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Prospective Study of Patients Undergoing Infrainguinal Bypass Surgery with Single Tibial Artery Outflow

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I. Aim Of The Study

To assess early postoperative outcomes in patients undergoing Infrainguinal bypass surgery with Single Tibial artery outflow and to study the factors affecting outcome

II. Material And Methods

- Retrospective study
- Case records and angiograms of patients who underwent femoropopliteal bypass procedures and tibial artery bypass procedures with single tibial vessel outflow on angiograms were studied
- Period : 2 years from August 2016 to July 2018
- **Records analyzed with respect to outcomes of**
  - immediate in hospital graft patency
  - limb salvage
- **Factors studied**
  - Age and sex distribution
  - Etiology– Atherosclerosis / Thromboangiitis obliterans / Vasculitides
  - Clinical presentation – critical limb ischemia (extent of tissue loss) / functional limb ischemia (severity of claudication)
  - Co morbid factors – diseases such as Diabetes Mellitus / Systemic Hypertension / Coronary Artery Disease with specific reference to LV function / previous cerebral infarction / history of tobacco abuse
  - Pre operative ABI and clinical level of occlusion
  - **Angiogram details**
    - Site of occlusion
    - Distal reformation
    - Runoff of tibial artery, pedal arch outflow
    - Angiographic runoff score
  - **Operative details**
    - Surgery done
    - Inflow vessel site
    - Inflow vessel wall / disease
    - Outflow vessel site
    - Outflow vessel wall / disease
    - Runoff
    - Conduit used
- If GSV used – quality, diameter
  - Sequential bypass if any
  - Post operative details
    - Category improvement
- Rest pain relief

- Ulcer healing
- Ankle brachial index
- Wound complications
- Further interventions, if any
- Final outcome – limb salvaged / major amputation required
- Condition at discharge

INCLUSION CRITERIA

- Patients who underwent infrainguinal bypass surgery whose angiograms showed single tibial vessel outflow.

EXCLUSION CRITERIA

- Infrainguinal bypass surgery with angiogram showing more than one tibial vessel outflow
- Infrainguinal bypass done as part of sequential bypass with proximal outflow disease correction.

The angiographic runoff was studied and reported as per the angiographic runoff scoring system described by the SVS/ISCVS committee report[2]. The runoff score predict the outcome of the bypass surgery. The scoring for angiogram for the single tibial vessel bypass as follows

As this study evaluated the single tibial vessel outflow as the other two arteries are occluded they carry a weightage point of 2 and theirwere occluded in their the length throughout which individually carry resistance value point of 3 so the total weightage score of 6 point and plus 1 point to correct the decimal point a total of 7 point. To start with a good single tibial vessel flow had a score of a minimal score of 7, in which outflow vessel had a stenosis less than 20% in its length. The score increases with length of stenosis in the single tibial artery taking the score to a maximum of 9.5 which has an occlusion of more than 50% of its length in a poor outflow.

Weightage points

Distal anastomosis	3	2	1
Popliteal above-knee	Distal popliteal		Anterior tibial
Popliteal below-knee			Posterior tibial
			Peroneal
Anterior tibial		Distal tibial	Pedal arch
Posterior tibial		Distal tibial	Pedal arch
Peroneal		Pedal runoff	Collaterals to anterior and posterior tibial arteries
Pedal/inframalleolar			

Resistance value point of runoff arteries (total of three units)—occlusion

Degree of occlusion	3	2.5	2	1	0
Major runoff vessels	Occluded throughout of length	Occluded less than ½ stenosis visible collateral	50% to 99% greatest stenosis	20% to 49% greatest stenosis	Less than 20% greatest stenosis

GRADING OF OUTCOME

Grading of the outcome is primary important goal of this study. The use of an ABI change of atleast 0.10 is the accepted evidence of hemodynamic improvement, to guard against the fallibility of basing success on symptomatic improvement alone. To provide an objective basis for claiming "improvement" and for defining "hemodynamic success" or "failure" and for a claim of patency, an ABI change of 0.10 has been used. The adhoc committee that originally developed these standards believed that a difference of 0.10 was sufficient to signify true change, if combined with categorical clinical improvement to define hemodynamic success or failure. The term" hemodynamic failure" has been used to indicate a lack of significant hemodynamic improvement (i.e., an increase in ABI) in spite of a patent revascularization[3].

OUTCOME REPORTING

Various outcomes can be used in the measurement after treatment including patency, limb salvage, clinical status, and quality of life. Scientific article should accept patency rates that are based on objective evaluation[3].

+3	Markedly improved	No ischemic symptoms, and any foot lesions completely healed; ABI essentially" normalized" (increased to more than 0.90)
+2	Moderately improved	No open foot lesions; still symptomatic but only with exercise and improved by at least one category; ABI not normalized but increased by more than 0.10
+1	Minimally improved	Greater than 0.10 increase in ABI" but no categorical improvement or vice versa (i.e., upward categorical shift without an increase in ABI of more than 0.10)
0	No change:	No categorical shift and less than 0.10 change in ABI
-1	Mildly worse	No categorical shift but ABI decreased more than 0.10, or downward categorical shift with ABI decrease less than 0.10
-2	Moderately worse	One category worse or unexpected minor amputation
-3	Markedly worse	More than one category worse or unexpected major amputations

Scale for gauging change in clinical status

The above said method of reporting system was followed in this study to follow uniformity in the reporting standard. In this method of reporting a combination of the clinical method and segmental pressure index were used to assess the patient's clinical improvement or deterioration. This categorizing of the result is useful in grading of the outcome in the same way for all the patients and useful in assessing clinical success in the follow up period.

A graft is considered to have **primary patency** if the graft is uninterrupted;i.e, there was no intervention such as transluminal dilation and distal extension from graft[2]. Dilation or minor revisions performed for the anastomotic or graft thrombosis or other structural defect before occlusion do not constitute exception in defining primary patency because the procedures were intended to prevent graft failures. The outcome of these graft after intervention are called as **assisted patency**[2]. The patencies of the grafts restored after occlusion by thrombolysis or thrombectomy with or without anastomotic revision or graft reconstruction is called as **secondary patency**[2].

III. Observation And Results

86 patients out of the 217 patients who had bypass fit into the selection criteria as previously described. They form about 40% of the total revascularization patients

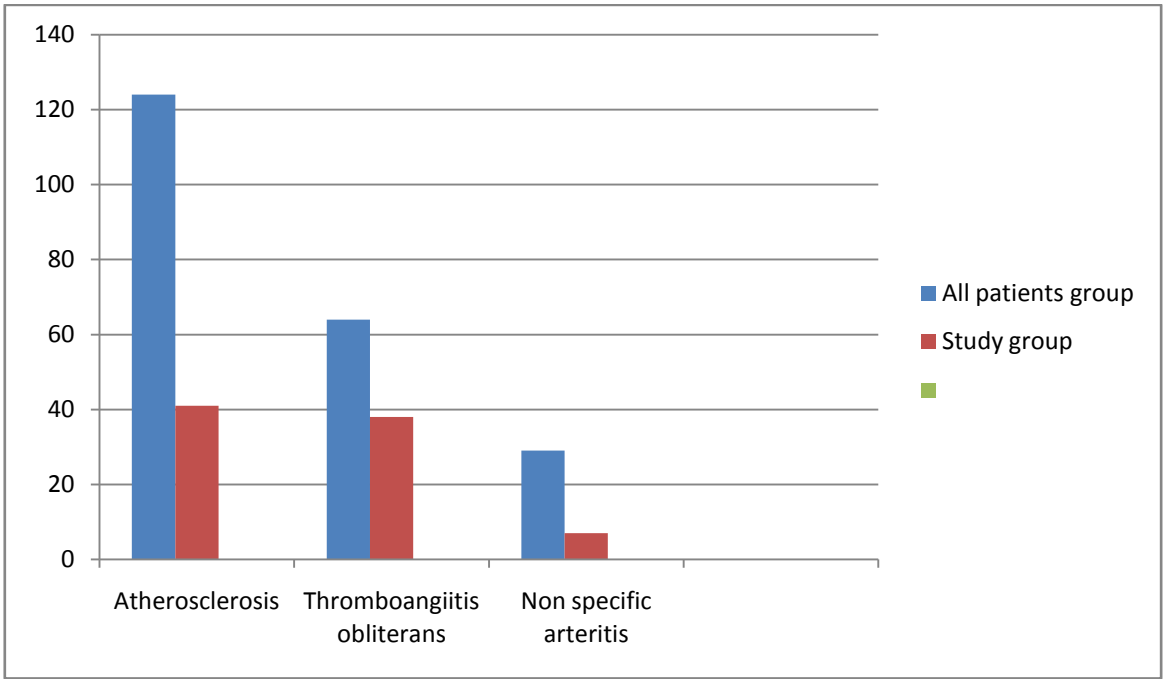
The mean age of patients was 42.5 +/- 14.5 years. The age varied between 25 yrs to 76 yrs. Most patients were in the age group 40 to 60 years(60.5%).

Age group	Number
20 – 29	2
30 – 39	18
40 – 49	28
50 – 59	24
60 – 69	10
70 – 79	4

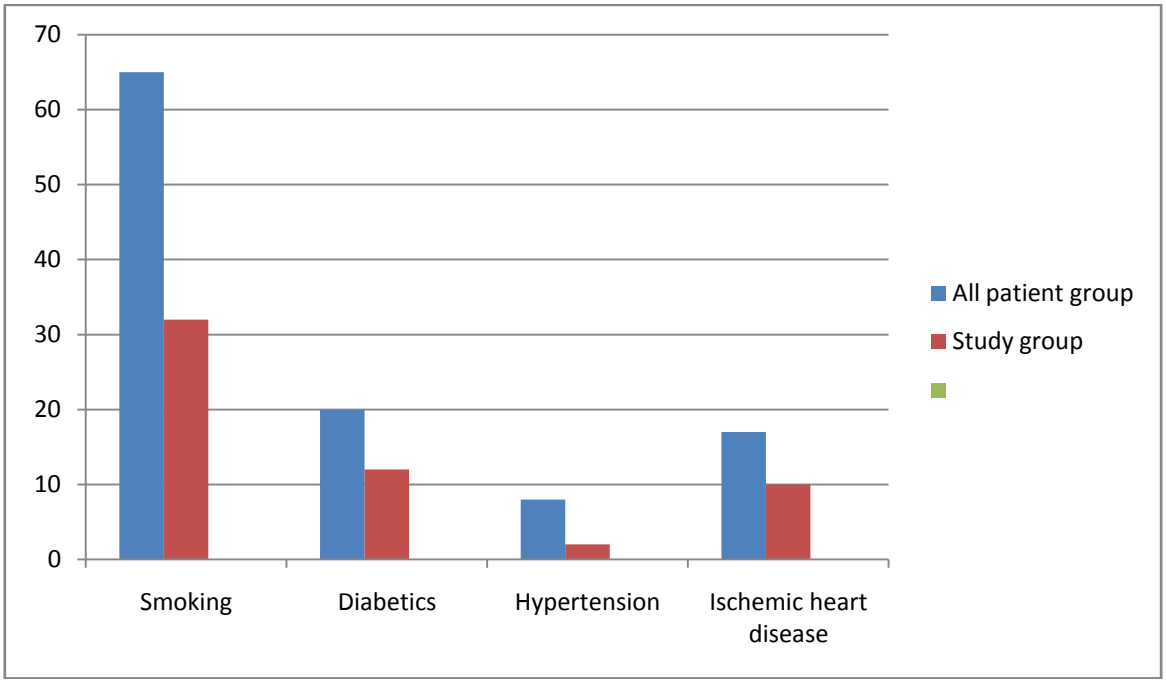
Table 1: Age group incidence

Clinical presentation	Number
Toe gangrene	60
Non healing ulcer	18
Forefoot gangrene	7
Functional limb ischemia	1
Rest pain	10

Table 2: Clinical presentation - incidence



Incidence of different etiologies



Risk factors	All patient group	Study group
Smoking	65	32
Diabetics	20	12
Hypertension	8	2
Ischemic heart disease	17	10
Others	8	3

	Resistance value points	**Posterior tibial**	**Anterior tibial**	**Peroneal**
Total occlusion	3	0	0	0
< 50% occlusion	2.5	11	5	5
50-99% stenosis	2	3	2	4
20-49% stenosis	1	4	5	3

<20% Stenosis	0	21	13	10
Total		39	25	22

Table 4; Resistance value points of the study group

Total score	Numbers patients
9.5	21
9	09
8	12
7	44

Table 5: Runoff Scores of the angiogram in the study group

Type of Bypass	Numbers(%)
Pop tibial	6(7)
Fem peroneal	13(14.2)
Fem ant tibial	6(7)
Fempost tibial	31(36)
Fempop	30(34.9)

Table 6: Types of bypasses in this series

Conduit used	Total number(%)
Reverse saphenous vein	78/86(90.6)
Composite graft	5/86(5.8)
Prosthetic graft with a vein cuff	3/86(3.4)

Table: Conduit usage

Complications	Number of the patients
Wound infection	9
Graft thrombosis	20
Redo surgery	13
Redo bypass graft salvaged	10
Major amputation	13

Table 7: Complications in this series

	Resistance value points	Pta	Ata	Per	Total no. of failed graft
Total occlusion	3	0	0	0	
Occlusion < 50% length	2.5	3/11	3/5	2/5	8/21
50 – 99% stenosis	2	0/3	0/2	0/4	0/9
20 – 49% stenosis	1	3/4	0/5	0/3	3/12
< 20% stenosis	0	5/21	2/13	2/10	9/44
Total no. of graft failures		11/39	5/25	4/22	20/86

Table 8: Failure of graft according to resistance value points

Score	Number
9.5	08(38.09%)
9	0
8	03(25%)
7	09(20.45%)

Table 9; Angio graphic runoff scores in the failed graft

Type of bypass	Number of failed grafts	Number of procedures
Fem peroneal	4	13
Fem ant tibial	3	6
Fem posterior tibial	9	31
Fem popliteal	2	30
Pop tibial	2	6

Table 10; Failures of graft according to bypasses

Conduit used	Total number in this study group	Number of Failures in the group(%)
Reverse saphenous vein	78/86	15/78(19.2)
Composite graft	5/86	2/5(40)
Prosthetic graft with a vein cuff	3/86	2/3(67)

Table 11: Conduit usage

IV. Conclusion

- Infrainguinal bypass with single tibial vessel outflow yields acceptable patency and survival rates.
- Patients with poor conduit quality, active tobacco use and LV dysfunction have poorer clinical outcome
- In patients with single vessel runoff, the angiographic runoff score does not affect early outcome.
  - It is however a marker for subsequent limb loss.
  - It should not preclude aggressive attempts at limb salvage in selected patients**.**

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