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ORIGINAL ARTICLE

Hepatology

Interventions to alleviate anxiety and pain during venipuncture in children with chronic gastrointestinal and/or liver disease: A single-center prospective observational study

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Abstract

Objectives: The goal of this longitudinal study was to reduce anxiety and pain in children with chronic conditions from the gastrointestinal tract during venipuncture. These children undergo regular venipuncture as part of their medical management and the procedure is often accompanied with anxiety and pain. In addition, children as well as their parents and health care professionals (HCPs) often suffer "compassionate pain" because of emotional interference.

Method: In a realistic clinical setting, different psychological and medical interventions were examined: (1) Psychoeducational brochures and (2) four different medical-technical interventions during venipuncture. In a large hospital in Germany, 169 children, their parents, and HCPs were asked to rate anxiety and pain during venipuncture before and after the intervention.

Results: Children showed a clear preference for some of the medical-technical interventions. Using *Linear Mixed Models* anxiety and pain rated by the children themselves showed no significant reduction. However, parents and HCPs reported a significant reduction. Age, gender, and status of liver transplantation were associated with a reduction in anxiety and pain in most of the analyses.

Conclusion: Both psychoeducational brochures and medical-technical interventions had a positive impact on anxiety and pain. However, effectivity for the medical–technical interventions was lower than in previous studies utilizing individual interventions. Reasons for this difference as well as possibilities to improve the intervention are discussed. In addition, this study provides practical day-to-day information about the implementation of interventions for the work in pediatric units such as when and how to provide psychoeducational materials.

KEYWORDS

blood, longitudinal, needle, psychoeducation, stress

1 | INTRODUCTION

Venipuncture for blood sampling is one of the most common medical interventions in hospitals and often is associated with distress.[1] Especially in children, venipuncture is associated with anxiety and pain.[2,3] Children with chronic illnesses often undergo routine examinations exposing them to more frequent venipuncture. According to Cummings et al.,[4] needle procedures are the third most frequent cause for pain for children in hospital care only topped by disease and postoperative related pain. Furthermore, 63% of children report fear of needles.[5] Needle-phobia (for a definition of phobia see ICD-10: F40.2[6]), can lead to less cooperation or avoidance of treatment.[7] A study by Öst showed that in a sample of 56 individuals with injection phobia (F40.23[6]) over 50% attribute their phobia to a stressful needle procedure in their past and another 20% to witnessing such an event, the mean age of onset being 8 years.[8] Together, these results indicate a need for child-friendly interventions reducing anxiety and pain during venipuncture.

So far, different approaches have been tested to mitigate the negative effects associated with venipuncture. Harrison[9] used a psychoeducational children's book about the purpose, procedure, and expectable pain of venipuncture, which prove to be effective in reducing anxiety and pain as well as improving coping behavior in children aged 6–12 years. Another commonly used method is the use of a mild topical anesthetic applied at the skin at the putative site of venipuncture. A pain-decreasing effect[10,11] and higher success rate for venipuncture[10] have been associated with the use of such anesthetic cream in children. A more technical approach—the BuzzyBee®—has proven to be effective in alleviating pain[12–14] and anxiety.[13] The BuzzyBee® is a bee-shaped device with a main body causing strong vibrations and wings made from ice packs. The BuzzyBee® is placed closely to the puncture site. The wings then cool the surrounding skin. The main body's functionality is based on the *Gate Control Theory* by Melzack and Wall[15,16] wherein the activation of larger A-beta fibers (vibration) inhibits the transmission of pain-related signals of smaller A-delta and C fibers (venipuncture). Based on the same theory vapocoolant spray, an alcohol-based mixture that evaporates upon release causing an endothermic reaction, being applied before venipuncture has shown mixed results with some studies proving effective[17,18] and others reporting higher pain scores in comparison to a control group.[19] Finally, there is evidence that a device for transcutaneous electrical nerve stimulation (TENS) which is usually used for chronic pain treatment also has an analgesic effect on acute pain.[20] Again, the Gate Control Theory is associated with the analgesic effect, wherein the light electric shocks activate the A-beta fibers. Other theories propose the increased release of endorphins as mechanism (see for an overview[21]).

What is Known

- Children suffer from anxiety and pain during needle procedures.
- Different interventions prove to be effective in reducing both.

What is New

- The combination of psychoeducation and a medical–technical intervention may prove more effective than each by itself.
- A realistic clinical setting reveals advantages and difficulties in the practical implementation of each intervention.
- Allowing children active participation and control in a painful procedure can provide pain relief.

So far, different interventions have been evaluated on their own, but few have been compared directly. It remains unclear if some interventions are better received and more accepted by children.

The goal of this study is to evaluate the acceptance and effectiveness of different interventions reducing anxiety and pain in children of all ages during venipuncture in a realistic clinical setting.

2 | MATERIALS AND METHOD

2.1 | Participants and design

This longitudinal study was conducted at a university hospital in Germany between 01/2020 and 03/2022. Participants were children with chronic illnesses treated at the pediatric hepatology and gastroenterology unit, their accompanying parents and health care professionals (HCPs). Because of their chronic diseases all children had routine follow-up visits at a minimum of every 6 months. Blood sampling at these visits was part of the routine disease assessment. Venipuncture was conducted by a pediatrician with the assistance of a nurse. Children and their families were often long-time acquainted with the HCPs. All patients and their parents received a letter sent to their homes containing information about the study and were asked to participate in the study. No financial incentive was provided. The final sample consisted of $N = 169$ children (82 male, 87 female) aged 10 months to 17 years ($M = 9.19$, SD = 4.90). The most typical disease was biliary atresia ($n = 55$). They had been ill for between 1.5 months up to 214 months ($M = 84$ months, SD = 58 months). In total, 81 children awaited liver transplantation and for 87 children transplantation had already been completed (one missing).

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board (or Ethics Committee) of the corresponding author's institution (No. Nr 8860_BOK_2020).

2.2 | Procedure and materials

All children enrolled in the study were divided in three age groups at the beginning: 24 children aged 0–3 years, 42 children aged 4–7 years, and 103 children aged 8–18 years. This was done to ensure an age-appropriate fit for the intervention.

Participants' anxiety and pain were measured after venipuncture on three occasions (see Figure 1). To evaluate the effectiveness of the different interventions, we first measured participants' anxiety and pain after a routine venipuncture, serving as a baseline (T1). Three weeks before the next venipuncture intervention materials were sent out. Upon the next visit, we measured anxiety and pain again (T2). We also conducted a follow-up measurement at the next visit (T3). Children, parents, and HCPs received a questionnaire following each venipuncture.

2.2.1 | Intervention

The children in the two older age groups were split in two different intervention groups. One intervention group received a purely psychoeducational intervention while the other group received the same psychoeducational treatment but in addition was provided access to a pool of medical-technical interventions. The assignment to the respective intervention group was randomized.

All children were accompanied by their parents during the venipuncture procedure. To allow for a realistic clinical setting as well as to not cause more distress the families were allowed to use their usual rituals and procedures they already employed during earlier venipunctures (e.g., comfort positioning, distraction, using a countdown). The described interventions were added to the individual procedure.

The first intervention group (PE) received age-appropriate (depending on the assigned age group) psychoeducational brochures focusing on cognitive understanding of anxiety mechanisms and the procedure of blood drawing. A preliminary survey indicated a correlation between the anxiety of children and their parents (for full results see[22]). Therefore, the brochures were designed to inform both family parts and could be worked through together. The brochures informed about health function, natural course, and the potentially vicious cycle of anxiety. It also provided some results from the preliminary survey about anxiety during venipuncture,[22] and links to different online versions of guided progressive muscle relaxation, autogenic training, and book recommendations. Additionally, the children aged 4–7 years old received a storybook about a girl named “Milla”[23] that goes through the process of a clinic visit involving venipuncture. The book was written and illustrated by one of the authors for the purpose of this study. All materials were designed by a multiprofessional team of psychologists, pediatricians, nurses, and a play therapist.

The second intervention group (MT) received the same brochures. Additionally, they had the choice to use one of

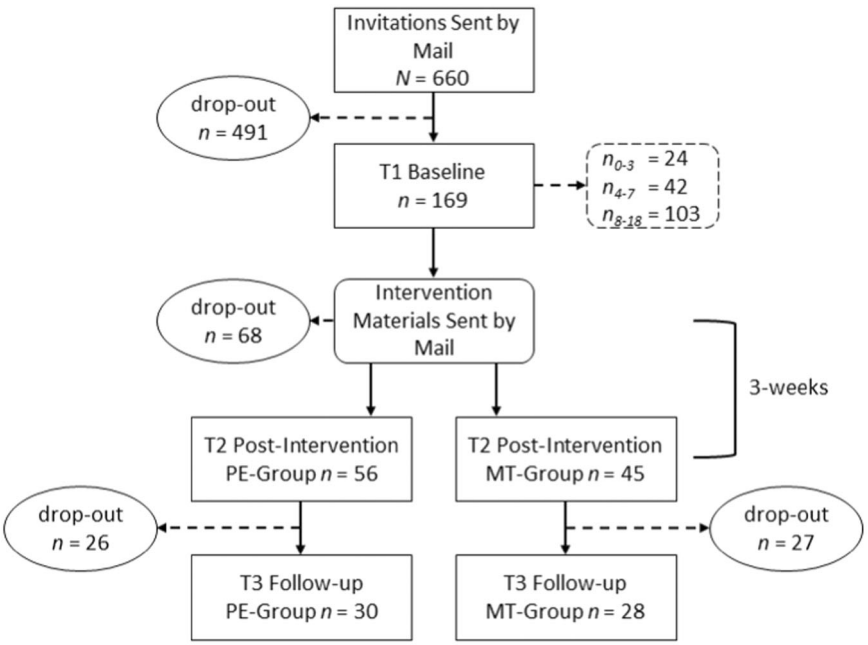

FIGURE 1 Study procedure. MT-group, intervention group with additional medical–technical intervention; PE-group, intervention group with only psychoeducational intervention; T1, baseline measurement; T2, postintervention measurement; T3, follow-up measurement.

four medical-technical interventions at their next venipuncture appointment[1]: a TENS device,[2] a vapocoolant spray (ethyl chloride, "Chloraethyl Dr. Henning®"),[3] a topical anesthetic cream (an eutectic mixture containing 2.5% lidocaine and prilocaine each, EMLA® Aspen Germany GmbH), or[4] a BuzzyBee®. An info sheet on all four possibilities was provided by mail accompanying the brochure (see Supporting Information). At the beginning of their next venipuncture, children were presented with all four interventions in a plastic box and given a short explanation for each application (Figure 1). Afterward, the children were encouraged to choose one option. Children aged 0–3 were not eligible for this intervention since some of the interventions had no clear approval for children that young.

2.2.2 | State anxiety

Children and their accompanying parents rated anxiety during venipuncture using the *Children's Fear Scale* (CFS,[24]). The scale is a 1-item measurement tool depicting five faces in increasing stages of fear. We added a question replacing the verbal instruction ("How fearful were you during today's venipuncture?") as well as check boxes (1 = "no fear at all" to 5 = "extreme fear") beneath the faces.

Furthermore, children's state anxiety was assessed using the 5-item State-Trait-Anxiety-Inventory—in the German short form to assess state anxiety (STAI-SKD,[25]). The 4-point scale (1 = "not at all" to 4 = "very") consists of five statements regarding different symptoms of anxiety (e.g., "I was nervous."). The STAI-SKD was provided to children (Cronbachs-α: $T1_{\alpha} = .85$, $T2_{\alpha} = .86$, $T3_{\alpha} = .86$), parents ($T1_{\alpha} = .90$, $T2_{\alpha} = .87$, $T3_{\alpha} = .90$), and HCPs ($T1_{\alpha} = .97$, $T2_{\alpha} = .90$, $T3_{\alpha} = .93$).

2.2.3 | Pain

Children's pain during venipuncture was measured using the Wong-Baker FACES scale.[26] The 6-point scale depicts emoticons in increasing stages of pain. We provided an introductory question and a numeric scale (0 = "does not hurt at all" to 10 = "hurts extremely"). The Wong-Baker FACES scale was provided to children, parents, and HCPs.

2.2.4 | Intervention usage and usefulness

At T2 and T3, children and parents were asked which of the provided interventions they used in preparation for the venipuncture in a multiple-choice question format. If an intervention was used, the perceived usefulness of that intervention was assessed using a 5-point Likert scale (1 = "not at all" to 5 = "very much").

2.3 | Data analysis

Statistical analysis was conducted using IBM SPSS version 29[27] and R.[28] To determine the effectiveness of the interventions on perceived anxiety and pain, we used linear mixed models (LMM) since LMMs can analyze longitudinal data sets while accounting for missing data (for a more thorough discussion see[29]). Analysis was performed using the lme4 package.[30] We included measurement point, intervention group (0 = PE, 1 = MT), child's age, gender (0 = male, 1 = female), status of liver transplantation (0 = no transplant, 1 = transplant) and duration of illness as fixed effects. We allowed for two-way interactions between measurement point, intervention group, and age. Measurement points were contrasted allowing for comparison between T1–T2 and T1–T3. We included a random intercept for participants to take interindividual differences into account. We used one model for each rating perspective (child, parent, HCPs) and measure (CFS, STAI-SKD, Wong-Baker FACES) combination.

3 | RESULTS

Table 1 depicts the means and standard deviations for anxiety and pain by measurement point and rating perspective. Following the intervention, there are small decreases in anxiety and pain across all raters. Parents and HCPs reported stronger changes than the children. Regarding the follow-up, some raters and scales show a continuing downward trend while others show an increase. The full summary of all LMMs is provided in the Supporting Information.

3.1 | Children self-ratings

For self-rated anxiety measured with the CFS, we found significant main effects for age ($\beta = -0.12$, $t = 2.63$, $p = .009$), gender ($\beta = -0.48$, $t = 2.29$, $p = .023$) and status of liver transplantation ($\beta = -0.53$, $t = 2.46$, $p = .015$). Older children, boys, and children who already underwent a liver transplantation reported less anxiety.

The LMM for self-rated anxiety measured with the STAI-SKD showed a significant main effect for gender ($\beta = 0.26$, $t = 2.19$, $p = .030$), meaning that on this scale girls reported less anxiety than boys.

The model for self-rated pain showed a marginally significant main effect for age ($\beta = -0.16$, $t = 1.74$, $p = .084$) and a marginally significant interaction between the contrast of T1–T2 and intervention group ($\beta = -1.03$, $t = 1.90$, $p = .060$). The interaction trend shows, that on average children in the MT-group reported a greater reduction in pain than the PE-group between T1 and T2. There were no significant main effects for intervention or measurement-point contrasts for all three models.

TABLE 1 Means and standard deviations for anxiety and pain by measurement point and rater.

	Children		Parents		HCPs	
	M	SD	*M*	SD	*M*	SD
CFS						
T1	1.94	1.18	2.42	1.31	2.44	1.29
T2	1.93	1.13	2.17	1.06	2.29	1.09
T3	1.96	1.14	2.26	1.11	2.42	1.09
STAI-SKT						
T1	1.61	0.68	1.75	0.71	1.90	0.87
T2	1.55	0.59	1.65	0.59	1.82	0.75
T3	1.67	0.77	1.68	0.72	1.50	0.53
WBFS						
T1	1.91	2.14	2.77	2.73	3.00	2.40
T2	1.93	2.18	2.45	2.34	2.49	2.18
T3	1.80	2.31	2.35	2.20	2.66	2.20

Abbreviations: CFS, Children's Fear Scale; HCP, health care professional; STAI-SKT, State-Trait-Anxiety-Inventory State version; T1, baseline measurement; T2, postintervention measurement; T3, follow-up measurement; WBFS, Wong-Baker FACES.

3.2 | Parent-ratings

For parent-rated anxiety measured with the CFS we found a significant main effect for the contrast of T1–T2 ($\beta = -0.59$, $t = 2.32$, $p = .022$), the contrast of T1–T3 ($\beta = -0.79$, $t = 2.46$, $p = .015$), intervention group ($\beta = -0.90$, $t = 2.07$, $p = .040$), age ($\beta = -0.14$, $t = 3.61$, $p = <.001$), gender ($\beta = 0.63$, $t = 3.17$, $p = .002$), and status of liver transplantation ($\beta = -0.49$, $t = 2.44$, $p = .016$). Postintervention venipuncture, receiving additional medical–technical interventions, older age, being female, and having received a liver transplant were associated with less perceived anxiety.

The LMM for parent-rated anxiety measured with the STAI-SKD showed a significant main effect for gender ($\beta = 0.28$, $t = 2.09$, $p = .038$) and status of liver transplantation ($\beta = -0.28$, $t = 2.06$, $p = .041$). Furthermore, the main effects for contrast of T1–T3 ($\beta = -0.45$, $t = 1.69$, $p = .093$) and age ($\beta = -0.05$, $t = 1.73$, $p = .085$) showed a marginally significant downward trend. Again, being female and having received a liver transplantation was associated with less anxiety.

The model for parent-rated pain showed a significant main effect for age ($\beta = -0.28$, $t = 3.40$, $p = .001$) and marginally significant main effects for duration of illness ($\beta = 0.01$, $t = 1.91$, $p = .058$) and the contrast T1–T3 ($\beta = -1.41$, $t = 1.73$, $p = .080$). The older the children, the less pain parents observed.

3.3 | HCPs-ratings

For HCPs-rated anxiety measured with the CFS, we found a significant main effect for the contrast of T1–T2 ($\beta = -0.57$, $t = 2.12$, $p = .036$), age ($\beta = -0.16$, $t = 4.57$, $p = <.001$) and gender ($\beta = 0.39$, $t = 2.16$, $p = .032$). The main effect for intervention group showed a marginally significant downward trend ($\beta = -0.74$, $t = 1.85$, $p = .066$). We found a significant interaction between the contrast T1–T2 and intervention group ($\beta = 0.55$, $t = 2.29$, $p = .023$), and a marginally significant interaction between the contrast T1–T3 and intervention group intervention group ($\beta = 0.54$, $t = 1.82$, $p = .070$). Postintervention venipuncture, increasing age, and being female were associated with less anxiety. Furthermore, less anxiety was observed postintervention in children who received additional medical–technical interventions.

The LMM for HCPs-rated anxiety measured with the STAI-SKD showed a significant main effect for the contrast T1–T3 ($\beta = -1.26$, $t = 4.44$, $p = <.001$), age ($\beta = -0.10$, $t = 3.35$, $p = <.001$) and a marginally significant main effect for duration of illness ($\beta = <0.01$, $t = 1.78$, $p = .077$). The interaction between the contrast T1–T3 and intervention group was significant ($\beta = 0.48$, $t = 2.08$, $p = .039$). Furthermore, the interactions between the contrast T1–T2 and intervention group ($\beta = 0.33$, $t = 1.75$, $p = .081$) and the contrast T1–T3 and age ($\beta = 0.06$, $t = 1.95$, $p = .052$) were marginally significant. Postintervention venipuncture and increasing age were associated with less anxiety.

The model for HCPs-rated pain showed a significant main effect for the contrast T1–T2 ($\beta = -1.40$, $t = 2.34$, $p = .020$), intervention group ($\beta = -2.01$, $t = 2.56$, $p = .011$), age ($\beta = -0.36$, $t = 5.11$, $p = <.001$), and a nearly significant main effect for the contrast T1–T3 ($\beta = -1.36$, $t = 1.93$, $p = .055$) and status of liver transplantation ($\beta = -0.60$, $t = 1.70$, $p = .091$). Postintervention venipuncture and receiving additional medical–technical interventions were associated with less pain. Furthermore, we found that higher age and having underwent a liver transplantation were associated with less anxiety and pain.

3.4 | Intervention usage

Table 2 shows the pick rate of each intervention for each measurement point. As can be seen, the brochure was used at a higher rate in the MT-group (62%) than in the PE-group (41%). The overall usage of the brochure drops in both groups at follow-up: 20% and 35%, respectively. The usage of the medical–technical interventions shows large differences. Both BuzzyBee® (33%) and vapocoolant spray (28%) received similar interest, whereas the topical anesthetic cream received less attention (13%), and the TENS device was only used once (2%). A total of 22% of all eligible children

TABLE 2 Intervention popularity measured at T2.

	Brochure	BuzzyBee®	Vapocoolant spray	TENS-device	Topical anesthetic cream
Parents					
PE-group					
Used	23				
Not used	33				
MT-group					
Used	28	15	13	1	6
Not used	17	30	32	44	39
Children					
PE-group					
Used	16				
Not used	40				
MT-group					
Used	24	17	15	1	5
Not used	21	28	30	44	40

Abbreviations: MT-group, intervention group with additional medical–technical intervention; PE-group, intervention group with only psychoeducational intervention; TENS, transcutaneous electrical nerve stimulation; T2, postintervention measurement.

did not use any medical–technical intervention given the opportunity. Differences in uptake will be discussed in the following section.

4 | DISCUSSION

The goal of this study was the evaluation of different interventions that have been shown to reduce pain and anxiety in children during venipuncture. We chose a design close to reality, leaving many choices to the participating families, and included children of all age groups. While we found no significant changes in self-rated anxiety and pain for the children, parents, and HCPs reported small but significant improvements. Parents noticed a decrease in anxiety in their children that was greater for the MT-group and a slight decrease in pain in both groups. The HCPs also observed a decrease in anxiety and pain and those were stronger in the MT-group. Furthermore, older age was associated with reduced anxiety and pain in all rating perspectives. Having undergone liver transplantation was also associated with less anxiety from children, parents', and HCPs perspective and with less pain from HCPs' perspective.

The small or nonsignificant effects are surprising, given that many of the interventions used in this study have been proven to be effective.[9,10,13,17,20]

One reason might be the already relatively low anxiety and pain scores before the intervention. On average, children already started with pain and anxiety scores on the second lowest level. Since the lowest level equals no anxiety or pain, it might be complicated to achieve this level with any intervention. Therefore, it could be that children might profit from the interventions, but since no total anxiety and pain reduction was achieved, gave the same rating as before the intervention. Further, children with little to no anxiety and pain could have also engaged less with the intervention since they might not feel any need for additional help. Given our sample size, we decided against a post hoc analysis with only highly anxious children. From a purely statistical view, it is also harder to detect significant changes, the smaller the change and sample. A larger sample might yield more consistent results. However, the overall low anxiety and pain scores should not be interpreted in a way that no interventions are needed. Our clinical impressions as well as the few highly anxious children show that further advances in the treatment of anxiety and pain in children are needed.

Another reason might be the realistic setting. Many factors could have influenced the venipuncture itself (e.g., accessibility, location) or the condition of the children, parents, and HCPs (e.g., stress). Since the routine examination often consists of multiple steps, venipuncture being just one of them, we could not guarantee the exact same procedure (i.e., what happened before and after the venipuncture) for each child. Furthermore, we chose liberal inclusion/exclusion criterions (e.g., no age restrictions), which allowed for a broad sample (which is more realistic and representative for clinical settings).

Furthermore, the missing effects for the self-ratings might be due to introspection and rating deficits among the children. Especially younger children might find it difficult to accurately rate their own anxiety and pain. Considering the already stressful hospital environment and venipuncture situation, this might be even more difficult. Another interpretation could be that parents and HCPs overestimate anxiety and pain of children. This might have implications since their own concerns could have an amplifying effect on the children's anxiety and pain.

Additionally, the psychoeducational intervention required enough self-motivation to read and (especially for younger children) work through the contents of the brochure together. Additionally, parents and children could engage in the different suggested exercises on their own volition. As we can see from the data, many families chose not to engage in the exercises or might not have been able to fulfill them. The medical–technical interventions were more likely to be used. This might be due to the easier accessibility since the interventions could be integrated easily in the venipuncture process. This might also explain why especially the BuzzyBee® and the vapoccolant spray were used most often, being the easier applicable options. Furthermore, the BuzzyBee® also showed high liking at follow-up indicating that it might be the most child-friendly intervention. The TENS device might deter children because of its modus operandi. The topical anesthetic cream requires an application time of a minimum of 30 min which might not always be feasible in practice.

Finally, the drop-out rate warrants mention. Considering the overall low pain and anxiety scores, a possible reason for some families to drop-out could be that the additional effort families must put into reading and applying the intervention materials and filling out the questionnaires during their visit subjectively outweighs the benefits of the interventions. Another explanation could be, that families of highly anxious children had no capacity to complete the questionnaires.

4.1 | Limitations

This study has several limitations. First, we did not compare our data to a control group with no or placebo treatment, allowing only for analysis of intraindividual change. However, it is unlikely that significant changes occur between multiple venipunctures given that some of the children participating had their blood drawn 100 and more times. In every study in which pre–post measures are compared, regression to the mean can lead to spurious changes. Although we believe that this is not a serious issue in the present data as most of the differences were very systematic and in the expected directions, future studies should involve control groups. Since changes between measurement points were significant but small, this raises the question, if further effects could not be detected due to the sample size. A larger sample might yield more results. Another caveat is the slightly differing intervention for different age groups. While the exact contents of the brochure differed for each age group, the overall information can be considered equal and age-appropriate. Finally, our sample consists of a specific pediatric patient group allowing for potential sample-specific effects. However, the procedure for venipuncture should be similar regardless of disease. Therefore, our sample should be comparable to other pediatric samples receiving routine venipuncture regarding the research questions.

5 | CONCLUSIONS, FUTURE RESEARCH, AND PRACTICAL IMPLICATIONS

We found a broad spectrum of responses to venipuncture in children. To our surprise, the majority of children showed only brief and limited aversion to the painful intervention. Only few children responded in longer lasting and severe anxiety. One of the key outcomes of this study was that even those children with brief and limited anxiety tolerated the procedure better when being actively involved in it and when they were allowed some degree of control over the procedure. Most of the offered forms of communication and participation were deemed helpful by the child. Distraction was only useful when the format of distraction was not a new source of uncertainty and potential pain. Positive interaction between the child and the parent was a key element of the perception of alleviation of pain by the child.

Our clinical experience shows that children also benefit from routine practices. As we can see, children who underwent liver transplantation showed less overall anxiety and pain. This might be due to their increased experience with the clinical routines and the increased care they received for their burdensome conditions. We introduced multiple interventions that were new to the children in this study. Applying those interventions over the course of multiple venipunctures could yield better results because the children would be more experienced with the intervention usage.

It could be interesting to see how the current interventions fare with (healthy) children that have little to no experience with venipuncture and might show greater initial anxiety and pain in contrast to the chronically ill children in the present study.

Alternatively, highly anxious children or children with high perceived pain by venipuncture could be preselected to better evaluate the effectiveness. It would also make sense from a psychological and medical view to especially help the most vulnerable children. Further usage of more objective stress measurements (e.g., cortisol levels) could provide new information. Since our results show that the overall anxiety level is rather low future research could look at individual trends, for example, using latent profile analysis.

Especially some of the medical-technical interventions can be integrated in a venipuncture on short notice without complicating the process itself.

We recommend supporting communication with the child by psychoeducational materials (e.g., brochures; see Supporting Information) when informing children and their parents about painful venipuncture. It is likely but needs further confirmation in further studies that such interaction may also be helpful for the child in other painful or worrisome interventions.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Data will be provided upon request to the first author.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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