High Altitude Polycythemia Presenting as Atypical Chest Pain with TMT Positive and Normal Coronaries

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KEYWORDS
high altitude, polycythemia, ischemia, chestpain, TMT, phlebotomy, coronaries

ABSTRACT
High-altitude polycythemia (HAP), also known as chronic mountain sickness (CMS), is a condition in which individuals residing at high altitudes develop increased red blood cell mass in response to chronic hypoxia. This leads to increased hemoglobin and hematocrit levels, which can result in complications such as blood hyperviscosity, thrombotic events, and rarely, cardiovascular symptoms like chest pain. This case report illustrates a patient presenting with atypical chest pain, a positive treadmill test (TMT), and normal coronary angiography, whose symptoms were ultimately attributed to HAP.

1. Case Presentation

A 45-year-old male who is working as a solider at a high altitude Siachen (~5500 meters above sea level) for over 12 months presented with atypical chest pain of several months duration. The pain was intermittent, non-exertional, and not related to food or posture.

The patient also reported occasional dizziness and shortness of breath, particularly after physical exertion.

He denied significant cardiovascular risk factors, including smoking or hypertension, and had no personal history of coronary artery disease.

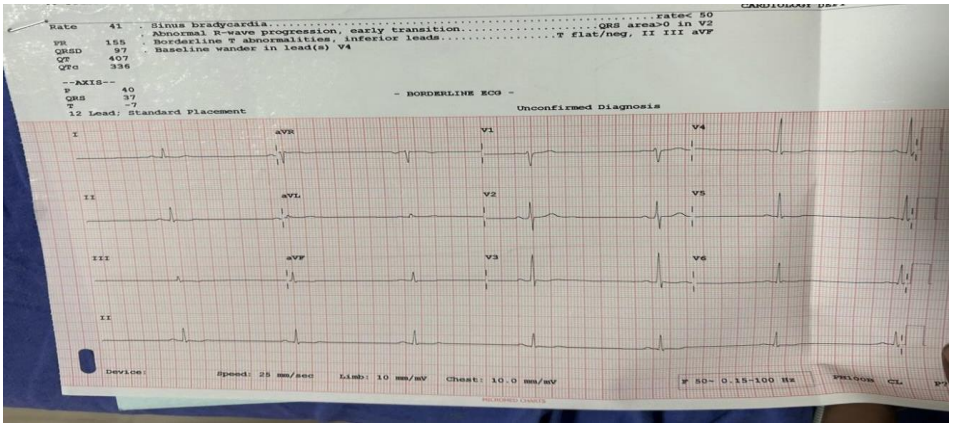
2. Physical Examination

BP: 110/80 mmHg, HR: 50 bpm, regular, SPo2 95% on room air. Systemic examination revelaed normal cardiovascular and respiratory findings

Laboratory Investigations: Hemoglobin: 19.5 g/dL (normal: 13-17 g/dL) Hematocrit: 58% (normal: 40-50%) ECG: Normal sinus rthym, Bradycardia present

3. Clinical course:

Cardiology opinion obtained, 2D ECHO taken which showed Normal LV systolic function (LVEF -69%) and was not significant except for Bradycardia during study. CV doppler showed which showed significant stenosis or occlusions.



Graph 1: As per cardiologist advice TMT done

Treadmill Test (TMT): A stress test was conducted, which demonstrated significant ST-segment depression, consistent with inducible ischemia. The TMT results raised suspicion of coronary artery disease (CAD)

Test Details

Protocol: Bruce
Total Exec. Time: 12 m 2 s
Max. BP: 150 / 80 mmHg
Test Termination Criteria:

Pr.MHR: 174 bpm
Max. HR: 153 (88% of Pr.MHR)bpm
Max. BP x HR: 22950 mmHg/min

THR: 156 (90 % of Pr.MHR) bpm
Max. Mets: 14.90
Min. BP x HR: 3360 mmHg/min

Protocol Details

Stage Name	Stage Time (min : sec)	Mets	Speed (mph)	Grade (%)	Heart Rate (bpm)	Max. BP (mm/Hg)	Max. ST Level (mm)	Max. ST Slope (mV/s)
Supine	0 : 43	1.0	0	0	42	120 / 80	-0.42 aVR	0.71 II
Standing	0 : 20	1.0	0	0	48	120 / 80	-0.21 aVR	0.71 V1
Hyperventilation	0 : 19	1.0	0	0	48	120 / 80	-0.21 aVR	0.71 V1
1	3 : 0	4.6	1.7	10	71	120 / 80	-0.64 aVR	-1.06 I
2	3 : 0	7.0	2.5	12	86	120 / 80	-0.64 I	-1.06 I
3	3 : 0	10.2	3.4	14	109	130 / 80	-2.34 V4	-2.12 II
4	3 : 0	13.5	4.2	16	153	150 / 80	-4.67 V4	-2.83 V4
Peak Ex	0 : 2	14.9	5	18	153	150 / 80	-3.40 V5	-1.06 III
Recovery(1)	1 : 0	1.8	1	0	92	150 / 80	-3.40 V5	-2.48 V3
Recovery(2)	1 : 0	1.0	0	0	82	150 / 80	-1.49 V4	-2.48 V3
Recovery(3)	1 : 0	1.0	0	0	75	150 / 80	-1.70 V5	-1.06 V1
Recovery(4)	0 : 47	1.0	0	0	74	150 / 80	-1.70 V4	-1.06 V4

Interpretation
The patient exercised according to the Bruce protocol for 12 m 2 s achieving a work level of Max. METS : 14.90. Resting heart rate initially 42 bpm, rose to a max. heart rate of 153 (88% of Pr.MHR) bpm. Resting blood Pressure 120 / 80 mmHg, rose to a maximum blood pressure of 150 / 80 mmHg.

TMT TEST IS POSITIVE FOR INDUCED ISCHEMIA.

Graph: 2 Further, coronary Angiography done to rule out ASVCD, atherosclerotic vascular coronary Disease.

Coronary Angiography: Surprisingly, coronary angiography showed normal coronary arteries, ruling out significant atherosclerosis or occlusion. Given these findings, the differential diagnoses were revisited.

CORONARY ANGIOGRAM REPORT

HB	15.7 gm/dl	WEIGHT	KG
UREA	19 gms/dl	BP	90/60 mmHg
CREATINE	0.5 mgs/dl	HEARTRATE	47 BPM
BLOOD GROUP		BMI	
HBSAG		RBS	Mgs/dl

CONTRAST : NON IONIC (VISI PAUQE 350)

ACCESS SITE : RIGHT RADIAL. 5F RADIAL SHEATH

CATHETER : TIG 3.5 (5 F)

HEPARIN DOSE : 2500 UNITS

OTHER MEDICATION : INJ. NTG 100 mcgs

LMCA - BIFURCATES, NORMAL

LAD - TYPE III VESSEL, NORMAL, SLOW FLOW IN MID LAD
DIAGONALS/SEPTALS –NORMAL

LCX - DOMINANT, NORMAL
OM –NORMAL

RCA - NON - DOMINANT, NORMAL
PDA/PLVB –NORMAL

LV FUNCTION - NORMAL LV SYSTOLIC FUNCTION (EF-69%)

IMPRESSION - NORMAL EPICARDIAL CORONARIES

DIAGNOSIS - CHEST PAIN UNDER EVALUATION / TMT POSITIVE / POLYCYTHEMIA
NORMAL LV SYSTOLIC FUNCTION
NORMAL EPICARDIAL CORONARIES

ADVICE – MEDICAL MANAGEMENT

Figure:1

4. Differential Diagnosis

1. **Microvascular angina:** Dysfunction of small coronary vessels.
2. **High-altitude polycythemia:** Increased blood viscosity impairing oxygen delivery and increasing cardiac workload.
3. **Coronary vasospasm:** Transient vasoconstriction of coronary vessels.
4. **Pulmonary hypertension:** Chronic hypoxia can lead to right heart strain.

5. Discussion

The diagnosis of HAP was confirmed based on the elevated hemoglobin and hematocrit levels. The patient's symptoms were attributed to blood hyperviscosity and impaired oxygen delivery. The patient underwent therapeutic phlebotomy, reducing hematocrit to 50%. Low-dose aspirin was started to prevent thrombosis.

Supplemental oxygen Advised for use during sleep and exertion to alleviate hypoxia.Hydration Ensured to prevent hemoconcentration. Advised to move to a lower altitude to prevent recurrence.

Outcome: The patient experienced marked improvement in symptoms after treatment. A follow-up TMT was negative for ischemia, and hemoglobin levels were maintained through periodic phlebotomy and lifestyle adjustments.

This case highlights the diagnostic challenge posed by HAP presenting with atypical chest pain and a positive stress test. Although the TMT was indicative of ischemia, normal coronary arteries on angiography pointed toward alternative causes such as blood hyperviscosity. The reduced oxygen-carrying capacity due to HAP can mimic ischemic symptoms, underscoring the importance of considering this condition in high-altitude populations.

6. Conclusion

Patients with high-altitude polycythemia may present with chest pain and ischemic-like symptoms despite normal coronary angiography. A multidisciplinary approach that includes hematologic, cardiologic, and respiratory evaluations is essential for appropriate diagnosis and management.This report emphasizes the importance of considering high-altitude polycythemia in patients with ischemic-like symptoms who reside at high elevations.

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