

Doctors treat patients atop remote Andean peak through study of Acute Mountain Sickness

September 18 2012



Working on a remote, barren peak in the Bolivian Andes, Ryan Paterson and his fellow emergency room doctors came face-to-face with everything from altitude sickness to appendicitis to complications of sickle cell anemia.

"The experience was incredible from a [global health](#) perspective," said Paterson, a physician at the University of Colorado Hospital. "You learn how to function in a low- resource environment rather than in a hospital

where you have nurses and all kinds of services available."

Paterson, along with Morgan Eutermoser, MD, and Christopher Davis, MD, spent three weeks each this summer atop 17,785-foot Mount Chacaltaya caring for students taking part in a major study by the Altitude Research Center (ARC) at the University of Colorado School of Medicine.

The project, funded by a \$4 million Pentagon grant, is investigating [Acute Mountain Sickness](#) (AMS), trying to determine its [genetic cause](#), who is susceptible and how it might be treated and possibly cured.

The Department of Defense wants to minimize the debilitating effects of AMS in fighting men and women serving in mountainous regions like Afghanistan.

Altitude Research Center director Robert Roach, Ph.D., said the project could lead to breakthroughs in areas like cardiac and pulmonary disease.

"We believe these studies will ultimately save lives," he said.

Austere, grueling and uplifting

The Bolivian leg of the study involved sending 25 students from the University of Oregon, which sits near sea-level, to a laboratory atop Mount Chacaltaya. The lab is the highest on earth reachable by road.

"Our primary role was to evaluate, treat, and support the staff and subjects," Eutermoser said. "We were also able to perform our own experiments while there."

Nearly everyone suffered altitude-related conditions like nausea, fatigue, headaches and sleeping difficulty.

But some cases were more serious.

A staff member was diagnosed with [appendicitis](#) and evacuated to La Paz, Bolivia's de facto capital. Someone else suffered complications of sickle cell anemia while another had Addison's disease that needed managing.

Without modern facilities at their disposal, the team quickly learned to improvise.

"What's so refreshing about working in an austere setting like Chacaltaya is the necessity to get back to the basics," Davis said. "Medical decisions are founded on a good history and physical (exam). I can recall on my first day thinking, 'I could really use some lab work and a CT scanner.'"

Just reaching the peak was an adventure.

The participants landed in La Paz, at about 11,975 feet above sea level, and were immediately driven down to Coroico, sitting at 5,003 feet, where they gradually acclimatized.

"After a day or two we would drive them up a pretty hairy four-wheel drive dirt road to Chacaltaya," Paterson said.

The summit was a harsh, otherworldly place. Temperatures dropped to zero at night and barely reached 40-degrees during the day.

The daily regimen was grueling. Students were put through a battery of tests as scientists investigated physiological and mental changes offering clues into the process of acclimatization.

"I think the most uplifting part of the trip was seeing the incredible attitudes of the researchers and subjects in such an environment," said

Eutermoser. "It was a wonderful group."

The doctors inserted arterial catheters into the subjects' wrists to measure blood pressure and to draw blood.

"They cycled on stationary bikes as we measured heart and lung function," Paterson said. "We would test their mental faculties at altitude. We drew a lot of blood that would be analyzed for many things including genetic factors, lactate, oxygen, and carbon dioxide levels looking for any changes in the body at altitude."

The mountain took its toll.

"Their exercise capacity was far less than at sea level," Paterson said. "But when they went to Coroico and came back they seemed to hold onto a great deal of what they had gained on the mountain. Generally speaking, acclimatization wears off fairly quickly. Why did they hang on to it? That's one of the questions that need to be answered."

The doctors also did research into whether the optic nerve swells at altitude and if so how that relates to mountain sickness.

"The ability to see patients at altitude and how they reacted allowed us as physicians to brainstorm future projects," Eutermoser said.

Overall, she described the experience as "priceless."

Davis agreed.

"At the end of three weeks, I was much more comfortable either without tests or improvising with the limited resources at hand," he said. "To me, that's the essence of wilderness medicine."

Engaging, adventurous work

The doctors have returned from South America but Roach and his team remain in La Paz studying local people for clues into how Bolivian physiology has adapted to altitude. He hopes to conduct similar studies in Ethiopia and Tibet.

Paterson said altitude physiology is highly popular among medical students.

"You talk to them about it and their eyes light up. It's very engaging and has this element of adventure to it," he said. "I see applications for this kind of research in all areas of health care, not just the military."

And at a time when the health care system is in flux and workloads are steadily increasing, such experiences can rekindle the fire that drew doctors into medicine in the first place.

Next month, Paterson is off to Kolkata, India where he will do clinical work in one of the city's slums. It will be his fourth journey to that country.

"Being a doctor means remaining curious," he said. "It's an ongoing process of working, learning and adapting to a wide variety of circumstances. I believe all of these experiences make us all better at what we do."

Provided by University of Colorado Denver

Citation: Doctors treat patients atop remote Andean peak through study of Acute Mountain Sickness (2012, September 18) retrieved 16 June 2024 from <https://medicalxpress.com/news/2012-09-doctors-patients-atop-remote-andean.html>

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