Journal of BTHA, Volume XV, 2010

Tibet's new railway: Social, cultural, political implications and new research on work at high altitude

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In 2006 a new railway, the Qinghai-Tibetan Railroad, was opened linking Golmud, at an altitude of 2808 metres, to the Tibetan capital, Lhasa at an altitude of 4658 metres. The track is over 1100 km long and much of it is at an altitude of over 4000 metres, rising to 5072 metres at its highest point at the Tanggula Pass. It has over 600 bridges, including the spectacular Lhasa River Bridge, and at one point there is a tunnel over 3 km long. Ingenious engineering solutions have had to be found for the problems involved in constructing a railway track over areas of permafrost, and it represents a major triumph for Chinese engineering. Rail links to Beijing, Shanghai and Hong Kong will make the journey to the Tibet Autonomous Region of China much easier and quicker from many different parts of China. The railway is said to have cost £ 2.3 billion, and China claims that it will improve trade, tourism and jobs in economically underprivileged Tibet.

There is an argument that the reasons for the building of the railway were as much political as economic. The railway will greatly facilitate administrative, political and possibly military control of an area that has seen widespread demonstrations for greater autonomy and, in some quarters, complete independence from China. Even the Dalai Lama now concedes that whilst greater autonomy is possible, complete independence from China is an unlikely goal. The railway will also open the way for even greater levels of immigration of ethnic Chinese into Tibet, making further inroads into the cultural and religious identity of Tibet which has already suffered much in the last 50 years. The promised new jobs connected with the railway are most likely to go to ethnic Chinese, who have the advantage of better education and training than Tibetans and who speak Chinese, now the official language of business and industry in Tibet.

The Tibetan plateau is one of the world's great wilderness areas. The Chinese maintain that they have respected the environment when building the railway, for example suspending work during the migration season of the Tibetan antelope, but there seems little doubt that long term environmental damage is likely from such a huge construction project.

In addition to the social, cultural, environmental and financial considerations, construction of the railway has also produced information of interest to the world of travel health, and in particular to those with an interest in the problems of high altitude. A paper by Tian Yi Wu *et al*[1] reported a study of the incidence and severity of acute mountain sickness (AMS) amongst the railway construction workers. 600 workers usually resident in the lowlands and employed for 5 years on the project were compared with 600 lowland workers newly recruited each year to work and also to 200 Tibetan workers usually resident at or around 4500 metres.

They found a lower incidence and severity of AMS on each successive return to high altitude, whereas the incidence and severity remained relatively constant in each new annual batch of recruits to high altitude work. Resting arterial oxygen saturation was higher and resting heart rate lower with increasing exposure to high altitude. AMS did not occur in Tibetan workers, who had even higher oxygen saturation levels and lower heart rates.

What is particularly interesting about these results is that periods of exposure to high altitude lasted 7 months, but periods at lower altitude between episodes of exposure to high altitude lasted for 5 months. Prior to this study there was no clear evidence of the effect of repeated exposure to high altitude or chronic intermittent hypoxia (CIH). Some studies [2,3,4] showed no major effect, with the incidence and severity of AMS being similar on each repeated exposure to high altitude. Other studies [5,6,7,8] showed that prior exposure to high altitude reduced the incidence and severity of AMS.

This Chinese study showed that 59-63% of newcomers to high altitude suffered symptoms of AMS, compared with 53% at 4559 metres in the Italian Alps [9] and 68% at 4300 metres in Nepal.[10] Differences may have been due to different criteria for diagnosis of AMS and different rates of ascent. Workers intermittently exposed to high altitude in this study subsequently suffered a much lower incidence of AMS at 29-51%. This was lower than has been found in previous studies of intermittent exposure at 3550 metres in Chile [4] and in astronomers at 4204 meters at Mauna Kea [11] in which the incidence was 60% and 69% respectively.

Previously it was thought that altitude acclimatisation was lost within 2 to 4 weeks of a return to lower altitude [7, 8, 12, 13, 14] but this study has shown that the incidence and severity of AMS was reduced on each subsequent exposure to high altitude after periods of 5 months at sea level. The authors hypothesise that when exposure to high altitude is intermittent the length the period of exposure is the critical factor in improving acclimatisation on subsequent return to high altitude and that shorter periods of exposure are less likely to be effective.

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