Pain 108 (2004) 58–66

PAIN

www.elsevier.com/locate/pain

A quantitative somatosensory testing of pain threshold in individuals with mental retardation

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Received 12 May 2003; received in revised form 21 September 2003; accepted 1 December 2003

Abstract

The commonly held view, mainly based on behavioral observations, is that individuals with mental retardation (MR) have a decreased sensitivity to pain. However, the sensitivity to noxious stimuli was not systematically measured in these individuals. For this purpose we developed an experimental protocol with which we trained individuals with mild MR (unspecified MR and Down's syndrome) in heat-pain threshold (HPT) measurement on the hand, and then performed the measurement using both the method of limits (MLI) which relies on reaction time (RT) and the method of levels (MLE) which is RT-free. This allowed for an indirect assessment of the RT and conduction velocity (CV) of these individuals. We found that HPT in individuals with unspecified MR (41.23 ± 1.86 °C) and Down's syndrome (40.96 ± 2.93 °C) was significantly lower than that of controls (42.86 ± 2.42 °C) when measured with the MLE ($P < 0.05$). With the MLI no significant differences in HPT were found between the groups. However, the RT and CV values of individuals with unspecified MR and Down's syndrome were significantly lower compared to controls (e.g. mean RT of 1.86 and 2.55 compared to 1.2 s, respectively, $P < 0.01$). From this work it would appear that individuals with MR are not only pain-sensitive, but also more sensitive to heat-pain than normal. It is suggested that computerized quantitative testing of pain threshold is feasible in individuals with MR preferably by using RT-free methods (e.g. the MLE) due to the low RT and CV values exhibited by them.

Keywords: Heat-pain threshold; Mental retardation; Down's syndrome; Limits; Levels

1. Introduction

Measurement of pain in individuals with mental retardation (MR) is important if pain is to be effectively dealt with in these individuals. Studies show that individuals with MR are frequently exposed to painful conditions and painful medical procedures (Schwartz et al., 1999; Stallard et al., 2001; Turk et al., 1997) and that they exhibit premature aging, resulting in a greater tendency towards morbidity and deconditioning (Ashman and Suttie, 1996; Carmeli and Coleman, 2002; McCarthy and Mullan, 1996). Yet caregivers seem to underestimate their painful experiences and complaints. Individuals with MR are prescribed and administered with significantly less analgesic medications compared to controls and in some instances active treatment is denied even when everyday pain is common (Dawson, 1998; Feldt et al., 1998; Horgas and Tsai, 1998; Kaasalainen et al., 1998; Malviya et al., 2001; Stallard et al., 2001).

Under-treatment of individuals with MR may be based on the assumption that these individuals have lowered sensitivity to pain. This assumption is based on observational studies and case reports. Biersdorff (1994) reported that 25% of individuals with MR observed, behaved in a manner that suggests they have high pain thresholds. In several instances, preventable but serious medical complications developed in individuals with MR, in conditions where pain was involved (Jancar and Speller, 1994; Roy and Simon, 1987). These were ascribed to a decreased sensitivity to pain; the actual sensitivity to pain however, was not measured in either of these studies.

Recently, Hennequin et al. (2000) measured cold-pain threshold in individuals with Down's syndrome by measuring the time elapsed from the application of an ice cube on the skin to the first expression of pain. The authors concluded that these individuals have higher pain thresholds

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0304-3959/$20.00
doi:10.1016/j.pain.2003.12.003

compared to controls. Such measurement is biased by a reaction time (RT) artifact. The RT, comprised of both peripheral and central components might be altered in individuals with MR. Individuals with Down's syndrome were found to have motor performance difficulties and slower conduction velocity (CV) compared to normal (Brandt and Rosen, 1995; Henderson, 1987). Individuals with MR might also exhibit central processing delays (Goodkin, 1980). Thus, higher pain thresholds in individuals with MR obtained with RT-dependent methods might result from an elongated RT.

Pain threshold, defined as the smallest amount of stimulus energy necessary to produce pain sensation can be regarded as an indicator of the organism's sensitivity to pain (Gescheider, 1985; Gracely, 1999; Harris and Rollman, 1983; Price, 1994). Its measurement in individuals with MR may reveal whether indeed their normal sensitivity to pain is decreased. We measured heat-pain threshold (HPT) in these individuals with both the RT-dependent method of limits (MLI) and the RT-free method of levels (MLE; Gescheider, 1985; Gracely, 1989). The use of these methods enabled the assessment of RT and CV. We also developed a procedure with which individuals with MR are pre-trained in threshold measurements. To the best of our knowledge, this is the first attempt to conduct quantitative somatosensory testing of HPT in individuals with MR.

2. Methods

2.1. Subjects

Twenty-five individuals (13 males and 12 females) with mild MR (mean age 37.72 years, range 22–56) and 14 normal controls (7 males and 7 females; mean age 36.35, range 24–54) participated in the experiment. Table 1 provides details of the age and sex distribution of the participants. The individuals with MR (14 with unspecified MR and 11 with Down's syndrome) were recruited from three boarding hostels. We included only those individuals with an asserted diagnosis of MR documented with an IQ of at least 66 (Grossman, 1983), or diagnosis by a psychiatrist of a mild or mild to moderate MR, with free ability to communicate verbally and to express emotions and sensory experiences. Normal controls were recruited from the university staff. Exclusion criteria for all individuals were: chronic or acute pain anywhere in the body, an intake of analgesic medications during the days of the experiment, any condition that might affect sensibility (e.g. diabetes mellitus), status post-fractures, and irregularities of the skin of any kind (e.g. bruises).

Table 1
Age and sex distribution of the participants in the three study groups

Age (years)	Controls ($n = 14$)		Unspecified MR ($n = 14$)		Down's syndrome ($n = 11$)	
	Males	Females	Males	Females	Males	Females
20–30	3	2	2	1	4	2
31–40	2	2	4	1	1	1
41–50	1	1		2		
51–60	1	2	1	3	1	2
Total	7	7	7	7	6	5

Prior to the study, all individuals with MR and controls were trained in pain threshold measurement and the results obtained in the training sessions were discarded. Since it is imperative for individuals with MR to feel comfortable in their environment in order to reduce their anxiety as much as possible, we conducted the experiments in the familiar surrounding of their rooms, with the caretaker present in the room. The caretaker was seated in a remote area of the room in order to avoid eye contact between him and the tested individual during the testing and was instructed not to interfere with the experimental procedure. The controls were tested in the laboratory at the University with no additional person present during the testing. Testing took place in a quiet room, with the individual sitting in an armchair, with the tested hand held on a holder. The measurement of HPT was conducted on the dorsal surface of each of the left and right hands, twice with each testing method.

The experiment was approved by the human rights committee of Tel-Aviv University and by the legal guardians of all the cognitively impaired individuals. An informed consent was obtained from all control participants and from all the guardians of the individuals with MR, after explaining the aims of the study and its protocol as well as the fact that they are not obliged to participate in the study and can withdraw from it when and if they wish to do so. In addition, an oral consent was obtained from the individuals with MR, to whom we explain and demonstrated the procedure of the experiment and also explained that they were not obliged to participate and that they could withdraw from the experiment whenever they wish to do so.

2.2. Equipment

Thermal stimuli were delivered using a Peltier-based, computerized thermal stimulator (TSA 2001, Medoc Inc., Israel) with a 3×3 cm^2, contact probe. The principles of the Peltier stimulator have been described elsewhere (Frustorfer et al., 1976; Verdugo and Ochoa, 1992; Wilcox and Giesler, 1984). Briefly, the computer-driven Peltier element delivers thermal stimuli to preset temperatures at rates of up to 10 °C/s determined by an active feedback system. The maximal temperature range of the stimulator is set to 0–51 °C in order to prevent skin damage. The temperature levels are monitored by a thermistor placed at the interface between the active element of the probe and the inner surface of the probe. A passage of a current through the Peltier element produces the pre-programmed temperature