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Clinical Study of Chronic Lower Limb Ischemia and its Management

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ABSTRACT
Background: Theaimofthestudywastostudythemodesofpresentationofchroniclowerlimbischemia,tostudytheeffectofcomorbidconditionssuchassmoking,diabetes,andhypertensiononthepresentation,progressionoflowerlimbischemia,andto correlate the abovestudyfinding withmanagement andoutcome.
Materials and Methods: This is a study of 77 cases of chronic lower limb ischemia admitted in Prathima Institute of Medical Sciences , Karimnagar,Telanganastate,duringtheperiodofFebruary2020–February2022.All the patients with a history of chronic lower limb ischemia requiring admission during the study period are included in thisstudy.Resultswereanalyzed.
Results: Inourhospital,125,263patientswereadmitted betweenthestudyperiod,i.e.,February2020–February2022.Amongthem, the number of cases of chronic lower limb ischemia was 77. Thus, the incidence of chronic lower limb ischemia amongthetotalnumberofhospitaladmissionswasfoundtobe0.06%.Thetotalnumberofsurgicaladmissionsinourinstituteduringthe period from February2020–February2022was 12,877, of which the number of cases of chronic lower limb ischemia was77 (incidence – 0.597%). The highest incidence of chronic lower limb ischemia is seen to occur in the age group of 50 yearsandabove.Themainfeaturesatthetimeofpresentationwerewithgangrenouschangesinthelowerlimb,ischemiculceration,claudication,andrest pain.
Conclusion: Atherosclerosis (77.92%) is the major etiological factor causing chronic lower limb ischemia.
Thromboangiitisobliteransisthesecondcauseanditexclusivelyaffectsmales.Smokingplaysamajorroleintheetiologyofchroniclowerlimbischemiaandsmokersgetaffectedatayoungerage,12.1years,thannon-smokers.Diabeteshasamajorroleintheetiologyofchroniclowerlimbischemia.Italsohasacrucialroleintheoutcomeofthepatients.Mostofthecasesinthepresentstudywithdiabeteshadsurgicalintervention(92.59%)withveryfewcasesmanagedbyconservativeapproachalone(7.41%).

Keywords: Gangrene,Intermittentclaudication,Limbischemia,Restpain

I. INTRODUCTION

Peripheralarterialdiseaseresultsfromanydisease-causing stenosis or occlusion of the lower limb arteries.[1]Peripheralarterial disease is an important manifestationof atherosclerosis involving the arteries of legs.[2] Vascularsurgeons continue to encounter complications ofatherosclerosisastheirmostcommonclinicalchallenge.[3]
Management of atherosclerosis plays an important role inadultmedicalcare.

Vascular disease is a leading cause of morbidity andmortality in people with diabetes. Diabetic foot problemsare due to the combination of ischemia and neuropathyoften complicated by infection.[4]Ischemia inhibits theability of the wound to heal, further complicated by thedevelopment of infection and gangrene. When associatedwithsignificantischemia,diabeticfootulcersrequirearterialrevascularizationtoachievewoundhealing.[5]
Thromboangiitis obliterans (TAO) is an inflammatoryocclusive disease primarily involving the medium-sizedmusculararteriesinextremities,withsmokingasthestrongassociatedcausativefactor.Inthelower

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limb, the disease commences in the digital arteries andsmall arteries of the foot and then proceeds to involve thecrural arteries.[6]The risks to involve limbs are greater inTAO than in peripheral arteriosclerosis occlusive arterialdisease.However,patientswithTAOhaveanormallifespan, whereas those with atherosclerosis have a greatlydecreased survival compared with a normal populationofthesameage.[7]

Intermittent claudication, heralded by pain in leg musclesduring ambulation, is the earliest and the most classicsymptomamongpatientswithperipheralarterial[2]disease.Astheseverityofarterialocclusionprogresses,symptomsoccur even at rest and may culminate in lower limbulcerationandgangrene.[8]

Atpresent,theappropriatemanagementofpatientswith chronic lower limb ischemia is a complex clinical issue.Despitetheadvanceintechnicalissuesofrevascularization,there remains much that can be done regarding education,riskfactormodification,andnon-operativetherapyforthese patients. Major amputation is eventually required in morethan half of the patients once limb-threatening symptomsandsignsoccur.[9]Nevertheless,thecauseofdeathinpatientswith peripheral arterial disease is seldom direct result oflowerlimbischemia,mostpatientsdiefromcomplicationsofcoronaryarteryorcerebrovasculardisease.[10]

Poplitealarteryentrapmentsyndromeandcysticadventitialdiseaseofpoplitealteryarerarecausesofchronicarterialischemia of generally young healthy individuals. Althoughthesediseasescanproduceseveredisabilityifleftuntreated,normalcirculationcanberestoredsurgically.[11]

II. MATERIALSANDMETHODS

This is a study of 77 cases of chronic lower limb ischemiaadmitted in Prathima Institute of Medical Sciences , Karimnagar, Telanganastate,duringtheperiodofFebruary2020–February2022.

All the patients with a history ofchronic lower limbischemia requiring admission during the study period areincluded in this study. Documentation of patients, whichincludedidentification,thoroughhistoryandclinicalexamination, diagnostic tests, operative procedure, andcomplicationsduringthestayinthehospitalandduringthe subsequent follow-up period were all recorded on apro forma specially prepared. The patients were followedupforaperioduptotheendofthestudyafterdischargefromthehospital.

Cases were collected as and when they presented with thefollowinginclusionandexclusioncriteria.

InclusionCriteria

Thefollowingcriteriawereincludedinthestudy:

1. Patients presenting with signs and symptoms ofchronic lower limb ischemia such as intermittentclaudication,restpain,ulcerationandgangrene
2. Patientswithevidenceoflowerlimbarterialocclusivediseaseon Dopplerstudy.

ExclusionCriteria

Thefollowingcriteriawereexcludedfromthestudy:

1. Patientspresentingwithpainofskeletalorneurologicoriginwithnoevidenceofvasculardamage
2. Patientspresentingwithparalysisandparesthesiaofneurologicorigin
3. Patientspresentingwithulcersoftraumaticorinfectiveoriginwithnoevidenceofischemia.

These cases were analyzed in detail with reference to age,sex incidences, clinical presentation, investigations, andtreatment,theyunderwentduringtheperiodofhospitalstay.

III. RESULTS

Inourhospital,125,263patientswereadmittedbetween the study period, i.e.,February2020–February2022.Among them, the number of cases of chronic lower limbischemiawas77.Thus,theincidenceofchroniclowerlimbischemia among the total number of hospital admissionswasfoundtobe0.06%.

The total number of surgical admissions during the sameperiod was 12,877, and hence, the incidence of chroniclower limb ischemia among total admissions under theDepartment of General Surgery at Prathima Institute of Medical Sciences wasfoundtobe0.597%.

Among the total number of (77) cases, 47 were male and30female.Thereisahigherinvolvementinmales(61.04%)whencomparedtofemales(38.96%).

The previous studies by Criquiet al., 1997, and Murabitoetal.,1997,showthattheprevalencehasbeenshowntobehigherinmenthaninwomen.[12,13]

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Criquietal.,1998,showedthat4.7%ofmen(12/256)and1.9%ofwomen(6/309)hadseverepheripheralarterydisease(PAD) (ankle–brachial index [ABI]: <0.6); the respectivepercentagesformoderatePAD(ABI:0.6–0.9)were3.5%(9/256)and2.9%(9/309)formenandwomen, respectively.[14]

Table 1 shows the distribution of the incidence of chroniclower limb insufficiency in different age groups. It clearlysuggests that the incidence is more in the age group of50yearsandabove.

Inseveralstudies,theriskforPADincreased1.5–2.0-foldforevery10-yearriseinage.[15,16]

TheprevalenceofPADishighlyagedependent.Inasurveyconductedin SanDiego,inanolderdefinedpopulation,theprevalencewas2.5%inpeopleaged<60yearsold;thisrosto8.3%at60–69yearsandreached18.8%inpeople >70years ofage.[17]

PADprevalencerates,Murabitoetal.,1997,bynon-invasivetesting are reported to be 2.5% at ages 40–59 years, 8.3%atages60–69years,and18.8%atages70–79years.[13]

InastudydonebySelvinandErlingerontheprevalenceofandriskfactorsforPADintheUnitedStates,itwasfoundthat, although,therewasaslightlyhigherprevalenceinmenthaninwomen,theprevalencedramaticallyincreasedwithage,risingfrom0.9%inthoseyoungerthan50yearsto14.5%inthose70yearsorolder.[18]

LifeexpectancyoftheIndianpopulationislessthanthe
In the present study, most of the patients presented to thehospitalwithgangrenouschangesinthelowerlimb,57outof77cases(74.02%),11outof77casespresentedwithischemic ulceration, and 9 out of 77 cases presented withclaudicationandrestpain[Table3].

A recently published study states that the public is poorlyinformed about peripheral arterial disease; this leads todelay in presentation and diagnosis. Hence, poor outcomeof any intervention or procedure, the patient ultimatelyrequiringamputationinsomeform.[24]

In the present study, Doppler study was undertaken for allthecasesofchroniclowerlimbischemia.Themostcommonsiteofobstructionwasfoundtobeinfrapoplitealvessels(37.67%)followedbyankleregionvessels(31.17%)[Table4].

Most patients in this study presented to the hospital in anadvanced stage of limb ischemia where the ankle–brachialpressure index of most of the patients was below 0.5[Table5]. All thepatients with ankle–brachialpressure

Table1:Incidenceofchroniclowerlimb insufficiency indifferentagegroups

Agegroup	Numberofpatients(%)
20–30	2 (2.60)
30–40	7 (9.09)
40–50	12(15.58)
50–60	18(23.38)
60–70	21(27.27)
70–80	15(19.48)
80–90	2 (2.60)

Table2:Causeofchroniclowerlimbinsufficiency

Sex	Atherosclerosis	TAO
Male	30	17
Female	30	0
Total(%)	60(77.92)	17(22.08)

TAO:Thromboangiitisobliterans

Table3:Modesofpresentationinthepresentstudy

Intermittentclaudicationonly	Nil
Intermittentclaudicationandrestpain	9(11.69)
Intermittentclaudicationandrestpainandgangrene	57(74.02)
Intermittentclaudicationandrestpainandulceration	11(14.29)

Table4:Dopplerfindingsintheaffectedlimbs

Levelofobstruction	Numberofcases(%)
Supra-popliteal	12(15.58)
Popliteal	12(15.58)
Infrapopliteal	29(37.67)
Ankle region	24(31.17)

Westernpopulation.Hence,thenumberofcasesabove

70yearsislessthantheWesternstudies.

In the present study, out of 77 cases, most of the caseswere caused by atherosclerosis (77.92%) and few caseswere caused by TAO (22.08%). The diagnosis was basedon Shionoya criteria and also on the biopsy reports of

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thevesselstakenfromtheamputatedspecimens[Table2].

MillsandPorterreportedthatTAOconstitutes1–3%ofPAD in the Western population;[19]Khanna reported thatTAO is the most common type of PAD in India.[20] Thereare widely varying prevalence rates of Buerger's diseasein patients with PAD in Europe and Asia. The rates ofTAO among all patients with PAD have been reported as0.5–5.6%inWesternEuropeancountries,3%inPoland,6.7%inEastGermany,11.5%inCzechoslovakia,39%in Yugoslavia, 80% in Israel, 45–63% in India, and 16–66%inKoreaandJapan.[21]

Kelkar conducted an Indian study of 489 cases of chroniclowerlimbischemiaandfoundthat50%wereduetoTAOand 43% were due to atherosclerosis, the rest being due tomiscellaneouscauses.[22] AstudydonebyNigamhadahigherincidenceofTAO,accounting for 63% of the cases and atherosclerosis only15%,therestbeingmiscellaneouscauses.[23]

In the present study, 82.35% of the patients with TAO(14cases)werebetween31and50yearsofage.Nigamreportedinhisstudythat88%oftheTAOcaseswereagedbetween31and50years.[23]
index above 0.5 could be managed either conservativelyor by sympathectomy or by toe disarticulation. Most ofthe patients with ankle–brachial pressure index below 0.5endedupwithamputation.

This can be compared with the existing studies, Hirschet al.,[25]2005, and Sacks et al.,[26]2002, which state thatan ABI <0.4 increases the risk of limb loss, gangrene,ulceration,anddelayedwoundhealing.

In the present study, more number ofpatients weremanaged surgically, either toe disarticulation or limbamputations,10caseswereconservativelyalone with cessation of smoking, limb exercises, low-dose aspirin, cilostazol, and pentoxifylline. Nine caseswere managed by lumbar sympathectomy. Sixteen casesunderwentdisarticulationofoneormoretoesand42casesunderwent limb amputations, both above-knee and below-kneeamputations.Allthecaseswhichunderwentsomeform of surgery also were supplemented with medicaltherapy[Table6].
The present study shows that the average age of cases oflowerlimbischemiawithsmokinghistorytendstopresent 12.1yearsearlierthannon-smokers.Thisisrepresentedin Table 7. A study by transatlantic intersociety consensusworkinggroupstatesthat,onaverage,thediagnosis of PAD is made 10 years earlier in smokers than non-smokers.[27]

Table 5: Ankle–brachial pressure index in thepatientsofchroniclowerlimbischemiainthisstudy

Ankle–brachialpressureindex	Numberofpatients(%)
0.2	18(23.38)
0.3	21(27.27)
0.4	13(16.88)
0.5	18(23.38)
0.6	6 (7.79)
0.7	1 (1.3)

Table6:Treatmentinpatientsofchroniclowerlimbischemiainthepresentstudy

Treatment	Number(%)
Only conservatively managed	10(12.99)
Toe/toesdisarticulation	16(20.78)
Lumbarsympathectomy	9(11.69)
Limbamputations	42(54.54)

Table 7: Comparison of the average age ofpresentation of smokers and non smokers in thepresentstudy

Cases	Averageageofpresentation
Smokers	53.58
Non-smokers	65.68

Outcome of Diabetic Patients with Chronic Lower LimbIschemiainthisStudy[Table8]
Thepresentstudyshowstheeffectofdiabetesonperipheral vasculardisease.Thisclearlysuggeststhatonly2outof27 diabetic cases could be managed conservatively withstrict glycemic control and foot care education, whereasmajority ofthem (92.59%) required surgical interventioneither in the form oftoe/toes disarticulation (29.63%) orlimb amputations (62.96%). This result can be correlatedwiththeexistingdatawhichclearlysuggeststhatworseoutcomes including limb loss are more in individuals withperipheral vascular disease and diabetes.[28,29] The Centersfor Disease Control and Prevention reported in 1997that, in the United States, the LEA rate among those

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withdiabeteswas28timesthatofthosewithoutdiabetes 73.In the present study, of the 42 amputations, 17 were ofdiabeticpatients.
Normallyindiabeticpatients,digitalamputationsaredone. However,ifassociatedwithperipheralvasculardisease,rate ofproximallimbamputationsincreases.
Thepresentstudyshowstheinfluenceofdiabetesandhy pertension,incombination,ontheoutcomeof lower limb ischemia. Table 9 clearly suggests thatmost of the cases, 12 out of 14, with both diabetes

Table8:Treatmentinchroniclowerlimbischemiapatientsw ithdiabetesinthepresentstudy

Treatment	Number(%)
Conservativelymanaged	2 (7.41)
Toe/toesdisarticulation	8 (29.63)
Lowerlimbamputation	17(62.96)
Total	27

Table 9: Effect of combination of diabetes andhypertensiononoutcomeinthepresentstudy

Treatment	Number(%)
Conservativelymanaged	2 (14.29)
Lumbarsympathectomy	0 (0)
Toe/toesdisarticulation	3 (21.43)
Lowerlimbamputation	9 (64.28)

withanincreasedriskofperipheralarterialocclusivediseasei n some studies. The Framingham data documented a 2.5-fold increase in the risk of PAD in men with hypertensionand a 3 9-fold increase in women with hypertension.[30]Almosteverystudyhasshownastronga ssociationbetweenhypertensionandPAD,andasmanyas,5 0–92%ofpatientswith PAD have hypertension. In the systolic hypertensionin the elderly program, 5.5% of the participants had anABIunder0.90.[31]

In the present study, 3 patients (3.9%) had a prior historyof myocardial infarction (MI) and 1 patient (1.3%) had ahistory of cerebrovascular accident (CVA). Three patientswithahistoryofMIwerefoundtobediabetic.Allth ethreepatientsunderwentamputations.Onepatientwit hCVAwashypertensiveandunderwentamputation.In astudy,amongthesubjectswithischemicclaudicationidentifie din the general population, the prevalence of ischemicheart disease varied between 30% and 40% and 6% of thepatientsgaveahistoryofthepreviousstroke.[32]

In the present study, 2 patients (2.6%) were found to havehypercholesterolemiaandserumcholesterol>200 mg/dland were managed with atorvastatin andhypertension, needed surgical intervention, either in theformofdisarticulationoramputation.Inthat,majorityo fthem, 9 out of13, ended up having amputation.This suggests the effect ofhypertension and diabetesontheoutcome.
In the present study, 23 cases (29.88%) out of 77 werefoundtobehypertensive.Hypertensionhasbeenli nked

postoperatively. Inepidemiological studies, total cholesterol levels are generallyhigher in patients with intermittent claudication than inthosewithoutlowerextremityperipheralarterialdisease. [33]

OutcomeoftheCasesTreated

Theoutcomeoftreatedcases,apartfromamputations,w asassessedbythefollowingcriteria:

1. Reliefofrestpain,asubjectiveimprovementfro mthepatientpointofview
2. Riseincutaneoustemperatureasjudgedbypalpa tion
3. Healingoftrophiculcers.

IV. DISCUSSION

In this study of 77 cases, conservative treatment wasadoptedinallthecases.Theyweretreatedbycessati onofsmoking,limbexercise,cilostazol(100mgBD),an dpentoxifylline(400mgBD).Medicaltreatmentalsoinclud edantibiotics, analgesics, antidiabetic, antihypertensive drugs,andlow-doseaspirin(150mgOD).

In this study, 10 cases out of 77 cases were exclusivelymanagedconservatively.Outof10cases,6pre sentedwithclaudication and rest pain. Four out of these six cases hadsymptomatic relief in rest pain. Remaining two cases hadnoimprovementinthepain.Fourcaseswithsmallsche miculcers were managed conservatively alone and all the fourcasesshowedsymptomaticrelieffrompainandthree ofthemhadhealingoftheulcer.Remainingonecaseshow ed noimprovementintheulcerbuthadsymptomaticrelief bytheendofthestudyperiod.
Inthisstudy,9outof77casesunderwentlumbarsympat hectomy. Three cases had claudication with restpainandallthethreecaseshadsymptomaticrelieffr ompain. Clinical improvement was also noted with the raiseof cutaneous temperature. Three cases had shallow smallulcers and two of them showed healthy granulation tissueatthebase,onecasetheulcerremainedthesameby theend of the study period. Three cases had gangrene

of thedigits, which had autoamputated with healthy granulationtissueatthebase.

In this study, 16 cases out of 77 cases were treated by toe/toes disarticulation. They also received medical treatmentsimultaneously. Thirteen cases out of16 had normalhealing ofthe skin. Two cases developed superficialinfectionwithwoundgaping,forwhichsecondarysuturingwasdone.Onecasedevelopednon-healingulceratthebaseofdisarticulationbytheendofthestudyperiod.

In this study, 42 cases out of 77 cases had underwentlower limb amputations. Seventeen out of42 casesunderwentbelow-kneeamputation.Theremaining25 cases underwent above-knee amputation. One case ofbelow-knee amputation underwent revision amputationdue to compression of the stump of the tibia onto theskin causing skin necrosis. Five cases had wound gapingthatwassubsequentlyclosedbysecondarysuturing.Remaining36caseshaduneventfulrecovery.Allthecasesof amputations were treated medically postoperatively. Allthecaseshadreliefofpainonfollow-up.

Post- operativeperiodinamputationsinthepresentstudy	
Uneventful(%)	36(85.71)
Secondary suturing (%)	5(11.91)
Revisionamputation(%)	1 (2.38)
Total	42

V. CONCLUSION

Thepresentstudy,77casesofchroniclowerlimbischemia, wasstudiedduringtheperiodofFebruary2020–February2022. A clinical study was done regarding the age andsex distribution, modes of clinical presentation, relevantinvestigations, and various modalities of treatment. Thepresent study shows: Chronic lower limb ischemia casesconstituteabout0.6%oftotalgeneralsurgicaladmissions.

Males(61.04%)aremorecommonlyaffectedthanfemales (38.96%),duetotheirhabitofcigarettesmoking.

Thepercentageoffemalesaffectedincreasedwithincreasingage.

The age group of60–70 years is the most commonpresentingage (27.27%) ofchroniclowerlimb ischemia.

Theyoungestpatientwas23yearsofageandtheoldestpatientbeing90yearsofage.

Atherosclerosis (77.92%) is the major etiological factorcausingchroniclowerlimbischemia.

TAO is the second cause and it exclusively affects males.FemalepatientswerenotaffectedwithTAOastheyarenon-smokers.

Most of the patients (74.02%) presented with gangrene ofsomepartofthelowerlimb.

Smokingplaysamajorroleintheetiologyofchroniclowerlimbischemiaandsmokersgetaffectedatayoungerage, 12.1years,thannon-smokers.

Diabetes has a major role in the etiology of chronic lowerlimb ischemia. It also has a crucial role in the outcome ofthe patients. Most of the cases in the present study withdiabetes had surgical intervention (92.59%) with very fewcasesmanagedbyconservativeapproachalone(7.41%).

Color Doppler was the main investigating modality usedinthepresentstudy.

Majority ofthe cases had block in the infrapoplitealsegment (37.67%) and in the ankle region (31.17%), withfew cases having obstruction at popliteal (15.58%) andsuperficialfemorallevel(15.58%).

Mostofthepatients(54.54%)endeduphavinglowerlimbamputations. Remaining cases were treated either withlumbarsympathectomy(11.69%),disarticulation(20.78%),orconservativeapproachalone(12.99%).

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