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Non-pharmacological methods of perioperative anxiety assessment among pediatric population- a review

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ABSTRACT

Fear is, next to the pain, one of the most challenging factors in the pediatric population. It affects nearly 70% of the hospitalized children. Pharmacological assessment is considered effective and safe, but it has its limitations. This review aims to find and categorize the non-pharmacological methods of fear management based on scientific reports. Among these techniques were: parental presence during induction of anaesthesia, psychological techniques (eg. music therapy), educational approach, introduction of new technologies, breathing techniques and aromatherapy. All these strategies combined are beneficial for the entire pediatric population. Nevertheless, its introduction should be personalized according to patients' age. Furthermore, these techniques should be regarded as complementary to the pharmacological treatment, not as the complete alternative. Finally, some of these methods require increased spending in healthcare and they lack definitive outcomes in the pediatric population or in the perioperative period. Because of that, more studies need to be performed for better personalization of anxiety treatment.

Key Words: Anxiety, Children, Psychology, Perioperative

1. INTRODUCTION

Fear is, next to pain, is one of the most challenging factors in the population of paediatric patients. According to research, nearly 70% of hospitalized children experience anxiety (Liang et al., 2021). Additionally, preoperative fear is responsible for a significant rise in public spending, especially in the increased consumption of opioids (Harris et al., 2020). Therefore, there has been a growing interest in the management of preoperative anxiety recently. The methods can be divided into two main categories: the pharmacological and non-pharmacological ones. Pharmacological interventions include a vast spectre of agents, such as benzodiazepines, α_2 -agonists, NMDA-antagonists, and opioids (Heikal and Stuart, 2020). Usage of benzodiazepines, midazolam above all, is considered safe and effective in the pediatric population (Xiong et al., 2024). Usage of α_2 -agonists, like dexmedetomidine or clonidine, resulted in the better recovery profile after

operation in comparison with benzodiazepines (Bromfalk et al., 2023). Nevertheless, it did not affect the period of recovery. What is more crucial, dexmedetomidine is known for its hypotensive effect which may be worrisome during performing surgery (Cruz et al., 2023). Ketamine, being an NMDA antagonist, was also reported as a successful anxiolytic (Jeong et al., 2012). Unfortunately, it lacks big randomized clinical trials and it is associated with haemodynamic changes (Bruton et al., 2024).

Fentanyl and opioids, besides pain relief, also reduced emergence agitation (Shi et al., 2015). Usage of opioids is associated with negative outcomes such as increased postoperative consumption of them or long-term effects on neurological development (Xu et al., 2019). Due to these factors and the overall trend to reduce the periprocedural usage of drugs, non-pharmacological methods are more widely explored in anaesthesia. In this report, we present the most popular methods of non-pharmacological anxiety assessment.

2. METHODOLOGY

This narrative review was based on a PubMed search using Medical Subject Headings and keywords: anxiety treatment, anxiety management, perioperative, children. The search included articles published between January 2003 and March 2025, written in English. Applicable articles were included based on the scope of the review and critical assessment by two co-authors. The final full-text was reviewed and edited by all co-authors.

3. RESULTS AND DISCUSSION

Intervention types

After examining the research on non-pharmacological methods for anxiety assessment, we summarize them, as shown in Table 1. The most well-documented interventions are 6 categories: parental presence during induction of anaesthesia, psychological techniques, education, usage of new technologies, breathing and relaxation techniques, and aromatherapy. It is essential to point out that these techniques tend to intertwine with each other in some publications. In such cases, we will mention them in the respective sections.

Table 1: Management of anxiety among pediatric population

Pharmacology	Non-Pharmacology
a2-agonists	Parental presence during induction of anaesthesia
Benzodiazepines	Psychological techniques (eg. CBT therapy, music therapy, hypnosis)
NMDA-antagonists	Education
Opioids	Usage of new technologies (eg. virtual reality)
	Breathing and relaxation techniques
	Aromatherapy

Parental presence during induction of anaesthesia

The presence of at least one parent is the most common type of non-pharmacological assessment of anxiety. According to previous studies, the passive participation of parents during anaesthesia induction significantly reduced children’s anxiety. However, it does not contribute to the reduction of parental anxiety (Sadeghi et al., 2017). Additionally, the effect is mostly described among younger paediatric patients (Akinci et al., 2008). Furthermore, it is even highly likely that the presence of parents may contribute to a higher level of anxiety (Watson and Visram, 2003). Another disadvantage of parental attendance is safety measures, which may be troublesome for inexperienced anaesthetic staff (Andersson and Österberg, 2024). This is because active participation by parents is considered a better alternative than just a passive one (Ismail and Mahrous, 2022).

Psychological techniques

Another possible management of anxiety is the vast scope of methods used by psychologists. One of the most promising outcomes is usage of the elements of cognitive behavioural therapy (CBT) according to patient age. As one of the studies proved, CBT therapy was as effective in reducing the severity of anxiety as sertraline (Walkup et al., 2008). Additionally, even critically ill children with stage III cancer were benefactors of the introduction of CBT therapy, also in the longer perspective of time (Zhang et al., 2019). CBT therapy may

also be combined with other methods of fear assessment. Rajeswari et al., (2019) study shows that combination of CBT elements and methods of audiovisual distraction has successful results in the reduction of anxiety, both objectively and subjectively.

The next promising technique is music therapy. It is a well-documented fact that listening to music contributes to the reduction of the level of fear to mild or moderate (Mohanasundari et al., 2020; Kain et al., 2004). The method is also beneficial for parents and guardians of children (Millett, 2015). It is speculated that music therapy may also help in reduction of postoperative pain, as study by Calcaterra et al., (2014) proved. However, the biggest disadvantage of music therapy is scarce data examining usage of anxiolytic drugs after its conducting (Giordano et al., 2020). Furthermore, to our knowledge, most research related to music therapy was conducted before operation and not during surgery. Therefore, it is difficult to estimate the value of music therapy in the operating theatre is challenging to estimate.

Moreover, hypnosis is a successful treatment for perioperative anxiety. Usage of “Magic Glove” hypnosis technique resulted in both reduction of anxiety and pain during the entire operational period (Kuttner, 2012). The next method of hypnosis with successful results is hypnosis audio intervention, which reduces perioperative anxiety among patients undergoing tonsillectomy and adenoidectomy (Schmidt et al., 2025). Another research shows that usage of hypnosis in superficial surgery resulted in lower anxiety levels compared with general anaesthesia (Sola et al., 2023).

Education

Another strategy concerning reduction of anxiety is an educational approach. Screening educational videos, even short ones, decreased postoperative pain and patients’ anxiety reduction (Baghele et al., 2019) and their parents (Härter et al., 2021). However, the researches indicated that appropriate timing and information should be provided according to the age and mental development of the target audience (Gamze et al., 2024; Hou et al., 2023). Educational proposals include the creation of educational centres in hospitals that can reduce the fear of both patients and their parents. The preparation of operations includes comic booklets, videos, and colouring game books. However, this preparation method has some limitations. Children need to be able to read and write, and the set of multimedia should be personalized to the specific medical centre (Bumin et al., 2021). To address this problem, readings may be performed by a parent, which also reduces patients’ fear level,

Usage of new technologies

The development of new technologies has found its way in treatment of anxiety. Most of the reports are focused mostly on usage of some forms of virtual reality (VR). Virtual touring before operation has shown promising results in anxiety reduction (Karaarslan and Ergin, 2024). As concluded in Ryu et al., (2022) study, the most appropriate time to use VR was immediately before performing anaesthesia. Besides virtual touring, there are also reports claiming that lipophilic virtual reality (ie. virtual reality enhanced with the elements of nature) reduces anxiety more effectively than the typical VR (Luo et al., 2023). Contrary to inner assumptions, implementation of VR was not statistically more expensive in comparison with ordinary methods. Surprisingly, in a longer period of time, VR was even responsible for the reduction of spending, which was demonstrated in a study on the usage of VR in pain assessment (Delshad et al., 2018).

Another possible alternative is the introduction of interactive robots, which not only decreases anxiety but also increases postoperative mobilization and satisfaction in the paediatric population (Topçu et al., 2023). Regarding anxiety in large and new technologies, the massive development of machine learning may be helpful in identification and personalization of the treatment (Liu et al., 2025). However, at this point there is no research regarding usage of artificial intelligence in the management of perioperative anxiety among children.

Breathing and relaxation techniques

Another possible way of managing anxiety is the introduction of breathing exercises. The easiest type of breathing technique is deep breath which gives promising results (Khng, 2017). However, these techniques must be adjusted to the psychological stages of children. Due to this fact, breathing techniques are sometimes performed as play therapy. There are reports regarding usage of pinwheel as an element of breathing exercises. The outcome has shown that the levels of both anxiety and pain were lower in children using pinwheels than in those using the standard breathing diaphragm technique (Bargale et al., 2021). Bubble blowers as a tool for breath exercises were praised as well (Bahrololoomi et al., 2022). However, the duration of breath exercise is crucial to the outcome. A controlled trial

showed that short-time breathing exercises are ineffective and speculated that a longer period of deep breath is needed to achieve positive outcomes (Hu et al., 2025).

The elements of meditation are also connected to breathing techniques. It is well reported that elements of meditation are beneficial to management with preoperative anxiety in the adult population. The introduction of yoga training has been found promising in reduction of stress among patients preparing for coronary bypass surgery (Kiran et al., 2017). Usage of monotone meditation was proven to be a successful technique in reduction of severity of anxiety related to injections (Sugimoto et al., 2021). Mindfulness meditation, which decreases sympathetic nervous system activity and increases parasympathetic tone, is also beneficial in reduction of the stress before performing surgeries. (Turer et al., 2023). In the paediatric population, the advantages of meditation have also been documented. Crescentini's longitudinal study has shown that the overall children's abilities were improved after an introduction of mindfulness meditation (Crescentini et al., 2016). Additionally, among primary school children, mind subtraction meditation resulted in an effective reduction of stress and anxiety (Yoo et al., 2016). Yoga performance also resulted in statistical significance lowering of anxiety among adolescents' females (Parajuli, 2022). Unfortunately, there has not been conducted any clinical trial concerning introduction of element of the meditation in management of preoperative anxiety. Another concern is that data regarding some meditation techniques, such as mindfulness, is scarce and does not give definitive answers regarding reduction of anxiety and stress among adolescents and children (Ruiz-Íñiguez et al., 2020).

Aromatherapy

Aromatherapy is a very successful and inexpensive method of anxiety treatment. As reported, the usage of essential oils over a span of over 8 months resulted in the effective reduction of the overall discomfort (Czarnecki et al., 2022). When it comes to the specific species, the lavender oil gave positive results in reduction of fear among children (Arslan, 2020). The same results were reported for sweet orange as a fragrant oil (Nirmala and Kamatham, 2021). However, this method does not seem to be beneficial for neurodivergent patients, as it has been proven to be ineffective (Hawkins et al., 2019). Another drawback of these studies is the fact that they were mostly conducted in dental assessments, not during general surgeries.

Treatment of anxiety in the pediatric population is a challenging and complicated topic. It requires a vast scope of strategies and it does not end with pharmacotherapy. As it was shown, there is a plentitude of non-pharmacological methods of managing fear among children. Unfortunately, some strategies are very poorly documented in the pediatric population or they have not been verified in the perioperative anxiety. What is crucial, these methods should not be treated as a counter-method to usage of fear-relieving medications but as complementary ones. Furthermore, not all the methods are suitable, effective and performable to the entire pediatric population. Because of that, every strategy of fear assessment should be personalized and applied. Additionally, some techniques require longer preparation, so they cannot be performed in the emergency situation or in the hospitals with underdeveloped premedication centres. Lastly, introduction of some techniques require higher or lower additional financial spendings. Because of that some medical centres may not be keen to implement them.

4. CONCLUSIONS

Non-pharmacological methods of anxiety treatment are very promising techniques in the pediatric population. They may be a good supplement for pharmacological management. Nevertheless, the studies regarding this topic lack standardization and personalization according to patients' age. Because of that, more research needs to be conducted in order to better understand and examine the complexity of this topic.

Author's Contributions

Methodology: Jakub Klamecki;

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Conflict of interest

The authors declare that there is no conflict of interest.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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