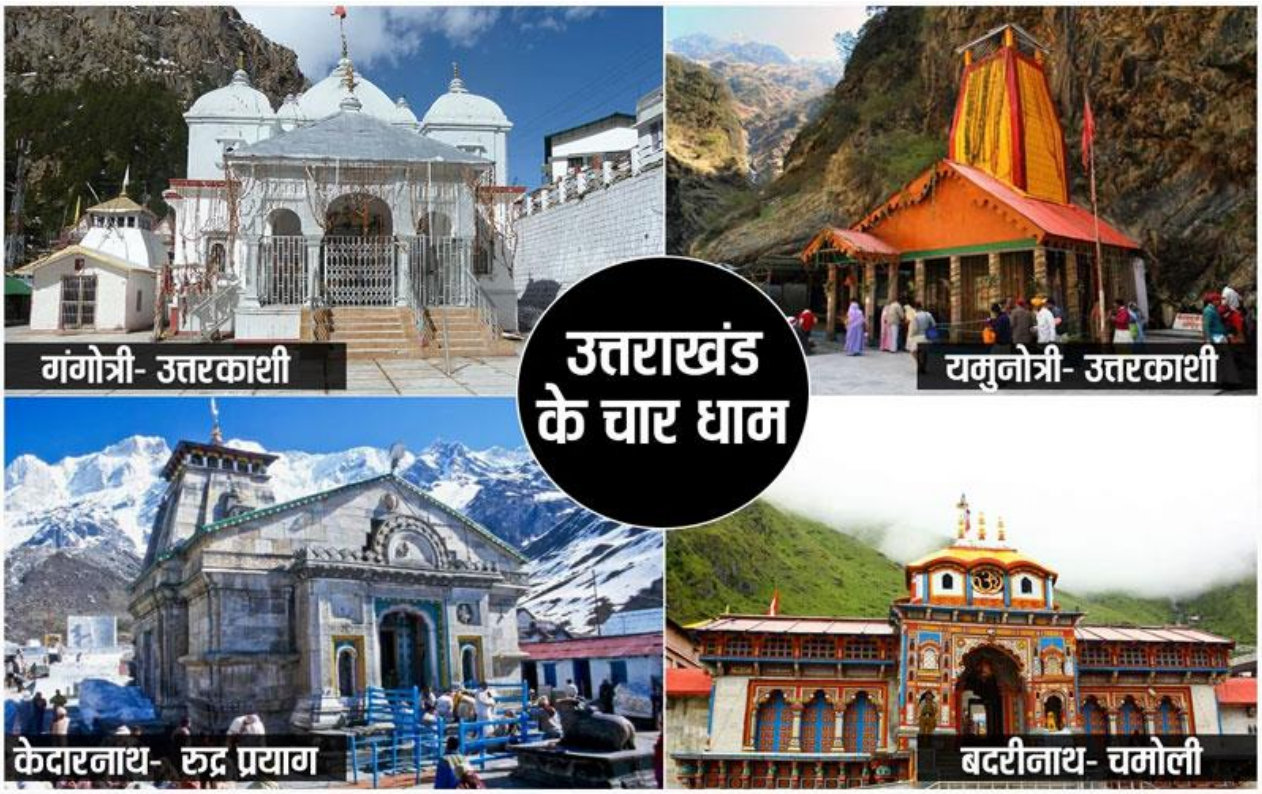

Patient Education Handbook on Char Dham Yatra pilgrimage

AIIMS Rishikesh

This handbook is dedicated to our patients who keep on teaching us valuable lessons in the subject

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Introduction

Uttarakhand, popularly known as Devbhoomi or the Land of Gods, is home to innumerable temples and attracts pilgrims annually. Among the several holy places and circuits pilgrims visit in Uttarakhand, the Char Dham Yatra is among the most popular. This Yatra, or pilgrimage, visits four holy sites perched high in the Himalayas: Yamunotri (3,291m), Gangotri(3,415m), Kedarnath(3,553m), and Badrinath(3,300m). However, reports show a large increase in tourist numbers for this year's Char Dham Yatra compared to 2023. As of May 24, official numbers reveal a staggering 9.67 lakh pilgrims have visited the pilgrimage sites since May 10, with Kedarnath topping the pack with 4.24 lakh people. However, this increase in visitors casts a dark shadow. According to health department records, approximately 60 pilgrims died of coronary artery disease during the Yatra, the majority of whom were over the age of 60. Kedarnath remains at the top of this dreadful list, with 28 fatalities. Thus, timely management of such a crisis is the need of the hour.

Dham	**Ht. in metres.**	**Ht in feet**	**Effective oxygen(%)**
Kedarnath	**3553**	**11,755**	**17.9-18.6%**
Badrinath	**3300**	**10,279**	**17.9-18.6%**
Gangotri	**3415**	**10,310**	**17.9-18.6%**
Yamunotri	**3293**	**10,797**	**17.9-18.6%**
Sea level			**20.9%**

PREPARING TO TRAVEL

If you plan to sleep above 8000 feet (2400 m) and are concerned about acquiring altitude sickness due to previous incidents or other risk factors, schedule an appointment with a skilled healthcare professional.

During this visit, you should discuss your travel plans, the availability of medical care at your destination, and the possibility of requiring medications to prevent and/or cure high-altitude illness.

The methods for decreasing risk and treating altitude sickness are covered below.

Acclimatisation

Slow ascent

It is wise not to exceed the suggested amount for healthy travellers (300-500 m/day while over 2500 m).

At ≤17,000 ft (≈5,200 m), the human body may acclimate to moderate hypoxia, but this process takes time.

Some acclimatisation to high elevation lasts weeks to months, but the acute process, which happens within the **first 3-5 days of ascent, is critical for travellers.** A continuous increase in breathing, increased oxygenation, and alterations in cerebral blood flow characterise the acute phase.

Acute acclimation does not involve increased red cell synthesis, although a decrease in plasma volume over the first few days does raise haemoglobin concentration.

Altitude illness can occur before the acute acclimatisation phase is completed but not after. Travellers can improve acclimatisation by changing their itinerary to

Avoid getting "too high too fast". Gradually ascending to elevation, or staging the ascent, allows the body to adjust.

Acclimatising for 2-3 nights at 8,000-9,000 ft (≈2,450-≈2,750 m) before ascending to higher elevations effectively prevents acute mountain sickness (AMS).

The Wilderness Medical Society recommends avoiding ascent to a sleeping elevation of ≥9,000 ft (≈2,750 m) in a single day, ascending at a rate of no greater than 1,650 ft (≈500 m) per night once above 9,800 ft (≈3,000 m), and allowing an extra night to acclimate for every 3,300 ft (≈1,000 m) of sleeping elevation gain.

Box 2: Acclimatisation steps that can be followed

- Ascend gradually, preferably
- Avoid moving from a low height to more than 9,000 ft (2,750 m) sleeping elevation in one day.
- Once over 9,000 ft (≈2,750 m), move sleeping elevation by no more than 1,600 ft (≈500 m) per day, with an extra day for acclimatisation every 3,300 ft (≈1,000 m). If a sudden ascent is unavoidable, you can be prepared with acetazolamide, which can help speed up acclimatisation.
- Avoid alcohol for the first 48 hours of elevation.
- Regular caffeine users should continue to avoid withdrawal headaches, which may be mistaken for altitude headaches.
- Limit exercise during the first 48 hours at elevation.
- A high-elevation exposure (> 9,000 feet [≈2,750 m]) for ≥2 nights, within 30 days before the trip, is good, but closer to the trip departure
- Plan to stay in the Helipad zone village for a night if planning to ascend by helicopter to the Kedarnath and Badrinath peaks as the ascent from the nearest Helipad zone (like Sersi village for kedarnath) is generally more than 1000 metres

These acceptable recommendations may still be excessively fast for some travellers and irritatingly slow for others.

RISK FACTORS

Altitude exposure carries very little risk for healthy subjects.

But it is impossible to predict if you may fall ill while travelling at a high altitude. Furthermore, being physically fit does not reduce your risk of acquiring a high-altitude disease.
Certain populations/factors increase risk of developing high altitude illness:

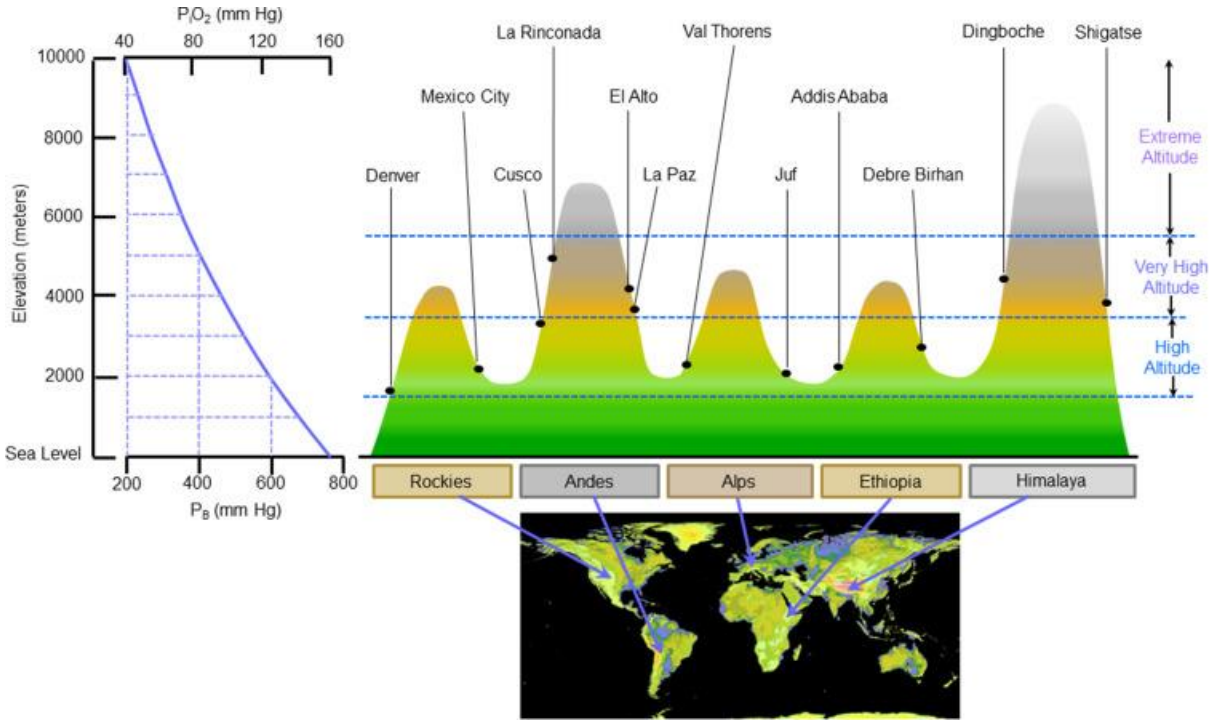
Box 1: Risk factors for developing high altitude-related illness

- Past history of high-altitude illness
- Over-exertion before adjusting to the altitude change.
- Rapid ascent (within a day) from low level to sleeping heights above 9000 feet (2750 meters).
- Fast ascent (>1640 to 3280 feet/day [>500 to 1000 m/day] in sleeping altitude), once over 9000 feet (2750 m).
- Physically unfit for exertion
- Have a medical condition that is not controlled/ not evaluated.
- History of cardiac issues in the family

Why worry

What happens with an increase in altitude?

Diagram of high altitude



A decrease in pO2 to 80 mm Hg level would cause the following

This will cause:

1) A decrease in Oxygen levels in the atmosphere will reflect the same in your blood, which will exacerbate cardio-pulmonary symptoms

2) Combining Hypoxia with environmental stressors like temperature, exercise, dehydration and injury may precipitate angina/ coronary artery disease symptoms.

3) Mountainous locations are remote, with limited access to healthcare

Patients with following conditions should consult a doctor Before travel

- diabetes.
- epilepsy.
- heart conditions.
- lung conditions, including chronic obstructive pulmonary disease (COPD) and moderate/severe asthma.
- sickle cell disease.

  For Males> 35 years of age and females> 45 years of age, it is advised to have a screening health check-up to rule out any undiagnosed condition, like diabetes, coronary artery disease and hypertension

Traditional risk factors for heart disease

Age, Blood pressure, Diabetes, Smoking, Total cholesterol, high LDL cholesterol Nearly all heart events occur in individuals with at least one risk factor and presence of even one risk factor at age 50 years substantially increases lifetime risk of CAD.

Acute and Subacute Effects of High-Altitude Exposure

Individuals who rapidly ascend from low to high altitudes (>2000 m) are at risk of developing acute mountain sickness (AMS), which is characterised by headache as the primary symptom, sometimes accompanied by nausea, loss of appetite, vomiting, sleeplessness, dizziness, and/or exhaustion.

In alpine locations, the prevalence of AMS increased from 7% at 2200 m to 38% at 3500 m and 52% while rapidly ascending to 4559 m,45,46, and a comparable risk was calculated from Chinese highland military medical records.

Diagnosis of AMS is based on a history of recent ascent to high elevation and subjective symptoms.

AMS symptoms are like those of an alcohol hangover; headache is the cardinal symptom, usually accompanied by ≥1 of the following: anorexia, dizziness, fatigue, nausea, or, occasionally, vomiting. Uncommonly, AMS presents without headache.

Symptom onset is usually 2–12 hours after initial arrival at a high elevation or after ascent to a higher elevation, and often during or after the first night.

Babies between six months to 5 years AMS can develop loss of appetite, irritability, and pallor. AMS resolves within 12–48 hours if travellers do not ascend farther.

The illness is usually self-limiting, developing and disappearing within 1-3 days. Symptoms that appear three days after arriving at high elevation and without additional ascent should not be attributed to AMS. AMS has no distinguishing physical features; pulse oximetry is typically within the normal range for the elevation or slightly lower.

Travelers with AMS experience quick improvement with descents of ≥1,000 ft (≈300 m), which can help diagnose the condition.

Treatment

- Supplemental oxygen at 1–2 litres per minute will relieve headaches within about 30 minutes
- Self-treat with non-opiate analgesics (e.g., ibuprofen 600 mg or acetaminophen 500 mg every 8 hours) and antiemetics (e.g., ondansetron 4 mg orally disintegrating tablets)
- Acetazolamide 125 mg BD can be used as prophylaxis
- Dexamethasone tablets as the last step

High-Altitude Cerebral Edema: Patients with a history of traumatic brain injury/tumours should have a neurological evaluation before travelling to high altitudes.

Visit to high altitudes specially by non-professionals make them prone to many acute health conditions or decompensation of impending health conditions. Change of oxygen level in air along with increased demand of oxygen by human body due to exertion, challenges human body and the body tries to compensate by activating different body mechanisms. Now the result of this activation of homeostatic mechanisms can lead to achievement of homeostasis and human body survives in the new environment or failure.

High altitude associated neurological complications

Headache, paralysis, seizures, speech abnormalities can be due to stroke, cerebral venous sinus thrombosis, or rarely brain oedema. This similarly can be prevented by taking adequate advice regarding the comorbidities in people with diseases in addition to avoiding excessive exertion in one go and adequate hydration. People having history of thrombosis (anywhere in body) in past are at increased risk of CVST and stroke. In addition to this the risk is further increased if medications like hormones/contraceptive pills, postpartum phase (before 42 week of delivery), genetic risk/history of hypercoagulable states is there.

So before going to such visits keep in your mind –

1. Get your routine checkups done, specially if family history of disease, having comorbidities (even controlled), elderly

2. Try to make a routine of similar gradually increasing physical exercise preferably one month before the start of visit

3. While on visit take rest at appropriate distances (already everyone will know his/her limits in above preparation phase) and keep yourself well hydrated.

High-Altitude Pulmonary Edema:

High Altitude Pulmonary Edema (HAPE) is a severe form of Altitude sickness where fluid accumulates in the lungs. It typically occurs at Altitude above 8,000 feet (2,500 meters). It can be life-threatening if not treated promptly.

Prevention

- Gradual Ascent - Ascend slowly to allow your body to acclimate. Spend a few days at intermediate Altitude before moving higher.
- Acclimatisation - Spend one at high Altitude gradually increasing exposure over several days.
- Hydration - Drink plenty of fluids but avoid overhydration.
- Avoid Alcohol and Sedatives - These can depress your breathing and make symptoms worse.
- Medications - Consider medications like acetazolamide or dexamethasone after consulting a healthcare provider.

Treatment

- Supplemental oxygen, immediate descent, Hyperbaric chambers
- Nifedipine and Sildenafil can be used in field settings(dose given in below table to be taken after consulting a doctor

Box 3: Recommended drugs with doses

MEDICATION	INDICATION	ROUTE	DOSE
Acetazolamide	AMS, HACE prevention	PO	125 mg twice a day; 250 mg twice a day if >100 kg body weight Pediatric: 2.5 mg/kg every 12 hours, up to 125 mg
	AMS treatment	PO	250 mg twice a day[1]
Dexamethasone	AMS, HACE prevention	PO	2 mg every 6 hours or 4 mg every 12 hours Pediatric: do not use for prophylaxis
	AMS, HACE treatment	PO, IV, IM	AMS: 4 mg every 6 hours HACE: 8 mg once, then 4 mg every 6 hours Pediatric: 0.15 mg/kg/dose every 6 hours up to 4 mg
Nifedipine	HAPE prevention	PO	30 mg SR version every 12 hours or 20 mg SR version every 8 hours
	HAPE treatment	PO	30 mg SR version every 12 hours or 20 mg SR version every 8 hours
Salmeterol[2]	HAPE prevention	Inhaled	125 µg twice a day
Sildenafil	HAPE prevention	PO	50 mg every 8 hours
Tadalafil	HAPE prevention	PO	10 mg twice a day

Preventing Severe Altitude Illness or Death

The primary goal of educating travellers about altitude illness is to prevent mortality or evacuation rather than to minimise the potential of moderate illness. Because the onset of symptoms and clinical course are sufficiently delayed and predictable, there is no reason for anyone to die from altitude illness unless they are trapped by weather or topography in settings that make descent impossible. Travellers can follow three rules to help prevent death or catastrophic repercussions from altitude sickness:

- Know the early symptoms of altitude illness and be willing to acknowledge when symptoms are present.
- Never ascend to sleep at a higher elevation when experiencing symptoms of altitude illness, no matter how minor the symptoms seem.
- Descend if the symptoms become worse while resting at the same elevation.

PRE-EXISTING CONDITIONS

CAUTION REQUIRED (IN INCREASING RISK)

- Asthma (well-controlled)
- Children and adolescents(specially less than 5 years of age)
- Chronic obstructive pulmonary disease (mild)
- Coronary artery disease (following revascularisation)
- Diabetes mellitus
- Elderly
- Hypertension (controlled)
- Neoplastic diseases
- Obesity (Class 1/Class 2)[2]
- Obstructive sleep apnea (mild/ moderate)
- Pregnancy (low-risk)
- Psychiatric disorders (stable)
- Sedentary
- Seizure disorder (controlled)
- Angina (stable)
- Arrhythmias (poorly controlled)
- Chronic obstructive pulmonary disease (moderate)
- Cirrhosis
- Coronary artery disease (non revascularized)
- Cystic fibrosis (FEV1 30%–50% predicted)
- Heart failure (compensated)
- Hypertension (poorly controlled)v Infants <6 weeks old
- Obesity (Class 3)[3]
- Obstructive sleep apnea (severe)
- Pulmonary hypertension (mild)
- Radial keratotomy surgery
- Seizure disorder (poorly controlled)
- Sickle cell trait
- Angina (unstable)
- Asthma (unstable, poorly controlled)
- Cerebral space–occupying lesions
- Cerebral vascular aneurysms or arteriovenous malformations (untreated, high-risk)
- Chronic obstructive pulmonary disease (severe/very severe)
- Cystic fibrosis (FEV1 <30% predicted)
- Heart failure (decompensated)
- Myocardial infarction or stroke (<90 days before ascent)
- Pregnancy (high-risk)
- Pulmonary hypertension (pulmonary artery systolic pressure >60 mm Hg)
- Sickle cell anemia

Arrowhead depicting progressive increase risk of the associated conditions in high altitude ascent

- If you have diabetes and check your blood sugar, be aware that blood glucose meters can produce erroneous results at high elevations. Consult the meter's manufacturer for high-altitude reading recommendations. Always take glucose with you for emergencies.
- Asthma may not worsen at high elevations. However, cold-induced bronchospasm may occur in low-temperature conditions at high altitudes.
- If you utilise oxygen for lung disease, you will require a higher flow rate at higher altitudes. If you don't require oxygen at home for your lung ailment, you may need it at high altitudes. Consult your doctor before you travel. You may want to bring a pulse oximeter to monitor your blood oxygen levels.
- Individuals with sickle cell disease may require oxygen when traveling beyond 7000 feet (2100 meters). If you have sickle cell trait (which some individuals are unaware of), altitude-related issues (for example, spleen injury) can occur even at altitudes lower than 9000 feet (2700 m), however this is uncommon.
- If you have a lung ailment (e.g. COPD, cystic fibrosis, pneumonia, pulmonary hypertension, or sleep apnea), see your doctor before traveling to high altitude.
- Traveling to sleeping altitudes of 8000-9000 feet is safe during pregnancy. If you have any pregnancy issues or are a smoker, see your doctor before going to altitude. pregnant travellers of the dangers of having a pregnancy complication in remote, mountainous terrain.
- At very high elevations, however, some people who have had radial keratotomy procedures might develop acute farsightedness and be unable to care for themselves
- High altitude exposure is shown to have an increased chance of ischemic stroke owing to increased blood viscosity thus, it is advised to undergo a carotid doppler screening before any high altitude exposure to prevent any untoward event

Cardiological problems in high-altitude

Patient advisory for high altitude exposure

[A] Hypertension

- Blood pressure to be well controlled for the last 3 months
- Do a 24-hour ambulatory BP monitoring and discuss with your general physician
- Discuss with your physician about changing of drugs if you are planning to ascend over 3400 m
- Avoid any ascent if Blood pressure is more than 180/100 mm Hg till well controlled

[B] Coronary artery disease

Consult your doctor. Before travelling

- Dehydration should be avoided at all cost
- You should continue pre-existing medications at HA.
- You should undergo stress testing like TMT/ CPET exercise testing to asses functionality before ascent
- All therapy changes, especially dual anti-antiplatelet therapy after drug-eluting stent implantation, must be discussed with a doctor before enactment.
- If you are taking ticagrelor, you might consider changing after discussion with your physician
- Patients should wait at least 6 months after uncomplicated ACS episodes as well as after revascularisation
- Patients should wait at least 6–12 months after coronary stenting before HA exposure.
- Individuals who do not engage in physical exertion at low altitudes should not engage in physical activity at HA.
- May consider taking acetazolamide after consulting your doctor
- If there is no chest pain on rest or exertion, one can ascend to 4200 m safely and perform light to moderate exercise
- If one has chest pain on mild or moderate exertion, one can ascend to 2500 m safely and can't perform any activities more than light exertion
- If one has chest pain at rest, one should avoid any exposure to height
- If you are diagnosed with an Ejection fraction less than 40% along with your CAD, avoid any ascent till six weeks after diagnosis
- Avoid further ascent and call for immediate help even if you feel the slightest symptom of chest pain, palpitations, diaphoresis
- Asymptomatic or moderately symptomatic stable CAD patients with a negative exercise test at sea level, well-controlled blood pressure, and absence of pulmonary illness can ascend to 3,500 metres with low additional risk.
- **In every case, a slow ascent allowing acclimatisation is mandatory**.
- Carry a load not more than 30% of one's body weight

[C] Arrhythmia

- If having a pacemaker in situ, Device interrogations of pacemakers before ascent should be done
- If suffering from PSVT, should be well controlled on medications; no episodes in last three months

- If suffering from past VT, should have an ICD device in situ (interrogated recently)
- Avoid ascent if untreated/ recent arrhythmia (< 3 months)

[D] Heart failure

- Slow ascent is recommended. It is prudent not to exceed that recommended for healthy travellers (300–500 m/day when above 2500 m)
- Seasonal vaccinations of Seasonal Influenza, COVID, Typhoidal, pneumococcal vaccine
- Any co-existing conditions like anaemia, obstructive sleep apnoea (frequent snoring), decreased KFT should be adequately assessed
- All drugs should be carefully evaluated and packed in adequate amounts
- Acetazolamide benefits to be asked of your physician
- One who is breathless at heavy exertion may safely reach high altitudes up to 3500 m, and one can do mild physical exertion
- One who is breathless while performing regular household activities may safely reach high altitudes up to 3000 m if needed; not heavier than light physical activity is recommended
- One who is breathless at rest should avoid all height exposure
- Stress testing like CPET/TMT should be considered after discussing with your physician before ascent
- To avoid ascent if there is a history of any hospital admission in the last 3 months for heart failure

[E] Congenital heart disease

A pediatric cardiologist should be consulted.

- If you suffer from cyanotic heart conditions and right to left shunting, please consult your doctor definitely before any ascent, and try to avoid ascent if possible
- Corrected shunt lesions have almost equal risk as a healthy individual for developing altitude illness; nonetheless, they should have screening echocardiography before travel
- If any corrective surgery is planned in the near future, any high altitude exposure should be avoided at all chances as it may elevate the pulmonary artery pressure and affect the surgery negatively

Emergency Preparedness

1. Closest hospital and emergency evacuation and descent routes to be clearly identified
2. Additional medications including aspirin, clopidogel, atorvastatin, furosemide, acetazolamide, dexamethasone, adrenaline, amiodarone but not limited to should be kept close by
3. Awareness about the symptoms should be properly spread amongst all travellers for quick identification of symptoms
4. Proper communication to the referring team should be maintained
5. **APP link for nearby hospitals of chardham yatra as provded**

Driver Advisory

- Make sure you are well rested, and your vehicle is in perfect working condition
- Make sure you are trained enough to drive in hilly terrain
- **Do not consume alcohol at least 48 hours before travel**
- Make sure to check spare tyres, insurance, and all necessary legal documents are up to date for your vehicle
- To keep emergency contact numbers in reach of everyone
- Do not use neutral gear when downhill to prevent wearing of brakes
- Do not drive rashly; the road is also as enjoyable as the destination
- Please use Dippers properly to prevent blinding of drivers in the opposite way
- You can carry emergency first aid kit in vehicle
- Do not overload your vehicle more than the recommended limit as per your vehicle capacity

Have a happy and safe journey!

References

- Coronary Artery Disease and High Altitude: Unresolved Issues Ivano Bonadei, Edoardo Sciatti, Enrico Vizzardi, Marialma Berlendis, Giordano Bozzola,and Marco Metra
- Clinical recommendations for high altitude exposure of individuals with pre-existing cardiovascular conditions-A joint statement by the European Society of Cardiology, the Council on Hypertension of the European Society of Cardiology, the European Society of Hypertension, the International Society of Mountain Medicine, the Italian Society of Hypertension and the Italian Society of Mountain Medicine
- Safety and exercise tolerance of acute high altitude exposure (3454 m) among patients with coronary artery disease, M Noveanu, R Gaillet, G Hellige, A Wahl, and H Saner