Original Article

Cognitive Emotion Regulation in Children with Acute Lymphoblastic Leukemia

Firoozi M[1], Besharat MA[1], Pournaghash Tehrani S[1]

Abstract

Background: Childhood cancer, as one of the life threatening and most serious health problems, considerably influences the cognitive and social functions of children with cancer and their families; however, surprisingly enough, these children are quite compatible with their peers and even function better emotionally compared with normal children. This matter still remains to be a mystery.

Methods: In this study, the ability of ignoring negative stimuli as a technique of emotion regulation was investigated in children with cancer. For this purpose, 78 children (33 girls and 45 boys aged 3 to 12 years) with pediatric acute lymphoblastic leukemia (ALL), and 89 healthy children (52 girls and 37 boys aged 3 to 12 years) participated in this study. At the first stage, a number of positive, negative and neutral pictures were displayed to children. At the second stage, they were asked to identify the pictures from among a collection.

Results: Data analysis by MANOVA indicated that children with cancer, compared with healthy children, could recognize more positive images than negative ones. Furthermore, it was found that age, sex, duration of hospital stay, duration of disease and financial situation had an effect on the difference between the two groups.

Conclusion: Positive bias memory can explain low depression and lack of symptoms of post traumatic stress disorder in children with ALL. Attention shifting is multifactorial phenomenon and neurologic factors and family support play important role in this happening.

Key words: Child; Acute lymphoblastic leukemia; Emotions; Regulation; Attention

Please cite this article as: Firoozi M, Besharat MA, Pournaghash Tehrani S. Cognitive Emotion Regulation in Children with Acute Lymphoblastic Leukemia. Iran J Cancer Prev.2011; Vol4, No4, P183-188.

1. Department of Psychology, Tehran University, Tehran, Iran

Corresponding Author:
Manijeh Firoozi ,PhD;
Assistance Professor of Health Psychology
Tel: (+ 98) 21 22 95 96 35
Email: Manijeh_firoozi@hotmail.com

Received: 19 Feb. 2011
Accepted: 10 Jul. 2011
Iran J Cancer Prev 2011; 4:183-188

Introduction

Pediatric oncology, as one of the life threatening and most serious health problems, disrupts cognitive and social functioning of children with cancer and cause their families to suffer from its consequences [1]. Chemotherapy-only -treatment has increasingly become the standard of treatment for children with ALL. On the other hand, researchers found that neurocognitive problems in pediatric ALL are very common after chemotherapy [2]. Chemotherapy causes central nervous system injury by oxidative stress as a potential mechanism and this leads to neurocognitive damages such as attention, memory and speed of information processing problems [3]. Studies indicate that children with cancer, especially those with ALL, suffer from psychosocial deficits. Social functions impairment appears in frequency of friendship and also maturation of relationship of these children [4].

Incredibly, most of the relevant studies suggested that children with cancer in the whole and children with ALL in particular function better emotionally compared to their healthy peers [5]. Some theories try to explain these findings, including post-traumatic growth or psychological resilience or biased reporting based on denial [5].

In this paper, it is assumed that the Emotion Regulation Mechanisms (ERM) play a key role in adaptive functioning of children with cancer. Emotion regulation mechanisms refer to all internal, external and exchange processes which operate through monitoring, evaluation and modification of emotional reactions to painful experiences [6].

Emotion regulation, in early childhood, runs as a developmental process [7]. Children are released

from negative emotion by modifying the amount of emotion or through cognitive and psychological processes – which are related to emotion (such as memory, attention and social interactions) – or via generating positive emotions [8].

Gross [9] suggests antecedent-focused versus response-focused emotion regulation. Antecedent-focused is a cognitive strategy which occurs before upcoming stress. However, response-focused happens after the occurrence of stress (Emotion regulation efforts that target pre-pulse processes are antecedent-focused, whereas emotion regulation efforts that target post-pulse processes are response-focused). Attention bias is dependent on response-focused regulation.

Theories with different approaches attempt to reveal the mystery of emotion regulation in children. For example, some researches put emphasis on the distinction between voluntary and involuntary strategies to regulate emotions [10]. Some researchers have indicated that attention shifting is an emotion regulation technique [11]. These studies deal with distraction as a voluntary strategy. However, we focus on distraction as an involuntary technique for special children. Other studies focus on behavioral interventions to increase children's ability to cope with negative emotions [12]. Perhaps, children do not need to function based on our hypothesis (they regulate emotions innately). Cognitive theories concentrate on cognitive planning, thinking, restructuring, long-term maintaining of positive emotion, and applying cognitive coping strategies such as distraction [13]. The findings of Cumberland-Li, et al. [14] suggest that children regulate their emotions by external and internal mechanisms. Cumberland-Li [14] identify a critical role for maternal intervention. Furthermore, he believes that children have a special ability to control their emotions and restrain their anger (avoidance of aggression). In this study, distraction from unpleasant stimuli has been shown as a regulating mechanism, alleviating negative feelings of children with cancer compared to their peers.

Materials and Methods

Participants

Seventy eight (girls=33; boys=45) children with ALL participated in this study. Potential participants were identified from the list of Outpatient Chemotherapy Room and were selected randomly. Eligibility criteria for inclusion in the original study were (1) age between 3 and 12 years; (2) diagnose of ALL ;(3) and having undergone chemotherapy. From the initial list of potential participants, three children did not take part in the research. Eighty nine healthy children (girls=52; boys=37) who were almost identical to the experimental group were selected from four schools.

Variables

Recognizing the pictures were criteria for the evaluation of emotion regulation in children with cancer. Therefore, we selected 25 pictures from the collections available on popular children websites. These websites had more than 250 visitors during a month. Pictures relating to children's playing were applied as positive, pictures relating to hospital and injection were applied as negative and pictures of such objects as shoes and tables were applied as neutral images. Before the test, 5 non-participating children were asked to judge the pictures as positive or negative and to express their agreement or disagreement (0 indicates disagreement and 1 indicates agreement). Finally, Kendall's coefficient of concordance was calculated ($W=0.86$; $P<0.001$). The pictures were exhibited by a 24-inch laptop. A separate room was dedicated to this purpose (to control distraction factors like noisy environment).

Procedure

At the first stage of the experiment, children were displayed 3 categories of pictures randomly and were asked to remember the pictures. There were 6 photographs in each category. At the second stage, a number of the previous pictures along with some new pictures, after a short delay, were exhibited to the participants (9 images were shown at this stage). Then, they were asked to recognize the pictures of the first stage (whether these pictures had been displayed before or not?). Mothers were asked to refrain from interfering with the test process (such as answering instead of their children).

Coding

Encoding was not based on the true or false responses. Rather, we scored the answers based on recalling the positive or negative pictures. In other words, we were seeking the answer to the question of whether children with cancer paid more attention to negative images or to positive ones. Therefore, the number of positive, negative or neutral responses was a criterion for scoring.

Results

General characteristics of the participants are presented in table1. In the cancer group, most of the subjects were boys, and 67.11% of the participants did not go to school (in most of the cases this was due

Table1. General characteristics of the study sample

	Children with cancer (%)	Healthy children (%)
Age	Mean:8.7	Mean: 9.3
Sex:		
Girls	38.9	62.6
Boys	61.10	37.4
Grade:		
Preschool	67.11	32.6
Primary	32.89	67.4
Duration of disease	Mean: 3.4 years	-
Duration of hospital stay	Mean: 2 weeks	-
Residency:		
Tehran	41.3	100
Other cities	58.70	

Table2. Comparison of recalling the pictures between groups

Recalling items	Group	X	SD	F statistic	P-value
Positive	cases	73.15	23.59	277.87	0
	controls	46.32	22.03		
Neutral	cases	54.76	17.11	31.51	0.640
	controls	60.84	14.10		
Negative	cases	39.53	34.35	186.59	0
	controls	61.81	39.89		
Total	cases	81.81	11.6	98.78	0.023
	controls	81.63	12.3		

Table3. MANOVA general F-test and Factors of recalling the negative pictures

Factor	F statistic	P-value	Eta squared
Age	7.76	0.000	0.10
Sex	2.18	0. 74	0.041
Duration of disease	3.26	0	0.11
Duration of hospital stay	2.83	0	0.012
Residency:			
Tehran	0.04	0.35	0.017
Other cities	0.28	0.22	0.015
Financial situation	6.89	0	0.046

to their illness and the necessity to continue treatment). In average, they had been challenged with their illness (duration of disease; M=3.4years) and 41.3% of the cancer patients were living in Tehran.

The prediction of the difference between children with cancer and the control group in remembering positive and negative visual stimuli, as criteria for assessing emotion regulation, was supported. Table 2 revealed that children with cancer had significantly worse mean in recalling the negative items (186.59, P<0.001) and they remembered more positive items even better than the healthy group (277.87, P<0.001).

A MANOVA with two between subject factors, child gender and recalling the pictures, one covariant (education status) and 4 dependent variables (age, duration of disease, duration of hospital stay and residency) was performed to study girls and boys with cancer with respect to their age, duration of disease, duration of hospital stay, residency and financial situation, and how they remembered the pictures. There was a significant interaction of gender× recalling the pictures× age F=7.76 P<0.001 η2=0.10. Univariate tests revealed the younger boys recalled less negative pictures (boys; M=-2.6 SD=0.04). Duration of disease showed a significant interaction to recalling the less negative and more positive images (F=3.26 P<0.001 η2=0.11). The boys displayed a little more impairment in negative recalling (girls; M=-2.4 SD=0.4, boys; M=-2.3 SD=0.7). Hospital stay in the both girls and boys showed an increase in recalling the negative pictures; F=2.83 P<0.001 η2=.012

Table 4. Recalling the pictures and gender in children with ALL

Dependent variables	Children with ALL					
	girls			boys		
	positive	neutral	negative	positive	neutral	negative
Age	2.6 (.054)	1.5 (0.73)	1.8 (0.12)	1.3 (0.3)	1.1 (0.62)	-2.6 (0.04)
Duration of disease	1.7 (0.67)	1.4 (0.39)	-2.4 (0.45)	2.1 (0.43)	0.7 (0.49)	-2.3 (0.7)
Duration of hospital stay	1.8 (0.27)	0.9 (0.81)	-2.1 (0.09)	2.3 (0.25)	0.5 (0.24)	-2.2 (0.6)
Financial situation	1.6 (0.65)	0.6 (0.36)	-2.6 (0.9)	2.4 (0.75)	08 (0.67)	-2.5 (0.6)

Note: Data are M (SD), controlling for education status.

(girls; M=-2.1 SD=.009, boys; M=-2.2 SD=.06). Financial situation demonstrated a connection to recalling the pictures. Both girls and boys who were living in other cities and were far from their home remembered less positive and more negative pictures; F=6.89 P<0.001 η2=0.046 (girls; M=-2.6 SD=0.9, boys; M=-2.5 SD=0.6).

Conclusion

Findings demonstrated that children with cancer recalled more positive pictures than negative ones compared to their healthy peers. The results suggested that children with cancer regulate their negative emotions by restricting attention. These finding is in accordance with the results of previous studies about adjustment to childhood cancer [16, 17, and 18]. Recently, in an interesting experience, it has been discovered that those men who received the double-dose of metyrapone, a drug that inhibits cortisol secretion, demonstrated impaired recall of the negative parts of the story [19]. Furthermore, Chemotherapy as part of standard treatment for ALL in children can cause adrenal suppression even after tapering the dose over 9 days [20]. Low level of cortisol level in children with ALL impairs negative memory. Apparently, reduced cortisol level led to more adjustment in children with ALL. Most studies have failed to show higher levels of post traumatic stress disorder (PTSD) in children with cancer compared to healthy children [21, 22]. The present study confirms these results. Symptoms of PTSD include prolonged and repeated trauma in the mind. Limitation of attention to aversive stimuli leads to preventing the repetition in the mind.

Based on numerous studied, survivors of childhood cancer, in the head ALL, displayed low depression [23, 24]. These findings can be explained by results of the present study. Positive versus negative focused attention is the important key to understanding why children with cancer, despite facing difficulties, obtain low depression score. Depressed patients almost demonstrate a bias in attention. They pay attention to just negative stimuli and interpret life events fit to their filtered attention [25]. Our results show that children with ALL reveal a positive bias in their attention. The function of positive-focused attention is in sharp contrast to negative-focused attention and the brain cannot simultaneously handle both processes. Therefore, positive filter overcome. A number of mechanisms are involved in attention switching. For example, Imaging studies using fMRI and Pet techniques reveal prefrontal activation patterns that are related to amygdale activity in adults. In other words, prefrontal activation affects Amygdala, which produces emotion, by mediating cognitive processes. Persons reappraise threatening experience by prefrontal lob. Prefrontal cortex reduces or increases sending signals to the Amygdala, and based on these signal patterns, Amygdala changes hormones secretion [26, 27]. However, children regulate their emotions in different ways. Children cannot interpret unpleasant events to prevent the surge of emotions, because the prefrontal lobe is immature [28] but, they automatically have limitations in focusing on the negative stimuli. Perhaps, Amygdala activity is controlled by other mechanisms. Amygdala activity control by other mechanism. For example, when neurons of Amygdala are activated more than usual, the level of their activity comes back to the base line.

In addition to studies in the field of pediatric oncology, Seligman [29] found that children showed resistance for learning hopelessness and depression. He believes that children are invulnerable to negative cognitive bias; and this is vital to the survival of generations. Furthermore, family as a

supportive factor plays an important role in good adjustment demonstrated by children with cancer [30, 31]. Family encourages the child to fight the illness; particularly, parents try to distract children's attention from unpleasant events. This behavioral model is gradually established in children and they become skillful in applying it.

Phips [31] showed a higher incidence of a repressive adaptive style in children with cancer which is then maintained over time. We believe that both mechanisms (repressive adaptive style and attention shifting) are similar to each other but not in all aspects. In the repressive adaptive style, children perceive negative stimuli and then suppress them; however, in the attention shifting, they have limited perception.

Acknowledgment

We, the authors, wish to thank the children with cancer who participated in this study.

Conflict of Interest

There is no conflict of interest in this article.

Authors' Contribution

MF and MAB designed the study. MF collected the data and wrote the paper. HF contributed in analyses of the data. All authors read and approved the final manuscript.

Reference

1. Rourke MT, Hobbie WL, Schwartz L, Kazak AE. Posttraumatic stress disorder in young adult survivors of childhood cancer. Pediatric Blood Cancer. 2007; 49: 177–182.

2. Mulhern RK, Fairclough D, Ochs J. A prospective comparison of neuropsychological performance of children surviving leukemia who received 18-Gy, 24-Gy or no cranial radiation. Journal of Clinical Oncology, 1991; 9: 1348-56.

3. Stephanie LS, Kevin RK, Marilyn H, Neelam J, Eriksen HR, Hanninen O. Oxidative Stress and Neurobehavioral Problems in Pediatric Acute Lymphoblastic Leukemia Patients Undergoing Chemotherapy. Journal of Pediatric Hematology/Oncology. 2010; 32 (2): 113-18.

4. Lund LW, Schmiegelow K, Rechnitzer C, Johansen C. A systematic review of studies on psychosocial late effects of childhood cancer structures of society and methodological pitfalls may chalange the conclusions. Pediatric Blood Cancer. 2011; 56(4): 532-43.

5. Langeveld NE, Stam H, Grootenhuis MA, Last BF. Quality of life in young adult survivors of childhood cancer. Support Care Cancer. 2002; 10(8): 579-600.

6. Phipps S. Adaptive Style in Children with Cancer: Implications for a Positive Psychology Approach Journal of Pediatric Psychology. 2007; 32, 1055–66.

7. Davidson RJ, Putnam KM, Larson CL. Dysfunction in the neural circuitry of emotion regulation a possible prelude to violence. Science. 2000; 289, 591–4.

8. Thompson RA. Emotion regulation: A theme in search of definition. The development of emotion regulation: Biological and behavioral considerations. Child Development. 1994; 59, 425-33.

9. Gullone E, King NJ, Tonge B. The normative development of emotion regulation strategy use in children and adolescents: a 2-year follow-up study. Journal of Child Psychology and Psychiatry. 2010; 51, 567-74.

10. Gross JJ, Richards JM, John OP. Emotion regulation in everyday life. In DK Snyder, JA Simpson, JN Hughes (Eds.). Emotion regulation in families: Pathways to dysfunction and health, 2010; Washington DC: American Psychological Association.

11. White LK, Helfinstein SM, Reeb-Sutherland BC. Role of attention in the regulation of fear and anxiety. Development Neuroscience. 2009; 31: 309-17.

12. Bloomquist ML, Schnell SV. Helping children with aggression and conduct problems: Best practices for intervention, 2002; New York: Guildford Press.

13. Derryberry D, Reed MA. Regulatory processes and the development of cognitive representations. Development and Psychopathology. 2011; 8: 215–34.

14. Cumberland-Li A, Eisenberg N, Champion C, Gershoff E, Fabes RA. The relation of parental emotionality and related dispositional traits to parental expression of emotion and children's social functioning. Motivation and Emotion. 2003; 27(1): 27–56.

15. Kersun LS, Rourke MT, Mickley M, Kazak AE. Screening for Depression and Anxiety in Adolescent Cancer Patients. Journal of Pediatric Hematology/Oncology. 2009; 31: 835-9.

16. Frank NC, Blount RL, Brown RT. Attributions, coping and adjustment in children with cancer. Journal of Pediatric Psychology. 1997; 22: 563–76.

17. Bonanno GA. Loss, trauma and human resilience: Have we underestimated the human capacity to thrive after extremely aversive events. American Psychologist. 2004; 59: 20–28.

18. Barakat LP, Alderfer MA, Kazak AE. Posttraumatic growth in adolescent survivors of cancer and their mothers and fathers. Journal of Pediatric Psychology. 2006; 31: 413–9.

19. Tollenaar MS, Bernet M, Elzinga BM, Spinhoven P, Everaerd W. Immediate and prolonged effects of cortisol, but not propranolol, on memory retrieval in healthy young men. Neurobiology of Learning and Memory.2009; 91: 23–31.

20. Ng AC, Kumar SK, Russell SJ, Rajkumar SV, Drake MT. Dexamethasone and the risk for adrenal suppression in multiple myeloma. Lukemia. 2009; 23 (5): 1009-11.

21. Rourke MT, Hobbie WL, Schwartz L, Kazak AE. Posttraumatic stress disorder (PTSD) in young adult survivors of childhood cancer. Pediatric Blood Cancer. 2007; 49: 177–82.

22. Schwartz L, Drotar D. Posttraumatic stress and related impairment in survivors of childhood cancer in

early adulthood compared to healthy peers. Journal of Pediatric Psycholology. 2006; 31: 356–66.

23. Bennett DS. Depression among children with chronic medical problems: A meta-analysis. Journal of Pediatric Psychology. 2004; 19: 149–69.

24. Dejong M, Fombonne E. Depression in pediatric cancer: An overview. Psycho-Oncology. 2006; 15: 553-66.

25. Leung KK, Lee TMC, yip P, LSW li, Wong MMC. Selective attention biases of people with depression: Positive and negative priming of depression-related information. Psychiatry research. 2009; 165 (3): 241-51.

26. Phan KL, Wager T, Taylor SF, Liberzon I. Functional neuroanatomy of emotion: A meta-analysis of emotion activation studies in PET and fMRI. Neuroimage. 2002; 16: 331-48.

27. Scherer K, Schorr A, Johnstone T. Appraisal processes in emotion: Theory, methods, research, 2001; New York: Oxford University Press.

28. Tsujimoto S. The Prefrontal Cortex: Functional Neural Development during Early Childhood. Neuroscientist. 2008; 14: 345-58.

29. Seligman M. Learned optimism, 1991; New York: Knopf.

30. Phipps S, Larson S, Long A, Rai SN. Adaptive style and symptoms of posttraumatic stress in children with cancer and their parents. Journal of Pediatric Psychology. 2006; 31: 298–309.

31. Kristen E, Robinson KE, Cynthia A, Gerhardt CA, Vannatta K, Gerhardt CA, et al. Parent and Family Factors Associated with Child Adjustment to Pediatric Cancer Pediatric. Psychology. 2007; 32: 400-10.