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Role of percutaneous endovascular intervention in acute limb ischemia

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***Abstract*---**Acute thrombotic lower limb ischemia is a limb- and life-threatening event. Catheter-directed thrombolysis is now one of the best choices in treatment of such condition. Tissue plasminogen activator like alteplase is a safe and efficient thrombolytic agent. The current study is designed to show its efficacy and safety and to investigate variables that correlate with outcome. This is a prospective observational study. It included patients with acute thrombotic lower limb ischemia. Exclusion criteria include acute lower limb ischemia due to embolism, trauma, arterial dissection, complicated aneurysm. Patients with bleeding risk, history of recent intracranial bleeding, massive gangrene, or uncontrolled hypertension are also excluded. The study is approved by ethical committee of Beni-Suef University and assigned number FWA00015574. Primary end points were technical success, clinical success, and limb salvage. Secondary end points were procedural complications. A total of 36 patients were enrolled in the study from March 2019 to February 2021 in Beni-Suef University hospital. It included 21 male patients (58.33%) and 15 female patients (41.67%). The patient's mean age was 58.42 years.

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The patient's mean BMI was 31.56. Risk factors were distributed as the following: smoking in 15 patients (41.67%), diabetes mellitus in 16 patients (44.44%), hypertension in 15 patients (41.67%), ischemic heart disease in 9 patients (25%) and hyperlipidemia in 14 patients (38.89%). Clinical presentation showed that 16 patients were in Rutherford IIa category (44.44%) and 20 patients were in Rutherford IIb category (55.56%). Limb salvage was achieved in 14/16 of patients in Rutherford IIa category (87.5%) and 12/20 (60%) of patients in Rutherford IIb category. Statistical analysis showed correlation of body mass index and severity of ischemia to outcome. Also, the frequency of risk factors in a single patient is correlated to outcome. Catheter-directed thrombolysis using alteplase is safe and effective treatment of acute thrombotic lower limb ischemia. The results were better with lower BMI, less severe clinical presentation, and less or no comorbid disease.

***Keywords*---**acute limb ischemia, acute thrombotic ischemia, catheter-directed thrombolysis.

Introduction

Acute limb ischemia (ALI) is defined as sudden onset of ischemic symptoms or signs due to a decrease in peripheral limb perfusion. It may occur as a result of a rapid disease progression in an already symptomatic patient suffering from peripheral arterial disease or as an acute onset in a previously asymptomatic patient *(Norgren et al., 2007)*. The etiology of the disease is mainly attributed to native thrombosis and embolism. Other less frequent causes include trauma, acute arterial dissection, reconstruction/graft thrombosis, and peripheral aneurysm provoking thrombosis or emboli *(Berridge et al., 2013)*. Clinical classification of acute ischemia was designed to help to direct treatment and urgency of intervention. Grade I indicates viable limb, grade II indicates threatened limb, and grade III indicates nonviable limb *(Lyden 2010)*.

Optimum treatment of acute ischemia has become a major source of debate over the past 2 decades. This is in addition to difficulty in differentiation between embolic and thrombotic ischemia. Moreover, demography of the patient, severity of ischemia, and status of the limb affect the process of decision making to treat acute limb ischemia *(Branco et al., 2015)*. Treatment options for viable threatened acute limb ischemia include endovascular (intra-arterial thrombolysis, aspiration or rheolytic thrombectomy, and/or angioplasty) or open surgical (thrombo-embolectomy, endarterectomy, and/or bypass) revascularization *(Enezate et al., 2017)*. Catheter-directed thrombolysis aims to dissolute the newly formed thrombus using fibrinolytic drugs *(Robertson et al., 2013)*. Adjunctive pharmacomechanical techniques have been advocated for some patients to minimize the dose of thrombolytic drug, embolic ischemia, and ischemia secondary to a stent failure or thrombosed prosthetic bypass grafts with an identifiable distal runoff vessel *(Byrne et al., 2014)*. Treatment of acute thrombotic limb ischemia constitutes two goals. First is the removal of the newly formed thrombus, and second is the correction of underlying arterial occlusion or

stenosis through endovascular technique or open surgery in case failed or not suitable endovascular options *(Branco et al., 2015).* The current study was designed to show the efficacy and safety of catheter-directed thrombolysis in treating acute thrombotic limb ischemia and show their predictors of outcome.

Patients and Methods

Study design

This is a prospective observational study. The study conducted in Bni-Suef University Hospital from March 2019 to February 2021. A total of 36 patients presented with grade IIa and IIb acute thrombotic limb ischemia – according to the Rutherford's clinical classification of acute limb ischemia – were assigned to one group. All patients are treated with catheter directed thrombolysis using alteplase (Actilyse®) and observed for outcome to determine its efficacy and safety. Patient's characteristics and risk factors were determined at time of presentation and correlated to the results to assess possible predictors of the outcome.

Inclusion criteria

Patients presented with acute thrombotic limb ischemia grade IIa and IIb according to Rutherford's clinical classification of acute limb ischemia. The diagnosis was confirmed clinically and radiologically (duplex and/or CTA), some patients were diagnosed incidentally during endovascular intervention in the angio suite.

Exclusion criteria

The following were the exclusion criteria:

- Traumatic acute limb ischemia.
- Acute embolic limb ischemia.
- Significant clinically active bleeding.
- Potential bleeding risk.
- Uncontrolled hypertension.
- History of recent intracranial hemorrhage.
- Extensive gangrene or infection beyond salvage.
- Acute ischemia due to arterial dissection or associated aneurysm.

The study was approved by the ethical committee of the Faculty of Medicine, Beni Suef University and its assignment number was FWA00015574. Written consent was obtained from participating patients. Data recorded: Patient's characteristics and demography were obtained as age, sex, body mass index (BMI), smoking and comorbidities. Preoperative laboratory evaluation, ECG and cardiac assessment were done for every patient.

Enrolment of patients

Patients attended the emergency department in Beni Suef university hospital suffered from acute limb ischemia. These patients had acute onset of ischemic symptoms (rest pain, paresthesia, sensory loss or motor weakness) and signs (coldness, cyanosis or pulselessness) from clinical history and physical examination. Routine laboratory, electrocardiogram, and imaging studies (duplex and/or computed tomographic angiography) were done. A provisional diagnosis of acute thrombotic limb ischemia was confirmed, then, patients asked to be enrolled in the study. Some patients were diagnosed incidentally during endovascular intervention and also asked to be enrolled in the study. After explaining the study concept, a written consent was taken from all patients.

On Admission

Patients admitted in surgery department in Beni Suef University Hospital and received oxygen, IV fluid for rehydration, proper analgesia and heparin (IV bolus loading dose of 5000 IU followed by IV maintenance dose of 1000 IU/h) to prevent thrombus propagation.

Interventional procedure

All patients were monitored in the angio suite for blood pressure, O2 saturation, heart rate and electrocariographic activity. They were given local anaesthesia at access site. The sheath was inserted. Initial diagnostic arteriography was done to demonstrate the anatomy and level of occlusion using either a contralateral or ipsilateral approach. Fountain® infusion catheter was used (Merit Medical Systems, Inc.) to inject Actilyse® (Boehringer Ingelheim, Ingelheim, Germany) directly into the site of thrombotic lesion. Each Actilyse® vial contains 50mg alteplase in powder form accompanied by another 50ml solvent vial, so, after dissolution of the vial the resulting vial contains alteplase in concentration of 1mg/ml. The method of infusion used was bolus administration of 10 mg alteplase followed by continuous infusion of 1.5 mg/h for 24-48 hours. The sheath side arm and catheter were looped in the groin, draped and fixed in position. Patients were monitored thoroughly in ICU especially to the general condition, vital signs, ischemic manifestations of the limb and complications. Follow up angiography in theater was done at 24 hours and 48 hours after alteplase infusion for confirmation of technical outcome of the procedure. Significant residual lesions were dealt with by angioplasty +/- stent. Sheath was removed 4 hours after cessation of infusion of thrombolytic agent followed by manual compression till ensuring good hemostasis then, a compressing bandage was applied to the site of arterial puncture for 24 hours.

Postoperative care

Patients were discharged on medical treatment includes; antilplatelet (low dose aspirin 75-150 mg/d) and anticoagualnt (marivan 5 mg once daily or rivaroxaban 5-10 mg once daily).

Outcome parameters

Several parameters were used to assess early and late outcomes that include:

- Primary endpoints:
  - Technical success: uninterrupted patency of the revascularized vessel with restoration of blood flow to the distal end of the limb.
  - Clinical success: relief of acute ischemic symptoms and return to at least a preocclusive clinical baseline level.
  - Limb salvage: avoidance of inevitable major amputation.
- Complications (secondary endpoints):
  - Hemorrhage.
  - Infection.
  - Death.
  - Other complications like pulmonary edema or renal complication.

Statistical Methods

Our patients were distributed into different categories according to their age, sex, BMI, risk factors and Rutherford's classification. Data were summarized using means and standard deviations, and frequencies and percentages for categorical factors. The data were analyzed using SAS (2013) software. The FREQ Procedure used in this analysis with Chi-Square test option to determine statistical differences. The significance of the results was assessed in the form of p value that was differentiated into non-significant when p value > 0.05 and significant when p value ≤ 0.05.

Results

The current study was conducted in Beni Suef University hospital from March 2019 to February 2021. It included 36 patients; all were presented with acute thrombotic lower limb ischemia. They were informed about the intervention and consented before being recruited in the study.

Patient's characteristics

The current study include 21 male patients (58.33%) and 15 female patients (41.67%). The patient's mean age was 58.42 years and they categorized into 4 age groups; first group included 6 patients (41 – 50 years old), second group included 17 patients (51 – 60 years old), third group included 11 patients (61 – 70 years old) and the fourth group included 2 patients older than 70 years. The patient's mean BMI was 31.56, distributed in 4 groups; 3 patients in the first group had normal weight (BMI 18.5 – 24.9), 11 patients in the second group were overweight (BMI 25 – 29.9), 15 patients in the third group were obese (BMI 30 – 34.9) and 7 patients in the fourth group were morbidly obese (BMI ≥35). The risk factors associated with acute thrombotic lower limb ischemia, determined in the study at time of patient's presentation, were smoking in 15 patients (41.67%), diabetes mellitus in 16 patients (44.44%), hypertension in 15 patients (41.67%), ischemic heart disease in 9 patients (25%) and hyperlipidemia in 14 patients (38.89%).

Patient's presentation: according to Rutherford's clinical classification of acute limb ischemia; 16 patients presented with grade IIa acute thrombotic limb ischemia (44.44%) and 20 patients presented with grade IIb acute thrombotic limb ischemia (55.56%). Table (1) demonstrates patient's characteristics and presentation.

Table 1
Patient's Characteristics and Presentations

		No. of patients	Percentage
Gender	Male	21	58.33%
	Female	15	41.67%
Age	41 – 50	6	16.67%
	51 – 60	17	47.22%
	61 – 70	11	30.56%
	> 70	2	5.56%
BMI	Normal weight 18.5 – 24.9	3	8.33%
	Overweight 25 – 29.9	11	30.56%
	Obese 30 – 34.9	15	41.67%
	Morbidly obese ≥ 35	7	19.44%
Risk factors	Smoking	15	41.67%
	Diabetes mellitus	16	44.44%
	Hypertension	15	41.67%
	Ischemic heart disease	9	25%
	Hyperlipidemia	14	38.89%
Rutherford's classification	Rutherford IIa	16	44.44%
	Rutherford IIb	20	55.56%

Primary end points

- Technical success was achieved in 13/16 of patients in Rutherford IIa category (81.25%) and 12/20 of patients in Rutherford IIb category (60%).
- Clinical success was achieved in 14/16 of patients in Rutherford IIa category (87.5%) and 13/20 of patients in Rutherford IIb category (65%).
- Limb salvage was achieved in 14/16 of patients in Rutherford IIa category (87.5%) and 12/20 of patients in Rutherford IIb category (60%).

Secondary end points

No complications happened in all patients except minor groin haematoma in only 2 patients in Rutherford IIb category. It disappeared spontaneously during follow up. Table (2) shows the study endpoints.

Table 2
Patient's Outcome

	Rutherford IIa		Rutherford IIb	
Primary end point	Number	Percentage	Number	Percentage
Technical success	13/16	81.25%	12/20	60%

Clinical success	14/16	87.5%	13/20	65%
Limb salvage	14/16	87.5%	12/20	60%
Secondary end point	Number	Percentage	Number	Percentage
Hemorrhage	0/16	0%	2/20	10%
Infection	0/16	0%	0/20	0%
Death	0/16	0%	0/20	0%

In Rutherford IIa category; CDT saved 14/16 limbs, one of them, although technical success was not achieved, the ischemia improved clinically due to opening of collateral vessels as confirmed in the post CDT arteriogrphy in comparison to preprocedural arteriography. The rest 2 patients had above knee amputation of the Rt lower limb following irresponsive ischemia to CDT. In Rutherford IIb category, CDT saved12/20 limbs in 12 patients. One patients, although technical success was not achieved, the ischemia improved clinically but unfortunately this was not enough to save his limb and had Rt above knee amputation. The rest 7 patients; 6 patients had above knee amputation of the Rt or Lt lower limb following irresponsive ischemia to CDT and one patient had Rt femoro-popliteal bypass and Rt forefoot amputation.

Correlation of patient's characteristics and presentation to patient's outcome

Catheter directed thrombolysis successfully result in limb salvage in 26 out of 36 patients (72.22%) categorized into different groups according to age, gender, BMI, risk factors and Rutherford's clinical classification of acute limb ischemia. We failed to achieve limb salvage in 10 out of 36 patients (27.78%) classified into the same groups.

- Age; Catheter directed thrombolysis successfully achieved limb salvage in 5 patients in the first age group (41 – 50 years), 12 in the second age group (51 – 60 years), 9 in the third age group (61 – 70 years) and none in the fourth age group (71 years or more).
- Gender; Catheter directed thrombolysis successfully achieved limb salvage in 16 male and 10 female patients.
- BMI; Catheter directed thrombolysis successfully achieved limb salvage in 1 normal weight, 8 overweight, 13 obese and 4 morbidly obese patients.
- Risk factors; Catheter directed thrombolysis successfully achieved limb salvage in 26 patients; 2 had no risk factors, 6 had one risk factor, 14 had two risk factors and 4 had three risk factors. Table (3) shows the correlation of number of risk factors observed in the patients and their outcome.
- In other classification of risk factors; catheter directed thrombolysis successfully achieved limb salvage in 10 smoker, 11 diabetic, 10 hypertensive, 6 cardiac and 9 hyperlipidemic patients. Figure (1) shows patient's outcome in relation to risk factors.
- Rutherford's clinical classification of acute limb ischemia; catheter directed thrombolysis successfully achieved limb salvage in 14 patients in Rutherford IIa category and 12 patients in Rutherford IIb caregory.

Table (4) shows the distribution of patient's demography and comorbidities in relation to their outcome.

Table 3
The Number of Risk Factors Observed in the Patients in Relation to their Outcome

	Success group			Failure group		
	Number	Percentage	P value	Number	Percentage	P value
No risk factor	2 out of 26	7.69%	0.0650	0 out of 10	0	0.0082
1 risk factor	6 out of 26	23.08%	0.0650	0 out of 10	0	0.0082
2 risk factors	14 out of 26	53.85%	0.0001	7 out of 10	70%	0.1025
3 risk factors	4 out of 26	15.38%	0.0650	3 out of 10	30%	0.1025

Figure (1). Pstient's Outcome in Relation to Risk Factors

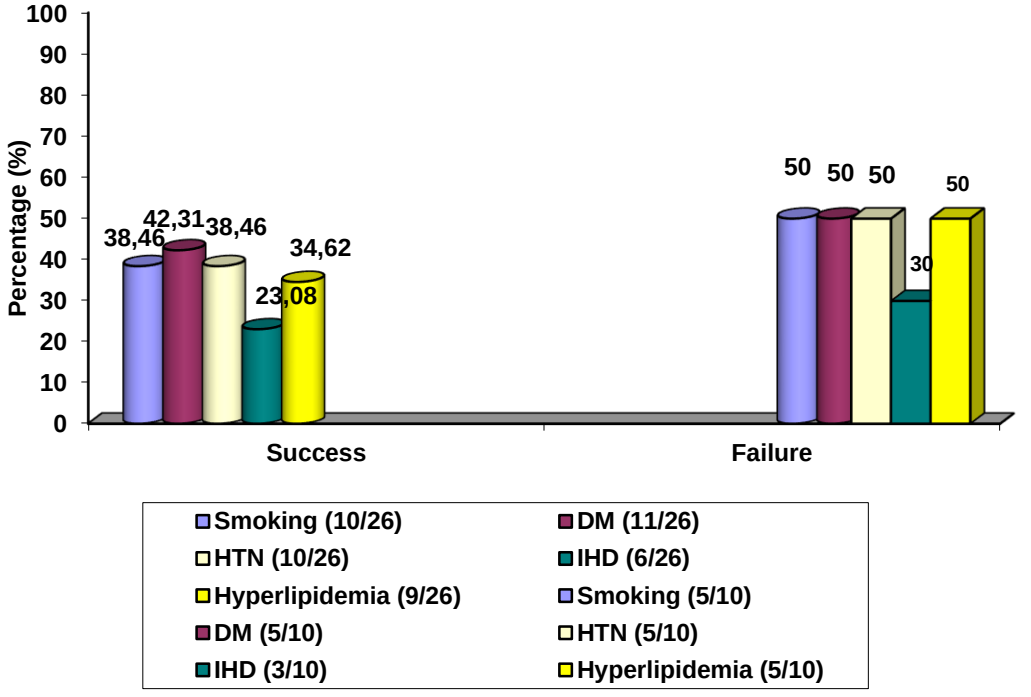

Table 4
Distribution of Patient's Demography and Comorbidities in Relation to their Outcome

Parameter	Category	Success		Failure	
		Number	Percentage	Number	Percentage
Age	41-50	5 out of 26	19.23%	1 out of 10	10%
	51-60	12 out of 26	46.15%	5 out of 10	50%
	61-70	9 out of 26	34.62%	2 out of 10	20%
	>70	0 out of 26	0%	2 out of 10	20%
Gender	Male	16 out of 26	61.54%	5 out of 10	50%
	Female	10 out of 26	38.46%	5 out of 10	50%
BMI	Normal weight	1 out of 26	3.85%	2 out of 10	20%
	Overweight	8 out of 26	30.77%	3 out of 10	30%
	Obese	13 out of 26	50%	2 out of 10	20%
	Morbidly obese	4 out of 26	15.38%	3 out of 10	30%
Risk factors	Smoking	10 out of 26	38.46%	5 out of 10	50%
	DM	11 out of 26	42.31%	5 out of 10	50%
	HTN	10 out of 26	38.46%	5 out of 10	50%
	Cardiac	6 out of 26	23.08%	3 out of 10	30%
	Hyperlipidemia	9 out of 26	34.62%	5 out of 10	50%
Rutherford Classification	IIa	14 out of 16	87.5%	2 out of 16	12.5%
	IIb	12 out of 20	60%	8 out of 20	40%

Table 5
Statistical Analysis Using Chi square Test for both Number of Success and Number of Failure Patients within Different Studied Categories

Parameter	Category	Success	Failure
Age	41-50	5	1
	51-60	12	5
	61-70	9	2
	>70	0	2
Chi square value		30.6667	5.4268
Prop (P <0.05)		0.0022	0.4901
Success by failure	Chi square value	7.7143	
	Prop (P <0.05)	0.4619	
Gender	Male	16	5

	Female	10	5
Chi square value		6	4
Prop (P <0.05)		0.1116	0.2615
Success by failure	Chi square value	13.5	
	Prop (P <0.05)	0.1413	
BMI	Normal weight	1	2
	Overweight	8	3
	Obese	13	2
	Morbidity	4	3
Chi square value		36	12
Prop (P <0.05)		<0.0001	0.0074
Success by failure	Chi square value	12	
	Prop (P <0.05)	0.0074	

				P value
Risk factors	Smoking	10	5	0.1841
	DM	11	5	0.4200
	HTN	10	5	0.5286
	Cardiac	6	3	0.1008
	Hyperlipidemia	9	5	0.1008
Chi square value		45	15	
Prop. (p < 0.05)		<0.0001	0.0047	
Success by failure	Chi square value	15		
	Prop (P <0.05)	0.0018		

Rutherford's Classification	IIa	14	2
	IIb	12	8
Chi square value		6	6
Prop (P <0.05)		0.0143	0.0143
Success by failure	Chi square value	6	
	Prop (P <0.05)	0.0143	

The statistical analysis of the results shows no significant difference between success group and failure group as regards age (Chi square value = 7.7143, P = 0.4618) and sex (Chi square value = 13.5, P = 0.1413). These values indicate that both age and sex is not a predictive parameter for either success or failure of catheter directed thrombolysis as a line of treatment in acute limb ischemia. BMI statistical analysis shows significant difference between success group and failure group (Chi square value = 12, P < 0.05). This indicates that BMI may be a valuable predictive parameter for a successful catheter directed thrombolysis in acute limb ischemia. The number of risk factors is also a valuable predictive parameter for a successful catheter directed thrombolysis in acute limb ischemia. The statistical analysis of risk factors shows significant difference between

success and failure groups (Chi square value = 15, P < 0.05). The probability of a successful catheter directed thrombolysis in acute limb ischemia is higher in patients with lesser or no risk factors. Patients presented with grade IIa acute thrombotic limb ischemia shows better results than those whom presented with grade IIb acute thrombotic limb ischemia. And with statistical analysis of these results, there is a significant difference between success and failure groups (Chi square value = 6, P < 0.05). So, the severity of ischemia at the time of presentation is of a valuable predictive value.

Discussion

Catheter directed thrombolysis (CDT) was introduced in the 1980s and its use has widely increased ever since. Compared to surgery, it is less invasive and allows concomitant management of the underlying lesions using endovascular facilities. It is well known, safe and accepted option to treat patients presented with acute thrombotic ischemia. Its outcome may be affected by some variables. The current study is designed to examine its efficacy, safety and predictors of outcome. This study included 36 patients; 21 male and 15 female patients (58.33% and 41.67% respectively), the mean age was 58.42 years. The patient's outcome in correlation with patient's age and gender were statistically insignificant mostly due to small sample number.

The patient's mean BMI was 31.56 in 4 groups. The body mass index (BMI) was the first significant predictor to outcome; success and failure results were statistically analyzed in each group and the overall analysis shows significant statistical difference between success and failure results (P <0.05). The lower is the BMI; the higher is the probability of successful results. The criticism that could be directed to these results is that we used non weight dependent instead of weight dependent regimen of alteplase in our study. The risk factors associated with acute thrombotic lower limb ischemia found in our study were smoking in 15 patients (41.67%), Diabetes mellitus in 16 patients (44.44%), Hypertension in 15 patients (41.67%), Ischemic heart disease in 9 patients (25%) and Hyperlipidemia in 14 patients (38.89%). The risk factors were statistically analyzed in two different methods; first, we divided the patients into 4 groups according to the number of risk factors (no risk factors, one risk factor, two risk factors and three risk factors) and the results of analysis of these numbers in relation to outcome were mainly insignificant mostly due to small sample number.

Second, we analyzed the effect of each risk factor separately on the patient's outcome and the results were also insignificant. But, when the sum of risk factors in success and failure groups were statistically analyzed in relation to the patient's outcome, the results were statistically significant indicating that risk factors at time of presentation may be a useful predictor to patient's outcome. Further large high quality studies are needed to prove these possibilities. The patients were classified according to Rutherford's clinical classification of acute limb ischemia; 16 patients presented with Rutherford IIa acute thrombotic limb ischemia (44.44%) and 20 patients presented with Rutherford IIb acute thrombotic limb ischemia (55.56). The success rate in patients presented with Rutherford IIa was 87.5% and in whom presented with Rutherford IIb was 60% with significant P <0.05.

So, the severity of ischemia at time of presentation is a good predictor to patient's outcome; less threatened limbs have good response to CDT. With correlation of patient's demography and clinical presentation to outcome, some variables were found to be correlated. Body mass index and clinical limb status were correlated. Also, the frequency of risk factors in an individual patient was found to be correlated. These results were supported by those of Plate et al. who showed non severe ischemia predict initially successful thrombolysis. However, body mass index and frequency of risk factors to outcome was not analyzed by Plate in his study *(Plate G et al, 2009).* Earnshaw et al. investigated clinical variable affecting outcome performed on large national audit of thrombolysis for acute leg ischemia (NATALI). Earnshaw et al. detected that diabetes, increasing age and severe ischemia were associated with worse outcome. While shorter duration of ischemia was associated with better outcome. The current study did not show association of gender and age to outcome *(Earnshaw JJ et al 2004).*

Our results are also supported by Rajan et al. who reported that sex and age do not have a significant effect on the outcome of thrombolysis *(Rajan DK et al, 2005).* Also, Kuoppala et al. did not find any association between increasing age and outcome *(Kuoppala M et al, 2008).* Ouriel and Veith proved a correlation between body weight and patient's outcome. But they showed improved outcome in heavier patients. The criticism that could be directed that Ouriel and Veith used bare body weight instead of body mass index in their study in contrast to what the current study did. That may explain this controversy. Of interest, Ouriel himself assumes that it was an accidental association rather than causality correlation. Certainly, he declared that if somebody looks at 28 variables at the 0.05 level, some may be significant by chance alone *(Ouriel and Veith 1998).* In a large retrospective study conducted by Urbak et al., CDT especially with supplementary angioplasty +/− stent confirmed to be a relatively safe and efficient procedure for acute lower limb ischemia when no irreversible ischemic damage is present at CDT start. Furthermore that study indicates that CDT is a reasonable treatment option even in patients without distal run-off at the primary angiogram and even though no run-off predicts increased rates of amputation and mortality *(Urbak L et al, 2017).*

Lian et al. used a modified Rutherford scoring system that incorporated both the distal popliteal and individual runoff scores. This allowed them to quantify the contribution of both the popliteal artery and the tibial vessels to measure procedural success. The patency rate was found to be incrementally curtailed by worsening runoff, with significant decreases as runoff category deteriorated *(Lian WS et al, 2020).* These results with fore mentioned studies including our study report a strong correlation between the severity of ischemia and clinical outcome with thrombolytic treatment. The strengths of the current study include that the provisional diagnosis of acute thrombotic limb ischemia was confirmed before the start of CDT by arteriography in the angio suite, and as we all know digital subtraction arteriography remains the gold standard in diagnosis of ALI and differentiation between embolic and thrombotic etiologies, the technical success was confirmed by arteriography at the end of the procedure and the patients were admitted in ICU with close monitoring to vital signs, response to treatment and complications.

The limitations to the current study include that it is a single center study with relatively small patient's number. Also, some variables were not assessed like patient's imaging, level of arterial occlusion and the state of distal run-off vessels at time of presentation. The prognostic values of hemostasis markers like D-dimer and FDPs on thrombolysis safety and outcome were also not assessed. Complications of CDT in the current study happened only in 2 patients presented with grade IIb acute thrombotic limb ischemia; they had minor groin haematoma that disappeared spontaneously during follow up. Future studies may investigate more options of revascularization like mechanical thrombectomy, combined methods and adjuvant techniques for revascularization like hybrid endovascular and surgical intervention. Also, larger high quality studies are needed to assess patient's variables the state of distal run-off vessels at time of presentation and the prognostic values of hemostasis markers like D-dimer and FDPs on thrombolysis safety and outcome.

Conclusions

Percutaneous catheter directed thrombolysis using actilyse is well known to be effective and safe in treating acute thrombotic ischemia. Its outcome is better with lower body mass index and less severe clinical manifestations. Patients with less or no comorbid disease are more likely to have better results.

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