

EQ-5D-5L and VascuQoL-6 in Assessing the Quality of Life of Patients with Critical Lower Limb Ischemia After Endovascular Treatment

Maksud Muminovich Shermatov*, Mirjamol Mirumarovich Zufarov

Republican Specialized Scientific and Practical Medical Center of Surgery named after academician V.Vakhidov, Tashkent, Uzbekistan

Abstract *Objective.* To evaluate the dynamics of quality of life (QoL) in patients with critical lower limb ischemia (CLLI) after X-ray endovascular interventions and to identify clinical predictors that determine long-term results. *Material and methods.* The study included 84 patients with CLLI, all of whom underwent endovascular procedures (balloon angioplasty, stenting, combined interventions). The average age was 67.1 ± 9.5 years; male — 65.5%. The universal EQ-5D-5L scale and the vascular-specific VascuQoL-6 scale were used to assess QOL. The assessment was carried out before the intervention, as well as 6 months, 1 year, 2 years and 3 years after treatment. Clinical outcomes were compared with medical records and included amputations, repeat revascularizations and patient mobility. Statistical analysis included parametric and nonparametric statistics methods, logistic regression to determine the factors associated with low QoL. *Results.* A statistically significant improvement in QoL was found during the first year after the intervention: EQ-5D-5L increased from 0.48 to 0.77 ($p < 0.001$), VascuQoL-6 - from 2.8 to 5.0 ($p < 0.001$). Subsequently, stabilization of the indicators was noted without a significant increase ($p > 0.1$). By the 3rd year of observation, the differences in EQ-5D-5L between the main group and the comparison group remained (0.76 versus 0.60). Comparison of the subgroups with and without amputation after 2 years did not reveal statistically significant differences ($p > 0.3$), indicating the leading role of functional status and rehabilitation. Multivariate analysis showed that independent predictors of decreased QoL were older age ($p < 0.001$), non-ambulatory status ($p < 0.001$) and severe pain syndrome ($p < 0.001$), while intensive rehabilitation, high quality of revascularization and psychosocial support had a significant positive effect ($p < 0.001$). *Conclusion.* Endovascular revascularization in patients with CLI provides a significant improvement in QoL during the first year after the intervention with subsequent stabilization of the effect. Long-term QoL indicators are determined not so much by the fact of amputation as by the functional status, quality of vascular reconstruction, pain level and the effectiveness of rehabilitation. The obtained results substantiate the need for a multidisciplinary approach with an emphasis on pain control, restoration of mobility and social adaptation. Our results recommend considering quality of life assessment (EQ-5D-5L and VascuQoL-6) as a mandatory component of monitoring the effectiveness of CLI treatment in clinical practice.

Keywords Critical lower limb ischemia, Quality of life, EQ-5D-5L, VascuQoL-6, Endovascular revascularization, Predictors, Rehabilitation

1. Introduction

Critical limb-threatening ischemia (CLTI) represents the most severe form of peripheral artery disease (PAD), associated with high mortality, amputation risk, and a profound decline in quality of life (QoL); terminology and the prioritization of QoL assessment were established in the Global Vascular Guidelines (GVG, 2019) [1]. For quantitative evaluation of QoL in CLTI, both generic and vascular-specific PROMs are utilized.

Among validated instruments, the most widely applied are EQ-5D-5L (generic, suitable for utility calculation) and VascuQoL-6/25 (vascular-specific, with established responsiveness to clinical change and defined MID/SCB thresholds) [2–4]. These instruments demonstrate acceptable validity and responsiveness in PAD/CLTI patients, ensuring both cross-group comparability (EQ-5D-5L) and symptom-specific sensitivity (VascuQoL-6).

Pooled evidence from a meta-analysis (EJVES, 2022) indicates moderate improvement in QoL following revascularization in CLTI, with low-to-moderate certainty of evidence and comparable trajectories after open and endovascular interventions; after Major lower extremity

* Corresponding author:

shermatov@yahoo.com (Maksud Muminovich Shermatov)

Received: Apr. 4, 2026; Accepted: Apr. 22, 2026; Published: Apr. 25, 2026

Published online at <http://journal.sapub.org/ajmms>

amputation (MLEA) or conservative management, QoL is generally maintained at baseline levels [5]. Randomized data from BEST-CLI (Circulation, 2024) demonstrated a sustained improvement in HRQoL across major scales following revascularization in CLTI patients [6].

Predictors of low preoperative HRQoL in BEST-CLI patients included lack of independent ambulation, smoking, opioid use, and female sex, confirmed by multivariable analyses across several instruments (VascuQoL, EQ-5D, SF-12) [7]. These findings support the inclusion of functional status and behavioral factors in the design of QoL studies in CLTI.

For purposes of comparability with clinical outcomes and cost-effectiveness assessment, a combined strategy of EQ-5D-5L (utility, comparability) plus VascuQoL-6 (vascular-specific sensitivity) is advisable; this approach is consistent with evidence on the high suitability of EQ-5D in PAD patients and the validated responsiveness of VascuQoL-6 [2,3,8,9].

Objective

To evaluate the dynamics of QoL in patients with CLTI after X-ray endovascular interventions and to identify clinical predictors that determine long-term results.

2. Material and Methods

A prospective cohort study was conducted with a follow-up period of three years, including multiple assessment time points: baseline (prior to intervention), 6 months, 1 year, 2 years, and 3 years after treatment.

The study enrolled 84 patients with a confirmed diagnosis of CLTI according to the Global Vascular Guidelines (GVG, 2019) [1]. Exclusion criteria included individuals with end-stage comorbidities and patients unable to complete questionnaires.

For comprehensive evaluation of QoL, a combination of EQ-5D-5L and VascuQoL-6 was employed. This approach allowed for simultaneous assessment of global and disease-specific domains with minimal burden on patients.

In addition to questionnaire-based assessment, clinical events were recorded: amputations (presence, level-major/minor, and timing); repeat revascularizations (intervention type—angioplasty or bypass, and interval); and mobility (independent ambulation, use of assistive devices). Data sources included medical records, operative logs, and standardized questionnaires.

The mean age was 67.1±9.5 years (range 42–86 years, median 67 years). The cohort consisted of 55 men (65.5%) and 29 women (34.5%). The majority were elderly patients (60–74 years, 62%), followed by senile patients (≥75 years, 19%), while younger individuals (<60 years) were less frequent (19%).

Multimorbidity was characteristic of the entire cohort. Arterial hypertension was present in 82 patients (97.6%). Coronary artery disease was diagnosed in 63 patients (75.0%), and chronic heart failure (stage III or higher) in 38 (45.2%). A history of myocardial infarction or coronary

intervention (PCI/CABG) was noted in 14 patients (16.7%).

Table 1. Demographic and clinical characteristics of the patients (n=84)

Characteristics	n	%
Age, years	67.1±9.5	
Male	55	65.5%
Female	29	34.5%
Associated pathology		
Arterial hypertension	82	97.6%
Ischemic heart disease	63	75.0%
Chronic heart failure stage III and higher	38	45.2%
Previous myocardial infarction/coronary intervention	14	16.7%
Chronic cerebral circulation insufficiency	17	20.2%
Chronic kidney disease	9	10.7%
Smoking (active/history)	52	61.9%
Obesity	34	40.5%

Rest pain was reported in 74 patients (88.1%). Trophic disorders were documented in 72 patients (85.7%), including gangrene in 33 (39.3%), trophic ulcers in 21 (25.0%), non-healing wounds in 9 (10.7%), phlegmon in 6 (7.1%), and soft tissue necrosis in 3 (3.6%).

The right lower limb was affected in 36 patients (42.9%), the left in 39 (46.4%), and bilateral involvement was observed in 9 (10.7%).

All patients underwent endovascular interventions: balloon angioplasty in 61 cases (72.6%); stenting (as a standalone procedure or combined with balloon dilatation) in 18 cases (21.4%); and combined endovascular interventions with retrograde access in 5 cases (6.0%).

Table 2. Localization of lesions and performed endovascular interventions

Localization	n	%
CLTI, right	36	42.9%
CLTI, left	39	46.4%
Bilateral	9	10.7%
Endovascular interventions		
Balloon angioplasty	61	72.6%
Stenting (isolated or combined)	18	21.4%
Combined procedures with retrograde access	5	6.0%

Thus, the studied cohort (n = 84) represents a demographically and clinically typical sample of patients with severe CLTI, characterized by a high level of multimorbidity, male predominance, and an age distribution skewed toward the elderly and senile groups, with all patients undergoing endovascular interventions.

3. Results

The results demonstrate a positive trend in QoL at all follow-up stages (Fig. 1). According to EQ-5D-5L, scores increased from 0.48 at baseline to 0.76 at 3 years. According to VascuQoL-6, values rose from 2.8 to 4.0.

It was also noted that, at the 2-year follow-up, no statistically significant differences in quality of life were observed between patients with and without amputation: mean EQ-5D-5L

index scores were 0.76 and 0.75 ($p=0.829$), EQ-5D-5L VAS scores were 70.1 and 68.6 ($p=0.584$), and VascuQoL-6 scores were 4.88 and 5.05 ($p=0.346$), respectively (Table 3).

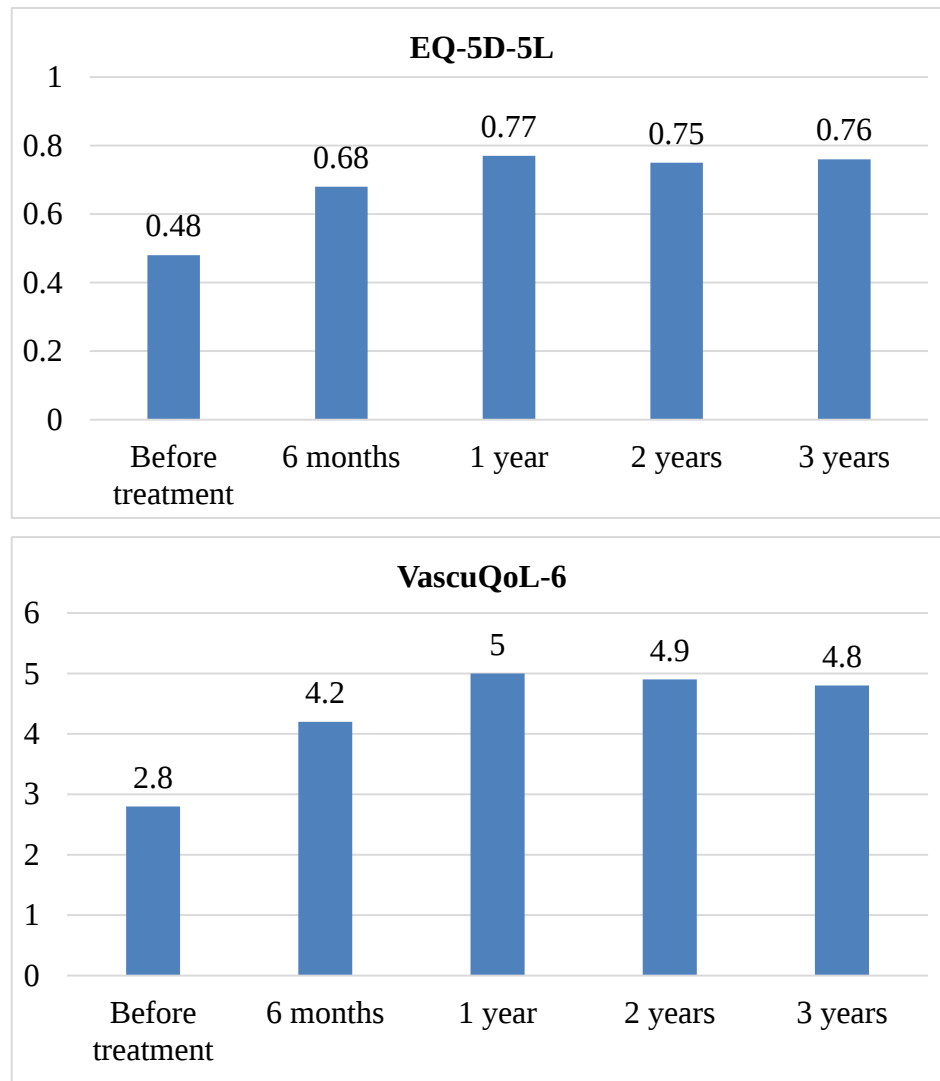


Figure 1. Dynamics of EQ-5D-5L and VascuQoL over time

Table 3. EQ-5D-5L and VascuQoL in subgroups with and without amputation

Amputation	EQ-5D-5L after 2 years	EQ-5D-5L self-assessment scale	VascuQoL-6 after 2 years
No	0,76	70,1	4,88
Yes	0,75	68,6	5,05
p-value	0,829	0,584	0,346

Table 4. Dynamics of QoL (n=84)

Variable	p-value	Interpretation
Δ EQ-5D Index (before → 1 year)	<0.001	Significant improvement
Δ EQ-5D Index (1 year → 2 years)	0.208	No statistically significant difference
Δ EQ-VAS (before → 1 year)	<0.001	Significant improvement
Δ EQ-VAS (1 year → 2 years)	0.128	Improvement is unstable, statistically insignificant
Δ VascuQoL-6 (before → 1 year)	<0.001	Significant improvement in vascular-specific QOL
Δ VascuQoL-6 (1 year → 2 years)	0.728	Stabilization, no significant dynamics

Table 5. Factor analysis of low QoL based on EQ-5D-5L and VascuQoL-6 data

EQ-5D-5L			
Variable	OR	p-value	Interpretation
Amputation	0.65	0.365	Not associated with low QOL
Re-intervention	1.13	0.771	No effect
Mobility	1.34	0.307	Tendency, but not significant
EQ-5D-5L			
Variable	β (coef.)	p-value	Significance
Age	−0.001	<0.001	Significant decrease in QOL with age
Non-ambulatory	−0.054	<0.001	Strong negative effect
Intensity of rehabilitation	+0.019	<0.001	Positive impact
Pain level	−0.009	<0.001	The higher the pain, the lower the QOL
Quality of revascularization	+0.022	<0.001	Significant contribution
Psychosocial support	+0.001	<0.001	Positive impact
VascuQoL-6			
Age	−0.015	<0.001	Moderate decrease in QOL
Non-ambulatory	−0.353	<0.001	One of the strongest factors for decreasing QOL
Intensity of rehabilitation	+0.459	<0.001	Most pronounced positive impact
Pain level	−0.123	<0.001	Very pronounced decrease in QOL with pain
Quality of revascularization	+0.405	<0.001	Strong positive impact
Psychosocial support	+0.018	<0.001	Significant role of support

Analysis of QoL dynamics (Table 4) demonstrated that during the first year after treatment, there was a statistically significant improvement across all assessment scales: EQ-5D Index ($p<0.001$), EQ-VAS ($p<0.001$), and VascuQoL-6 ($p<0.001$), reflecting both global and vascular-specific enhancement of QoL.

In the subsequent period (from year 1 to year 2), no significant positive changes were observed: EQ-5D Index $p=0.208$, EQ-VAS $p=0.128$, VascuQoL-6 $p=0.728$, indicating stabilization of the achieved effect without further statistically significant gains.

Comparison of patients with and without amputation at the 2-year follow-up revealed no significant differences across all scales (EQ-5D Index $p=0.829$, EQ-VAS $p=0.584$, VascuQoL-6 $p=0.346$).

Despite the presence of amputation in a subset of patients (20%), no differences in quality of life (QoL) were observed after 1 year, which may indicate a high level of adaptation or compensatory mechanisms. The univariate logistic regression model (Table 5) aimed at identifying predictors of low QoL (EQ-5D < median) revealed no statistically significant associations with any of the examined factors. Amputation (OR=0.65; $p=0.365$) and reintervention (OR=1.13; $p=0.771$) did not demonstrate a relationship with low QoL scores, while limited mobility showed only a statistically non-significant trend toward increased risk (OR=1.34; $p=0.307$). This indicates that the reduction in QoL is not directly determined by these clinical variables and is likely attributable to the combined influence of other factors.

Multivariate analysis demonstrated that in the long-term postoperative period, QoL in patients with CLTI, as assessed

by the EQ-5D-5L and VascuQoL-6 scales, was reliably and independently determined by the following predictors: older age was associated with decreased QoL scores ($p<0.001$); non-ambulatory status was among the strongest negative factors ($p<0.001$); and higher pain intensity was likewise accompanied by a significant deterioration in QoL ($p<0.001$). At the same time, high-intensity rehabilitation, adequately performed revascularization, and the presence of psychosocial support exerted a significant positive influence ($p<0.001$), contributing to improved long-term outcomes.

4. Discussion

Thus, in the long-term postoperative period, QoL in patients with CLTI is determined not so much by the fact of amputation, but rather by functional status (mobility), the quality of vascular reconstruction, the intensity of rehabilitation, pain level, and social adaptation. Age and the presence of hypertension are also significant, although less modifiable, predictors. These findings confirm the clinical importance of a strategy that emphasizes multidisciplinary rehabilitation, effective pain management, and optimization of vascular restoration in improving QoL.

The study results demonstrate a significant and sustained improvement in QoL among patients with CLTI following endovascular revascularization, which is consistent with findings from large randomized and prospective trials. According to BEST-CLI (2024), patients with chronic limb-threatening ischemia (CLTI) who underwent revascularization (either endovascular or bypass) exhibited statistically significant

improvements in HRQoL measured by VascuQoL, EQ-5D, SF-12, and other scales-independent of the intervention type [6].

A meta-analysis by Shan LL et al. (2022) confirmed similar trends: revascularization substantially improved both general and disease-specific QoL in patients with CLTI [5]. This further strengthens the rationale for endovascular procedures as not only limb-saving but also transformative for patient experience.

Our data demonstrate stable QoL dynamics regardless of amputation status, particularly during the 1-2-year period—are in line with findings from Peters et al. (2020), where even elderly patients with limited life expectancy or without further treatment options maintained relatively stable QoL until the end of follow-up [10]. This highlights the critical role of adaptation, restoration of mobility, and pain control.

In the study by Paius et al. (2023), interventions delivered within a multidisciplinary framework (vascular surgeon + rehabilitation specialist + psychologist) were shown to produce substantial improvements in HRQoL among CLTI patients [11]. Our results, confirming the positive impact of intensive rehabilitation and psychosocial support on long-term QoL, further validate the effectiveness of such approaches.

In the long-term period, the main predictors of reduced QoL were identified as older age, inability to ambulate independently, and severe pain. Conversely, intensive rehabilitation, high-quality revascularization, and psychosocial support emerged as independent factors associated with improved QoL.

These findings are concordant with the literature: in BEST-CLI (Powell et al., 2022), predictors of low QoL included female sex, smoking, and impaired mobility—underscoring that interventional treatment should be accompanied by strategies focused on mobility restoration and pain reduction [7].

Our study has clear strengths, including the combined use of EQ-5D-5L and VascuQoL-6, its prospective design, and long follow-up period. Nevertheless, limitations include the lack of randomization and the absence of a non-intervention control group, which reduce the level of evidence. Moreover, the presence of amputations and repeat interventions may have exerted non-global influences on QoL perception, requiring further in-depth analysis.

Future steps should involve the inclusion of comparative cohorts and the application of more advanced tools for psycho-emotional assessment (e.g., SF-36, Beck Depression Inventory), which would allow deeper exploration of the mechanisms through which interventions impact quality of life.

5. Practical Significance and Recommendations

Our findings recommend considering QoL assessment (EQ-5D-5L and VascuQoL-6) as a mandatory component of

monitoring treatment effectiveness in CLTI clinical practice. The combination of a generic and a disease-specific instrument enables objective evaluation of intervention outcomes and allows for reliable tracking of dynamics throughout long-term follow-up.

Given the identified predictors, optimization of vascular reconstruction, intensive rehabilitation measures, adequate pain control, and the provision of psychosocial support should be regarded as priority strategies in the management of CLTI patients. These measures have not only clinical relevance but also proven significance in improving the long-term QoL of patients.

6. Conclusions

Endovascular revascularization in patients with CLI provides a significant improvement in QoL during the first year after the intervention with subsequent stabilization of the effect. Long-term QoL indicators are determined not so much by the fact of amputation as by the functional status, quality of vascular reconstruction, pain level and the effectiveness of rehabilitation. The obtained results substantiate the need for a multidisciplinary approach with an emphasis on pain control, restoration of mobility and social adaptation.

REFERENCES

- [1] Conte MS, Bradbury AW, Kolh P, et al. Global Vascular Guidelines on the Management of Chronic Limb-Threatening Ischaemia. *Eur J Vasc Endovasc Surg.* 2019; 58(1S): S1–S109.e33. doi: 10.1016/j.ejvs.2019.05.006.
- [2] Larsen ASF, Reiersen AT, Jacobsen MB, et al. Validation of the Vascular Quality of Life Questionnaire-6 (VascuQoL-6) for clinical use in PAD. *Health Qual Life Outcomes.* 2017; 15(1): 187. doi: 10.1186/s12955-017-0760-3.
- [3] Hageman D, Fokkenrood HJP, Teijink JAW, et al. Vascular Quality of Life Questionnaire-6 Before and After Supervised Exercise Therapy in Patients with Intermittent Claudication: establishing MID/SCB. *Eur J Vasc Endovasc Surg.* 2022; 63(4): ePub ahead/print doi: 10.1016/j.ejvs.2021.11.019.
- [4] Shan LL, Yang LS, Tew M, Westcott MJ, Spelman TD, Choong PF, Davies AH. Measuring Quality of Life in Chronic Limb-threatening Ischemia Patients and Informal Carers: A Scoping Review. *Ann Surg.* 2022; 276(5): e331–e341. doi: 10.1097/SLA.0000000000005477.
- [5] Shan LL, Yang LS, Tew M, Westcott MJ, Spelman TD, Choong PF, Davies AH. Quality of Life in Chronic Limb Threatening Ischaemia: Systematic Review and Meta-Analysis. *Eur J Vasc Endovasc Surg.* 2022; 64(6): 666–683. doi: 10.1016/j.ejvs.2022.07.051.
- [6] Menard MT, Farber A, Powell RJ, et al. Quality of Life in Patients With Chronic Limb-Threatening Ischemia Treated With Revascularization (BEST-CLI). *Circulation.* 2024; 149(16): 1241–1253. doi: 10.1161/CIRCULATIONAHA.123.065277.

- [7] Powell RJ, Choudhry N, Conte M, Cziraky M, Giles K, Hamza T, et al. Factors associated with lower preoperative quality of life in patients with chronic limb-threatening ischemia in the BEST-CLI trial. *J Vasc Surg.* 2022; 76(6): 1642–1650. doi: 10.1016/j.jvs.2022.06.004.
- [8] Petersohn S, Ramaekers BLT, Olie RH, ten Cate-Hoek AJ, Daemen J-WHC, ten Cate H, Joore MA. Comparison of three generic quality-of-life metrics in peripheral arterial disease patients undergoing conservative and invasive treatments. *Qual Life Res.* 2019; 28(8): 2257–2279. doi: 10.1007/s11136-019-02166-0.
- [9] Kim M, Kim Y, Ryu GW, Choi M. Functional Status and Health-Related Quality of Life in Patients with Peripheral Artery Disease: a Cross-Sectional Study. *Int J Environ Res Public Health.* 2021; 18(20): 10941. doi: 10.3390/ijerph182010941.
- [10] Peters CML, Lodder P, de Vries J, et al. Two-year Outcome of Quality of Life and Health Status for the Elderly with Chronic Limb-threatening Ischemia. *Clin Interv Aging.* 2020 Dec 22; 15: 2383-2395. doi: 10.2147/CIA.S272078.
- [11] Paius CT, Constantin VD, Carap A, Tarus A, Tinica G. Revascularization Impact: Quality of Life Enhancement in Chronic Limb-Threatening Ischemia. *J Mind Med Sci.* 2023; 10(2): 321–329. doi: 10.22543/2392-7674.1441.