

# Feeding Related Errors Jeopardize Safe Care in the Neonatal Intensive Care Unit

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## ABSTRACT

Neonatal intensive care units (NICU), currently considered as technological driven environment, there is great advances and progress regarding respiratory support equipment as well as growing interest in training personnel regarding safe strategies and modalities involving use of mechanical ventilation. Still other care modalities do not have the same vigilance as feeding process and procedures that subsequently may be associated with medical errors and incidents.

Harmful incidents as adverse events cause morbidity often with devastating results, while non harmful incidents as near misses may serve as free lessons to the health care workers. Medical error ensues owing to active failure and or latent failure. Active failure contains incidents related to persons as doctors and nurses, whereas latent failure involves errors associated to the system. Imperfect data management, demanding environment, insufficient training of staffs and unproductive communication systems are several models of latent failures.

The impact of medical errors may be ameliorated once thorough investigation and causal factors as well as consequences are tackled and preclusion measures are implemented. NICU's medical and nursing staff should be familiar with patient safety language, implement best practices, and support safety culture, maximizing efforts for reducing errors. Furthermore, top management commitment and support in developing patient safety culture is essential in order to assure the achievement of the desirable organizational safety outcomes.

## INCIDENCE AND FREQUENCY OF FEEDING RELATED ERRORS

A few studies looked at the feeding and nutrition related errors in the NICU. Feeding related errors was reported by limited studies, it ranged from 24.17% [1-3] of the total registered errors to 1.78 % in Elshazly et al., 1,88 in EL Meneza et al. studies, while Egyptian neonatal safety training network (ENSTN) reported 1.51% of the total reported errors to be categorized as feeding related errors [4-6].

### Nature of feeding related errors

The nature of feeding related errors varies according to the type of milk, route of administration as well as the patient's characteristics.

The feeding errors could be related to type and amount of feeding, time to start, time to stop or restart oral/enteral feedings. Handling expressed breast milk or formula feeding both may carry risk for errors. Initiation of trophic feeding was also among the recorded feeding related errors. In khalifa study, the most common feeding

errors was the use of formula instead of breast milk in 60.46% of cases, followed by development of NEC in 6.08% of cases and over feeding in 5.70%[3].

El-Shazly et al. study showed other causes as poor storage of milk bottle, overfeeding of crying babies lead to abdominal distension and vomiting, delayed initiation of trophic feeding and increase caloric intake<sup>4</sup>. Suresh et al., found that the most common enteral feeding error in the NICU was feeding a mother's expressed breast milk (EBM) to the wrong infant. One quarter of misidentification errors that were reported to the Vermont oxford Network involved EBM administration errors. Contributing factors to these events included incorrectly labeled specimen, difficult-to-read handwritten specimen labeled, errors in verification of patient /aliquot identification, and systematic problem with the way EBM aliquots are stored<sup>7</sup>. In a rare case nasogastric tube caused perforations of stomach [5].

There are errors that may results from use of expressed milk; one of the most serious human milk errors that can occur is administration of the wrong milk to the wrong infant [7,8].

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Several latent and active causes may be related to these errors, absence of suitable room for the mother to breast feed or facilities to store milk, presence of untrained nurses in the NICU of the study and fear from feeding expressed milk to wrong baby [3].

Frequent reports depict the hazards from misconnections of enteral feeding tubing (such as tubes being connected to catheters or to non-enteral tubing), sometimes with fatal outcomes [9]. The interchangeability of luer connectors was the main contributing factor to these errors. Human factors were also identified as staff fatigue from working consecutive shifts [10].

### Aftermaths of feeding related errors

There are data showed adverse events in 74.83% of the reported cases with different grades of harm<sup>3</sup>. Contamination of maternal milk or and commercial nourishing foodstuffs during preparation possibly will

boost latent onset infection and sepsis hazard among preterm infants and other immunocompromised newborn infants [11-13]. Also it can increase patient risk for allergic reactions [13].

The neonates who received the incorrect maternal or commercial feeding product had inappropriate nutrient supply for their daily need and their clinical status, that may decrease the daily attain of weight and affect maturation of the different organs most important the brain. Transmission of infectious diseases present in one mother milk can transmit infection when given to the inappropriate neonates with subsequent ethical and legal liability. The neonates who receive an incorrect human milk preparation are at increased risk for infectious disease [12].

Wrong human milk administration errors are serious errors that endanger the trust and confidence of families and result in increased costs from additional tests<sup>(14)</sup>. Moreover, in Muslim countries it is not acceptable unless apply several restrictions.

Some authors reported that neonates receive wrong human milk are considered fluid exposure and provide an opportunity for spread of pathogens [12-15].

Large volume handled to feed newborn infants whether once or frequent times per day carried risk of abdominal distension, vomiting with subsequent aspiration and respiratory complications. Also when high concentrated milk or formula products are given to compromised newborn infants, it may cause necrotizing enterocolitis. On the other side inadequate feeding carried risk of hypoglycemia and inadequate growth to the neonates.

Intravenous administration connected to nasogastric tubes or enteral feeding solutions connected to peripheral or central IV catheters is one of the serious incidents. The first known report of an enteral misconnection was reported in 1972 [16]. Adult patient received almost 100 mL of milk intravenously. This error was endorsed to indistinct ordering by the physician. The "look-alike" of the milk with intravenous fat emulsion, which was newly in use, caused this incident. Other similar thirty-three proved incidents were reported by the British National Health Service [17].

### Strategies that may decrease feeding related errors in NICU

Maternal expressed milk is widely used in all NICUs all over the world especially during the early post-natal age in very low birth weight infants or sick neonates, human milk feeding is the optimal

nutrition for newborn infants especially preterm infants, maternal milk decreases the frequency of necrotizing enterocolitis. Also, it improves cognitive development [18,19] and decreases neonatal sepsis. Expression of breast milk is not simple process from the moments mother started to express milk, then when nurse staff receive it, stored it, divide and prepare to feed to the designated baby. Several latent and active errors may be developed at any of these steps. Handling EBM process showed similarity to medication process and medication errors [20].

Generally, in order to decrease feeding related errors, initially, identification of the current feeding errors and incidents in the NICU is the crucial step, then assemble quality improvement team and apply plan-do-study

act rules of quality improvement. It is important to identify both adverse or near miss related errors. Appraise the existing feeding processes and techniques along with recognition of the flaw in the practices. Trigger tools can provide a considerable amount of information about the health care system, including where the harm is occurring and the degree of harm that patients experience [21]. When feeding related errors are identified, use root cause analysis to identify the cause, then investigate the proper action/process to diminish feeding related errors. Study the effect of the new action/process and find if it decreases the rate of errors, then communicate effectively to all staff involved in feeding the neonate.

According to accreditation standards, adverse safety incidences from feeding errors should be reported and may have associated fines, eliminate reporting bias and develop evidence-based recommendations [22].

In order to ensure safe and accurate provision of food and nutrition products, the joint commission suggested the use of centralized food preparation, trained technicians dedicated to feeding preparation, inclusion of a registered dietitian and use of feeding related software. The hospitals must prepare food and nutrition products using proper sanitation, temperature, light, moisture, ventilation, and security. All hospital components and functions are integrated into infection prevention and control activities. These measure have to be applied in conjunction with use at least 2 patient identifiers when providing treatments or procedures. The patient's room number or physical location is not used as an identifier [23]. Healthcare organizations have to develop policies and procedures for safe handling of human milk practices in NICU as with the other body fluid due to risk of infection.

The addendum of the infant formula act, advice designates a separate, centralized room or nutrition lab for expressed human milk intake, storage, and preparation as the criterion standard, moreover the American society for parenteral and enteral nutrition recommends implementation of procedures, and compliance monitoring for the handling and administration of enteral nutrition requiring an open system, such as infant feedings [24,25].

The US news best hospitals' criteria, advocate central milk preparation and assign points to NICUs with registered dietitian with patient ratios of less than 20:1 as well as for reserved central area for milk and formula preparation [26]. Vigilances during preparation of enteral feeding include apply hand hygiene, make sure it is right baby, right milk, right route and avoid any miss-connections.

The effect(s) of centralized milk preparation, use of trained technicians, use of feeding-related software as bar code-scanning technology and collaboration efforts between registered dietitians

decrease nursing demand, improves control, and prevents “near misses” [22].

As enteral misconnections were reported among near miss feeding related errors in the NICU, the use of connectors will standardize the connection between all enteral devices, helping to ensure that enteral connectors will fit only with each other, and not with other connector types [27].

A report regarding implementation of formula tracking tool (scan fortifiers and formulas and all human milk additives,) ensure the products match the electronic order have shown to be effective as the number of near-misses declined. This decline suggests that not only does the system prevent errors, but also serves to provide ongoing education and assist in behavior change of the users [27].

The health care organizations pursue for safe infant feeding may include; a preserved location that assist aseptic practice, precise equipment and supplies, devoted personnel and staff hygiene, suitable storage of human milk and formula, and use of technology (including bar code scanning) to improve safety and workflows [27-29].

## CONCLUSION

To conclude reporting and sharing feeding related errors among health care workers in the health care organization and nationally is a step to improve practice. Furthermore, maintaining of training and implementation of technology, effective communication and improvement of the procedures related to feeding process may improve safety in NICU. Always make feeding safety checklist to ensure right baby -right milk- right route, early trophic feeding when possible, appropriate handling of EBM and follow protocol feeding protocols appropriate to the designated baby.

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