

A study of clinical and management outcomes in lower limb ischemia in a teaching hospital

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Abstract: chronic lower limb ischemia is the common cause of limb ulceration and is due to atherosclerosis and thrombo angiitis obliterans. Smoking is a major adverse factor for causation and relief of symptoms. The common symptoms are intermittent claudication and rest pain along with ulceration and gangrene. Due to public ignorance the patients present at a later stage and are not relieved of pain by conservative means, requiring surgical treatment in the form of lumbar sympathectomy and major amputations. Limb salvage can be attempted with early presentation and cessation of smoking.

This was a cross sectional and observational study of 50 cases diagnosed with chronic lower limb ischemia, done during the period from December 2013 to September 2014 after approval from Institutional Ethical Committee.

Key words: atherosclerosis, thrombo angiitis obliterance, duplex scan, limb salvage.

I. Introduction

Peripheral arterial disease includes those entities that result in arterial occlusion in vessels other than those of oronary and intra-cranial vascular bed and the term is usually applied to disease involving the arteries of lower extremity. Atherosclerosis, Buerger's disease, popliteal entrapment syndrome, cystic adventitial disease etc., are various forms of presentation of lower limb ischemia. Peripheral arterial disease is an important manifestation of

atherosclerosis involving arteries of the limbs. Management of atherosclerosis plays an important role in adult medical care. Although only 1-2% of people younger than 50 years of age suffer from symptoms of intermittent claudication, this figure rises to 5% in those aged 50 to 70 yrs and to 10% in those older than 70 yrs.

Vascular disease is a leading cause of morbidity and mortality in people with diabetes. Diabetic foot problems are due to combination of ischemia and neuropathy often complicated by infection, ulceration and gangrene^{1,2}

Intermittent claudication, is the earliest and the most classic symptom among patients with peripheral arterial disease and as arterial occlusion progresses, symptoms occur even at rest and lead to lower limb ulceration and gangrene. Thrombo-angiitis obliterans is an inflammatory occlusive disease primarily involving the medium sized muscular and smaller arteries in extremities, with smoking as the strong associated causative factor. In the

lower limb, the disease commences in the digital arteries and small arteries of the foot and then proceeds to involve the crural arteries.³

The clinical course of TAO is tremendously influenced by whether the patient stops smoking or not. Patients with TAO have a normal life span, where as those with atherosclerosis have a greatly decreased survival compared with a normal population of the same age.

Major amputation is eventually required in more than a third of patients and most patients die from complications of coronary artery or cerebro-vascular disease.

Diagnostic criteria for TAO

1. Presenting with features of lower limb ischemia.
2. History of tobacco use.
3. Younger age of onset.
4. Lesions of distal arterial occlusion.
5. Atherosclerotic risk factors like hyperlipidemia, diabetes, hypertension, hematologic disorders or potential source of embolus are absent.

6. Radiological features:

- i. Arterial calcification usually absent.
- ii. Arterial wall is usually smooth.

- iii. Lumen shows generalized narrowing.
- iv. Abrupt occlusion of lumen.
- v. Collaterals – Cork Screw, Spider leg, Tree root configuration of vessels
- vi. Coexisting aneurysm is rare.

Diagnostic criteria for Atherosclerosis

- 1. Presenting with features of limb ischemia.
- 2. History of tobacco usage may or may not be present.
- 3. Usual age of onset is older age.
- 4. Proximal or Distal arterial occlusion lesions.
- 5. Atherosclerotic risk factors like hyperlipidemia, diabetes, hypertension, hematologic disorders or potential source of embolus may be present.

6. Radiological features:

- i. Arterial calcification usually present.
- ii. Arterial wall is usually irregular
- iii. Lumen shows localized or segmental narrowing or stenosis.
- iv. Gradual occlusion of lumen.
- v. Collaterals – normal or often larger

II. Materials (Persons) And Methods

This study was conducted by random selection of 50 cases with chronic lower limb ischemia admitted to surgical wards of Sri Venkateswara Ramnarain Ruia Government General Hospital, attached to Sri Venkateswara Medical College, Tirupati. This was a cross sectional and observational study of 50 cases diagnosed with chronic lower limb ischemia, done during the period from December 2013 to September 2014 after approval from Institutional Ethical Committee. The method of the study consisted of taking a good clinical history in a chronological order as soon as the patient was admitted. A thorough clinical examination was carried out personally to find out and establish clinically, the presence of vascular obstruction. Later after clinical scrutiny, essential laboratory investigations were done to look for the presence of atherosclerotic risk factors. Patients were further evaluated objectively by Doppler scanning whenever feasible to assess the level and degree of obstruction objectively.

The treatment of each patient was individualized with the aim to achieve foot salvage wherever feasible. A record of patient's progress and response to various modalities of treatment was made. Patients who returned for follow up were followed up for minimum of one month and at each follow up detailed history was taken and progress of the disease was assessed. In all cases, a structural Proforma was used to collect the information of an individual patient. Cases were studied as and when they presented with the following inclusion and exclusion criteria.

Inclusion criteria

- Patients presenting with signs and symptoms of Peripheral Arterial disease of the lower extremities like intermittent claudication, rest pain, ulceration and gangrene.
- Patients with evidence of lower limb arterial occlusive disease on Doppler study.

Exclusion criteria

- Patients with Peripheral Arterial disease of regions other than the lower extremities.
 - Patients with history of trauma to the lower extremities were excluded.
 - Patients presenting with pain of skeletal or neurologic origin of lower limbs with or without evidence of vascular damage.
 - Patients presenting with ulcers of traumatic or infective origin with or without evidence of ischemia.
- These cases were analyzed in detail with reference to age, sex incidence, and duration of clinical presentation, clinical manifestations and various investigations they underwent during the period of hospital stay.

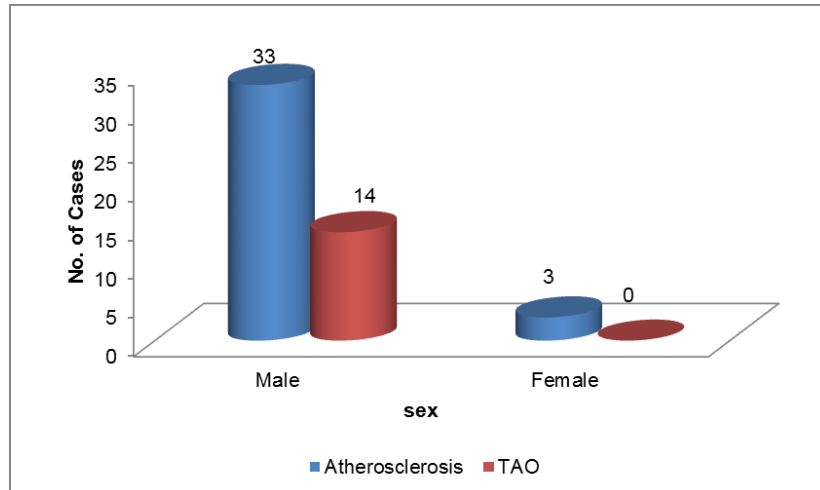
Software

Statistical software namely SPSS 11.0 and Systat 8.00 was used for analysis of data and Microsoft word and Excel has been used to generate graphs and tables, etc.

III. Results

Gender	atherosclerosis	TAO	Total
Male	33	14	47(94%)
Female	3	0	03(6%)
Total	36 (72%)	14 (28%)	50(100%)

Table 1: Gender wise distribution of patients

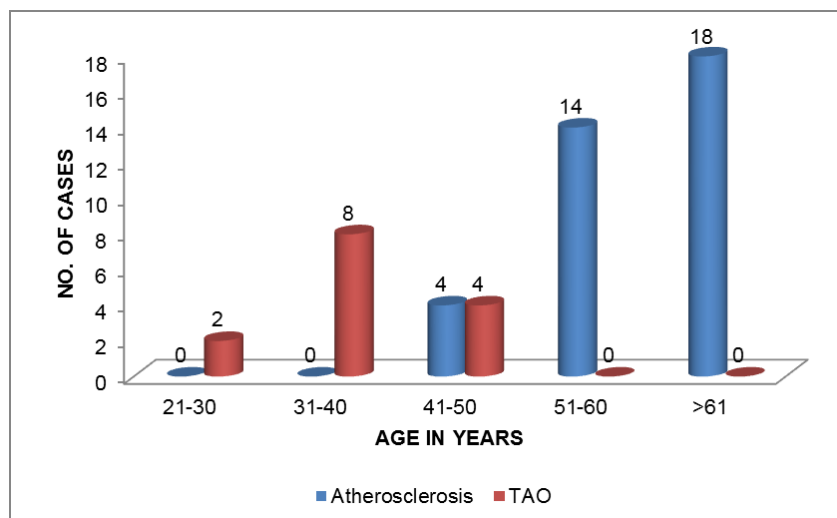


Graph 1 : Gender wise distribution of patients

Table 1 shows out of total 50 cases 36 cases belong to Atherosclerosis and 14 cases are TAO. All TAO cases were males and in the atherosclerosis group there were 3 female and 33 male. The diagnosis was done based on history, examination and relevant investigations.

Table 2: Age wise distribution of patients

Age group (in years)	Atherosclerosis	TAO
21-30	0	2 (14%)
31-40	0	8 (57%)
41-50	4 (11%)	4 (29%)
51-60	14 (39%)	0
>61	18 (50%)	0
Total	36	14

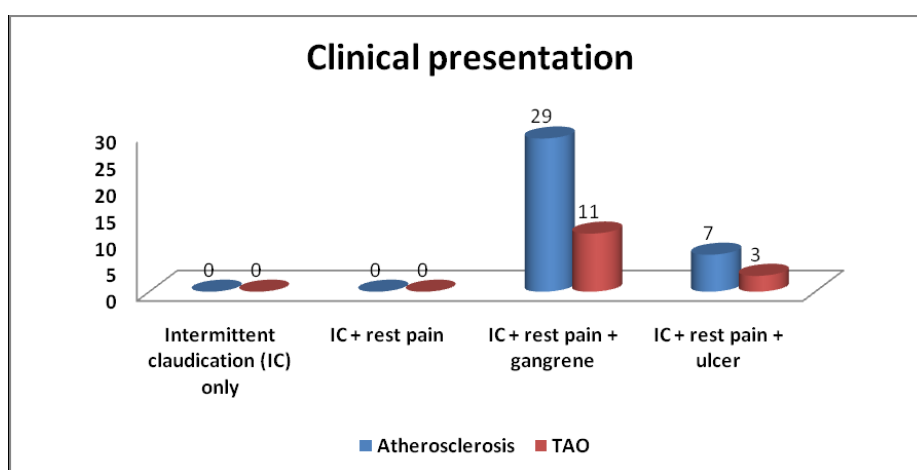


Graph 2 : Age wise distribution of patients

Table 2 shows the age distribution of the cases in the study. 32 (89%) of the cases in atherosclerosis were above the age of 50 yrs, while in the TAO group 12 (86%) belong to the age group between 31 to 50 yrs.

Table 3: Clinical presentation of patients

Symptoms	Atherosclerosis	TAO
Intermittent claudication (IC) only	00	00
IC + rest pain	00	00
IC + rest pain + gangrene	29 (81%)	11(79%)
IC + rest pain + ulcer	07 (19%)	03(21%)
Total	36	14

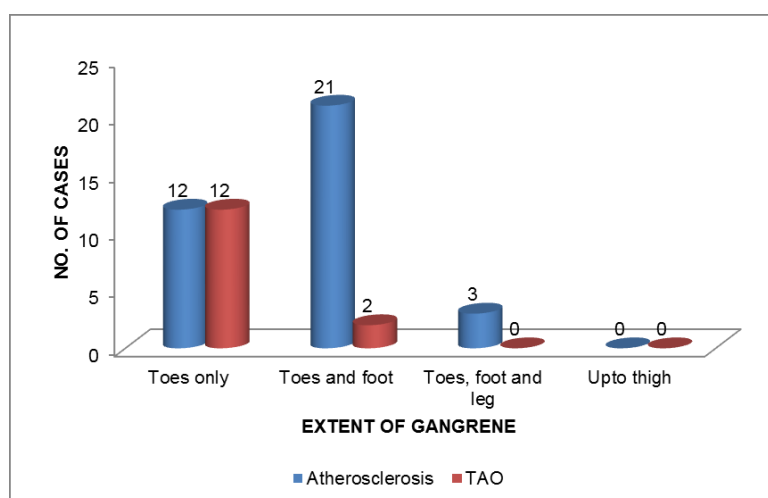


Graph 3 : Clinical presentation of patients

Table 3 shows the pattern of clinical presentation in the present study. 29 (81%) patients of atherosclerosis and 11 (79%) patients of TAO presented with gangrenous changes. The incidence of gangrene is almost equal in both the groups. All patients had dry gangrene. Ischemic ulceration was present in 10 patients

Table 4: Extent of gangrenous changes in lower limbs

Site	Atherosclerosis	TAO
Toes only	12 (33%)	12 (86%)
Toes and foot	21 (59%)	2 (14%)
Toes, foot and leg	3 (8%)	0
Upto thigh	0	0
Total	36	14

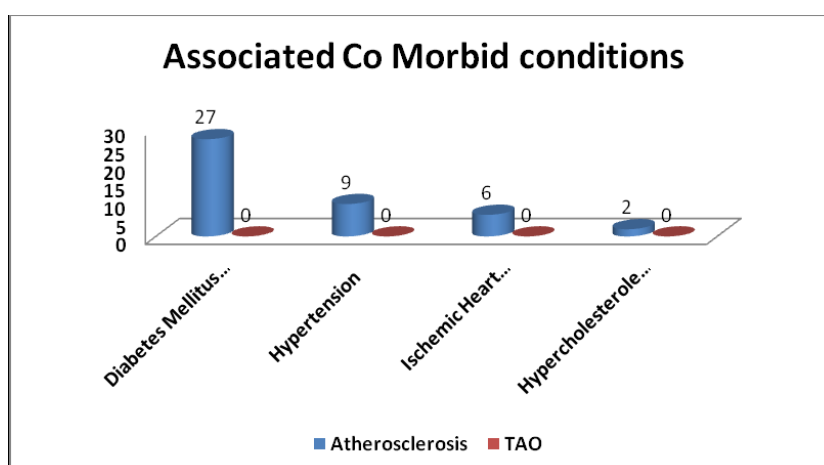


Graph 4 : Extent of gangrenous changes in lower limbs

Extent of gangrenous changes in the patients is depicted in Table 4. TAO was usually limited to the distal part of the limb, whereas atherosclerosis was seen extending proximally. Three cases due to atherosclerosis had gangrene extending up to the leg. No cases had gangrene extending up to the thigh.

Table 5: Associated Co- morbid conditions

Associated diseases	Atherosclerosis	TAO
Diabetes Mellitus (DM)	27 (75%)	0
Hypertension	9 (25%)	0
Ischemic Heart Disease	6 (17%)	0
Hypercholesterolemia	2 (5%)	0

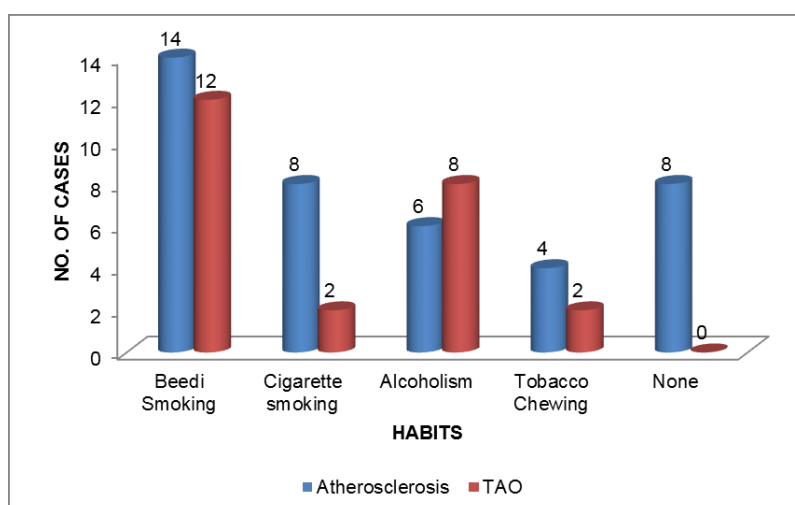


Graph 5 : Associated Co- morbid conditions

Table 5 shows the other associated Co morbid conditions in the study. DM was the commonest associated disease among the atherosclerosis group, other conditions being hypertension and Ischemic Heart Disease. In the atherosclerosis group, 6 cases had DM along with hypertension. In the present study 2 patients had hypercholesterolemia and were also diabetic

Table 6: Associated Habits

Habits	Atherosclerosis	TAO
Beedi Smoking	14 (39%)	12 (86%)
Cigarette smoking	8 (22%)	2 (14%)
Alcoholism	6 (17%)	8 (57%)
Tobacco Chewing	4 (11%)	2 (14%)
None	8 (22%)	0

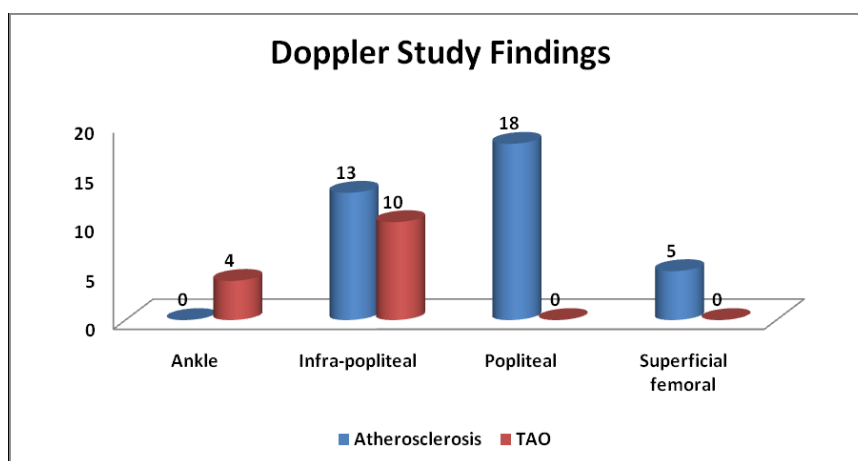


Graph 6 : Associated Habits

Table 6 shows that all patients with TAO had a history of smoking and 61% of atherosclerotic patients gave history of smoking. Smoking beedi is the most common form of addiction. In the atherosclerosis group, eight patients had no history of any addiction to smoking or alcohol.

Table 7: Arterial Doppler findings in the affected limbs

Site of obstruction	Atherosclerosis	TAO
Ankle	0	4 (29%)
Infra-popliteal	13 (36%)	10 (71%)
Popliteal	18 (50%)	0
Superficial femoral	5 (14%)	0
Total	36	14



Graph 7 : Arterial Doppler study findings in the affected limbs

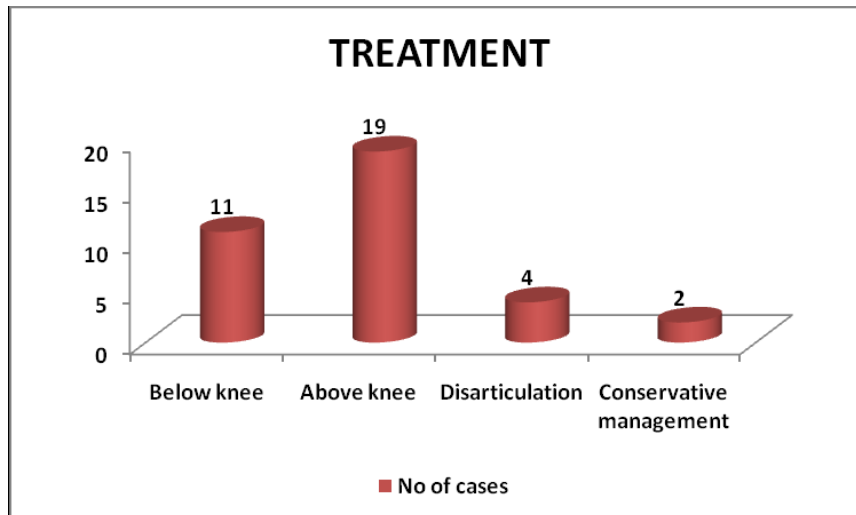
Table 7 shows the Doppler findings in the 50 patients who were subjected to arterial Doppler study. 23(13 atherosclerosis+ 10 TAO) patients had infra popliteal vessel involvement. TAO involves distal arteries and Atherosclerosis proximal arteries.

Atherosclerosis

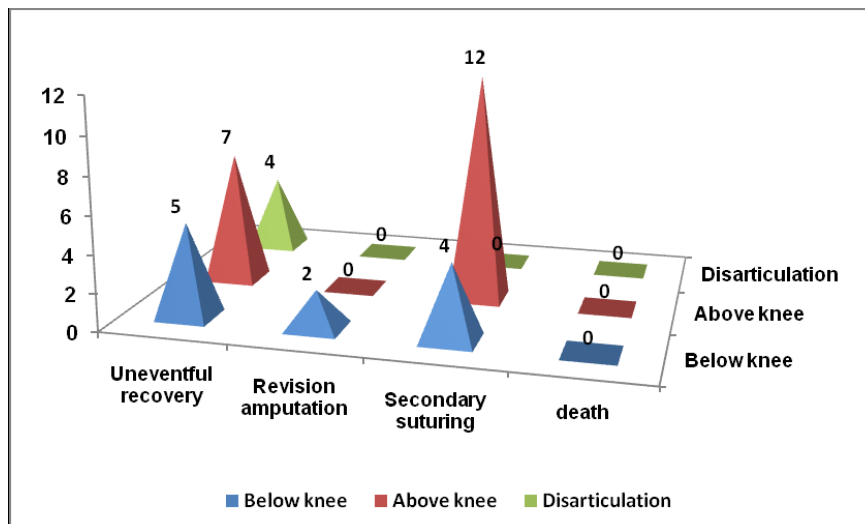
Table 8: Treatment And Postoperative Recovery

Atherosclerosis						
TREATMENT		No of cases	Post operative recovery			
			Uneventful recovery	Revision amputation	Secondary suturing	death
Amputation (83.5%)	Below knee	11 (30.5%)	5	2	4	0
	Above knee	19 (53%)	7	0	12	0
disarticulation		4 [11%]	4	0	0	0
Conservative management		2 [5.5%]	0	0	0	0
total		36	16[44%]	2[6%]	16[44%]	0

Table 8 shows treatment and post operative recovery of atherosclerosis. Among 36 cases 30 patients underwent amputation (11 below knee and 19 above knee). 4 cases underwent disarticulation. 44% had uneventful recovery, 2 cases required revision amputation and 16 cases required secondary suturing. 2 cases were managed conservatively. So, these 2 cases do not come under post operative recovery. There were no deaths in this study.



Graph 8 : Atherosclerosis - Treatment



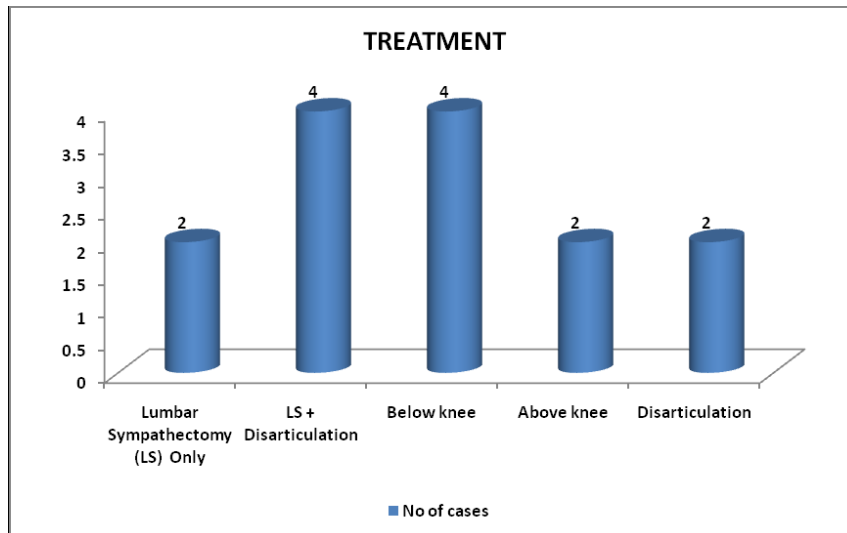
Graph 9 : Atherosclerosis - Postoperative Recovery

Tao

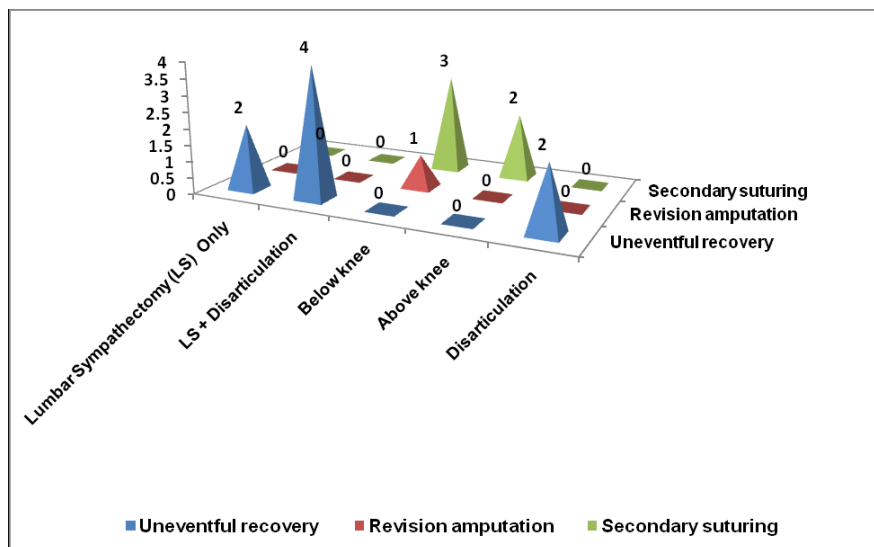
Table 9: Treatment And Postoperative Recovery

TAO						
treatment	No. of cases	Postoperative recovery				
		Uneventful recovery	Revision amputation	Secondary suturing	death	
Lumbar sympathectomy [LS]only	2 [14%]	2	0	0	0	
LS+disarticulation	4 [29%]	4	0	0	0	
Amputation 43%	Below knee	4 [29%]	0	1	3	0
	Above knee	2 [14%]	0	0	2	0
disarticulation	2[14%]	2	0	0	0	
total	14	8[57%]	1[7%]	5[36%]	0	

Table 9 shows treatment and postoperative recovery of TAO. Among 14 cases 6 patients underwent amputation (4 below knee and 2 above knee). 4 cases underwent Lumbar Sympathectomy + Disarticulation, 2 cases were managed with only Lumbar Sympathectomy and 2 with only Disarticulation. 57% had uneventful recovery, 1 case required revision amputation and 36% cases required secondary suturing. There were no deaths in this study.



Graph 10 : TAO - Treatment

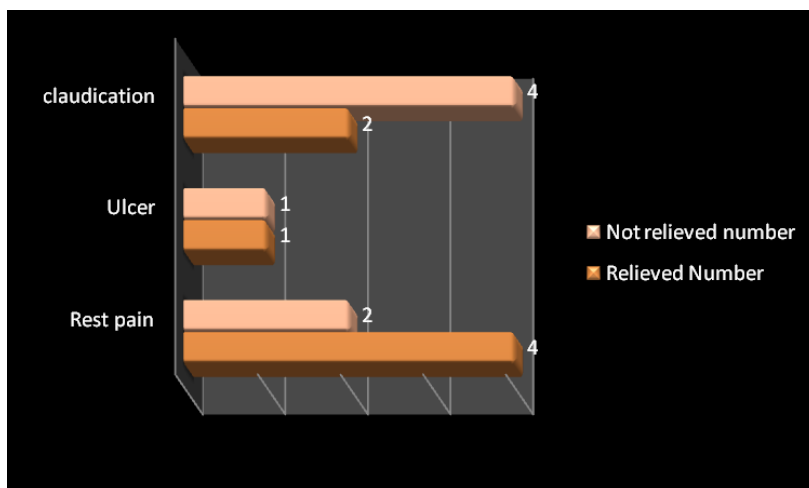


Graph 11 : TAO - Postoperative Recovery

Table 10: Lumbar Sympathectomy-Post operative events

Lumbar sympathectomy					
Signs and symptoms	No.of cases	relieved		Not relieved	
		number	%	Number	%
Rest pain	6	4	67%	2	33%
ulcer	2	1	50	1	50
claudication	6	2	33	4	67

Table 10 shows the results of Lumbar Sympathectomy in terms of improvement in symptoms. Improvement of rest pain noted in 67% of cases, healing of ulcer in 50% of cases and improvement in claudication pain in 33% of patients who underwent Lumbar Sympathectomy.

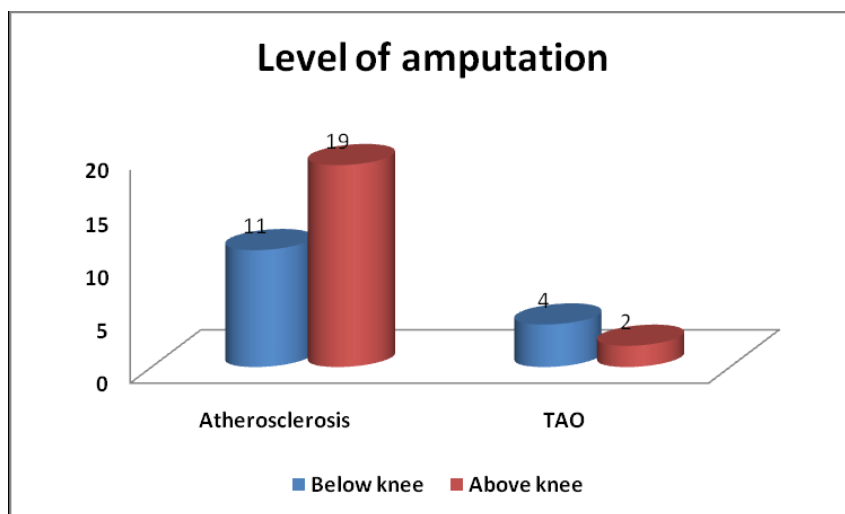


Graph 12 : Lumbar Sympathectomy-Post operative events

Table 11: Different levels of Amputations in both groups

Amputation	Atherosclerosis	TAO	Total
Below knee	11[37%]	4[67%]	15[42%]
Above knee	19[63%]	2[33%]	21[58%]
Total	30	6	36

Table 11 shows Total 36 patients subjected to amputation which includes smokers and other associated habits and disorders. In atherosclerosis out of 30 amputations 11 underwent below knee amputation 19 underwent above knee amputation. In TAO out of 6 amputations 4 underwent below knee amputation and 2 underwent above knee amputation.

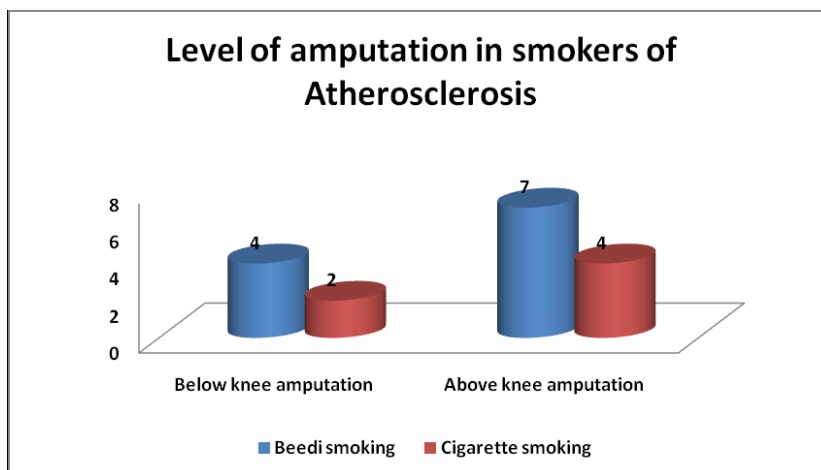


Graph 13 : Different levels of Amputations in both groups

Table 12: Levels of Amputation in smokers of atherosclerosis

Smoking	Total no. of smokers in both groups	atherosclerosis			
		No. smokers	Below knee amputation	Above knee amputation	Total amputations no.
Beedi smoking	26	14	4[29%]	7[50%]	11
Cigarette smoking	10	08	2[25%]	4[50%]	6
total	36	22	6[27%]	11[50%]	17[77%]

Table 12 shows out of 14 beedi smokers in atherosclerosis 4 underwent below knee amputation and 7 underwent above knee amputation. Out of 8 cigarette smokers 2 underwent below knee amputation and 4 underwent above knee amputation. Total number of amputations in smokers of atherosclerosis group is 17(11 in beedi smokers + 6 in cigarette smokers).

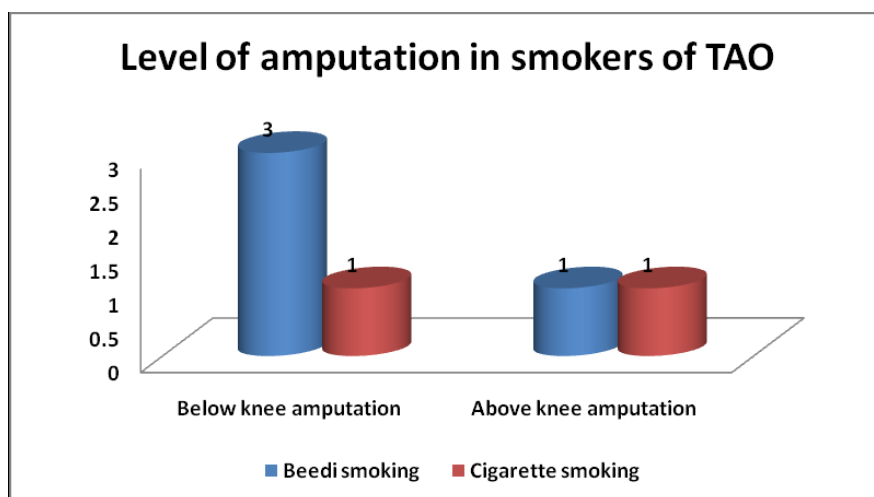


Graph 14 : Levels of Amputation in smokers of atherosclerosis

Table 13: Levels of Amputation in smokers of TAO

smoking	Total no. smokers in both groups	TAO			Total no. of amputations
		No. of smokers	Below knee amputation	Above knee amputation	
Beedi smoking	26	12	3[25%]	1[8%]	4
Cigarette smoking	10	02	1[50%]	1[50%]	2
total	36	14	4[29%]	2[14%]	6[43%]

Table 13 shows out of 12 beedi smokers 3 underwent below knee amputation 1 underwent above knee amputation. Out of 2 cigarette smokers 1 underwent below knee amputation and other one above knee amputation. This constitutes total 4 amputations in beedi smokers and 2 amputations in cigarette smokers. Hence 6 out of 14 TAO cases had amputations at different levels.



Graph 15 : Levels of Amputation in smokers of TAO

IV. Discussion

4.1 Distribution of etiology

In the present series of 50 cases of Peripheral Arterial disease (PAD) of the lower extremities, all the cases in the present study fall under the category of chronic lower limb ischemia. The diagnosis was done based on detailed history, thorough physical examination and appropriate investigations.

Out of the total 50 cases, 36 (72%) cases were due to Atherosclerosis and 14 (28%) were due to Thrombo Angitis Obliterans. Atherosclerosis was a more common presentation in this study.

Selvin E and Erlinger TP reported from National Health and Nutrition Examination Survey (NHANES) conducted from 1999 to 2000 in the United States, that the overall prevalence of PAD (defined as an ABI <0.90) was 4.3% (95% confidence interval [CI], 3.1% to 5.5%).⁴ The prevalence of Peripheral arterial

disease in the general population is essentially unknown, primarily because of the lack of data on asymptomatic PAD.

Criqui MH et al. conducted a study and the prevalence of ischemic claudication in the population was found to be 2.2%, but on noninvasive testing, it was found that 11.7% of the population had large vessel PAD, 5.2% had both large and small vessel disease. A recent study conducted by Sigvant B et al. for evaluating prevalence of PAD, found that 18% of the population suffered from PAD, with 0.5% having CLI.

In a study conducted by Hirsch AT et al, the prevalence of peripheral arterial disease was 29%, and Ankle Brachial Index was used to identify large number of patients with previously unrecognized PAD.⁵ Mills JL and Porter JM reported that TAO constitutes 1-3% of PAD in the western population. Khanna SK reported that TAO is the commonest type of PAD in India.⁶

There are widely varying prevalence rates of Buerger's disease in patients with peripheral arterial disease in Europe and Asia. The rates of TAO among all patients with peripheral arterial disease have been reported as 0.5% to 5.6% in Western European countries, 3% in Poland, 6.7% in East Germany, 11.5% in Czechoslovakia, 39% in Yugoslavia, 80% in Israel (Ashkenazim), 45% to 63% in India, and 16% to 66% in Korea and Japan.

Kelkar MD conducted an Indian study of 489 cases of chronic lower limb ischemia and found that 50% were due to TAO and 43% were due to Atherosclerosis, the rest being due to miscellaneous causes.

The study done by Nigam R had a higher incidence of TAO, accounting for 63% of the cases and atherosclerosis only 15% and the rest being miscellaneous causes.

4.2 Sex distribution

Among the 36 cases diagnosed with PAD due to Atherosclerosis in this study 33 (92%) were males and three (8%) patients were females. The female patients in this study were of the age group 65 years or older and had other associated co morbid diseases like diabetes mellitus and hypertension. In this study all the 14 patients diagnosed with TAO were males.

In a study done by Selvin E and Erlinger TP on the prevalence of and risk factors for peripheral arterial disease in the United States, it was found that although there was a slightly higher prevalence in men than in women, the prevalence dramatically increased with age, rising from 0.9% in those younger than 50 years to 14.5% in those 70 years or older.

Mills JL and Porter JM reported in their study that the incidence of TAO in females was found to on the rise in the western population due to the increasing prevalence of smoking in females. Ranjan B reported that in a series of 188 cases of TAO in India, 4 were found in females.

4.3 Age distribution

Atherosclerosis was commonly seen among the age group of above 60 years (50%) in this study and 89% cases were over the age of 50 yrs. 11% cases were seen in the age group of 41-50 yrs. Although atherosclerosis may be present in younger individuals, age has a dominant influence. All forms of cardiovascular disease become more prevalent in the elderly. In several studies the risk for PAD increased

1.5 to 2.0 fold for every 10 year rise in age.

The study done by Nigam R., reported that 56% of the atherosclerosis cases belonged to the age group 60-70 yrs, oldest being 78 yrs.⁷ The age distribution pattern is similar in this study, with 50% of the atherosclerosis cases were in the age group of above 60 years.



Figure1: Photograph showing gangrenous changes in all the toes



Figure 2 : Ischemic ulceration and gangrene of the foot

86% of the patients in the TAO group in this study were between 31 to 50 yrs, with about 57% between 31 to 40 yrs. The youngest patient was 28 years of age, with a history of smoking for 9 yrs. The oldest patient with TAO was of the age 48 years, diagnosed with the disease since 10 years.

Nigam R. reported in a study that 88% of the TAO cases were aged between 31-50 yrs, Similar to findings in the present study (86% of TAO cases belong to 31-50 yrs).

4.4 Clinical Presentation

In the present study, all the cases of PAD presented with intermittent claudication and rest pain as common symptoms, while gangrene (80% of cases) and ischemic ulcer (20% of cases) were the other predominant symptoms.

81% per cent of the cases in the atherosclerosis group and 79% of the cases in the TAO group presented with gangrenous changes in the affected lower limb. Ischemic ulcer over the foot was present in 19% of the cases in the atherosclerosis group and 21% of the cases in the TAO group.

A study on the clinical profile of TAO and Arteriosclerosis obliterans done by Nigam R reported that claudication was the commonest presentation in TAO and ulcer or gangrene with claudication was common mode of presentation in Atherosclerosis.⁷ The commonest site of involvement in the form of critical limb ischemia was foot in both groups. In this study, 86% of the cases in TAO group and only 33% cases

in the Atherosclerosis group had gangrene limited to the toes only. In the atherosclerosis group, 8% cases presented with gangrene extending to the leg, and these patients were above the age of 60 years.

Mills JL and Porter JM reported in their study of TAO that, 50% had isolated lower limb involvement, 40% had both upper and lower limb involvement and only 10% had isolated upper limb disease due to TAO.

A study from Japan determined the distribution of arterial involvement in TAO on the basis of a nationwide survey carried out in 1993. The subjects were 749 men and 76 women, with a mean age of 50.8 ± 0.4 years. In 42 patients (5.1%), involvement was limited to upper extremity arteries; in 616 patients (74.7%), disease was limited to the lower extremity; 167 patients (20.2%) showed involvement of both upper and lower extremities. The most frequently affected arteries were the anterior (41.4%)

or posterior (40.4%) tibial arteries in the lower extremities.

At the Cleveland Clinic Foundation, 112 patients with TAO were evaluated between 1970 and 1987. Intermittent claudication occurred in 70 patients (63%). 46% of patients had ischemic ulcerations of the lower limb at the time of presentation. Rest pain occurred in 81% of patients.

4.5 Habits

History of smoking was present in 61% patients in the atherosclerosis group and in 100% of the patients in the TAO group. The patients in the TAO group were chronic smokers with history of smoking beedi or cigarette for 10 yrs or more, with 86% of the cases smoking beedis. In a study done by Nigam R, the incidence of smoking in TAO and atherosclerosis was reported to be 98% and 72% respectively.

Smoking is also closely linked to PAD, a relation first identified by Erb in 1911, when the risk of intermittent claudication was reported to be three times greater in smokers. The increased risk seems to be correlated with the number of cigarettes smoked, cessation of smoking has been associated with a rapid decrease in the risk for intermittent claudication.^{8,9}

The risk of PAD was documented to be twice in smokers compared to non-smokers in the Framingham study. In the Framingham study, after 16 yrs follow-up, it was estimated that nearly 80% of the cases of intermittent claudication could be attributable to smoking.¹⁰

Cigarette smoking is an exceptionally powerful etiologic risk factor for lower extremity peripheral arterial disease. It is 2 to 3 times more likely to cause lower extremity peripheral arterial disease than coronary artery

disease. Large epidemiological studies have found that smoking increases the risk of lower extremity peripheral arterial disease by 2 to 6 fold and the risk of intermittent claudication by 3 to 10 fold. More than 80% of patients with lower extremity peripheral arterial disease are current or former smokers. The risk of lower extremity peripheral arterial disease increases in a powerful dose-dependent manner with the number of cigarettes smoked per day and the number of years smoked.

Hill et al. found that all the TAO patients in their study were cigarette smokers and patients who smoked more than 10 cigarettes per day had a much worse prognosis than those who smoked less than that. In 1904 Erb mentioned the possible relationship of smoking to the vascular disease and called it nicotine arthritis. In 1918, Mayer stated that the disease was due to tobacco smoke. In 1927 Silbert stated that whatever the underlying causes of arterial pathology, prolonged smoking was the immediate causative factor in the disease. Many workers agreed to the fact that great majority of the patients who had Buerger's disease had been heavy smokers and smoked more than 20 cigarettes per day on the average.

4.6 Associated Diseases

4.6.1. Diabetes mellitus (DM)

In the present study Diabetes mellitus (DM) was present in 27 cases of atherosclerosis and none of the patients with TAO had DM. A study conducted by Nigam R on the clinical profile of TAO and Arteriosclerosis obliterans had 40% cases of atherosclerosis were associated with DM and no case of TAO associated with DM.

In the Framingham Heart Study, diabetes increased the risk of intermittent claudication by 3.5 and 8.6 fold in men and women, respectively.¹⁰

Diabetes mellitus increases the risk of lower extremity peripheral arterial disease by 2 to 4 fold and is present in 12% to 20% of persons with lower extremity peripheral arterial disease.¹¹

The risk of developing lower extremity peripheral arterial disease is proportional to the severity and duration of diabetes. The risk of developing CLI is also greater in diabetics than nondiabetics. Diabetic patients with lower extremity peripheral arterial disease are 7 to 15 fold more likely to undergo a major amputation than non-diabetics with lower extremity peripheral arterial disease.

4.6.2. Hypertension

Hypertension was seen in 25% of the cases with atherosclerosis, whereas none of the TAO patients had associated hypertension.

Hypertension has been linked with an increased risk of peripheral arterial occlusive disease in some studies. The Framingham data documented a 2.5-fold increase in the risk of PAD in men with hypertension and a 3.9-fold increase in women with hypertension.

Almost every study has shown a strong association between hypertension and PAD, and as many as 50% to 92% of patients with PAD have hypertension. In the Systolic Hypertension in the Elderly Program, 5.5% of the participants had an ankle brachial index (ABI) under 0.90.

Cumulatively, these studies underscore the high prevalence of PAD in patients with hypertension. Hypertension is associated with lower extremity peripheral arterial disease, although the association is generally weaker than that with cerebrovascular and coronary artery disease.

Hypertension increased the risk of developing lower extremity peripheral arterial disease in the Whitehall study.

4.6.3. Ischemic heart disease

In the present study 6 (17%) patients with atherosclerotic PAD gave a history of ischemic heart disease or had ECG changes suggestive of myocardial ischemia. No patients with TAO had any form of myocardial episode. These findings correlate with Nigam R study where 20% of atherosclerosis cases and only 1% of TAO cases had some evidence of cardiovascular disease.

In a study from the Cleveland Clinic, some degree of coronary atherosclerosis was present in 90% of patients undergoing routine coronary angiography before elective peripheral vascular surgery and 28% of the patients had severe three-vessel coronary disease.

Long-term survival in patients with lower extremity PAD is greatly diminished as a result of atherosclerotic complications in the coronary and cerebrovascular beds. In the classic study of Criqui, even symptom-free patients with peripheral atherosclerosis had a risk of mortality that exceeded that of the population without disease, a finding substantiated by other studies.

In a study, among the subjects with ischemic claudication identified in the general population, the prevalence of Ischemic Heart Disease varied between 30-40% and 6% of the patients gave history of previous stroke.

4.6.4. Hypercholesterolemia

In the present study 2 patients had hypercholesterolemia and were also diabetic. In the Framingham Study, an elevated cholesterol level was associated with a 2-fold increased risk of claudication.

In NHANES (National Health and Nutrition Examination Survey), more than 60% of patients with PAD had hypercholesterolemia, whereas in the

PARTNERS (PAD Awareness, Risk, and Treatment: New Resources for Survival) program, the prevalence of hyperlipidemia in patients with known PAD was 77%. Hyperlipidemia increases the adjusted likelihood of developing PAD by 10% for every 10 mg/dL rise in total cholesterol.¹² The 2001 National

Cholesterol Education Program Adult Treatment Panel III considered PAD a CAD risk equivalent.

Lipid abnormalities that are associated with lower extremity peripheral arterial disease include elevated total and low density lipoprotein (LDL) cholesterol, decreased high density lipoprotein (HDL) cholesterol, and hypertriglyceridemia. In epidemiological studies, total cholesterol levels are generally higher in patients with intermittent claudication than in those without lower extremity peripheral arterial disease.

A combination of DM and hypertension was seen in 6 cases among the atherosclerosis group, and all these patients were above the age of 60 yrs. None of the patients in the present study gave history of stroke or any other cerebrovascular event in the past.

The concurrence of a multiplicity of risk factors in a single patient dramatically increases the risk for PAD. In the Basle longitudinal study the relative risk for PAD increased from 2.3 to 3.3 to 6.3 in individuals who had one, two, or three of the risk factors, respectively: smoking, diabetes, and systolic hypertension.

The Clopidogrel versus Aspirin in Patients at Risk of Ischemic Events (CAPRIE) trial tabulated the frequency of comorbid problems in patients with claudication.¹³ In this study of almost 20,000 patients with atherosclerotic disease in the peripheral, coronary, or cerebrovascular beds, about a third had intermittent claudication as their primary presenting symptom. Men outnumbered women by a ratio of almost 3:1. Co morbid risk factors were present in a large number of patients who entered the trial; cigarette smoking (current 38%, former 53%), hypertension (51%), and hypercholesterolemia (45%) were most frequent. The generalized nature of atherosclerosis was well shown by the CAPRIE data; 41.1% of patients with PAD had concurrent coronary artery or cerebrovascular disease, and 8.6% had disease in all three beds.

4.6.5. Arterial Doppler study

Doppler examination of the ischemic lower limb was undertaken for all the cases in this study.

The commonest site of obstruction in atherosclerosis group was found to be popliteal and infra-popliteal vessels involvement. Femoral block was seen in 5 cases and all these patients had no distal collaterals. None of the atherosclerotic patients had disease limited to the ankle. In Nigam R study, ilio-femoral site of block was commonest in atherosclerosis and infra- popliteal was commonest in TAO.

In the TAO group, the commonest site of arterial block was infrapopliteal vessels, seen in 71% of the cases. None had popliteal vessel disease and none extended to the femoral artery. Disease limited to the ankle vessels was seen in 29% of the TAO cases.

A study from Japan determined the distribution of arterial involvement in TAO on the basis of a nationwide survey carried out in 1993. The most frequently affected arteries in the lower extremities were the anterior (41.4%) or posterior (40.4%) tibial arteries.

4.6.6. Management modalities

All the patients in this study were initially started on conservative management, and eventually underwent different modalities of surgical management.

Conservative: In the present series of 50 cases studied, initially conservative treatment was adopted in all the cases. They were treated by vasodilators, exercise therapy and local care of the ulcer. Medical management also consisted of analgesics, antibiotics, cessation of smoking, anti-diabetic and anti-hypertensive drugs. Complete cessation of smoking was strongly advised as it is the mainstay of therapy.

Jonason T and Bergstrom R reported in their study that smokers have poorer survival rates, a greater likelihood of progression to critical limb ischemia and amputation, and decreased artery bypass graft patency rates when compared to nonsmokers.

However, patients who are able to stop smoking are less likely to develop critical limb ischemia and have improved survival. A variety of drugs were used in the medical management which include Tab Aspirin 150 mg od, Tab Trental 400 mg tid, Tab Pletoz (Cilostazole) 100 mg bd (in affordable patients as it is an expensive drug). Analgesics were used to relieve pain. No patient was benefited from the medical therapy and all patients underwent surgery.

a. **Lumbar Sympathectomy (LS):** In the present series of 50 cases, 2 patients were managed by LS alone .

b. **Amputation:** In the present 50 cases, 36 patients had undergone major amputation during their attendance at the hospital at different times. 21(58%) patients underwent above knee amputation and 15(42%) patients underwent below knee amputation. The level of amputation in the atherosclerosis was above knee 19 cases and below knee in 11 cases. For TAO, the level of amputation was above knee in 2 cases and below knee in 4 cases. Out of 36 smokers in both groups 23 had amputation.

c. **LS and disarticulation:** In the present 50 cases, 4 patients were also subjected to disarticulation in addition to lumbar Sympathectomy. The toe was disarticulated due to previous gangrene.

d. **Disarticulation:** Total of 10 patients were subjected to disarticulation of toe/ toes. Lumbar Sympathectomy was done in 6 cases of TAO, among these cases disarticulation was done in 4 cases. 2 cases of TAO had only disarticulation. In atherosclerosis 4 patients underwent disarticulation. All the cases are managed with some form of surgery and majority of them had limb loss. This may be due to majority of the cases presenting in the terminal stages with gangrenous changes, thus leaving no scope for limb salvage.

A recently published study states that the public is poorly informed about peripheral arterial disease, this leads to delay in presentation and diagnosis. Hence poor outcome of any intervention, the patient ultimately requiring amputation in some form. Limb-loss is much more frequent once symptoms of rest pain or tissue loss become evident (critical limb ischemia).

In a prospective study from Italy, the risk of major amputation was 12.2% after only 3 months in patients with rest pain or ischaemic ulceration. The risk of limb-loss is increased further when patients continue to smoke, and in patients with diabetes.

Results of LS

Total of 6 patients were subjected to LS. In all these patients the approach to the lumbar sympathetic chain was retroperitoneal lumbar



Figure 3: Lumbar Sympathectomy intra operative photo



Figure 4: Lumbar Sympathectomy specimen

Approach with patient tilted to 15° on the unaffected side. Lumbar L2, L3 and L4 were removed routinely. The efficacy of operative treatment of LS was assessed purely on the subjective improvement of the patient.

Following criteria were taken as good result.

1. Relief of Rest Pain.
2. Rise in cutaneous temperature of denervated limbs as judged by palpation.
3. Rapid healing of trophic ulcers.
4. Improvement in claudication distance.
5. Resumption to their occupation.

Patients who complained of IC showed subjective evidence of improvement in 2 out of 6 cases (33%). Statistical data of the results of LS on IC alone do not show much improvement. Gillespie (1960) had studied 100 cases and gave his analysis as follows. Overall improvement was seen in 86% of cases. In cases of claudication only, improvement was seen in only in 13% of cases. Oldham JB (JRCS, 1964) concluded that Sympathectomy had little or no influence on the blood supply of muscle during activity and therefore not indicated in patients in whom only symptom was uncomplicated IC.

In this study, 4(67%) patients out of 6 patients with Rest Pain at presentation showed improvement in this study. 1 patient out of 2 patients with ulceration showed improvement in healing (50%).

The best results of Lumbar Sympathectomy were reported by Persson and Co- workers who performed Sympathectomy on 22 limbs with adequate inflow but importantly with no evidence of neuropathy. Following



Figure 5: Above knee amputation



Figure 6: Photograph showing below knee amputation

Are the results. 87% demonstrated complete ulcer healing whereas only 12% required amputation. Lee and colleagues reported somewhat lower healing rates for patients with superficial toe gangrene with 56% of the involved digits salvaged by Sympathectomy and a 40% toe salvages rate among those with 3 or more digits involved.

4.6.7. Post-operative recovery

Total 24 patients had uneventful recovery in the postoperative period. In the TAO group, 8 (57%) cases had an uneventful recovery and in the atherosclerosis group, 16(44%) had uneventful recovery.

Revision amputation was required in 2 cases in atherosclerosis group and in 1 case of TAO. Secondary suturing of the surgical site was required post operatively in 16(44%) cases of atherosclerosis and in 5(36%) cases of TAO. There were no deaths in the study.

V. Summary

In the present study, 50 cases of Peripheral Arterial disease of the lower extremities were evaluated during the period from December 2013 to September 2014.

1. The youngest patient was 28 years of age and suffered from TAO, the oldest patient was 70 yrs of age and suffered from Atherosclerosis.
2. The commonest age group affected by TAO is between 31 to 40 yrs and those affected with Atherosclerosis is above the age of 60 yrs.
3. All patients with TAO had a history of chronic smoking and 61% of Atherosclerosis patients had a history of smoking.

4. In the present study, all the cases of PAD presented with ischemic claudication and rest pain as common symptoms, while gangrene (80% of cases) and ischemic ulcer (20% of cases) were the other predominant symptoms.
5. 40 (80%) of the patients in this study presented at a late stage in the disease process, with gangrenous changes, thus leaving minimal options for salvaging the affected limb. The level of amputation was below knee in 42% and above knee in 58% cases.
6. Even after the surgical treatment in the TAO patients, cessation of smoking was an important factor in giving relief from the pain. The patients who continued to smoke had aggravation of symptoms.
7. Post operatively 24 had uneventful recovery, 21 required secondary suturing, 3 required revision amputation at a higher level.
8. Two cases were managed conservatively.

VI. Conclusion

The present study consists of 50 cases presenting with Peripheral Arterial disease of the lower extremities and following are the conclusions which are drawn from the present study:

1. Atherosclerosis being more common.
2. TAO presented at a younger age group whereas atherosclerosis presented in the older age group.
3. All the cases of PAD presented with ischemic claudication and rest pain as common symptoms, while gangrene (80% of cases) and ischemic ulcer (20% of cases) were the other predominant symptoms.
4. Gangrene was limited to the distal limb in the TAO cases and extended to the proximal limb in atherosclerosis.
5. Atherosclerosis is more frequently associated with Diabetes mellitus.
6. Lumbar Sympathectomy had helped in Improvement of rest pain noted in 67% of cases, healing of ulcer in 50%
7. The level of amputation was below knee in 42% and above knee in 58% cases.
8. 48 cases were managed with some form of surgery and 36 of them had limb loss. This is due to late presentation with gangrenous changes, thus leaving no scope for limb salvage. Two were cases managed conservatively
9. Post operatively three of the cases required revision amputation.

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