Chapter 85

Use of scenographic simulation to perform magnetic resonance imaging to reduce the indication of anesthesia in children

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ABSTRACT
Introduction: Health professionals who are specialists in performing MRI exams, note that there is a need for greater preparation of the team when the exam is performed with pediatric patients. Being observed in the patients of this age group greater anxiety, fear, curiosity and lack of understanding in the instructions necessary to perform the exam. The use of a simulator in the pre-examination can help the patient understand what will be done during the MRI examination and consequently, the use of sedation is not necessary in these patients. Objective: To analyze, from the perspective of nursing, the effectiveness of using scenographic simulation in magnetic resonance imaging exams to reduce the need for anesthesia in children, in order to expand its use in public hospitals in the Federal District. Materials and methods: A cross-sectional, retrospective, descriptive and observational study was carried out. With data collection directly from the medical records of selected research participants. The medical records of patients aged between 5 and 10 years old, who underwent the magnetic resonance exam from January 1, 2008 to December 30, 2019, were included. Results: 4,252 patients who met the inclusion criteria were included, of these, 53.3% were male and 46.7% female. The average age of the patients was 7.12 years and the fashion was 9 years (5-9 years). There was no need to use anesthesia in 97.4% of patients, it was used in 2.3% and there was no information in the medical records of 0.3% of patients. Conclusion: The use of the simulator - "scenographic resonance", in the desensitization of children to perform magnetic resonance imaging, proved to be an effective technique to perform this exam. Through this technique, with the proper training of nurses, it was possible to demonstrate the high success rate and the reduction of risks inherent to the anesthetic procedure, as well as the reduction of expenses related to this procedure.

Keywords: Simulation, Scenographic, Magnetic Resonance, Sedation, Pediatrics.

1 INTRODUCTION

The first successful experiment of Núclear Magnetic Resonance (NMR) was carried out in 1946 by two American scientists, Felix Bloch and Edward Purcell. It is a noninvasive imaging diagnostic method, which does not emit ionizing radiation, presenting good spatial and contrast resolution in the evaluation of organs, besides allowing a panoramic view with the possibility of multiplanar and three-dimensional reconstructions. In the 1970s, imaging began in medicine, gaining importance in medical practice only in the 1980s. (BLOCH & HANSEN, 1965) (NASCIMENTO, 2018) (PODGAEC , 2014)

For this reason, NMR scans are excellent instruments that allow the visualization of body structures that require a conclusive clinical diagnosis, however, the performance of these tests has a high cost. To perform the examination, the patient must remain lying, completely immobile, for a period of 15 to 120 minutes, in which a magnetic field can have a high-definition view of the patient's internal organs. The performance of the examination can bring some discomforts such as having to stay a long still period, the high noises that magnetic resonance apparatus emits and the possibility of claustrophobia due to the place of examination of the device being tight . (PODGAEC , 2014) (MAPP , MORAN , & SWAN , 2009)

Health professionals specialising in performing MRI scans note that there is a need for greater team preparation when the examination is performed with pediatric patients. Being observed in patients in this age group greater anxiety, fear, curiosity and lack of understanding in the instructions necessary to perform the test (MARSHALL, SMITH and WEINBERGER, 1995; TYC, FAIRCLOUGH, *et al.* , 1995). It is observed in the literature that moderate to severe anxiety may occur two to three children during nMR examination, this due to the space of the apparatus, difficulty in remaining immobile in the magnet, intravenous injection, fear of the unknown and the noises that the device emits (MARSHALL, SMITH and WEINBERGER , 1995; TYC, FAIRCLOUGH, *et al.* , 1995). This anxiety crisis may cause in the patient, in the short term, stressful effects to clinical procedures to be performed after nMR examination, increased pain, crying crisis and lack of cooperation. In the immediate term, posttraumatic stress syndrome, fear, changes in pain perception and the effectiveness of coping with the disease and resistance to clinical procedures may occur. The harmful effects on performing NMR tests on pediatric patients may lead their caregivers to have increased anxiety, heart rate and blood pressure. (ALEXANDER , 2012)

(Bartels , Althoff, & Boomsma, 2009)

Sedation is often used to improve the adhering of pediatric patients to NMR, however, this procedure can produce side effects such as interference in cognitive function and altered brain physiology (GREENBERG, FAERBER, *et al.* , 1993; GREENBERG, FAERBER, *et al.* , 1994). Risks associated with sedation and general anesthesia include: oversedation; depression of protective reflexes, predisposing to pulmonary aspiration; depression, resulting in hypoxemia, myocardial ischemia, and arrhythmia; depression of the cardiovascular system; drug interactions; potential for overdose; individual variations in drug response, particularly in children, risks related to inadequate skills or experience of the person administering sedation, including drug errors, inadequate assessment, inadequate monitoring or premature discharge, and development of atelectasis during mechanical ventilation (HUNG, CHOW, *et al.* , 2002; LUTTERBEY, WATTJES, *et al.* , 2007). According to the literature (HUNG , CHOW, *et al.* , 2002; LUTTERBEY, WATTJES, *et al.* , 2007; BARTELS , ALTHOFF and BOOMSMA, 2009), there is an association between early exposure to anesthesia and learning difficulties or behavioral disorders. It is recommended, whenever possible, that imaging tests be performed without the use of sedation. (Bartels , Althoff, & Boomsma, 2009)

As an alternative to anesthesia, several preparatory strategies have been proposed to increase the proportion of successful magnetic resonance imaging (CLAAR, WALKER and BARNARD, 2002; CEJDA, SMELTZER, *et al.* , 2012). Previous studies have reported success rates of MRI scans in different clinical populations of young children, using scanning during natural sleep, a toy MRI model or a commercial simulation scanner (DE-BIE, BOERSMA, *et al.* , 2010; CARTER , GREER, *et al.* , 2010). However, there are no reports of the success rates of unseed MRI scans in a large sample of young children,

after a comprehensive, simple and inexpensive behavioral preparation and training program (HARNED and STRAIN, 2001; BARNEA-GORALY , WEINZIMER, *et al.* , 2014).

The Sarah Network Hospitals act in the rehabilitation of patients, pediatricand adult, orthopedic and with sequelae of brain and/or spinal cord injury, where the evaluation of neuromuscular, tumor and specific structures of the nervous system, by the magnetic resonance method becomes indispensable.

Thus, the main objective of this study is to analyze, from the nursing view, the effectiveness of the use of scenographic simulation in magnetic resonance imaging as a reduction of the need for anesthesia in children, in order to expand its use in public hospitals in the Federal District.

2 MATERIAL AND METHODS

A cross-sectional, retrospective, descriptive and observational study was conducted. With data collection directly from the medical records of the selected research participants. The medical records of patients aged 5 to 10 years who underwent magnetic resonance imaging were included from January 1, 2008 to December 30, 2019. Participants with cognitive impairment or who are not able to participate in the scenographic simulation were excluded.

Data collection was performed by the researcher based on a survey of the children's medical records, in which data were recorded on each patient attended and who had the indication of the magnetic resonance imaging. Once these patients were identified, the following data were collected: age, gender, medical diagnosis, affected region on examination, need for anesthesia, pre- and post-examination complications, time of hospitalization, clinical evolution of the patient and whether there was training in a scenographic simulator as preparation for the examination. In addition to knowing the epidemiological profile, the number of patients who performed previous desensitization with the scenographic simulation was performed, and whether these patients completed the examination with quality images for the reports. In addition, the number of children who needed anesthesia and the reason that led to this procedure were also analyzed. After data collection, a comparison was made with respect to whether or not desensitization was performed using scenographic simulation, and whether there was a decrease in the number of anesthesia indications.

Hospital Sarah created a simulator ("scenographic resonance") devoid of magnet, which replicates the environment of magnetic resonance imaging, even preserving the noises produced by radio frequency and maintaining equipment that mimics the coils used for the examination itself. The "scenographic resonance", as it was called, has been used, in a playful way, for training with children as desensitization prior to the examination. Sarah Hospital is the only one in the Federal District who does this kind of examination. The children are directed and monitored by the nursing of the Imaging Diagnosis Service of Sarah Hospital.

The procedure is performed by nursing when patients are outpatients and by psychologists in the program when patients are hospitalized. In the previous consultation, the professional establishes a

relationship of empathy with the child, objectively and briefly evaluates the children's behavior, interests and fears, also obtaining information directly from the guardian. To do so, a team with preparation is required to perform this assignment. Subsequently, nursing diagnoses are identified and care plans defined. After the definition of the care plans, the children are sent to the scenographic simulator, where they will have the first contact with the equipment, its forms and noises, in order to be in touch with the situation and have their anxiety and their fears attenuated. The way the examination will be conducted is explained to the children, emphasizing the need for them to remain immobile during the procedure, so that they have good quality images. Thus, then, the children are referred to the actual device for the examination to be performed. All information and stages of examination and/or training in the scenographic simulator are inserted in the patients' electronic medical records, from which the data for the research will be collected.

3 FINDINGS

We included 4,252 patients who met the inclusion criteria, of which 53.3% were male and 46.7% female. The mean age of the patients was 7.12 years and the fashion was 9 years (5-9 years). There was no need for anesthesia in 97.4% of patients, it was used in 2.3% and there was no information in the medical records of 0.3% of patients.

Figure 1: Year of MRI by patients.

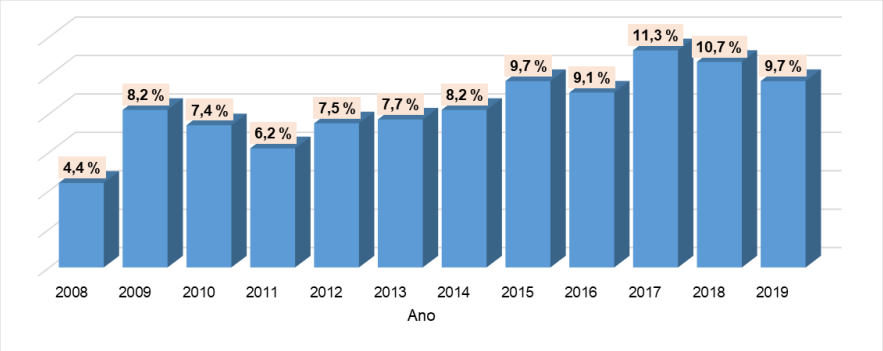


Figure 2: Sex of patients

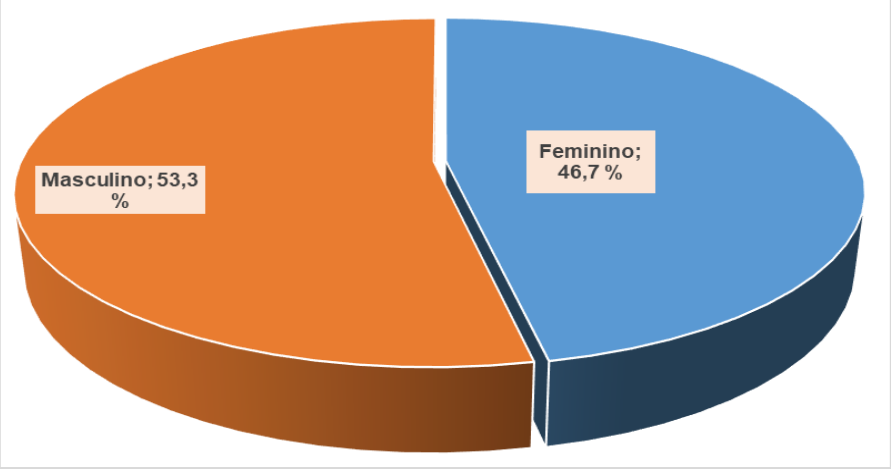


Figure 3: Patients' age

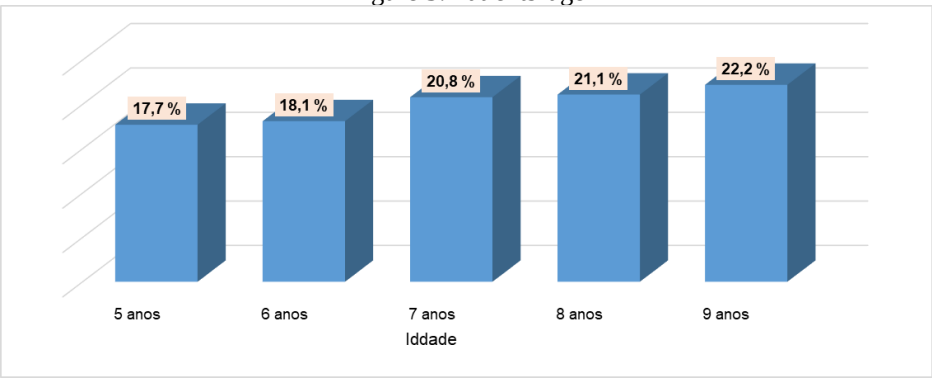
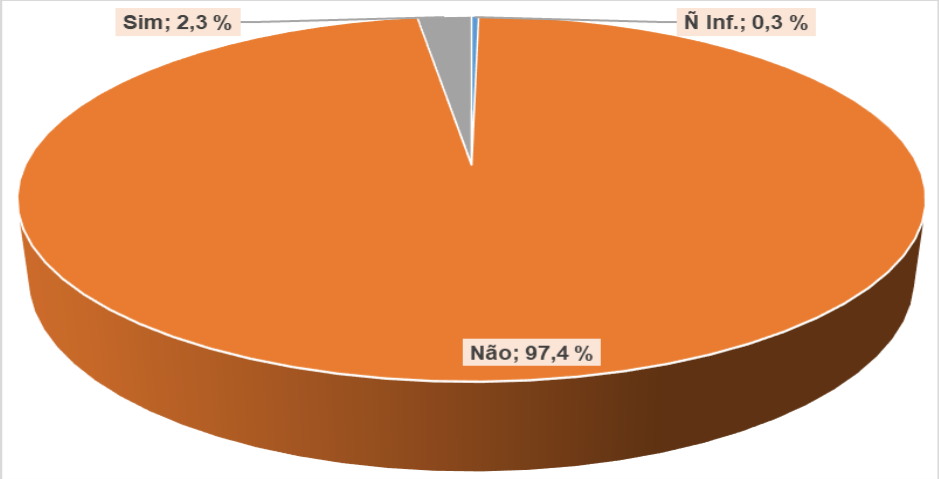


Figure 4: Use of anesthesia by patients who underwent MRI



In the correlation of anesthesia use with other variables, it was possible to observe that in 2011, 100% of patients did not need anesthesia. It was also possible to observe that from 2014 on, there was an average annual increase of 0.58% in anesthesia use for MRI in pediatric patients. Male patients had 0.3 percentile lower than female patients. Patients between eight (98.3%) and nine (98.7%) years. However, patients aged five (95.9%) and six (96.7%) years.

Figure 5: Correlation of year of MRI X examination using anesthesia

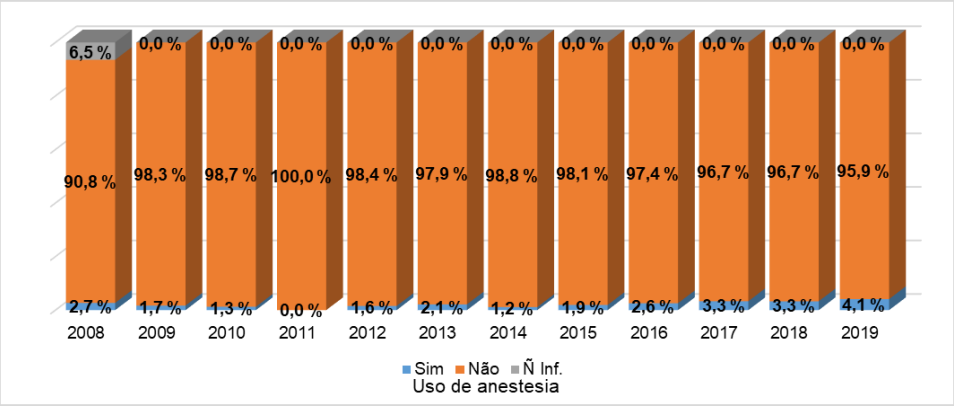


Figure 6: Sex X use of anesthesia

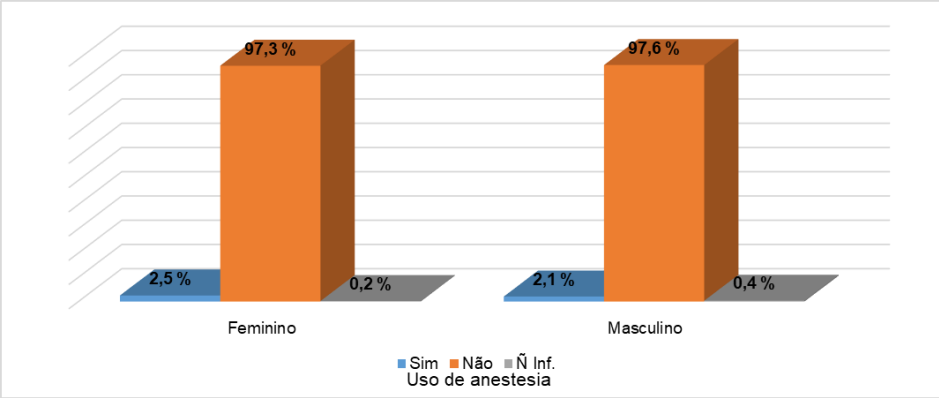
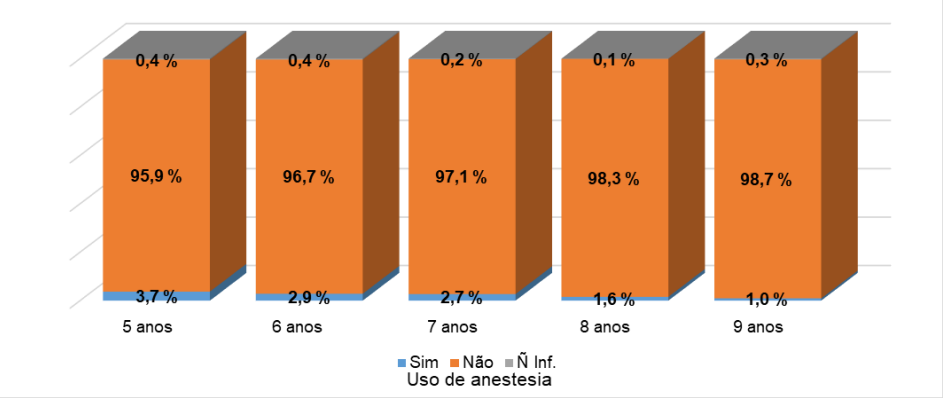


Figure 7: Age X use of anesthesia



4 DISCUSSION

During the eleven years (2008 to 2019), after implementation of the scenographic simulation system for magnetic resonance imaging, in order to reduce the indication of sedation in children during the MRI examination. It was possible to observe that there was a significant reduction in the use of sedation during the examination, 97.4% of the patients did not have the need to use sedation after undergoing scenographic simulation. In a study conducted by HARNED, R.; STRAIN, J. 2000, in order to evaluate virtual reality glasses with MRI scan simulation system, the authors observed that without simulation it was necessary to use sedation in 53% of patients, after the simulation was 40%, with a reduction of 13%. However, VR eyewear technology in 2000 was not as good quality as the current ones. In a study conducted more recently by FARIAS, C. et al. 2019. With the VR glasses for simulation, there was a reduction in claustrophobic anxiety disorder in the performance of MRI.

There was no significant difference between the sexes (97.3%-female; 97.6%-male) in relation to the reduction in sedation use after simulation.

Between ages, it was possible to observe that younger patients between five years (95.9%) and six years (96.7%) had lower acceptance of scenographic simulation. It is less acceptance is related to the difficulty of this age to understand, less ludditeally, the procedure that will be performed during the MRI examination. The fear of being alone inside the device may also be related to less acceptance of the simulator.

5 CONCLUSION

The use of the simulator - "cenografica resonance", in the desensitization of children for magnetic resonance imaging, proved to be an effective technique for performing this test. Through this technique, with the proper training of nurses, it was possible to demonstrate the high success rate and reductions in the risks inherent to the anesthetic procedure, as well as a reduction in expenses related to this procedure.

We indicate further studies evaluating the application of the MRI scenographic resonance simulator system with the reduction of adverse events caused by sedation and cost reduction for the institution because there is no need to perform this procedure.

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