

## A SURVEY OF SYSTEMIC DISTURBANCES TRACEABLE TO INFECTED TEETH

RUSSELL L. HADEN, M.D.

Because medicine is a dynamic science, our ideas of the nature and the causative factors in many diseases are constantly changing. In the past twenty years, the possible relation of focal infection to almost every disease has at least been considered. Different observers hold widely different views concerning the role of foci of infection in the causation of systemic disease. This survey is an attempt to summarize the most competent medical opinions on the subject. Such an accounting at intervals is most important in the study of dental focal infection.

Dental infection may cause systemic disease by direct extension into adjacent structures or by metastasis to distant parts of the body. Infection may spread from a tooth into the alveolar process, producing a diffuse osteomyelitis; into the soft tissues, producing a cellulitis, or into the nearby lymph glands, producing a lymphadenitis. The maxillary sinus is not infrequently infected from the upper molars or bicuspid. Occasionally, a sinus thrombosis results from the direct extension upward of an acute dental infection. Rarely, the bacteria entering the blood may multiply and produce a true septicemia. No discussion concerning the role of the dental focus in such conditions is needed. The relation is too apparent.

Metastatic systemic disease is usually due to the actual transference of bacteria from the focus to different parts of the body. The organisms are carried by the blood or lymph stream to the point of localization, where they multiply and incite an infection of the tissues in which they have lodged. At times, the bacteria remain encapsulated at the focus and give off toxins which may produce functional or structural changes in different organs of the body. Systemic disease may also be due to the development of allergy from a focus of infection. Here, the individual becomes sensitized to toxins absorbed from the focus, so that further absorption of poisonous products produces the characteristic symptoms of the hypersensitive state. The discussion and difference of opinion about the importance of dental infection is concerned only with systemic disease of metastatic origin. Diseases of different organs of the body will be considered in detail.

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## ARTHRITIS

Arthritis is one systemic condition which well illustrates the flux of medical opinion concerning the relation of dental infection to distant disease. It is one of the most common clinical conditions met with in medical practice. It is likewise the lesion most commonly seen in animals after the injection of bacteria from foci of infection.

We have gone through a period in which it has been thought that most cases of arthritis were infectious in origin. A few exceptions, such as gout and the joint manifestations of serum disease, have been recognized. It seems settled that acute rheumatic fever is always due to infection. This usually comes from lymphoid tissue and seldom from teeth. Other types of acute arthritis are usually also due to foci of infection, which are often around the teeth and gums.

Benjamin Rush, in 1801,<sup>1</sup> reported the cure of a patient with rheumatism of the hip by the extraction of a tooth. Many other clinicians have since emphasized the casual relation of dental infection to arthritis, especially of the chronic type, although opinions vary widely concerning the frequency with which dental infection occurs as the primary focus. Barker<sup>2</sup> thinks that the majority of cases of arthritis in middle life and in later life are due to dental infection. Wilcox<sup>3</sup> estimates that 90 per cent of all cases of chronic arthritis are due to dental foci. Cecil and Archer,<sup>4</sup> in studying 379 cases of chronic arthritis of probably infectious origin, decided that only 33 per cent were due to infection about the teeth.

As chronic diseases of the joints have been more carefully studied and classified, it has become more and more apparent that many cases of arthritis formerly thought due to dental or other infection are in reality due to a disturbance of metabolism, errors in diet, abnormal absorption from the intestinal tract or to other toxemias not of bacterial origin. We are now much less prone to decide at once that every case of arthritis is due to infection. We still think that most cases of acute arthritis are the direct result of the metastasis of bacteria from a focus. Some cases of chronic arthritis are due to teeth. Probably no cases of true hypertrophic arthritis are due to focal infection. Chronic arthritis of the atrophic type may be due to focal infection, although it constantly assumes less importance in the treatment of the disease.

Diseases of the muscles, periarticular tissues, tendons and bursae are often associated with joint disease. Disorders of these tissues are often the result of dental or other focal infection, although it is possible that any factor in joint disease may also involve these tissues.

Most cases of arthritis due to infection result from the direct localization of bacteria in the joints. In a certain group of cases, the reaction in the joints is due to the absorption of toxins from the focus. I recall one case of acute arthritis in which removal of a badly infected tooth gave immediate relief from the joint symptoms. The next day after extraction, he could walk without trouble although previously he had been on crutches. Here, the joint symptoms must have been due to the presence of toxins or to allergy. The latter probably plays a more important part in infectious arthritis than we usually believe. The classic example of this type of allergic arthritis is that occurring in serum disease.

#### DISEASES OF THE KIDNEY

One type of kidney disease, glomerulonephritis, is probably always of bacterial origin, the organisms entering from a focus of infection. The classic example is the glomerulonephritis occurring in scarlet fever in which the tonsils are the focus. Occasionally, dental infection may be the focus for such a lesion, for a nephrosis or for a chronic diffuse nephritis.

Disease of the kidney medulla and pelvis in the absence of obstruction to urinary flow is probably always due to hematogenous infection. There has been much discussion concerning so-called "pyelitis." The symptom complex which this term designates is very commonly met with in medical practice. The clinical picture of chills, fever, pain in the kidney region and pyuria is usually a pyelonephritis, with the principal lesion in the medulla of the kidney. In the past, these conditions have been ascribed to *B. coli* infection, although there is not much doubt concerning the etiologic relation of this organism to the disease. There is much to suggest that the initial kidney damage is due to the streptococcus or staphylococcus. Bumpus and Meisser<sup>5</sup> have shown experimentally that such kidney infections are frequently produced by bacteria brought to the kidney from areas of chronic dental infection. I have reported similar cases.<sup>6</sup>

Hunner emphasizes the relation of chronic infection to ureteral stricture and certain types of ulcer of the bladder.<sup>7</sup> Rosenow and Meisser have shown experimentally the possible relation of infection to renal calculi.<sup>8</sup> Rarely, other diseases of the genito-urinary tract, such as prostatitis, epididymitis, ovaritis and salpingitis, may result from dental or other focal infection.

The fact that focal infection may cause lithiasis and infection of the urinary tract, and possibly other diseases of the kidney such

as nephrosis and chronic diffuse nephritis, seems definitely settled. Certainly, the elimination of infection in such conditions is always indicated.

#### HEART AND VASCULAR DISEASE

Acute endocarditis is always due to some focus of infection. In young individuals, the focus is usually in the tonsils and adenoid tissue. In older individuals, endocarditis lenta, the type commonly encountered, is often due to dental infection. This is a very serious condition, usually progressive, and practically always ultimately fatal.

Myocarditis occurs very commonly in association with acute rheumatic fever. Chronic myocarditis is a frequent cause of death. Here, the heart muscle is being slowly injured over a long period of time, the muscle fibers being gradually replaced with fibrous tissue. Most observers believe that the initial damage is usually due to infection. This may occur during an acute infection such as typhoid fever or pneumonia. In many instances, the damage results from the continuous absorption of toxins over a long period of time from some chronic focus, which is frequently in the teeth. Some of the arrhythmias which do not depend on permanent structural damage to the heart may be due to absorption from foci of infection. This is particularly true of transient acute auricular fibrillation and paroxysmal tachycardia.

There is much difference of opinion concerning the relation of chronic infection to arteriosclerosis and arterial hypertension of the essential type. It probably has little to do with either. Acute phlebitis and arteritis are often due to focal infection. I have reported several cases of arteritis in which I believe dental infection was probably the focus. The almost constant association of focal infection with thrombo-angiitis obliterans seems most significant.

#### DISEASES OF THE ALIMENTARY TRACT

Digestive disturbances such as gaseous eructations and lack of appetite may result from the swallowing of products of infection about the teeth. These occur principally with pyorrhea. Most diseases of the alimentary tract due to dental infection are hematogenous and not due to swallowing infectious material.

There has been much discussion concerning the relation of focal infection to gastric and duodenal ulcer. Bevan<sup>9</sup> thinks that hematogenous septic infarcts of the mucosa may have a role in these ulcers but are not the common cause. Eusterman<sup>10</sup> states that the

theory that infection is the cause of ulcer is admittedly the only tenable one at this stage of medical progress. Between those two diverse views is the classification of Smithies,<sup>11</sup> who divides ulcer from the stand-point of etiology into ten groups, and classifies one-third of the total number as bacterial.

Rosenow<sup>12</sup> has shown that the intravenous injection of streptococci may be followed by ulcer of the stomach and duodenum; that streptococci are commonly found in the ulcer of man, and that the injection of streptococci isolated from the ulcer wall as well as from foci of infection in patients suffering from peptic ulcer produces when injected into animals, ulcers of the stomach and duodenum resembling those of man. Nakamura,<sup>13</sup> working in Rosenow's laboratory, injected sixty-six animals with cultures from the tonsils in cases of gastric ulcer and found gastroduodenal lesions in 70 per cent. Similar lesions were found in 25 per cent of control animals injected with tonsil cultures from other patients.

The results of such experiments afford evidence that focal infection may cause peptic ulcer. The frequent improvement resulting after removal of the focus is additional evidence. Another point is the anatomic location of the gastric and duodenal lesions in experimental animals. It is well recognized that gastric ulcer may occur in any part of the stomach but is much more frequent in the pyloric region. The experimental gastric lesions have a similar distribution. Clinically, duodenal ulcer is always limited to the first third of the duodenum. The usual explanation given for this localization is that only in this portion is free hydrochloric acid present, and that here the gastric contents are retained longer than in any other portion of the duodenum. In animals, the duodenal lesions are limited to the duodenal bulb.

Chronic ulcerative colitis has recently been added to the gastrointestinal diseases probably due to focal infection. Bargaen,<sup>14</sup> in an excellent series of experiments, has shown that this disease is due to a specific nonhemolytic streptococcus, which he has frequently recovered from chronic foci of infection, especially about the teeth. Marked clinical improvement has resulted from the elimination of the foci of infection and treatment with vaccines made from the causative agent.

Appendicitis or cholecystitis may result from dental infection. Acute dental infection may occasionally so metastasize. I am inclined to think that chronic cholecystitis is very infrequently due to focal infection. Barker<sup>15</sup> reports a case of hepatitis due to pyorrhea alveolaris.

Certainly the statement is justified that the importance of dental and other foci of infection in gastric and duodenal ulcer and in chronic ulcerative colitis is undoubted. The removal of foci in the treatment and prevention of such conditions is always indicated.

#### DISEASES OF THE EYE

A close clinical relationship between oral sepsis and infections of the uveal tract has long been recognized. Black,<sup>16</sup> in summarizing the literature concerning ocular disease resulting from dental lesions, cites clinical reports bearing on this relation which were published as early as 1842. Butler,<sup>17</sup> in a study of 100 cases of infection of the uveal tract, decided that 12 per cent were definitely due to oral sepsis. He considered that the etiology of 41 per cent was doubtful, but concluded that probably a large part of these originated in oral sepsis. B. T. Lang<sup>18</sup> classified seventy-one of 176 cases of eye infection as due to septic foci about the teeth. William Lang<sup>19</sup> thought that pyorrhea was responsible for 139 cases of 215 cases reported by him. De Schweinitz<sup>20</sup> aptly sums up the question in the statement that there is "no better established etiological relationship than that between septic foci in dental areas and certain diseases of the eye, notably those of the uveal tract." Irons, Brown, and Nadler<sup>21</sup> studied a streptococcus isolated from the infected tissues of a patient suffering from dacrocystitis and iritis. They found that a large percentage of rabbits developed eye lesions when injected intravenously with the freshly isolated culture. The ability to produce specific lesions was lost on subculture and on passage. The loss of a specific tendency to localize in the eye was not accompanied by any demonstrable decrease in virulence for rabbits. Rosenow<sup>22</sup> has reported cases of eye infection from dental pulpitis with the reproduction of the lesion in animals. I have reported a group of ocular disorders due to dental infection.<sup>23</sup>

#### DISEASES OF THE BLOOD-FORMING ORGANS

Anemia is well organized as one of the cardinal symptoms of oral sepsis. The anemia is usually of the secondary type. Some clinicians believe that pernicious anemia also may result from focal infection. It is true that oral sepsis is exceedingly common in pernicious anemia, and the anemia is often improved temporarily by the removal of focal infection. The improvement is probably due to the removal of an added load rather than removal of the cause. I consider it exceedingly doubtful that pernicious anemia is ever due primarily to focal infection. At times, other blood diseases, such as hemophilia or chronic thrombopenia, may be due to dental or other focal infection.

# NERVOUS AND MENTAL DISEASES

Oral sepsis may be a factor in certain diseases of the nervous system. Trigeminal neuralgia, sciatica and other forms of neuritis are not infrequently due to dental infection. I have seen one case of encephalitis manifestly of dental origin. It is especially important to search carefully for infection of the dental pulp in cases of neuritis.

The symptom complex to which we give the name neurasthenia may be due to the slow absorption of poisons from a chronic focus of infection. Cotton<sup>24</sup> has studied especially the relation of dental infection to mental diseases and reported marked improvement after the removal of foci. Graves<sup>25</sup> has reported similar results. It is the opinion of many critical observers that the importance of focal infection is much overemphasized in such case reports.

## SUMMARY

There are few tissues of the human body in which bacteria from a dental focus may not localize. Clinically, only a small number are commonly found affected. The incidence of involvement as observed in clinical work checks closely with the incidence of lesions as found in the experimental animal after intravenous inoculation with organisms recovered from dental foci. The lesions most frequently seen in patients due to focal infection are those of the locomotor system. The kidney, heart, stomach and duodenum and eye are often affected. Less commonly, other organs, such as the nervous system and blood building tissues, may be involved. Rarely, very unusual lesions, such as onychia<sup>26</sup> or thyroid disease,<sup>27</sup> may result from dental infection.

Every clinician is disappointed in the results obtained by the removal of foci of infection in the treatment of disease even of proven metastatic origin. To me, the lesson to be learned from the demonstration of a definite relation of foci of infection to various systemic diseases is the need for the removal of such foci before metastasis to other organs has taken place. Disease, once initiated, is often not affected by removal of the cause. Why remove a cancer of the breast after metastatic nodules in the liver can be demonstrated? Why not remove foci of infection before metastatic disease has resulted? This is the lesson to be learned from all clinical and experimental demonstration of the causal role of chronic foci of infection in systemic disease.

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