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# Criteria for Using INSURE in Management of Premature Babies with Respiratory Distress Syndrome

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## ABSTRACT

**Introduction:** Respiratory distress syndrome (RDS) is defined as acute respiratory distress caused by surfactant deficiency that disturbs gas exchange in preterm infants. It is one of the most common neonatal problems and has been considered to be the most common cause of mortality and morbidity in preterm babies. **Aim:** In this study, different variables were studied to predict factors for INSURE failure that might help in choosing infants for this procedure early. **Methods:** Sixty three (63) patients were enrolled in this study as they met the inclusion criteria. All neonates were intubated briefly less than 2 hours, given natural surfactant in the dose of 3 ml/kg. As soon as it was appropriate and the neonate was stable in the form of normal heart rate and oxygenation, extubation was done and the baby connected to NCPAP at a pressure of 6 cmH<sub>2</sub>O. INSURE failure was considered if the patient needed mechanical ventilation for more than 72 hours while INSURE success was considered if we were able to wean the patient from CPAP or if the patient didn't need mechanical ventilation in the first 72 hours after surfactant administration. The indications for mechanical ventilation after INSURE procedure were respiratory distress with desaturation (O<sub>2</sub> sat less than 90%), recurrent apnea, Pco<sub>2</sub> more than 60 mmHg. **Results:** Since INSURE procedure is being largely applied in the neonatal intensive care units, it is important to determine the candidate neonate for this procedure with the minimum failure rate. Although the sample of our study is small, but we can suggest that neonate with gestational age less than 28, birth weight less than 1000 gm, umbilical PH of less than 7, low Apgar score and anemic patients are at high risk for INSURE failure. **Conclusion:** Early diagnosis of PDA and IVH is essential to avoid INSURE method in these patients.

**Keywords:** Premature babies, Respiratory Distress Syndrome, INSURE.

## 1. INTRODUCTION

Respiratory distress syndrome (RDS) is defined as acute respiratory distress caused by surfactant deficiency that disturbs gas exchange in preterm infants. It is one of the most common neonatal problems and has been considered to be the most common cause of mortality and morbidity in preterm babies (1-4).

Surfactant therapy, as rescue or prophylactic therapy, has proven to enhance gas exchange, and hence decrease alveolar collapse, and reduce mortality and morbidity in the form of pulmonary air leak and duration of ventilatory support in preterm infants (4-6).

Surfactant administration followed by mechanical ventilation is associated with many complications related mostly to the ventilator induced lung injury that contribute to bronchopulmonary dysplasia (BPD) (7-12).

Nasal continuous positive airway pressure (NCPAP) is considered as better alternative to mechanical ventilation with fewer side effects as it stabilizes the chest wall, reduces airway resistance and increases functional residual capacity so improving lung volume and oxygenation (13-19).

Although the optimal strategy for treating RDS is still controversy, INSURE procedure has been investigated and resulted in a reduced need for mechanical ventilation as it involves the use of surfactant therapy with transient intubation in neonates who breathe spontaneously (20-24).

## 2. AIM

In this study, different variables were studied to predict factors for INSURE failure that might help in choosing infants for this procedure early.

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### 3. METHODS

This study was conducted between the period May 2015 till April 2016 at the neonatal intensive care unit in King Hussein Medical Centre and Queen Rania Hospital for Children. It was approved by the Ethical committee of the Royal Medical Services.

Inclusion criteria were: All neonates who were less than 37 week of gestation according to the gynecologist record. Neonates who breathe spontaneously and were eligible for exogenous surfactant therapy according to our unit guidelines were enrolled in the study.

Exclusion criteria were: a) Severe birth asphyxia; b) Neonate who needed immediate intubation and resuscitation; c) Major malformation and chromosomal abnormalities.

A consent form was obtained from all patients and a prepared data sheet was filled by the neonatologist containing all the predictors of concern, which are: sex, mode of delivery, gestational age, history of preeclampsia, presence of rupture of membrane, PH of the umbilical cord, use of antenatal steroid, Apgar score at 5 minutes, presence of anemia in neonate.

Post surfactant characteristics were: prolonged use of antibiotics, presence of patent ductus arteriosus, necrotizing enterocolitis, retinopathy of prematurity, intraventricular hemorrhage, duration of NCPAP, duration of hospital stay, and duration of supplemental oxygen.

All neonates were intubated briefly less than 2 hours, given natural surfactant in the dose of 3 ml/kg. As soon as it was appropriate and the neonate was stable in the form of normal heart rate and oxygenation, extubation was done and the baby connected to NCPAP at a pressure of 6 cmH<sub>2</sub>O.

INSURE failure was considered if the patient needed mechanical ventilation for more than 72 hours while INSURE success was considered if we were able to wean the patient from CPAP or if the patient didn't need mechanical ventilation in the first 72 hours after surfactant administration. The indications for mechanical ventilation after INSURE procedure were respiratory distress with desaturation (O<sub>2</sub> sat less than 90%), recurrent apnea, Pco<sub>2</sub> more than 60 mmHg.

All neonates underwent cardiac echocardiogram to rule out patent ductus arteriosus (PDA), cranial ultrasound to rule out intraventricular hemorrhage and ophthalmic review to rule out retinopathy of prematurity according to our unit protocol.

Umbilical cord PH was obtained for all patients and complete blood count (CBC) was done for all of them at the age of 3 days. Any hemoglobin level less than 14 mg / dl was considered anemia.

#### Statistical analysis

Patients' data were analyzed with Minitab release software version 13.1. Statistical analysis was performed using t-test and test statistics for the difference of two population proportions. Confidence interval of 95 % is considered. P value <0.05 was considered statistically significant.

### 4. RESULTS

Sixty three (63) patients were enrolled in this study as they met the inclusion criteria. Thirty three were males (52.4%) and 30 (47.65%) females. The gestational age ranges between 24-37 weeks, birth weight ranges between 0.625-3.9 kg. Thirty six cases (57.1%) underwent caesarian section for different reasons. Most of the patients were born to multiparous women with an average age of 29.4 years. Other characteristics of this study population are shown in Table 1.

Variable	N (%)	
Sex	Male	33 (52.4%)
	Female	30 (47.65%)
Cesarean section	36 (57.1%)	
Birth weight	<1000	9 (14.3%)
	1000-1500	27 (42.8%)
	1500	27 (42.8%)
Gestational age	<28 weeks	7 (11.1%)
	28-30 weeks	22 (34.9%)
	30-32 weeks	26 (41.3%)
	>32 weeks	8 (12.7%)
Parity	Primigravida	15 (23.8%)
	Multiparity	48 (76.2%)
Antenatal steroid use	28 (44.4%)	
Pregnancy induced hypertension	20 (31.7%)	
Premature rupture of the membranes	4 (6%)	
Maternal age at delivery (mean)	29.4 years	

Table 1. Characteristics of patients

INSURE success was seen in 47 cases (74.6%), while INSURE failure was seen in 16 cases (25.3%). As we can see in Table 2, significant differences concerning the following variables were noted: gestational age, birth

Variable	INSURE failure Group n= 16	INSURE success Group n= 47	P value
Gestational age <28 week	6 (37.5%)	1 (2%)	0.004
28-30 week	8 (50%)	14 (29.8%)	0.154
30-32 week	2 (12.5%)	24 (51%)	0.000
>32 week	0%	8 (17%)	0.002
Birth weight <1000 gm	6 (37.5%)	3 (6%)	0.014
Male	9 (56.25%)	24 (51%)	0.718
Pregnancy induced hypertension (PET)	8 (50%)	12 (25.5%)	0.081
Antenatal steroid use	2 (12.5%)	26 (55%)	0.000
Cesarean suction (CS)	7 (43.75%)	29 (61.7%)	0.209
Anemia HB below 14 mg/dl	9 (56.25%)	5 (10.6%)	0.001
APGAR Score below 7 at 5 min	10 (62.5%)	1 (2%)	0.000
Pco <sub>2</sub>	10 (62.5%)	27 (57%)	0.720
Umbilical cord PH <7.2	6 (37.5%)	0%	0.002
primigravida	6 (37.5%)	9 (19%)	0.171
multigravida	10 (62.5%)	38 (80.8%)	0.171
Premature rupture of the membrane (PROM)	1 (6%)	3 (6%)	0.985
Maternal age (mean)	30.7	28.69	0.163

Table 2: Comparison in monitored variables between two groups

Variable	INSURE failure Group n=16	INSURE success Group n=47	P value
Antibiotic use >7 days	5 (31.25%)	8 (17%)	0.267
Patent ductus arteriosus	11 (68.75%)	6 (12.7%)	0.000
Intraventricular hemorrhage	6 (37.5%)	3 (6%)	0.014
Retinopathy of prematurity	0%	1 (2%)	0.312
Days of oxygen requirement (mean)	10.4	17.5	0.044
Days of nasal CPAP (mean)	1.75	5.64	0.000
Days of hospital stay (mean)	34	10.6	0.001

Table 3. Post surfactant complication

weight, Apgar score, antenatal steroid use, umbilical PH and anemia in newborn.

Gestational age below 28 week is significantly associated with increased risk for INSURE failure, while gestational age more than 30 wk is associated with increased risk for INSURE success.

Low birth weight as well as low Apgar score, low hemoglobin (HB) and low umbilical PH were associated with increased risk for INSURE failure.

T test and p value for these variables are shown below.

Sex, parity, mode of delivery and maternal age were not significantly different between the two groups while antenatal steroid use was in favor of INSURE success. Table 3 showed post surfactant characteristics which showed that patent ductus arteriosus and intraventricular hemorrhage were seen more in the INSURE failure group significantly.

## 5. DISCUSSION

The most appropriate strategy for management of respiratory distress syndrome is still a controversial debated issue. Reports from different countries showed that INSURE procedure and avoidance of mechanical ventilation has improved respiratory outcome (2, 26).

In our study, the success rate of INSURE procedure was 74.6% which is comparable to other studies (2, 27, 28). Higher failure rate was seen in other studies with different variables (29, 30).

Our study showed that gestational age, birth weight, Apgar score, umbilical PH and neonatal HB level were significantly lower in the failure group. It was found that the less the gestational age, the higher the probability to have INSURE failure similar to other studies (2, 27, 31), but it was not the case in other reports where gestational age was not a significant predicting factor (28, 30).

This can be applied also on birth weight with the same results, the less the weight the more chance to have INSURE failure (2, 27, 28, 32, 33). This was not the case with Brix report where birth weight was not a risk factor for INSURE failure (31). This can be explained by the fact that the less the gestational age and birth weight, the more immature the lung is leading to more severe RDS and INSURE failure.

Anemia was associated with INSURE failure like others (28, 31), this is mostly due to the fact that anemia leads to insufficient oxygen delivery to the peripheral tissues and more hypoxia. Low Apgar score at 5 minutes is indicative of failure; this was seen in our study and some other reports (2, 31). Parameters like sex, mode of delivery, parity, maternal age were studied but not found to be a significant predictors like other studies (27).

Pregnancy induced hypertension was found to have a protective effect over the neonatal lung so it decreases the risk of INSURE failure (31) but it was not the case here in our report.

Intraventricular hemorrhage and patent ductus arteriosus were more common in the failure group resembles that seen in others (34). This signifies the importance of early diagnosis of such cases. Mortality rate was 22.2 %, a relatively high percent that was comparable to others (34) but serious issue that needs enhancement.

### Limitations

Sample size was limited and larger samples are needed in future to implement the INSURE technique in all nurseries

## 6. CONCLUSION

Since INSURE procedure is being largely applied in the neonatal intensive care units, it is important to determine the candidate neonate for this procedure with the minimum failure rate. Although the sample of our study is small, but we can suggest that neonate with gestational age less than 28, birth weight less than 1000 gm, umbilical PH of less than 7, low Apgar score and anemic patients are at high risk for INSURE failure.

Early diagnosis of PDA and IVH is essential to avoid INSURE method in these patients.

- **Author's contribution:** F.A, N.H, R.G, A.B and M.H. gave substantial contribution to the conception or design of the work and in the acquisition, analysis and interpretation of data for the work. Each author had role in drafting the work and revising it critically for important intellectual content. Each author gave final approval of the version to be published and they agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.
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