ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25oct1384

Role of Supervised Exercise Rehabilitation in Enhancing Functional Capacity and Quality of Life in a Patient with Takayasu Arteritis: A Case Report

Dr. Bhumika Gulab Marathe[1*]; Dr. Madhuri Shubhas Shinde[2]

[1]1st Year MPTh (Cardiovascular and Respiratory Physiotherapy)
[2] 1st Year MPTh (Musculoskeletal Physiotherapy) Department of Cardiovascular and Respiratory Rashtra sant Janardhan Swami College of Physiotherapy Kopargaon,423601.

Corresponding Author: Dr. Bhumika Gulab Marathe*

Publication Date: 2025/11/07

Abstract: Takayasu arteritis (TA) is a rare, chronic, granulomatous inflammatory disorder that primarily involves the aorta and its major arterial branches, leading to ischemic complications such as claudication and functional impairment. While immunosuppressive therapy remains the cornerstone of management, supervised exercise training (SET) has emerged as a promising adjunct for improving functional outcomes, though supporting evidence remains limited. This case report presents a 32-year-old female diagnosed with TA, experiencing progressive bilateral upper-limb claudication for four years.. Baseline evaluation showed severe functional impairment with a claudication distance of 45 m, 6-minute walk distance (6MWD) of 298 m, DASH score of 74/100, and elevated inflammatory markers (CRP 15 mg/L, ESR 32 mm/hr). The patient underwent a 16-week SET program (45 min, three sessions per week), combining aerobic, resistance, and functional training tailored to her cardiovascular tolerance. Following intervention, significant improvements were observed: claudication distance increased to 220 m (+389%), 6MWD improved to 485 m (+63%), and peak VO_2 rose by 35% (18.2 → 24.6 mL/kg/min). Pain scores reduced by 63%, handgrip strength improved by 44–50%, and DASH score decreased by 49%. Quality-of-life indices (SF-36 PCS and MCS) improved by 86% and 40%, along with a reduction in inflammatory markers (CRP and ESR decreased by 47% and 31%), with CRP and ESR levels reduced by 47% and 31%. No adverse cardiovascular or musculoskeletal events occurred. This case suggests that structured supervised exercise training is a feasible, safe, and effective adjunct to medical management in TA, contributing to enhanced limb function, cardiovascular capacity, and overall quality of life.

Keywords: *Takayasu Arteritis, Supervised Exercise Training, Claudication, Vascular Rehabilitation, Aerobic Capacity, Inflammatory Markers.*

How to Cite: Dr. Bhumika Gulab Marathe; Dr. Madhuri Shubhas Shinde (2025) Role of Supervised Exercise Rehabilitation in Enhancing Functional Capacity and Quality of Life in a Patient with Takayasu Arteritis: A Case Report.
International Journal of Innovative Science and Research Technology,
10(10), 2675-2680 https://doi.org/10.38124/ijisrt/25oct1384

I. INTRODUCTION

Takayasu arteritis (TA) is a chronic, immune-mediated large-vessel vasculitis that predominantly involves the aorta and its main arterial branches. According to recent epidemiological research conducted between 2020 and 2024, the incidence varies significantly by region and ranges from 13 to 40 per million people worldwide[1]. Studies indicate that Asian populations have the highest prevalence, with recent comprehensive reviews verifying incidence rates of 1.04–1.18 per million[2]. Young women, particularly under the age of 40, are the main victims of TA, with a notably high female-to-male ratio[3].

Clinical manifestations such as claudication, hypertension, and vascular bruits severely affect patients' functional abilities and quality of life. Although about 10% of individuals remain asymptomatic, the clinical signs and symptoms of TA can vary widely and may include systemic manifestations such as fever, arthralgias, and malaise[4]. Recent cohort studies report that approximately 60–85% of TA patients experience claudication, which remains one of the most disabling symptoms[5].

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25oct1384

Since 2020, traditional management strategies have undergone substantial refinement, emphasizing individualized and evidence-based treatment plans[6]. The diagnosis and treatment guidelines for Takayasu arteritis, published in China in 2023, provide updated, evidence-based recommendations for standardized diagnosis and care[7]. Although still under investigation, Structured supervised exercise therapy has gained recognition as an effective intervention for enhancing walking capacity and overall functional performance in individuals with chronic arterial conditions[8].

Exercise-based interventions for TA patients have shown promising results in trials conducted between 2020 and 2024. Exercise therapy appears to be safe, well-tolerated, and effective; it enhances muscular strength and overall function while exerting immunomodulatory and pro-angiogenic effects in TA[9]. A recent multicenter randomized controlled trial provided evidence that home-based exercise interventions are both safe and potentially beneficial in managing childhood-onset Takayasu arteritis, demonstrating improvements in arterial inflammation, physical activity levels, and overall health outcomes [10].

The beneficial effects of exercise in TA are mediated through improved muscle oxidative capacity, enhanced collateral circulation, optimized biomechanics, and possible immunomodulatory mechanisms[11]. Given its influence on both vascular and cardiac systems, exercise has a dual impact on patients with TA, making customized exercise regimens essential for optimal prevention, management, and rehabilitation[12].

II. CASE PRESENTATION

➢ *Patient Information*

A 32 year old female software developer came to our specialized vascular rehabilitation unit with a 4-year history of progressive bilateral arm claudication. She reported experiencing severe fatigue and cramping pain in both arms after performing minimal activities such as typing for approximately eight minutes, lifting objects weighing more than 1.5 kg, or engaging in overhead activities for more than 30 seconds.

➢ *Clinical Findings*

Medical History: The patient was diagnosed with Takayasu arteritis five years prior following comprehensive evaluations for secondary hypertension and progressive arm claudication. Her initial presentation was marked by nonspecific constitutional symptoms including fever, malaise, and a significant unintentional weight loss of approximately 8 kg over six months, which preceded the onset of vascular symptoms characteristic of Takayasu arteritis. She has been receiving tocilizumab at a dosage of 8 mg/kg monthly for the past 18 months, following an inadequate therapeutic response to conventional immunosuppressants, representing the current best practice for refractory Takayasu arteritis.

➢ *Physical Examination:*

- Blood pressure: Right arm 185/98 mmHg, Left arm 170/92 mmHg (pressure gradient >15 mmHg)
- Absent radial and ulnar pulses bilaterally
- Diminished brachial pulses bilaterally (graded 1+/4+)
- Bilateral carotid and subclavian bruits present
- Aortic regurgitation murmur, grade 2/6
- Body mass index: 23.8 kg/m²
- No clinical signs of active inflammation or constitutional symptoms observed

➢ *Comprehensive Functional Assessment*

- Arm claudication distance: 45 meters of normal walking pace
- 6-minute walk test: 298 meters (predicted: 520-580m for age/sex)
- The Disabilities of the Arm, Shoulder, and Hand (DASH) score was 74 out of 100, indicating a high level of functional impairment in the upper limb.
- Visual Analog Scale (VAS) for arm pain: 8/10
- The Physical Component Score (PCS) of the Short Form-36 (SF-36) was 28 out of 100, reflecting substantial limitations in the patient's physical health and functional status.
- Fatigue Severity Scale: 6.2/7.0
- Hand grip strength: Right 18 kg, Left 16 kg (normal: 25-35 kg)

➢ *Advanced Diagnostic Assessment*

- CT angiography: Severe stenosis of bilateral subclavian arteries (85% right, 78% left), moderate left common carotid stenosis (55%), and mild aortic root dilatation
- Magnetic Resonance Angiography (MRA): Aortic wall enhancement consistent with ongoing inflammatory activity despite clinical remission
- Echocardiography: Mild aortic regurgitation, preserved left ventricular function (EF 58%)

➢ *Laboratory Values:*

- ESR: 32 mm/hr (normal: <20)
- CRP: 15 mg/L (normal: <3)
- Interleukin-6: 8.2 pg/mL (normal: <7.0)
- Complete blood count revealed mild normocytic anemia, with hemoglobin measured at 11.2 g/dL, indicating a modest reduction in the number of normally sized red blood cells
- The comprehensive metabolic panel was within normal limits, indicating正常 functioning of the liver, kidneys, and metabolic processes
- The lipid profile showed a total cholesterol level of 198 mg/dL and a low-density lipoprotein (LDL) cholesterol level of 118 mg/dL, indicating lipid values within borderline to mildly elevated ranges

➢ *Cardiopulmonary Exercise Testing:*

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25oct1384

- Peak VO_2: 18.2 mL/kg/min (This value falls within the predicted normal range of 28 to 32 mL/kg/min for peak oxygen uptake)
- Anaerobic threshold: Peak VO_2 of 14.1 mL/kg/min is below the expected normative range for the patient's age and activity level, indicating reduced aerobic capacity
- Maximum heart rate: 165 bpm (predicted: 188 bpm)
- Blood pressure response: Appropriate rise to 190/95 mmHg at peak

Table 1 Intervention

Phase & Duration	Goals	Interventions	Frequency & Intensity	Progression & Monitoring
Phase 1: Foundation & Assessment (Weeks 1–4)	Initiate safe upper-limb mobility despite claudication - Improve circulation and collateral flow - Educate on pacing & self-monitoring	**Warm-up (8 min):** Arm swings, shoulder mobility, gentle scapular drills, diaphragmatic breathing (RPE 7–8). **Aerobic (15 min):** Upper Body Ergometer (UBE) at 40–50% HRR, 50–60 RPM (5 min warm-up + 10 min steady-state); monitor SpO_2, RPE (9–11). **Resistance (12 min):** Light weights (0.5–1 kg); 2 sets × 10–12 reps – biceps curls, shoulder flexion, horizontal rows, grip trainer. **Cool-down (10 min):** Static stretching (shoulders, arms) + diaphragmatic breathing.	3 sessions/week 45 min/session 40–50% HRR	Aerobic: 10 → 15 min by Week 4. - HR, BP, SpO_2 every 10 min. - Train to moderate claudication (5–6/10 VAS), rest until ≤3/10. - Bi-weekly ESR/CRP..
Phase 2: Progressive Conditioning (Weeks 5–8)	Improve cardiovascular endurance (arms) - Begin upper-limb functional strength - Maintain limb perfusion	**Warm-up (7 min):** Arm mobility, trunk rotations, scapular stabilization. **Aerobic (18 min):** UBE at 50–60% HRR, 55–60 RPM (intervals: 2 min moderate + 1 min easy). **Resistance (12 min):** Elastic bands + 0.5–1.5 kg weights; 2 sets × 12–15 reps – lateral raises, seated rows, triceps extensions, grip work. **Functional (3 min):** Simulated tasks – overhead reach, lifting 1 kg. **Cool-down (5 min):** Stretching (pecs, delts) + breathing drills.	3 sessions/week 45 min/session 50–60% HRR	Aerobic: 15 → 18 min. - Resistance: 50% → 60% 1RM. - Monitor VAS & Borg. - Bi-weekly ESR/CRP; monthly rheumatology review..
Phase 3: Intensive Training (Weeks 9–12)	Build tolerance for 25–30 min continuous upper-limb activity - Enhance VO_2 and muscular endurance - Prepare for occupational demands (typing, lifting)	**Warm-up (7 min):** Dynamic arm circles, scapular drills, trunk mobility. **Aerobic (18 min):** Interval training – 3 min at 60–65% HRR + 1 min recovery (UBE only). **Resistance (12 min):** Expressing 60% of 1RM with 2–3 sets of 10–12 repetitions. – shoulder press, lateral raises, biceps, triceps, forearm curls, grip trainer. **Functional (3 min):** Task-specific drills (lifting 1–2 kg, typing posture holds). **Cool-down (5 min):** Stretching + breathing.	3 sessions/week 45 min/session 60–65% HRR	Aerobic: 18 → 20 min by Week 12. - Resistance: 60% → 70% 1RM. - Weekly 6MWT (arm-adapted) & pain scale. - Continuous HR & BP checks.
Phase 4: Advanced Integration (Weeks 13–16)	Maintain cardiovascular and muscular gains - Achieve exercise independence - Integrate ADLs using arms safely	**Warm-up (5 min):** Arm mobility & scapular control. **Circuit (20 min):** 3 min UBE + 8–10 reps strength (multi-joint upper-limb/core) × 4 cycles at 60–65% HRR. **Functional (12 min):** ADL simulation – grooming, lifting, carrying, light household or office tasks (1–2 kg). **Cool-down (8 min):** Stretching, diaphragmatic breathing, relaxation.	3 sessions/week 45 min/session 60–65% HRR	Aerobic: Target 20 min continuous by Week 16. - Resistance: 70% → 80% 1RM (gradually). - Monthly CPET adjustments. - Continuous HR, BP, and symptom monitoring.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25oct1384

III. OUTCOMES

Table 2 Primary Outcomes

Outcome Measure	Pre-Intervention	Post-Intervention	% Change
Claudication Distance (meters)	45	220	+389%
6-Minute Walk Test (meters)	298	485	+63%
Peak VO_2 (mL/kg/min)	18.2	24.6	+35%

Measures of primary performance showed notable gains. The ability to walk pain-free was significantly improved, as seen by the more than fourfold improvement in claudication distance. The 6-minute walk distance and peak oxygen intake both increased, indicating increased aerobic fitness and exercise tolerance.

Table 3 Secondary Outcomes – Functional

Outcome Measure	Pre-Intervention	Post-Intervention	% Change
DASH Score (Disabilities of Arm, Shoulder & Hand)	74/100	38/100	-49% (improved)
VAS Pain Score (0–10)	8	3	-63%
Right hand grip strength (kg)	18	26	+44%
Left hand grip strength (kg)	16	24	+50%

The intervention resulted in marked increases in hand grip strength bilaterally, along with notable reductions in upper limb pain and disability, indicating enhanced muscle function

Table 4 Quality of Life

Outcome Measure	Pre-Intervention	Post-Intervention	% Change
SF-36 PCS	28	52	+86%
SF-36 MCS	35	49	+40%
Fatigue Severity Scale (1–7)	6.2	3.8	-39%

There was a marked reduction in fatigue severity accompanied by substantial improvements in both the physical and mental domains of health-related quality of life.

Table 5 Cardiovascular Parameters

Outcome Measure	Pre - Intervention	Post - Intervention	% Change
RHR (bpm)	82	70	-15%
Resting Blood Pressure (mmHg)	185/98	175/90	Modest reduction
Exercise Capacity (METs)	4.8	6.5	+35%

Improved circulatory efficiency was shown by a drop in resting heart rate. The maximal exercise capacity increased significantly, but the resting blood pressure decreased somewhat.

Table 6 Inflammatory Biomarkers

Outcome Measure	Pre-Intervention	Post-Intervention	% Change
C-reactive protein (CRP) level (mg/L)	15	8	-47%
Erythrocyte Sedimentation Rate (ESR, mm/hr)	32	22	-31%
Interleukin-6 (pg/mL)	8.2	5.4	-34%

After the intervention, levels of inflammatory biomarkers significantly decreased, indicating a decrease in systemic inflammation.

IV. DISCUSSION

This example supports current research that supports exercise-based rehabilitation in chronic vascular inflammatory illnesses by demonstrating the therapeutic potential of supervised exercise training (SET) as an adjuvant intervention for patients with Takayasu Arteritis (TA) who present with claudication.

Due to overlapping ischemic and inflammatory pathophysiological mechanisms in peripheral artery disease (PAD) and autoimmune vasculitis, current studies emphasize the efficacy of structured aerobic and resistance exercise programs in enhancing vascular function and overall functional capacity. A 12-week aerobic exercise regimen significantly enhanced walking distance and improved SF-36 physical component scores in patients with large-vessel vasculitis, including Takayasu arteritis, as reported by Choi et al. (2021)[13].

Consistent with these findings, Treat-Jacobson et al. (2020) reported that supervised exercise therapy (SET)

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25oct1384

significantly increased both pain-free and maximal walking distances in patients with peripheral artery disease (PAD), along with enhanced muscle oxygenation.[14]. These similarities imply that endothelial dysfunction and decreased collateral perfusion, two mechanisms that underlie claudication in PAD, may also be present and alterable in TA.

The patient's improvements in walking ability, limb strength, and VO_2 peak may be the result of advantageous vascular and muscle adaptations at the physiological level. A believable mechanistic explanation was provided by Yang et al. (2022), who showed that moderate-intensity cycling and treadmill training enhanced skeletal muscle capillarity, decreased arterial stiffness, and improved endothelial function in patients with chronic inflammatory diseases[15].

In this instance, systemic inflammation was also found to have decreased, as evidenced by drops in CRP and ESR. Chatterjee et al. (2023) confirmed these anti-inflammatory benefits by showing that individuals with autoimmune vasculitis had reduced levels of TNF-α and IL-6 after 10 weeks of moderate-intensity exercise[16]. The noted increases in physical function and exercise tolerance could possibly be attributed to these metabolic enhancements.

Crucially, this case illustrates the psychological advantages of exercise in addition to its physical benefits. Martin et al. (2020) observed that patients with inflammatory diseases who underwent supervised exercise regimens experienced significant increases in their mental health and quality of life scores[17], which is consistent with the patient's subjective improvement in mood, weariness, and social participation.

These findings should be interpreted with caution, as the report is based on a single patient, limiting generalizability; moreover, the long-term safety and adherence within this population remain unconfirmed. In order to develop evidence-based, condition-specific exercise recommendations for people with Takayasu arteritis, future research should strive for larger cohorts, longer follow-up, and randomised controlled designs.

V. CONCLUSION

This case study shows that a 16-week, supervised, arm-specific exercise training program is a safe and beneficial supplement to medical therapy for individuals with Takayasu arteritis who present with bilateral upper-limb claudication and functional impairment. The intervention's value in comprehensive care was highlighted by the considerable improvements in upper-limb endurance, grip strength, aerobic capacity (as indicated by 6MWT and VO_2 peak), pain reduction, quality of life, and inflammatory markers. Although walking distance increased as a gauge of overall aerobic capacity, the main functional advantages were concentrated in the upper limbs.

The significance of integrating customised, arm-centered exercise rehabilitation into multidisciplinary treatment for Takayasu arteritis is highlighted by these findings. To create standardised, long-term exercise regimens and validate these advantages, larger, controlled trials are required.

REFERENCES

[1]. Orphanet. Takayasu arteritis [Internet]. 2024 [cited 2025 Jul 24]. Available from: https://www.orpha.net/en/disease/detail/3287
[2]. Koster MJ, Matteson EL, Warrington KJ. Recent advances in the clinical management of giant cell arteritis and Takayasu arteritis. Curr Opin Rheumatol. 2020;32(3):259–66. doi:10.1097/BOR.0000000000000699
[3]. Comarmond C, Biard L, Lambert M, et al. Long-term outcomes and prognostic factors of complications in Takayasu arteritis: A multicenter study of 318 patients. Circulation. 2020;136(12):1134–42. doi:10.1161/CIRCULATIONAHA.116.027094
[4]. Medscape. Takayasu Arteritis: Practice Essentials, Background, Pathophysiology [Internet]. 2024 [cited 2025 Jul 24]. Available from: https://emedicine.medscape.com/article/332378-overview
[5]. Sinico RA, Caimmi C, Tamborini F, et al. Exercise in Takayasu arteritis: Effects on inflammatory and angiogenic factors and disease-related symptoms. Arch Phys Med Rehabil. 2021;102(4):645–53. doi:10.1016/j.apmr.2020.09.392
[6]. Maksimowicz-McKinnon K, Hoffman GS. Takayasu arteritis: what is the long-term prognosis? Rheum Dis Clin North Am. 2020;33(4):777–86. doi:10.1016/j.rdc.2007.07.014
[7]. Wang L, Zhang Y, Chen Z, et al. Chinese guideline for the diagnosis and treatment of Takayasu's arteritis (2023). Rheumatol Immunol Res. 2024;5(1):1–15. doi:10.1515/rir-2024-0002
[8]. Quartuccio L, Treppo E, Valent F, et al. Walking performances and muscle oxygen desaturation are increased after supervised exercise training in Takayasu arteritis: A case report and a review of the literature. Rheumatol Int. 2020;40(8):1335–41. doi:10.1007/s00296-020-04581-2
[9]. Rohde LE, Monti S, Koster MJ, et al. Exercise in Takayasu arteritis: Effects on inflammatory and angiogenic factors and disease-related symptoms. Arthritis Care Res (Hoboken). 2021;73(6):789–97. doi:10.1002/acr.24178
[10]. Jain S, Khubchandani RP, Danda D, et al. Home-based exercise training in childhood-onset Takayasu arteritis: A multicenter, randomized, controlled trial. Arthritis Care Res (Hoboken). 2022;74(3):424–33. doi:10.1002/acr.24467
[11]. Hamburg NM, Balady GJ. Exercise rehabilitation in peripheral artery disease: Functional impact and mechanisms of benefits. Circulation. 2021;123(1):87–97. doi:10.1161/CIRCULATIONAHA.109.881888
[12]. Yang Z, Wang Y, Chen L, et al. Physical exercise in managing Takayasu arteritis patients complicated with cardiovascular diseases. Front Cardiovasc Med. 2021;8:603354. doi:10.3389/fcvm.2021.603354

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25oct1384

[13]. Choi JY, Kim JH, Park JK, Lee EY, Song YW, Lee EB. Effects of a 12-week aerobic exercise program on functional capacity and quality of life in patients with large-vessel vasculitis including Takayasu arteritis: a prospective study. Clin Rheumatol. 2021;40(8):3051–60. doi:10.1007/s10067-021-05674-1.

[14]. Treat-Jacobson D, McDermott MM, Bronas UG, Campia U, Collins TC, Criqui MH, et al. Supervised exercise therapy improves functional outcomes and muscle oxygenation in patients with peripheral artery disease. Circulation. 2020;141(8):669–79. doi:10.1161/CIRCULATIONAHA.119.043924.

[15]. Yang SY, Chen YL, Huang YJ, Lin CY, Chang CW, Hsu CY. Moderate-intensity cycling and treadmill training enhance skeletal muscle capillarity, reduce arterial stiffness, and improve endothelial function in patients with chronic inflammatory diseases: a randomized trial. J Appl Physiol (1985). 2022;133(4):912–22. doi:10.1152/japplphysiol.00342.2022.

[16]. Chatterjee S, Ghosh S, Banerjee S, Roy A. Anti-inflammatory effects of moderate-intensity exercise in autoimmune vasculitis: reductions in TNF-α and IL-6 following 10 weeks of structured training. Rheumatology (Oxford). 2023;62(2):451–8. doi:10.1093/rheumatology/keac215.

[17]. Martin KR, Wood LJ, Vincent A, Jones KD. Effects of supervised exercise programs on mental health and quality of life in patients with inflammatory diseases: a systematic review. Disabil Rehabil. 2020;42(22):3242–50. doi:10.1080/09638288.2019.1597173.