

relevant pain impulses are connected ultimately to special receptors in the sensorium. Speaking of sensation generally, the nerve ending is specialized to receive particular forms of stimulus and to convert these into nerve impulses; there is reason to think that all these nerve impulses are fundamentally alike and that the nerves are mere conductors of a common pattern of excitation thrown into them by the end-apparatus. If this is indeed so, then the sensorium, which ultimately receives these impulses, alone determines the form of sensation, be it light, sound, or pain. The kind of pain which skin is capable of awakening is common to all parts of the skin and to the stratified mucous membranes; the corresponding nerves evidently belong to a common system and connect to a common centre.

We may for present purposes leave on one side the finer distinction between pain derived from muscle and that from other deep-lying structures, such as tendon, and deal only with pain from the skin and from deep-lying structures as a whole. The difference between the quality of skin pain and of deep pain is so clear, the quality of the former is so exclusive to skin and mucous membrane and of the latter to deep structures, that it is possible we are in error in classing both together under the one term "pain." It is a matter of usage; these two sensations have not been shown to possess the common properties which the use of a single term would imply, and I can see no conclusive reason for regarding them as more fundamentally akin than are other forms of sensation which are distinguished by separate terms. If we are right in concluding that the system of fibres subserving cutaneous pain passes to an appropriate and exclusive part of the sensorium which determines this particular sensation, we are brought to consider whether fibres subserving pain derived more deeply do not connect to a separate part of the sensorium.* At all events, we should bear in mind the possibly serious fallacy of regarding both types as represented in a common centre.

It is usual to-day to refer almost all peripheral sensations to the four specific systems—touch, pain, warmth, and cold—and there is a definite tendency to ascribe all other sensations, such as itch, tingling, and the various but different sensations classed together popularly as pain, to the touch or pain nerve system. This procedure is an arbitrary one, and has arisen out of a surrender to simplicity rather than from the dictates of evidence. It is conceivably the correct view, but it is not necessarily so, and we should be on guard. The difference in the quality of pain derived from skin and from deeper structures has led me to suppose that these may be fundamentally separate forms of sensation. The idea suggested that the two corresponding systems of peripheral nerves establish different connexions within the central nervous system is supported in other ways. Painful stimulation of the skin is well known to awaken quick protective reflexes. Painful stimulation of deeper structures does not appear to possess this association. Thus, stimulation of a decerebrate frog's toe results in instant withdrawal by flexion of the limb; so, too, will stimulation of any other part of the skin of the limb. But, if care is taken to avoid escape to cutaneous nerves, such reflexes do not seem to be obtainable from muscle or periosteum of the leg, or from abdominal viscus. While painful sensations derived from the human skin are associated with brisk movements, with rise of pulse rate, and with a sense of invigoration, those derived from deeper structures like

periosteum and joints are often associated, as are for the most part those from the viscera, with quiescence, with slowing of the pulse, a fall of blood pressure, and nausea, the last phenomenon being responsible for the common designation "sickening" which is applied to this but never to cutaneous pain.

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A PRELIMINARY ACCOUNT OF REFERRED PAINS ARISING FROM MUSCLE*

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During the last year I have made an extensive investigation of the character and distribution of muscular pain produced experimentally in normal subjects. A detailed account of this work will appear in the next number of *Clinical Science*. Briefly I find that pain arising from muscle is always diffuse and is often referred, with a distribution which follows a spinal segmental pattern; and that this referred pain is associated with referred tenderness of the deep structures.

A number of cases of "fibrositis" or "myalgia" have been investigated from this point of view. The distribution of the pain was noted as accurately as possible, and experience of the distribution of pain provoked from normal muscles guided me to the muscles from which spontaneous pain might have arisen. Such muscles almost always presented tender spots on palpation. Pressure on these spots sometimes reproduced the patient's pain; but a method more often successful was the injection of sterile saline into the tender muscle. The injection of novocain may also reproduce the pain momentarily.

The search for the source of trouble by defining areas of tenderness is often confused by the patients calling attention to areas of referred tenderness. But referred tenderness is rarely conspicuous, and I have found it a useful guide to consider tenderness to be referred unless the patient winces under the palpation of a given spot. When these acutely tender spots were not too extensive they were infiltrated with 1 per cent. novocain, and the patients were then re-examined, more attention being paid to pain on movement and limitation of movement than to spontaneous pain. This infiltration often produced relief of the symptoms and signs, and sometimes abolished them completely.

In the eight illustrative cases here reported clear-cut results have been obtained in that the full spontaneous pain has been reproduced by manipulating the tender spots and all symptoms then abolished by anaesthetizing these spots locally; in these cases, therefore, it is sound to conclude that the widespread referred pain arose from the tender regions of the muscle. It has been found, too, that in instances in which novocain infiltration abolished the symptoms this effect often outlasted the actual anaesthesia and was more or less permanent. This suggests

* Pain of both kinds is conveyed by the antero-lateral tract, as is shown by the abolition of both in cases in which this tract has been divided surgically.

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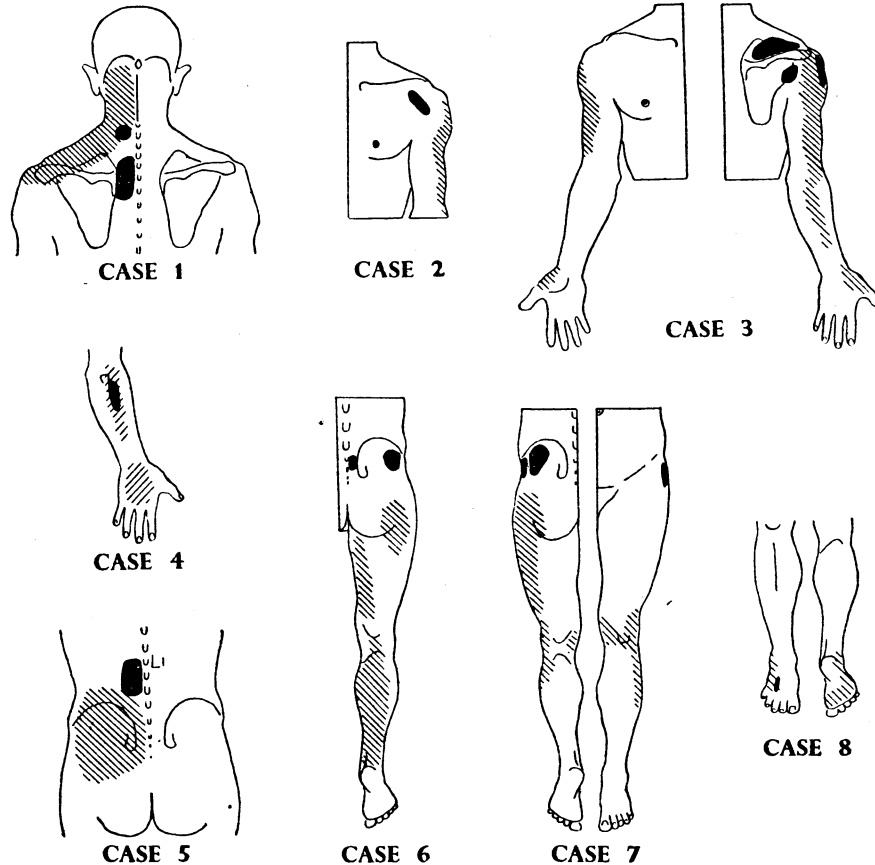
that novocain injection may be of therapeutic value in these cases, though the reason for its permanent effect is at present uncertain, and is under investigation.

The injection of local anaesthetics is of course a well-known therapeutic measure which has claimed occasional successes in these complaints, as indeed have most forms of local therapy. The uncertain results obtained with local therapy are not surprising when one considers that without an accurate knowledge of the distribution of muscular pains the therapy must often be applied to areas of referred pain and tenderness instead of to the source of the pain. It remains to be seen how much a further knowledge of muscular pain will help in the treatment of these very difficult cases.

(trapezius or rhomboids). The tender spots were infiltrated with 16 c.cm. novocain. This abolished the pain and he could move his head and neck painlessly through an almost normal range. One week later he was quite free from symptoms and had a full range of movement in the neck, though he had had some pain for two days after the injection.

Case II

A housewife, aged 35, who for two weeks had suffered from an aching pain felt down the outside of the left arm from the shoulder-tip to the elbow. The pain was continuous and aggravated by use of the arm, and she also had sudden stabs of pain when moving the abducted arm.



Showing the distribution of pain (hatching) and tender spots (black) in eight cases in which the pain was abolished by anaesthetizing the tender spots with novocain.

Case I

A builder, aged 41, who had suffered for six months from pain in the left side of his neck. This came on gradually while he was doing overhead work to which he was unaccustomed. The pain was a continuous ache felt over the left side of the neck from the shoulder-tip to the occiput. The pain was aggravated by any use of the left arm; his neck felt stiff, and he had sudden exacerbations of pain on attempting to move his head. For the two weeks before he was seen the pain had been worse and had kept him awake at night.

He was a muscular man who appeared in fair general health. He held his head flexed to the right, and all neck movements were greatly limited by pain. He had a full range of passive movement in the left shoulder, but active movements were painful. Two tender spots were found—one in the erector spinae at the root of the neck, and the other by the vertebral border of the scapula

She was a stout woman who appeared in good general health. Her shoulder movements were full, except extension and internal rotation, which were limited by pain. A tender spot was found in the deltoid near its anterior border. This spot was infiltrated with 10 c.cm. novocain. During injection the pain in the arm was momentarily increased; then it was abolished, and at once internal rotation and extension of the shoulder became full and painless.

Case III

A housewife, aged 50, who for six months had suffered from pain in the right arm. This was of gradual onset and there was no history of trauma. Lately the right hand had felt weak and she had had some numbness and tingling of the fingers. The pain was a continuous ache felt from the shoulder-tip down the outside of the arm, the back of the forearm, and in the thumb.

She was a stout woman in good general health. All movements of the right shoulder were painful, and abduction and internal rotation were limited. The elbow, wrist, and hand joints appeared normal and there was no wasting and no sensory changes in the skin. A radiograph showed no bony abnormality in the shoulder or neck. Tender spots were found in the deltoid and supraspinatus and at the back of the shoulder over the latissimus dorsi or teres minor. These spots were infiltrated with 18 c.cm. novocain. There was a momentary increase of pain in the arm, forearm, or thumb during the injection of the different spots. When all the spots were anaesthetized the pain in the arm was abolished and the patient could move her shoulder painlessly through a full range. One week later there had been no return of pain in the arm, though it still felt heavy and weak.

Case IV

A police constable, aged 45, who had knocked his right elbow six weeks earlier, and since then had suffered from aching pain in the forearm and over the back of the hand.

He was a healthy muscular man. His elbow and wrist movements were full and painless, but gripping with the right hand was painful and weak. Extension of the fingers against resistance was also very painful. A tender spot was found in the belly of the extensor digitorum communis, and the tip of the external epicondyle was tender. The tender muscle was infiltrated with 5 c.cm. novocain. This abolished the pain, and his right grip was now strong and painless. One week later there had been no return of pain and his right grip was strong; the epicondyle was still tender.

Case V

A potato porter, aged 62, had suffered from lumbago on and off for forty years, but had been in more or less constant pain for the last year. Ten days previously he had had a great increase of pain, and since then this had been continuous; he obtained no relief in any position, and all movements were painful. The pain was felt over the left sacro-iliac joint and the left buttock.

This patient was an old but muscular man. He had great difficulty in moving because of pain, and he held his back quite rigid. Straight knee leg-raising: right to 65 degrees, left to 40 degrees, both limited by pain in left buttock. A tender place was found in the left erector spinae opposite the first, second, and third lumbar spines. This place was infiltrated with 30 c.cm. novocain. The pain was abolished; he could then move about painlessly and had fair mobility in his back. Straight knee leg-raising to 75 degrees on both sides. One week later he had had little pain since the injection and was free from pain except after prolonged sitting. Straight knee leg-raising to 80 degrees on both sides.

Case VI

A van driver, aged 33, had suffered for a year from aching pain in the right calf of gradual onset. For the last six months this had been getting worse, and had spread to the thigh and hip; it was a continuous ache, aggravated by walking or sitting down.

The patient was a thin man who appeared in good general health. In standing his weight was on his left leg, with his pelvis lower on the right side and with a lumbar scoliosis. He had a full and painless range of movement in the right hip, knee, and ankle, but there

was some stiffness of the lumbo-sacral spine. Straight knee leg-raising to 80 degrees on left side and 40 degrees on right (limited by pain in leg). The right ankle-jerk was absent, but there were no sensory changes in the skin of the right leg.

Two tender spots were found—one in the right gluteus medius and the other in the right sacral erector spinae. Pressure on the sacral spot gave pain in the calf. The sacral tender spot was infiltrated with 40 c.cm. novocain. During the injection there was a momentary increase of pain in the calf. When this spot was anaesthetized the pain in the calf was abolished, but there was still some pain in the hip. Straight knee leg-raising to 75 degrees on right side, 80 degrees on left. The scoliosis was less obvious on standing. One week later he had been free from pain for two days, after which there had been some return of pain in the calf. The erector spinae was still tender, and the novocain infiltration was repeated. One month later he had had no pain in the calf since the second injection, but still had pain in the thigh and hip. He had no scoliosis on standing, but the right ankle-jerk was still absent.

Case VII

A baker of 36, who for seven months had suffered on and off from pain in both hips and legs. For the last week he had had a continuous aching pain in the left knee and in the outside of the left thigh and calf.

He was a muscular man who appeared in good general health and had a normal posture. He had limitation of abduction and rotation in both hips, but only the left was painful; there was full and painless movement in both knees and back. Straight knee leg-raising to 75 degrees on both sides. His knee- and ankle-jerks were present, and there were no sensory changes in the skin. Radiographs showed bilateral coxa vara, with very slight osteo-arthritis changes. Tender spots were found in the left gluteus medius and tensor fasciae femoris. These spots were infiltrated with 70 c.cm. novocain. During injection there was a momentary increase of pain in the knee. When the infiltration was complete the pain in the knee was abolished, but there was still slight pain in the hip. There was no change in the range of movement. One week later he had been free from pain for six days, though the night after the injection he had had much pain. The movements of both hips were still limited, though painless.

Case VIII

A clerk, aged 17, who had suffered from pain in his right foot for three weeks. This was not of sudden onset, and he had had no injury. The pain was felt under the metatarsal heads and in the outside of the foot and ankle. He had pain with each step and walked with a gross limp.

He appeared in good general health. His ankle and foot movements were full and only slightly painful. Radiographs showed no bony abnormality in the right foot. There was tenderness of the third interosseous space. The tender space was infiltrated with 3 c.cm. novocain. During the injection his pain was reproduced momentarily. Then it was abolished, and he could walk normally with complete comfort. Three weeks later he had been quite well except for two days following the injection, when he had had slight pain.

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