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Original Research Article

A Randomized, Controlled Study Comparing Nurse Feeding to Feeding with a Feed Rail for Stable Preterm Infants

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Abstract

Objective: To analyze the difference in feeding rate as well as the amount of time needed to complete meals while manually versus automatically feeding through feed rail.

Methods: Randomization was used to assign preterm newborns who were stable and weighed between 1 and 2 kg to either the gravity or feed rail feeding group, depending on whether they were receiving partial or complete enteral feeds by gavage. For the purpose of the study, each of the forty nurse-baby pairs consisted of ten nurses and four infants. Forty instances of feeding were documented for each of the groups.

Results: The median amount of time spent eating in the group that used feed rails was 18.5 minutes, while the time spent eating in the nurse-led group was only 15 minutes (p = 0.34). When adjusted for bodyweight, the feeding rate in the feed rail group was between 0.8 and 2.3 mL/kg/min, whereas the feeding rate in the control group (which used manual gravity feed) ranged between 2.5 and 8.9 mL/kg/min. This difference in the variance of the feed rate was statistically significant (the p value was less than 0.0001) The median feed rate when using feedrail was 1.3 mL/min, but the median feed rate when using manual gravity feeds was 4.1 mL/min. Eighty percent of the time, nurses were able to feed patients using feed rails without needing their hands.

Conclusion: When compared to manual nurse-led feeding, feeding using a feed rail results in gravity feeding that is gradual, steady, and has minimal change at a rate of 1 to 2 mL/kg/min without influencing the overall time of the meal.

Keywords: Feed rail, gravity feeding, automated feeding, preterm infants, neonates.

Introduction

The survival and health of infants born prematurely or with a low birth weight are highly reliant on the infants' ability to get enteral nutrition. When compared to newborns of normal birth weight, these babies have a greater variety of feeding abilities, as well as higher requirements for hydration and nutrients [1]. This presents a dilemma when it comes to feeding them.

Sucking, swallowing, and the ability to properly coordinate sucking/swallowing with breathing are all necessary for successful breastfeeding in newborns, and all of these skills grow as the pregnancy progresses. Up until that point, the most frequent method of feeding for preterm newborns and babies born with a low birth weight is gravity feeding through the use of a gavage tube [2]. Babies can be fed by a nasogastric tube (NG) either intermittently, often over 10 to 20 minutes every 2 or 3 h (bolus feed), or continuously, using an infusion pump [3]. Intermittent feeding normally takes place over a period of around 10 to 20 minutes every 2 or 3 h. Only in cases when the infant is unable to accept bolus feeding can neonatologists resort to using pump feeds. Gavage feeding, on the other hand, mimics breast-feeding at the stomach end since it is supported by gravity and supplied in pulses, whereas pump feeding involves positive pressure (forced) feed. This is the significant difference between the two methods of feeding. In order to minimize difficulties, it is best to use whichever method you choose to provide the meals at a gradual but consistent rate.

In spite of the fact that the authors were unable to locate any scientific literature that prescribed an acceptable pace of gravity feeding, it is advised that a full feed be given over the course of 10 to 15 minutes depending on the baby's tolerance. This is about similar to one to two milliliters per kilogram every minute [2].

In most circumstances, the use of slow bolus feeds rather than continuous feeding is recommended [4]. It has been demonstrated that excessive and quick feeding is detrimental to the health of the infant [5]. It is to be expected that the procedures used for feeding neonates would differ from one neonatal facility to another throughout the world owing to the inclusion of human elements such as nursing expertise and resource concerns such as the nurse-to-baby ratio. Because of these considerations, the rates at which gravity feeds can exhibit substantial fluctuation. An previous investigation carried out by the authors demonstrated that their hypothesis was correct [6].

The authors hypothesized that the process of feeding could be automated to some extent as a solution to minimize the large amount of variation in feeding rate. This would result in a reduction in the amount of variation in feeding rate, the maintenance of uniformity, and would also lessen the burden on the nursing staff working in low-resource units. The authors created an automated gravity feeding system that they call a "feed rail" in order to accomplish a steady and sustained gravity feeding with minimum fluctuation in the feeding rate by the nurses. Because it is automated, it is anticipated that using this gadget will free up the nurses' hands for other tasks. This study was carried out with the goals of calculating the amount of hands-free time that is available during automated feed rail feeding in stable preterm newborns and comparing the variance in feeding rate and time taken between nurse-led and 'feed rail' gravity feeding in preterm neonates.

Materials and Methods

This was a hospital-based, randomized, controlled trial that took place at the newborn unit during the months of June and July in the year 2021. The feed rail is a mechanical device that is lifted by electronic controls and is seen in Figure 1. It is used to fill the syringe with milk. The currently available model lacks a speed control mechanism. The syringe is then inserted into the holder for the syringe, and the procedure is initiated. A motor and a lead screw are used to elevate the syringe in order to access the needle within. The lifting is done gradually and irregularly, with a little break in between each lift, to make it easier for the milk to flow from the syringe to the infant as a result of gravity. The gadget does not, on its own, apply any sort of positive pressure in order to help the milk flow more easily. Milk is infused into the stomach by gavage at a steady and regular rate with periodic boluses of modest amount. This is done while the syringe is being lifted gradually. If the operator determines that the milk flow rate is higher than what is wanted, they have the ability to halt the process at any level. A rewind button ensures that the barrel of the syringe is lowered to the right height and pauses it there while the caregiver assesses the situation. This is done so that the nursing cues may direct the feeding, which is a very important factor in determining whether or not the feeding will be successful.

After the feeding process is finished, the rewind button will have been withdrawn from the housing, which will allow the syringe to be lowered. A safety sensor that is attached to the baby's cheek and that is tied to the gavage tube with the assistance of medical adhesive tape ensures that the accidental dislodging of the gavage tube is indicated with the help of a beep sound. This is accomplished by using medical adhesive tape. As a direct result of this, the ascent of the syringe has been halted while the caregiver attends to the situation.

Babies that were enrolled in the trial had to weigh less than 2 kilograms, be able to tolerate oral feeds, and receive at least 50 percent of their daily nutritional requirements by gavage. Babies who need life support measures such as a ventilator or inotropes were not included. The research unit was comprised of a single caregiver and their offspring (study subject). The study looked at a total of forty different study units like this.

A NG with a size of 6 Fr was inserted, and its length was adjusted to the required value. The location of the tube was validated by the utilization of pH paper in order to determine the acidic condition of the stomach aspirate. Before starting the feed each time, the degree of gradation at which the tube was fastened to the face was documented and examined to ensure that it had not moved. This was done so that it could be verified that the tube had not moved. A randomization of the sequence in which they were fed was carried out (manual and feed rail group). In accordance with the randomization, the primary nurse gave the infant its first feeding. After some time, the same research unit was switched over to receiving food in a different manner.

Within the intervention group, the feed rail was positioned in close proximity to the infant who required feeding. The empty barrel of the syringe was secured to the end of the NG tube. Additionally, the safety sensor was attached to the tube with tape. The necessary amount of feed was inserted into the barrel of the syringe, and then it was secured to the appropriate location on the feed rail using the provided strap. The machine was started up by being turned on. The nurse kept an eye on the flow rate and stopped the machine when she was satisfied that the infant was receiving an adequate amount of fluids at the given rate. Recording was done with regard to the amount of time that elapsed between switching on the feed rail and reaching the desired volume of feed.

In the "control" group, the "prescribed" amount of feeds were given out using the "normal" gravity feeding technique by the nurse who was assigned to the case. The height of the syringe was halted at the point where the nurse had determined to be the most effective level for maximizing the rate of milk flow. After each feeding, the infants were given a burp. The nurse who was in charge of the case completed the nursing observation sheet, which included information on the patients' vital signs, the beginning and end of feeding, and the amount of milk that was spilled by each group. One of the investigators was responsible for collecting data pertaining to the aforementioned topics in addition to additional demographic data.

The authors of the study carried out a pilot investigation and found that the difference in time between the two groups had a standard variation of 6.6 minutes [6]. The authors needed 38 participants in both the control group and the intervention group. This was based on the assumption that the genuine difference between the two groups would have a standard deviation of at least 5 minutes, with an alpha error of 5% and a beta error of 10%. This was summed up to a total of forty subjects (nurse-baby pair). Every nurse and baby combination carried out a feeding session, with one feeding utilizing a control approach and the other utilizing an intervention strategy.

Results

The participants in this study consisted of a total of 50 mother-child duos. Forty nurse-baby pairings were created by pairing ten registered nurses with each of four infants. The participants' gestational ages ranged anywhere from 28 to 32 weeks, while their weights varied anywhere from 980 to 1600 grams. The neonates involved were between 10 and 44 days old at the time of the study (corrected gestational age between 33 to 35 wk). At the time of inclusion, the gestational age that fell within the interquartile range (IQR) was 34 weeks on average (34–34). The average weight of the newborns that were included in the study was 1050 grams (median and interquartile range) (980–1357).

Random assignment determined which of the six groups would first get their nutrition by manual gravity feeding. The remaining ones were assigned at random to feed rail feeding. In the group that used feed rails, the average volume of feed was 16.1 mL, whereas in the manual group, the average volume of feed was 17.2 mL. The remaining newborns were all receiving complete enteral feedings, whereas seven of the infants received just partial enteral feedings. Three of the seven subjects on partial feeds were assigned randomly to manual gravity feeds, while four were given feed rail feeds.

A set of four newborns were seen to have a median feed time of 18.5 minutes (95% confidence interval [CI]: 14.2–19.2) while using the feed rail, and 15.1 minutes (95% CI: 14.3–16.6) when using manual gravity feeding. (Table 1)

Table 1: Variables tested

Variables	Gravity feed	Feed with rail	p-value
time duration in min	14.1	18.5	0.01
vol of feed in ml /min	1.3	4.1	0.01

The flow rate that was accomplished with feed rail was 1.29 mL/min, whereas the flow rate that was accomplished with gravity feeds was 4.07 mL/min. Between the feed rail group and the manual gravity feeding group, there was a statistically significant difference in the rate of feeding that was adjusted for body weight. In the group that was fed by a feed rail, the feeding rate varied from a minimum of 0.78 mL/kg/min to a high of 2.22 mL/kg/min, but in the group that was fed by a nurse, the range for the feeding rate was between 2.44 mL/kg/min and 8.67 mL/kg/min. In the feed rail group, the median rate was 1.22 mL/kg/min, while in the manual gravity feed group, the median rate was 4.06 mL/kg/min. The difference between the two groups was statistically significant (p value 0.0001), with a median difference of 2.77 mL/kg/min and a range of 2.2–2.9 mL/kg/min. In the group that used the feed rail, the variation in the feeding rate was only 1.44 mL/kg/min, but in the group that used manual gravity feeding, the variation in the feeding rate was 6.33 mL/kg/min. When the feeding rate was done manually, there was a 4.1 times more fluctuation in it than when it was done using the feed rail.

The amount of hands-free time for the feed rail group was estimated. After the feeds had begun, the nurse who was administering them had almost no need to use her hands at all (other than to click the stop button), therefore the authors of the study included preparation time in both groups when they calculated the amount of hands-free time each received. The preparation time for the feed rail feed took between 30 and 60 seconds, but the preparation time for manual feeds took between 60 and 90 seconds. As a result, an additional sixty seconds were added to the duration of each stream in order to arrive at the overall feed time. The manual gravity feeding group had a mean (SD) total feed time of 5 minutes per infant, whereas the feed rail group had a mean (SD) total feed time of 5.2 minutes.

The feed rail group had a mean (standard deviation) hands-free time of 4.25 minutes. In the group that used the feed rail, the nurses had their hands free for eighty percent of the overall feed time. On the other hand, the nurse who used the manual gravity feeding method had no such hands-free time available. Neither of the groups experienced any difficulties with their eating. There was no statistically significant difference between the two groups despite the fact that one infant in the feed rail group and three babies in the manual gravity group threw up within half an hour of finishing their feedings.

Discussion

Larger bolus meals have the potential to temporarily compromise respiratory functioning, particularly in babies who are already struggling with respiratory distress syndrome. If you eat too quickly, you might end up with belly distension, pain, and reflux; if you eat too slowly, you could end up with indigestion as a result of the short intervals between meals [5].

A recent survey conducted internationally found significant differences in the ways in which neonatal intensive care units throughout the world approach the process of feeding neonates [7]. However, the majority of these research have focused on investigating the many different gravity feeding systems. Unfortuitously, no published research was able to be located that examined the feeding rates in relation to a variety of the health care provider's personal characteristics. In one of their earlier studies, the authors made an effort to address this issue by demonstrating a variation in the rate of gravity feeding that ranged from 32 times between different nurses to 17 times with the same nurse feeding at different times [6]. This study was one of the authors' earlier attempts to address this issue. According to the findings of this study, the variance in the rate of feeding that occurred among nurses was due to factors such as the individual abilities of the nurses, the dynamics of the nurse-baby pair, and the time of day or night.

If the process is automated, the gravity feeding rate will be slowed down, maintained, and consistent. All of these characteristics may be managed if the process is automated. By using this automated apparatus to provide the infants with food, the authors were able to demonstrate that human influences may be reduced to a significant level, which in turn reduced the amount of variance in the pace at which they were fed by gravity. This is accomplished without any change to the amount of time that must be spent feeding. All of this is accomplished despite the fact that the attentive nurse retains the ability to use her own judgment on the appropriate flow rate for that particular infant based on her prior interactions with that child. In other words, the human aspect that is important for nursing infants, also known as nursing cues, is still maintained intact, although automation considerably minimizes the undesired variance in the feed rate.

In addition to this, nurses were able to do much of the feeding process without needing to use their hands, which resulted in a more efficient use of their time for clinical observation and recording. The authors discovered an increase in the level of satisfaction felt by nurses as a result of improved nursing care on two factors. The first advantage was that they were able to observe the babies and complete documentation during the actual feeding event

The second advantage was that multiple babies were able to be fed at the same time, which eliminated the distress of seeing unfed babies crying out of hunger while one baby was fed. The nurses had a significantly decreased amount of physical labor to do as a result of the hands-free time during the feeding that was up to 80% of the time, which led to an improvement in the quality of nursing care. To confirm the safety of this device and make it suitable for general endorsement, a few additional trials with a comparable design are required at various levels of newborn care.

One of the drawbacks of the study was that there were not enough people in the sample to accurately evaluate the risks that were linked with the new intervention. When trying to solve this problem, having a big sample size could be helpful.

Conclusion

There is a significant amount of inter- and intrapersonal heterogeneity in the pace of feeding that occurs when infants are being fed by gravity. However, mechanized feeding through the use of a "feed rail" can result in continuous and consistent feeding at a rate of one to two milliliters per kilogram per minute. A single nurse can successfully breastfeed many infants at the same time. During feedings, there is sufficient time for nurses to do clinical observations and paperwork without needing to use their hands.

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