



ORIGINAL ARTICLE

Aromatherapy massage seems effective in critically ill children: an observational before-after study

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Abstract

Children treated in a pediatric intensive care unit (PICU) are at risk of distress and pain. This study investigated if aromatherapy massage can reduce children's distress and improve comfort. This observational before-after study was performed in a 22-bed PICU in Cape Town, South Africa. The aromatherapy massage consisted of soft massaging using the "M-technique" and a 1% blend of essential oils of Lavender (*Lavandula angustifolia*), German Chamomile (*Matricaria recutita*) and Neroli (*Citrus aurantium*) mixed with a grapeseed carrier oil. All present children were eligible, except those who had recently returned, were asleep or deemed unstable. The primary outcome was distress measured with the COMFORT-Behavior scale (COMFORT-B). Secondary outcomes were heart rate, oxygen saturation (SatO₂), the Numeric Rating Scale (NRS)-Anxiety and pain assessed by the NRS-Pain scale. Outcomes variables were evaluated with Wilcoxon signed-rank test and multiple regression analysis. The intervention was applied to 111 children, fifty-one of whom (45.9%) were younger than three years old. The group median COMFORT-B score before intervention was 15 (IQR 12–19), versus 10 (IQR 6–14) after intervention. Heart rate and NRS-Anxiety were significantly lower after the intervention ($P < 0.001$). Multiple regression analysis showed that interrupted massages were less effective than the uninterrupted massages. Parental presence did not influence the outcome variables. We did not find a significant change on the NRS-Pain scale or for SatO₂. Aromatherapy massage appears beneficial in reducing distress, as measured by the COMFORT-B scale, heart rate and the NRS-Anxiety scale, in critically ill children. Thus, the potential of aromatherapy in clinical practice deserves further consideration.

KEYWORDS

aromatherapy, COMFORT-Behavior scale, critical care, distress, massage therapy, pediatrics

1 | INTRODUCTION

Critically ill children treated in a pediatric intensive care unit (PICU) may experience distress and pain, and require sedation and analgesia. A recent study showed that a child in the PICU undergoes an average of seven painful and three stressful procedures per day.¹ In addition, they are in an unknown environment with continuous exposure to noise from machines, alarms, and other disruptive noises. Pain and distress are intertwined and if not treated properly, they can negatively influence the child's pain perception later in life.² The management of pain and distress has the potential harm of undertreatment or overtreatment. Undertreatment can have negative behavioral and biochemical consequences, can lead to stress, and delay the healing process. Overtreatment can delay recovery and cause tolerance.^{3,4} Thus, there is an unmet need for a broader approach in pain and distress management, including the intention to improve the comfort of children treated in a PICU.^{5,6} Nonpharmacological, complementary mind-body interventions such as music, touch, guided imagery, virtual reality, and distraction seem beneficial to this aim in other pediatric populations.⁷⁻¹³

A potential beneficial intervention for children treated in a PICU could be aromatherapy massage. Massage, aromatherapy or a combination of the two is increasingly used and assessed in critically ill adults.^{14,15} A recent meta-analysis and randomized controlled trial showed that massage was associated with a lesser need of sedatives and analgesics required in adults following cardiac surgery.¹⁶ While the few studies on aromatherapy massage in critically ill children show promising yet inconclusive results, the authors report limitations in the study design.¹⁷⁻¹⁹ Our group has performed two studies on aromatherapy massage in the pediatric burn unit at the Red Cross War Memorial Children's Hospital (RCWMCH) in Cape Town, South Africa.^{20,21} One of these was an observational study, in which we noted that the children's heart rate and respiratory rate had gone down after aromatherapy massage with the "M" Technique massage and that the children fell asleep easier. The second study, however, which was a randomized controlled trial (RCT) in the same setting, did not show a significant effect of massage in distress reduction. We hypothesized that filming the infant during the massage intervention and the application of a saturation device to monitor heart rate and oxygen saturation may have been disturbing factors. In the PICU setting, the advantage is that monitoring is in place already. We decided to refrain from filming in the current study.

This observational study investigated the effectiveness of aromatherapy massage in critically ill children treated in a PICU.

2 | METHODS

2.1 | Study design

In this prospective before and after study, children received a gentle aromatherapy massage intervention once parents had provided informed consent prior to starting the study procedure. The

aromatherapy massage intervention consisted of a manual manipulation also known as the "M" Technique, applied with a blend of essential oils. We have reported this study according to the Statement for Strengthening the Reporting of Observational Studies in Epidemiology (STROBE Statement) (Appendix S1. Strobe Statement).²² Furthermore, we followed the CONSORT guidelines in reporting nonpharmacological treatment interventions.²³

2.2 | Patients and setting

This study took place at the pediatric intensive care unit (PICU) at the Red Cross War Memorial Children's Hospital (RCWMCH) in Cape Town, South Africa from November 2018 to April 2019. The RCWMCH is a state hospital that admits children aged 0 to 13 years and has a 22-beds PICU. Eligible patients were those admitted to the PICU and deemed stable by the medical team. These patients needed to be in a medically stable condition, defined as oxygen saturation (SatO₂), pulse, blood pressure, and other medical parameters within the medically acceptable range. Patients were excluded at the discretion of the medical staff if their medical condition was deemed unstable; if they were asleep; or if they had returned to the ward after surgery within a period of 6 hours. The medical ethical review committee of The University of Cape Town and the medical ethical committee of the RCWMCH approved this study (HREC REF: 128/2018).

2.3 | Intervention

The "M" Technique is a method of massage developed for vulnerable patients particularly.^{18,24} Each movement and sequence is systematically performed a set number of times, in a set pattern, at a set pressure (3 on a scale of 0-10, where 0 = no pressure and 10 = crushing pressure), and at a set speed.²¹ The therapist applies a blend of essential oils, in this study consisting of a 1% mixture of Lavender (*Lavandula angustifolia*), German Chamomile (*Matricaria recutita*), and Neroli (*Citrus aurantium*), mixed in a Grapeseed carrier oil (see Appendix S2 for the chemical constitutions of the three oils). A therapeutic effect is proposed for these three oils. Lavender is assumed to have analgesic, antiseptic, sedative, and cytophylactic properties. German chamomile is considered an analgesic and anti-inflammatory agent. Neroli is supposed to have an alleviating effect on anxiety.^{21,25} The aromatherapy massage intervention with a blend of essential oils is appropriate for children over the age of six months and has been used in previous studies.^{20,21} Infants younger than 6 months old still have a sensitive skin. Therefore, as a precautionary measure, we applied grapeseed oil only to this group.

The aromatherapy massage intervention consisted of the following steps. Firstly, the therapist washed her hands and put on a disposable plastic apron. The patient was then positioned in a comfortable way, either lying on the bed, sitting in a chair, or being held by the caregiver. The patients' position was mostly dictated by their

diagnosis, positioning of drips, drains, endotracheal tubes, catheters, or wound dressings. If needed, the medical staff advised on the most comfortable position for the child. Secondly, the therapist made initial physical contact with the patient by placing her hands on the child's feet. Gradually, the therapist massaged the body from the feet up to the legs, arms, hands, back, shoulders, abdomen, and the head, should these areas be available for massage. Although the intervention was standardized, it was sensitive to the subject's needs. At any time, the patient or their parent could pause or stop the intervention. Furthermore, children or their parents were at liberty to request specific areas to be massaged. Older, verbal children could ask by mouth. When working with younger and nonverbal children, the therapist used her expertise and intuition to determine what body areas the child is most enjoying during the treatment. The duration of a massage session depended on the patient's medical condition, needs and preferences, age and size. A standard massage session usually takes some 20 minutes. Massaging a small baby will take less time than massaging a teenager. Also, only a small area may be available to be massaged due to the presence of dressings, tubes, drips, etc Each child was massaged for as long as they were comfortable receiving the treatment or when the therapists deemed them to be in a calm relaxed state. Each child in the study received one aromatherapy massage.

The aromatherapy massage intervention was carried out by one certified therapeutic aromatherapist (LO), who received her diploma in 2003 from the Cape Institute for Allied Health Studies and who has been working at RCWMCH since 2004. The therapist received her qualification in the "M" Technique[®] from RJ Buckle Associates LLC in 2008. The measurements and observations for the purpose of this study were carried out by a fourth-year medical student (SV) who had received the necessary training for this study.

2.4 | Outcome measurements

The primary outcome was distress as assessed by the COMFORT-behavior scale (COMFORT-B scale). The COMFORT-B scale has been validated for use in sedated and invasively ventilated children of all ages, for postoperative pain in 0-to 3-year-old children, and cross-culturally.²⁶⁻²⁸ The COMFORT-B scale requires the observer to consider intensity of six behavioral items: alertness; calmness or agitation; respiratory response (for mechanically ventilated children) or crying; body movement; muscle tone; and facial tension. For each of these items, five response categories are provided, rated from 1 to 5, reflecting increasing intensity of the behavior in question. Summating the six ratings leads to a total score from 6 to 30. In an earlier sedation study in a PICU, COMFORT-B scale cut-off points were set at ≤ 10 to indicate over-sedation (unless a child does not receive sedatives or opioids) and ≥ 23 as under-sedation.²⁶ A reduction of 5 points on the COMFORT-B scale is considered clinically relevant.

The secondary outcomes were distress as measured by increased heart rate (HR), decreased SatO₂, Numeric Rating Scale

(NRS)-Anxiety Scale, and pain as assessed by the NRS-Pain scale. HR was continuously monitored by electrocardiography. Two minutes before and after the intervention, HR was recorded in intervals of twenty seconds, resulting in six scores per timeframe. The means of the before and after measurements were compared.

SatO₂ was continuously measured with a pulse oximetry device attached to the patient's finger or toe. Two minutes before and after the intervention, SatO₂ was recorded in intervals of twenty seconds, resulting in six scores per timeframe. The means of the before and after measurements were compared.

The NRS-Anxiety and NRS-Pain scales are frequently used as self-report tools but they are also applied as validated observational tools used by nurses, parents, and other professionals to assess the intensity of anxiety and pain in children.²⁹ The NRS-Anxiety and NRS-Pain scales range from 0 (no anxiety/pain) to 10 (worst anxiety/pain possible).

Background characteristics of the children included type of analgesic treatment, sex, age, reason of admission, type of ventilator support, and the pediatric index of mortality score (PIM).³⁰ Background characteristics of the aromatherapy massage intervention included parental presence, the child's position during the intervention (in bed, sitting on a chair, on parent's lap), possible interruptions of the intervention and reasons for stopping the intervention (ie, at the discretion of the aromatherapist, at the child's request, or urgent medical intervention).

2.5 | Sample size calculation

A moderate effect of the massage was expected; that is, a Cohen's *d* effect size of 0.50. With a power of 0.90 and alpha set at 0.05, inclusion of 44 children was required to be able to detect a significant reduction of distress levels assessed with the COMFORT-B scale. Our previous study suggested that effects of aromatherapy massage could be more pronounced in older, verbal children.²⁰ Therefore, we aimed to include a convenience sample of three age groups, each including 44 patients: 0-3 years old, 3-6 years old, and older than 6 years old.

2.6 | Procedure

Before the study took place, the observer (SV) completed a training module on the use of the COMFORT-B scale. Interrater reliability between the observer and an experienced COMFORT-B observer (LO) was calculated using the linearly weighted Cohen's kappa for the COMFORT-B scale items. Cohen's kappa based on 60 COMFORT-B items was 0.86 (95% CI 0.780-0.93), and the ICC of the total COMFORT-B scores was 0.98 (two-way mixed model, absolute agreement, single measures procedure in SPSS). The observer had also been trained to complete the NRS-Anxiety and NRS-Pain scales.

The aromatherapist and the observer identified eligible patients. In addition, PICU staff doctors, nurses, physiotherapists, or

occupational therapists could recommend eligible patients. Written informed consent was obtained from the parents and assent from children older than 7 years after the study aim and procedure had been explained to them. After enrolment, data collection would start. Each patient was assigned a study number and a clinical research form that included information such as age, sex, and diagnosis. Two minutes before the aromatherapy massage intervention, the observer assessed the outcome measurements COMFORT-B scale, HR, NRS-Anxiety scale, SatO₂, and NRS-Pain scale. During the intervention, the observer recorded the characteristics of the aromatherapy massage intervention. Upon completion of the intervention, the observer had another two-minute observation period to assess the primary and secondary outcome measurements.

If the child needed care from a nurse or doctor during the aromatherapy massage intervention, the intervention would pause. The child or their parent would then choose either to stop the intervention completely or to continue after the disruption. The PICU at RCWMCH attempts to have a “quiet time” in the afternoons. In coordination with the medical staff, our study was mostly performed between 14:00 and 16:00 when the ward was quieter, and therefore, seemed like an appropriate time to provide comfort. The intervention was performed before the evening meal was served.

2.7 | Statistical analysis

Normally distributed data are presented as mean and standard deviation (SD) and the continuous variables that are not normally distributed as median and interquartile range (IQR). The Wilcoxon signed-rank test was used to compare the outcomes of scores before and after the aromatherapy massage intervention for COMFORT-B scale scores, HR, SatO₂ levels, NRS-Anxiety scores, and NRS-Pain scores. Multiple regression analyses were performed to determine the potential impact of covariables such as sex, age, massage interrupted (yes = 1, no = 0), parental presence (yes = 1, no = 0), and the assessment before the massage. Analysis was performed in SPSS 25. A *P*-value of 0.05 was considered statistically significant. Normality of the residuals was assessed using histograms.

3 | RESULTS

Data were collected from November 2018 through April 2019. One hundred-and-fourteen children were eligible for inclusion, 111 of whom received one intervention and whose data were included in the analysis. One child was excluded from the study for medical reasons and two because they eventually did not want to receive a massage. We had intended to include 44 patients per age group. Unfortunately, during the study period, fewer children than expected between three and six years old were admitted (see Table 1). We offered aromatherapy massage to all eligible patients present when

TABLE 1 Background characteristics of patients (n = 111)

Variables	n (%)
Gender	
Boy	58 (52.3)
Girl	53 (47.7)
Age groups	
<6 months	19 (17.1)
>6 months to 3 years	32 (28.8)
3-6 years	18 (16.2)
>6 years	42 (37.8)
Days admitted to the ICU	
Median (IQR)	3 (2 to 7)
Risk of mortality (PIM)	
Median (IQR)	0.013 (0.006 to 0.038)
Reason for admission	
Cardiovascular disorder	41 (36.9)
Respiratory disorder	20 (18)
Neurological disorder	13 (11.7)
Gastro-enterology and liver disorders	9 (8.1)
Vehicle or pedestrian accident	6 (5.4)
Oncology	5 (4.5)
Gun shot	3 (2.7)
Ear, nose, throat	3 (2.7)
Intoxication	3 (2.7)
Genetic disorder	3 (2.7)
Organ transplantation	2 (1.8)
Immune system disorder	2 (1.8)
Burns	1 (0.9)
Ventilatory support	
None	35 (31.5)
Yes	
Nasal or face mask oxygen	42 (37.8)
CPAP or high flow ventilation	22 (19.8)
Ventilation through intubation or tracheostomy	12 (10.8)

Abbreviations: CPAP, continuous positive airway pressure; ICU, Intensive Care Unit; IQR, Interquartile range; PIM, Pediatric Index of Mortality Score.

the therapist visited the PICU during that period. Table 1 presents the background characteristics of the children who had received the intervention. Almost half of them (45.9%) were 0-3 years old, with 19 children of this group younger than 6 months old. Median length of stay was 3 days (IQR 2-7). Table 2 shows the analgesics and sedatives, as well as other relevant drugs, administered on the day of the intervention (Table 2). The administration of sedatives did not have a significant effect on the primary outcome measurement COMFORT-B (*P* = 0.506). Table 3 presents the characteristics of the aromatherapy massage interventions. The median duration was

TABLE 2 Analgesics and sedatives and other relevant drugs administered on the day of aromatherapy massage intervention (n = 111)

Medication	n (%)
Analgesics	
Opioids	54 (49.1)
NSAID/Acetaminophen	93 (84.5)
Glucocorticoids	19 (17.3)
Sedatives ^b	73 (66.4)
Anti-epileptics	8 (7.3)
Benzodiazepine	6 (5.5)
Muscle relaxant	3 (2.7)
Other ^b	14(12.7)

^aMidazolam, Esketamine, Dexmedetomidine, Clonidine.

^bPropranolol, Melatonin, Promethazine, Levothyroxine.

20 minutes (IQR 16-24 minutes). One or both parents were present in 64% of the occasions. On 22 occasions (19.8%), the aromatherapy massage intervention was interrupted but resumed.

Comparing the overall COMFORT-B scores before and after the aromatherapy massage intervention, we found a significant reduction from a median 15 (IQR 12-19) to a median of 10 (IQR 6-14, $P < 0.001$). HR and NRS-Anxiety scores were also significantly lower after the aromatherapy massage intervention (Table 4). No significant differences were found for SatO₂ or NRS-Pain ratings. Despite the overall significant reduction on the COMFORT-B scale, the outcome measurements had not improved for all children. The COMFORT-B scores of 20 children had remained unchanged, and of 18 children had gone up by a few points after the intervention. In 10 children of the latter group, the intervention had been interrupted by a medical procedure such as repeated tracheostomy suctioning, a nursing procedure, or a mother interrupting the intervention to breastfeed.

Tables 5-7 give the results of the multiple regression analyses with the COMFORT-B scores, heart rate, and NRS-Anxiety after massage as outcome variables. The COMFORT-B score before the massage was significantly associated with the COMFORT-B after massage ($B = 0.180$; 95%CI 0.003-0.357; $P = 0.05$). Interruption of the massage intervention negatively affected distress and resulted in higher COMFORT-B scores ($B = 3.645$; 95%CI 1.127-6.163; $P = 0.005$). Age had a small effect on the COMFORT-B scores ($B = -0.244$; 95%CI -0.488 to 0.000; $P = 0.05$). Older children seemed to have lower COMFORT-B scores after the massage intervention than younger children. Other covariables were not significantly associated with the COMFORT-B after the massage intervention (Table 5).

Similarly, for HR and NRS-Anxiety, the interrupted massages were less effective than the uninterrupted massages (HR: $B = -0.530$; 95%CI -0.915 to -0.146; $P = 0.01$ and NRS-Anxiety: $B = 0.931$; 95% CI 0.094-1.767; $P = 0.03$). Parental presence during the massage was not significantly associated with the outcome variables (Tables 6 and 7).

TABLE 3 Characteristics of aromatherapy massage interventions (n = 111)

Variable	n (%)
Duration of massage in minutes	
Median (IQR)	20 (16 to 24)
Patient selection	
Selected by the therapist	104 (93.7)
Referred by ICU staff	7 (6.3)
Areas massaged (combinations possible)	
One or both feet	109 (98.2)
One or both legs	107 (96.4)
One or both arms	83 (74.8)
One or both hands	73 (65.8)
Head	44 (39.6)
Back	22 (19.8)
Shoulders	5 (4.5)
Belly	1 (0.9)
Parent(s) present during massage	
Not	40 (36.0)
One parent	62 (55.9)
Both parents	9 (8.1)
Massage interrupted and continued	22 (19.8)
Interaction with parent	9 (40.9)
Medical reason	4 (18.2)
Breastfeeding	5 (22.7)
Patient picked up	4 (18.2)
Reason to end the massage	
At the discretion of the therapist	105 (94.6)
At the request of the patient	1 (0.9)
Medical need	3 (2.7)
Parental or social interaction	2 (1.8)

Abbreviation: IQR, Interquartile range.

4 | DISCUSSION

In this observational before-after study, we investigated the effects of an aromatherapy massage intervention on the COMFORT-B scores, HR, NRS-Anxiety, SatO₂, and NRS-Pain of children treated in the PICU at RCWMCH in Cape Town, South Africa. The data demonstrated that the intervention overall was associated with a significant and clinically relevant reduction of the children's distress as assessed with the COMFORT-B scale. Age had a small effect; older children showed more improvement in comfort. This is in line with our previous study on massage in children with burns, in which younger children had higher COMFORT-B scores—indicating more distress—than the older children.²¹ A prospective pilot study in 60 pediatric heart surgery patients older than 6 years old found significantly lower state-trait anxiety scores after repeated gentle massage therapy compared with children receiving reading visits.¹⁹ In a pilot study, in 18 critically ill children, the children's parasympathetic activity increased during

TABLE 4 Scores before and after massage session^a (n = 111)

Outcome	Median (IQR) before	Median (IQR) after	P-value
COMFORT-B	15 (12-19)	10 (6-14)	<0.001
Heart rate	129 (100-147)	126 (99-143)	<0.001
NRS-anxiety	2 (0-4)	0 (0-0)	<0.001
NRS-pain	0 (0-0)	0 (0-0)	0.86
SatO ₂	98 (70-100)	98 (60-100)	0.178

^aWilcoxon signed-rank test

TABLE 5 Multiple regression analysis effect with COMFORT-B score after massage as outcome variable

Outcome	B	95% CI	P-value
Sex	0.879	-1.099 to 2.856	0.38
Age in years	-0.244	-0.488 to 0.000	0.05
Parental presence ^a	-0.317	-2.357 to 1.722	0.76
Massage interrupted ^a	3.645	1.127 to 6.163	0.005
COMFORT-B before	0.180	0.003 to 0.357	0.05

^aParental presence: 1 = present, 0 = not present. Massage interrupted = 1, not interrupted = 0

TABLE 6 Multiple regression analysis effect with heart rate after massage as outcome variable

Outcome	B	95% CI	P-value
Sex	-0.121	-0.428 to 0.185	0.43
Age in years	0.007	-0.028 to 0.042	0.71
Parental presence	0.190	-0.124 to 0.503	0.23
Massage interrupted	-0.530	-0.915 to -0.146	0.01
HR before	0.610	0.479 to 0.741	<0.001

repeated hand and foot massages—indicating a positive effect on the autonomic nervous system.¹⁷ In the present study, we did not find a reduction in pain intensity. This could be explained by a floor effect: the assigned pain scores before the intervention were already very low, limiting the ability to detect response.

Massages were more effective when they were not interrupted, which happened in 19.8% of the cases. The PICU environment remains a busy setting, in which unexpected medical procedures can be required at any time. This inherently makes it difficult, but not impossible, to provide interventions aimed at increasing comfort.

Aromatherapy massage interventions can be an appealing noninvasive complementary approach to improving critically ill children's comfort. A wide variety of massage interventions exist, ranging from a classic circulatory massage, such as Swedish massage, to gentler forms of massage and touch, such as the "M" technique.³¹ Circulatory massage is performed with a deeper pressure than that applied with gentler forms of massage. Some therapists combine

TABLE 7 Multiple regression analysis effect with NRS-Anxiety after massage as outcome variable

Outcome	B	95% CI	P-value
Sex	0.024	-0.634 to 0.681	0.94
Age in years	-0.076	-0.152 to 0.001	0.05
Parental presence	-0.462	-1.137 to 0.212	0.18
Massage interrupted	0.931	0.094 to 1.767	0.03
NRS-Anxiety before	0.174	0.056 to 0.299	0.01

touch with oils that are each attributed a different effect, although it is unclear whether this effect is physiological and pharmacological, or psychologically and culturally based.³²⁻³⁴ For critically ill children, the gentle and repetitive "M" Technique with calming oils seems the most appropriate. The three oils we have used have proposed calming qualities. However, it remains difficult to separate the effect of the massage from the proposed attributes and chemical constituents of the oils.

Aromatherapy massage has long been considered a nursing intervention.^{24,35,36} However, for children, it may be confusing to have a nurse perform both painful and distressing procedures as well as a soothing and relaxing intervention. A trained therapeutic aromatherapist has the advantage of being neutral in the caring process. However, especially in younger children, the fear of strangers can overshadow the possible relaxing effect of the intervention.³⁷ Alternatively, we could turn to the parents, as suggested in recent studies.³⁸⁻⁴¹ Parental involvement increases parents' self-confidence in their caregiving role and participation in their child's care process.^{40,42} Nevertheless, parents may be afraid to unwittingly harm their child during massage. Some parents themselves may experience high levels of distress, which could be transmitted to their child.⁴³ Thus, the question who is best suited to perform aromatherapy massage intervention in children is hard to answer.

The positive results of this study should be interpreted in light of its limitations. First, the before-after design without a control group prevented establishing a solid cause-and-effect relationship between the exposure to aromatherapy massage and the reduction in distress. Second, despite the staff's support of aromatherapy massage, we noted that often a nursing or medical intervention was prioritized over providing the aromatherapy massage intervention, which then needed to be interrupted or stopped. Third, due to the nature of the intervention, it was not possible to blind the therapist, patient, or researcher to the intervention. Lastly, in this study we aimed to examine the effectiveness of the aromatherapy massage intervention in a real-life PICU setting. As a result, and as is typical for the PICU, we had a heterogenic study population. Therefore, a shortcoming of this study is the reliability of our results. A strength of the study is assessment with the COMFORT-B scale, which has been validated for this patient group and only takes observable behavior into account. Furthermore, we used physiological parameters as objective secondary outcomes.

4.1 | Future research

Recommending an RCT design for future studies seems an obvious choice. However, as we know from our previous studies,^{18,21} performing a rigorous RCT on aromatherapy massage in children comes with challenges. First, due to the nature of the intervention, it is not possible to blind the therapist, patient, or researcher to the intervention. Second, most of the critically ill children treated in a PICU are not able to self-report outcome measures. Third, an aromatherapy massage intervention aimed to improve relaxation, but the two existing relaxation scales, the Muscle Tension Inventory (MTI) and the Behavioral Relaxation Scale (BRS), have limited utility in young children.^{44,45} Nasr and colleagues have proposed that future research on nonpharmacological interventions for critically ill children should include sedation algorithms, impact on clinical and neurodevelopmental outcomes, delirium, and withdrawal rate.⁶ Although this is a valid point, the question is whether we are overstating the possible effect of a subtle intervention such as aromatherapy massage. Although the effects of aromatherapy massage have been shown to be significant, they appear short-lasting.

5 | CONCLUSIONS

In this study, aromatherapy massage appeared beneficial in reducing distress, as measured by the COMFORT-B scale, heart rate, and the NRS-Anxiety scale, in critically ill children. As clinicians worldwide aim to reduce distress in critically ill children, we should consider its potential in clinical practice. However, we should also consider that "one size does not fit all"⁴⁶: not every child will be comforted by a particular approach. We need to be open to the different needs of individual patients and the heterogeneity of the families.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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