CHICAGO—New magnetic resonance imaging (MRI) research shows that mountain climbers who experience a certain type of high altitude sickness have traces of bleeding in the brain years after the initial incident, according to a study presented today at the annual meeting of the Radiological Society of North America (RSNA).

High altitude cerebral edema (HACE) is a severe and often fatal condition that can affect mountain climbers, hikers, skiers and travelers at high altitudes. Mountaineers who have experienced HACE in the past should acclimatize to the altitude very slowly.

HACE results from swelling of brain tissue due to leakage of fluids from the...
capillaries. Symptoms include headache, loss of coordination and decreasing levels of consciousness.

"HACE is a life-threatening condition," said Michael Knauth, M.D., Ph.D., from the University Medical Center's Department of Neuroradiology in Goettingen, Germany. "It usually happens in a hostile environment where neither help nor proper diagnostic tools are available."

Dr. Knauth and colleagues at the University Hospitals in Goettingen and Heidelberg, Germany, compared brain MRI findings among four groups of mountaineers: climbers with well documented episodes of HACE; climbers with a history of high altitude illness; climbers with a history of severe acute mountain sickness (AMS); and climbers with a history of isolated high altitude pulmonary edema (HAPE), a life-threatening accumulation of fluid in the lungs that occurs at high altitudes. Two neuroradiologists assessed the brain MRI findings without knowing the status of the mountaineers and assigned a score based on the number and location of any microhemorrhages.

"In most cases, these microhemorrhages are so small that they are only visible with a special MRI technique called susceptibility-weighted imaging," Dr. Knauth said. "With this technique, the microhemorrhages are depicted as little black spots."

The MRI results showed brain microhemorrhages almost exclusively in HACE survivors. Of the 10 climbers with a history of HACE, eight had evidence of microhemorrhages on MRI. The other two had uncertain results. Only two of the remaining 26 climbers were positive for microhemorrhages.

"It was previously thought that HACE did not leave any traces in the brains of survivors," Dr. Knauth said. "Our studies show that this is not the case. For several years after, microhemorrhages or microbleeds are visible in the brains of HACE survivors."

Survivors of the most clinically severe cases of HACE had the most prominent evidence of microhemorrhages on MRI. The bleeds were found predominantly in the corpus callosum, the thick band of nerve fibers that connects the right and left halves of the brain, and showed a characteristic distribution different from other vascular diseases like vasculitis, or blood vessel inflammation.

"The distribution of microhemorrhages is a new and sensitive MRI sign of HACE and can be detected years after HACE," Dr. Knauth said. "We will further analyze our clinical and MRI data on patients with acute mountain sickness, which is thought to be a precursor of HACE."

In the meantime, Dr. Knauth does not think HACE survivors need to give up climbing.

"We cannot give such a strong recommendation," he said. "However, mountaineers who have already experienced HACE once should acclimatize to the altitude very slowly."
Coauthors are Kai Kallenberg, M.D., Peter Bartsch, M.D., and Kai Schommer, M.D.

# # #

Note: Copies of RSNA 2012 news releases and electronic images will be available online at RSNA.org/press12 beginning Monday, Nov. 26.

RSNA is an association of more than 50,000 radiologists, radiation oncologists, medical physicists and related scientists promoting excellence in patient care and health care delivery through education, research and technologic innovation. The Society is based in Oak Brook, Ill. (RSNA.org)

Editor's note: The data in these releases may differ from those in the published abstract and those actually presented at the meeting, as researchers continue to update their data right up until the meeting. To ensure you are using the most up-to-date information, please call the RSNA Newsroom at 1-312-949-3233.

For patient-friendly information on MRI of the brain, visit RadiologyInfo.org.

| Abstract: | High Altitude Climbing: Are Microhemorrhages Only Found in the Brains of Survivors of High Altitude Cerebral Edema (HACE)? A Cross Sectional Study including Healthy Extreme Altitude Climbers and Those with Different High Altitude Illnesses |

- **Press conference video**

Video clips

- (.MP4 format)
  1. **Video clip** (659 Kbyte)
     Footage showing the view from the control room during a magnetic resonance imaging (MRI) scan.
  2. **Video clip** (172 Kbyte)
     Footage showing a patient entering a magnetic resonance imaging (MRI) scanner.
  3. **Video clip** (616 Kbyte)
     Footage showing a radiologic technologist preparing a patient for a magnetic resonance imaging (MRI) scan and the view from the control room.
  4. **Video clip** (362 Kbyte)
     Footage showing the view from the control room during a magnetic resonance imaging (MRI) scan and brain MR images.

Images (.JPG format)
**Figure 1.** The images show magnetic resonance (MR) slices through the brains of two mountaineers. The image on the left is from a mountaineer who climbed to altitudes above 7,000 meters, and the one on the right is from a mountaineer who survived a high altitude cerebral edema (HACE).

The arrows point to a brain structure which is called corpus callosum—it consists of densely packed nerve fibres connecting the two brain hemispheres. This part of the corpus callosum is normal in the left image, whereas in the right image (HACE survivor) it shows black spots representing multiple small hemorrhages (microhemorrhages).