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Pain in Dreams and Nightmares

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While it is clear that pain can interfere with a myriad of sleep-related variables, the ways in which pain may affect dreaming and dream content remain poorly understood. This chapter reviews the literature on pain sensations experienced during dreams. We begin with an overview of historical observations and early studies on the experience of the sensory modalities that show up more infrequently in dreams. We then review laboratory, home log, and questionnaire investigations of naturally occurring and experimentally induced pain dreams. Our focus will then turn to studies of pain dreams in patients suffering from acute pain conditions.

HISTORICAL OBSERVATIONS ON PAIN SENSATIONS DURING DREAMS

Several writers from the late 19th and early 20th centuries reported numerous anecdotal accounts of sensory stimuli affecting dream content (e.g., Macnish 1836; Cubberly 1923; Freud 1953; Saint-Denys 1982). For instance, Macnish reported that applying a flower to the sleeper's nostrils could affect the sense of smell and induce dreams of walking in a garden. With respect to physical pain, 19th-century views suggested that noxious stimuli could affect the content of dreams, albeit without incorporating actual pain sensations into the dream narrative (Seafield 1869; MacFarlane 1890). In his pioneering work from the mid-19th century, which included extensive self-experimentation on dreaming, Saint-Denys (1982) documented several cases demonstrating the sleeper's extreme sensitivity to slight physical sensations while dreaming. However, he believed that the processes underlying dream construction could not reconstitute the exact character of past physical pain and that consequently

pain itself could not be experienced in dreams. For his part, Freud (1953) described several unpleasant dreams, including being scalped, being tortured on the rack, and standing on intolerably hot ground, and concluded that external sensory stimuli had instigated these dreams. He argued, however, that somatic stimuli were never the sole cause of such dreams, but served only to elicit specific dream images.

Early studies on the prevalence of various sensory modes in dreams revealed that dreams sometimes contained explicit references to auditory, kinesthetic, gustatory, or olfactory sensations in the absence of known external stimuli (e.g., Calkins 1893; Weed and Hallam 1893; Bentley 1915). References to taste and smell were rare, occurring in less than 1% of all dream reports. These studies made no mention of dreamed pain.

In summary, early investigations suggested that a range of sensory experiences could occur naturally or experimentally in dreams. However, references to physical pain either were absent from everyday dream reports or were only indirectly incorporated into the dream narrative when generated by external stimuli.

LABORATORY DREAM STUDIES OF PAIN

Although dream recall is preferentially associated with random eye movement (REM) sleep, dream processes are clearly evident in other sleep stages (see Nielsen 2000 for a review). Some authors have also questioned the standard criteria of Rechtschaffen and Kales (1968) used to determine REM sleep, suggesting that REM processes may occur covertly in other sleep stages (Nielsen 2000). However, researchers studying the sensory representations described in dream reports collected in the sleep laboratory have been primarily interested in dream recall from REM sleep.

Experimental studies conducted in the sleep laboratory indicate that a variety of sensory stimuli applied during REM sleep can influence dream content. In their classic work, Dement and Wolpert (1958) found that the sensation from a fine spray of cold water applied to the sleeper was incorporated in 42% of dreams during REM sleep, while a flashing lamp shining directly on the sleeper and an auditory tone featured in 23% and 9% of dreams, respectively. In another study, external olfactory stimuli appeared in approximately 20% of dreams during REM sleep (Trotter et al. 1988).

With respect to pain sensations, a study of 180 reports of dreams during REM sleep that were scored specifically for references to sensory events found no instances of pain (McCarley and Hobson 1979). One ambiguous reference to pain was found in an earlier study of 119 REM sleep reports (Arkin et al.

1975). Thus, in these first studies to have explicitly tabulated such references, almost 300 laboratory dream reports yielded only one vague reference to physical pain.

These initial reports could be taken as suggesting that dream processes cannot reproduce physical pain or that the dreaming mind is impervious to concomitant bodily pain sensations. Cerebral and autonomic reactions such as cortical arousal and cardiac acceleration have been reported in laboratory experiments on healthy participants exposed to nociceptive stimulation during various sleep stages (Lavigne et al. 2000, 2001). When they awakened, participants generally did not recall the stimulations administered during their sleep. By contrast, a pilot study found that when participants were asked about the last dream they recalled after a night in which noxious injections of hypertonic salt were administered in the deltoid muscle during different sleep stages, two of the nine subjects reported having painful sensations in their dreams (Manzini et al. 2002).

Two studies have focused explicitly on physical pain in subjects' laboratory dreams during the testing of a method for administering pressure stimulation during REM sleep. Nielsen et al. (1993) described 13 dreams from REM sleep that included references to pain subsequent to the administration of gradually increasing pressure stimulation of either the right or left leg. In 11 of the 13 pain dreams, "the representation of pain was direct and realistic—an accurate reflection of what might be expected in the waking state." Almost half of the dreams with pain also contained strong negative affect, with anger being reported most frequently. Nielsen et al. (1993) also described a nonstimulated laboratory dream in which pain was depicted. This report may represent evidence of dreams incorporating an uncomfortable stimulation from memory—in this case, from a preceding stimulation trial.

In a subsequent study, Zadra et al. (1996) found that gradually increasing pressure stimulation of the hand (rather than the leg) during REM sleep did not result in subjects reporting pain dreams. Possible reasons for the differing results include the fact that pressure cuffs induce stimulation over a greater surface area on the legs compared to the hands or the possibility that ischemia (pressure pain) is more unpleasant in the leg muscles than in the hand. Alternatively, perhaps pain-discriminating mechanisms subserving the hand are relatively less sensitive to sensory intrusions during REM sleep. Approximately 10% of all pressure stimulation trials of either the right or left hand, however, did result in direct or indirect incorporations into the dream narrative of the physical sensations. Examples of direct incorporations of these sensations include dreams of unusually vigorous handshakes involving the stimulated hand, strangling an aggressor with only the stimulated hand wrapped around the dream character's neck, and masturbating (in a male subject). Indirect incorporations included

dreaming that the pillow on which the subject was sleeping was being inflated (presumably reflecting the inflation of the pressure cuff).

As observed by Nielsen et al. (1993), Zadra et al. (1996) also found evidence that unambiguous pain dreams could occur during REM periods without experimental stimulation. Pain was featured in about 1 out of every 125 dream reports during REM sleep. These results suggest that noxious stimuli need not be present for physical pain to appear in dreams.

In sum, findings from laboratory studies indicate that although rare, pain can arise in both stimulated and naturally occurring dreams during REM sleep. However, these studies also reveal a high level of individual variability in susceptibility to dreaming about pain. The reasons underlying this variability remain unknown. Possibilities include gender effects, individual differences in thresholds for uncomfortable sensations from pressure stimulation to surface in dreams, and variations in subjects' past real-life experiences with pain.

HOME DREAM STUDIES OF PAIN

As with the literature on the effects of noxious stimuli on dream content, little is known about the nature of pain dreams that occur in the absence of any noxious or uncomfortable stimuli. Case reports of individuals who repeatedly experience violent dream imagery, including images of severe bodily wounds, rarely contain references to dreamed pain as part of the experience (e.g., Levitan 1980). Most contemporary studies of large samples of prospective dream logs reporting on sensory experiences (Hall and Van de Castle 1966; Snyder 1970; Okada et al. 2005) do not mention dreamed pain; in fact, pain was not one of the variables that were directly assessed.

One study (Zadra et al. 1998) investigated pain dreams using retrospective tools (questionnaires) as well as prospective instruments (2-week daily dream logs) in a sample of 185 participants with no history of recent pain or sleep disorders. Results from the retrospective responses to self-report questionnaires indicated that approximately half of these normal adult men and women had experienced physical pain in their dreams on at least one occasion. These findings suggest that many healthy individuals can experience dreams containing sensations of physical pain. Furthermore, over 80% of the 91 participants who reported pain dreams in response to the questionnaire localized the pain to a specific area of their body. Fig. 1 presents the distribution of body areas in which pain arose during the dreams. The three most frequently implicated regions were the abdomen, the legs, and the head or face, which together accounted for almost 50% of the references. This frequency distribution of dreamed pain across body parts showed no association of the body areas where

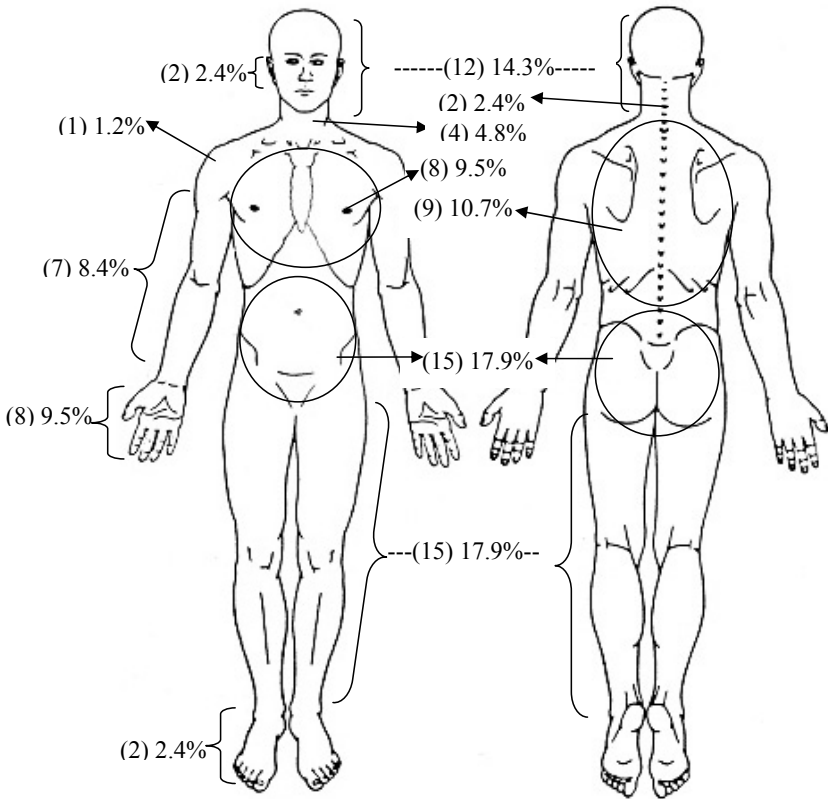


Fig. 1. Areas of the body in which pain was localized in questionnaire-based reports of pain dreams in 185 healthy individuals (Zadra et al. 1998). There were 84 references to specific body areas.

pain was experienced with Penfield's homunculus, which reflects various body zones represented in the somatosensory cortex (Penfield and Rasmussen 1968). It therefore appears that physical pain during dreams does not result from a proportional or random activation of the somatosensory cortex.

A total of 3045 dreams were reported in the home dream logs collected in this study. Eighteen of these dreams contained unambiguous experiences of pain. These prospective data thus indicate that the prevalence of dreams containing physical pain appears to be very low, occurring once in every 170 dream reports. Nevertheless, when pain dreams are reported, the physical pain is well integrated into the dream narrative. For example, reports of pain dreams include having a stomachache during a difficult pregnancy (in a subject who was not pregnant in real life), crying because of a terrible toothache, having one's arm and shoulder run over by a bus, being speared in the rib cage by tribal people,

and having one's hand burned by hot coal. Many of these dreams were described as being distressing nightmares and ended with an abrupt awakening.

The experience of pain in dreams is neither an inevitable result of normally pain-producing scenarios nor a consequence of expectancy on the dreamer's part. In fact, 7 of the 185 subjects in the Zadra et al. (1998) study noted a total of nine dreams in which they would have expected pain but did not feel any. In all cases, these subjects spontaneously indicated that they were surprised in the dream that they felt no pain or had only experienced an uncomfortable "hot flash" or mild tingling sensations. For example, one participant reported feeling surprised about not feeling any pain during his dream when someone cut the palm of his hand with a blade. Another subject reported a dream in which he was hit directly on his head by a fast-moving baseball and described thinking that his head should have hurt after being hit, but that he felt no pain. Hence, expecting to feel pain in one's dream does not necessarily lead to dreamed pain sensations.

In addition, Zadra et al. (1998) found no relationship between the pain content described in the dream narratives and the physical health of the participants who reported them. In only one case were the pain sensations described in a dream associated with a waking pain-related condition: a patient with frequent back pains dreamed of having lower back pain that began to spread toward the upper back. The participant noted that the back pain in her dream was still present when she awakened. The process of dream construction seems to have been influenced by real bodily pain sensations, in much the same way as the laboratory dream reports discussed above were shaped by external stimuli.

Some participants reported that the intense sensations of physical pain that occurred in their dreams completely and instantly disappeared upon awakening. Similar cases have been reported in laboratory studies (Nielsen et al. 1993; Zadra et al. 1996). These observations suggest that pain sensations, much like visual and auditory components of dream narratives, can be endogenously generated as part of the hallucinatory dream experience, and that the neural and cognitive systems that represent pain imagery are functional during dreams.

The prevalence of pain dreams reported in the home setting by Zadra et al. (one in every 170 dreams) was most likely underestimated by the methods employed. For instance, participants were not specifically instructed to note the presence of sensory experiences (including pain) in their dreams, and pain-related questions were imbedded in a large questionnaire. Thus, the participants were not sensitized to reporting pain sensations in their dream logs, and consequently some participants may have overlooked reporting them.

The inclusion in dreams of the more infrequent sensory modalities, such as odor, taste, and pain, demonstrates the significance of the representative capacities of the dream process and of general mental imagery. Therefore, the

relatively low frequency of reports of these sensory modalities during dreams probably does not indicate that they cannot be represented. This issue could be further elucidated by studies of pain in the dream reports of populations suffering from chronic pain. Unfortunately, to our knowledge, no studies have been conducted on the content of dreams in chronic pain patients. The existing reports on the dreams of persons with acute pain are reviewed below.

CLINICAL PAIN AND DREAMS

In addition to anecdotal reports (Garfield 1991), two studies have investigated pain sensations during dreams of individuals suffering from acute pain. The first of these reports (Boeve et al. 2002) examined sleep-related problems and their effects in 74 hospitalized patients suffering from accidental burns. A comparison of patients' retrospective prehospitalization reports with those collected 1 week after hospital discharge revealed a significant increase in nightmares (28%) and in dreams containing painful sensations (24%). The incidence of dreams involving burns (19%) and fire (16%) was also significantly higher.

In the second study, Raymond et al. (2002) asked 28 patients who were hospitalized for accidental burns to report their last dream of the night and to rate the quality of their sleep for 5 consecutive days. The level of each patient's pain was measured regularly, and medication intake and burn areas were also noted. A total of 63 dream reports were collected, with 39% of the patients ($n = 11$) reporting at least one nightmare and 39% reporting at least one dream containing painful sensations, for a total of 19 pain dreams (30% of the entire dream sample). The body areas that were painful in dreams generally corresponded to the participants' actual burned or painful areas, but not all injured or affected areas were represented in the dream narratives. In 6 of the 19 dreams containing painful sensations (32%), the location of dreamed pain did not correspond to the location of the burn injuries, to pain sensations experienced during the night, or to the pain described upon awakening. Finally, over 60% of the study's participants did not report any pain dreams even though they were suffering from acute pain. These results are reminiscent of those obtained from laboratory studies indicating that painful stimulations during REM sleep do not necessarily result in dreams containing pain sensations. It thus appears that during their dreams, certain individuals can suppress the direct experience of acute pain sensations (either experimentally induced or associated with severe burn injuries).

Raymond et al. (2002) also compared various sleep variables between participants who reported pain dreams and those who did not. Patients with pain dreams reported lower sleep quality, with significantly more awakenings from

sleep and more nightmares. These patients also received more benzodiazepines during the day and had higher scores on a measure of post-traumatic stress symptoms than did patients without pain dreams.

Raymond et al. (2002) note that no direct relationship can be established between sleep quality and the pain experienced in dreams. They suggest, however, that poor sleep can increase the frequency of pain dreams. Perhaps, in turn, pain dreams contribute to sleep fragmentation. Raymond et al.'s previous work (2001) showed that the intensity of pain experienced during the night can also affect sleep quality and that higher levels of pain are reported after a night of poor sleep. Finally, Raymond et al. (2002) suggest that pain dreams and nightmares may represent an additional source of stress for burn patients, which may contribute to both poor sleep and higher pain intensity. In effect, these interactions may evolve into a repetitive and chronic cycle of pain, apprehension, and impoverished sleep. The extent to which these findings can be generalized to other acute pain populations (e.g., postoperative patients) remains to be determined.

SUMMARY AND CONCLUSIONS

Results from laboratory and home dream studies converge in showing that the human brain can generate vivid and varied sensory dream experiences, including dreams of pain. That the more infrequent modalities of smell, taste, and pain occur at all in dream reports is an important demonstration of the representational capacities of dreaming. These sensory experiences can arise in dreams either through direct incorporation of external stimuli or through construction from recent or distant memories.

With respect to physical pain in dreams, the data indicate that pain sensations are experienced as being realistic and clearly localized. Reports of intense physical pain in dreams that completely disappear upon awakening also have important implications. Specifically, these observations suggest that the cognitive systems that may contribute to the representation of pain imagery are sometimes functional during dreaming and that noxious stimuli need not be present for pain sensations to occur in laboratory or home dreams.

Overall, it appears that pain dreams occur in less than 1% of everyday dream narratives and dream reports during REM sleep. The percentage of recalled dreams containing pain is markedly greater in populations suffering from acute pain. It is possible that the occurrence of these pain dreams may reduce sleep quality. The role of pain dreams in chronic pain populations, however, remains unknown.

In summary, although several innovative studies in the field of pain and dreams have contributed to a better description and understanding of pain experiences during dreaming, many questions remain unanswered. Why do some patients suffering from acute pain experience frequent pain dreams and nightmares while others do not? How do pain sensations affect the process of dream construction? Do pain dreams contribute to or result from poor sleep quality? What is the impact of chronic pain conditions on dream processes? Does dream content normalize over time or do dreamed pain sensations vary according to pain intensity and its impact on the dreamer's daytime physical and psychological well-being? The answers to these intriguing questions not only will help us to understand the nature of pain representations but will also have important heuristic and applied implications for clinicians and researchers alike.

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