

## COMMENTARY

# Disease and survival on the Thai-Burma railway: lessons for modern tropical medicine?

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## Summary

During the 2nd World War, large numbers of allied military personnel in south-east Asia became prisoners-of-war (POWs) of the Japanese. During their internment of three and a half years, they suffered undernutrition, exposure to tropical diseases and frequently overwork. Perhaps the harshest POW experience was the construction of the railway between Thailand and Burma. This paper explores the medical conditions during Far East imprisonment, and in particular on the Thai-Burma Railway, as well as the long-term health effects in post-war decades.

## Japanese victory and allied captivity

In late 1941 and early 1942, the Imperial Japanese Army (IJA) swept across the lands of south-east Asia and the Pacific Islands, in what later became known as their 'Lightning War.' Large numbers of allied troops were captured in various locations including Singapore, Hong Kong, Java and Sumatra. The POW nationalities included British, Dutch, Australian and American.

A particularly significant defeat was the fall of Singapore, which capitulated to the IJA on 15 February 1942. A military garrison of some 100 000 men became POWs, and were marched to Changi POW Camp on the eastern side of Singapore Island. Food provided was insufficient in quantity and quality, being mainly low quality rice and B vitamin deficient syndromes soon appeared. Poor sanitation also encouraged the spread of bacillary dysentery.

In mid-1942, large numbers of POWs began to be transported to Thailand and Burma for the construction of the Thai-Burma Railway. This was to be over 400 Km long through inhospitable jungle and hills. Conditions were significantly worse than at Changi, with forced hard labour and severely inadequate supplies of food and medicines.

## Medical problems on the Thai-Burma railway

About 60 000 POWs (mostly British, Australian and Dutch) were involved with the railway project, about 20% of whom died during its construction. Additionally, there was a large (over 100 000) of local labourers, who suffered an even higher mortality. There were five major causes of morbidity and mortality, as follows:

1. **Malaria.** Most POWs on the railway had literally dozens of attacks of malaria. Most was 'benign tertian' due to *Plasmodium vivax*, but in more remote jungle camps up to one-third of cases were due to *Plasmodium falciparum* with associated complications including cerebral malaria.<sup>1</sup>
2. **Dysentery.** Like malaria, most prisoners had several attacks of bacillary dysentery, but the more chronic and debilitating amoebic dysentery was a particular problem. Dysentery of both types were the leading cause of death on the railway—for example in 1943 at Tamarkan Camp in Thailand, 67% of deaths were due to dysentery.<sup>2</sup>
3. **Beriberi.** Thiamine deficiency led to 'wet' (heart failure) and 'dry' (sensory neuropathy) beriberi. Other neuropathic syndromes occurred, possibly related to other B vitamin

deficiencies. These involved neuropathic lower limb pain ('burning feet'<sup>3</sup>), nutritional amblyopia ('camp eyes') and sensori-neural deafness.<sup>4</sup> Supplies of vitamin supplements were always short, but home-made yeasts ('camp marmite') or grass extracts ('jungle spinach') were often successfully used.

4. **Tropical ulcer.** These were deep and painful infected ulcers which were common on the Thai-Burma Railway. Treatments included curettage with sharpened spoons, maggots, and even immersion in river water for carnivorous fish to nibble at slough. Amputation was, however, often necessary (Figure 1)—one railway POW surgeon recorded in 1946 a series of over 100 above-knee amputations successfully performed under very basic conditions at railway camp hospitals.<sup>5</sup>
5. **Cholera.** Serious cholera outbreaks took place mainly in the more remote jungle camps of Thailand and Burma. With only rudimentary rehydration systems, mortality was high (up to 50%<sup>6</sup>). Patients were treated in isolation huts or tents (Figure 2) and the bodies of those who died were often mass-cremated on horrific 'cholera pyres.'

Disease rates and mortality varied greatly with location. The more remote camps suffered heavily from cholera, and death rates were high. Conversely, mortality was much lower in the better equipped base camps.

## The medical aftermath

Perhaps not surprisingly, the dreadful medical experiences of Far East POW captivity in general, and the Thai-Burma Railway in

particular, was to have later health effects. Debilitating anxiety and depression, with flashbacks and nightmares, affected at least one-third long term and would now be regarded as post-traumatic stress disorder (PTSD).<sup>7</sup> Recurrences of malaria and amoebic dysentery were common in the early post-war years. There was also an excess of deaths from tuberculosis and liver disease (cirrhosis and hepatoma). The latter was later shown to almost certainly be due to high levels of hepatitis B transmission in the jungle camps,<sup>8</sup> possibly related to blood transfusion practices.

The neurological effects of beriberi and other B vitamin deficient disorders had lasting effects, and over 30 years post-release, about 5% of surviving Far East POWs had symptomatic syndromes, mostly peripheral neuropathy (sometimes of the 'burning feet' type) and optic nerve damage.<sup>9</sup> The nematode worm *Strongyloides stercoralis*, often transmitted on the railway, also caused chronic (even lifelong) infection—overall affecting about 12% of ex-Far East POWs, but up to 20% of those who worked on the Thai-Burma Railway.<sup>10</sup> The infection could cause diarrhoea or skin rashes due to larval migration ('larva currens' or 'creeping eruption'), but also occasional deaths due to 'hyperinfection' in immune-compromised patients.<sup>11</sup>

## Learning lessons

Between late 1946 and 1990 over 4000 ex-Far East POWs were screened at the Liverpool School of Tropical Medicine. The psychiatric effects of Far East imprisonment were being seen and described before PTSD became an accepted diagnosis. Potentially permanent neurological damage from vitamin B deficiency had not been previously described. Similarly, the

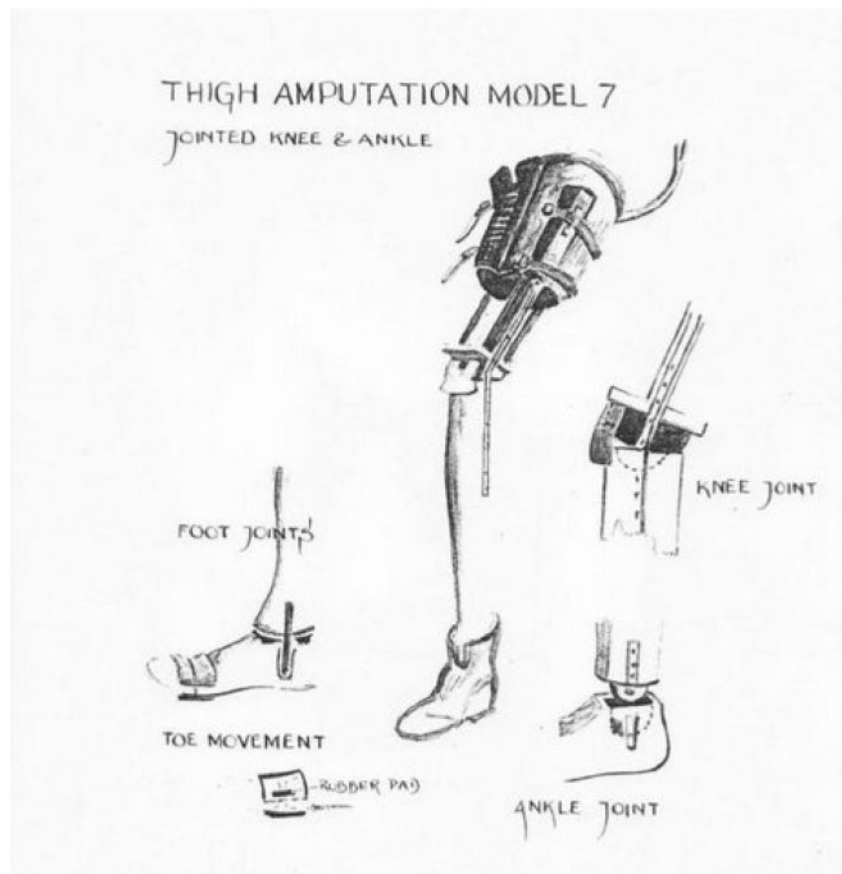


Figure 1. Drawing of post-amputation prostheses constructed in the workshop of Nakom Paton Camp—one of the base hospital camps (copyright Jack Chalker).



**Figure 2.** A tent for the treatment of cholera cases at Hintok Camp during railway construction. Note the makeshift intravenous saline equipment to the right of the medical orderly leaning down to tend to one of the sick POWs (copyright Jack Chalcker).

extreme longevity of chronic *Strongyloides stercoralis* infection was not previously recorded—the last case in a Far East POW was diagnosed 64 years after repatriation.

These lessons extend to modern military medical practice. In 1945, returning Far East POWs were told to not talk of their experiences, but in more modern conflicts there are active programmes for the detection and treatment of PTSD.<sup>12</sup> Parasitological investigations for military personnel returning from tropical conflict zones are similar to systems developed at the Liverpool School for screening ex-Far East POWs.<sup>13</sup>

### Current Far East POW research

With few ex-Far East POWs now alive, the Liverpool Tropical School has become involved with medical historical research. A major oral history project of over 60 surviving ex-Far East POWs was carried out between 2007 and 2010, resulting in the book *Captive Memories*.<sup>14</sup> More recently, the story of disease and survival on the Thai-Burma Railway has been recounted in a companion volume *Burma Railway Medicine*.<sup>15</sup> The Far East POW experience was described by one of the POW doctors on the railway as a 'bizarre natural experiment' into malnutrition, tropical disease exposure and deprivation.<sup>16</sup> It is a story worth telling, and has relevance and meaning for medical practice today.

*Conflict of interest:* None declared.

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