ORIGINAL RESEARCH

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Dermal Reflections of Neural Disorders: An Hypothesis

Introduction

This thesis reports a clinical research project which was undertaken to study a pattern existing between certain skin lesions on the upper extremity and structural and inflammatory changes in the upper thoracic and cervical vertebral areas.

Attention was drawn to this pattern by a patient who had a "common wart" on the palmar surface of his distal left index finger. He was being treated for numbness and pain in the left upper thorax, shoulder, arm and hand; however this problem was secondary to cervico-thoracic disc degeneration with associated inflammatory changes. The disc degeneration was demonstrated by X-ray. After the patient's symptoms cleared, he noted that the wart had also disappeared; during a subsequent recurrence of the pain pattern a wart reappeared on the index finger. After the pain had been present longer another wart appeared on the palmar surface of the distal segment of the left thumb. Both warts partially disappeared after the symptoms eased.

William Boyd in his Textbook of Pathology views the common wart as "the result of invasion of the epithelial cells by a specific virus" (1). The possibility that a cause-effect relation existed between the disc degeneration and emergence of the wart prompted the professional staff at the Zeller Osteopathic Center to look for similar cases. Four more were quickly found. (This search also revealed some patients with a different kind of skin lesion on the leg and associated pain and other symptoms in the distribution of the sciatic nerve.)

Five patients with cervico-thoracic problems and similar skin lesions in the distribution of the brachial plexus were hardly coincidental. It was decided to study the group both for differences and similarities.

The structure-function relation is the most plausible explanation for the existence of certain syndromes in the human. This concept provides the principal rationale for osteopathic manipulative therapy; it has been discussed, illustrated and demonstrated in case report after case report. In those reports little reference is made to the dermatological aspects of the structure-function relation. In the review of the literature there was no reference suggesting that alteration of the trophic state of this peripheral tissue was secondary to abnormal spinal reflex arc activity.

The observed association of dermatological changes related to spinal disturbance

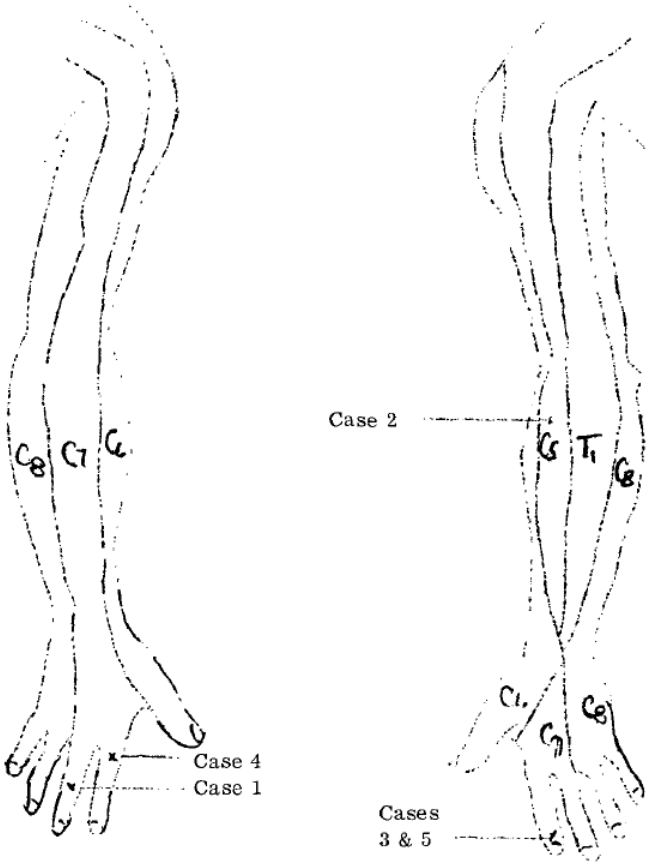
Editor's Note

David A. Patriquin, DO, FAAO passed away on October 16, 2020. This 1967 AAO Yearbook reprinted article was completed as part of his requirement toward earning the designation of Fellow in the American Academy of Osteopathy. Opinions expressed in this article are those of the author and do not necessarily reflect the viewpoint or official policy of the American Academy of Osteopathy, and it was edited to conform to *AAOJ* style guidelines.

Keywords

Neural disorders, skin lesions, x-rays, cervical x-ray, thoracic convexity

Figure 2. *Neural Segmentation and Location of Skin Lesion. Drawings taken from the Cibe Collection of Medical Illustrations, Volume I.*[10]



is consistent with present day osteopathic theory. This restatement of the structure-function concept in terms of visible dermal manifestations of chronic internal derangement stresses the general application of the osteopathic concept. It broadens the clinical applicability of the structural aspects of osteopathic practice in the thinking of the average practicing physician.

Observations in the Center suggest the hypothesis that a cause-effect relation exists between cervicothoracic vertebral abnormalities and benign lesions appearing in neurally segmentally related skin, and that chronic physiologic disturbances in the cervicothoracic area cause an epidermal susceptibility to a specific virus. This change in the epidermis is believed to be trophic in origin; it may be the result of chronic abnormal sympathetic activity. Sympathetic control of dermal vasculature may be the most important factor causing the trophic skin changes which permit viral invasion.

Methods

Five patients with a history of cervical or thoracic distress and having what appeared to be a verruca on either upper extremity were chosen from the general practice of the Zeller Osteopathic Center. The five patients and their records were studied individually and compared with each other. No controls were used.

Skin lesions were examined and described as to location and physical appearance. Black and white and color photographs were made of each lesion. The lesions were removed by a dermatologist, placed in Bouin's solution and sent to a histopathologist for study The symptoms of each patient were studied regarding duration, distribution and time of onset. The location of the skin lesion and the distribution and origin of symptoms were compared for anatomical or physiologic similarities and differences,

Postural X-ray studies of the lumbar spine and pelvis and the cervico-thoracic area were made to evaluate postural (structural) factors. Standard postero-anterior, lateral and oblique X-rays of the cervical and cervico-thoracic areas were made to permit study of the osseous structures in the area of origin of the brachial plexus.

The postural X-ray studies were made by an osteopathic physician who has had special training in the techniques of postural X-ray. The standard X-ray studies were done by a medical radiologist. All postural and standard studies were sent to a certified osteopathic radiologist for individual and comparative studies.

The X-ray results were then correlated with the symptoms and related skin lesions and tabulated.

The principle limitations in this study were the lack of methods for direct measurement of the hypothesized structure-function relation and the lack of standardized methods of measuring the trophic effect of the nervous system on skin. Because of the lack of controls, it was also difficult to rule out local microtrauma, psychological factors, or chemical or physical conditions which would have to be taken for granted if not specifically dealt with in the history. In addition, the usual limitations of X-ray were considered. Finally, the small sample studied could have affected the validity of results.

Results

The most outstanding finding of the study was that in all five cases distress at the neck, shoulder, arm or hand was located on the same side as the skin lesion (Table 1).

The X-rays showed degenerative changes in one or more of the lower three cervical vertebrae in all of the patients (Table 2).

Table 1. *Location of Skin Lesions and Symptoms*

Case No.	Location of Skin Lesions	Location of Symptoms
1	Right Hand	Right and Left Arms
2	Left Forearm	Left Cervico-Thoracic Area
3	Left Hand	Left Cervico-Thoracic Area
4	Right Hand	Right Cervico-Thoracic Area
5	Left Hand	Left Cervico-Thoracic Area; Left Arm and Hand

Table 2. *Comparison Between Location of Skin Lesions and Degenerative Changes in the Vertebrae*

Case No.	Location of Skin Lesions	Cervical X-Ray Findings
1	Right Hand	C5, C6, C7 Degeration; Moderate to Marked
2	Left Forearm	C3, C4, C5 Degeneration
3	Left Hand	C5, C6 Degeneration
4	Right Hand	C3, C4, C5, C6 Degeneration
5	Left Hand	C4, C5, C6 Degeneration; Marked

Table 3. *Comparison Between Location of Skin Lesion and Direction of Cervico-Thoracic Convexity*

Case No.	Location of Skin Lesions	Direction of Cervico-Thoracic Convexity
1	Right Hand	Left
2	Left Forearm	Right
3	Left Hand	Left
4	Right Hand	Left
5	Left Hand	Left

Table 4. *Comparison Between Location of Skin Lesion and Direction of Thoracic Convexity*

Case No.	Location of Skin Lesions	Direction of Thoracic Convexity
1	Right Hand	Right
2	Left Forearm	Right
3	Left Hand	Right
4	Right Hand	Left
5	Left Hand	Right

Table 4. *Comparison Between Location of Skin Lesion and Direction of Lumbar Convexity*

Case No.	Location of Skin Lesions	Direction of Lumbar Convexity
1	Right Hand	Left
2	Left Forearm	Left
3	Left Hand	Right
4	Right Hand	Left
5	Left Hand	Left

Four skin lesions were reported as verruca vulgaris by the histopathologist. The fifth lesion was a nevus of unna which is thought to be a form of verruca.

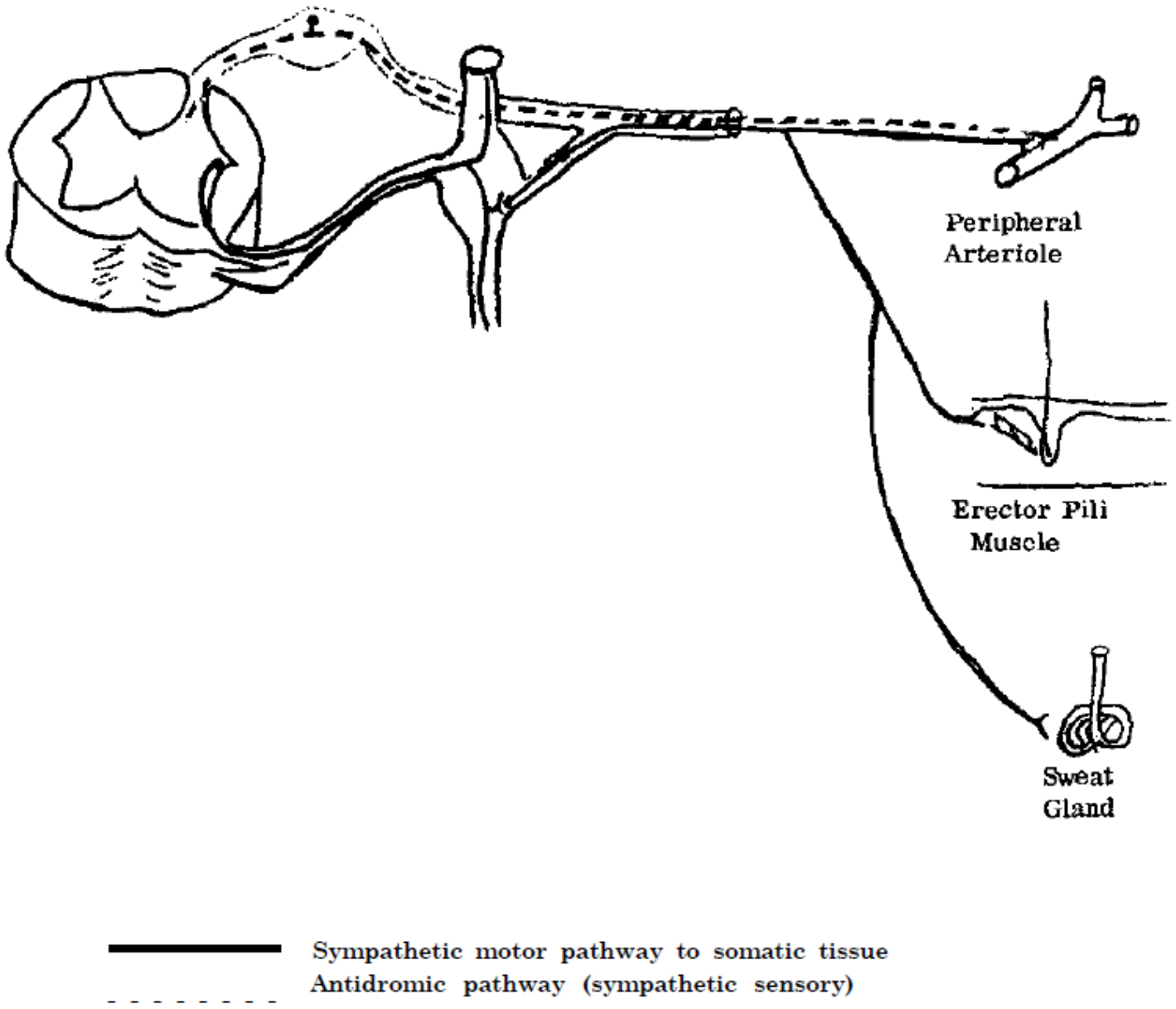
The four verruca vulgaris lesions were located in the dermal distribution of the seventh cervical nerve on the hand or fingers (Figure 2).

Tabulation of comparative studies indicated no correlation between the direction of spinal convexities and the location of the skin lesion (Tables 3, 4, and 5). However, all the cases did have lateral convexities at the cervico-thoracic area.

Discussion

This study was undertaken to evaluate the report of one patient who suggested that he developed "warts" on his left thumb and index finger when he had acute left brachial neuritis. The same directional relation was found in all five patients studied, which is remarkable even in our small sampling.

Figure 1. *Sympathetic Reflex Arc. Drawings taken from the Cibe Collection of Medical Illustrations, Volume I.*[10]



Neuritis and trophic changes are most often secondary to pathology at the spinal cord and nerve root levels. In this study X-rays were taken of the spinal level corresponding to the origin of the brachial plexus, and in every case there was evidence of mild to severe degeneration of at least one of the three lower cervical vertebrae. This degeneration may be the third corner of a triangle, or it may be only a secondary change resulting from a postural disturbance. However, postural studies and tabulation fail to indicate a definite relation between the direction of any spinal convexity and the location of distress or skin lesion. The only finding in this research was that every patient had lateral convexities demonstrated by X-ray.

The assumption that there was a common denominator for the similar distributions of distress and pain can be explained by the structure-function interrelation, the philosophical backbone of osteopathy. The vertebral degenerative changes may be the structural component of a structure-function relation whose functional component is pain, paresthesia and/or trophic change. There is no proof that the pain was directly related to the vertebral alteration, but similar referred patterns of distress have been frequently documented. Neither was it proved that the vertebral changes were directly related to the presence of the verrucae, but such a deduction in terms of trophic disturbance and tissue susceptibility would seem as well founded as the referred pain mechansim.

The answer to the dilemma appears to lie with the structure-function interrelation, segmental facilita-tion and the trophic actions of the central and autonomic nervous systems.

The structure-function relation is as non-traditional in allopathy as it is traditional in osteopathy. A review of non-osteopathic publications produces little to support the hypothesis that a disease process involving vertebrae and surrounding structures can be related, directly or indirectly, to changes in the skin. Descriptions can be found of other reflex phenomena such as referred pain. There are a number of articles and books on viscera-somatic and somatico-somatic relations, but pain and trophicity are two different functions served by different portions of the nervous system. Pain pathways have been well mapped out but neuro-physiologists are still searching to find the mechanisms by which trophism is mediated.

I. M. Korr noted that the so-called trophic function of the nervous system has not been explored because of the lack of means of measuring trophic response. He states in "The Concept of Facilitation and its Origins" that "The trophic functions of nerves unquestionably have a very important bearing on the phenomena with which osteopathic physicians deal" (2).

Trophic changes in skin are usually the result of impaired nutrition or metabolism which are partially under neurogenic control. The effect of neural factors has been stressed in studies of tissue trophism. Other factors including physical activity and nutritional supply (vitamins, etc.) are also important. The skin shows more signs of trophic disturbance than most other tissues, e. g., dryness, cyanosis, loss of hair, brittleness of nails, ulceration and slow healing (3). Perhaps only marked weakness and diminution of the mass of muscle are more dramatic atrophic signs.

We may assume that the skin depends upon the autonomies for most of its trophic control. Chusid and McDonald support this assumption in their work Correlative Neuroanatomy and Functional Neurology. They state : "The sympathetic nerves (from the cells of the intermediolateral cell column) affect the trophic state of tissues through their vasomotor activities and, according to the results of some workers, also exert a specific effect on the metabolism of muscles and other tissues" (4).

How can a chronic structural problem alter impulse pduction sufficiently to produce trophic skin changes? Allopathic authors such as Pottenger (5) and Judovich and Bates (6) have described some clinical aspects of the viscera-somatic and somatico-somatic reflexes, however they do not discuss how these reflexes develop and operate. Pottenger does describe a "viscerotrophic reflex": "This reflex degeneration, for which I would suggest the term viscerotrophic reflex...is well illustrated in the trophic changes in the soft somatic structures which are so commonly found in chronic pulmonary tuberculosis and pleuritis. In pulmonary tuberculosis the skeletal tissues which are supplied by the cervical spinal nerves, particularly the IIIrd, IVth, and Vth, are affected by this trophic reflex" (7).

It has remained for osteopathic researchers such as Korr and his associates at Kirksville to formulate explanations. They have proposed segmental facilitation as part, if not the major portion, of the answer. They have demonstrated that the autonomic nervous system, especially the sympathetic portion, plays an important role in the highly organized response of the human to environmental change (8). A large part of this response is organized as spinal cord reflexes including the sympathetic spinal reflex.

The typical sympathetic spinal reflex consists of a motor preganglionic fiber from the anteromedial cell column of the spinal cord to a synapse in the lateral chain ganglion (Figure 1). The postganglionic fiber goes from the chain ganglion synapse to the structure innervated (arteriole in skin, sweat gland or hair follicle). The sensory component of the sympathetic reflex arc is called an antidromic fiber. It returns to the ventral horn of the cord in the spinal nerve via the dorsal root ganglion without a synapse. Irritation at the spinal cord level gives rise to a situation in which abnormal maintenance or aggravation of normal impulse traffic occurs in that segment.

The segment is then in a hyper-responsive state (segmental facilitation). Impulses from other structures served by this segment, or adjacent or distant ones having common neurologic connections, can trigger or maintain this reflex response after the originating factor has passed (9).

Facilitation of a spinal cord segment can result from a chronic postural problem. The axial skeletal structure of man is poorly adapted to the biped stance. It is still in the process of evolution from the quadruped to the vertical position. Evolutionary changes in pelvic, vertebral, rib and cranial configuration areinsufficient to make this structure stable in the weightbearing posture.

The postural (structural) and myofascial asymmetries which result from upright positioning of the human body may be the source of chronic irritation which causes facilitation to develop in one or several spinal cord segments. On the other hand, the musculoskeletal components of the body may become involved by cord facilitation of visceral origin. The secondary involvement may remain as an important sustaining mechanism after the visceral cause of facilitation has passed.

Successful management of a chronic postural problem may not remove the facilitation. The segmentally related area is conditioned and responds to the smallest stimuli from local structures. The abnormal impulse output from the facilitated segment may continue to maintain peripheral changes that we see in the skin. An example of this is the reported case of a patient who had an extradural hemangioma in the thoracic spine with a port wine nevus on the skin in the associated neuromere (10).

One can see how segmental facilitation can involve the whole spinal reflex including the sympathetic component. This sympathetic reflex arc can, when facilitated, adversely influence the trophic state of the skin through chronic alteration of its vasculature.

This study deals with an area of the body served by the brachial plexus. Although the motor and sensory nerve fibers of this plexus arise mostly from spinal cord levels C5 through C8 and Tl (usually with some fibers from C4 and T2) the sympathetic components come from the upper five thoracic cord levels via the middle and inferior cervical sympathetic ganglia and the first thoracic sympathetic ganglion. The anterior primary divisions of C5 and 6 receive postganglionic sympathetics from the middle cervical ganglion; those of C7 and 8 get their gray rami from the inferior cervical ganglion; and the 1st thoracic somatic nerve receives two gray rami from the first thoracic sympathetic ganglion. This means that the brachial plexus branches and the tissues served by them have sympathetic fibers from the upper five thoracic cord segments. It means further that disturbances in the upper five thoracic segments resulting from facilitation may cause trophic changes anywhere in the distribution of the brachial plexus.

If there are areas of facilitation in cord segments C4 through T2, stimuli may be instituted which can flow over into the antidromic "compartment" of the brachial plexus to establish a facilitated sympathetic reflex arc in cord levels T1 through T5. This segmental facilitation of upper thoracic and cervical spinal cord segments can result in abnormal sympathetic activity in the distribution of the brachial plexus with alteration of the trophic state of any tissues served by that plexus.

Alteration in the trophic state of tissue, especially reduction of its blood supply, lowers the vitality or resistance of that tissue. Atrophic skin, like other atrophic tissues, is more susceptible to bacterial and viral invasion. Invasion of the atrophic skin by the appropriate virus then causes the development of the verruca.

Conclusion

The complete coincidence of findings of degeneration of the lower cervical vertebrae, and distress and dermal lesions on the same side is strong evidence in support of the original hypothesis. We conclude that a cause-effect relation does exist between cervicothoracic abnormalities, especially vertebral degeneration associated with lateral spinal curving, and benign lesions appearing on neurally segmentally related skin.

Summary

This study strongly suggests that vertebral degenerative changes, possibly originating from postural distortion, are directly related to the emergence of pain and skin lesion patterns. The mechanism of segmental neural facilitation, especially as it affects the sympathetic reflex arc helps to explain how this structure-function mechanism works. The sympathetic involvement is considered to play an important role in the causation of an atrophic state in the skin. This atrophic condition permits invasion by organisms which themselves cause the skin lesion or favor the development of atrophic skin lesions.

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