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Seasonal Variation In The Occurrence, Severity And Outcome Of Acute Limb Ischemia

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ABSTRACT

Objective: To evaluate whether seasonal variation is present in the incidence, severity and prognosis of ALI.
Study Design: Retrospective longitudinal study
Place and Duration of Study: Department of Vascular surgery CMH Rawalpinidi from Jan 2021 to March 2022
Methodology: All the patients aged between 15 and 80 years with clinical diagnosis of Acute limb Ischemia confirmed by ultrasound doppler or Computed tomography angiogram warranting any intervention were included in the study. Rutherfords acute limb ischemia grade, limb involved were, co-morbid conditions and time of onset of symptoms were noted. Demographic data as time of year, surgical procedure done, outcome at time of discharge and at three months follow up were also analyzed.
Results: A total of 191 patients underwent embolectomies. There were 129 males (67.5%) and mean age of the was 58.24±10.113 years. In winters there were 86(45%) operations (21.5 surgeries per month), whereas in summer season there were 50(26.2%) (12.5 cases per month) cases (p value <0.001). In winters around 55(49.1%) patients presented with Rutherford's grade II, whereas, in summers 20(17.8%) patients had grade II ALI (p-value=0.022). Similarly, more patients suffered from complications during cold weather (p-value=0.011).
Conclusion: There is seasonal variation in the incidence of ALI. Severity of disease is also more during the winter weather and patients presenting during cold weather have higher chances of complications.

Keywords: Acute limb Ischemia, Embolectomy, Rutherford classification, Seasons

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INTRODUCTION

Critical limb ischemia (CLI) is a stage of arterial occlusive illness in which the extremity is at danger of losing function, gangrene, or limb loss. More than 2.5 million Americans were diagnosed with CLI in 2003, resulting in over 240,000 amputations in the US and Europe.[1] Critical limb ischemia may be separated into acute or chronic and has diverse etiologies and natural histories.[2]

Acute limb ischemia (ALI) is defined as any abrupt reduction in limb perfusion presenting a possible hazard to limb viability. The presentations lasted anywhere from a few hours to two weeks.[3]The lower extremities has a rate of 9–16 cases per 100,000 people per year, whereas the upper extremity has a rate of 1–3 cases per 100,000 people per year.[4] Embolization, in situ thrombosis with concurrent peripheral artery disease (PAD), graft/stent thrombosis, trauma, or peripheral aneurysm with embolism or thrombosis are some of the etiologies.[5] For the average vascular specialist, ALI management accounts for 10–16 percent of their job. Because of the significant limb loss and fatality rates associated with ALI, early detection and treatment are critical in order to save the ischemic extremity.[6] However, with breakthroughs in anticoagulation and surgical treatments, these rates have reduced over time.[7] Previous research has looked at the seasonal variance of cardiovascular disorders including Ischemic heart disease. There have been few studies on how ALI incidence varies with ambient temperature, but there is no regional data for the subcontinent. There is also evidence that the severity of ALI and other cardiovascular disorders is affected by the temperature of the surroundings.[8]

The aim of the current study is to evaluate whether seasonal variation is present in the incidence, severity and prognosis of ALI. This study would help us in formulating strategy to manage this disease in proactive manner.

METHODOLOGY

This was a retrospective longitudinal study carried out at Vascular Surgery Department, Combined Military Hospital, Rawalpindi, from Jan 2021 to March 2022. The study was commenced after

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approval from institution ethical committee (ID no 252). Sample collection was done by non-probability consecutive method. Sample size was calculated using WHO calculator keeping power of 80% and incidence of acute limb ischemia to 0.170 daily.[9]

Inclusion Criteria: All the patients aged between 15 and 80 years with clinical diagnosis of Acute limb Ischemia confirmed by ultrasound doppler or Computed tomography angiogram warranting any intervention were included in the study.

Exclusion Criteria: Patients with non salvageable limb (Rutherford III), history of previous vascular intervention or having bypass procedures cases were excluded from study.

The patients records were analyzed in retrospect. Presenting symptoms, Rutherfords acute limb ischemia grade and limb involved were noted. In addition co-morbid conditions and time of onset of symptoms were also seen. Moreover, demographic data as time of year, surgical procedure done, outcome at time of discharge and at three months follow up were also analyzed. Data was extra plotted in pre-designated performa and various factors as severity of disease and time of presentation were noted. The surgical procedures were performed by a team of trained vascular surgeons under Local or regional anesthesia.Post operatively patients were closely followed for 3 months to assess the complications during that season.

Statistical Package for Social Sciences (SPSS) version 21 was used for data analysis. Descriptive statistics were used to calculate mean and standard deviation for age, frequencies, and percentages for gender. Chi square test was applied to ascertain significance in of weather conditions on ALI presentation keeping p-value<0.05.

RESULTS

A total of 243 patients presented in emergency with ALI and out of them 52(21.4%) were delayed for any intervention and were excluded. Rest 191 patients underwent embolectomies in a year. There were 129 males (67.5%) and 62 females (32.5%). The mean age of the individuals was 58.24±10.113 years. The minimum age of patient was 32 years and the oldest case was 87 years old. In terms of co-morbid conditions most common disease was Diabetes Mellitus present in 73(38.2%) patients, followed by hypertension in 57(29.8%), ischemic heart disease in 36(18.8%) and prior stroke in 5(2.6%) patients. 20(10.5%) had no known previous illness and 120(62.8%) had more than one co-morbidities.

The monthly distribution of all embolectomies is given in Figure 1. July month had the lowest embolectomies (09) and December month had the highest number of embolectomies, 23 in total. The months of December till March were graded as winter months, April and May were graded as Spring, June till September were regarded as summers and October, November were counted as Autumn. In winters there were 86(45%) operations (21.5 surgeries per month), followed by Spring which had 31(16.2%) cases (15.5 cases per month). In summer season there were 50(26.2%) cases (12.5 cases per month) and in Autumn there were 24(12.6%) patients (12 cases per month). There was significant difference between the seasons especially in summers and winters (p value <0.001).

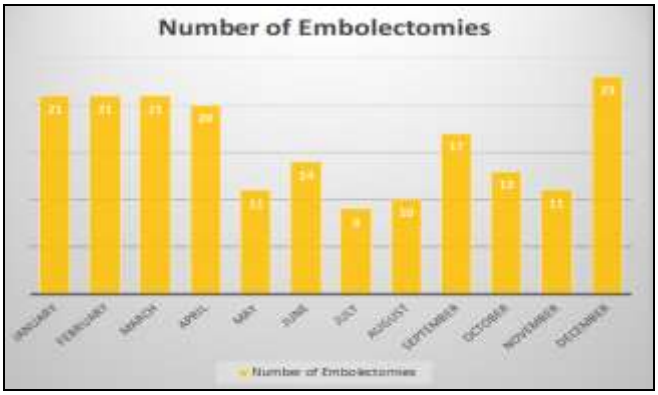

Figure-1: Number of Embolectomies Done in Each Month of Year 2020

There were a total of 161(84.3%) transfemoral emboletomies, 28(14.7%) trans brachial embolectomies and 2 (1%) trans-popliteal embolectomies. In terms of severity, there were 79(41.4%) patients of Rutherford's Grade I ALI, 74(38.7%) patients of Rutherford's Grade IIa ALI and 38(19.9%) patients of Rutherford's Grade IIb ALI. Rutherford's Grade III ALI were excluded from study. Analysis showed that 38.7% patients suffered some form of complications after embolectomies in winter season. Three months follow up showed symptomatic improvement in 139(72.8%), 43(22.5%) progressed to Critical limb ischemia warranting further intervention and mortality was 9(4.7%). Further association in terms of complication, outcome and seasonal variation is shown in Table.

A total of 62(32.5%) patients suffered various forms of complications. The break up of complications is shown in figure 2.

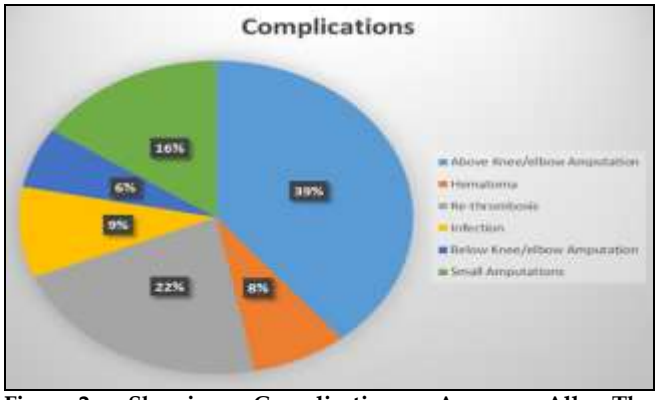

Figure-2: Showing Complications Among All The Embolectomies (n=62)

peripheral vascular disease present late and limb loss was as high as 60% in ALI.[12]

There was male (67.5%) preponderance in our study which was also evident in a study Takahara M and colleagues which showed 62% were males.[13]The mean age of presentation in our study was 58.24±10.113 years. The co-relates well with study conducted in on limb ischemia in other parts of the country.**Error! Bookmark not defined.** However, when comparing with international literature, a study in Japan showed a mean age of 73±10 years in patients of limb ischemia.[14] Most of the embolectomies were done on lower limb (85.3% Vs 14.7%). Transfemoral embolectomy was the most common. Lower limb have higher incidence of Ischemia because of muscle bulk and less collaterals. [15]

Pakistan lies in sub-tropical climate

Table: Showing Association of Seasons with Severity,Complications and Outcome At 3 Months Follow Up of All Embolectomies (n=191)

S.no	Severity	Winter	Spring	Summer	Autumn	*p*-value
1	Rutherford's I	31(39.2%)	10(12.7%)	30 (38%)	8 (10.1%)	0.022
	Rutherford's IIa	40(54.1%)	10(13.5%)	13(17.6%)	11(14.9%)	
	Rutherford's IIb	15(39.5%)	11(28.9%)	7(18.4%)	5(13.2%)	
	Complications					
2	No	62(48.1%)	13(10.1%)	37(28.7%)	17(13.2%)	0.011
	Yes	24(38.7%)	18(29.0%)	13(21.0%)	7(11.3%)	
	Outcome at 3 month Follow up					
3	Improvement	63(45.3%)	20(14.4%)	38(27.3%)	18(12.9%)	0.219
	Critical Limb Ischemia	21(48.8%)	8(18.6%)	11(25.6%)	3(7.0%)	
	Mortality	2(22.2%)	3(33.3%)	1(11.1%)	3(33.3%)	

DISCUSSION

In the present study we investigated the affect of various seasons on the outcomes of ALI who underwent embolectomies in one year in terms of incidence, severity and prognosis. Previously various studies were conducted to ascertain affects of ambient temperature on occurrence of various cardiovascular diseases as myocardial infarction and stroke in Pakistan but no study was done on Peripheral vascular disease.[10,11] To the best of our knowledge this is the first study conducted in a tertiary care hospital to see seasonal variations of ALI. The information gathered from the study would help in the bed management during peak seasons and doctors could be educated to keep a low threshold to diagnose ALI.

Approximately 21.4% patients presented with Rutherford grade III presentation. A study done in Agha Khan Hospital also showed that most patients of

area.Rawalpindi is part of Punjab province in which during winters temperature go as low as 2-8 degree celsius and during summers can be as high as 40-44 degree celsius. We found that as the temperatures dropped there was a increase in influx of patients with ALI warranting surgical intervention. In winters there were 86(45%) operations (21.5 surgeries per month), followed by Spring which had 31(16.2%) cases (15.5 cases per month). In summer season there were 50(26.2%) cases (12.5 cases per month) and in Autumn there were 24(12.6%) patients (12 cases per month). A study done by Soni G in USA also showed that during months of January and February there were a total of 840 cases of ALI which were almost doubled as compared to summer months.[16] Similarly, a research conducted in Singapore found that the daily incidence was 0.274 at zero degrees Celsius, and that the incidence decreased by 0.040 for every 10 degrees Celsius increase. The daily incidence of ALI was 0.154 at 30 degrees Celsius.[9] Whereas study in Japan showed

peak incidence of limb ischemias in March.[Error! Bookmark not defined.3]

We also noticed that severity of ischemia was also affected by seasonal variation. In winters around 55 (49.1%) patients presented with Rutherford's grade II, whereas, in summers 20(17.8%) patients had grade II ALI. There was significant difference between the two (*p* value=0.022). Similar pattern was also observed in study by Takahara M. They also noticed that difference was more marked in severe cases of limb ischemia.[12] Similarly, more patients suffered from complications during cold weather (*p*-value=0.011). There was some sort of amputation in more than half of the complicated cases. The most common was above knee amputation present in 24(39%) cases. This can be either due to progressive nature of disease or re-thrombosis. The compliance to medicine can also be the issue but it was not assessed. A study done by Earnshaw JJ et al showed that even after intervention around15-20% patients still have to under go some sort of amputation.[17] Three months follow up showed mortality of 4.7% although causes were not assessed. In 22% cases the disease progressed to Critical limb Ischemia requiring further intervention. This pattern of seasonal variation among ALI patients is unknown.However, as various other cardiovascular diseases also show seasonal change, the underlying mechanism could be same.[18] One possible explanation can be initiation of vasoconstriction on peripheral vasculature upon exposure to cold. There is however, ambiguity regarding effect of cold on macrovascular blood flow.[19]

LIMITATION OF STUDY

There were a few limitations of study. We included only one center and other centers of Rawalpindi were not enlisted. The study being retrospective in nature has inherent short comings of recall bias and in complete notes. Moreover, the level of disease occlusion, ethnicity and endemic home town of patients were not taken in to account. The study's biggest strength is that it is the first of its kind to investigate the seasonal variation on occurrence, severity and prognosis of ALI. We propose several activities at various levels to enhance the results based on the findings. It is important to sensitize the administration to enhance bed capacity of vascular units during winters as well as educating the emergency residents to identify early signs and symptoms of ALI especially in cold weather.

CONCLUSION

There is seasonal variation in the incidence of ALI. Severity of disease is also more during the winter weather and patients presenting during cold weather have higher chances of complications. Although further research on this topic is warranted.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MWB & ABS: Data acquisition, data analysis, critical review, approval of the final version to be published.

AM & MJ: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

I & KS: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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