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Abstract

To evaluate the sensitivity of diagnostic criteria for post-traumatic stress disorder (PTSD) in pre-school aged children involved in a gas explosion, post-traumatic symptoms of the children were investigated four times after the accident, immediately, 10 days, 6 months, and 1 year late. Using symptoms on 6 months after the accident, sensitivity of diagnostic criteria was assessed by comparing the fourth edition of the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders (DSM-IV), and alternative criteria for infants and young children (Scheeringa et al. 1995). In addition, published Child Post-traumatic Stress Disorder Reaction Index (CPTSD-RI) and its modified version proposed by us were also evaluated their sensitivity to rate the symptoms.

Girls had a tendency to show more post-traumatic symptoms than boys. Although no children met the DSM-IV criteria for PTSD, eight children out of 32 were diagnosed as PTSD with alternative criteria. With our modified CPTSD-RI, all eight children were statistically more distinguishable from those without PTSD than with original one.

Our data indicate that the sensitivity of DSM-IV and CPTSD-RI in rating symptoms of pre-school aged children is not sufficient. Alternative criteria of

DSM-IV and modified version of CPTSD-RI would be the better choice in this age group.

Key words: post-traumatic stress disorder, pre-school aged children, diagnostic criteria.

Abbreviations: PTSD (post-traumatic stress disorder), DSM-IV (the fourth edition of the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders), DSM-III-R (the third edition of the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders revised), CPTSD-RI (Child Post-traumatic Stress Disorder Reaction Index).

Introduction

Post-traumatic stress disorder (PTSD), a natural emotional reaction to a deeply shocking and disturbing experience, is defined in the fourth edition of the American Psychiatric Association's Diagnostic and Statistical Manual (DSM-IV) [2]. The diagnosis is well established in adults, adolescents, and preadolescent children. However, studies of PTSD in infants and young children have not been conducted extensively. Although an existence of PTSD in young children is well recognised [6, 14], diagnostic criteria are not fully established. Scheeringa et al. assessed reliability and validity of DSM-IV criteria and alternative set of criteria proposed by them in infants and young children [3, 10]. They found alternative criteria were more reliable and more valid for diagnosing PTSD in infancy than DSM-IV criteria. In this report, we used and assessed sensitivity both DSM-IV and alternative criteria to diagnose 32 pre-school aged children, who were encountered a gas explosion accident in a nursery school. Furthermore, we modified Child Post-traumatic Stress Disorder Reaction Index (CPTSD-RI) based on alternative criteria, and applied in our cases. Alternative criteria and modified CPTSD-RI were revealed to be more sensitive and reliable tool to assess PTSD in pre-school aged children.

Methods

On October 12th 1998, leaking liquefied petroleum gas for cooking exploded in a nursery school in Shibetsu, Hokkaido, Japan. Thirty two children and a nursery nurse were involved in the accident. Eleven children were slightly burnt or wounded with no need of hospitalisation. The nurse was fairly burnt and hospitalised for a couple of months. To help prevent and minimise PTSD for the children, group consultations of their mothers by the paediatric psychiatrist were carried out, on 1 and 7 months after the accident. Personal consultations with interview or telephone by the general psychiatrist, paediatrician or public health nurses were also provided on request.

Study subjects were all the 32 children involved, aged 32 to 73 months (male: 21, female: 11), and their mothers. No children have shown distinct developmental delay. We have interviewed the mothers and filled questionnaires on 10 days, 6 months and 1year after the accident. On 10 days after the accident, immediate symptoms of the children were also inquired with recollection. In the questionnaires, following 12 items [16] concerning symptoms of their children were asked.

(1) Bed wetting and thumb sucking (regression to an earlier behavioural stage).

(2) Fear of the darkness and “monsters” (regression to an earlier behavioural stage).

(3) Fear of the sound and place relating to the disaster (regression to an earlier behavioural stage).

(4) Loss of appetite, excessive eating, apepsia and vomiting (physiological reaction).

(5) Constipation and increased frequency of urination (physiological reaction).

(6) Unexplainable aches and pains (physiological reaction).

(7) Fear of left alone / clinging (emotional and behavioural reaction).

(8) Withdrawal (emotional and behavioural reaction).

(9) Irritability and aggressive behaviour (emotional and behavioural reaction).

(10) Hyperactivity and loss of concentration (emotional and behavioural reaction).

(11) Difficulty falling and staying asleep and night terrors (emotional and behavioural reaction).

(12) Speaking of the traumatic event over and over, and exaggerated stories about it (emotional and behavioural reaction).

For diagnosing PTSD with symptoms on 6 months after the accident, both DSM-IV and alternative criteria [3, 10] were used and compared each other. For rating the post-traumatic symptoms, CPTSD-RI [4, 9, 15] and the modified CPTSD-RI were used. Tables 1 and 2 show the symptoms listed under DSM-IV and alternative criteria, **Table 1** **Table 2**

CPTSD-RI items, and corresponding items in our questionnaire of (1) to (12). CPTSD-RI items were composed on the basis of DSM-III-R [1] or DSM-IV criteria. Thus, we modified CPTSD-RI (Table 3) to rate post-traumatic symptoms for pre-school aged child on the basis of alternative criteria, and applied it to our cases. **Table 3**

The positive ratios of the post-traumatic symptoms and percentages of PTSD according to characteristics of the children were compared by Fisher's exact probability test. The numbers of positive CPTSD-RI and modified CPTSD-RI items in children with PTSD were compared with those without PTSD using Mann-Whitney U test.

Results

Distributions of sex, burn and wound, and age were not statistically different among subjects. Immediately after the accident, 30 out of 32 children presented more than one post-traumatic symptom. The appearance ratios of the post-traumatic symptoms were compared among groups in terms of sex, age, and the presence of burn and wound. Girls tended to show symptoms of bed wetting and thumb sucking immediate after the accident (girl: 9/11 vs. boy: 9/21, P=0.06: Fisher's exact probability test), and fear of the sound and place relating to the accident on 6 months after the accident (girl: 3/11 vs. boy: 0/21, P=0.03: Fisher's exact probability test). The

appearance ratios of other symptoms were not significantly different in terms of age, sex, and presence of burn and wound. Figure 1 shows the trends in the number of children with positive items in our questionnaire. In three items, bed wetting and thumb sucking (Fig 1A), fear of the darkness and "monster" (Fig 1B), and hyperactivity and loss of concentration (Fig 1J), the positive number of children have not changed basically during one year after the accident . Interestingly, in two items, fear of the sound and place relating to the disaster (Fig. 1C) and post-traumatic play and stories (Fig. 1L), the positive number, once decreased at 10 days after the accident, recovered initial level or even more at 6 months and one year. **Figure 1**

Both in DSM-IV and alternative criteria, timing of application is determined at one month or more after the accident. Thus, we applied these criteria with symptoms on 6 months after the accident. Table 4 shows the number of the children with positive response in the criteria. No children met DSM-IV criteria. On the other hand, 8 children were diagnosed as PTSD with alternative criteria. Percentages of PTSD diagnosed with alternative criteria were not statistically different among children according to their characteristics (Data are not shown). PTSD-RI and modified PTSD-RI were also applied to our cases. The numbers of children with positive items in both reaction indexes were shown in Table 5. We also counted the number of **Table 4** **Table 5**

positive items in each child individually. Figure 2 shows the distribution in the number of positive items among PTSD negative and positive children diagnosed by alternative criteria. The children with PTSD were more statistically distinguishable from those without PTSD by modified CPTSD-RI than CPTSD-RI. **Figure 2**

Discussion

The present analysis illustrates that DSM-IV criteria and CPTSD-RI on the basis of DSM-III-R or DSM-IV criteria were not sensitive enough to diagnose PTSD in pre-school aged children. To date, only Scheeringa ~~MS~~ et al. has pointed out this problem, and they proposed alternative criteria for younger children [3, 10]. In alternative criteria, observable behaviours were incorporated, and subjective experiences, those are thoughts and feelings, difficult to be rated reliably in preverbal or barely verbal children, were deleted from DSM-IV. CPTSD-RI items were composed on the basis of DSM-III-R or DSM-IV criteria and should be basically applied in a self-reported fashion. Because children do not usually develop the ability to recall a memory from the past and communicate it to others before the age of about 5 years [5], rating post-traumatic symptoms with self-reported CPTSD-RI items supposed to be unreliable in pre-school aged children. We modified CPTSD-RI with incorporating

observable behaviour and deleting subjective experiences, and proposed new rating system on the basis of alternative criteria. Alternative criteria and modified CPTSD-RI were revealed to be more sensitive to diagnose PTSD and to rate post-traumatic symptoms in our cases than DSM-IV criteria and CPTSD-RI.

In accordance with previous studies [7, 11, 12], in which most of the study subjects were adolescents, and preadolescent children, the present study indicated that girls tended to show more post-traumatic symptoms than boys also in pre-school aged children. In previous studies, the reasons why girls tended to show post-traumatic symptoms were not discussed sufficiently. Whether the children were burnt/wound or not was unrelated to the appearance rate of the symptoms. In this accident, physical trauma of the children might be too slight to cause serious psychic trauma. Although two items, the expression of fear and play relating to the accident, seems to be masked shortly after the accident, the symptoms surfaced after 6 months (Fig. 1, C and L). The phenomenon of this suppression of the symptoms could be an interesting subject to study. Children might be eased to express fear and play with relieving environment and the development of cognitive and expressive skills with growing. On the interview, we suggested the mothers not to restrain their children from talking about the accident and post-traumatic play.

There are some limitations in our study. First, we estimated post-traumatic symptoms not by the direct interview with children, but by the interview with their mothers. In Japan, parents are generally unwilling to let investigators to interview their children directly, especially pre-school aged children. In such a case, alternative criteria and modified CPTSD-RI were supposed to be more suitable to diagnose and rate post-traumatic symptoms, as those measures made more account of observable behaviours than subjective experiences. It was unlikely that fear of the mothers immediately after the accident might influence on high prevalence of the post-traumatic symptoms immediately and 10 days after the accident. The appearance ratio of some items in the questionnaire 6 months and 1 year after the accident, when mothers probably had already recovered from their fear, was higher than that immediately and 10 days after the accident. Second, the number of the subjects was not sufficient for analysis. In Japan, post-traumatic symptoms in children were drawn attention recently. In moderate number of clinical reports concerning to disasters, almost all subjects were recruited from school aged children [8, 13]. This study was a preliminary report concerning post-traumatic symptoms in pre-school aged children, in Japan. We expect that future research with larger samples will clarify the adequacy and sensitivity of the alternative criteria and modified CPTSD-RI for pre-school aged children. Third, cases

were selected only in a gas explosion accident. Alternative criteria and modified CPTSD-RI might not be suitable for the pre-school aged children with other types of psychic trauma. We expect future studies concerning various types of trauma in infancy and early childhood. Fourth, we did not compare the children with normal control. In the interview, however, we inquired the mothers whether the behaviour and emotional response of their children were different from those before the accident. The children before the accident had been normally developed.

Post-traumatic symptoms do appear to exist in pre-school aged children exposed to traumatic events. The alternative criteria proposed by Scheeringa et al were more sensitive to detect PTSD in pre-school aged children than DSM-IV criteria. We proposed diagnostic tool for rating post-traumatic symptoms in pre-school aged children on the basis of alternative criteria. We hope that our preliminary investigation would encourage clinicians to pay more attention to post-traumatic symptoms of pre-school aged children.

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Table 1. DSM-IV criteria, CPTSD-RI items and corresponding items of post-traumatic symptoms in our questionnaire.

DSM-IV diagnostic criteria			CPTSD-RI items	Items in our questionnaire
A	1	Identified as traumatic (essential symptom)	• Identified as traumatic	
	2	Regular fear (essential symptom)	• Regular fear	
B	1	Repetitive images and thoughts	• Repetitive images	(12)
			• Repetitive thought	(12)
	2	Nightmares	• Nightmares	
	3	Fear of recurrence	• Fear of recurrence	(12)
	4	Upset by reminders	• Upset by reminders	
	5	Somatic complaints	• Somatic complaints	(4), (5), (6)
C	1	Emotional avoidance	• Emotional avoidance	(3)
	2	Social avoidance	• Social avoidance	(3)
	3	Inability to recall an important aspect of the trauma		
	4	Anhedonia	• Anhedonia	
	5	Emotional detachment	• Emotional detachment	
	6	Emotional numbing	• Emotional numbing	
	7	Sense of a foreshortened		
D	1	Sleep disturbance	• Sleep disturbance	(11)
	2	Behaviour outburst	• Behaviour outburst	(9)
	3	Memory difficulties and concentration difficulties	• Memory difficulties	(10)
			• Concentration difficulties	
	4	Hypervigilance		(2)
	5	Easily startled	• Easily startled	(3)
E	The symptoms on Criteria B (at least one of the symptom), C (at least three of the symptom) and D (at least two of the symptom) last for more than one month			
F	The disturbance causes clinically significant distress or impairment in social, occupational or other important areas of functioning.			
—			• Guilt	
—			• Sense of foreshadowing	

Table 2. Alternative criteria, DSM-IV criteria and corresponding items of post-traumatic symptoms in our questionnaire.

	Alternative criteria	DSM-IV criteria	Items in our questionnaire
A			
	1 Identified as traumatic (essential symptom)	A1	
B	Re-experiencing. One item needed.		
	1 Repetitive images and thoughts	B1	(12)
	2 Play re-enactment		
	3 Recurrent recollections of the traumatic event		(12)
	4 Nightmares	B2	(11)
	5 Fear of recurrence	B3	(12)
	6 Distress at exposure to reminders of the event		(3)
C	Numbing of responsiveness. One item needed.		
	1 Constriction of play		(12)
	2 Socially more withdrawn		(8)
	3 Restricted range of affect		(8)
	4 Loss of acquired developmental skills		(1)
D	Increased arousal. One item needed.		
	1 Night terrors	D1	(11)
	2 Difficulty going to sleep	D1	(11)
	3 Night-walking	D1	(11)
	4 Decreased concentration	D3	(10)
	5 Hypervigilance	D4	(2)
	6 Exaggerated startle response	D5	(3)
E	New fears and aggression. One item needed.		
	1 New aggression.		(9)
	2 New separation anxiety.		(7)
	3 Fear of toileting alone.		
	4 Fear of the dark.		(2)
	5 Any other new fears of things or situation not obviously related to the trauma.		
F	Duration of disturbance greater than one month.	E	

Note: No item in alternative criteria corresponds to our questionnaire items of (4), (5) and (6).

Table 3. A set of items (modified CPTSD-RI), alternative criteria and corresponding items of post-traumatic symptoms in our questionnaire.

Modified CPTSD-RI items	Alternative criteria	Items in questionnaire
Identified as traumatic	A1	
Repetitive images	B1	(12)
Repetitive thought	B1	(12)
Nightmares	B4	(11)
Fear of recurrence	B5	(12)
Easily startled	D6	(3)
Sleep disturbance	D2	(11)
Memory difficulties	D4	(10)
Concentration difficulties	D4	(10)
Somatic complaints		(4), (5), (6)
Behaviour outburst	E1	(9)
Loss of acquired developmental skill	C4	(1)
New separation anxiety	E2	(7)
Fear of toileting alone	E3	
Fear of the dark	E4	(2)

Table 4. The number of the children with positive response in DSM-IV and alternative criteria on 6 months after the accident.

DSM-IV criteria	positive response n	Alternative criteria	positive response n
A1	32 /32	A1	32 /32
A2	—	B1	9 /32
B1	9 /32	B2	—
B2	—	B3	9 /32
B3	9 /32	B4	1 /32
B4	—	B5	9 /32
B5	0 /32	B6	19 /32
C1	19 /32	C1	9 /32
C2	19 /32	C2	0 /32
C3	—	C3	0 /32
C4	—	C4	3 /32
C5	—	D1	1 /32
C6	—	D2	1 /32
C7	—	D3	1 /32
D1	11 /32	D4	0 /32
D2	9 /32	D5	6 /32
D3	0 /32	D6	19 /32
D4	6 /32	E1	1 /32
D5	19 /32	E2	7 /32
E	—	E3	—
F	—	E4	6 /32
		E5	—
		F	—
met criteria	0 /32	met criteria	8 /32

—: not rated.

Table 5. The number of children with positive items in CPTSD-RI and modified CPTSD-RI on 6 months after the accident.

CPTSD-RI items	positive n		Modified CPTSD-RI items	positive n	
Identified as traumatic	32	/32	Identified as traumatic	32	/32
Regular fear	—		Repetitive images	9	/32
Repetitive images	9	/32	Repetitive thought	9	/32
Repetitive thought	9	/32	Nightmares	1	/32
Nightmares	1	/32	Fear of recurrence	9	/32
Fear of recurrence	9	/32	Easily startled	19	/32
Anhidonia	—		Sleep disturbance	1	/32
Emotional detachment	—		Memory difficulties	0	/32
Emotional avoidance	19	/32	Concentration difficulties	0	/32
Emotional numbing	—		Somatic complaints	0	/32
Easily startled	19	/32	Behaviour outburst	1	/32
Sleep disturbance	1	/32	Loss of acquired skill	3	/32
Memory difficulties	0	/32	New separation anxiety	7	/32
Concentration difficulties	0	/32	Fear of toileting alone	—	
Social avoidance	0	/32	Fear of the dark	6	/32
Upset by reminders	—				
Somatic complaints	0	/32			
Behaviour outburst	1	/32			
Guilt	—				
Sense of foreshadowing	—				

—: not rated.

Figure legends

Figure 1. Trends in the number of children with positive items in our questionnaire.

Figure 2. Distribution in the number of positive CPTSD-RI and modified CPTSD-RI items among PTSD negative and positive children diagnosed by alternative criteria. Mann-Whitney U test was used to compare the numbers of positive items in PTSD positive children with those in PTSD negative children.

Figure 1. Trend in the number of children with positive items in our questionnaire.

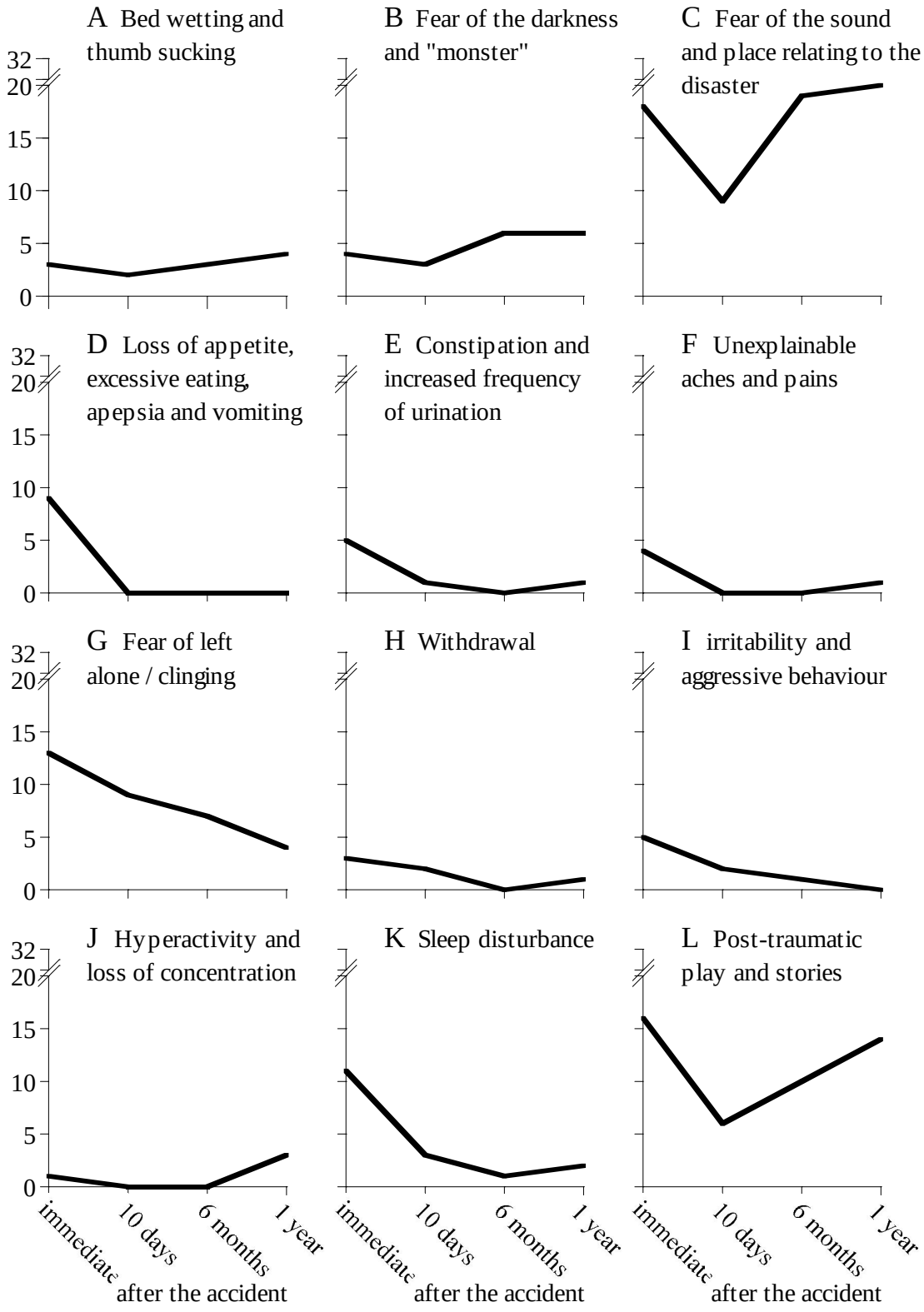

Figure 2. Distribution in the number of positive CPTSD-RI and modified CPTSD-RI items among PTSD negative and positive children diagnosed by alternative criteria.