DISSERTATION
ON

AETIOPATHOGENESIS AND CORRELATION OF CLINICAL FINDINGS WITH DOPPLER STUDY IN THROMBOANGITIS OBLITERANS

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CERTIFICATE

This is to certify that this dissertation entitled ***"AETIOPATHOGENESIS AND CORRELATION OF CLINICAL FINDINGS WITH DOPPLER STUDY IN THROMBOANGITIS OBLITERANS"*** is the bonafide record of work done by **Dr. R.MANOHARAN M.S**, submitted as partial fulfillment for the requirements of M.S. Degree Examinations, (Branch I) General surgery, MARCH 2008.

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AETIO-PATHOGENESIS AND

CORRELATION OF CLINICAL FINDINGS WITH DOPPLER STUDY IN THROMBO ANGIITIS OBLITERANS

INTRODUCTION

The incidence of arterial disease has assumed alarming proportions all over the world.

Medical treatment cannot be directed to correct or reverse the cause of the disease once it is established.

Occlusion of the peripheral arteries used to concern the surgeon only as his/her unpleasant duty to amputate the gangrenous limb. Now his aim and endeavour is to forestall the progress and prevent this tragic finish.

The basis of surgical treatment is the correction of the pathological and haemodynamic disturbances, produced by these lesions and restoration of normal circulation.

One among the occlusive vascular disease TAO which affects predominantly young males of low socioeconomic status with special predilection to involve the lower extremities. The disease has worldwide distribution though it is more prevalent in Indonesia, India and the Orient.

Buerger in his first paper published in 1908 brought out a new concept of pathogenesis, which concluded that the disease started as an acute inflammation of vessels, which leads to formation of thrombi. These changes then progress to chronic inflammation, the thrombus is replaced by granulation tissue.The lesion almost always begins in medium sized or small arteries but seldom-large vessels.

This study is based on the cases, ThromboAngiitis Obliterans, of which were identified and treated in Thanjavur Medical College Hospital Thanjavur.

AIM OF STUDY

The present study was undertaken with the following objectives.

1. To determine the various etiologic factors in Thrombo Angiitis Obliterans (T.A.O).
2. Correlation of clinical findings with Doppler study.
3. Outcome of the medical and surgical management.

HISTORY

1. (Hippocrates 460 B.C. to 377 B.C.). He described gangrene and the effects of vascular insufficiency.
2. (Leonardo DeVinci 1452 to 1515 A.D.). He dissected the human body and observed that the arteries of the young were elastic and straight, where as in the aged they were thick, rigid and tortuous.
3. William Harvey showed that the blood circulates in a closed system of vessels.

In 1879, Von Wini Water described the first case of TAO in a 57-year-old man that he called endarteritis and endophlebitis. In 1908 Leo Buerger first gave the world the clinical picture of this dreadful disease which he called TAO. These pathologic studies led him to conclude that the disease started as an acute inflammation of vessels, which led to formation of thrombi;

In 1925 Maleng and Miller succeeded in isolating a variety of organisms viz., Staphylococci and other types of gram-negative bacilli from cultures of tissues taken from the neighborhood of the involved vessels in T.A.O.

In 1947 Leriche and his senior produced a paper on 98 Adrenalectomies combined with lumbar sympathectomies. At the European Congress of Vascular Surgery in 1952, Dos Santos and Fantaise stated that adrenalectomy and

sympathectomy was an operation of value, which apparently seemed to slow down or even check the progress of disease. Out of 66 patients treated they registered 74% of good results.

The existence of Burgers Disease as a distinct process appeared unquestioned until 1960, when Wessles et al seriously challenged Buerger's original description. In 1962 Victor A. McKusick published a paper on Buerger's Disease, " A distinct clinical and pathologic entity" and demonstrated the characteristic pathological extents in the involved vessels.

Review of Literature

Incidence:

TAO cases have been found all over the world and no particular area is said to be epidemic or endemic. This is one of the commonest peripheral vascular diseases in Asian countries. TAO is widely prevalent in most parts of the country. 0.4 to 0.6% are TAO out of the total annual surgical hospital admissions and this is the commonest cause of limb ischaemia.

Anatomy:

Development of lower limb vessels.

The primary arterial trunk or axis artery of the lower limb arises from the dorsal root of the umbilical artery and courses along the posterior surface of the thigh.

The femoral artery that develops later passes along the ventral surface of the thigh and opens up a new channel to the lower limb. It arises from a capillary plexus; connected proximally with the femoral branches of the external iliac artery and distally with the axis artery near the popliteal origin.

At the proximal margin of popliteus, the axis artery gives off primitive Posterior Tibial and Peroneal branches that run distally on the dorsal surface of that muscle and on Tibialis Posterior to enter the sole of the foot. At the distal border of Popliteus, the axis artery gives a perforating branch, which passes between the tibia and the fibula and then runs downward towards the dorsum of the foot, forming the Anterior Tibial Artery and the Arteria Dorsalis Pedis.

The femoral artery gradually increases in size and coincident with this increase, most of the artery that is present proximal to its communication with the femoral artery disappears.

ANATOMY OF LOWER LIMB ARTERIES

Femoral Artery:

This is the continuation of external iliac artery. It begins at the mid-inguinal point and runs downwards. At the junction of the middle and lower third of the thigh, it passes through an opening in adductor magnus to become the popliteal artery.

Surface Anatomy:

The femoral artery corresponds to the upper 2/3rd of a line that joins a point in the fold of the groin present midway between anterior superior illiac spine and pubic symphysis to the adductor tubercle, when the thigh is flexed, abducted and rotated laterally.

Branches of femoral artery:

i. Superficial Inferior epigastric artery;
ii. Superficial circumflex Iliac artery;
iii. Superficial external pudendal artery;
iv. The deep external pudendal artery;
v. Muscular branches to sartorius, vastus medialis and adductor muscles and
vi. Profunda femoris artery.

Profunda Femoris artery:

It arises from the lateral side of the femoral artery about 3.5cm below the inguinal ligament. At first it is lateral to the descending femoral vein. Later it passes between the pectineus and the adductor longus and then lies between the latter and the anterior surface of adductor brevis.

Variations of profunda femoris artery:

a) It sometimes arises from the medial side of femoral artery and courses in front of femoral vein and passes backwards around its medial side.

b) It may arise from posterior side of the femoral artery.

c) Its point of origin may vary between 2.5 to 5cm below the inguinal ligament.

Branches:

a) The lateral circumflex femoral artery.

b) The medial circumflex artery.

c) The perforating arteries are 3 in number.

Popliteal artery:

The popliteal artery is the continuation of the femoral artery and courses through the popliteal fossa. It commences at the opening in the adductor magnus at the junction of the middle and lower 1/3rd of the thigh and courses downward and slightly laterally up to the intercondylar fossa of the femur.

It then runs vertically downwards to the lower border of popliteus where it divides into anterior and posterior tibial arteries.

Surface Anatomy:

A line that begins at the junction of the middle and lower 1/3rd of the thigh can represent the popliteal artery. 2.5cm medial to the midline of the limb at the level of the knee joint. If then descends vertical to the level of the tibial tubercle.

The Anastomoses Around The Knee-Joint:

Around and above the patella and on the contiguous ends of the femur and tibia, an intricate arterial anastomosis is present and forms superficial and deep networks.

The superficial network:

It is situated between the fascia and skin over the patella and forms 3 well defined arches; one, above the patella in the loose connective tissue over the

quadriceps femoris and the second, below the patella in the fat behind the ligamentum patellae.

It lies on the lower end of the femur and upper end of the tibia around their articular surfaces and sends numerous offshoots in to the interior of the joint. The vessels forming the anastomosis are the medial and lateral circumflex, the descending branch of the lateral circumflex femoral, the circumflex fibular and the anterior tibial recurrent arteries.

The Anterior Tibial Artery:

The anterior tibial artery is one of the two terminal branches of the popliteal artery and arises at the lower border of the popliteus. Situated at first on the back of the knee, it passes forwards between two heads of the tibialis posterior through a gap in the interosseous membrane and comes medial to the neck of the fibula. If next descends on the anterior surface of the interosseous membrane and gradually approaches the tibia. In the lower part of the leg it lies on the bone.

It lies midway between the 2 malleoli on the front of the ankle joint and continues on to the dorsum of the foot as the Dorsalis pedis artery.

Variations:

1. This vessel may be smaller than usual or may be absent when the perforating branches of the posterior tibial or the perforating branches of the peroneal artery supplies the foot.
2. The artery occasionally deviates to the fibular side of the leg but regains its usual position at the front of the ankle.

Branches:

1. The posterior tibial recurrent artery.
2. The anterior tibial recurrent artery.

3. The muscular branches.
4. The anterior medial malleolar artery.
5. The anterior lateral malleolar artery.

The arteries around the ankle joint anastomose freely with one another and form networks below the corresponding malleoli. The anterior medial maleolar branch of the anterior tibial artery forms the medial malleolar network, along with the medial tarsal branches of the dorsalis pedis artery and the malleolar and calcaneal branches of the posterior tibial artery and branches from the medial plantar artery. The lateral malleolar network formed by the antero-lateral malleolar branch of the anterior tibial artery the lateral dorsal branch of the dorsalis pedis artery, the perforating and the calcaneal branches of the peroneal artery and twigs from the lateral plantar artery.

The Arteria Dorsalis Pedis:

The Arteria Dorsalis Pedis, the continuation of the Anterior Tibial Artery. It passes distally from the ankle joint along the tibial side of the dorsum of foot to the proximal part of the first intermetatarsal space. From there it descends into the sole of the foot between the two heads of the first dorsal interosseous muscle and completes the plantar arch. At its junction with this artery, it gives off the first plantar metatarsal artery.

The Posterior Tibial Artery:

The posterior tibial artery begins at the lower border of the popliteus opposite the interval between the tibia and fibula and passes downwards and medially on to the back of the leg. In the lower part of its course, it is situated midway between the

medial malleolus and the medial process of the tubercalcaneii (Medial tubercle of the Calcaneus). It divides under the cover of the origin of the Adductor Hallucis into the medial and lateral plantar arteries.

Surface Anatomy:

The posterior tibial artery runs from the middle of the calf at the level of neck of fibula to a point midway between the medial malleolus and the prominence of the heel. In the later situation, its pulsations can be felt.

Branches:

1) The circumflex fibular artery
2) The peroneal artery.

Sympathetic Ganglia in Relation to Lower Limbs:

The lumbar ganglia are very variable in their site and size. Usually there are four ganglia present on each side but their arrangement need not necessarily be identical on both sides. The ganglia are usually fused and the thickness of the trunk varies greatly. Inconsistency of position of the first lumbar ganglion is very frequent. It usually lies by the side of second and third lumbar vertebrae partly or completely covered by the crus of the diaphragm and occasionally lie either above or below it. Its recognition is essential for its ablation and will relieve the vasoconstrictor influence over the lower extremity as far down as the level of knee joint.

The lumbar ganglia lie on the anterolateral aspect of vertebral column behind the peritoneum and along the medial

border of psoas muscle. The lumbar veins and arteries are present behind them although occasionally one of them may be found crossing in front. The right trunk is partly covered by the inferior venacava and the left trunk is lateral to the abdominal aorta.

Control of Peripheral Circulation:

I. Nervous control of limb blood vessels:

The nervous control is constituted by the existence of vasoconstrictor and vasodilator fibres.

It is generally agreed that the skin of the fingers, toes, hands and feet is supplied with vasoconstrictor fibres. The rate of flow of blood is governed by the tone of arterioles.

Unlike in the hand, vasodilator fibres supply the forearm. The central nervous system vasomotor fibres via sympathetic fibres that send impulses through mixed nerves to arteries arterioles arteriovenous anastomoses control the vessels of the limb.

II. Metabolic control:

The products of local metabolism have a direct influence on the vessels in their vicinity and produce appropriate alterations in the calibre of vessels. This is best exemplified by ligation of a main vessel, which causes an accumulation of metabolites in the tissues distal to the ligation resulting in dilatation of collateral vessels.

Similar adjustments of local circulation are produced in response to injury, which causes the release of Histamine.

III. Control by Temperature:

Arteries capillaries and veins react to an increase in temperature by dilatation and contract when cooled. The metabolic needs of tissues are reduced when they are cooled and hence, in the cold season there is lesser energy expenditure. The vessels of the skin shrink to conserve body heat. The reverse is the case in summer.

Phenomenon of Vasoconstriction:

The vasomotor nerves to the vessels of the body are sympathetic and exert a tonic action. They maintain the tonic action over arteries, arterioles and capillaries, arteriovenous anastomoses and veins. The tone is abolished by cutting these fibres.

A) Vasoconstriction of central nervous system origin:

This is seen normally in response to apprehension, emotion, anger, fear, etc. As a reflex it may be produced by cold or by painful stimulation to the skin. This effect is supplemented by the release of adrenaline from the suprarenals that produces generalized vasoconstriction of skin and splanchnic vessels.

B) Local vasoconstriction due to trauma:

Following Trauma an abrupt contraction or spasm of a segment of the artery occurs, which may be complete or partial, lasting hours or days. It is said that this spasm is due to a reflex effect of the sympathetic nerves initiated by trauma.

The narrowing of an artery that occurs due to structural changes is generally permanent, whereas, the narrowing that occurs due to arterial spasm is transitory.

Phenomenon of Vasodilatation:

Vasodilatation causes an increase in the size of arteries and arterioles. Flushing occurs as a result of dilatation of smaller vessels. If the tone of these vessels is good, flushing is less marked.

a) Generalized Vasodilatation: This is of central nervous system origin. Vasodilatation is produced when warm blood goes to the hypothalamic region in fever

and thyrotoxicosis. The vasodilatation is due to the effect of raised blood temperature on hypothalamic centres.

CLASSIFICATION OF OCCLUSIVE ARTERIAL DISEASE

I. Degenerative Arteriopathies:

a) Atherosclerosis

b) Medial Arteriosclerosis Sclerosis, (Monckeberg sclerosis)

c) Cystic Medial Necrosis, Marfans syndrome

d) Cystic Adventitial degeneration, Unilocular or Multilocular cysts in the arterial wall

e) Fibromuscular dysplasia

It is common in renal arteries and causes hypertension.

II. Occlusive Disease of diverse origin:

i) Thrombo angiitis obliterans

ii) Vasculitis

Polyarteritis

Systemic lupus erythematosus

Erythema nodosum

Systemic giant cell arteries

Nodular Vasculitis

Idiopathic medial arteriopathy (Takayasus disease)

iii) Infection

a) Leprosy

b) Tuberculosis

c) Syphilis

d) Septicemia

e) Mycotic

III. Raynauds phenomena and allied vasospastic disease:

1. Raynauds disease is without any associated or contributory condition or disease.
2. Raynauds phenomenon is associated with some underlying condition or disease.

Example: a) After trauma

1. Related to occupation

a) Pneumatic hammer disease, b) Occupational occlusive arterial disease of hand c) Occupational Acro-osteolysis d) Vasospastic phenomenon of typists and pianists

2. Following injury or operation.

b) In Neurogenic lesions

(a) Shoulder girdle compression syndrome

(b) Carpal tunnel syndrome

(c) Other diseases of nervous system

c) In occlusive arterial disease

(a) Atherosclerosis (b) TAO (c) Embolism

(d) Thrombosis

d) In Intoxication with heavy metals and in ergot poisoning.

e) Miscellaneous diseases and conditions

(a) Scleroderma (b) Rheumatoid Arthriti

(c) Dermatomyositis (d) Cryoglobulinemia

(e) Myxoedema

IV. Occlusive vascular diseases related to environmental temperature

1. Pernio syndrome

   Acute chilblains, chronic chilblains, Trench foot and immersion foot

2. Frost bite

V. Trauma

1. Mechanical trauma

   Complete severance, Laceration, Traumatic vascular spasm, Local thrombosis, Secondary hemorrhage, Delayed traumatic Aneurysm or A.V. fistula

2. Iatrogenic e.g., after arteriogram
3. Non mechanical arterial injuries

   Thermal burns, U.V. light, short wave diathermy and ultrasound, Electric shock, Irradiation

4. Neurovascular compressor syndromes of thoracic outlet

Histology of Blood Vessels

Arteries:

There are three layers: Intima, Media and Adventitia, which constitute the wall of an artery. They have different function in health and are subject to different diseases.

The tunica intima is relatively acellular and is lined by a delicate endothelium. It is separated from tunica media by the internal elastic lamina. The function of the intima is to provide a non-wettable lining. Damage to the intima invites the deposition of platelets, which acts as the starting point for thrombosis.

The tunica media provides strength for the arterial wall. It is composed of smooth muscle in smaller arteries and arterioles, where as in larger vessels, elastic

tissue is also present.

The Tunica Adventitia consists of areolar tissue and serves to carry the vasavasorum and a plexus of nerves, which are destined for the media.

Capillaries:

Its wall consists of a single layer of flattened endothelial cells.

Veins:

Veins are wider than arteries. Valves are present in the veins of the limbs.

It also has three layers.

PATHOLOGY AND PATHOGENESIS

T.A.O. produce a characteristic pathological picture that has been described by Buerger, McKusick. This picture is quite distinct from that of other vascular lesions such as Atherosclerosis Obliterans. Simple arterial thrombosis, Polyarteritis nodosa and secondary type of thrombophlebitis.

TAO is primarily a disease of the blood vessels of the extremities. It involves the lower limbs more commonly and more severely than the upper extremities. Typical lesions in the extremities are rare and usually develop only when the disease has been present in the extremities for some time.

Mostly it is a disease of medium and small sized arteries, commonly involved are posterior tibial, anterior tibial, radial, ulnar, plantar, palmar and digital arteries. Larger vessels like femoral popliteals brachial are affected late and only when the disease is severe and progressive unlike arteriosclerosis. TAO also affects periarterial structures like veins and nerves. Small and medium size veins are chiefly affected.

The T.A.O lesions are distinctly segmental, normal segments of the vessels are situated between diseased segments of vessels. The line of demarcation between them

is fairly distinct.

The disease produces organic occlusion of vessel. The occlusion is permanent and usually complete, which is followed by development and enlargement of collaterals and anastomotic vessels.

The secondary anatomical effects of disease are the results of ischaemia and malnutrition of tissues complicated by congestion in some cases, trauma and infection.

The severity of disease is directly proportionate to the rapidity and extent of arterial occlusion and is inversely proportional to the rapidity and extent to which the collateral arterial circulation can develop.

Macroscopic:

The vessels affected appear to be constricted both at the site of occlusion and in neighborhood segments where occlusion does not exist. The occluded segments are definitely indurated but not brittle. In the early lesions, the occluding mass within the vessel may be red or brown. In older lesions the occluding mass appears yellowish. The arteries are more frequently obliterated than their accompanying veins. Sometimes occlusions occur at two different levels in the same vessels and between the sites of occlusion the lumen is entirely patent.

Histological Changes:

The lesions are an inflammatory non-supportive, pan-arteritis, pan-phlebitis with thrombosis but without necrosis of the wall of the vessel.

Acute Changes:

Thickening of intimae due to proliferation of the intimal cells with occasional

small collections of lymphocytes in isolated portions of intima where cellular proliferation is most marked.

The internal elastic lamina is intact, wary or slightly thickened or occasionally split. But in Atherosclerosis it is stretched out, distorted and deficient in parts (Kinmonth). The media has a few cellular infiltrations and is intact. The muscle fibres are well preserved

The adventitia contains many fibroblasts, and endothelium of the vasa vasorum will have proliferation.

The lumen is occluded by a thrombus that is extensively organised and contains numerous endothelial cells and fibroblasts. The thrombus of recent onset is cellular and may contain round cells with occasional giant cells of the foreign body type.

The leucocytes in acute lesions are few or sometimes not found at all, even though acute inflammatory cells infiltrate the vessel wall, no micro abscesses are detected.

Chronic Changes:

Picture is same as in the acute lesion except that the thrombus is less cellular more fibrotic and organized by minute canalizations. As the perivascular fibrosis prevents dilatation of channels, the new channels invariably fail to maintain the nutrition of the part affected.

Secondary Pathological Changes:

Occurs in skin, muscles, bone, nerves, soft tissues, etc. These are the result of primarily ischaemia of the tissues of the limbs. Contributing factors may be capillary and venous congestion, tissue atrophy, minor or major mechanical, chemical and thermal injuries to ischaemic tissues and secondary infection.

CLINICAL CLASSIFICATION OF TAO

Allen-Barker-Hynes' have classified the disease into 8 groups.

1. Arterial occlusion causing intermittent claudication as the only symptom.
2. Intermittent claudication with cold digits and mild rest pain.
3. Severe ischaemic neuritis.
4. Marked colour changes and Raynauds phenomenon.
5. Minor gangrene with local infection.
6. Gangrene of digits.
7. Severe gangrene spreading on to foot or hand.
8. Thrombophlebitis as major or only complaint.

Etiology: The cause is not known.

Age: Common between the ages of 25-50 years.

Sex: Formerly considered to be exclusively a disease of male. Recent reports show that there is an increase in the incidence of the disease in female, consistent with the increase in their smoking habits.

Race: T.A.O is known to be present throughout the world and no race or colour is known to be immune.

Heredity: No hereditary basis is established.

Occupation: Has no relation. But is believed to be more common in farmers from low socioeconomic group.

Climate: Geographic location and climate are questionable factors. However cold has a deleterious effect on patients suffering from T.A.O by causing vasoconstriction superimposed on arterial occlusion.

Tobacco: The great majority suffering from T.A.O are heavy smokers.

If the patient with T.A.O continues to smoke, the disease has a tendency to progress inspite of treatment. But if the patient discontinues smoking the disease tends to run a favourable course and exacerbations and new vascular occlusions are rare.

Nicotine is said to be the cause of spasm of blood vessels decreased oxygenation of blood, increase production of new platelets, increase coagulability of blood and increased free fatty acids.

Changes in Blood:

The evidence that changes that favour hypercoagulability occurs in the blood of patients who have T.A.O is inconclusive.

Clinical Features:

1. Intermittent Pain
2. Colour Changes
3. Skin Temperature
4. Absence of Arterial Pulsation
5. Nutritional Changes
6. Swelling and Oedema
7. Miscellaneous Observations.

Pain:

1. Intermittent Pain:

This type of pain is dependent on

i) Exercise

ii) Temperature and

iii) Posture

i) Intermittent pain dependent of temperature:

The onset of such pain depends upon exposure to either cold or warmth.

The best example of the former is Raynauds disease. Raynauds phenomenon may also appear as a secondary manifestation of Thromboangiitis Obliterants (T.A.O) due to exposure to cold. This pain is rarely severe.

ii) Intermittent Pain Dependent on Exercise:

This type of pain is otherwise known as intermittent claudication. The term stems from the Latin verb Claudicare, meaning to limp. The French Veterinary Surgeon Bouley first described it in 1981 as a cause of recurrent limping in horses. It was found to be associated with obliteration of the main artery of leg. Intermittent claudication in man is an indication of obstruction to the free flow of blood to the tissues of the affected limb. It may be due to Atherosclerosis, Diabetes, and TAO of the main artery of the limb. Arterio venous fistula, aneurysm or thrombosis of the main arterial trunk may also cause this. Intermittent claudication is a symptom and not a disease. It only indicates that the muscles in active exercise are not receiving enough blood. Its onset is thus experienced in those groups of muscles that are actively engaged in exercise e.g. small muscle of foot, muscles of calf and muscles of thigh. The amount of exercise necessary to produce pain remains remarkably constant. To begin with it is usually after a very long walk, may be after a mile. But as the disease progresses and with it the degree of vascular occlusion, the distance of claudication becomes gradually reduced.

It is important to note that intermittent claudication is brought on only by

exercise and never as a result of standing and sitting. It is always an accompaniment of obliterative disease of a major artery in the involved limb. It ceases promptly with discontinuation of exercise.

The pain becomes very severe and reaches the zenith of intolerance as the patient continues to walk and compels him to stop. It is described as a "CRAMP". It starts as a vague pain of fatigue and progresses to a sharp and shooting pain down to the muscles of calf and foot. Many patients complain of pain with exercise in one limb only, but careful examination will reveal that both limbs are affected. This is due to the pain in the severely affected limb, preventing the patient from walking sufficiently far enough, to produce the limp in the better limb.

The site of claudication is a rough measure of the level of vascular occlusion. It is more commonly observed in the calf and small muscles of the foot than in the thigh because in the later part there is a generous collateral circulation to compensate for the partial occlusion of the main vessel. Claudication is only a reflection of insufficient blood supply to a part and this may be experienced in advanced stages. Even abdominal intermittent claudication is described.

Mechanism of Claudication: The studies of Lewis (1936) stand foremost in explaining the cause of pain. He observed that claudication was not due to arterial spasm, but was the result of accumulation of excessive 'P' substance due to inadequate blood flow.

iii) Intermittent Pain Dependent on Posture:

Chronic venous congestion due to long standing varicose veins or due to venous thrombosis produces a constant dull ache in the lower extremities. It subsides on taking rest in a recumbent position or on elevation of the limbs. This pain has no relation to exercise.

iv) Nocturnal cramp:

It is an acute muscle cramp occurring whilst the patient is in bed or at rest and is the result of an exaggerated involuntary tonic contraction of a muscle or a group of muscles. It is more frequent in the abductor group of muscles of the great toe and in the muscles of the calf. It has been proved to occur in myopathies and in normal muscles as a result of fatigue and exposure to cold. This nocturnal cramp occurs at rest and is relieved by exercise where as the Intermittent Claudication essentially occurs during exercise and subsides with rest.

A. Persistent Pain:

a) Persistent pain of ischaemia and gangrene: It is extremely severe. Partial relief is obtained by dependency and application of heat. But elevation and cold increase the severity.

b) Pain of sudden arterial occlusion: It is characterized by a sudden or delayed shooting pain in the direction of the main trunk. The limb distal to the obstruction becomes useless and numb. The cause was thought in the past to be due to occlusion by an embolus. But the present concept is that it is due to ischaemia produced by spasm.

c) Pain of Arthritis, Phlebitis and Lymphangitis: Acute Inflammation of arteries causes pain. The patient, as in T.A.O, notices this unless thrombosis sets in. The pain is of full and diffuse in nature along the course of vessels. Phlebitis has a similar pain.

2. Colour Changes:

Lewis classic monograph (1936) concludes that skin colour is a good index of the adequacy of peripheral blood flow when the normal responses to environmental conditions are known.

The colour of skin attributable to circulation depends on two factors (i) Amount of blood (ii) Colour of blood. The depth of the colour of skin depends upon the amount of blood contained with in the capillaries of the skin. This may be decreased when the limb is elevated and increased when the limb is lowered by passive filling of minute vessels.

When the circulation of skin is slow there is a cyanotic tinge to skin. A violet tinge is a sign of complete arrest of flow. The colour of skin also depends on the temperature. When the body temperature is raised, the tissue takes up more oxygen and if the flow of blood does not increase correspondingly the onset of cyanosis is hastened. Colour changes may be intermittent or constant. The former may be affected by

(i) Posture and (ii) Temperature.

A. Effect of Posture:

Abnormal response of skin colour to change of posture is an important feature of the occlusive arterial disease. Normally when the limb is elevated, there is only a minimal change of colour that is not marked and quickly disappears on assuming normal posture. In a diseased limb, the degree of pallor that occurs on elevation of limb is a rough indicator of the adequacy of circulation. This pallor can be uniform or patchy. On bringing the limb down, colour returns to normal in less than ten seconds. But in a diseased limb this time may be forty-five to sixty seconds or more.

B. Effect of Temperature:

This is seen in Raynauds phenomenon where in on immersion of the limb in cold water, a series of changes are seen ranging from cyanosis to pallor and rubor.

Progressive and persistent cyanosis often heralds the onset of actual gangrene. It may also be noted in chronic venous congestion. The so-called “Stay

Pigmentation". It may also be seen in Acrocyanosis.

3. Skin Temperature:

When the blood flow to a limb is reduced the amount of heat brought to it is reduced. Hence the part becomes cool. Environmental factors also influence the skin temperature, but when both limbs are examined under identical conditions, the colder one may be assumed to have impaired flow. Whether it is due to organized changes in the vessels or due to vasospastic factors can only be determined by a repeat examination after release of vasomotor control.

Clinically temperature differences are best made out by the dorsal aspect of the middle phalanx of fingers, which can distinguish temperature differences as small as one degree centigrade. Recording skin temperature only once is valueless. It has to be repeated frequently under identical basal conditions.

4. Absence of Arterial Pulsations:

All arteries are felt against a bone. While searching for pulsations, the volume and amplitude of pulsations are recorded and compared with the other limb. The vessels are examined in the following order.

- Femoral artery.
- Popliteal artery
- Dorsalis Pedis Artery.
- Posterior tibial Artery.
- Radial artery.
- Ulnar artery.
- Brachial artery.
- Digital arteries.

5. Nutritional changes:

Atrophy: In chronic arterial insufficiency, muscles, subcutaneous tissue, skin and skin appendages show the effect of long standing impairment of blood supply. These are most noticeable in the distal parts of the limb. Thus diminution in the amount of and complete loss of hair on dorsum of toes is a good index of the severity and duration of ischaemia. Presence of hair even when there is an occlusion is an evidence of good collateral circulation. The shape form and rate of growth of nails may also be affected.

The skin becomes glossy, parchment like and the digital pulp atrophies. Muscle wasting can be detected by measurements. Atrophy of several inches of calf muscles is not infrequent, though part of it is due to disuse.

Chronic sepsis: Impaired circulation undermines the tissue resistance so that chronic paronychia and whitlow may arise spontaneously or following careless manicure. Such affiliations become chronic and recurrent as, impaired circulation handicaps healing.

Ulceration: Arterial ulcers following trauma may occur at the site of injury where as, spontaneous ulcers are mostly found on the anterolateral aspect of the limb. Such ulcers, especially in Thromboangiitis Obliterans tend to be deep, indolent and are accompanied by severe rest pain. **Gangrene:** Massive death of the tissue is the end phase of severe ischaemia. It often follows ulceration. Gangrene usually begins in the digits and in arterial obstruction of the lower limbs, usually on the undersurface

of the fifth or first toe. But if it is precipitated by trauma it arises at the site of trauma.

6. Swelling and Oedema:

Swelling of the extremities of peripheral vascular origin is due to (i) Obstruction to the flow of lymph (lymph edema) (ii) Obstruction to flow of venous blood due to C.V.I. (iii) Diffusion of fluid from the small vessels into the surrounding tissues due to prolonged dependency.

7. Miscellaneous Observations:

Anaesthesia: It may develop rapidly after an episode of acute arterial occlusion such as embolism. This anaesthesia is of glove and stocking nature and is present distal to the site of occlusion.

Hyperaesthesia:

It may complicate ischaemic neuropathy in T.A.O.

Buergers angle of circulating insufficiency:

This has been recommended to estimate the state of circulation in a limb.

A normal limb retains its colour even when held at ninety degrees to the horizontal unlike an ischaemic limb that develops pallor after elevation to an angle less than ninety degrees. This angle is called Buergers angle.

INVESTIGATIONS

Most of the conditions of vascular disease can be diagnosed on the basis of general history, clinical examination and few simple tests. But more elaborate investigations are necessary to determine the accurate level of obstructive pathology when surgical intervention is contemplated.

Routine investigations like urine for sugar and albumin, serum cholesterol; X-ray and ECG for cardiac size and coronary state, serological studies for evidence of

syphilis are done.

Tests of vasomotor tone:

These tests give us information about the degree of vasospasm due to sympathetic over activity.

Peripheral Nerve Block:

Various nerve blocks including posterior tibial block, lumbar paravertebral block and epidural and spinal anaesthesia are found to be helpful in assessing the degree of vasospasm.

In lower limbs the lateral popliteal nerve at the head of fibula or posterior tibial nerve behind the medial malleolus can be blocked with 1% Xylocaine, for upper limb ulnar nerve at elbow can be blocked.likewise median nerve at wrist can be blocked. Any rise in skin and oral comparative are recorded.

$$\text{Brown's Vasomotor Index} = \frac{\text{Rise of skin temp} - \text{Rise of oral temp}}{\text{Rise of oral temperature}}$$

Operation is not advised unless the index is 3.5 or more.

Skin Temperature Study:

It is best done by an electrically devised thermocouple in a thermostatically controlled room. Normally there is a very slight difference in skin temperatures between symmetrical points over the body. A prompt rise of skin temperature due to the above procedures indicates predominant vasospasm and predicts a good response to sympathetic denervation. The more delayed and smaller the increase in skin temperature, more likely that it is due to organic disease and so, less satisfactory is the response to sympathectomy.

The Doppler Ultrasonic Flow Detector:

It is the most usefulS instrument in vascular diagnosis. This instrument detects the frequently shift of ultrasound from moving particles in the blood and processes them in a variety of ways ranging from an audible sound to a colour flow map, as a component of a Duplex scanner. This technique offers the advantage of simplicity. Its major disadvantage is that it does not detect disease in the absence of haemodynamic alterations.

Colour Doppler:

It is a very useful noninvasive test. This instrument is a modified Duplex scanner that overcomes the technical difficulty of the test. This provides a colour image in which the velocity and direction of blood flow is keyed to the colour of the image at all points within the vessel.

Duplex scanner combines pulsed Doppler measurements with a B-mode ultrasound image. In addition to providing an image of vascular lesion and the anatomic profile of the arteries, it also allows for estimation of blood flow by providing data of velocity of blood flow.

It is best to use a low frequency transducer (2.0 to 3.5 MHz) for the proximal segment of the examination. The aortic bifurcation is best seen with the patient turned to the left side and with the transducer placed just in front of the right iliac crest in a longitudinal plane.

The patient should return to the supine position, and a higher – frequency, liner array transducer (5 to 10 MHz) should be used for evaluation of the arteries of the lower extremity.

Colour Doppler Parameter:

1. **Critical stenosis**:

It refers to the degree of arterial narrowing that is required to produce a significant reduction in distal pressure or flow. There is an exponential relationship between pressure drop and lumen size.

Large and Medium sized arteries: Critical stenosis values = 50% diameter reduction and 75% area reduction.

Once stenosis has occurred, intermittent claudication occurs.

2. **Peak flow velocity**:

It is the maximum velocity encountered within the lumen of the vessel under consideration.

3. **Vortex flow:**

It is a localised, slowly swirling or stagnant blood flow and is often described as a 'Flow Eddy'. Vortex flow occurs distal to areas of arterial stenosis and at sites of bifurcations. A vortex is created when blood accelerates through a vascular stenosis and decelerates rapidly.

4. **Grading of Arterial Disease in Lower limbs – Duplex criteria:**

I. Normal: Triphasic waveform. Normal flow.

II. 1-19% stenosis: Wall irregularities present. Normal waveforms with spectral broadening but no increase in peak systolic velocity.

III. 20-40% stenosis: These lesions are not associated with a pressure gradient at rest. Increase in peak systolic velocity of more than 30% but less than 100% is oberved. Reverse flow component.

IV. 50-99% stenosis: There is greater than 100% increase in peak systolic velocity within the narrowed area. Loss of reverse flows and marked spectral

broadening.

V. 100% stenosis: No flow in artery. Total occlusion.Monophasic pre-occlusive thump is heard proximal to occlusion.

Indications:

1. Postoperative assessment of graft patency.
2. Routine baseline scans for follow up studies.
3. A decrease in ankle-brachial indices.
4. Presence of a thrill, bruit or pulsatile mass on physical examination.
5. New claudication or other vascular symptoms.
6. A reduction in velocity of greater than 30 cm per second from a previous Duplex scans.

Arteriography:

Visualization of vessels by intra-arterial injection of radio-opaque substances affords information that can be very significant. The state of the arterial wall, the presence of collateral system of vessels and the smaller impalpable vessels are easily recognized.

Indications:

1. To confirm the presence and to identify the nature of obliterative arterial disease.
2. To establish the location and extent of block.
3. To visualize distal run off.
4. To assess collaterals.

Contrast Media:

A great variety of substances were used in the past like Sodium bromide,

Sodium Iodothanate etc. Most of which are abandoned for fear of ill effects. 35-50% iodine is the contrast medium of choice.

Before arteriography, the patient is tested for sensitivity an intra arterial injection of 20cc. of the contrast for lower limbs and 15cc. for upper limbs will be adequate to demonstrate the entire arterial trunk. If the patient is sensitive, a desensitization course may be given Closed method of injection of radio opaque contrast medium is the method of choice, since by open method a simple procedure is turned into a formal operation. If percutaneous method fails, the open method may be resorted to. It should be carried out under general anaesthesia this avoids pain produced by arterial puncture and prevents movements of the limb that is essential for a good radiograph.

Arteriography of the lower limb by the femoral artery if palpable, is carried out below the inguinal ligament. If the pulse is absent, aortography is necessary.

Direct Technique:

A short beveled needle is used to pierce the femoral artery. The flow of blood back into the syringe containing the contrast occurs. With another syringe, 20cc. of the selected medium is injected rapidly and a series of x-rays are taken. A mechanical device is of great advantage.

Modified Seldinger Tecnique:

Most radiographers use the percutaneous technique described by Seldinger. A guide wire is advanced under fluoroscopic control to the appropriate site. A catheter is advanced over the wire. Then the wire is withdrawn and the contrast is injected.

Interpretation of Arteriograms:

It needs great care because any error in the technique or a premature exposure may give an appearance that may be mistaken for disease. In reading an arteriogram

the following points need close observation.

1. The anatomical arrangement of the main vessel.
2. The presence of any irregularity in the wall.
3. The presence of any block in a major vessel.
4. The extent of collateral circulation.
5. Patency of the vessel distal to the block.

A normal Arteriogram shows smooth vessel walls and the calibre diminishes gradually towards the periphery. In the thigh, superficial femoral and profunda femoris arteries are clearly retained. Around the knee descending genicular branches are seen. In the leg anterior and posterior tibial arteries and peroneal artery are clearly outlined.

Appearance in Thrombo Angiitis Obliterans .

In T.A.O it is more common for the smaller calibre peripheral vessels to be affected first hence it is not uncommon for the femorals to be relatively normal. The limit of thrombosis is nearly clear-cut and regular. Rarely is the main trunk patent distal to thrombus. It is not uncommon to find extensive multiple blocks affecting all major vessels extending up to the knee or even above it. Proximal to the block, the vessel is smooth and no abnormality detected.

The arteriographic differentiation of TAO from degenerative arterial disease can be made out in most instances.

Collaterals in T.A.O are numerous but are very small and provide a less adequate circulation than those in degenerative arterial disease where they are not so numerous but are of good calibre. In degenerative arterial disease besides the irregular moth eaten appearance of the main trunk, the main vessels are often patent distal to the block. In some cases, however the differentiation may be impossible.

Segmental Pressure Gradients:

In a normal person, the ankle pressure when measured in supine position is equal or higher than the brachial (arm) systolic blood pressure.

$$\text{Pressure Index} = \frac{\text{Ankle B.P}}{\text{Brachial B.P}} = \text{One}$$

Normally the pressure index is greater than 1, 0.9 with intermittent claudication, 0.26 to 0.05 with rest pain and impending gangrene.

An 8-MHz continuous wave transducer can be used for most patients. However, if the Doppler signal is attenuated because of depth, a 5-MHz transducer may be necessary to improve penetratuion.

Pressure may be falsely elevated in obese patients, and a proximal thigh pressure may be lower in extremely thin patients. The cuff-to-limb ratio should be kept in mind when the patient's legs are either abnormally large or abnormally small.

TOE PRESSURES

Toe pressure may also be used to determine if there is obstructive disease involving the pedalarch and digital arteries.

Normal if it is 50mm Hg or more than 64% of the brachial pressure, whichever is higher. The mean toe PI in patients with claudication is 0.35 ± 0.15 and 0.11 ± 0.10 in patients with rest pain.

Flexible Angioscopy:

Technical refinements and miniaturization of fibreoptic endoscopes have resulted in the development of a new flexible angioscope designed specifically for intravascular visualization.

Diagnosis

The exact diagnosis of T.A.O cannot be made, as there are no definite criteria for it.

I. Diagnostic criteria for Buergers Disease (Wong et al)

- Age below 50 years
- Chronic smoker usually male
- Involvement of medium to small arteries of the lower limbs with rest pain, intermittent claudication, ischaemic ulcer or gangrene
- Similar upper limb involvement
- Thrombophlebitis
- Raynauds phenomenon
- Absence of atherosclerosis, collagen disease hematological disorders or sources of embolism at the time of diagnosis.

II. Angiographic criteria for Buergers Disease (Mckusick et al)

- Vessel appearance predominantly small and tapering
- Flow of contrast – arterial fade out with or without early venous filling
- Small and medium size distal vessel involvement
- Segmental or focal and intermittent occlusion of vessels, often bilateral
- Smooth and even caliber proximal vessels
- Spider leg or tree root configuration of collateral vessels
- Abnormal corkscrew tortuosity of small apparently recanalised vessels.

TREATMENT

Since the etiology is unknown, most of the methods of therapeutic approaches are empirical. The primary aim of the treatment is to prevent gangrene or at least

retard its progress. If the case has become refractory to conservative management sooner or later some part of operative intervention will be required to increase blood supply or relieve pain.

Management

I) Conservative:

1. General care and protection measures
2. Abstinence from smoking to arrest progress of disease
3. Drugs
4. Physical therapeutic procedures to increase blood flow
5. Procedures to relieve pain.
6. Radiological Interventional Procedures

II) Surgical:

1.Sympathectomy

2.Omento plasty

3. Amputation

General Care:

The patient should take high protein and low fat diet. Direct heat to legs by hot water bottles and heat lamps could be avoided.

Exercise and abstinence from smoking:

Cessation of Smoking is frequently combined with exercise therapy in patients with intermittent claudication, cigarette smoking is the most significant independent risk factor for development of chronic peripheral arterial occlusive disease and is associated with progression of established disease and a higher likelihood of disabling claudication limb threatening ischaemia, amputation and the need for

intervention.

Drugs:

- Antibiotics
- Vasodilators
- Haemorrheologic agents
- Other agents
- Hemodilution
- Antithrombotic therapy

1. **Suitable systemic and local antibiotics are used depending on culture and sensitivity report.**
2. **Vasodilators:**

Collaterals are already maximally dilated in patients with intermittent claudication, hence the role of vasodilators is doubtful.

3. **Hemorheologic Agents:**

The actual improvement in walking distance attributable to pentoxifylline is often unpredictable. A small increase in claudication distance has been noted in individuals with markedly reduced walking distances earlier. Pentoxifylline has been reported to improve abnormal erythrocyte deformability, reduce blood viscosity and decrease platelet activity and plasma hypercoagulability.

Niftidroturyl:

A 1+7 tlyptomaine antagonist it may reduce platelet aggregation and improves walking distance

Cilostazol :

A phosphodiesterase III inhibitor with antiplatelet and vasodilator activity also

increases walking distance

Antithrombotic Therapy:

Aspirin alone or combined with Dipyridamole (or) clopidogrel will delay the progression of established arterial occlusive disease.

The antiplatelet agent ticlopidine has also beneficial effects in relieving symptoms, increasing walking distances and improving ankle pressure indices.

Prostaglandins: ilioprost may provide temporary relief of rest pain in patients with severe arterial insufficiency and may promote healing of ischaemic ulcerations when given intra venously,oral preparations under trial.

Physical Therapeutic Procedures:

Rest in bed, Buergers position, Buergers exercise, and avoidance of vasoconstriction by preventing exposure to cold and drugs that produce vasoconstriction.

Procedures to relieve Pain:

Repeated use of various analgesics may be necessary for the temporary relief of pain.

Radiological Interventional Procedures:

1. Percutaneous Transluminal Angioplasty
2. Intra vascular stents
3. Intra arterial thrombolysis

1. Percutaneous Transluminal Angioplasty (PTA):

Currently the primary indications for an interventional procedure in patients

with lower extremity arterial disease include

a) Incapacitating claudication interfering with work or lifestyle.

b) Limb salvage in patients with limb threatening ischaemia as manifested by pain at rest, non healing, ulcers and or infection or gangrene

c) Vasculogenic Impotence

PTA is an appropriate choice when two important criteria are met. These include arterial disease localized in a vessel segment less than 10 cm. in length and availability of a skilled vascular interventionalist.

PTA of iliac arteries is associated with better long-term success rates than more distal angioplasty.

Factors predicting outcome of P.T.A.

Factors predictive of favourable outcome included claudication as the indication for the procedure. A stenotic rather than occlusive lesion, good distal run off, more proximally situated lesion.

2. Intra vascular stents:

Currently available intravascular stents are either balloon expandable (e.g., the Palmaz and Streckter Stents) or self-expandable (e.g., the Wallstent and Gianturco Stents). At present the role of stents in treatment of lower extremity arterial disease is unclear.

3. Intraarterial thrombolysis:

Thrombolytic agents like tissue plasminogen activator streptokinase, urokinase have been used for acute arterial embolism. Based on a review of literature, Hess has suggested that local thrombolytic therapy can be used for all arterial thrombosis existing for 6-8 months and all embolic occlusions present for 6-8 weeks.

Lumbar Sympathectomy:

In the extremities, the vascular response to sympathetic stimulation is vasoconstriction with blanching and cooling of skin and increased sweating, whereas blocking of the system results in increased blood flow through cutaneous arteriovenous fistulae and cessation of sweating thereby resulting in increased dryness, warmth and accentuation of pink color. Effect on blood flow to the muscles are considered incidental to the effect as flow in the skin and are overshadowed by the local effect of muscle metabolites.

Indications:

1. Patients with advanced ischaemia resulting in pain at rest.
2. Ischaemic ulcers
3. Frank gangrene or impending gangrene
4. Distal arterial occlusion
5. Failure of direct arterial surgery in symptomatic patients.

Technique of Sympathectomy:

There are three approaches to the lumbar sympathetic chains. The transperitoneal anterior approach, the extra peritoneal anterior flank approach (Anderson) and extraperitoneal posterior flank approach (Flowthow).

The ultimate aim is to denervate the lower limb. If it is required to be done on both sides it can be done at the same time by the transperitonial route. The position of lumbar ganglia is very variable and inconstant.

An oblique subcostal incision is made which extends upto a point 1½" short of the umbilicus, after arranging the patient in lateral position. All the muscles are cut in the line of incision. The peritonium is pushed medially and psoas muscle identified. At the inner border of psoas muscle, a finger against the lumbar vertebral

bodies can roll the lumbar sympathetic chain. On the right side special care should be taken to avoid injury to inferior venacava and to the thin walled intercostal and lumbar veins, which enter into it. For a complete sympathetic denervation of lower extremity, it is necessary to remove the 1st and 2nd lumbar ganglia. For denervation of the foot and leg alone 2nd and 3rd ganglionectomy is sufficient. The first ganglion has to be removed for denervation of thigh.

Causes of failure of sympathectomy:

1. Wrong selection of patient
2. Progress of disease
3. Incomplete denervation
4. Accessory ganglia
5. Accessory sympathetic nerves, which do not pass through the sympathetic trunk, are left untouched.

Omentoplasty:

Casten and Alday first studied omental transplantation.

Omentoplasty is a procedure in which greater omentum is released greater curvature of stomach depending on upon which sides the transplantation is contemplated. The omentum is released from the greater curvature of the stomach with an intact epiploic artery one side. It is brought down in the subcutaneous tunnel in the medial side of the limb upto the ankle and is fixed to the muscle. Through the intact epiploic artery ischaemic limb will get some nourishment. A rich lymphatic supply probably aids in cleaning infection whereas its vascularity promotes angiogenesis in compromised tissue.

Direct Arterial Surgery:

TAO is a disease of small and medium sized vessels and segmental involvement

is present and it is episodic in nature so the direct arterial surgery has a limited role in T.A.O.

Arterial Bypass:

The various common bypasses for Aorto Iliac and Infra inguinal occlusive diseases are:

1) Aorto-Iliac, 2) Aorto External Iliac bypass (in presence of common iliac block), 3) Aorto femoral bypass, 4) Ilio femoral bypass (Block in External Iliac artery), 5) Femoro Popliteal bypass, 6) Femoro-Tibial bypass, 7) Extra anatomic bypass.

Graft Materials:

Aorto Femoral Bypass:

A bifurcated dacron graft or less commonly Polytetrafluoroethylene (PTFE) is used to bypass the stenotic lesions. In Aorto femoral grafting, patency is excellent with any conduit. The five and ten year patencies of Aortoiliac reconstructions are 90% and 75% respectively.

Dacron Grafts:

These are constructed in either a knitted or a woven configuration. The advantages of the knitted structure are excellent tissue in growth that occurs through the wide interstices of the graft and the technical ease of handling at the time of operation. Preclotting with the patient's blood is required, to avoid massive haemorrhage when blood flow through the graft is initially established. Knitted grafts have also been associated with degeneration and aneurysmal dilatation over a period of time.

For woven Dacron grafts, preclotting is infrequently required and graft dilatation is less common. Dacron grafts have been coated with albumin or collagen, eliminating the need for preclotting and aneurysmal dilatation has not yet been

reported with these coated Dacron grafts.

PTFE grafts also need not be preclotted and aneurysmal dilatation has not yet been reported.

Infra Inguinal Bypass:

The selection of conduit material is of paramount importance in infra inguinal arterial reconstruction as the long-term patency rate is highly dependent on two primary factors 1) Site of outflow 2) Type of bypass material.

Saphenous vein is the best infra inguinal bypass conduit material, conduit must be credited for the reintroduction of the autogenous vein for arterial reconstruction. Among prosthetic graft PTFE is the most commonly used. Dacron is infrequently employed.

The patency of Saphenous vein grafts is better than that of prosthetic grafts and the problem with postoperative infection is reduced by avoidance of prosthetic material. If great Saphenous vein is not available lesser saphenous or cephalic veins can be used.

In the absence of autogenous veins, some surgeons have used fresh homologous veins. Although the antigenicity of venous tissue is low, it is nonetheless important to match the compatibilities of the ABO system of donor and recipient. Tice and Zerbina have tested homologous veins preserved at 50°C for as long as 3 months and have showed good results.

Bypass in Aorto Iliac Disease:

Aorto femoral bypass is currently the treatment of choice for symptomatic Aorto-Iliac occlusive disease.

Procedure:

Once the graft is selected and the patient has been systematically heparinised, the proximal anastomosis between the graft and the infrarenal aorta is created using

either an end to end or end to side technique. The graft limbs are then delivered to the femoral vessels through tunnels that are created besides the external iliac arteries. The distal anastomosis is placed at the common femoral level through bilateral groin incisions.

Aorto iliac bypass eliminates the needs for grion incisions but the patency rate is substantially lower than Aorto femoral bypass.

Bypass in Infra-inguinal occlusions:

The two most commonly preferred infra inguinal reconstructions are as femoro-popliteal and femoro-tibial bypasses.

Popliteal to tibial and popliteal to pedal bypasses are performed less frequently as are more distal reconstructions to the arteries of the foot. There are two general techniques used in autogenous vein bypass procedures, differentiated by the orientation of vein in relation to the direction of blood flow and the alignment of venous valves.

i) The reversed bypass technique:

Excises the vein in its entirety and reverses it such that the caudal end is anastomosed proximally and the cranial end distally.

ii) Insitu vein bypass technique:

First performed in 1960s, the vein is left in usual orientation and the venous valves are disrupted to allow blood to flow from the cranial end of vein to the caudal end.

Extra Anatomic Bypasses:

Indications:

1. Patient's medical condition renders the risk of major intra abdominal procedure unacceptable.

2. Lower extremely ischaemia in presence of an infected aortic graft.
3. Re-operation for Aorto-femoral graft occlusion.
4. In reoperation in a sexually active male to avoid the possibility of postoperative sexual dysfunction.

Prosthetic grafts are almost always employed. The best results of extra anatomic bypass procedures are achieved with femoro- femoral bypass grafts. 5 years patency rates of these grafts range between 50-70%.

Reconstruction of Profunda femoris artery:

In the presence of occlusive disease of the superficial femoral artery, the profunda femoris artery plays the chief role of collateral circulation between the Iliac and popliteal arterial systems. Clinical and angiographic data have provided direct and abundant evidence of this significant fact.

Ischaemia both chronic and acute of the lower extremity, whether due to Aorto-iliac of femoro-popliteal disease, can often be managed by increasing arterial pressure and flow through this artery. Under these circumstances, the profunda femoris is truly the artery of revasclarisation of the leg and foot. Its reconstruction, whether isolated or combined with any other procedures has assumed in recent years an increasingly important role in the management of occlusive arterial disease of the lower extremity.

The operative procedures designed to achieve patency of profunda femoris artery consist of Endarterectomy or Thromboendarterectomy, usually associated with a patch graft. Reconstruction of the profunda femoris artery or profundoplasty may be performed either as sole procedure or more commonly in combination with reconstruction of the Aorto Iliac segment.

Angioscopy:

Intraoperative angioscopy has become an attractive technique for evaluating bypass grafts and arterial procedures, since the introduction of small flexible catheters with high-resolution optical systems. Angioscopy requires irrigation with saline accompanied by inflow and sometimes outflow occlusion to provide a visually clear image. The use of a specifically designed infusion pump with high and low flow rates has greatly facilitated the visualization. It has been most widely used to inspect insitu saphenous vein graft to ensure complete valve lysis and to exclude unligated venous branches. Ideally 1.4mm diameter angioscope may be used in such grafts, introducing the angioscope through a sheath placed through the most proximal branch of the Saphenous vein that is left unligated for this purpose. Saline irrigation is administered through the sheath. Prior to angioscopy it is useful to identify and ligate as many venous side branches as possible to optimize distal irrigation and visualization. Angioscopy can be used in other sites if blood flow can be temporarily excluded which sometimes requires the use of balloon occlusion catheters if proximal control is not surgically accessible.

Endothelial injury leading to late hyperplasia, creation of intimal flaps and fluid overload due to excess irrigation.

Minor Amputation:

Amputation of a digit or a part of the digit is indicated when an ulcer refuses to heal, when there is severe pain restricted to the affected digit and when there is gangrene limited to the toe.

Transmetatarsal amputation is the amputation of choice in the foot in selected cases as advocated by Mekiffrick, especially so after a sympathectomy. Amputations like Choparts, Lisfrancs and Symes are not considered suitable. If amputation of the

toes alone or a transmetatarsal amputation does not leave a satisfactory stump, then a below knee amputation is indicated

Major Amputation:

The chief indications are

1. Presence of gangrene that extends into the foot with proximal ischaemia.
2. Severe rest pain uncontrolled by any means.

The selection of a proper site for amputation should be done carefully to prevent ischaemia in the stump and re-amputation. The decision should be based on a thorough clinical examination coupled with radiological investigations.

A below knee amputation can always be done if the popliteal artery is patent. If femoral artery is blocked the success of this operation is less assured. A simple and valuable procedure, perhaps is to proceed for a below knee amputation without a tourniquet and note the condition of the muscles and the degree of bleeding from the small arteries and capillaries. If the blood supply to the muscles is found to be fairly adequate the amputation can be completed below the knee.

It is always better to do a below knee amputation whenever possible. The patient can go around better without much disability with an artificial limb. The importance of a below knee amputation is still more in cases where both legs are involved.

MATERIALS AND METHODS

The present study was undertaken with the following objectives.

1. To determine the various etiologic factors in Thrombo Angiitis Obliterans (T.A.O).
2. Correlation of clinical findings with Doppler study.
3. Outcome of the medical and surgical management.

A study of cases of lower limb Ischaemia due to Thrombo Angiitis Obliterans.

Patients and Methods:

In this series I have taken 52 cases of TAO for study during the period July 2005 to September 2007.

The 52 cases were selected after preliminary screening of number of patients

with non-healing ulcer, gangrene and history of intermittent claudication. Patients with history of atherosclerosis, diabetes and peripheral neuropathies were not considered. Patients having chronic ulcers due to diseases like varicose veins were also not considered.

These 52 patients were subjected to elicitation of proper history, physical examination and investigations. In the history, importance was given to features like site, nature and duration of pain, claudication distance, rest pain, previous history of treatment, details about smoking, chewing tobacco and alcohol intake.

In physical examination, more importance was given to palpation of different arterial pulses and skin temperature at different levels. Blood pressure, signs of thrombophlebitis, skin changes, sensory changes and muscle power were taken into account.

Investigations Included:

Routine Investigations

Hb, TC, DC, ESR

Urine Sugar, Albumin and Deposits,

Blood Urea, Serum Creatinine, Random Blood Sugar,

Lipidprofile, VDRL – Test

Bleeding time, clotting time, prothrombin time and platelet count

Chest X-ray and ECG were taken.

X-ray of affected limb.

Doppler Study of affected limb.

OBSERVATIONS IN THE STUDY OF 52 CASES OF T.A.O

1. AGE INCIDENCE

Maximum age is 64 and minimum age at the onset of symptoms is at 28 years.

Age / years	No. Of Cases	Percentage
21-30	2	3.8 %
31-40	22	42.3%
41-50	11	21.2%
51-60	12	23%
61 years above	5	9.6%

2.SEX INCIDENCE:

In this series we didn't come across any female with TAO. So in our series sex incidence is 100% males.

3. OCCUPATION

Occupation	No. of Patients	Percentage
Manual labour/coolie	22	42.3%
Agriculture	18	34.6%
Drivers	9	17.3%
Others	3	5.8%

4.INCOME:

We have taken Rs.2500 per month as lower income and middle-income groups Rs. 2500-5000 and above Rs. 5000 as higher income group.

Group	No. Of Cases	Percentage

Lower income group Less than Rs. 2500	32	61.5%
Middle income group Rs. 2500-5000	17	32.7%
Higher income group above Rs. 5000	3	5.8%

5. SMOKING:

In our series all the patients were smokers so incidence of smoking in our series is 100%. Beedi smokers – 34, cigarette smokers – 18(12+6) 12 – Non filter, 6 of them filter cigarette users.

Number of cigarettes/beedies smoking per day

No. Of Beedies/Cigarettes / day	**No. of Patients**	**Percentage**
Below 10	8	15.4%
10-20	20	38.5%
20-30	21	40.4%
30-40	3	5.8%

Duration of smoking before onset of symptoms

Years of Smoking	**No. Of Patients**	**Percentage**
1-10 Years	12	23%
11-15 Years	19	36.5%
16-20 years	10	19.2%
21 years & above	11	21.1%

6. OTHER HABITS

Other Habits	No. of Patients	Percentage
Alcohol	28	53.8%

Chewing Tobacco	20	38.5%
Containing Pan/Mixtures Both	4	7.7%

7. INCIDENCE OF LIMB INVOLVEMENT CLINCALLY

RT	Left	BL
16	22	14

8. Pain:

Pain was present in all 52 cases.

Type of Pain	No. Of Cases	Percentage
Intermittent Claudication	13	26.6%
Intermittent Claudication with Ulcer/Gangrene related Pain	17	32.7%
Rest pain	22	42.3%

CLAUDICATION DISTANCE:

Claudication Distance in meters	No. Of Patients	Percentage
Rest Pain	22	42.3%
Below 10	-	-
11-25	7	13.4%
26-50	23	44.2%

Trauma:

In 2 cases history of trauma was there where in it resulted in ulcer of foot.

Physical Examination:

Ulcer: Total 11 patients came with chronic non-healing ulcer over the lower extremities mainly in the distal part of foot.

Patients with history of trauma - 2

Ulcer associated with gangrene - 9

Ulcer associated with oedema - 2

Ulcer associated with pregangrene - 0

Gangrene:

Total number of patients with gangrene - 50

Gangrene associated with ulcer - 9

Gangrene associated with edema - 1

Pregangrenous State:

No. Of patients with pregangrenous state - 0

Oedema:

Oedema was present in - 3 cases

Oedema associated with ulcer - 2

Oedema associated with gangrene - 1

Thrombophlebitis:

Signs of thrombophlebitis observed in - 0 case

DURATION OF SYMPTOMS:

Duration of Pain	No. Of Patients	Percentage
1 to 3 Months	3	5.8%
3-6 Months	16	30.8%

6 Months-1 Year	22	42.3%
1-4 Years	10	19.2%
Above 4 Years	1	1.9%

Pulsations:

All peripheral pulses were palpated. Abnormalities detected commonly in dorsalis pedis, posterior tibial and popliteal arteries. Feeble/absent femoral pulsation noted in 3 cases.

ARTERY	RIGHT	LEFT	BILATERAL
Post tibial and Dorsalis pedis	8	12	5
Popliteals	7	9	8
Femoral	1	1	1
Percentage	30.8%	42.3%	26.9%

Skin Temperature:

This can be Clinically assed by dorsum of middle phalanx of fingers.

In many cases both the limbs had subnormal temperature basically below the knee, on the side with signs of ischaemia, being cold.

Investigations:

In various leads. No one had arrythmias.

X-ray of affected linbs: Anterior, Anterolateral views taken

No one showed arterial calcification

X-ray chest PA view : 1 patient showed Bilateral P.T.

23 cases amongst the study group Doppler study had been done. The study confirmed most of the palpatory findings.

Anterior, Posterior tibials, Dorsalis pedis

Arteries showed absent flow	- 8 Cases
Absent flow in popliteal artery level in	- 7 Cases
Occlusion at superficial femoral artery level in	- 5 Cases
External iliac level occlusion in	- 2 Cases
Common iliac level occlusion in	- 1 Cases

In most cases Doppler study showed deficient collateral formation distal to the obstruction.

Arterial intervention studies are not done in our institutes.

Treatment :

General Measures:

All the patients were advised to stop smoking and following measures were given to all the patients irrespective of the mode of treatment.

- Bed rest and protein rich diet.
- Antibiotics.
- Pentoxifylline 400 mg 1-0-1
- Nifidepine 5mg 1-0-1
- Acetyl salicylic acid 75/150 mg lod
- General wound care / ulcer care (cleaning & dressing).

- Analgesics/Sedatives (SOS)

Conservative Treatment:

The general measures mentioned above have been given in 6 patients. But all the other patients needed surgery in one form or other.

Minor Amputations:

Minor amputations like toe amputations (1-2 toes) were done in 28 patients.

Major Amputations:

Below knee amputation was done in 5 patients.

Lumbar Sympathectomy with Amputation:

Lumbar sympathectomy with minor amputation was done in 12 patients. Lumbar sympathectomy with major amputation was done in 1 patient. Bilateral Lumbar sympathectomy done in one patient.

Omentoplasty: No cases underwent Omentoplasty.

Summary of Treatment:

Mode of treatment	No. of Patients	Percentage
Conservative treatment alone	6	11.5%
Minor amputation and conservative treatment	28	53.8%
Major amputations	5	9.6%
Lumbar sympathectomy with major amputation	1	1.9%
Lumbar sympathectomy with minor amputation	12	23%

Progress:

Progress was assessed by

Change in intensity of pain

Progress is ulcer healing

Change in colour of skin

Change in temperature of skin.

Conservative treatment (6)

Ulcer healing promoted and oedema subsided with drugs.

Lumbar sympathectomy with Minor amputation (12)

Pain relief:

Mild to Marked relief of pain	-5
No relief of pain	- 2
Partial healing	- 3
Complete	- 2

Temperature change in limbs

Slight increase in skin temperature of the limb noted. In - 5 patients after surgery.

DISCUSSION

Age incidence:

The maximum age incidence in this series was 64 years and minimum age is 28

years.

Average age of incidence in this series is 46 years.

Author	Year	Range	Average
Buerger	1924	20-40	32.5
Brocans Allen	1928	20-50	30.0
Shivaji Row	1975	16-41	38
Our study	2007	28-64	46

Sex Incidence:

In our series we did not come across any female patient, probably Habit of smoking is rare in females in our place.

Hereditary and Family Incidence:

In the present series no family incidence of the disease was recorded.

Socio Economic Status:

In the present series 61.5% of cases belonged to the lower Income group. 32.7% belonged to the middle-income group 5.8% belongs to high income group.

Occupation:

In our study 42.3% of them were manual laborers and 34.6% were agricultural workers.17.3% drivers and 5.8% others

Smoking:

It is a very important etiological factor for T.A.O. In the present series all 52 patients were smokers.

The number of beedies/cigarettes smokers ranged from 10 to 30/day.

The number of years of smoking ranges from 7 to 32 years.

Beedi smokers are most commonly affected in T.A.O, because the raw tobacco packed in Beedies contains high level of nicotine.

Tobacco smoke has been thought to trigger some immunopathogenic mechanism responsible for the disease.

In our study association with smoking is the main aetiological factor for T.A.O. In this series all the patients stopped smoking after the treatment from day 1 onwards.

Incidence of Limb Involvement:

In our study involvement of left 42.3% and right lower limb 30.8% and both in 26.9%. In bilateral symptomatic cases one side was more affected than other.

Pain:

Pain was the main symptom and it was present in all the patients. Pain was felt in calf muscles and foot in most patients.

Intermittent claudication was present in 26.6% of patients. In 32.7% of patients in addition they had ulcer/gangrene related pain.

Claudication distance is a good index of the severity of arterial occlusion.

Pain was aggravated by exercise and elevation of the limb in all cases. Rest and dependency gave relief to most of the patients.

Rest pain was present in 42.3% of patients. Rest pain is due to severe ischemia of tissues and sensory nerve terminals. Patient grasps and rubs the foot in an endeavour to relieve pain. Obliteration of the terminal vessels gives rise to more severe local ischaemia than obliteration of proximal vessels with patent distal vessels due to better collateral formation.

Ulceration:

Total number of patients with chronic non-healing ulcer was 11. In 9 patients ulcer was associated with gangrene and in 2 patients associated oedema. The oedema subsided with limb elevation and Antibiotics,

Gangrene:

Gangrene was present in 50 patients. In 9 patients gangrene was associated with ulceration and in 1 patient it was associated with oedema.

Because, of ignorance, patients came to hospitals in late stages.

Duration of Symptoms:

Most patients came with duration of symptoms between 6 months to 1 years (42.3%).

Temperature Changes:

Determination of skin temperature may be useful in evaluation of effectiveness of the drugs, sympathectomy and other procedures used for the purpose of vasodilatation.

In many cases both sides had subnormal temperature even though the side with signs of ischaemia had maximum reduction.

Arterial Pulsations:

All peripheral pulses were examined. Abnormalities were detected only in dorsalis pedis, posterior tibial and sometimes in popliteal.

Unilateral absence of Dorsalis pedis and posterior tibial pulsations observed in 23 patients.

Bilateral absence of Dorsalis pedis and Posterior tibial pulsations observed in 5

patients.

Popliteals were involved in - 24 Cases

Bilateral involvement - 4 Cases

Unilateral involvement - 20 Cases

Unilateral Femoral - 3 Cases

On symptomatic side both Dorsalis pedis and Posterior tibial were always absent with or without popliteal pulsation.

Thrombophlebitis:

Typically a tender red painful swelling appears in line of superficial vein often with slight edema around it. Attacks recur at interval of months or years.

In our study no case had evidence of thrombophlebitis.

Investigations:

Investigations like urine routine, blood sugar, serum creatinine, blood urea, clotting time and bleeding time, Prothrombin time were normal in all cases.

VDRL test found negative in all cases.

Increased serum Cholestrol – 3 Cases, Lipid profile found normal in others.

X-ray chest were normal in all patients. Except – 1(Bilateral P.T)

He was started on antituberculosis treatment.

Limb x-ray done in 20 patients and no one showed vessel calcification

ECG with ischemic changes seen in 6 patients and they were done echo, treated medically.

No major surgical intervention was planned for them.

Doppler Study:

Doppler study confirmed most of the palpatory findings in 23 patients in whom it was done.

In the 5 patients with clinically absent popliteal flow, diminished flow was detected in Doppler.

In 15/23 cases diminished or absent flow around in popliteal Anterior tibial, Posterior tibial vessels found.

In 5/23 cases occlusion seen at the superficial femoral artery level.

2 cases at external iliac level, and 1 case at common iliac level.

87% of patients had infra inguinal involvement 13% had supra inguinal involvement.

In most cases Doppler study showed deficient collateral formation distal to the obstruction.

Treatment Given:

Conservative treatment alone in - 6

Lumbar sympathectomy with minor amputation - 12

Major amputations - 5

All the patients were advised to stop smoking and given

- Ulcer/wound care with daily dressing
- Systemic antibiotics
- Protein rich diet
- Pentoxifylline
- Acetyl salicylic acid
- Analgesics (mostly NSAIDS)

Biopsy :

Biopsy of amputated limb in 5 and toes in 15 patients done.

Report showed

All the 3 layers of vessels showed inflammatory polymophonuclear cell infiltration in 12 cases.

Luminal Microthrombus with inflammatory cell infiltration in vessels 3 cases.

Perivascular fibrosis and adjacent vein involvement in 4 cases seen

In 5 cases no specific changes noted

15 / 20 cases shows specific pathology related to T.A.O noted.

Follow up:

Patients treated with aspirin have been monitored with

Bleeding time, clotting time and prothrombin time periodically

Platelet count routinely

Medical management improves pain by 2-3 weeks]

Lumbar sympathectomy gave only mild to moderate relief of pain with healing ulcer in 5 patients.

In Patients with Major amputations, stump had healed well

Prosthesis were advised to them. They got registered in artificial limb centre.

Symptomatic treatment was given with drugs, which marginally improved their quality of life.

SUMMARY AND CONCLUSION

Study of 52 cases of Thrombo Angiitis Obliterans was carried out at Government Thanjavur medical college Hospital during the period from July 2005 to September 2007.

- All the patients affected were males.
- In our series all the patients were chronic smokers. Most of them are beedi smokers
- Minimum age of onset of symptoms is 28 years and maximum age is 64 - years.
- 42.3% of the patients were manual laborers and 34.6% agricultural workers.
- 61.5% of the patients belonged to low-income group.
- No familial incidence of TAO was reported.
- All biochemical parameters were within normal limits in most of patients, (except 3).
- All the patients had pain as the presenting symptoms with or without gangrene/ulcer.
- Rest pain was present in 42.3% of patients.
- In Doppler study shows in 87% patients medium or small size vessels involvement.
- Both medical and surgical management gives moderate relief of symptoms only.
- Cure and Prevention of TAO yet to be achieved.

BIBLIOGRAPHY

1. Baker JD, Dix D: Variability of Doppler ankle pressures with arterial occlusive disease: an evaluation of ankle index and brachial-ankle pressure gradient, Surgery 89:134, 1981.
2. Bandyk DF, Cato RF, Towne JB: A low flow velocity predict failure of femoropopliteal and femorotibial bypass graft, Surgery 98:799, 1985.
3. Camm-'Luselter, surrey's- Esc Text book of cardio vascular medicine -2006
4. Car MT.Jr.Hackny MIF, Hines SJ.et.al enhanced platelet force development despite drugs in T.A.O case repots. Vac. Endovascular surgery 2002
5. Collier P and others: Improved patient selection for angioplasty utilizing color Doppler imaging, Am J Surg 160:171, 1990.
6. Cossman DV and others: Comparison of contrast arteriography to arterial mapping with color flow duplex imaging in the lower extremities, J Vasc Surg 10:552, 1989.
7. Edwards JM and others: The role of duplex scanning in the selection of patients for transluminal angioplasty, J Vasc Surg 13:69, 1991.
8. Hagen Ansert – Textbook of diagnostic ultra sonography.6th edition, 2006.
9. HillGL GL , Moeliono J.Tumaruv Fet.al. Burger's synd-java. A description of clinical syndrome and some aspect of its aetiology Dr.J.Surg 60. 606-613,1973
10. John L.Cameron's current surgical Therapy, 8th Edition, - 2004
11. John N Hellet,Mills, Earnshaw Reeker's comprehensive endo vascular surgery - 2004
12. Kumar kortan Robin's pathological basis of diseases 5th edition 2002
13. Papa M.Bass A.Adar R.et.al autoimmune mechanism in T.A.O the role of Thrombo Angiitis major histo compatibility complex Surgery, 111 527-531,1992
14. R.Ruther fords, Vascular Surgery, 6th Edition, 2005.
15. Rahman M. choudhury AS fuki.T.et.al Association of thrombo Angiitis Obliterans with

cigarette and bide smoking- Intel J.Epidemiol, 29. 266-270-2000

16. Silver Bag's principle and practice of surgical pathology and cytopathology 4th Edition -2006
17. Sir. Alfred Curschieri, Robert J C, Steele, Abdool Rahim Moossa, Essential Surgical practice, 4th Edition, - 2002

CASE PROFORMA

NAME OF THE PATIENT **OP/IP NO: -**

AGE

SEX

OCCUPATION

INCOME

RELIGION

MARITAL STATUS

COMPLAINTS

HISTORY OF PRESENT ILLNESS

H/O CLAUDICATION, CLAUDICATION DISTANCE, REST PAIN, LIMB EDEMA, ULCER, GANGRENE, THROMBOPHLEPHITIS

PAST HISTORY

PREVIOUS ILLNESS, TREATMENT

PERSONAL HISTORY

SMOKING – CIGARETTE, BEEDI, NUMBER PER DAY, DURATION

ALCOHOLISIM, TOBOACCO CHEWING

FAMILY HISTORY

CLINICAL EXAMINATION

INVESTIGATIONS

HB, DC, TC, ESR

BT, CT, PROTHROMBIN TIME,

UREA, SUGAR, CREATININE, ELECTROLYTES

LIPID PROFILE, V.D.R.L. TEST

ECG, X-RAY CHEST 'PA' VIEW

X-RAY, AFFECTED LIMB

DUPLEX ULTRASOUND

TREATMENT

-MEDICAL

-SURGICAL

BIOPSY

FOLLOW UP