



## Clinical note

## Pain flashbacks following the July 7th 2005 London bombings

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**Abstract**

Flashbacks in posttraumatic stress disorder (PTSD) are commonly experienced as visual, auditory, olfactory or tactile re-livings of a previously experienced traumatic event. We present the case report of one survivor of the July 7th 2005 London underground bombings who was diagnosed with PTSD and who experienced painful flashbacks. We present retrospective multidimensional measures of his pain using standardised instruments. The case provides further evidence that somatosensory re-experiencing of pain memories is possible. Findings are discussed with regards to memory for pain.

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**1. Introduction**

A diagnosis of post-traumatic stress disorder (PTSD) may follow exposure to an extreme stressor and is characterised by symptoms in three categories, (a) re-experiencing of the event in the form of nightmares, flashbacks or intrusive recollections, (b) avoidance of reminders of the event, and emotional numbing, and (c) increased arousal. The key set of symptoms for any theory of PTSD to explain is the re-experiencing cluster. Flashbacks are most commonly experienced visually or auditorily, but can also be experienced in other modalities (e.g. Shin et al., 1999). This raises the important question of whether PTSD may sometimes involve the re-experiencing of pain.

One recent report described case studies of two patients with PTSD who experienced painful flashbacks after regaining consciousness while under general anaesthesia (Salomons et al., 2004). In both cases the pain sensations in the flashbacks were similar to the pain experienced during surgery, and were triggered by stim-

uli associated with the operation (e.g. the sight of surgical scrubs). Only one other previous paper reported the traumatic re-experiencing of pain. Schreiber and Galai-Gat (1993) described the case of a soldier who lost his left eye and who recurrently re-experienced headaches for several years following the event. In this case the patient reported that the headaches felt the same as pain he had felt in the hospital prior to surgery (“*That’s the pain that comes back now, all the time*”). Importantly, these cases suggest that it is possible to experience memories of pain in a somatosensory fashion, i.e., accompanied by an actual experience of pain.

These examples are particularly interesting because while previous studies have found evidence for the accurate recall of pain (Beese and Morley, 1993), albeit with occasional biases (e.g. Hunter et al., 1979; Linton, 1991), there is little evidence for such somatosensory re-experiencing. In one of the few non-hypnotic empirical studies on the topic, Morley (1993) asked 136 healthy participants to recall past pains. He found that 59% of the subjects had recall of the pain sensation (memory for the sensory and affective qualities without somatosensory re-experiencing), but that no subjects reported re-experiencing the pain. One of us (MW) has recently conducted

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a series of experiments investigating the capacity for hypnotised individuals to experience painful sensation in the absence of a nociceptive stimulus, finding that this ability is more concentrated in highly-hypnotisable individuals, but these experiences were not explicitly based on memories of prior events (Whalley and Oakley, 2003; Whalley and Oakley, in preparation).

Here we describe a case of painful flashbacks in a patient suffering from PTSD subsequent to the July 7th 2005 London bombings. We obtained his consent to be interviewed and to publish his case history. Uniquely, we were able to assess him within a year of the index trauma and used standardised instruments to assess his experiences of pain.

## 2. Case report

### 2.1. Initial screening

H.B., a 37 year old male, was on a London Underground train near Edgware Road tube station on the morning of July 7th 2005 when a bomb exploded in his carriage. He was assessed two and a half months later, in October 2005, by a senior clinician (not one of the present authors) at the NHS Trauma Response (London bombings) screening team. His notes indicate that H.B. said that during the event it felt as if electricity had passed through him, that the whole experience was unreal, and that time had seemed a lot longer than it was. H.B. was concerned that his mind was not processing events accurately. His main problem was poor concentration, but he additionally suffered from high anxiety when travelling on the underground. At this time he was diagnosed using the Structured Clinical Interview for DSM-IV (First et al., 1997) with specific phobia and in the opinion of the screening clinician he suffered from “enough symptoms of PTSD to warrant psychological therapy”. Specifically, he met all criteria for PTSD except for being one symptom short of the three required in cluster C (avoidance/numbing: he scored positively for two avoidance items but scored intermediate on the emotional numbing item, reporting having been unable to cry). At this initial screening his scores on the Posttraumatic Diagnostic Scale (PDS: Foa et al., 1997) were 6 for intrusions, 9 for avoidance, and 7 for arousal (total 22). His score on the Beck Depression Inventory (BDI: Beck et al., 1974) was 8. Notes made verbatim by the clinician at the screening, based on what H.B. said, included: “*Felt trapped – surreal. Felt like I was being electric – did not know where I was. Seemed unreal like was not on tube . . . Felt current running through my body.*”

### 2.2. Treatment

H.B. was referred and began treatment at the Institute of Psychotrauma in November 2005. By the time

he entered treatment his PDS score was 23 (up 1 from the screening) and his BDI was 15 (up 7 from screening). One of us (EF) conducted 16 sessions of trauma-focussed cognitive behavioural therapy with H.B. Treatment finished in April 2006, 9 months after the bombings. Directly after treatment his score on the PDS was 17 and BDI was 10.

### 2.3. Experimental pain interview

H.B. was interviewed by MW about his pain experiences 12 months after the July 7th, 2005, London bombings. At the time of this interview he did not meet DSM-IV criteria for PTSD and his score on the PDS was 9 (2 for intrusions, 5 for avoidance, and 2 for arousal).

### 2.4. The traumatic event

H.B. was in the same carriage as the explosion, sitting one set of doors away (about 4 m) from the bomb when it was detonated. At the moment of the blast H.B. was reading a book. He heard screaming and felt as if he was being electrocuted, described by him as an enormously strong feeling of rhythmic electricity running through his body. He reported that the pain was particularly strong in his arms and in his head (areas where he was burnt) and said that the pain stopped him from thinking. He recalled that the pain felt like it lasted for 15–20 s, although he estimates it may have only been for 2–3 s. While experiencing the pain H.B. reported feeling “*unreal, as if space and time were distorted*”, and says that he had no idea of where he was. His initial thought was that his mobile phone had gone wrong and was causing the electric shock, but he dismissed this idea as the sensation was so strong. He had very clear thoughts that “*I am going to die*” and “*I can’t survive this*”. His next memory is of sitting on the floor of the tube carriage, momentarily feeling good to no longer have the electricity pain, but this feeling being quickly replaced by pain in his hands which were both burnt and bleeding. At the time he was 100% certain that he had been electrocuted, although he revised this figure downwards to 80% when doctors at the hospital told him that this was not possible. H.B.’s hospital discharge report records that he received a flash burn to the dorsum of the left hand and superficial partial thickness burns to the ulnar aspect of the dorsal 2, 3, 4 metacarpal phalangeal joints. On his right hand he received a superficial partial thickness burn to the volar distal phalanges of the middle ring and little fingers, total less than 1%.

After the bombing H.B. received 16 sessions of cognitive behavioural therapy including ‘reliving’ work involving extremely detailed recall of his experiences. He estimated that he experienced over 40 painful flashbacks following the bombing, most of them during sessions in therapy where he was asked to re-live the

experience (until the reliving he reported having felt emotionally numb). The first such pain flashback occurred during the second reliving session and he described it as a “bizarre sensation” but similar in quality to the original electrocution pain. Pain came up in every reliving except the first one (a very intense session, the main component of which was fear). He reported that the pain in the flashbacks was distinctly unpleasant, but relatively mild compared to the strong emotions experienced during reliving. Reliving sessions varied in the extent to which it felt like H.B. was back in the tube carriage. When this feeling was strong the predominant experience was fear and emotional involvement. When this reliving intensity was less H.B. reported that pain and olfactory flashbacks were more prominent.

During the course of the interview, while talking in detail about the pain, H.B. reported feeling pain in his hands in the areas where he had been most seriously burnt. He reported that he can feel pain in this way in his hand just by thinking about it. Upon questioning he reported that it was definitely an unpleasant painful sensation and was not imagined – he could feel it.

### 2.5. Pain assessment

Following the interview H.B. completed a number of questionnaires to quantify his experiences of pain. McGill Pain Questionnaires (MPQ; Melzack, 1975) were given for H.B. to retrospectively assess the magnitude of pain experiences (1) at the time of the trauma, (2) as flashbacks during therapy sessions, (3) pain felt in the hands when we talked about the pain during the interview 12 months after the attack. Visual analogue scale measures of pain intensity, unpleasantness, externality and clarity, as used in a previous study of imagined and suggested pain (Whalley and Oakley, in

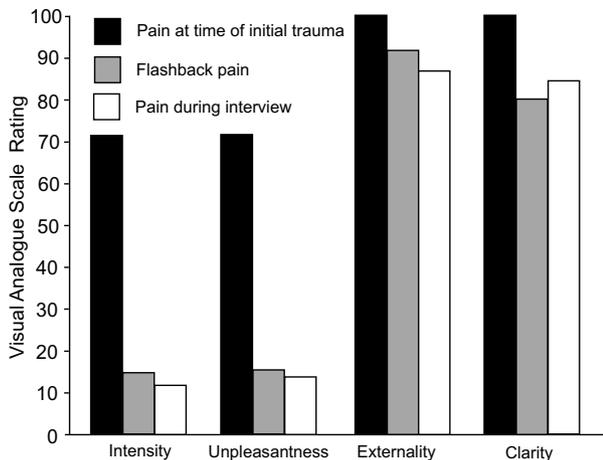


Fig. 1. Visual analogue scale ratings of pain intensity, unpleasantness, externality and clarity for the three pain experiences. Ratings for the pain flashbacks are H.B.'s estimated average across approximately 40 flashbacks. Pain during interview refers to the sensation H.B. felt in his hand when discussing his experiences during the interview.

Table 1  
Breakdown of scores on the McGill Pain Questionnaire

	Pain of original event (retrospective)	Flashback pain (retrospective, averaged)	'Pain memory' at time of interview
Sensory	19	12	8
Affective	2	0	0
Evaluative	4	0	0
Miscellaneous	3	3	4
PPI	3/5	3/5	2/5
Pain at its worst	4/5	4/5	3/5

PPI, present pain intensity.

preparation) were also obtained for these time points and are reported in Fig. 1.

Descriptions of the pain were elicited by the McGill Pain Questionnaire. The pain felt at the time of the index trauma was described as ‘throbbing, flashing, pricking, sharp, pinching, burning, stinging, aching, exhausting, intense, agonising’. Flashback pain felt during therapy session was described as ‘throbbing, pricking, stinging, hurting, numb, nagging’. The pain ‘memory’ felt during the interview, or whenever H.B. talks about his experiences was rated as ‘quivering, pricking, gnawing, tingling, dull, spreading, numb, nagging’. All three pain types were described as ‘steady’, but the pain felt during interview was additionally described as ‘rhythmic’. MPQ subscale scores are given in Table 1.

### 3. Discussion

Cases of pain flashbacks such as that reported here raise important questions about the link between pain, memory, and subjective experience. These examples provide naturalistic evidence that people can experience a sensation of pain in the absence of an external nociceptive stimulus, a phenomenon recently demonstrated experimentally in healthy controls using functional neuroimaging (Whalley and Oakley, 2003; Derbyshire et al., 2004; Raji et al., 2005) and in occasional case studies (e.g. Fisher et al., 1995).

Some painful conditions have traditionally been thought to be the result of inappropriately or chronically activated pain memories. Phantom limb pain, for example, has been suggested to be the result of reactivated pain memory (Merskey, 1975; Katz and Melzack, 1990). Recent evidence from neuroimaging studies of amputees indicates that cortical reorganisation following amputation is associated with a mismatch between a neural model of the body and actual sensory input, often leading to the experience of phantom pain (Flor, 2002; Flor, 2003; Flor et al., 2006).

However, alongside common phantom limb pains which are experienced by up to 70% of amputees (Sherman et al., 1984) there are reports of highly specific pains in phantom limbs which are not explained by the cortical reorganisation account. Bailey and Moersch

(1941) describe an amputee who had a sliver under the nail of his finger a week prior to the accident leading to his amputation. The patient reported that the feeling of the sliver was present in the phantom limb for up to two years following the amputation. Nathan (1985) reports a specific phantom pain from a pre-amputation ice-skating accident, and Ramachandran (1998) reports a specific phantom pain from pre-amputation arthritis. These reports indicate the possibility of a more explicit pain memory which Katz and Melzack (1990) refer to as somatosensory memory. H.B.'s report of electrocution when the bomb exploded is a specific one. Importantly, his report of electrocution tallies with that of another survivor of the Edgware Road blast who reported a similar sensation, and a similar report from a survivor of the bomb on the Russell Square underground train: "My whole body was shaking, it felt like I was being electrocuted" (Pook et al., 2007). H.B. reported experiencing the same distinct sensation as flashbacks during reliving sessions.

We managed to speak to H.B. relatively soon after we became aware of his symptoms, a significantly shorter delay than in the only other published reports of pain flashbacks (Salomons et al., 2004; Schreiber and Galai-Gat, 1993), although our use of standardised pain assessment instruments is still retrospective and therefore subject to biases inherent in pain recall. The present report of actual somatosensory re-experiencing contrasts with the results of Morley's (1993) experiment which found no somatosensory re-experiencing when healthy students were asked to recall past pain. It is possible that somatosensory re-experiencing is linked to the initial severity of an injury, and it would be interesting to repeat Morley's study with a clinical population such as patients who have recovered from burns.

We acknowledge that H.B. suffered injuries to his hands and this makes it difficult to conclusively ascertain the relative contribution of peripheral nociceptive versus more central sources or triggers of the pain. Specifically we can't rule out peripheral changes interacting with the effects of psychotherapy. However, H.B. reported that his hands were healed and pain free by early August 2005 ("healed so well that you wouldn't notice the burns unless you knew"), three months before he entered therapy, and the temporal relationship between the reliving sessions and the pain support the view that the pain flashbacks originated centrally.

That pain sensation can be felt in the absence of a nociceptive peripheral stimulus raises the possibility that some pain conditions in which observed pathology is not sufficient to account for the reported pain may be underscored by psychological factors (Derbyshire et al., 2004). Salomons et al. (2004) explained their pain flashbacks in terms of a fear conditioning model whereby flashbacks are triggered by stimuli associated with the trauma. With an emphasis on bodily reactions

though, a fear conditioning account can not readily explain the re-experiencing of the traumatic event in visual, auditory, and other modalities. If it is assumed that the re-experiencing of pain is similar to these other aspects of reliving the trauma, it can perhaps be most parsimoniously be explained by the dual representation theory of PTSD (Brewin, 2003; Brewin et al., 1996). According to some cognitive models of PTSD, flashbacks are the result of improperly encoded and consolidated memories, and when triggered by internal (thoughts) or external stimuli they are experienced as if the events were happening again. The dual representation theory of PTSD proposes two memory systems, with separate 'verbally-accessible' memory supporting deliberate recall and 'situationally-accessible' memory supporting involuntary flashbacks (Brewin, 2003; Brewin et al., 1996). Specific mention of pain experience was made in regards to flashbacks: "The SAM[situationally-accessible memory]system also stores information about the person's bodily response to the trauma, such as changes in heart rate and temperature, flushing, and pain. This results in flashbacks being more detailed and emotion-laden than ordinary memories" (Brewin, 2003, p. 110). According to this memory based approach the sensation of pain is encoded in the SAM system along with other sensory, physiological, and emotional information, and all aspects of the event are re-experienced together when an appropriate cue is encountered (in this case the detailed discussion of the trauma experience during therapy). Alternative mechanisms such as auto-suggestion (Oakley, 1999), implicit pain memory (Flor, 2003), and similarities between central sensitization and LTP (Ji et al., 2003), are also in need of exploration.

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## References

- Bailey AA, Moersch FP. Phantom limb. *Can Med Assoc J* 1941;45:37–42.
- Beck AT, Rial WY, Rickets K. Short form of depression inventory: cross-validation. *Psychol Rep* 1974;34:1184–6.
- Beese A, Morley S. Memory for acute pain experience is specifically inaccurate but generally reliable. *Pain* 1993;53:183–9.
- Brewin CR, Dalgleish T, Joseph S. A dual representation theory of posttraumatic stress disorder. *Psychol Rev* 1996;103:670–86.

- Brewin CR. Post-traumatic stress disorder: Malady or myth. London: Yale University Press; 2003.
- Derbyshire SWG, Whalley MG, Stenger VA, Oakley DA. Cerebral activation during hypnotically induced and imagined pain. *Neuroimage* 2004;23:392–401.
- First MB, Spitzer RL, Gibbon M, Williams JBW. Structured clinical interview for DSM-IV Axis I Disorders - Patient Edition (SCID-IP, Version 2.0. 4. 97 revision): Biometrics Research Department, New York State Psychiatric Institute. New York; 1997.
- Foa EB, Cashman L, Jaycox L, Perry K. The validation of a self-report measure of posttraumatic stress disorder: the posttraumatic diagnostic scale. *Psychol Assessment* 1997;9:445–51.
- Fisher JP, Hassan DT, O'Connor N. Minerva. *Br Med J* 1995;310:70.
- Flor H. Phantom limb pain: characteristics, causes and treatment. *Lancet* 2002;1:182–9.
- Flor H. Cortical reorganisation and chronic pain: implications for rehabilitation. *J Rehabil Med Suppl* 2003;41:66–72.
- Flor H, Nikolajsen L, Jensen TS. Phantom limb pain: a case of maladaptive CNS plasticity? *Nat Rev: Neurosci* 2006;7:873–81.
- Hunter M, Phillips C, Rachman S. Memory for pain. *Pain* 1979;6:35–46.
- Ji R-R, Kohno T, Moore KA, Woolf CJ. Central sensitization and LTP: do pain and memory share similar mechanisms? *Trends Neurosci* 2003;26:696–703.
- Katz J, Melzack R. Pain 'memories' in phantom limbs: review and clinical observations. *Pain* 1990;43:319–36.
- Linton SJ. Memory for chronic pain intensity: correlates of accuracy. *Percept Mot Skills* 1991;72:1091–5.
- Melzack R. The McGill Pain Questionnaire: major properties and scoring methods. *Pain* 1975;1:277–99.
- Merskey H. Pain, learning and memory. *J Psychosom Res* 1975;19:319–24.
- Morley S. Vivid memories for 'everyday' pains. *Pain* 1993;55:55–62.
- Nathan PW. Pain and nociception in the clinical context. *Philos Trans R Soc London* 1985;308:219–26.
- Oakley DA. Hypnosis and conversion hysteria: a unifying model. *Cogn Neuropsychiatry* 1999;4:243–65.
- Pook S, Davies C, Gardham D. We were like sardines in there, just waiting to die. *The Daily Telegraph*, 8th July 2005. Retrieved from: <http://www.telegraph.co.uk/news/main.jhtml?xml=/news/2005/07/08/nbomb108.xml>, 18.1.2007.
- Raij T, Numminen J, Närvänen S, Hiltunen J, Hari R. Brain correlates of subjective reality of physically and psychologically induced pain. *Proc Nat Acad Sci USA* 2005;102:2147–51.
- Ramachandran VS. Consciousness and body image: lessons from phantom limbs, Capgras syndrome and pain asymbolia. *Philos Trans: Biol Sci* 1998;353:1851–9.
- Salomons TV, Osterman JE, Gagliese L, Katz J. Pain flashbacks in posttraumatic stress disorder. *Clin J Pain* 2004;20:83–7.
- Schreiber S, Galai-Gat T. Uncontrolled pain following physical injury as the core-trauma in post-traumatic stress disorder. *Pain* 1993;54:107–10.
- Sherman RA, Sherman CJ, Parker L. Chronic phantom and stump pain among American veterans: results of a study. *Pain* 1984;18:83–95.
- Shin LM, McNally RJ, Kosslyn SM, Thompson WL, Rauch SL, Alpert NM, Metzger LJ, Lasko NB, Orr SP, Pitman RK. Regional cerebral blood flow during script-driven imagery in childhood sexual abuse-related PTSD: a PET investigation. *Am J Psychiatry* 1999;156:575–84.
- Whalley MG, Oakley DA. Psychogenic pain: a study using multidimensional scaling. *Contemp Hypn* 2003;20:16–24.
- Whalley MG, Oakley DA. Can you imagine? A comparison of imagined and hypnotically suggested pain, in preparation.