LUETIC CARDIOVASCULAR DISEASE

MEDICAL GRAND ROUNDS
UNIVERSITY OF TEXAS HEALTH SCIENCE CENTER AT DALLAS
SOUTHWESTERN MEDICAL SCHOOL
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"Probably no syphilitic involvement of the human body is more frequently overlooked than that of the cardiovascular system."
H.N. Cole and L.J. Usilton (1)

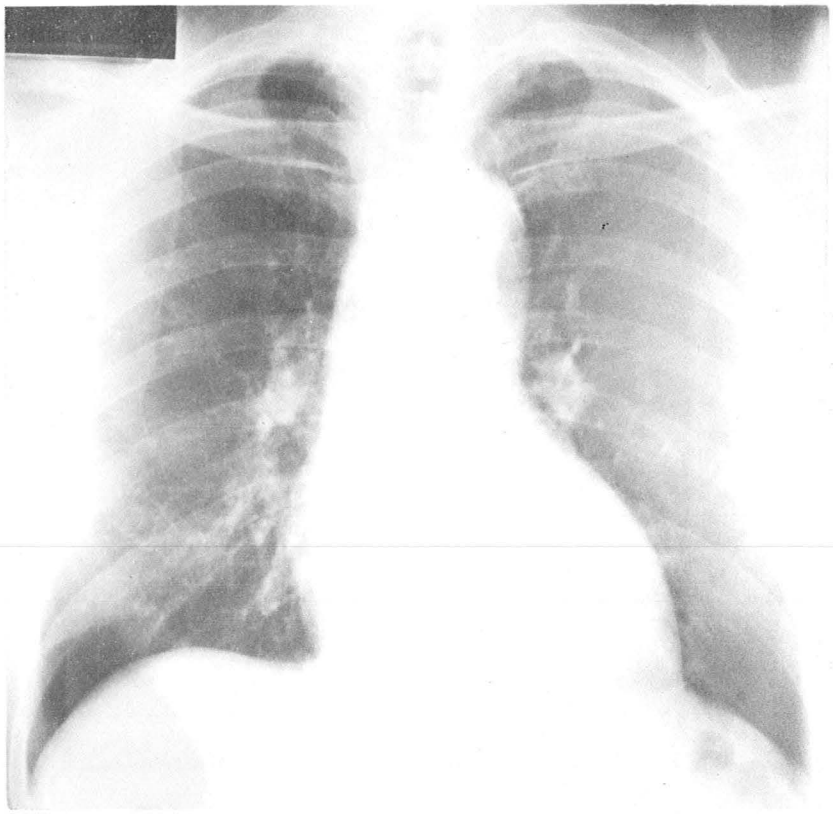
Two patients who have been seen at this center recently are illustrative of the spectrum of luetic heart disease and I should like to begin by briefly discussing these two cases. I am indebted to Dr. L. Maximilian Buja for his careful work in the clinico-pathologic correlates of these two men.

Patient No. I

A 57 year old white man presented with symptoms of left-sided congestive heart failure. On physical examination he had evidence of left ventricular decompensation and moderately severe aortic regurgitation. VDRL was positive. Chest x-ray (page 3, A and B) showed linear calcification and slight dilatation of the ascending aorta and slight enlargement of the left ventricle. At cardiac catheterization, he was found to have 3+/4+ aortic regurgitation by angiographic estimate and ostial stenosis of both coronary arteries (page 3, C). During selective injection of the left coronary artery (right anterior oblique projection), the catheter could not be kept in the coronary ostium and had just retracted a few millimeters from the ostium. A small amount of contrast material can be seen in the sinus of Valsalva. The mouth of the vessel is markedly narrowed compared to the lumen of the vessel at its widest part. He underwent aortic valve replacement and coronary artery by-pass grafts but sustained an intraoperative myocardial infarction and could not be weaned from cardiopulmonary by-pass. At necropsy (page 3, D), the aorta showed changes of severe luetic aortitis and severe calcific arteriosclerosis. The prosthetic valve has been removed. Both coronary ostia were narrowed but probe patent (probes present in the ostia). Patency of the ostium of the left coronary artery was produced at surgery by debridement of calcific plaque from over and around the ostium. This procedure resulted in left coronary artery embolization and myocardial infarction.

PATIENT I

A



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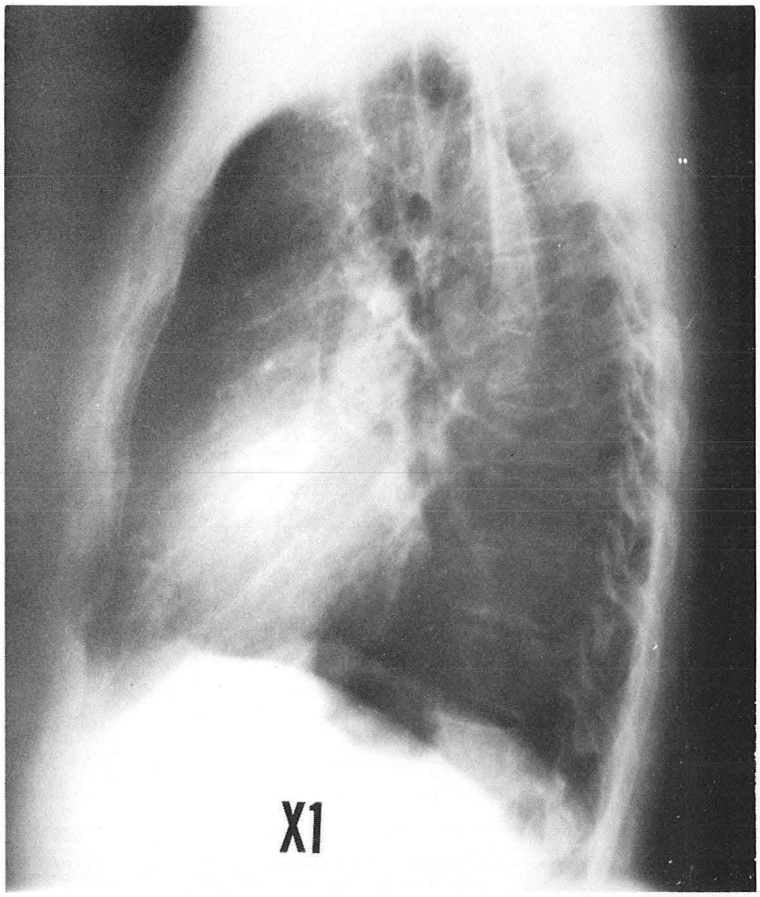

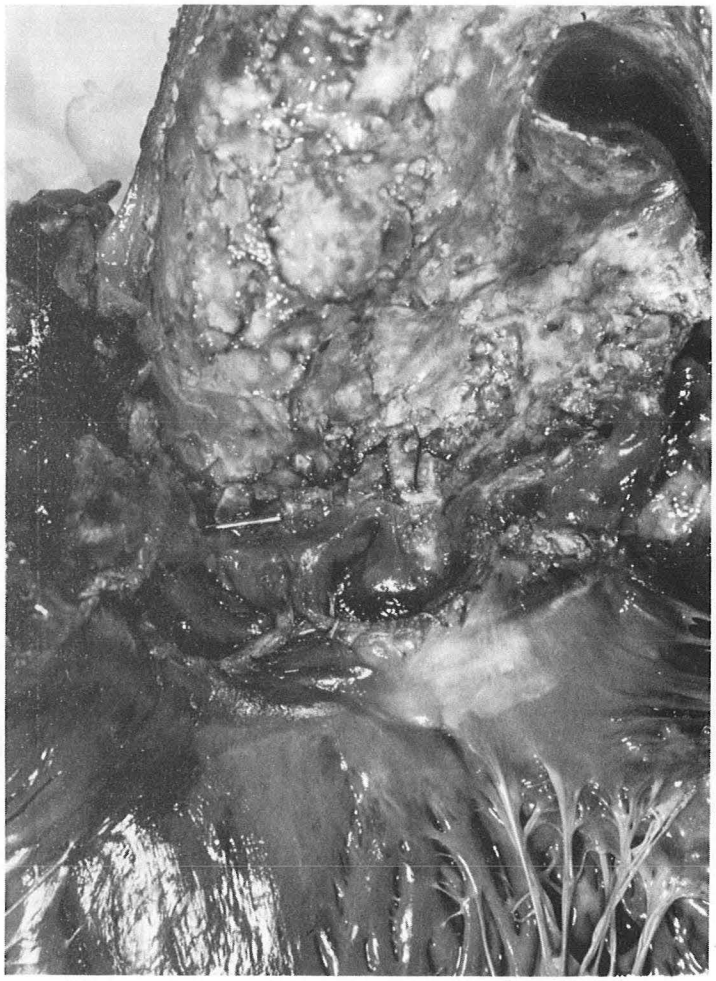

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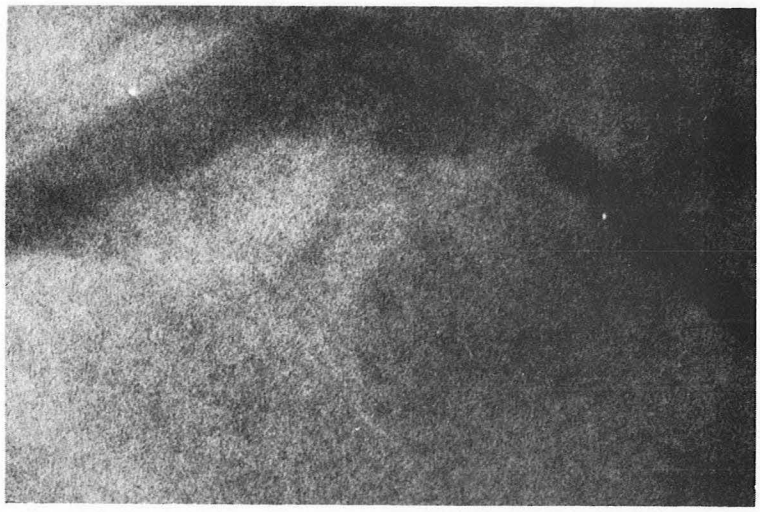
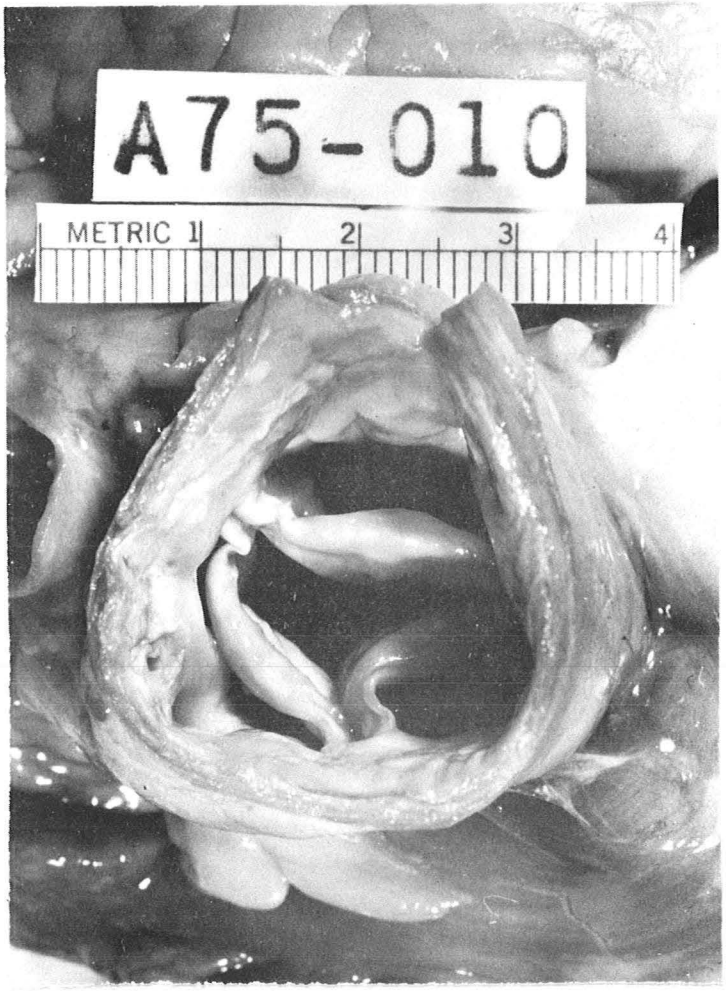


C

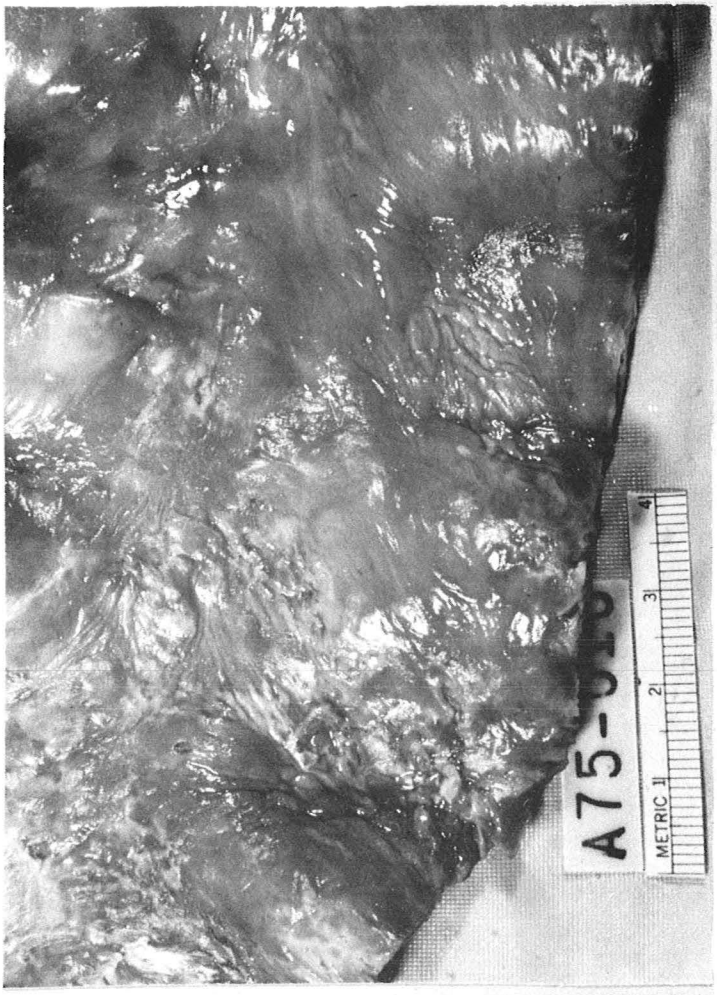
Patient No. II

A 66 year old black man presented with progressive edema, orthopnea and chest pain that was atypical for angina pectoris. Examination showed signs of moderately severe biventricular failure and moderately severe aortic regurgitation. A murmur of mitral regurgitation was also heard. Serum and cerebro-spinal fluid VDRL were positive and the diagnosis of neurosyphilis was made. He was treated for neurosyphilis and congestive heart failure with marked improvement in compensation of both ventricles. On plain chest x-rays, the aorta was not dilated and calcification could not be appreciated. Because of the absence of calcium in the aorta, the diagnosis of cardiovascular syphilis was doubted and the etiology of the heart disease was felt to be uncertain. Hypertensive cardiomyopathy, atypical arteriosclerotic heart disease, and Listeria endocarditis secondary to a skin infection were entertained as possibilities. Six months later he suddenly deteriorated and suffered cardiac arrest from which he could not be resuscitated. At necropsy, typical findings for luetic aortitis were seen. The aortic valve (page 5, A) exhibited commissural separation and thickening of the free edges of the cusps. The thickened and dilated aorta (page 5, B) prevented complete closure of the valve. The intimal surface of the ascending aorta showed both arteriosclerotic plaques and wrinkling that is typical of luetic aortitis. A low magnification view (x22, elastic-van Gieson stain) of the aorta revealed (page 5, C) fibrous thickening of the intima, extensive alterations in the media including small, angular scars in the outer media as well as extensive destruction of the inner media with loss of densely stained elastic lamellae, and fibrous thickening of the adventitia and vasa vasorum of the adventitia. A high power view (x400, hematoxylin and eosin stain) of the aorta (page 5, D) showed thickened vasa vasorum with a perivascular inflammatory infiltrate containing many plasma cells.

PATIENT II



A



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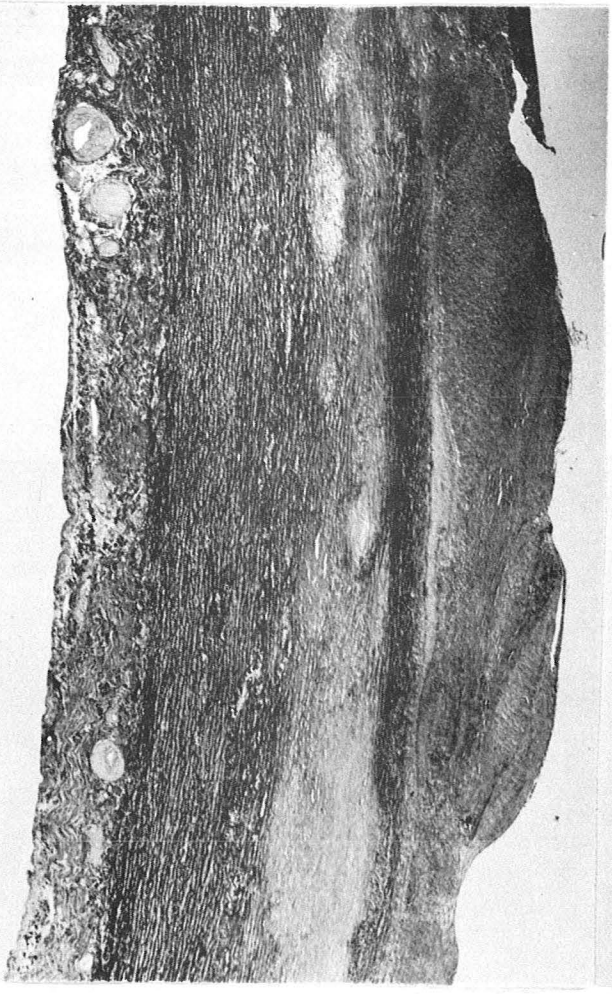

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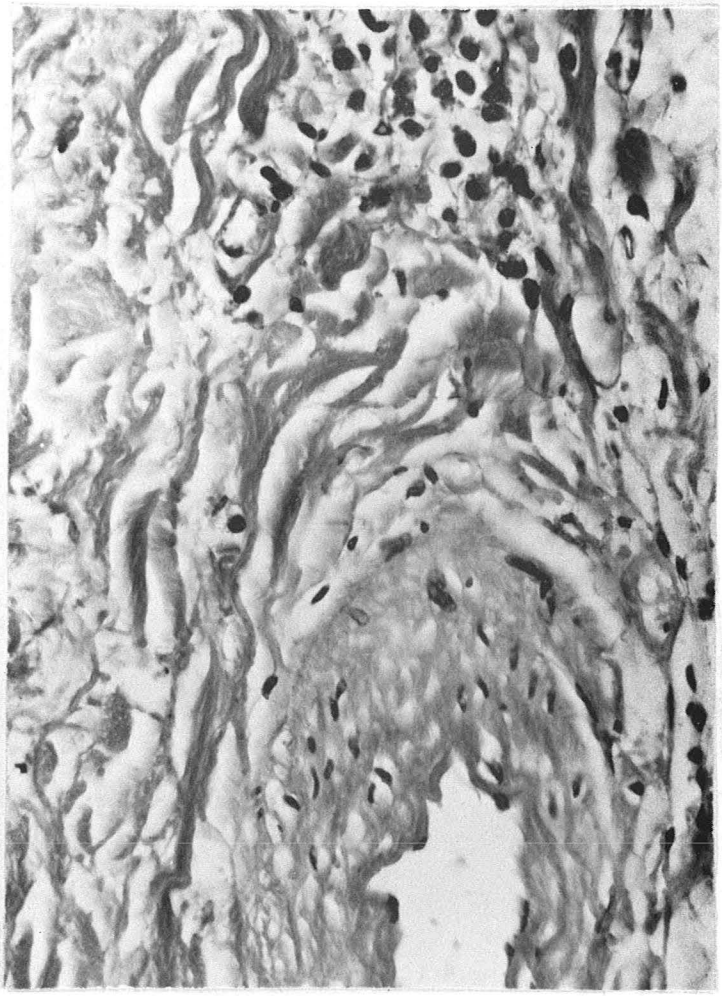


D

Cardiovascular complications of syphilis were common worldwide until the 1940's. Subsequently the incidence has dropped markedly in the western industrialized world, while probably remaining at about the same level in developing nations. In the USA and Canada, during 1920 to 1940, cardiovascular manifestations of syphilis were reported in 5-7% (2) of autopsies; but from 1950 to the early 1960's dropped to 0.6 (3) to 0.76% (4) of autopsies. By 1968, the death rate attributed to syphilis in the United States was only 0.3 per 100,000 population. (5) In 1964 syphilis was the etiology in only 0.4% of all cases of cardiovascular-related deaths (6) in the country as a whole. (Syphilitic cardiovascular disease is still more common in the Southeast and Southwest and may account for close to 1% of all cardiovascular deaths.) Of those 586 deaths, 338 were due to cardiovascular syphilis. This dramatic drop was due to development of vigorous public health measures to seek and treat new cases and by the widespread availability of adequate drug therapy. In the mid-1950's it was hoped that syphilis and its cardiovascular complications could be eradicated in the western world by the end of this century. However, the steady decline in the number of cases of syphilis in the United States was reversed in 1957 after an all time low report of 6,400 new cases in 1956. By 1972 there were 24,429 new cases reported with 91,000 known cases in all stages. (5) Because of the social stigma attached to venereal diseases, many cases are unknown. The U.S. Public Health Service has estimated that the true number of undetected cases of syphilis in the United States in 1972 exceeded 500,000. (5) Other estimates of the reservoir of untreated syphilis are as high as 1.2 million persons.(7) Furthermore, the incidence of syphilis remains high in the "third world". Recently, a study from our next-door neighbor Mexico showed that the incidence of cardiovascular lues was 5.2% at autopsy. (8) With an increasingly "shrinking" world, international travel may also further increase the reservoir of untreated syphilis. Consequently, while syphilitic cardiovascular disease is now uncommon, it is possible that a resurgence of this disorder will occur in the next 10 to 20 years. What attenuating effect the widespread use of penicillin and other antibiotics for minor as well as major illnesses will have on the appearance and nature of cardiovascular lues is unknown.

The cardiovascular manifestations of syphilis usually become apparent 10-20 years following primary infection, although relatively accelerated cases have been reported with complications appearing in a few years after initial infection. (9,10) In recent years, the age group afflicted with clinically apparent luetic involvement of the cardiovascular system has risen. Before 1940, the age of these patients' presentation was 35-55; by 1964 the mean age had risen to 63. (4) Increasingly cardiovascular lues is becoming a disorder of senior citizens instead of the middle aged in the western world. (11,12) Cardiovascular manifestations of syphilis are more common in men than in women, not only because there are more cases of syphilis reported in men than women, but also because cardiovascular involvement is more likely in men. In the United States, cardiovascular syphilis is more common among blacks than Caucasians,(13) a phenomenon that may be due to socioeconomic factors rather than a true racial predisposition. (14) Cardiovascular syphilis is generally more common the lower the socioeconomic group (14) probably due to the lack of treatment of the disease in the primary form. Cardiovascular manifestations of syphilis are almost always due to acquired syphilis, congenital

syphilis rarely being associated with these complications.(15-20)

The basic lesion of cardiovascular syphilis is a destructive aortitis, which typically involves the ascending or transverse thoracic aorta or both, but rarely the abdominal aorta. The predilection for the ascending aorta and the arch of the aorta is due to the large number of perivascular lymphatic vessels and vasa vasorum in these regions.(19) The initial phase of luetic aortitis occurs in response to invasion of the aorta via the vasa vasorum by spirochetes, and is characterized by a proliferative endarteritis of the vasa vasorum and an associated inflammatory reaction in the adventitia and media. Healing of the inflammatory process results in a thick walled, dilated aortic segment which has: 1) narrowed, thickened vasa vasorum with perivascular infiltrates rich in plasma cells as well as lymphocytes, 2) fibrous thickening of the adventitia, 3) stellate and angular scars in the media which frequently result in thinning of the media, and 4) fibrous thickening of the intima with wrinkling due to puckered or angular sunken areas.(21) These changes are responsible for the characteristic "tree bark" appearance. The typical gross intimal changes frequently become obscured in long standing cases by the development of severe arteriosclerosis, a likely development since cardiovascular lues appears to accelerate arteriosclerosis. The histologic features of syphilitic aortitis are identical to those of the aortitis that accompanies ankylosing spondylitis. The aortic involvement of the former usually spares the aortic wall behind the sinuses of valsalva and adventitial scar does not extend below the aortic valve or involve mitral valve or interventricular septum. This contrasts with the characteristic location of changes with ankylosing spondylitis behind and immediately above the sinuses of valsalva, especially behind and adjacent to the commissures with extension of adventitial scar below the base of the aortic valve to form a characteristic subvalvular ridge which may cause mild mitral regurgitation. Further, this scar may extend into the interventricular septum and cause conduction delays which are commonly seen with ankylosing spondylitis. While changes of the aortic leaflets are confined to the margins in syphilis, the proximal portions are involved as well in ankylosing spondylitis.(22)

The anatomic features of other disorders that commonly cause aortic regurgitation are completely different from those of syphilis. Rheumatic heart disease spares the aorta and virtually always involves the mitral valve. In rheumatoid arthritis, distinctive nodules similar to subcutaneous nodules may infiltrate endocardium, myocardium, and pericardium and regurgitation is generally mild. Aortic regurgitation complicating Marfan's syndrome is due to aortic dilatation caused by a thinned aortic wall with medial and intimal tears with histologic cystic medial necrosis. Occasionally the aortic valve (but much more commonly the mitral valve) may be redundant and "floppy" and add a valvular component to the regurgitation. The anatomic lesions of a dissecting aortic aneurysm and congenitally deformed aortic valve leaflets are, of course, characteristic and easily separated from syphilis.(22)

The pathologic physiology of luetic cardiovascular disease is dependent on the location and severity of the damage. Therefore, the clinical aspects of cardiovascular syphilis are most readily approached by consideration of the manifestations of aortitis, which occurs frequently, and its three complicating features, aortitic regurgitation, coronary arterial ostial stenosis, and aortic aneurysms and the manifestations of gummatous myocarditis, which is exceedingly rare.

Aortitis

Some degree of syphilitic aortitis complicates the course of 75 to 80% of untreated syphilitic patients.(19,23-24) In most of these patients the aortitis is mild and does not lead to symptoms.(2) Clinically apparent aortitis is found in only 10% of patients with late syphilis; (25) and only about 1 in 6 of patients found to have aortitis at autopsy had been so diagnosed during life.(26-27) The prognosis of uncomplicated syphilitic aortitis is generally good.(28-29) However, one or more of the three complications of aortitis occur in one-third of patients with aortitis (28,30) which emphasizes the need for early and adequate treatment. The development of cardiovascular lesions in untreated syphilitic patients is much more common than in patients who receive early and adequate therapy.(31-33) Early adequate therapy virtually prevents development of aortitis altogether.(31,34) However, there is no clear evidence that treatment of syphilis alters the natural history of fully established cardiovascular syphilis.

When aortitis is uncomplicated the patients are asymptomatic. There are no diagnostic signs, although a tambour quality of the aortic component of the second heart sound and a rough aortic systolic ejection murmur are frequently heard. The diagnosis should be suspected if there is radiographic evidence of dilatation of the aorta in the absence of other heart disease that could lead to this finding and when the patient has a history of syphilitic infection or a positive serologic test for syphilis. Linear calcification of the ascending aorta occurs in about one-fifth of these patients and previously was thought to be a reliable sign of luetic aortitis.(35-41) With the rise in the number of the elderly in the western world and the attendent rise in the incidence of advanced atherosclerosis, cardiovascular syphilis is now less commonly a cause of linear aortic calcification than atherosclerosis.(42) It has, however, been suggested recently that the aortic calcification seen with atherosclerosis is apt to be anterolateral wall in contrast with a medial location seen with syphilis.(25) Furthermore other radiographic findings that were considered typical of luetic aortitis such as elongation of the thoracic aorta, loss of parallelism of the aortic walls and aneurysms of the ascending aorta (35,39) were also found to be similarly unreliable as diagnostic findings. (42) Serologic tests that are based on non-treponemal antigens are positive in 70 to 95% of these patients.(4,10,13) In most of the seronegative patients a positive reaction is present with the more sensitive flourescent treponema antibody-absorption (FTA-ABS) test.(43)

An expert committee assembled by the Venereal Disease Control Division of the Center For Disease Control revised the recommendations

for the treatment of cardiovascular syphilis in February, 1976.(44) These recommendations are:

1. Benzathine penicillin G, 2.4 million units intramuscularly weekly (1.2 million units in each buttock) for 3 successive weeks;
   or
2. Aqueous procaine penicillin G, 600,000 units intramuscularly, daily for 10 days;
   or
3. Tetracycline or erythromycin, 500mg orally QID for a minimum of 30 days for a total dose of at least 60gm for those patients who are allergic to penicillin. (However, this report noted that there are no clinical data to support the use of anything other than penicillin and recommended cerebrospinal examinations before initiation of one of these regimens).

The risk of a Jarisch-Herxheimer reaction is very small.(45-47) In uncomplicated aortitis, no special precautions are necessary. Fever, which usually appears a few hours after the first penicillin injection, can be managed with aspirin. There are rare reports of complicated aortitis suddenly worsening after penicillin injection.(48) Hence, in selected patients with complicated aortitis in whom a small focal reaction might have serious effects, administration of a corticosteroid such as 60mg of prednisone or its equivalent may be considered prior to the first penicillin dose.

The FTA-ABS test cannot be used as an indicator of the effectiveness of treatment since it remains positive for many years following adequate therapy in a large number of syphilitic patients at any stage of disease. The non-treponemal serologic tests in patients with cardiovascular syphilis are unlikely to revert to negative even after adequate treatment. (49) A four-fold or greater decrease in the titer of these tests between 12 and 24 months after treatment is considered evidence for effective treatment.(44)

It is legitimate to have some reservations about the dictum that all patients with cardiovascular syphilis should be treated with penicillin. There is no evidence that penicillin treatment of patients with fully established cardiovascular complications of syphilis alters the history of their disease; nor is it certain that progression of aortitis from an uncomplicated to a complicated state can be prevented by penicillin therapy. Also, treponemas have been identified in several tissues of these patients after adequate penicillin therapy.(50-52) Yet, there is widespread agreement that the dictum should be followed for the present time, with the above reservations, for the following reasons:

1. There is some evidence that patients with early aortitis have a more benign course and live longer if treated early.(10,53)
2. Treatment of patients with advanced aortitis may arrest the progress of the disease in other parts of the aorta and in other organs, especially the central nervous system, which is also infected in almost one-half of patients with cardiovascular involvement.(10)

3. The incidence of serious morbidity and mortality following penicillin is very low, in contrast to the frequent side-effects which complicated treatment with heavy metal compounds in the "pre-penicillin era".

Aortic Regurgitation

Aortic regurgitation develops as the result of significant involvement of the aortic root leading to dilatation of the lumen, thickening and distortion of the wall, and frequently separation of one or more valvular commissures. These alterations of the aortic root result in failure of coaptation of the aortic valvular cusps and a central regurgitant stream. The aortic cusps themselves are not directly involved by the luetic process, but may develop secondary changes characterized by thickened, everted edges. Severe luetic involvement of the ascending aorta may occur without the development of aortic regurgitation if the aortic wall behind the sinuses of Valsalva is spared.

Aortic regurgitation is the most frequent complication of syphilitic aortitis, occuring in 20 to 35% of these patients.(54) It is about 3 times more common in blacks than in whites and about 4 times more common in men than in women. Seventy five to 85% have positive non-treponemal serologic tests. About 50% have evidence of central nervous system involvement on examination of the cerebrospinal fluid.(10) Most of the patients with a negative non-treponemal serologic test have a positive FTA-ABS test.(43) Narrowing of the ostia of coronary arteries is also present in 20% of patients with syphilitic aortic regurgitation.(4) Aortic aneurysm co-exists with aortic regurgitation much less commonly and rarely develops after marked incompetence of the aortic valve is established.(25) Stenosis of the aortic valve does not occur unless the aortitis is associated with another disease such as rheumatic heart disease or a congentially abnormal (usually bicuspid) aortic valve.

Most of these patients remain almost symptom free for 10 to 25 years following the primary infection, although 7% develop symptoms within 5 years.(10) Some patients without major symptoms have an uncomfortable awareness of the increased stroke volume, which is appreciated as a pulsation in the head or neck. The chief symptoms are angina pectoris and dyspnea due to left-sided congestive heart failure. Angina is a more frequent complaint in patients with syphilitic aortic regurgitation than in those with rheumatic aortic regurgitation. While this frequently is due to co-existence of ostial stenosis of the coronary arteries, it can occur because of severe aortic regurgitation alone, which causes both increased myocardial oxygen demand due to increased left ventricular mass and left ventricular dilatation and decreased coronary artery perfusion secondary to decreased diastolic pressure. The symptoms of left-sided failure are due principally to the presence of severe aortic regurgitation, although in those patients with narrowing of the coronary ostia, the consequent myocardial ischemia may hasten left ventricular dysfunction. Paroxysmal nocturnal dyspnea and dyspnea on exertion occur relatively early and are followed by episodes of

pulmonary edema and right ventricular failure. The clinical signs that are present vary with the degree of aortic regurgitation. A wide pulse pressure is usually present and becomes wider with increased degrees of valvular incompetence. The carotid arteries may have a bisferiens contour in the presence of moderately severe or severe regurgitation. The diastolic decrescendo blowing murmur of aortic regurgitation becomes longer with increasingly severe regurgitation and tends to be heard better along the right sternal border (in common with other diseases of the aortic root causing aortic regurgitation) than to the left of the sternal border (the usual case in valvular aortic regurgitation). A rough systolic ejection murmur frequently is heard at the aortic area and is due to increased flow across the aortic valve consequent to the large stroke volume. An apical diastolic rumble (Austin Flint murmur) may be heard and confused with the murmur of mitral stenosis. If the regurgitation is of severe degree, the dramatic, classical peripheral signs of this lesion may be present: Corrigan's pulse (rapidly collapsing arterial pulse), Quincke's pulse (exaggerated nail bed capillary flushing and blanching), Traube's sign (pistol shot arterial sound), DeMusset's sign (systolic head bobbing), Duroziez's sign (diastolic murmur beyond partial compression of a peripheral artery) and Hill's sign (systolic pressure in the leg 40 or more mm Hg greater than that in the arm).

The radiographic findings also depend on the amount of regurgitation. In some cases, there may be only mild dilatation of the ascending aorta. In more advanced cases of regurgitation the aorta is dilated and seen to be excessively pulsatile during fluoroscopy.(page 17) The left ventricle may be dilated. When left-sided heart failure has supervened, this can be appreciated radiographically. The electrocardiogram usually shows left ventricular hypertrophy.

The chief disorder to be considered in the differential diagnosis is rheumatic heart disease. A congenitally abnormal aortic valve rarely becomes chiefly regurgitant in the absence of bacterial endocarditis. The differentiation from rheumatic heart disease usually can be made by the historical or serologic evidence for syphilis in the absence of a history of rheumatic fever, the absence of mitral valvular disease, the right-sided location of the diastolic blow, and the appearance of signs and symptoms later in life. Differentiation of the Austin Flint rumble from the rumble of mitral stenosis can usually be made from the absence of an opening snap and by echocardiography of the anterior leaflet of the mitral valve. With syphilitic aortic regurgitation, the closing rate of the anterior mitral valve leaflet is within normal limits and may show diastolic fluttering due to the regurgitant jet. Angina is somewhat more common in patients with syphilitic aortic regurgitation than in rheumatic aortic regurgitation because the aortic regurgitation tends to be somewhat more severe in luetic aortitis and may be associated with narrowing of the ostia of the coronary arteries. Differentiation from other disorders that cause aortic regurgitation by damaging the aortic root is usually not difficult because historical or serologic evidence of syphilis is present and the typical history and findings seen in the other disorders (ankylosing spondylitis, Marfan's syndrome, Reiter's syndrome, etc.) are absent.

The prognosis of these patients is poor in general, although there is substantial variability. The best predictor of prognosis is the absence of symptoms, especially congestive heart failure. The survival of these patients after the onset of symptoms ranges from 2-14 years with a mean of 5.6.(56) Overall, the ten year survival is 30-40%.(57-58) However, 84% of patients who are asymptomatic survive five years from the time of the diagnosis.(59) In the absence of congestive heart failure 56% survive fifteen years, but after the onset of congestive heart failure less than 20% survive for five years and only 6% live ten years with an average life expectancy of three years.(57)

These patients should be treated with one of the dose regimens of penicillin outlined above. However, the only definitive therapy is surgical correction of the regurgitant aortic valve. The timing of aortic valve replacement is crucial in these patients. Many tolerate the regurgitation with minimal hemodynamic effects for many years. Operative replacement of the aortic valve in these patients carries a somewhat greater risk than it does in those with valvular heart disease and the "perfect" prothesis has yet to be developed. However, delay of surgery until severe left ventricular damage has occurred increases the operative risk and diminishes the likelihood of a beneficial result. When the patient develops symptoms at ordinary activity or exhibits progressive increase in heart size in spite of a good medical regimen, consideration for surgery should usually be advised. The presence of an aortic aneurysm or ostial narrowing of the coronary arteries may, of course, influence the timing of surgical consideration.

Ostial Stenosis of the Coronary Arteries

There is at least some narrowing of one or both coronary ostia in 33% (60) and severe narrowing in 20 (55) to 26% (4) of patients with syphilitic aortitis. It is associated with aortic regurgitation in 87% of cases.(60) The disorder usually involves only the coronary ostia. True syphilitic coronary arteritis is rare and when it occurs, involves only the first few centimeters of the coronary artery.(61) Complete ostial stenosis is not uncommon.(62) Development of ostial stenosis is slow and leads to the development of extensive collaterals in the coronary circulation which probably accounts for the rarity of myocardial infarctions in these patients.(4,55) Angina pectoris is common. Sudden death occurs occasionally and may be due to arrythmias or coronary artery embolization.(62)

There are no specific signs of ostial stenosis except for those of aortic regurgitation, which is usually also present. The diagnosis can be suspected in the patient with angina pectoris and a widened aorta with a history of syphilis or positive serology. However, even in those patients with known luetic aortitis, the presence of arteriosclerotic heart disease as an additional problem must be strongly considered since most of these patients are middle-aged men. Differentiation of luetic ostial stenosis from arteriosclerotic coronary artery diseases requires coronary arteriography. The lesions of syphilis are limited to the coronary ostia and rarely the first few cm of the coronary arteries.(61) The lesions of arteriosclerotic coronary artery disease occur both

proximally and distally in the arteries.

These patients should be treated with penicillin according to one of the regimens described above. Definitive therapy requires surgery. Both coronary arteriotomy (63) and aorto-coronary by-pass grafts (64) have been reported to be successful. Coronary by-pass grafts are the current surgical therapy of choice. Debridement of the material occluding the coronary ostia must be carried out with great caution in order to avoid coronary artery emboli. Because of the frequent association with aortic regurgitation, aortic valve replacement will often accompany revascularization of the coronary arteries. Precise figures of the operative mortality of this combined procedure are not available because of the small number of patients. However, the operative risk in these patients appears to be relatively high. Neverless, the untreated outlook is fairly bleak and for those patients disabled with angina pectoris or when accompanied by severe aortic regurgitation most patients should be considered potential surgical candidates. The vast experience gained in coronary artery by-pass grafts in patients with ischemic heart disease in the last 10 years has greatly decreased the mortality of the procedure and this experience is fortunately applicable to these patients.

Aortic Aneurysm

Luetic aneurysms usually are saccular, but may be fusiform. Saccular aneurysms develop as a result of particularly severe localized aortic damage, and typically communicate with the aortic lumen by a round opening of smaller diameter than the aneurysm itself. After the process of aneurysm formation is established to this degree, mechanical stresses alone are sufficient to continue the progression of the aneurysm, even in the absence of ongoing aortitis. The aortic wall is often virtually destroyed beyond recognition and consists mostly of fibrous tissue. The aneurysms frequently become filled with lamellated thrombus. Thrombus formation along the aneurysm wall may strengthen it and protect it from further dilatation. There is consensus that this fibrotic process protects the patient from dissection of the aorta. Certainly, dissecting aortic aneurysms are exceedingly uncommon in this setting.

Aortic aneurysm is the least common complication of syphilitic aortitis. They occur only 1/3rd as frequently as aortic regurgitation and complicate the clinical course of 5-10% of patients with aortitis. (65) The overall incidence of aneurysms is closer to 40% of patients with syphilitic aortitis; (4,54) many are clinically inapparent. Yet, syphilis is still the second most common cause of aortic aneurysms, following arteriosclerosis, and is responsible for about 20% of all aortic aneurysms.(66) They occur singly or as multiple lesions. The ascending aorta is the most frequently involved segment, accounting for 50% of these aneurysms.(67) The transverse aorta is the site in 30-40% of cases. Most of the remainder, 10-15%, occur in the descending thoracic aorta. About 5% occur in the abdominal aorta. This distribution reflects the severity of aortic involvement mentioned earlier, the disorder being more severe proximally than distally; the converse of arteriosclerotic aneurysms. Involvement of the sinuses of Valsalva occurs rarely.

The symptoms caused by a syphilitic aneurysm are dependent on the location of the aneurysm and the structures that are adjacent to it. The structures that may be compressed and damaged by syphilitic aneurysms in the ascending and transverse aorta and the symptoms that are produced by this process are enumerated below.

Complications of Luetic Aortic Aneurysms Caused by Compression of Adjacent Structures

Sign or Symptom	Structure Compressed
Ascending Aorta	
Anterior chest mass	Chest wall
Superior vena cava syndrome	Superior vena cava
Atelectasis and infection	Right bronchus
Chronic cor pulmonale	Pulmonary artery
Transverse Aorta	
Dysphagia	Esophagus
Atelectasis and infection	Trachea and bronchi
Dyspnea	
Cough	
Stridor	
Hemoptysis	
Hoarseness	Recurrent laryngeal nerve
Hiccough	Phrenic nerve
Chest pain	Vertebrae
Superior vena cava syndrome	Superior vena cava
Unequal pupils	Left stellate ganglion
Unequal pulses in arms and neck	Origin of arteries

Symptoms tend to occur later when the aneurysm involves the ascending aorta since the expanding mass is less apt to compromise vital structures there. Frequently, expansion of ascending aortic aneurysms occurs anteriorly and laterally and may not be associated with any symptoms except for an expansile, pulsatile tumor in the first and second intercostal spaces along the right sternal border. When the transverse aorta is involved, the close proximity of a number of vital structures makes the development of early symptoms likely. When the abdominal aorta is involved, an expansile, pulsatile mass in the abdomen or pain in the abdomen and back are the commonest complaints. With a syphilitic aneurysm of the sinus of Valsalva, there are usually no symptoms until rupture occurs. The right ventricule or the right atrium are the usual receptacles of the rupture. Consequently, a continuous murmur is usually heard and there is often electrocardiographic evidence of acute cor pulmonale. The diagnosis is usually facilitated by radiographic evidence of the aneurysm (page 17) and positive serology or history of syphilis.

The greatest problem in the differential diagnosis is with arteriosclerotic aneurysms. The latter have a similar radiographic appearance including linear calcification (see above). Arteriosclerotic aneurysms tend to occur in a somewhat older age group, although there is substantial overlap. Non-vascular structures must be differentiated. While this can usually be accomplished with plain films, laminograms, and flouroscopy, aortography may be necessary, especially if surgery is contemplated. Chronic dissecting aneurysms, traumatic aneurysms, coarctation of the aorta, post-stenotic dilatation with aortic stenosis and associated aortic regurgitation, and cystic medial necrosis in association with Marfan's syndrome are not

usually difficult to distinguish because of their distinctive historical, physical, and radiological features.

The prognosis generally is poor, but tends to be better the earlier the diagnosis is made and depends on the location of the aneurysm, its size, and the clinical manifestations. The mean life expectancy after the onset of symptoms is only 6-9 months; the 2 year mortality is 80%. (68) The greatest risk to life is from exsanguination through rupture of the aneurysm. The usual receptacles of the rupture are the pericardium, pleural cavities, the bronchi, esophagus, and less commonly the pulmonary artery and abdomen. Rupture through the anterior chest wall is a rare, but dramatic site of exsanguination. Pneumonia due to tracheo-bronchial obstruction is also a common cause of death.(69)

The patient should be treated with penicillin according to one of the regimens outlined above. However, definitive therapy requires surgical intervention. Some small saccular aneurysms with small discrete necks can be treated simply by clamping the neck and amputation of the aneurysm. Fusiform and saccular aneurysms with a wide neck require resection and replacement with a dacron graft. The risk of the surgery varies with the extent and location of the aneurysm and the patients overall condition. However, recent advances in aortic replacement, even of the arch (69) and the exceedingly poor prognosis untreated make most patients with expanding or symptomatic aneurysms potential candidates for surgery.

Gummatous Myocarditis

Gummas may occur diffusely or localized in the myocardium. Even in the heyday of cardiovascular syphilis they were rare enough to all become pathologic museum pieces. Only a few more than 100 cases have been reported, (70) and most of these are autopsy reports of patients who had no symptoms referable to the gummas. Diffuse gummatous myocarditis is usually asymptomatic. Localized gummas cause symptoms if they occur in strategic locations. The most common locations are the interventricular septum and the base of the left ventricle. Atrioventricular block and interventricular conduction defects may occur when the gummas occur in the interventricular septum and interrupt the conduction system. (71) Ventricular gummas may cause left ventricular aneurysms which rarely perforate. Gummas at the base of the heart infrequently impenge on the cardiac valves and cause pseudostenosis.(71-72) The semilunar valves are most commonly involved, the pulmonic valve more frequently than the aortic. Impengement on the atrioventricular valves is exceedingly uncommon. Gummas can cause an electrocardiographic picture similar to that of myocardial infarction.(73)

Summary:

In summary emphasis is due to several points.

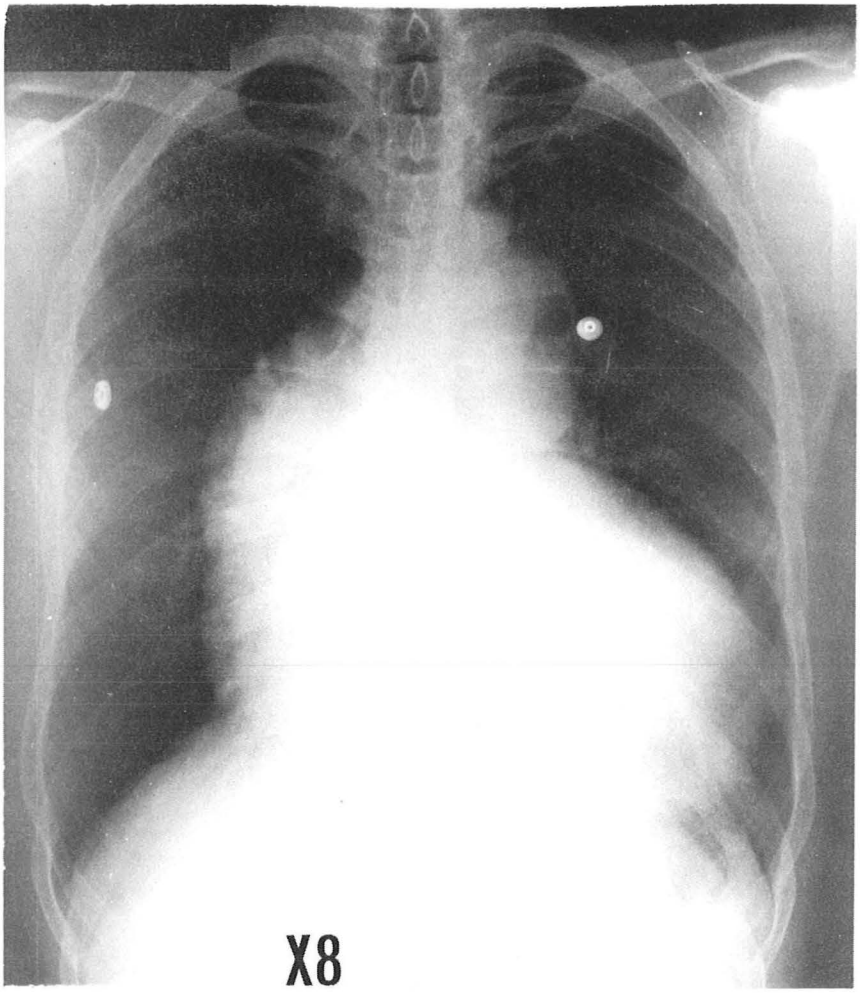
First, cardiovascular syphilis has been on the wane in the western world for the past four decades for a variety of reasons. Chief among these reasons is the presence of diligence of public health forces seeking and treating primary syphilis and the inexorable rise in the socioeconomic status and access to health care of the general population. However, the widespread use of antibiotics and an inexplicable change in the natural history of the disease may also be forces at play. But cardiovascular lues has far from vanished, especially in the South. Based on the prevalence of this complication, there are probably approximately 50 patients per year admitted to each Parkland and the VA hospitals with cardioaortic syphilis. Of these, about 1/3 to 1/2 should be clinically apparent.

Second, a variety of forces have come to play on the usual clinical presentation of these patients. The major change is the increase in the age of the patients at the time of presentation from the 4th and 5th decades of life to the 6th and 7th and older. With greater availability of health care and greater diagnostic sophistication, patients will often be seen in an earlier stage of their disease than previously. Consequently, luetic aortitis will become increasingly diffcult to diagnose.

Third, extraordinary advances in aortic and aortic valvular surgery have made the complication of luetic aortitis treatable. It is imperative to appreciate the problem and plan hemodynamic evaluation and surgical correction before the patient becomes subject to an inordinately high operative risk or frankly inoperable.

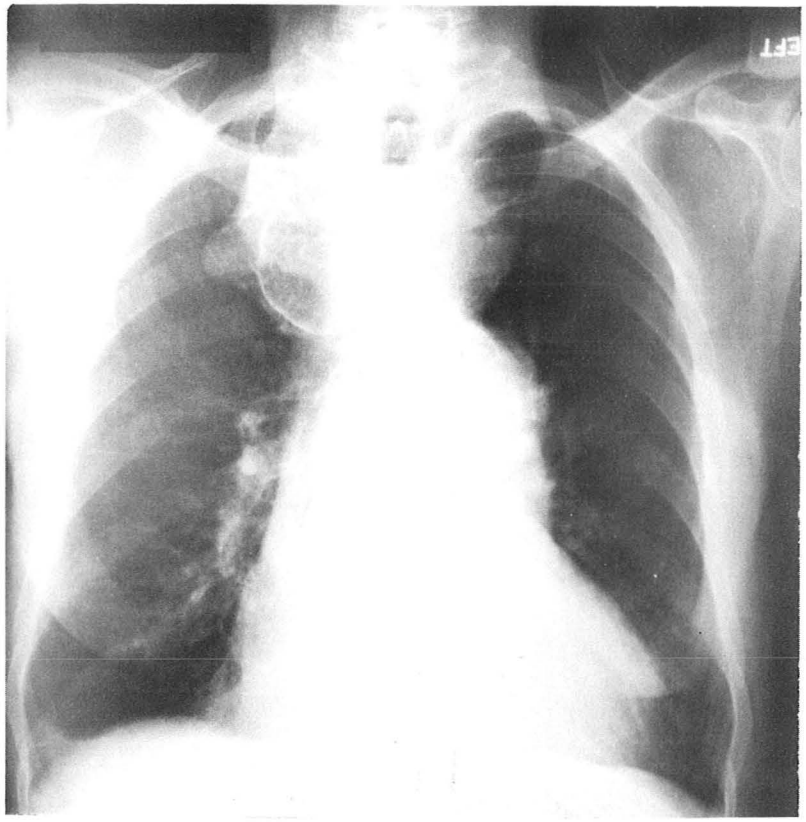
Fifth, it is important to recognize that luetic cardiovascular disease is apt to continue to change its colors as a new generation of young adults with a drastically increased incidence of lues enters middle life while receiving one or more inadvertent partial treatments of latent lues.

Finally, it is essential to conclude with an admonition that we make certain to keep up our guard for the presence of primary and early latent lues and to adequately treat these patients. It is unfortunate to end on this note since this is the one cardiovascular disease that conceivably could have been eradicated in this century.



PA Chest X-ray of a man with marked syphilitic aortic regurgitation. The aorta is markedly dilated. Cardiac enlargement is chiefly due to left ventricular hypertrophy and dilatation.

PA Chest X-ray of a 78-year-old man with syphilitic aortitis. There is heavy calcification of the ascending aorta and an aneurysm that also involves the inominate artery.



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