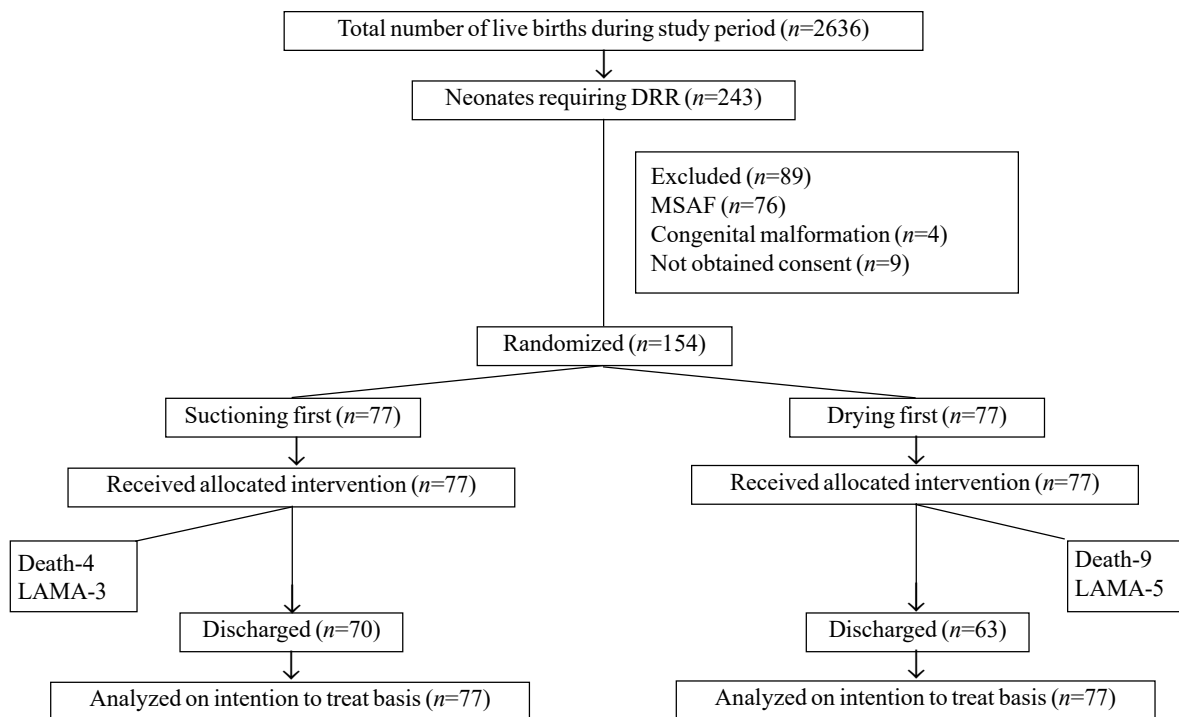
DRR: Delivery room resuscitation; MSAF: Meconium stained amniotic fluid; LAMA: Left against medical advice.

Fig.1 Flow of participants in the study.

Table I Maternal and Neonatal Characteristics of Study Participants

	Suctioning first (n=77)	Drying first (n=77)
Maternal characteristics		
*Maternal age, y	26.2 (4.5)	25.9 (4.1)
#Gravida	2 (1-3)	2 (1-3)
PIH/ Pre-eclampsia	7 (9)	6 (7.7)
Eclampsia	21 (27.2)	10 (12.9)
Antepartum hemorrhage	4 (5.1)	5 (6.4)
PV leak >18 h	11 (14.2)	16 (20.7)
Maternal fever	2 (2.6)	2 (2.6)
Fetal distress	10 (12.9)	15 (19.4)
Cesarean section	56 (72.8)	53 (68.9)
Neonatal characteristics		
*Gestation, wk	35.4 (3.5)	34.7 (3.1)
*Birthweight, g	2123 (67)	2131 (64)
Male gender	43 (55.8)	46 (59.7)
#APGAR score		
1 min	4 (3-5)	4 (3-6)
5 min	7 (6-8)	8 (7-9)

*Values in no. (%) except*mean (SD) or #median (IQR); PIH: Pregnancy induced hypertension; PV: Per vaginal; P>0.05 for all variables between the two groups.*

(**Table II**). Among the secondary outcome variables, oxygen saturation within 10 minutes after birth, incidence of hypothermia at admission, and respiratory distress at different time intervals during first 6 hours of age were also similar (*P*>0.05) (**Table II**). On admission to NICU, 26 (33.8%) neonates in suctioning first group and 33 (42.8%) neonates in drying first group experienced hypothermia (**Table II**). By one hour of age hypothermia was observed in 13 (16.9%) and 14 (18.1%) neonates, respectively. The differences were not significant.

Resuscitation details for both the groups are summarized in **Table II**. No significant difference was observed in the extent of delivery room resuscitation received by both the groups. Four (5.2%) neonates expired in the suctioning first group, whereas 9 (11.7%) expired in the drying first group (*P*>0.05) (**Table II**).

DISCUSSION

The present study demonstrated that suctioning first or drying first during initial steps of delivery room resuscitation result in comparable rates of composite outcome of hypothermia at NICU admission or respiratory distress at 6 hours of age in depressed newborns. We could not find any study in literature which investigated the comparative efficacy of drying versus suctioning as a first intervention during delivery room resuscitation.

WHAT IS ALREADY KNOWN?

- During delivery room resuscitation, the sequence of performing suctioning and drying is based on expert opinion rather than any evidence.

WHAT THIS STUDY ADDS?

- Suctioning first or drying first during delivery room resuscitation has comparable effect on the composite outcome of admission hypothermia or respiratory distress at 6 hours of age in newborn infants.

Table II Outcome Variables in Neonates in the Two Study Groups

Variable	Suctioning first (n =77)	Drying first (n=77)	Relative risk (95% CI)
Composite outcome, *n* (%)	46 (59.7)	55 (71.4)	0.84 (0.66-1.05)
Hypothermia at admission	26 (33.8)	33 (42.8)	0.79 (0.52-1.18)
Respiratory distress at 6 h	34 (44.2)	38 (49.4)	0.89 (0.64-1.25)
Oxygen saturation (%)[a]			
At 1 min	60 (56-63)	59 (54-63)	-
At 2 min	68 (64-72)	68 (64-72)	-
At 5 min	84 (82-87)	84 (81-86)	-
At 10 min	94 (92-95)	93 (92-95)	-
Bag and mask ventilation	73 (94.8)	75 (97.4)	0.97 (0.91-1.04)
Duration, s[a]	30 (30-30)	30 (30-60)	-
Bag and tube ventilation	50 (64.9)	43 (55.8)	1.16 (0.89-1.50)
Duration, min[a]	5 (5-10)	5 (1-10)	-
Chest compressions	0	4 (5.1)	0.11 (0.01-2.03)
Adrenaline usage	0	2 (2.5)	0.20 (0.01-4.10)
Death	4 (5.2)	9 (11.7)	0.44 (0.14-1.38)

All values in no (%) except [a]median (IQR); RR: Relative risk; Composite outcome - hypothermia at admission or respiratory distress at 6h of age; P>0.05 for all variables between the two groups.

The incidence of hypothermia was quite high in our study cohort, as compared to previous data from India [9-11]. Although newborns were resuscitated under radiant warmer, they were transported to NICU without any additional source of heat, which might have led to higher incidence of admission hypothermia in our study population. Preponderance of preterm newborns in study population might have added to the burden of hypothermia in study cohort. We did not measure the temperature of newborns in delivery room before transporting them to NICU. The possibility that some babies developed hypothermia during resuscitation cannot be excluded. It is well known that hypothermia at admission is associated with poor outcome [4-6]. We did not use polyethylene wraps to maintain temperature of extremely preterm newborns at birth, which obviates the need for drying in these cases, as drying was applied as one of the comparator interventions in the present study.

We observed no difference in the extent and duration of resuscitative interventions between the two groups. The mortality rates were also comparable in the two groups.

To conclude, it makes little difference to the outcome whether newborns are suctioned first or dried first and either approach is acceptable. However, to bring uniformity and consistency among health professionals and to avoid confusion in the implementation of NRP guidelines, we should follow an approach which is in agreement with standard guidelines unless there is a definite evidence of preferring one approach over the other.

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