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Diabetic Foot: Angiographic Assesment and Management

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Abstract

Diabetes is no longer a disease of the affluent west. Global prevalence of diabetes in 2003 was estimated to be 194 million. By 2030, this figure is predicted to rise to 366 million due to longer life expectancy and changing dietary habits. In fact the prevalence is soaring in southern India it may reach an astronomical figure 13% to 18%. In such a scenario knowing about the disease is important [1]. The purpose of the study is to access the percentage of lower limb ischemia in patients with diabetic foot, to study the Efficacy of the lower limb revascularization procedures (open and endovascular) and conventional medical management in ischemic diabetic foot. We also study the role of antiplatelet and anticoagulant agents in ischemic diabetic foot and to study the percentage of patients with diabetic foot prevented from Amputations. The main reasons to diagnose Peripheral artery disease in diabetic individuals are to initiate therapies that decrease the risk of atherothrombotic events, improve quality of life, and decrease disability. A diagnosis of Peripheral artery disease indicates the presence of systemic atherosclerosis that confers additional cardiovascular risk to the patient with diabetes, and gives further impetus to aggressively manage vascular risk factors in this high-risk group. The clinical material for this study consisted of 150 cases of Diabetic foot patients admitted in the surgical wards of Thanjavur Medical College Hospital, Thanjavur during the period September 2016 to September 2017. Various diagnostic and therapeutic criteria were followed, protocols was framed and progress recorded.

Keywords: Diabetes; ulcers; peripheral artery disease; Doppler; Angiography; stents; grafts.

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Introduction

The diabetic foot may be defined as a group of syndromes in which neuropathy, ischaemia, and infection lead to tissue breakdown resulting in morbidity and possible amputation. This is of great socioeconomic importance as majority of them are in the prime earning age group and are poor. The treatment of foot ulcers needs frequent surgical consultations, use of costly antibiotics, repeated investigations, dressings and minor surgical procedures. Treatment of diabetes transgresses specialty and hence the need of the hour is 'multidisciplinary approach' [2]. This is well exemplified in the management of foot complications. This requires the expertise of diabetic physician, vascular surgeon, orthopaedician, neurologist, and orthoptist and social workers. Vascular surgery is one of the recent specialization and essentially, vascular surgery involves removal of blocks and by passing obstructions. Judicious and appropriate use of revascularization results in a cumulative limb salvage rate of greater than 70% at 5 years in high risk groups. Restoration of flow can be achieved either by management or by Bypass surgery or by a combination of both. There is no increased morbidity for reconstructive surgery in a diabetics and the long-term patency rates are comparable to the nondiabetics. Strandness et al, reported that diabetic patients had more infrapopliteal disease [3].

King et al. found greater involvement of the profunda femoris in diabetic patients [4]. Lower limb ischemia may cause nonhealing ulcers, infection, amputation and even mortality in diabetic patients [5].

In this study, we review our data of ischemic lower limb revascularization procedures in diabetic patients and present results of its efficacy.

Material and Methods

The clinical material for this study consisted of 150 cases of Diabetic foot patients admitted in the surgical wards of Thanjavur Medical College Hospital, Thanjavur during the period September 2016 to September 2017.

The patients were selected based on the following criteria:

1. Patient with Proven Diabetics.
2. Diabetic Patients with Lower Limb Ulcers and Discolouration.
3. Diabetics Patients with Lower Limb Pain.

The patients were excluded based on the following criteria:

1. Diabetic Patient with Traumatic Ulcers.
2. Patient with Non Diabetic Vaso-Occlusive Disorders.
3. Diabetic Patients with Concurrent Hypercoagulable Diseases.
4. Diabetic Patients with Hansens/Filarial Diasease are Excluded.
5. Diabetic Patients with Ulcers Due Non Vasculopaphic Cause Like Uncontrolled Diabetics, Neuropathy.
6. Diabetic Patients with well Set Gangrene before any Medical/Surgical Intervention

Revascularization was performed for relief of intermittent claudication in 60% of the subjects. Open bypass were done. Peripheral artery bypass is surgery to re-route the blood supply around a blocked artery in one of your leg [6]. Fatty deposits can build up inside the arteries and block them. A graft is used to replace or bypass the blocked part of the artery.

Observation

Various factors were observed and analyzed.

The statistics were made using the Software Graph Pad Prism Version 5.

ABPI is subject of variability with patients diabetes vessel disease and not considered as primarily modality in outcome of patient

Table 1: Age distribution of the study subjects involved in the study (overall)

S. No	Age (in years)	Number (n)	Frequency (%)
1	≤35	12	8
2	36-45	31	20.67
3	46-55	54	36
4	56-65	34	22.66
5	66 - 75	18	12
6	>75	1	0.67

Data are expressed as absolute numbers with percentage.

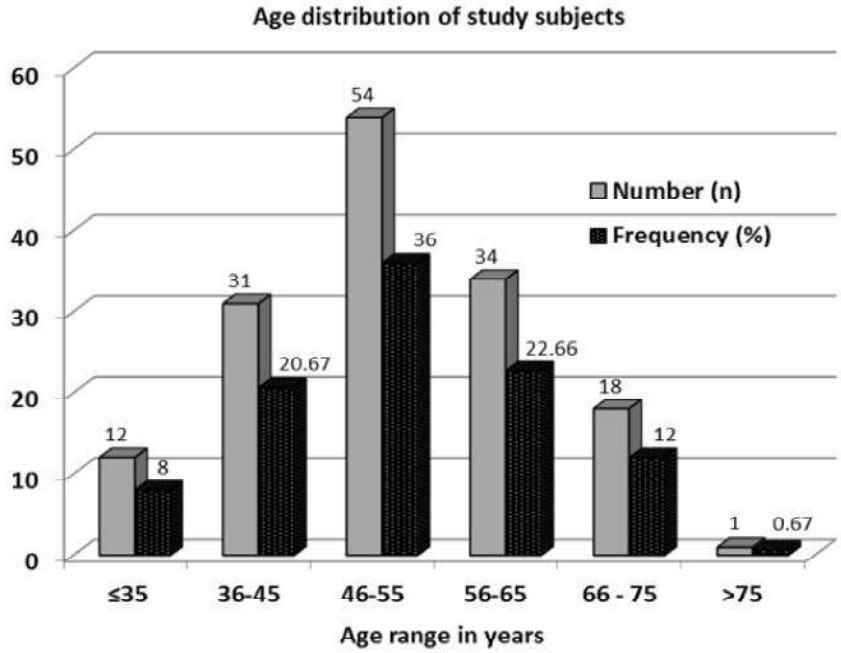


Fig. 1: Age distribution of the study subjects involved in the study (overall)

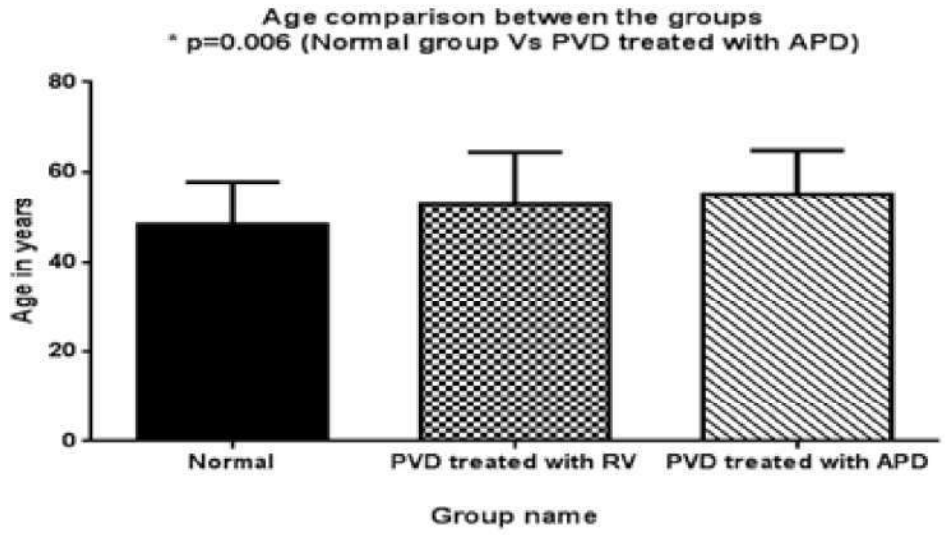


Table 2: Statistical description of age of the study subjects. (Overall)

S. No	parameter	Value
1	Mean	52.4 years
2	Median	52 years
3	Mode	50 years
4	Standard deviation	10.6
5	Variance	112.5
6	Range	30 to 87 years

Table 3: Comparison of age in years between the groups in the study population

S. No	Age in years	Normal group (n=42)	PVD with revascularization done (n=52)	PVD with only antiplatelet drugs given (n=56)
1	Mean years	48.31	52.79	55.13
2	Standard deviation	9.5	11.6	9.59
3	Median years	47	52.5	55

Statistical values of the comparison between the groups. Test used: ANOVA

S.No	Group comparison	Mean difference	P value	95% confidence interval
1	Normal group Vs PVD with revascularization	-4.47	0.052 (NS)	-9.54 to 0.58
2	Normal group Vs PVD with only antiplatelet drug	-6.815	0.0006*	-11.8 to -1.83
3	PVD with Revascularization VS PVD with only antiplatelet group	-2.337	0.255 (NS)	-7.04 to 2.367

The sample sizes are unequal in all three groups. * indicates p <0.05 and is considered statistically significant.

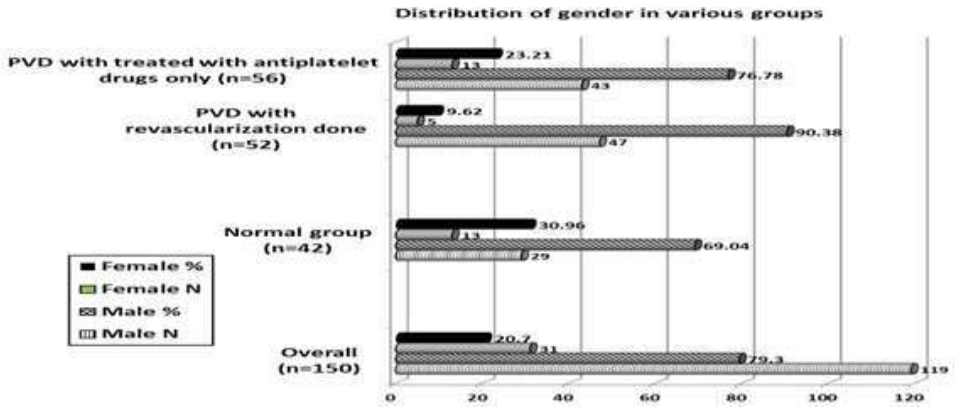


Fig. 2: Comparison of age in years between the groups

Data are expressed as mean with standard deviation. The height of the bar in the vertical bar diagram represents the mean and the error bars represents the mean. N in normal group is 42, PVD treated with RV was 52 and PVD treated with antiplatelet drugs was 56. ANOVA with Bonferroni multiple comparison was used to test the statistical differences between the groups. *indicates $p<0.05$ and considered statistically significant. PVD= Peripheral vascular disease; RV = Revascularization & APD = Antiplatelet drugs.

Table 4: Distribution of gender in the study population.

S. No	Type of the group	Gender			
		Male		Female	
		N	%	N	%
1	Overall (n=150)	119	79.3	31	20.7
2	Normal group (n=42)	29	69.04	13	30.96
3	PVD with revascularization done (n=52)	47	90.38	5	9.62
4	PVD with treated with antiplatelet drugs only (n=56)	43	76.78	13	23.21

Table 5: Frequency distribution of type of artery involved in the PVD with revascularization done as treatment group (n=52)

S. No	Type of the artery involved	Number (n)	Frequency (%)
1	Anterior tibial artery	12	23.08
2	Posterior tibial artery	18	34.62
3	Anterior and posterior tibial artery	3	5.77
4	Femoral artery	4	7.69
5	Bilateral femoral artery	1	1.92
6	Popliteal artery	7	13.46
7	Femoral with popliteal artery	4	7.69
8	Iliac artery	3	5.77

Table 6: Frequency distribution of type of artery involved in the PVD treated with antiplatelet drugs group (n=56)

S. No	Type of the artery involved	Number (n)	Frequency (%)
1	Anterior tibial artery	6	10.71
2	Posterior tibial artery	6	10.71
3	Dorsalis pedis artery	38	67.86
4	Popliteal artery	5	8.93
5	Iliac artery	1	1.79

Table 7: Comparison of frequency of anti-platelet drug received in various groups

S. No	Type of the group	Antiplatelet drugs received			
		Yes		No	
		N	%	N	%
1	Overall (n=150)	111	74	39	26
2	Normal group (n=42)	3	71.4	39	28.6
3	PVD with revascularization done (n=52)	52	0	0	0
4	PVD with treated with antiplatelet drugs only (n=56)	56	0	0	0

Table 8: Outcome of wound healing in the normal group of the study population (n=42).

S. No	Quality of the wound healing	Number (n)	Frequency (%)
1	None	2	4.8
2	Poor	3	7.1
3	Better	18	42.9
4	Good	15	35.7
5	Excellent	4	9.5

Table 9: Outcome of wound healing in the PVD treated with revascularization group of the study population (n=52).

S. No	Quality of the wound healing	Number (n)	Frequency (%)
1	None	10	19.2
2	Poor	4	7.7
3	Better	2	3.8
4	Good	4	7.7
5	Excellent	32	61.5

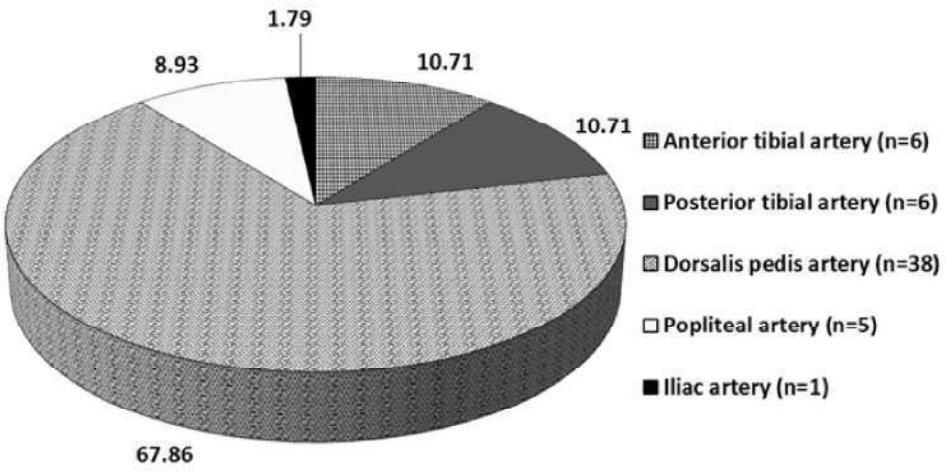


Fig. 5: Frequency distribution of artery involved in the PVD treated with anti platelet drugs only group (n=56) in pie chart.

Data are expressed as percentage. The area in the pie chart represents the percentage value of each group.

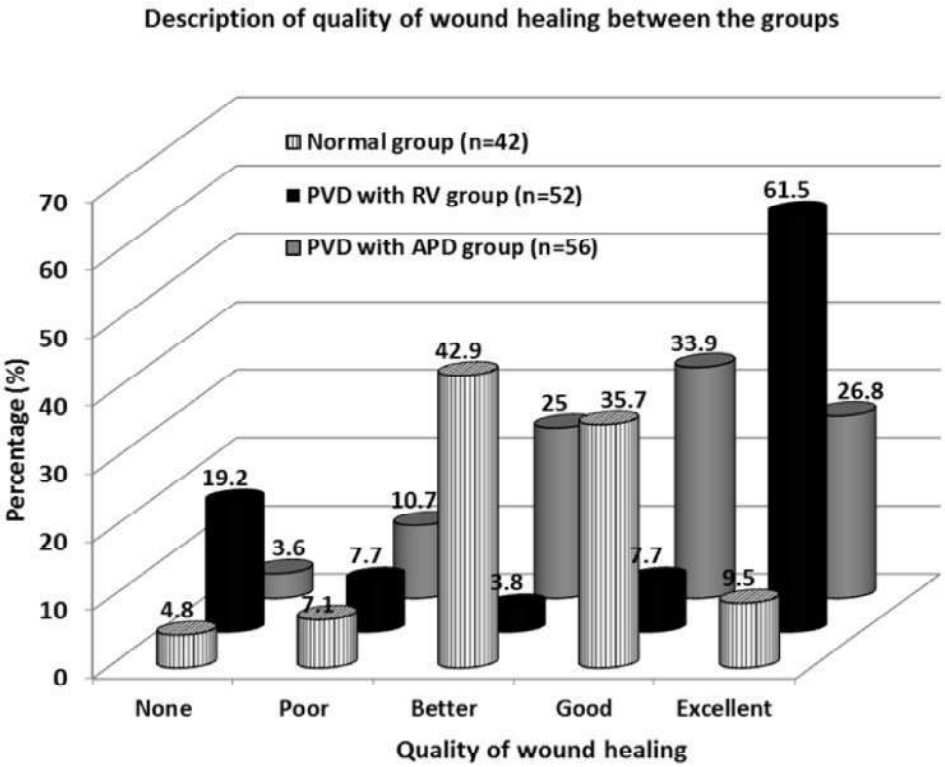


Fig. 6: Description of different qualities of wound healing in various groups in the study

Table 10: Outcome of wound healing in the PVD treated only with the antiplatelet drugs group in the study population (n=56).

S. No	Quality of the wound healing	Number (n)	Frequency (%)
1	None	2	3.6
2	Poor	6	10.7
3	Better	14	25
4	Good	19	33.9
5	Excellent	15	26.8

Table 11a: Comparison of excellent quality of wound healing between the groups

S. No	Quality of wound healing	Group comparison	Proportions		Statistical test And p value
			PVD with RV	PVD with APD	
1	Excellent	PVD with RV Vs PVD with APD	32/52	15/56	Fisher's exact test (p=0.0004*) Relative risk = 2.2 (95% CI =1.14 to 3.7)

Table 11b: Comparison of excellent quality of wound healing between the groups

S. No	Quality of wound healing	Group comparison	Proportions		Statistical test And p value
			Normal	PVD with RV	
1	Excellent	Normal Vs PVD with RV	4/42	32/52	Fisher's exact test (p<0.0001*) Relative risk = 6.4 (95% CI =2.4 to 16.8)

Table 11c: Comparison of excellent quality of wound healing between the groups

S. No	Quality of wound healing	Group comparison	Proportions		Statistical test And p value
			Normal	PVD with APD	
1	Excellent	Normal Vs PVD with APD	4/42	15/56	Fisher's exact test (p=0.04*) Relative risk = 2.8 (95% CI =1.07 to 7.8)

On comparison of wound healing within Various groups Normal Vs PVD with Revascularization Vs PVD with Antiplatelet, the proportions for PVD with RV Vs PVD with APD were 32/52 for RV and 15/56 for APD, using the Fischer's exact test the P Value is 0.0004 which is statistically significant and the Relative Risk is 2.2 which is under positive Range which shows that patients are definitively benefitted by this study who underwent various Revascularization and Antiplatelets Drugs (Table 11a)., the proportions for PVD with RV Vs Normal group were 32/52 and 4/42, using the Fischer's exact test the P Value is < 0.0001 which is statistically significant with Relative Risk of 6.4 (Table 11b)., The proportions for Normal Vs PVD with APD were 4/42 and 15/56, using the Fischer's exact test the P Value is 0.04 which is statistically significant with Relative Risk of 2.8 (Table 11c).

Discussion

Diabetic foot ulcer is the commonest cause of foot ulcers in Thanjavur Medical College Hospital, Thanjavur. In this study, the incidence of Diabetic foot ulcers increased with age, which correlates with the literature [7]. The total number of patients included in my study were 150.120 were male patients accounting for 80% of the total, 30 were female patients accounting for 20% of the total. Incidence of diabetic foot increased with advancing age in our study. Incidence of diabetic foot was more in age group more than 52 years. Out of 150 patients 108 patients belonged to this age group.

On comparison of age groups among the groups of study population, who were medically managed with antiplatelet and with those managed using surgical revascularization procedures. The mean age of normal group are 48 years and those who were treated with antiplatelet only were 55 years and those treated with revascularization were 52 years, and these were comparatively analyzed using ANOVA test which showed mean difference for normal group vs Peripheral vascular disease(PVD) with revascularization was -4.47 and normal group vs PVD with only antiplatelet are -6.815 and p value is 0.0006, as the value is <0.05 which indicates the sample size and comparison is statically significant (Table 3).

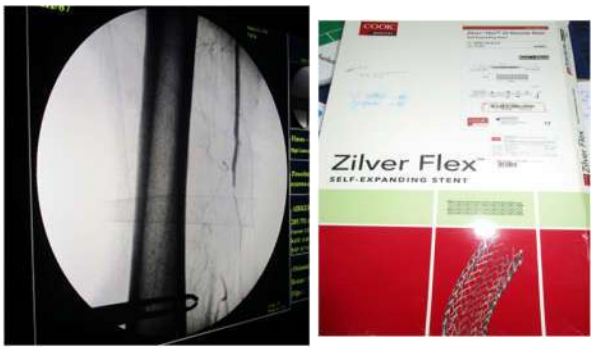
On studying the gender distribution in study population, out of overall 150 numbers, the normal group had 42 numbers, out of which 29 were male and 13 were female in population of those treated with revascularization in patients with PVD, totally 52 patients were benefitted which includes 47 males and 5 females. Of those 56 patients who were treated with antiplatelet only 43 were male and 13 were female (Fig. 3).

On studying the distribution of type of artery involved in the PVD with revascularization done on study groups (n=52), involvement of Anterior tibial artery is 12 with frequency (%) of 23.08, Posterior tibial artery is 18 with frequency (%) of 34.62, Anterior tibial artery and posterior is 3 with frequency (%) of 5.77, Femoral artery is 4 with frequency (%) of 7.69, bilateral femoral artery is 1 with frequency (%) of 1.92, Popliteal artery is 7 with frequency (%) of 13.46, Fempop artery is 4 with frequency (%) of 7.69, Iliac artery involvement is 3 and frequency is 5.77 (Table 5).

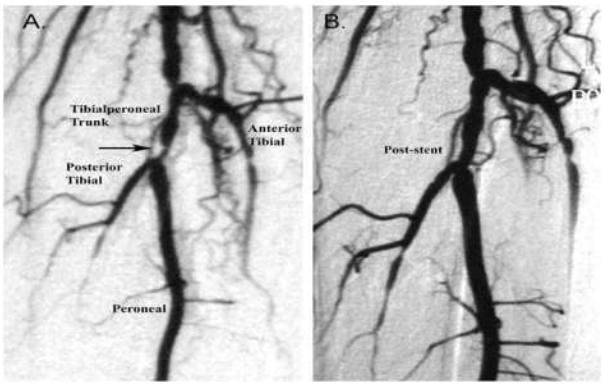
On studying the distribution of type of artery involved in the PVD with antiplatelet drugs done on study groups (n=56), involvement of Anterior tibial artery is 6 with frequency (%) of 10.71, Posterior tibial artery is 6 with frequency (%) of 10.71, Dorsalis pedis artery is 18 with frequency (%) of 67.86, Popliteal artery is 5 with frequency (%) of 8.93, Iliac artery involvement is 1 and frequency is 1.79 (Table 6). This shows the distal collateral arteries are mostly managed using the antiplatelet drugs rather than going for endovascular procedures. Of various outcomes studies, the major relief for the patient was relieved from claudication and improvement from ischemic changes and wound healing. Out of which wound healing was intensively followed for better significance, which eventually proves patients were improved from pain and symptoms of ischemia. The scale made were Excellent (if wound healing was <4 weeks duration), Good (if wound healing was 4 to 6 weeks duration), Better (if wound healing was 6 to 12 weeks duration) and finally Poor (if > 12 weeks duration or patients went for failures of intervention or major amputation performed, which does not include pre study period factors gangrene or uncontrolled diabetics, osteomyelitis, chronic infections who needed life saving amputations)

Diabetic foot with PVD, both ATA and PTA involvement.

Revascularization Tibial stenting with antiplatelets done and gangrenous toes disarticulated, patient got positive ATA and PTA.



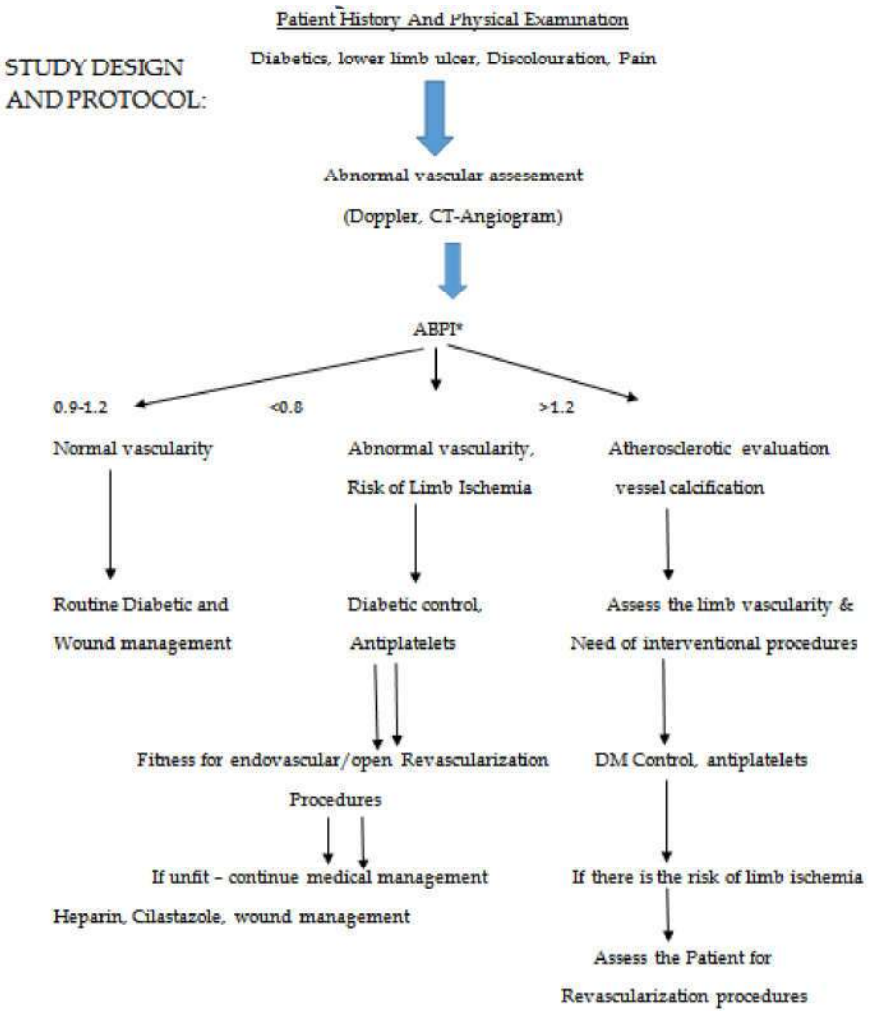
Digital subtraction Angiogram and Tibial Stenting done under C-ARM guidance.



The outcomes of wound healing in the PVD treated with Revascularization group of study Population (n=52), the excellent wound healing is seen in 32 patients with frequency of 61.5% and good in 4 patients and better in 2 patients and poor in 4. In those of patients with PVD treated with Antiplatelets alone (n=56), Excellent wound healing was seen in 15 patients with frequency of 26.8% and Good in 19, better in 14 patients and poor in 6 patients. On comparison of wound healing within Various groups Normal Vs PVD with Revascularization Vs PVD with Antiplatelet, the proportions for PVD with RV Vs PVD with APD were 32/52 for RV and 15/56 for APD, using the Fischer's exact test the p Value is 0.0004 which is statistically significant and the Relative Risk is 2.2 which is under positive Range which shows that patients are definitively benefitted by this study who underwent various Revascularization and Antiplatelets Drugs (Table 11a)., the proportions for PVD with RV Vs Normal group were 32/52 and 4/42, using the Fischer's exact test the p Value is< 0.0001 which is statistically significant with Relative Risk of 6.4 (Table 11b)., The proportions for Normal Vs PVD with APD were 4/42 and 15/56, using the Fischer's exact test the p Value is 0.04 which is statistically significant with Relative Risk of 2.8 (Table 11c).

The overall Results shows that the patients who had- *Angiographic Assesementand Management*

in Diabetic Foot Patients Hadgood Wound Healing, Relieved of Ischemia and Less Amputation Rates.



*ABPI is subject of variability with patients diabeties, vessel disease and not considered as primarily modality in prognosis of patient.

Conclusion

Ischemia of the lower limb is an important social health problem. Limb salvage in patients with extensive tibial and peroneal occlusive disease is feasible with aggressive revascularization of the vessels of the ankle and foot. The main goal of distal arterial revascularization procedures is to eliminate symptoms, achieve recovery of ulcers, obtain high graft patency and return the patients to an active social life [8].

In patients with Diabetic foot, Angiography like Doppler and CT angiography play a major role in assessing the arterial status and disease and plan its intervention. Distal arterial Revascularization in patients with critical limb ischemia is a limb saving procedure [9]. This study had proven that early assessment of arterial disease and treatment with medical and surgical Revascularization procedure has salvaged many limbs of the patients and improved the wound healing and symptoms of ischemia. This study had shown incidence of Arterial involvement and success rate of revascularization procedure and Antiplatelets in those patients with peripheral vascular disease. Lower limb ischemia is a serious event in patients with diabetes mellitus [10]. The consequences may include increased mortality and morbidity in this particular patient population. However, distal arterial revascularizations are considerably effective procedures to avoid amputation, to eliminate symptoms, to promote ulcer recovery and to help the patient participate in social life.

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