

Assistance of Medical Clowns Improves the Physical Examinations of Children Aged 2–6 Years

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ABSTRACT: **Background:** A good physical exam is necessary to help pediatricians make the correct diagnosis and can save unnecessary imaging or invasive procedures. Distraction by medical clowns may create the optimal conditions for a proper physical examination.

Methods: Children aged 2–6 years who required physical examination in the pediatric emergency department were recruited and randomly assigned to one of two groups: physical exam by a pediatrician in the presence of caregivers vs. physical exam with the assistance of a medical clown. Outcome measures consisted of the level of child’s discomfort, anxiety, and the quality of the physical examination.

Results: Ninety three children participated. Mean age was 3.3 ± 3.6 years (range 2–6). The duration of the physical exam was similar between the clown and control groups (4.6 ± 1.4 minutes vs. 4.5 ± 1.1 minutes ($P = 0.64$)). The duration of discomfort was shorter in the clown group (0.2 ± 0.6 minutes) than the control group (1.6 ± 2.0 minutes, $P = 0.001$). In the medical clown group, 94% of pediatricians reported that the medical clown improved their ability to perform a complete physical examination. A trend of less hospitalization in the medical clown group was also noticed (11.3% in the medical clown group vs. 18.3% in the control group, $P = 0.1$); however, further study is required to verify this observation.

Conclusions: Integration of a medical clown in physical examination improves the overall experience of the child and the caregivers and helps the pediatrician to perform a complete physical examination.

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KEY WORDS: medical clown, physical examination

A complete physical exam is one of the most important procedures needed to evaluate and diagnose a patient arriving at the emergency department (ER) [1]. An efficient physical examination may reveal the source of the complaint, which can save unnecessary discomfort, pain, time, and resources. Sophisticated technological advances in medicine have proven to be remarkably beneficial in the diagnostic process, yet a complete medical history and physical examination remain

the clinician’s most important means of evaluating a patient. This assessment is especially important when the patient is a young child. [2].

On occasion, a limited or inadequate examination may overlook a significant condition or potentially life-threatening condition. This situation is especially relevant for pediatrics because an agitated and struggling child may distract the clinician and affect the ability to perform a complete examination. For example, conducting lung auscultation and a good respiratory assessment in a child with a fever and cough may reveal pneumonia, which may reduce the need for further procedures such as blood drawing and chest X-ray [3,4]. Examining the ears of a crying child may lead to mistaken diagnosis of otitis media due to redness of the eardrum during examination as crying may cause the ear to appear more red. [5].

Challenges facing the clinician examining young children include physical struggles with the patient or interruptions by a distraught caregiver, which can impact the quality and reliability of the physical exam [6]. These difficulties may cause an examination to take longer or require invasive procedures and imaging, which can lead to an unpleasant atmosphere for the child and caregiver.

Furthermore, a hospital stay is considered an adverse event in life, usually causing distress that may become traumatic, especially for children [7]. Even a short pediatric hospitalization can have negative consequences on the emotional, behavioral, cognitive, and educational development of a child [8]. Children may experience feelings of tension, uneasiness, and anxiety during the hospitalization period [9,10]. Anxiety of caregivers is also common during hospitalization due to the perception of the child’s pain and their own personal worries and fears [11]. Hence, some hospitals have developed, over time, various programs of support for hospitalized pediatric patients undergoing examinations and therapy. These programs include various forms of art and play therapy for children. Some hospital rooms are equipped with televisions playing children’s movies and library shelves filled with comic books. In addition, in recent years, clown therapy has become an integral part of the hospital setting.

Medical clowning is an emerging field, which is constantly growing. Historically, medical clowns were used only to enter-

tain patients in the ward corridors. The increased presence of medical clowns in pediatric departments, along with their use in daily medical procedures has shown promising outcomes. An evidence-based medical study regarding the usefulness of medical clowns is needed.

In Israel, Tener and colleagues [12] examined the role of clowns during medical examinations of children who had been sexually abused. The authors concluded that clowns play a unique role both in lowering anxiety and fear among children before and during examination and assist in creating a pleasant and calm atmosphere, thus improving the child's cooperation during the examination and helping investigators to gather forensic evidence. Many studies have shown that medical clowning relieves anxiety and pain in children preparing for surgery [13-16] and reduces pain and anxiety in children undergoing blood exams [17] as well as many other procedures [18-21].

A qualitative study of children's perceptions of hospital clown humor, using the draw and write/draw and tell techniques, showed beneficial effects for children during a clown visit during their hospital stay [22]. In fact, before the clown visits, the majority of comments written by children to annotated to their drawings were negative (i.e., scared, sad, worried, nervous). Subsequent to the medical clown visits there was a significant increase in the positive comments with no negative verbal comments recorded.

Our study group noticed that a pediatrician examining a child in the ER may ask for the assistance of medical clowns to distract the child during the examination so that the child will be more relaxed and more cooperative during the physical exam. To the best of our knowledge no study has evaluated the use of medical clowns to assist during initial physical examinations in the ER setting.

In this study we incorporated medical clowns during routine physical examination in the ER. We found that the use of medical clowns improved the outcome of the physical examination and the overall experience of the physical exam.

PATIENTS AND METHODS

We conducted an open-label randomized control trial. The study was approved by the internal review board for human subject studies at the Carmel Medical Center. Caregivers signed informed consent prior to participation. Children were recruited from the pediatric ER at the Carmel Medical Center. The recruitment process, which lasted 12 months, started in October 2012 and continued until we reached the sample size of 90 children. The randomization was based on order of arrival. Inclusion criteria consisted of children aged 2 to 6 years who required a physical examination in the pediatric ER. Exclusion criteria included children who were acutely ill and unstable or presenting with a life-threatening clinical condition.

Following recruitment, the children were randomly divided into two groups:

- Physical exam by a pediatrician alone in the presence of a caregiver
- Physical exam with the assistance of a medical clown in the presence of a caregiver

In the first group, during the physical exam a caregiver held the child sitting or standing or the child was lying on the bed while the caregiver held the child's hand. In this group, the pediatrician approached the child while trying to gain trust by smiling, playing, or asking the caregiver to distract the child. Most pediatricians started the physical exam in quiet areas, where silence is required to accurately perform the exam, such as lung and heart auscultation, and after the initial exam, moving to areas that can cause discomfort for the child, such as ear and throat exams. Some children get agitated just from a stranger approaching or from seeing the pediatrician in the white coat, which they relate to former unpleasant experiences.

In the second group, a medical clown was incorporated into the physical examination. While the medical clown distracted the child by singing, dancing, or performing magic tricks, the physician performed the physical exam. The medical clown entered the room 10 to 15 minutes before the pediatrician entered the room, allowing the medical clown time to gain the trust of the child and create a more relaxed atmosphere for the child and caregiver. In our study we employed two certified medical clowns who used similar techniques to relax the child before the pediatrician began the examination. No instructions regarding the medical clown techniques were given, and most of the techniques were designed to distract the child.

After the physical exam ended, the medical clown stayed in the examination room for 10 to 15 minutes to continue distracting the child and provide a pleasant atmosphere when the exam was finished.

Demographic parameters such as age, gender, reason for admission to the ER, body temperature during the examination, and rate of hospitalization in each group were used as independent variables. Whether this was the first time the child visited the ER was also noted [Table 1].

Outcome measures (measured in minutes) consisted of the duration of the whole procedure (assessed by a research assistant), the duration of the crying phase, and the time at which the child experienced discomfort and anxiety. These measures were compared between the two groups. All parameters were evaluated by an independent observer and were added in case of intermittent crying [Table 2].

Questionnaires were given to clinicians by the research assistant to assess the benefits and disadvantages for each patient. Similarly, caregivers completed a questionnaire, which

Table 1. Demographic parameters used as independent variables

Variable	Medical clown group (n=44)	Control group (n=49)	
Age, mean ± SD	3.7 ± 1.3	3.3 ± 1.2	P = 0.599
First visit to emergency room (n, %)	23 (44.8)	22 (52.2)	P = 0.411
Gender (male, %)	21 (48)	27 (55)	P = 0.477
Hospitalization (n, %)	5 (11.3)	9 (18.3)	P = 0.346
Hour of examination, mean ± SD	14:11 ± 0.16	11:27 ± 0.04	P = 0.349
Reason for administration			P = 0.06
Fever	15	26	
Abdominal pain	5	3	
Headache	0	1	
Ear pain	3	1	
Limping	7	0	
Sore throat	1	0	
Urinary tract infection	1	1	
Pneumonia	2	1	
Other	10	16	
Fever during examination, n (%)	5 (11.3)	16 (32.7)	P = 0.014

asked about the benefits and disadvantages of the presence of the medical clown.

Sample size calculation was based on an alpha error of 5% and a power of 80%, with predicted difference in the groups of 10% on the discomfort/anxiety scales. Based on these requirements, it was determined that a minimum of 90 children needed to be recruited. Descriptive statistics were used to describe the two groups. Unpaired 2-tailed *t*-tests were used to compare the groups. For each variable, *P* < 0.05 was considered statistically significant.

RESULTS

Ninety-three children participated in the study, 44 children in the medical clown group and 49 in the control group. In the control group 44.8% of the children were visiting the ER for the first time, the others had visited at least once in the past. In the medical clown group 52.2% of the children were visiting the ER for the first time while the rest had visited the ER at least once in the past. Mean age of the participants was 3.3 ± 3.6 years (range 2–6) with no significant difference between the groups [Table 1]. There was no significant difference regarding the gender or ethnic group (Jews, Arabs, Druze, or other minorities) of the participants. The mean rate of hospitalization was 11.3% in the medical clown group and 18.3% in the control group.

The average hour that the physical examination began was between 11:00 and 14:00 (range 9:00–22:50). The hour was partially chosen due to the working schedules of the medical clowns and the research assistant. The medical cause requiring

Table 2. Comparisons between the medical clown group and the control group

Variable	Medical clown group (n=44)	Control group (n=49)	
Duration of physical examination (minutes), mean ± SD	4.6 ± 1.4	4.5 ± 1.1	P = 0.64
Duration of discomfort before physical examination (minutes), mean ± SD	0.1 ± 0.3	0.5 ± 0.7	P = 0.001
Duration of discomfort during physical examination (minutes), mean ± SD	0.2 ± 0.6	1.6 ± 2	P = 0.001
Duration of discomfort following physical examination (minutes), mean ± SD	0	0.6 ± 1	P = 0.000
Discomfort reported by caregiver, mean ± SD	1.5 ± 0.9	2.0 ± 1.1	P = 0.069
Child's "traumatic" experience, reported by caregivers, mean ± SD*	1.3 ± 0.7	1.5 ± 0.8	P = 0.12
Child's cooperation level, reported by the pediatrician, mean ± SD*	1.5 ± 0.8	2.1 ± 1.1	P = 0.005
Child's resistance, estimated by the pediatrician, mean ± SD*	2.7 ± 1.1	3.5 ± 0.9	P = 0.001
Crying disrupt physical exam, estimated by the pediatrician, mean ± SD*	1.8 ± 1.1	1.4 ± 0.8	P = 0.04

*based on a scale of 0–4 (0 = no resistance, 4 = major resistance)

physical exam at the ER varied. Some common reasons included fever, abdominal pain, limping, and vomiting [Table 1].

Fever during the physical exam was also taken into consideration. In the control group 67% had no fever during the examination (33/49), 22% had fever above 38°C (11/49), and 10% had fever above 39°C (5/49).

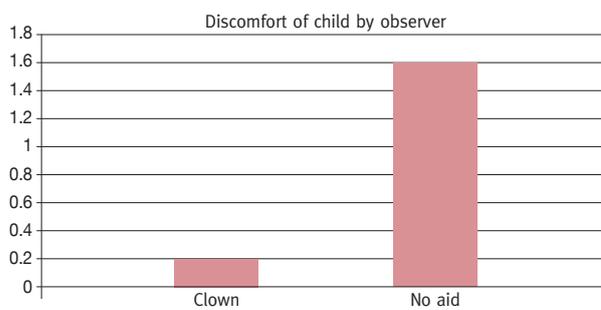
In the medical clown group 88% had no fever during the examination (39/44), 6% had fever above 38°C (3/44), and 4% had fever above 39°C (2/44).

The duration of the physical exam was measured by an independent observer. It was calculated from the time the pediatrician entered the examination room until he left, excluding the work of the medical clowns. The duration was similar between the clown and control groups (4.6 ± 1.4 minutes vs. 4.5 ± 1.1 minutes, *P* = 0.64). The duration of discomfort before the physician entered the room was shorter in the medical clowns group vs. the control group (0.1 ± 0.3 minutes vs. 0.5 ± 0.7 minutes, *P* = 0.001). In the control group the child was in the examination room with only familiar caregivers. In the medical clown group, the child was in the examination room with familiar caregivers as well as the medical clown, who was distracting the child.

The duration of discomfort during the physical examination was shorter in the medical clown group (0.2 ± 0.6 minutes) vs. the control group (1.6 ± 2.0 minutes, *P* = 0.001) [Figure 1]. The duration of discomfort measured following the physical exam was significantly lower in the medical clown group compared to the control group (0.6 ± 1.0 minutes vs. 0 minutes, *P* = 0.0001).

Questionnaires for the caregivers included items regarding the discomfort they experienced during the time the child was being examined (0 = no distress, 4 = significant distress). The caregivers in the medical clown group reported less discomfort compared to the control group (1.5 ± 0.9 vs. 2.0 ± 1.1, respectively, *P* = 0.069). Furthermore, 95% of the caregivers in the

Figure 1. Discomfort of child from physical exam expressed as crying, agitation, and restless. Measured by the independent observer based on cry time and facial expression. Based on a scale of 0–4 (0 = no resistance, 4 = major resistance)



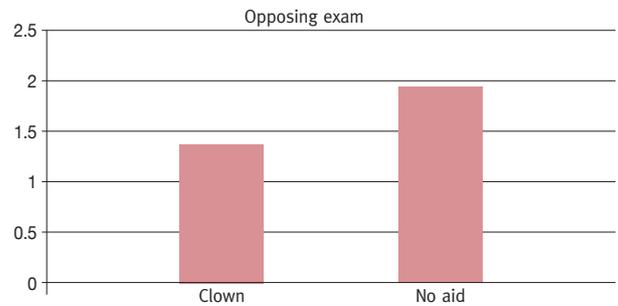
medical clown group reported that in the future they would ask for the presence of a medical clown during the physical exam. Caregivers in both groups were asked whether distracting the child during the physical exam improved their overall experience, (0 = not at all, 4 = significantly). No significant difference was found (medical clown 3.3 ± 0.9 control 3.7 ± 0.7 , $P = 0.03$). We also asked the caregivers whether they thought that the physical exam was a traumatic experience for the child. Interestingly, no significant difference was observed in the groups (medical clown 1.3 ± 0.7 , control 1.5 ± 0.8 , $P = 0.12$).

The examining pediatricians estimated that the children's resistance during the exam was significantly lower in the medical clown group (1.5 ± 0.8 , scale of 1–4) compared to the control group (2.1 ± 1.1 , $P = 0.005$) [Figure 2]. The pediatricians also reported that the cooperation of the children in the medical clown group was significantly better than in the control group (2.7 ± 1.1 vs. 3.5 ± 0.9 , respectively, $P = 0.001$). When pediatricians were asked whether the crying child interfered with the completion of the physical exam, (0 = not interrupted at all, 4 = severe interruption) they noted that crying had been a higher disturbance in the clown group (medical clown 1.8 ± 1.1 , control 1.4 ± 0.8 , $P = 0.04$). Of pediatricians, 94% in the medical clown group reported that the medical clown improved their ability to perform a complete physical examination and that the clown helped them determine pathological findings when they were presented. Furthermore, they reported that in the future when they encounter difficulties in examining a crying and agitated child they would ask for the assistance of a medical clown to improve the outcome of the physical exam.

DISCUSSION

The study examined the influence of medical clowns on the physical examination of children, which is a key element in assessment and correct diagnosis of patients in any field of medicine, and pediatrics in particular. We estimated the influence of medical clowns on a children aged 2–6 years, which is

Figure 2. Degree of children's resistance to the physical exam estimated by the pediatrician based on a scale of 0–4 (0 = no resistance, 4 = major resistance)



an age known for increased stranger anxiety and is considered challenging for completing a proper physical examination and correct estimation of the child by the pediatric ER physician [6].

The children who participated in the study were divided for two groups with similar demographics regarding age, gender, ethnic group, first visit to the ER, and hour the examination began [Table 1].

Reasons for coming to the ER varied as mentioned before [Table 1], but there was a statistical difference between the groups regarding fever as a cause for ER admission, which can affect the level of discomfort and distress in a children. However, when assessing the data we noticed that there was no statically significant difference in the fever degree during the actual physical exam. Hospitalization rate was slightly higher, with no statistical significance, in the control group. This may be related to the ability of the medical clown to relax the caregiver and child, which may have decreased the rate of hospitalization, as was demonstrated previously [23–25] but more work is needed to establish this hypothesis.

The duration of the physical examination by the pediatrician was similar between the medical clown and control group, but children in the medical clown group occupied the examination room significantly longer than the control group because the medical clown started working 10–15 minutes before the pediatrician entered the room and finished 10–15 minutes after the pediatrician left the room. The use of the medical clown had the advantage of relaxing and distracting the child; however, it was more time consuming regarding the ER facilities.

The duration of discomfort before the physical examination was observed to be significantly lower in the medical clown group due to the ability of the medical clown to change the atmosphere in the examination room [8,12] to a more relaxed and “fun” situation, which is probably why we also noticed a decrease in discomfort measured during the actual physical exam. Since the pediatrician was joining the already relaxed atmosphere and was in the “shadows” of the child's attention, the clinician could initiate the physical exam in a more calm atmosphere, which is especially advantageous for children

undergoing examinations needing “quiet areas” (e.g., lung and heart auscultation). This environment is no less important to achieving a general impression of the child’s wellbeing.

Remarkably the discomfort following the physical examination was extremely low in the medical clown group. This might be related partially to the positive effect created by the medical clown and also to the fact that the child was occupied by the clown following the examination for at least 10 additional minutes after the exam.

Caregiver reports in the medical clown group showed a lower rate of anxiety and discomfort. This finding may have been partially due to the ability of the child to be more relaxed in the presence of the medical clown and the formed atmosphere and partially due to the affect of the medical clown on relaxing the caregiver, which had further effect on the relaxation and decreased struggle of the examined child. Caregivers in both groups reported that distraction of the child can improve the outcome and the general experience of the physical examination. Other ways of distraction are also implemented (e.g., television programs and other technical aids).

Surprisingly the caregiver report on the “traumatic” affect of the physical exam showed no significant difference in the groups, which might be related to the phrasing of the question in the caregiver questionnaire or that the word “traumatic” was misunderstood by the caregiver.

The pediatrician reported a lower resistance to the physical exam in the medical clown group. We think that this result is of major importance because a physical examination is the cornerstone in the diagnosis and treatment decisions of the pediatric professional and a more relaxed and less struggling child can improve the outcome of the physical examination. Interestingly, the pediatricians in both groups reported that the crying of the child didn’t interfere with completion of the physical exam. This could be due to the ability of the pediatrician to perform a physical exam while a child is crying; however, the pediatricians reported that in the future when a “difficult child” is encountered, they will ask for the assistance of a medical clown due to the ability of the medical clown to reduce the struggle level of the child, which can improve the outcome of the physical examination.

STUDY LIMITATIONS

The study has some limits. It was not blinded, but blinding was not possible in consideration of the characteristics of the research. The study was also limited to the working hours of the medical clowns and the research assistant.

CONCLUSIONS

Despite these limitations, we consider our study results to be a valid indication that utilizing medical clowns in physical examinations in young children is a major advantage. We have shown that the ability of the medical clown to distract

children between the ages of 2 and 6 years can be useful for the examining pediatrician. It can reduce the distress of the child as well as that of the caregivers, thus enabling the pediatrician to perform a more accurate and meaningful physical exam. A secondary outcome, which also is highly important, was that relaxing the child and caregivers leaves a better feeling about the examination experience.

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Capsule

Neutrophils rip fragments of platelets and induce thrombosis

In critically ill patients, ischemia can result in thrombosis in unrelated organs, partially owing to neutrophil recruitment. **Yuan** et al. combined intravital microscopy of thrombosis after gut ischemia-reperfusion injury with samples from patients with acute respiratory distress syndrome. Rolling neutrophils grabbed and ripped fragments of phosphatidylserine-expressing

dying platelets, thus forming macroaggregates. These macroaggregates induced thrombosis that could not be targeted by conventional therapies such as aspirin. Encouragingly, however, the necrotic factor cyclophilin D had beneficial effects.

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Eitan Israeli

Capsule

Two-step role for mutant TERT promoters

Telomeres preserve genomic stability by preventing chromosomal fusions. The recent discovery that human tumors harbor mutations in the promoter region of the telomerase gene (*TERT*) produced a flurry of research aimed at elucidating the role of these mutations in cancer development. **Chiba** and co-authors presented data that reconcile many of the conflicting results reported to date.

In human melanoma samples and a fibroblast model, *TERT* promoter mutations acted in two steps. First, the mutations allowed cells to proliferate with short telomeres. This action fueled genomic instability and up-regulation of telomerase expression, leading to uncontrolled cell proliferation.

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Eitan Israeli

Capsule

Chromosome 1q21.3 amplification is a trackable biomarker and actionable target for breast cancer recurrence

Tumor recurrence remains the main reason for breast cancer-associated mortality, and there are unmet clinical demands for the discovery of new biomarkers and development of treatment solutions to benefit patients with breast cancer at high risk of recurrence. **Goh** et al. reported the identification of chromosomal copy-number amplification at 1q21.3 that is enriched in subpopulations of breast cancer cells bearing characteristics of tumor-initiating cells (TICs) and that strongly associates with breast cancer recurrence. Amplification is present in approximately 10–30% of primary tumors but in more than 70% of recurrent tumors, regardless of breast cancer subtype. Detection of amplification in cell-free DNA (cfDNA) from blood is strongly associated with early relapse in patients with breast cancer and could also be used to track the emergence of tumor

resistance to chemotherapy. The authors further show that 1q21.3-encoded S100 calcium-binding protein (S100A) family members, mainly S100A7, S100A8, and S100A9 (S100A7/8/9), and IL-1 receptor-associated kinase 1 (IRAK1) establish a reciprocal feedback loop driving tumorsphere growth. Notably, this functional circuitry can be disrupted by the small-molecule kinase inhibitor pacritinib, leading to preferential impairment of the growth of 1q21.3-amplified breast tumors. This study uncovers the 1q21.3-directed S100A7/8/9–IRAK1 feedback loop as a crucial component of breast cancer recurrence, serving as both a trackable biomarker and an actionable therapeutic target for breast cancer.

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