Landmines

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The Ottawa Treaty of 1998 seeks to ban the use of antipersonnel landmines, which have been one of the needless scourges of the developing world.

DURING THE FIRST WORLD WAR, the British forces (including Australian troops) facing Messines Ridge used coal miners and tunnellers from the London Underground to dig tunnels and place 14 mines and a large amount of ammonal (an explosive) under the German lines. The Commander of the British 2nd Army (General Plumer) had realised that a breakthrough by frontal assault was not practicable unless extraordinary measures were taken to disrupt the German defences. On 7 June 1917, the mines were detonated (12 exploded), creating a massive gap in the German line. It was said the explosion, the largest on the Western Front to that time, was heard in Paris and rattled windows in London. Australian troops occupied the devastated area and duly repelled the expected counterattack.

Many years later, one of the two remaining mines at Messines exploded. Even now there is at least one remaining mine at Messines — lost and unrecoverable, but still potentially a threat to human life.

Since the First World War the modern landmine has developed as a tactical battlefield weapon — and the problem of lost landmines has developed too. More than 50 years on from World War II, there are still casualties each year from mines laid in Poland, Libya, Egypt and other countries during that conflict. All over the world, landmines laid in various conflicts kill or maim thousands of civilians every year.

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Types of mines

There are various types of mines: antipersonnel mines, antitank mines and command-detonated mines (eg, the Claymore, designed to break up a massed infantry charge). Antipersonnel mines and antitank mines are normally pressure-sensitive. The M16 "Jumping Jack" mine used in South Vietnam produced two explosions on release of pressure: the first caused the mine to jump to waist level, whereupon the second devastated the individual and troops nearby. Towards the end of the Australian commitment in the Vietnam War, the second explosion did not always occur, because of degradation of the mine, much to the relief of the victims (as I observed when on duty with 8 Field Ambulance, South Vietnam, 1971).

Routine military doctrine requires that minefields be mapped and protected by fire to minimise enemy clearance and penetration. During the Australian commitment in the Vietnam War, a minefield laid by Brigadier S Graham was not protected, and the enemy forcibly coopted civilians, who lifted the M16 mines and relocated them as booby traps, wounding many Australians (Ashley Ekins, Researcher, Official History Unit, Australian War Memorial, personal communication).

Effects of antipersonnel mines on civilians in peacetime

Antipersonnel mines are now the most widespread kind of mine. Some estimates have suggested that there may be 65 to 113 million antipersonnel mines laid around the world.[1] Other estimates are lower,[2] but there is no doubt that mines are hugely disruptive to many developing countries. People's whole way of life is changed, with a burden of mine injuries stretching medical resources, preventing the use of essential agricultural land, inhibiting communications and disrupting public health programs (eg, people would rather drink dirty but "mine-safe" water).

Over 2000 individuals are injured by landmines every month somewhere in the world, and 30% to 40% will die. In a third world subsistence environment, the families of victims are so dependent on their agricultural workers that the

social damage is extensive and the families' survival may be threatened, with the difficulties of caring for a maimed relative exacerbating their problems.[3]

Treatment of landmine injuries

Landmine injury requires first aid and evacuation. Landmines normally produce a traumatic amputation below the knee, with peeling back of the soft tissue along fascial lines. This usually preserves the gastrocnemius muscle, its neurovascular supply and the associated skin. After extensive debridement a delayed primary closure is performed, with a below-knee amputation flap fashioned from the surviving skin and muscle. Debridement should include the depths of all tissue planes and should be painstaking and aggressive. The medullary cavity of the bone can be contaminated (I have removed pieces of rubber thong sandals from this area). The blast forces debris, shoe, the involved leg and dirt into the "good" leg. Extensive surgical work is normally required to save the good leg, including delayed primary closure and split skin grafting. Antibiotics are no substitute for debridement.

Rehabilitation includes the fitting of a prosthesis, which is normally provided by non-government organisations such as Handicap International and the International Committee of the Red Cross.

Banning and control of landmines

The International Campaign to Ban Landmines[4] began in 1992 and, under the auspices of eminent people such as the late Princess of Wales and the United Nations Secretary-General, Kofi Annan, resulted in the Ottawa Treaty coming into force on 1 March 1999.[5] This treaty bans "the use, stockpiling, production and transfer of antipersonnel landmines."[1] It also requires the destruction of stockpiles within four years and the clearing of minefields within 10 years. Rehabilitation of victims is part of the treaty, and an annual compliance report is to be forwarded to the United Nations.

However, this treaty bans only antipersonnel mines and not antitank mines, and the difference can be exploited. Non-victim-activated or command-detonated mines escape the treaty provisions, as can the *shikousei sandan*, or "projectile scattering device", which is under human control.[6] Australia has signed the treaty, while the United States, Russia, China, India, Pakistan and the two Koreas, plus other countries, have not. Recently, an 18-nation conference, of which 13 were non-signatories, was held in the Middle East with a view to making progress in banning antipersonnel mines.[7]

Mine detection and mine resistance

Military research is being carried out to minimise the effects of mines. Australians are working on mine-resistant boots and mine-resistant vehicles (Dr Alex Krstic, Research Scientist, Surrogate Project, Defence Science and Technology Organisation, Adelaide, personal communication).

A mine-resistant vehicle developed in South Africa, and now a museum exhibit. Photographs courtesy of Dr A Pohl, Director of Orthopaedics and Trauma, Royal Adelaide Hospital.

A mark 2 version of the Werewolf mine resistant vehicle, with underbody shaping and ceramic armour, is being tested in Namibia.[8] My personal view is that the wheels of the vehicle should be placed at distance from the body of the vehicle, either sideways or forward and rear, so that when the mine is detonated both the wheel and axle may be destroyed, but the vehicle remains intact.

If this concept could be developed further, it is possible that not only could personnel survive but that the vehicle could be repaired quickly, as has been demonstrated by vehicles in South Africa.

An Adelaide-based company (Minelab) has developed the FIA4 detector, which detects the metal firing pin in the millions of plastic antipersonnel mines sown in magnetic soils.[9] Minelab's research is leading to developments in the detection of mines ahead of moving vehicles.

Future trends

Despite the Ottawa Treaty, a number of "rogue" states and companies will continue to supply antipersonnel mines for use as indiscriminate weapons. Vigilance by the Ottawa sig-

natories will be required, and there is a possibility of class actions by victims against the manufacturing companies. It is my understanding that General Motors in the United States initially made landmines, but was forced to cease production because of public opinion (Dr Jason Garoood, HMAS STIRLING, personal communication). General Motors' clients were next supplied by the Fiat company in Italy, but after further pressure there they are now being made in Algeria. The industry is certainly innovative. Biodegradable mines are available. New detector technology is required, and the military requires an alternative barrier system which could detect and easily deactivate the mines of friendly forces.

Just as air warfare is becoming more discriminatory, as we have seen with NATO's Kosovo campaign in 1999, antipersonnel mines may well develop in ways that minimise "collateral damage". If the future of warfare in democratic countries is to support human values, as appears to have been the mission in Kosovo, it is counterproductive to devastate the population the force is trying to protect by polluting their environment with lethal weapons.

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Award

In May this year, Brigadier Robert Atkinson was honoured by the Royal Australasian College of Surgeons. The President of the College, Dr Bruce Barraclough, presented Brigadier Atkinson with the prestigious *E S R Hughes Award* for the year 2000. The medallion was awarded in recognition of Brigadier Atkinson's distinguished contributions to military surgery.

— Bruce Short, Editor

Letter to the Editor

Military psychiatry

TO THE EDITOR: John Ellard's article on military psychiatry[1] was a timely reminder of the importance of the principles of proximity, immediacy and expectancy in the treatment of combat stress reactions. These therapeutic guidelines were formulated by the work of Salmon and colleagues in World War I,[2] and remain the recommended approach today.[3]

As Ellard described, these principles are effective in returning soldiers to duty. There is even some evidence that they can be effective in reducing the development of post-traumatic stress disorder. Solomon et al reported that the rate of post-traumatic stress disorder in Israeli veterans was inversely related to the number of Salmon principles that were put into practice in their treatment.

But were these principles employed in the care of ADF personnel during the recent conflict in East Timor? Or was the temptation to evacuate too great, with Darwin just 60 minutes away by air?

Martin and Cline described the consequences of the failure to adhere to these principles: "The worst mental health outcomes follow inappropriate evacuation out of the combat theater; soldiers can be lost to military servce or effective civilian functioning."[5]

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