CARE FOR THE USE OF CROCHET OCTOPUS IN A NEONATAL INTENSIVE CARE UNIT: PROTOCOL PROPOSAL

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ABSTRACT: Crochet octopuses accommodated to newborns allow them to be more relaxed, helping to normalize cardiac and respiratory parameters, preventing them from pulling out devices and catheters, ensuring greater clinical stability and comfort for babies. This study aimed at evaluating the washing and disinfection process of the crochet octopus, in order to propose a hygiene and disinfection protocol to be used safely by the patient in the Neonatal Intensive Care Unit of a University Hospital. Samples of specific sizes were made, which went through a contamination process with two types of microorganisms with different characteristics (*Staphylococcus aureus* and *Candida albicans*). Following, three methods of hygiene and disinfection were applied. Afterwards, samples were cultured, sowing in a Petri dish containing specific culture medium for each microorganism. Thus, a comparison was made among the growth plates of the samples before and after going through the hygiene and disinfection processes. From the results it was possible to conclude that only the samples that went through the heavy washing process, showed zero growth, the other samples showed no difference in growth before and after the washes, thus the disinfection protocol that includes washing and sterilization is indicated, ensuring safety in the use of devices by patients admitted to the Neonatal Intensive Care Unit.

KEYWORDS: Child Development; Humanization of Assistance; Intensive Care Units; Protocol; Disinfection.

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CUIDADOS PARA O USO DO POLVO DE CROCHÊ EM UNIDADE DE TERAPIA INTENSIVA NEONATAL: PROPOSTA DE PROTOCOLO

RESUMO: Os polvos de crochê acomodados aos recém-nascidos permitem que eles fiquem mais tranquilos, ajudando a normalizar parâmetros cardíacos e respiratórios evitando que arranquem dispositivos e cateteres, garantindo assim maior estabilidade clínica e conforto aos bebês. Este estudo teve como objetivo avaliar o processo de lavagem e desinfecção do polvo de crochê, a fim de propor um protocolo de higienização e desinfecção para ser utilizado com segurança pelo paciente em Unidade de Terapia Intensiva Neonatal de um Hospital Universitário. Foram confeccionadas amostras de tamanhos específicos, as quais passaram por um processo de contaminação com dois caldos diferentes. Na sequência três métodos de higiene e desinfecção foram aplicados. Após a esses procedimentos foi realizada cultura das amostras, semeado em placa ágar para comparação com as placas de crescimento das amostras antes de passar por esses processos. A partir dos resultados foi possível concluir que apenas as amostras que passaram pelo processo de lavagem pesada, apresentaram crescimento zero, as demais amostras não apresentaram diferença no crescimento antes e após as lavagens, dessa forma está indicado o protocolo de desinfecção que inclui lavagem e esterilização, garantindo a segurança no uso dos dispositivos pelos pacientes internados na Unidade de Terapia Intensiva Neonatal.
PALAVRAS-CHAVE: Desenvolvimento infantil; Desinfecção; Humanização da Assistência; Protocolo; Unidades de Terapia Intensiva.

CUIDADOS PARA EL USO DEL PULPO A CROCHET EN UNA UNIDAD DE CUIDADOS INTENSIVOS NEONATAL: PROPUESTA DE PROTOCOLO

RESUMEN: Los pulpos de crochet acomodados a los recién nacidos les permiten permanecer más tranquilos, ayudando a normalizar los parámetros cardíacos y respiratorios, evitando que se saquen dispositivos y catéteres, asegurando así una mayor estabilidad clínica y comodidad a los bebés. Este estudio tuvo como objetivo evaluar el proceso de lavado y desinfección del pulpo crochet, con el fin de proponer un protocolo de higiene y desinfección para ser utilizado de forma segura por los pacientes de la Unidad de Cuidados Intensivos Neonatales de un Hospital Universitario. Se prepararon muestras de tamaños específicos, las cuales pasaron por un proceso de contaminación con dos caldos diferentes. Posteriormente se aplicaron tres métodos de higiene y desinfección. Después de estos procedimientos, las muestras se cultivaron y se sembraron en una placa de agar para compararlas con las placas de crecimiento de las muestras antes de pasar por estos procesos. De los resultados se pudo concluir que solo las muestras que pasaron por el proceso de lavado fuerte mostraron crecimiento cero, las demás muestras no mostraron diferencia de crecimiento antes y después del lavado, por lo que se indica el protocolo de desinfección que incluye lavado y esterilización, asegurando. la seguridad en el uso de dispositivos por parte de pacientes ingresados en la Unidad de Cuidados Intensivos Neonatales.
PALABRAS CLAVE: Desarrollo infantil; Desinfección; Humanización de la Asistencia; Protocolo; Unidades de cuidados intensivos.

1. INTRODUCTION

The first 28 days of life, neonatal period, are the most vulnerable moments for children's survival, as they face the greatest risk of dying in the first month of life, at an overall rate of 18 deaths per 1,000 live births (UNICEF, 2019).

The survival of these newborns has resulted in an increase in the length of hospital stay in the Neonatal Intensive Care Unit (NICU). The hospitalization environment promotes increased exposure to stressful factors, such as painful procedures, increased risk of infectious complications, impaired neurological development, visual and pulmonary morbidities, among others (Brasil, 2011).

In order to reduce the burden of mortality and morbidity for newborns hospitalized in the NICU, many units have implemented models of care to improve the quality of care, such as the Newborn Individualized Developmental Care and Assessment Program (NIDCAP) and the Kangaroo Method. The Kangaroo Method, as an assistance model, allows advancement in stimulating the presence and participation of the family in the care of newborns (NB), in establishing skin-to-skin contact, and in changing posture in care (Brasil, 2018).

Different technology and humanized care strategies transform the NICU into an environment that inspires perseverance for the maintenance of life. A humanization action was initiated in 2013 by a group of volunteers from Denmark Spruttegruppen who created the project The Danish Octo Project, with the proposal of making crochet octopuses, in order to provide comfort to family members and premature babies admitted to the NICU (Spruttegruppen, 2020)

The crocheted octopus is a toy that helps in the neurocognitive development of children, seen as a way for sensory, tactile and visual stimulation. It can provide comfort to the baby, improving the respiratory and cardiac systems, since the tentacles refer to the umbilical cord, which enable safety similar to intrauterine life (Moura; Lins; Soriano, 2018)

So far, there is little literature related to the benefits of crochet octopus in this context, in other words, that this playful resource improves the quality of care or allows clinical stability and comfort to newborns, preventing them from pulling out devices and catheters. However, it is extremely important to ensure that crocheted octopus is used safely, as hygiene becomes an essential part of the routine in the NICU, which, if properly

conducted, are essential in the prevention and control of infections related to health care (Bugs *et al*., 2017)

In view of the above, the objective of this study is to evaluate the washing and disinfection process of crochet octopuses in a controlled laboratory setting, with the aim of developing a standardized hospital protocol to be used as a humanization and safety strategy in neonatal intensive care units.

2. MATERIAL AND METHODS

This is an in vitro, exploratory and descriptive study. The octopus is made of 100% cotton, using specific manual skills, crochet technique, with the head filling in acrylic fiber, with eight tentacles measuring 22cm in size, in order to prevent entanglement and accidental asphyxiation. For the microbiological test, 30 samples were made with the same tissue used to make octopuses with the size of 0.5 cm x 3 cm in two different colors, identifying which microorganism would be inoculated, blue for inoculation of *Candida albicans* (CA) and green for inoculation of *Staphylococcus aureus* (SA). Before contamination, all samples underwent manual washing and sterilization.

2.1 Sample contamination process

Initially for the contamination process of the samples, the broth of the microorganisms SA and CA was prepared at a concentration of 1.5x108 CFU/ ml in sterile saline solution, on the MC FARLAND 0.5 scale. The inoculation process started inside the laminar flow chamber. Each sterile crochet sample was dipped in BHI broth and then placed with the help of a 1ml micropipette of the broth containing the SA and CA inside the Falcon tube with the crochet sample. This process was repeated 30 times until all samples passed through the inoculation, 15 contaminated with the SA broth and 15 with the CA broth, always following the protocol against contamination of the laboratory.

All Falcon tubes with the duly contaminated samples were taken to the sterilization oven in order to wait the 24 hours necessary to observe the SA growth and 48 hours for the CA growth.

After the time of growth of the microorganisms, sowing was carried out in Petri dishes containing the culture medium Agar BHI (Brain Heart Infusion), for samples contaminated with SA; and BDA Agar (Potato Dextrose Agar) for samples contaminated with CA. First, the crochet samples were washed in sterile saline under agitation for 40

seconds and after washing the samples were placed in Falcon tubes with 5 ml of saline solution. The Falcon tubes with the sample were homogenized on a Vortex shaker for 1 minute.

After shaking the tube containing the washed sample, it was proceeded to the dilution process before sowing in the Petri dish. This step proved to be necessary since in the pilot study the growth of SA and CA was very large, preventing the counting of colonies. The dilution was made on a 10-2 scale, placing 5 ml of sterile saline in new Falcon tubes, 1 microliter of the solution in this tube was discarded and 1 microliter of the solution in which the crochet sample was immersed was added, this process was carried out again for then the last tube derived from the second dilution, containing only 4.9 ml of saline solution +1 microliter of the solution of the microorganism broth, to be used to sow in the Petri dishes.

To sow in the Petri dishes, a 1 microliter micropipette was removed from the solution containing the diluted SA and CA and seeded with a sterile Swab on the plate using the streak technique according to the laboratory's internal criteria. Sowing was carried out in duplicate, therefore 60 plates in total, 30 sown with SA broth and 30 with CA broth.

Then, the ready and properly identified plates were sealed with masking tape, to prevent external contamination during growth, and taken to the sterilization oven. After 24h the plates sown with SA, and 48h the plates sown with CA, were removed from the sterilization oven and stored in the refrigerator until the colonies were counted. After the contamination of the samples was confirmed, the washing process was carried out.

2.2 Sample washing and disinfection process

In addition to the samples containing two different colors to identify the inoculated microorganism, prior to the contamination process they were demarcated in three subgroups (green, orange and white) indicating which washing process would be carried out, each group was composed of five samples. Thus, samples from the green subgroup CA (n=15) and SA (n=15) underwent manual washing, samples from the orange subgroup through machine washing and samples from the white subgroup through machine washing and sterilization.

The manual washing process was carried out with neutral liquid soap, strictly following all necessary precautions, in order to avoid possible contamination of the

samples with another type of microorganism. For the machine washing process, neutral liquid soap and a 15-minute machine wash cycle were used. The machine went through a disinfection process before being used to wash the samples, a complete washing cycle was carried out with only water and 1L of sodium hypochlorite. Only after this process the machine was ready to be used to wash the samples.

The samples were placed in a closed bag with a zipper, previously sterilized since they were very small, thus preventing them from being trapped or entangled inside the machine, being damaged. All samples underwent the natural rinsing and drying process (24 hours), as well as the entire washing process was carried out separately for samples contaminated with SA and CA, thus avoiding contamination between the two groups. After drying, the samples of the white subgroup were sent to the sterilization process.

Following the washing procedures, the crochet octopuses were sterilized using a hospital-grade autoclave through saturated steam under pressure. The standard moist heat sterilization cycle was applied, consisting of exposure to steam at 121 °C for 20 minutes, in accordance with widely accepted hospital protocols for textile materials. This method ensures effective microbial inactivation, including bacterial spores, and is considered the gold standard for sterilizing heat-resistant medical and hospital items.

2.3 Microorganism counting process after washing

Then all samples (n = 30) returned to the laboratory and were returned to BHI broth, stored in the oven at the appropriate temperature (36^0C) for 24h samples contaminated with SA, and for 48h samples contaminated with CA, time required for the growth of these microorganisms to occur.

After the time necessary for the growth of the microorganisms had elapsed, the samples that passed through the disinfection processes were sown. The same protocol and sowing were followed in the Petri dishes of Agar BDA for CA and Agar BHI for SA, used in the contamination phase. After sowing, all the plates were properly sealed with masking tape and taken to the greenhouse again for 24h and 48h, to check if there would be growth of SA and CA colonies.

Even with a 10-2 dilution of the sowing, it was not possible to count by quadrant in most plates, due to the large growth of colonies, already observed in a pilot study. Thus, the plaques were classified as countless, for those that showed growth, and as absent, for those that did not show growth.

3. RESULTS

3.1 Microbiological analysis: hygiene and disinfection process of crochet octopus

The results obtained after the entire contamination process carried out in the microbiology laboratory, following the protocol of biosafety and against contamination, showed that only the samples that went through the process of heavy washing, machine washing and sterilization, showed zero growth, and the others samples showed no difference in growth before and after washing (Table 1).

Table 1. Multiple Comparisons among groups. Statistically significant differences were found in the groups where sample sterilization was performed. Statistical analysis considering scores (presence or absence of microbial growth). Kruskal Wallis Test and Dunn post hoc test. SA: *Staphylococcus aureus;* CA: *Candida albicans*; MAN: Manual washing process; MAC: Machine washing process; MACS: Machine washing process + sterilization. *P* value: $\prec 0.01$ represents statistically significant differences.

Multiple comparisons	Microorganisms counting process (p value)
SA MAN x CA MAN	$\succ 0.01$
SA MAN x SA MAC	$\succ 0.01$
SA MAN x CA MAC	$\succ 0.01$
SA MAN x SA MACS	$\prec 0.01$
SA MAN x CA MACS	$\prec 0.01$
CA MAN x SA MAC	$\succ 0.01$
CA MAN x CA MAC	$\succ 0.01$
CA MAN x SA MACS	$\prec 0.01$
CA MAN x CA MACS	$\prec 0.01$
SA MAC x CA MAC	$\succ 0.01$
SA MAC x SA MACS	$\prec 0.01$
SA MAC x CA MACS	$\prec 0.01$
CA MAC x SA MACS	$\prec 0.01$
CA MAC x CA MACS	$\prec 0.01$
SA MACE x CA MACS	$\succ 0.01$

3.2 Standard operating protocol (SOP) on the hygiene and the disinfection of crochet octopus in NICU Patients

The in vitro study contributed to the development of a protocol for hygienic care and disinfection of crochet octopus for the NICU, with the aim of: a) improving knowledge of the safe use of the octopus; b) standardizing the maintenance of hygiene and disinfection; c) preventing and reducing complications due to poor hygiene; d)

promoting a humanization and security strategy; e) promoting comfort to the NB, in view of the stimulating sources of the environment (sounds and noises) and reducing the impact of maternal withdrawal; f) a complementary method for the patient's quality of life (Table 1).

Table 2. Description of the Standard Operating Protocol (SOP) for Hygiene and Disinfection of the use of crochet octopus in NICU Patients

	Description
Objective	This procedure aims at standardizing the hygiene and disinfection of the crochet octopus, for the use of the device in order to calm and provide comfort to patients admitted to the NICU. The octopus is made as a single piece, colored, in 100% cotton, through specific manual skills, crochet technique, with the filling of the head in acrylic fiber, with eight tentacles of 22cm dimension, in order to prevent entanglement and accidental choking. Do not use the crochet octopus during phototherapy and extreme premature newborn (below 1000g) that is in an incubator with humidification.
Sectors Involved	Neonatal Intensive Care Unit Hospital Infection Control Center Center for Safety and Quality of Hospital Care
Procedure	The newborn receives two octopuses at the time of admission, being changed every 72 hours after use, or earlier depending on the dirt present. The Octopus is for the exclusive RN's use. The mother must be delivered weekly (Friday) for cleaning (first stage) at home and returned to the hospital on Sunday to forward for sterilization (second stage). - Octopus usage guidelines. - Signature of the octopus use authorization term. - Delivery of the sterilized octopus to the RN. - Deliver an octopus for the washing process to the person in charge. - Recommendations for the octopus washing process delivered in writing. - Octopus receiving after washing. - Place in packaging. - Identify this package with the RN's name and medical record number. **First stage:** Performed by the responsible of the RN, who are instructed to wash in a washing machine, with neutral soap and drying in room air. After that, it must be returned to the hospital within the specified period to continue the disinfection. **Second stage:** Performed at the hospital's sterilization center for the 121oC sterilization process. At the time of use, handling must be carried out before contact with the NB, in order to verify the integrity and quality if they remain unchanged and without risks to the NB.

Recommendations	**General care with the use of crochet octopus:** - The octopus is for the exclusive RN's use. - The newborn receives two octopuses at the time of admission, being changed every 72 hours after use, or earlier depending on the visible dirt present. - Follow the hand hygiene and NICU protocols. - Observe the integrity of the octopus before placing it in the heated incubator or crib; avoiding contact with contaminated materials in the sector or that have traces of biological material (secretions, blood and its components, tissues or fluids, among others). - Accommodate octopus next to the newborn, observing the positions and providing warmth. - Carry out the hygiene of the newborn, remove octopus and place it on the bench previously sanitized under a clean towel or leave it inside the incubator, in the head area, an area with less risk of contamination. - Send the octopus for purge (in a plastic bag and identified with the child's name and medical record) in the presence of dirt, in a container with a lid for exclusive use to store it.

4. DISCUSSION

The hygiene and disinfection of the crochet octopus are primarily justified by the need to prevent healthcare-associated infections (HAIs) and sepsis in neonatal intensive care settings, aiming to ensure correct and effective asepsis of objects used within the hospital environment (Lima *et al*., 2016). According to Moura and collaborators (2018), hygiene care involving frequent washing, combined with the guidance to avoid unnecessary handling of the crochet octopus by the healthcare team, significantly reduces the risk of device colonization.

These measures are necessary to contain the most common etiologic agents of neonatal infection: Staphylococcus coagulase negative, followed by Gram-negative (Escherichia coli and Klebsiella spp.) and fungi, such as Candida spp. (Pinheiro *et al*., 2009).

In view of the results of this study, we can describe that the first stage of the hygiene protocol can be performed by the responsible of the NB, who on a specific day of the week take it to the washing, preferably in a washing machine, with neutral soap and drying in room air. Afterwards, the patient must return to the hospital within the specified period to continue the disinfection. In this second stage, the octopus is sent to the sterilization process at 121^0C at the hospital level.

In the protocol, the newborn receives two octopuses at the time of admission, being changed every 72 hours after use, or earlier depending on the dirt present. It is worth noting that the octopus is made as a single piece, containing no moorings, which guarantees the safety of the device in not loosening smaller parts. At the time of use, handling must be carried out before contact with the NB, in order to check the integrity and quality, observing whether they remain unchanged and without risks to the NB.

The study shows us the type of washing and the need for sterilization, thereby providing subsidies for the elaboration of a standard hospital protocol to guarantee the quality of the use of crochet octopus. According to Werneck and collaborators (2009), the protocol is defined as a routine of care and the result of the actions of a given service, elaborated based on current scientific knowledge, supported by scientific evidence, by professionals in an area and that serves to guide flows, conduct and clinical protocols of workers working in health services. As for its nature, the protocol can be clinical or service organization. In this case, the study resulted in the elaboration of a clinical protocol as a normative instrument directed to preventive actions in order to standardize the hygiene and disinfection of the crochet octopus.

The structured Standard operating protocol (SOP) addresses the technology that will be employed and whether it allows the problem to be tackled properly; the purpose of adopting the SOP; what skills professionals need to have to perform it; and what resources the unit needs to implement it. In this case, the structured SOP has hard technology, related to technological equipment, standards, routines and organizational structures (Silva; Alvim; Figueiredo, 2008). And it fits the classification through the applicability of a protocol linked to the service's routines and depends on technological equipment, since the Sterilization Materials Center participates in the sterilization process.

It is worth noting that in order to implement a standard procedure standardization protocol, it must be discussed with the multidisciplinary team and approved by the competent bodies of the hospital.

In addition to infection prevention care, neonatal units seek measures to reduce the impact of maternal withdrawal, in order to ensure a better bond among mother, baby, motor, affective and cognitive development. It appears that the newborns's stay in the NICU exposes them to stress and pain due to complex therapies. Thus, whenever possible, promote the bond between mother and baby in this period of hospitalization, making it as

humanized as possible (Moura; Lins; Soriano, 2018; Naidon, 2018; Rocha; Chow-Castillo, 2020).

Humanized care should not be just a concept, but a practice based on human valorization and its uniqueness. Thus, the health professional during the care of the NB must consider the human issues involved in the whole context, as these are inherent to the care routine (Noda *et al*., 2018)

Humanized alternatives, such as playful, non-pharmacological techniques, which minimize the stress generated by hospitalization and maternal separation, and early stimulation has become a differential in care in neonatal intensive care units, as the first years of life are considered critical for the development of motor, cognitive and sensory skills, in which the process of maturation of the central nervous system occurs, being the crucial phase for neuronal plasticity (Brasil, 2016)

The crochet octopus can be understood as a complementary practice, not therapeutic, with the function of calming and promoting comfort to the baby (Brasil, 2017). According to Moura *et al*. (2018) it is a simple strategy, with an established care protocol, the small crochet octopus allows the babies to begin their process of self-knowledge, to have contact with the external reality and, based on bonded relationships they can interact with the world. There are reports by the Poole Hospital that the octopus aims at calming and promoting comfort in premature newborns, where it highlights that the tentacles of the octopus apparently resemble their mothers' umbilical cord. The octopus seems to calm down, normalizing parameters such as heart and respiratory rate, preventing sensors and catheters from being pulled out (NHS, 2017).

According to Siqueira *et al*. (2019) the news mostly highlighted the benefits of using crochet octopus by newborns admitted to the NICU, but there is no mention of scientific studies that prove the instrument's effectiveness. The Ministry of Health does not recommend the use of octopus as a therapeutic technique (Brasil, 2017).

It is essential to remember that the crochet octopus does not replace the Kangaroo Method, neither breastfeeding nor the presence of parents in the NICU, but it can be a playful method, complementary in measures to protect against stress from pain and early stimulation.

Given that this study was conducted in a controlled laboratory setting, the applicability of the proposed protocol to routine hospital practice has yet to be determined. Accordingly, further research is warranted to validate the protocol under real-

world clinical conditions, to establish its effectiveness, feasibility, and safety within neonatal intensive care environments.

5. CONCLUSION

This study concludes that the most effective and safest protocol for ensuring the proper use of the crochet octopus device in neonatal intensive care units involves a combination of machine washing and sterilization, along with guidance aimed at minimizing unnecessary handling of the octopus device. Likewise, developing and standardizing a clinical protocol is essential to improve care practices and prevent healthcare-associated infections. Although these findings are promising, the study was carried out in a controlled laboratory environment, which may not fully reflect the complexities of routine hospital settings. Therefore, additional studies conducted in real-world clinical contexts are necessary to confirm the protocol's practicality, effectiveness, and safety in neonatal intensive care units.

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