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LONG-TERM PAIN CONDITIONS AFTER A STROKE

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The aim of this study was to classify and describe the characteristics of different long-term pain conditions after a stroke by clinical examination and pain assessment using the Pain-O-Meter and a Pain questionnaire. Pain was classified as central post-stroke pain ($n = 15$), nociceptive pain ($n = 18$), and tension-type headache ($n = 10$). In 65%, pain onset was within 1–6 months and the pain intensity revealed individual differences. Many pain descriptors was common, some were discriminating as burning in central and cramping in nociceptive pain, and pressing and worrying in headache. More than half with central or nociceptive pain had continuous or almost continuous pain. Cold was the factor mostly increasing the pain in central, physical movements in nociceptive pain, and stress and anxiety in headache. More than one-third had no pain treatment and two-thirds of those with central pain had no or inadequate prescribed pain treatment. The clinical findings support the classification of pain and describe discriminating and common pain characteristics in pain conditions after a stroke.

Key words: pain, pain measurement, stroke, central post-stroke pain (CPSP), shoulder pain, headache.

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INTRODUCTION

Stroke affects approximately 30,000 (20,000 first-ever) individuals in Sweden each year (population of 8.9 million) and is the most common cause of disability and the third most common cause of death in the Western world (1). Studies published in Sweden have shown lack of conformity on incidence, but the results tend to be comparable with those regarding Western Europe (2–4). The overall incidence rates of first-ever stroke, standardised to the 1991 European population, were 8.72 per 1000 person-years for individuals aged 65–84 years, and 17.31 per 1000 person-years for individuals aged 75 years and over (5). Besides common symptoms such as sudden onset of hemiparesis, sensory deficits and speech disorders, pain is frequently encountered as a consequence of stroke, often causing great suffering and problems in rehabilitation (6, 7).

There are different types of pain following a stroke. Central post-stroke pain (CPSP), i.e. neurogenic pain caused by a lesion affecting the spinothalamic pathways in the brain with sensory deficit, is seen in 2–8% of patients after a stroke (6–8). Nociceptive pain, most often affecting the shoulder and related to changed dynamics due to paresis or weakness on the affected side, has been reported in 5–84% (9–11). Suggested causes are for example subluxation of the glenohumeral joint, rotator cuff tears and soft tissue injuries as a consequence of unwary physical handling and spasticity of the shoulder musculature. Headache following stroke has been reported in a few studies with different study designs and populations (12–14). In two studies, tension-type headache was reported to be the most common type of late-onset headache after a stroke (13–14). Previous studies of pain after a stroke have mainly focused on pathophysiology and only one type of pain in each study. An investigation including different types of pain to get a coherent view of pain conditions related to a stroke is therefore of importance. The aim of this study was to classify and describe the characteristics of different long-term pain conditions after a stroke.

MATERIAL AND METHODS

The data collection was performed 2 years after the stroke incident by means of clinical examinations and pain assessment. All patients were examined and assessed by three investigators independently, with 2–6 weeks between each investigation. Each investigation lasted 1–2 hours. The data collection was preceded by written and oral information together with written informed consent. A Research Ethics Committee in Sweden has approved the research project.

Material

Patients were identified, 2 years after an acute stroke incident, by means of an in-patient register at the Department of Neurology and Clinical Neurophysiology in a University Hospital in Sweden. During 1996 and 1997, a total of 972 stroke patients were registered in the county area. The catchment area of the hospital included a population of approximately 170,000 (15). Patient selection was based on the Swedish version of ICD-9 and ICD-10; Infarctus cerebri (433, 434/I63) and Hemorrhagia cerebri (431/I61). The diagnosis of a stroke was based on clinical examination and computerized tomography (CT scan) within the first week after onset of symptoms.

At the time of investigation, i.e. 2 years after the stroke incident, 37% had died (Table I). The inclusion criteria were an unequivocal stroke episode and long-term pain (>6 months) that occurred after the stroke in patients with no other major pain conditions. The exclusion criteria were communicational disability and/or intellectual impairment and non-Swedish-speaking patients, since they were not expected to be able to participate independently in the data collection. This resulted in 356 out of 616 patients. In reply to an introductory letter 65 patients declined or did not answer, and 245 were excluded since they did not meet the inclusion criteria. Included in this study were finally 43 patients with

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Table I. *Selection procedure for patients with long-term pain after a stroke, admitted to a neurological clinic*

	Excluded, dropouts and included 1996		Excluded, dropouts and included 1997	
	n	%	*n*	%
Total admitted	528		444	
Died after 2 years	185	35.0	171	38.5
Total excluded at patient selection	165	31.3	95	21.4
Communicational disability:				
Impressive and/or expressive aphasia	54		30	
Sight/hearing	7		4	
Intellectual impairment	102		57	
Non-Swedish-speaking	2		4	
Total requested	178	14.0	178	12.9
No answer	25		23	
Declines	17		0	
Total excluded after answering	115	64.6	130	73.0
No pain	69		82	
Other major pain conditions	46		48	
Total dropouts	2	1.1	1	0.6
Died	1		0	
Discontinued	1		1	
Total subjects included	19		24	

long-term pain after a stroke and with no other major pain conditions (Table I).

Clinical examination and pain assessment

Clinical examination. The first clinical examination was performed (S.K-T.) according to a protocol designed for the study, including:

(1) Systematic medical and pain history. Medical history was particularly regarding prior diseases, current illnesses and the stroke event. Pain history was by structured questions, particularly concerning pain occurrence and duration in relation to the stroke incident. Regarding pain locations, pain drawings were used.

(2) Sensory and motor testing. A thorough general somatic and a neurological examination including detailed bedside clinical testing were performed. The examination of sensory modalities included touch (cotton wool), cold (tuning fork at room temperature) and pinprick. The regions of testing were cheek, arm, hand, leg, foot and trunk. The asymptomatic, contralateral side was used as a control. Motor impairment was graded as mild, moderate or severe. Joint mobility was assessed as normal or limited.

Location of the cerebrovascular lesion (CVL) was determined by CT scan and if the CT did not reveal a relevant lesion the location was based on clinical presentation only. According to the location of the lesion and the clinical examination at the time of the acute incident, the patients were classified into the following groups (6):

BS—brainstem: CVL located in the medulla oblongata, pons and midbrain.
TH—thalamus: CVL affecting the thalamus.
SE—supratentorial, extrathalamic: CVL not affecting the thalamus.
TH/SE—supratentorial: CVL affecting the thalamus.
UI—unidentified: CVL location based on clinical examination only.

Types of pain. The patients were classified in accordance with three types of pain conditions. Chronic pain was classified according to the criteria of the International Association for the Study of Pain (IASP), and the tension-type headache according to the criteria of the Headache Classification Committee of the International Headache Society (IHS) (16–18):

- Patients with central neurogenic pain, i.e. central post-stroke pain (CPSP); pain initiated or caused by a primary lesion or dysfunction of the central nervous system.
- Patients with nociceptive pain; pain due to actual or potential tissue damage, mainly shoulder pain in the post-stroke affected side.
- Patients with tension-type headache; associated with disorder of the pericranial muscles, with debut at the time of or after the acute stroke incident.

To support the clinical classification of central post-stroke pain, thermal quantitative sensory testing (QST) was performed for cold, warmth and heat pain by one of the investigators (L.S.), using a modified Marstock thermostimulator operating on the Peltier principle (Thermotest, Somedic AB, Stockholm, Sweden) (19). In accordance with the distribution of sensory deficit affecting spinothalamic pathways in stroke patients, thermal thresholds were obtained from the cheek, hand (thenar or hypothenar eminence) and lower leg (L5 dermatome), using the asymptomatic, contralateral side as a control (6, 20).

Pain assessment

The pain assessment was performed by one of the investigators (M.W.) in the home of the patients using the Swedish version of the Pain-O-Meter (POM). Within 2 weeks after this a Pain Questionnaire covering pain duration, quality and frequency, together with factors affecting pain and treatment was answered by the patient and posted. The POM combines the evaluation of pain characteristics, i.e. pain sensations such as pain intensity (VAS—visual analogue scale) and pain quality (MPQ—McGill Pain Questionnaire), in one tool, as well as location and frequency (21). The visual analogue scale (POM-VAS) is a 10 cm line with a movable marker with "no pain" and "worst imaginable pain" assigned to the ends of the scale. Pain quality, consisting of 12 sensory and 11 affective pain descriptors/words (POM-WDS) is on the reverse side of the instrument. The results of psychometric testing of POM-VAS and POM-WDS in different acute and chronic pain populations, i.e. patients in labor pain, post-operative pain and rheumatic disorders has been presented in one study and has shown an acceptable reliability and validity (21).

The patients described their pain locations and the investigator marked these locations on the POM pain drawing chart. In order to make it easier for the patient an enlarged version was shown to him or her. The POM-VAS rating was carried out by the patient. The pain intensity rating referred to the day of data collection. The decimals under/above 0.5 were rounded off to the nearest whole number. The pain descriptors were written in separate columns on a separate sheet. The columns were shown separately to the patient in order to make the descriptors easier to distinguish. This was done for each pain location. Further, a question was asked as to whether the pain "is continuous" or "comes and goes".

The two pain drawings from the clinical examination and the pain assessment were in conformity in respect of the two independent investigations.

Table II. *Descriptive data regarding the study group*

	All $n = 43$	Men $n = 30$	Women $n = 13$	Central pain $n = 15$	Nociceptive pain $n = 18$	Tension-type headache $n = 10$
Age, median (range)	66.0 (33–82)	64.0 (33–79)	76.0 (54–82)	65.0 (37–80)	70.0 (33–82)	66.0 (48–82)
Stroke related medical history (number):						
Previously healthy	8	7	1	6		2
Cardiovascular disease	26	17	9	7	13	6
Diabetic	1	1			1	
Cardiovascular disease and diabetic	8	5	3	2	4	2
Pain onset after the acute stroke incident (number):						
<1 week	12	7	5	5	1	6
1 week–1 month	10	8	2	3	6	1
2–6 months	19	14	5	7	10	2
20–27 months	2	1	1		1	1

Statistical analysis

The software Statistical Package for the Social Sciences (SPSS 10.0) was used for statistical analysis. Beyond descriptive statistics, the Kruskal-Wallis test for group comparison was used. In order to confirm the classification of pain based on the clinical examination, the Wilcoxon signed-ranks test was performed to statistically compare thermal thresholds (QST) on the affected and non-affected sides. A level of $p < 0.05$ was considered statistically significant.

RESULTS

Descriptive data is presented in Table II. At the stroke incident 38 were diagnosed as cerebral infarcts and 5 as cerebral hemorrhages. The locations of CVL was supratentorial, extra-thalamic (SE) in 27 patients, brainstem (BS) in 5 patients, thalamus (TH) in 4 patients, supratentorial (TH/SE) in 1 patient and unidentified in 6 patients.

As a result of motor testing, 29 patients had mild paresis and 5 patients had moderate paresis. In 9 patients the motor impairment was severe, i.e. hemiparesis. Of those with spactisity (18/43) were 3 patients spastic in the shoulder/arm or in the leg only. Five patients had decreased joint mobility in the shoulder/arm.

In patients classified as having central pain at the first clinical examination, the thermal sensibility was significantly reduced on the symptomatic side. Four patients had two types of pain (central and nociceptive) and 2 of them were classified as having central pain by support from QST.

Seven of the patients with central pain had allodynia for touch and/or cold, 6 patients hypoalgesia for pinprick and 1 patient hyperalgesia for pinprick. Concerning patients with nociceptive pain, hypoalgesia for pinprick was found in 6 patients, and allodynia for touch and hypoalgesia for pinprick in 2 patients. Four patients with headache had hyperalgesia for pinprick.

Pain onset and duration. The mean duration of pain was 20 months for all patients at the time of investigation (Table II). The pain onset was sudden in half of the patients with central pain or headache, and gradual in two-thirds of the patients with nociceptive pain. The pain was reported to be worse and had increased since onset in 12/43. In five the pain location was extended, proportionally most in patients with nociceptive pain. More than half of the patients (28/41) answered that they did not know the cause of their pain, proportionally most patients with headache (7/10).

Location. All patients (39/43), except 3 with headache and 1 with nociceptive pain, considered it easy to describe their pain location. Location and distribution of pain was contralateral to the CVL lesion in all patients with central or nociceptive pain (Table III).

Of the patients with nociceptive pain ($n = 18$), 3 were estimated as frozen shoulder, 3 as subluxation, 2 as both frozen shoulder and subluxation and 9 as non-specific muscular pain from the shoulder/arm or in leg.

Pain intensity. The median value of pain intensity ratings on the POM–VAS scale (see Table IV). The highest value of the VAS rating (9–10) was in two hemiplegic patients.

Pain quality. The median of pain descriptors is presented in Table IV. The most frequent sensory descriptors for patients with central pain were stabbing, aching, dull and burning and of the affective descriptors troublesome, annoying and tiring. Cramping was the most frequent sensory descriptor for patients with nociceptive pain and all other descriptors including the affective were the same as for the patients with central pain except for burning. The sensory descriptors for patients with headache differed from those of the other groups since the most frequent descriptor was pressing and of the affective worrying. Two hemiplegic patients chose the sensory descriptor tearing and the affective descriptor torturing.

Pain was reported to be both superficial and deep in most of the patients (36/43), with no proportional differences in patients with the different types of pain.

Pain frequency. According to the POM assessment, nearly half of all patients (20/43) had continuous pain and in others the pain "comes and goes". More than half of the patients with central or nociceptive pain suffered from pain continuously or almost

Table III. *Location and distribution of pain* (n = *43*). *Number of patients are given*

Central pain (*n* = 15)	
Hemipain	4
Hemipain except the face	4
Abdomen—lower limb	1
Upper and lower limbs	1
Upper limb	1
Lower part of upper and lower limbs	1
Hand—digits III–V and lateral side of foot	2
Hand—digits I–IV	1
Nociceptive pain (*n* = 18)	
Shoulder—arm–hand	5
Shoulder–arm	3
Shoulder–upper arm	8
Shoulder	1
Lower part of lower leg	1
Tension-type headache (*n* = 10)	
Crown—half of the head	4
Crown—occiput	3
Crown	3

continuously, according to the answers in the Pain Questionnaire (Table IV).

Factors affecting the pain. Factors increasing and decreasing pain are shown in Table V. Touching increased pain in 20–25% of the patients with central or nociceptive pain. More than one-third of the patients (16/43) reported no pain medication. One-fifth used prescribed medication regularly (9/43) and nearly half (18/43) when necessary. Only 4 of 15 patients with central pain had been prescribed amitryptylin and one other patient tramadol. Two of them ceased their treatment because they experienced insufficient pain relief. Eight others with central pain had tried analgesics such as dextropropoxifen, paracetamol, acetylic acid and ibuprofen, on their own or in combinations, but without sufficient pain relief. Three patients with central pain had a high daily intake of paracetamol, more than eight 500 mg tablets a day without prescription. Prescribed medication for 4 of the 18 patients with nociceptive pain were paracetamol, dextropropoxifen or codeine, on their own or in combinations. Six of 10 patients with headache took paracetamol or codeine when necessary. Two others took prescribed medication for other reasons, dextropropoxifen when they had headache.

Six patients reported that they were having or had tried other treatments. QiGong and massage had some effect and TENS (transcutaneous electrical nerve stimulation) no effect in the case of 1 patient with central pain. Three patients with nociceptive pain were treated with TENS and physiotherapy. Two others with nociceptive pain had tried acupuncture and one massage, with somewhat acceptable pain relief. Patients with headache had used pharmacological treatment entirely.

DISCUSSION

In this study, three types of long-term pain conditions were classified that may occur after a stroke. The results of this study corresponds with previous studies according to the pain locations and sensory deficits reported by Bowsher (7), Boivie (22) and Samuelsson et al. (20) in patients with central pain. The pain history and pain location in patients with shoulder pain, described by Joynt (10) and Jespersen et al. (11), also correspond with findings of this study. In agreement with previous studies by Bowsher (7) and Boivie (22), the results also show that some patients may suffer from more than one type of pain following a stroke.

The pain intensity was similar in the different pain conditions but since the range reveals individual differences, the pain should not be considered in the light of pain diagnosis but as an individual subjective experience (23). The pain intensity rating was for the day of data collection. Jensen & McFarland (24), show that the reliability and validity of pain intensity measurements (as measures average pain) in patients with long-term pain can be improved by increasing the number of assessments. The pain ratings in this study were planned for different occasions, but were not carried out since several patients, because of their suffering, were given pain relief medication after the first rating.

Elderly people might have difficulty in using the VAS scale, for which reason combinations with verbal scales are recommended (25). The combined tool (POM) comprises two common measures of pain (21). The POM was adjusted to the patients included in this study, i.e. the text was enlarged. Furthermore, the construction of the POM-VAS scale differs from that of the common VAS scales. POM-VAS is longer,

Table IV. *Pain intensity, quality and frequency* (n = *43*)

	All *n* = 43	Central pain *n* = 15	Nociceptive pain *n* = 18	Tension-type headache *n* = 10
Pain intensity, median (range)	5.0 (3–10)	6.0 (4–10)	4.5 (3–9)	5.0 (3–8)
Number sensory pain descriptors, median (range)	2.0 (1–4)	2.0 (1–4)	2.0 (1–4)	1.5 (1–3)
Number affective pain descriptors, median (range)	2.0 (1–4)	2.0 (1–3)	2.0 (1–4)	2.0 (1–3)
Continuously, never free from pain (number)	12	6	3	3
Continuously, free from pain for an hour or so, after treatment, medicine or rest	11	2	8	1
Almost every day, maybe completely free from pain some days	8	4	4	0
Almost every week, maybe completely free from pain some weeks	9	3	3	3
Comes and goes	3	0	0	3

Table V. *Factors increasing and decreasing pain*

	All $n = 43$	Central pain $n = 15$	Nociceptive pain $n = 18$	Tension-type headache $n = 10$
Increasing				
Nothing definite	5	3	1	1
Lying	8	1	5	2
Cold	15	6	5	4
Change of weather	8	2	5	1
Lifting	12	1	7	4
Sitting	8	3	4	1
Warmth	2	2	0	0
Stress/anxiety	16	5	5	6
Walking	8	3	5	0
Other movement	8	1	6	1
Touching	9	4	4	1
Decreasing				
Nothing definite	7	4	3	0
Cold	2	1	1	0
Peace and quiet	13	4	5	4
Medicine	18	6	7	5
Rest	18	6	6	6
Warmth	6	2	3	1
Physical exertion	8	2	2	4
Change of body posture	21	4	14	3

thicker and has a manageable marker, which was found to make it easier to understand and handle for patients with locomotor difficulties in this study. The psychometric testing of the English version has been performed with satisfactory result (21), but has not been done on the Swedish version. POM has previously been used in Swedish studies (26, 27).

Recent studies have pointed out that classification of pain cannot rely on pain descriptors only since there may be considerable overlap between descriptors chosen in different types of pain (28). Pain descriptors can however give useful information for better understanding of each patient's pain experience (23). In this study some of the descriptors were discriminating, as reported in previous studies. Only patients with central pain had burning pain (7, 22) and patients with headache differed in that they described their pain as pressing (12, 13).

Factors increasing the pain in persons with headache were mainly stress and anxiety, which has been suggested by Arboix et al. (29) as being the cause or at least the contributory cause of tension-type headache. In patients with central pain, the factor mostly increasing the pain was cold, which corresponds to the findings of previous research (7, 22). Since patients with nociceptive pain reported lifting as well as other physical movements as factors increasing pain, this should be considered in physical handling and other activities in order to provide good rehabilitation and care. Therefore the health care staff and other carers of patients with shoulder pain need advice about correct handling (9, 30). Previous studies (9) report conflicts regarding causes, prognoses and treatment of shoulder pain. The cause of pain must be identified in each individual patient and appropriate treatment used, where possible (7, 9, 10). Change of body posture was a factor decreasing pain, an important factor to consider in rehabilitation and care planning of paretic and hemiplegic patients.

The results show that half of all patients, i.e. those with central or nociceptive pain, seem to suffer from pain continuously or almost continuously. However, the item "pain comes and goes" was rated differently on the two scales used. The Pain Questionnaire includes more variables, is more detailed and may be more reliable. It may also mean that the patients in this study suffering from long-term pain interpreted the item as pain can "come and go" even though pain is continuous.

Several of the patients in this study had inadequate prescribed pain-relief treatment or none at all. Conventional analgesics are reported by Bowsher (7) and Boivie (22) to be ineffective in central pain. According to a recent study, tricyclic antidepressants, e.g. amitryptyline, are still the drugs of first choice in the treatment of neurogenic pain conditions (31). It also seems that the patients may have lack of information and knowledge about relevant pain treatment and dosages, based on the reported amount of for example paracetamol taken. The patients who stopped their treatment because of no effect may have been prescribed amitryptyline too late or stopped the treatment too early. Bowsher (7, 32) emphasizes that the best effect is seen if treatment is started early after pain onset and that pain-relief usually demands the maximal tolerable dose for several weeks.

Three investigators were involved in this study, responsible for independent areas of the data collection and involved on different occasions. The time between the clinical examinations and pain assessment is not taken to influence the results since the patients had experienced pain for more than 1.5 years.

The mean age for stroke incident in Sweden today is approximately 75 years, even though it may occur at any age (1). The lower age (median value 66.0) in this study is because

of the patients excluded. The median age of patients excluded because of communicational disability and/or intellectual impairment as well as the patients without pain, was 74 years. The median age of patients with other major pain conditions was 76, and of dropouts 71. Bowsher (8) reports that most patients with central pain appear to be younger than the general stroke population, which is in conformity with this study (median value 65.0) and previous Scandinavian studies (7, 9). Patients with headache in previous studies (14, 15) were also younger than the general stroke population, which corresponds with this study (median value 66.0). More men than women (30/13) were represented in this study as in previous studies (4, 6, 12), which might be because men are at higher risk for getting a stroke.

In agreement with previous studies (7, 22), the pain onset was in most of the patients after 1–6 months or after the discharge from hospital. In this study more than half of the patients did not know the cause of their pain even though the duration of pain was more than 1.5 years and most of them found it easy to describe their pain locations. This may be due to lack of awareness, knowledge or information on the part of the health care staff. According to Bowsher (32), patients with pain after a stroke have reported that they never had been asked about pain by their carers.

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