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History of mountain warfare

Markus Tannheimer[1], A,B,D-G, Raimund Lechner[2], A,B,D-G

[1] University Hospital Ulm, Department of Sports and Rehabilitation Medicine, Ulm, Germany
[2] Bundeswehr Hospital of Ulm, Department of Anesthesiology, Intensive Care, Emergency Medicine and Pain Therapy, Ulm, Germany

Original article

Abstract

Mountain warfare has thousands of years of history and presents numerous challenges to military operations. History proves, that this environment has decreased combat strength, caused more casualties than the enemy in some operations and influenced war tactics significantly. Mountain warfare has an increasing frequency due to withdrawal areas for hostile forces, being home of ethnic minorities, being origin of many water supplies and being a natural frontier between countries. Mountains influence all warfighting functions, but especially movement and manoeuvre (mobility) and force protection (health support). To overcome the hardships of mountain warfare, special mountain units including support elements are mandatory, especially for health service support.

Abbreviations

BC – Before Christ
m – Meters
NATO – North Atlantic Treaty Organization

Mountainous terrain is a special circumstance, one greatly complicating the other hazards of war.[1]

Background

The challenges of mountain warfare are not a modern phenomenon. The Chinese general and military strategist Sun Tzu has recommended to pass quickly over mountains and to not climb to heights in order to fight as early as 500 BC.[2] The ongoing war against terrorism has brought mountain warfare

Keywords

- mountain warfare
- military operations
- mountains
- health support

Contribution

A – the preparation of the research project
B – the assembly of data for the research undertaken
C – the conducting of statistical analysis
D – interpretation of results
E – manuscript preparation
F – literature review
G – revising the manuscript

Corresponding author

Assoc. Prof. Markus Tannheimer, PhD
e-mail: M.tannheimer@adk-gmbh.de
tel.: + 49 73 441 706 301
University Hospital Ulm
Department of Sports
and Rehabilitation Medicine
Leimgrubenweg 14
89075 Ulm, Germany

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once more into the focus. To meet the challenges of mountain warfare, shareknowledge, and enhance mountain warfare capabilities, the *NATO Mountain Warfare Centre of Excellence* in Poljče, Slovenia, was founded in 2015 and hosted the 8th European Hypoxia Symposium (September 2016) with a special focus on health problems during military operations in mountainous terrain.[3] Additionally, national military institutions focus on how to deal with environmental challenges and publish useful open-source recommendations, primarily the United States Army Research Institute of Environmental Medicine.[4]

As mountain warfare has direct impact on health and physical performance of the soldiers the aim of the present review is to show how mountain environments influenced war-fighting in the past by referring to accounts from the long history of mountain warfare, analyse them and derive recommendations for future military mountain campaigns. A selective PubMed and Internet search was conducted. In addition, we hand searched bibliographies for useful supplementary literature. The presented historical events are based on the definition of mountain warfare proposed by us.[5]

Ancient history

It is not possible to identify a specific event as the starting point of mountain warfare. However, conflict is as old as mankind and there have been many events where opponents have used terrain to their advantage. The Battle of Thermopylae in 480 BC, in which the Greeks, led by Leonidas I, were for days able to prevent a much larger Persian force from invading Greece, certainly has the characteristics of mountain warfare.[6] Leonidas was finally outflanked by highly mobile Persian forces via a small mountain track and he and his men were defeated.[7]

Alexander the Great's traverse of the Khawak Pass (4,500 m) was so demanding that his 50,000 men only covered 60 miles in 15 days and hundreds of his soldiers died due to a combination of hypoxia, cold, hunger and dehydration, making it one of the most costly campaigns of mountain warfare.[1] In 250 BC Mogul Mirza Mohammed Haidar conducted a campaign on the Tibetan Plateau (4,000–5,000 m) and complained severely about performance decrements among his troops. He described weakness, dyspnoea and hallucinations to the point of coma and death.[8]

In the year 218 BC, famous Carthaginian commander Hannibal crossed the foothills of the Pyrenees and the Alps in order to invade the Roman Empire. His approach is an early and deliberate act of mountain warfare.[1,9-11]

In the fourteenth and fifteenth century, a light armoured but highly mobile Swiss force was able to out-manoeuvre, surround, and finally defeat the heavy encumbered and therefore immobile opponents of Austria and Burgundy in the battles of Morgarten, Sempach, Grandson and Murten. These battles created Switzerland's reputation for being an impregnable mountain-fortress.[12]

Obviously, history offers some remarkable mountain campaigns up to the late 18th century, but mostly the Alps were only crossed by larger forces such as Caesar's campaign in Gallia or the German Emperors' campaigns in Italy against the popes in the Middle Ages.[6] Generally, during the ancient "period of line tactics [...] all difficult ground was studiously avoided [...]."[12] Even at the beginning of the 19th century General Clausewitz postulates that "mountain-positions are little suited for decisive defensive battles" and therefore recommends that one "avoid mountains with the principal mass of force" because he judged it impossible to achieve a decisive victory in the mountains.[6] He admits, however, that mountains are "the real place of refuge for the weak" and those "who dare not any longer seek an absolute decision".[13] Summing up, in ancient times, mountain warfare was the exception, not the rule.

Development of modern mountain warfare in the 19th century

Beginning in the late 18th century, three developments occurred from which modern mountain warfare evolved. The first is the development of modern alpinism. The first ascent of Mont Blanc by Balmat and Paccard in 1786 is generally accepted as the dawn of modern alpinism and the start of mankind's endeavour to conquer harsh and permanently uninhabitable high mountains. The mountains were no longer considered as the home of the Gods.[6] The colonization of mountainous terrain and infrastructural development progressed. Before that, only relatively low altitudes and easy terrain had been accessible, with few exceptions, such as the ascent of Mount Aiguille in 1492.[10]

The ambition to conquer high mountains led to the increasing development and refinement of mountain equipment and mountaineering techniques. Without the availability and proper use of crampons, ice axes, ice screws, shoes, pitons, ropes, harnesses, goggles,

helmets, carabiners and specialized clothing, moving in difficult terrain would have been impossible. Although some kind of crampons were already used in 400 BC and rock pitons and ropes were first used to conquer a fortress on top of a steep rock in Greece by Alexander the Great in 327 BC, such techniques and equipment remained relatively simple until the 19th century.[10]

In addition, military tactics changed from the relatively immobile line and Phalanx tactics to the more agile and manoeuvrable column tactics.[6] With mobility becoming one of the central characteristics of the military, the command and control, and movement of forces in rough terrain were facilitated, which paved the way for mountain warfare. Engels states that with the traverse of the Col di Cadibone during the Battle of Montenotte in 1796, General Bonaparte established the new science of mountain warfare.[12]

Along with these developments, an increasing number of mountain warfare events took place at the beginning of the 19th century, many of them in conjunction with the wars between different coalitions of European monarchs and the Napoleonic Empire, including Napoleon's crossing of the Great Saint Bernard Pass with 40,000 men in May 1800, the Russian General Suvorov's retreat over the Panixer Pass in Switzerland, the siege of Porta Claudia and the Peninsular War.[1,6,12] Several events of national insurrection also occurred in mountainous country, namely the Tyrolean Rebellion (1809), the Carlist Basque insurrection (1830s and 40s) and the uprising of the Caucasian Tribes against Russia with its peak in the 1840s.[6,12] All examples for the development of modern guerrilla warfare.[6]

Between 1808 and 1824 José de San Martín and Simón Bolívar liberated South America from the Spaniards. San Martín crossed the 4,575 m Uspallata Pass with his troops in 1817 in order to invade Chile. Simón Bolívar attacked the Spaniards in the northern regions of South America. He and his men crossed a mountain pass of 4,880 m during their march from Venezuela to present-day Colombia in 1819. In 1822 General Sucre defeated the Royalists on the steep slopes of Pichincha Volcano right above Quito, which resulted in the final liberation of today's Ecuador. In 1823 and 1824 Bolívar led his forces nearly 1,000 miles south into today's Peru, where the final battles of the Spanish American Wars of Independence were fought, again partly at altitudes of almost 4,300 m and in predominantly rugged terrain.[1]

During the 18th and 19th century and in the early 20th century, a long smouldering conflict between Russia in the north and British controlled present-day India and Pakistan in the South took place over military and commercial dominance in South and Central Asia. This conflict was referred to as the "Great Game" and it focused on controlling the natural mountain barrier with passes often higher than 5,000 meters between the Russian Empire, China and Mongolia to the north and India and Pakistan to the south.[1] Adjacent areas such as Afghanistan and Tibet were hard-fought buffer zones that the Russian and the British Empire as well as China tried to control, including the local population living there. Two military campaigns are particularly worth mentioning. In January 1842, General Elphinstone and his 4,500 men, accompanied by 15,000 wives, children and servants, were annihilated in the Battle of Gandamak and in numerous skirmishes on their retreat from Kabul to Jalalabad over mountain passes in heavy snow. Only a two-digit number of dispersed survivors finally made it to Jalalabad, weeks after the expulsion had started.[1,6] During Younghusband's military escorted diplomatic mission to Tibet in 1904, at least two documented battles exceeding 5,500 m took place, raising warfare of European forces in hitherto unknown altitudes.[1,4]

Although mountain combat obviously weakened the fighting force, no special training or special support was conducted or planned. The only special preparation was that residents of the mountain valleys were often recruited as soldiers for this purpose. Therefore, no specialized mountain warfare health support units existed either. Around 1900 this changed and several countries recognized the importance of special mountain warfare troops and the first specially equipped and trained units were founded. In 1872 Italy founded the "Alpini". In 1887 the "Chasseur Alpin" in France, in 1907 the Imperial-Royal Mountain Troops of the Austria-Hungary Empire and in 1914 the Royal Bavarian Snowshoe Battalions, later part of the Alpenkorps, were established.[6,14]

Modern Mountain Warfare

World War I changed warfare forever through new techniques and highly developed weapon systems. And it was also the first time that great armies fought each other in such an extended mountainous terrain over years in ruthless static warfare. In the Alps, a 600-mile front line was established with the heaviest fighting in the Dolomites. Professional civilian mountain guides with additional military training and specially trained mountain troops took warfare into previously unimaginable terrain (Figure 1). However, cold, rock fall, avalanches, malnutrition and abominable sanitary conditions caused more casualties than the enemy. Besides the Alps, campaigns also took place in the

Caucasus between Russian and Turkish forces. 78,000 of 90,000 Turkish soldiers, led by Enver Pasha, died due to cold, altitude and malnutrition which even caused scurvy.[1,10,11] In the Carpathian campaign in 1915 also huge losses were sustained. The total losses of the Habsburg Third Army during the first offensive for example exceeded 75 percent, most of them resulting from environmental factors. In retrospect, none of the conflicting parties were prepared for winter mountain warfare.[15]

Figure 1. A dilapidated emplacement in the Ortler Alps. In the background on the right is the snow flank of Gran Zebrù east face and Ortler (fot. R. Lechner)

In contrast to World War I, no static mountain warfare front line developed during World War II, but several short-term mountain warfare campaigns were conducted. In the summer of 1942, German *Gebirgsjäger* (mountain infantrymen) crossed the Caucasus in cold summer blizzards using passes up to 3,200 m in order to break through to the rear of the Soviet 18th Army defending the Black Sea coast and climbed the Elbrus (5,642 m).[1,11,16] One other example is the 600-m vertical night assault on Riva Ridge and surrounding peaks in the Italian Apennine Mountains by the United States 10th Mountain Division, a newly formed division specialized and equipped for mountain warfare.[1,17] From the medical point of view the Wehrmacht was not well prepared and had to improvise when evacuating casualties during mountain warfare, despite of special medical equipment suitable for mountain operations was available since the 1930s.[18]

Besides World War I and II, the 20th century saw a great deal of mountain warfare campaigns all over the world. It is impossible to mention all in detail but campaigns with a significant proportion of warfare in mountainous terrain were for example "The long march" in 1934 and 1935[1], the retreat from the Chosin Reservoir in the Korean War,[11,19] the Mau uprising in the mountain forests of Mount Kenya and Aberdare Range[20], the Radfan campaign during the Aden emergency in Southern Arabia in 1964,[21] or the Falklands War in 1982, which was partly fought in South Georgia, which is mostly glaciated and very mountainous.[21-23] Most combat operations were conducted on the Falkland Islands with a maximum altitude of only 708 m. There, the stormy, cold and wet weather caused a significant number of cold injuries.[11,21] This conflict shows impressively that with increasing distance to the equator rough mountain climate already prevails at much lower altitudes. In the operational planning process this is often underestimated by Westerners due to the habituation to their living environment. Not to be forgotten are the drug conflicts and the far-left guerrilla movements in South America, the latent conflict between Nepal and India over the drinking water resources of the Himalayas, the Chechnya conflict and the Uganda civil war in the in the Rwenzori Mountains.[24,25]

The area with the highest number of mountain warfare campaigns is most likely to be Southcentral Asia and adjacent regions. Although India gained independence from the British Crown and Great Britain withdrew from South and Central Asia, other players continued to play the Great Game almost without interruption. In 1962, China attacked India unexpectedly. Whereas Chinese forces were well acclimatized and equipped, Indian forces suffered hundreds of casualties as a result of cold and altitude.[4] Soon after independence from the United Kingdom in 1947, India and Pakistan both laid claim to the area of Kashmir. Several wars resulted from this unresolved territorial dispute, often in mountainous terrain.[1] The climax was the Siachen conflict (1984 – ongoing and actually resurgent) in eastern Kashmir, which has involved the highest military operation in history, a Pakistani reconnaissance mission to the summit of Sia Kangri in 1988 under Indian fire (7,422 m), and regularly manned military posts up to 6,447 m.[1,4,26] In 1978, Russia invaded Afghanistan. However, the Afghan rebels used the mountainous land to their advantage and the Russian troops had to withdraw after 10 years of heavy fighting.[1,4] Finally, in the ongoing war on terrorism, Afghanistan has re-entered the spotlight. During *Operation Enduring Freedom*, the *International Security Assistance Force* mission and the *Resolute Support Mission* several battles were fought in altitudes often exceeding

3,000 m, sometimes even 6,000 m, the most famous being *Operation Anaconda*.[4,26-28]

A characteristic of all these conflicts was that the effects of poor equipment and insufficient resupply repeatedly limited combat strength and caused devastating cold injuries because the effects of mountain environment were simply underestimated.[1,16,18,27,29] To summarize, the most frequent causes of morbidity and mortality were cold, terrain, malnutrition, subacute hypoxic exposure , and most often a combination and mutual aggravation of these factors.[30]

Specific characteristics and key factors of mountain warfare

It is very difficult to define what constitutes a mountain. Consequently, it is difficult to define mountain warfare.[16] To define a mountain or summit, reference is often made to such factors as elevation, steepness, topographical isolation and topographical dominance. Local usage complicates homogeneous nomenclature. Elevations considered as mountains in lowlands would be only hills in a mountain area.[30] Naturally grey zones and transition zones exist and a generally accepted definition does not exist. We have developed a definition that tries to capture the specifics of mountain warfare and refer to that in this article.[5]

Pierce mentions that "conflicts increasingly occur in a mountain / cold weather environment", and according to the United Nations Food and Agricultural Organization, "mountain people are affected by conflict disproportionately to their numbers and the land they occupy" and "it is an alarming fact that in the last 50 years conflicts in mountain regions have greatly increased. Violent conflicts are now almost twice as likely to occur at high altitude".[16,31] Mountains roughly cover one fourth of the earth and account for only 10 percent of its population.[25] There are many reasons for this imbalance. First separate movements and terrorist organizations find havens in the highlands.[25,32] Second ethnic minorities are often located in mountainous areas simply because topography and harsh environments create defensive and isolated communities, with a strong desire for freedom and a unique culture, tradition and language. The needs and unique ways of these communities are usually overlooked or repressed by the capitals in the lowlands.[25] Third, mountains are the place where much of the earth`s water supply originates and the rivers which rise in the hills are vital for the cultivation of the adjacent flatlands. As a result, conflicts over vital water supplies are fought in mountainous terrain.[25] Fourth, mountains constitute a natural frontier between countries with the consequence that border conflicts are inevitably fought in mountainous terrain.[25]

The effects of mountain environments on humans and on military operations are indisputable. For example, all six warfighting functions defined by the U.S. Army are influenced by the mountainous environment.[16] We think that the most critical warfighting functions in mountain warfare are movement and manoeuvre (mobility) and force protection (health support). Mobility in mountainous terrain is remarkably limited, due to the terrain and harsh weather conditions. A considerable amount of training is necessary to cope with those hardships. In addition, march time calculations have to be adapted. For example an activity such as a march of >2 h at sea level takes about 40% longer at an altitude of 3000 m in un-acclimatized and 28% longer in acclimatized condition. At 4000 m altitude this increases even to 65% in un-acclimatized and 45% in acclimatized condition.[33] This has a significant impact on the planning and mission accomplishment.[34] High mobility has been a key factor of successful mountain warfare campaigns from the very beginning, e.g. Leonidas's defeat at Thermopylae, resulting from being outflanked, or the highly mobile Swiss force in the 14th and 15th century.[6] In order to provide the obligatory assistance, support elements, especially medical personnel, have to be able to follow the fighting forces independently. Some historians also state as one reason for Hannibal's avoidance of attacking some clearly outnumbered hostile forces on his crossing of the Alps, that if he did so, any wounded would have slowed down his forces in the difficult mountain terrain significantly.[9] This shows, that patient evacuation and casualty care are closely intertwined with mobility, on a tactical as well as on a strategical level.[6]

As a consequence of reduced mobility overstretched lines of logistics are likely to occur. Not only is the delivery of supply goods more demanding, the need for special equipment and the amount of supplies is increased due to the environmental conditions. The need of water and fuel for cooking and heating increases considerably with altitude.[35] This may result in reduced supplies and thereby a reduction in fighting power.

There are several possibilities to overcome those environmental restrictions, one of them are pack animals. Predominantly in past conflicts, but also in current wars like the war on terror in Afghanistan, they are regularly used, especially by small units and special forces.[36] Not only supply goods can be transported, there are also possibilities of casualty evacuation with pack animals. However, nowadays the primary means

of transportation in mountainous terrain is air transport via rotary wings. Due to strong winds, poor visibility, altitude dependent power reduction, poor landing zones and not least the enemy threat, utilization is often limited in the mountains and contingencies are therefore mandatory.[35] A supply via motor vehicles is possible in principle, but often limited by the prevailing road conditions and the altitude related power reduction of diesel engines. Thus, transportation by porters is often the only way to ensure sufficient resupply.[35] This requires a high physical fitness and, in some cases, even the ability to perform rope manoeuvres and the knowledge of belay techniques. In some areas, mountain rivers may also be considered for material transport.[35] Finally, drones have become increasingly important in recent years. Not only in terms of air strikes, but also concerning the possibility of intelligence gathering in rugged and inaccessible terrain. With advances in technology, transportation of larger amounts of material is a possible field of application in the future. Reconnaissance drone flights above 8000 meters and drone flights for the delivery of drugs to almost 7000 meters are already being used in mountain rescue operations in the Himalayas.[37] Often military mountain training focuses mainly on climbing skills of the individual. But mountain warfare is more than mobility, transportation and special equipment. It is also about survival skills, building shelters and special tactics like to identify and build potential shooting positions and move in squad sized or even platoon sized units not only in very small teams. Marksmanship techniques in the mountains require adaptions due to wind, humidity, temperature and altitude differences compared to shooting on flat land, which have to be practiced intensively.[35] The effect of artillery shells and mortars is also different on snow covered ground. Communicating in the mountains is another problem to be faced. Line of sight communication systems often do not work, because signals are absorbed by terrain folds. Communication sites have to be chosen carefully. Satellite communication systems provide some improvement, but communication is still not satisfactory.[35] Taken as a whole, the tactical characteristics of mountain warfare result in a huge military advantage of a defensive mountain force over invaders. Conventional forces without special training are without chances, no matter how well equipped they are.

Although, any incidence of losses due to mountainous environments is difficult to determine exactly due to accumulation of many factors, the large proportion of casualties due to environmental triggered diseases and non-battle injuries is well documented.[5] The main enemies of the soldier in mountain warfare are altitude, cold and terrain – not the hostile forces. But this knowledge is not implemented with the necessary consistency, resulting in high but largely avoidable casualty numbers. One particularly striking example of avoidable environmental damage is the Falkland Wars, where 98% of the troops at the front line suffered non-freezing cold injuries. This is a type of injury the British had experienced many times on the Somme in the fall of 1916 during World War I, not in mountainous terrain but in similar weather conditions.[29] In current mountain conflicts high altitude diseases are becoming increasingly important. In the Kashmir border conflict for example, up to 90% of the dead are attributed to altitude and cold.[4] In general, many of the casualties of mountain warfare can be attributed to inadequate planning, training and equipment in combination with the unyielding environmental conditions. To overcome the hardships of mountain warfare, special mountain units exist in many military forces today. However, during their foundation phase, they often only consisted of infantry and some still do so today.[18] There seems to be a widespread lack of awareness of the necessity of mountain warfare support units, especially health service support units. Consequently, units specially equipped and trained in mountain mobility, evacuation strategies and treatment of mountain environment related disease and injuries are rare. In view of the years of personnel and monetary cuts in the military of the western armed forces, existing structures have been further reduced and now require a time-consuming and costly reconstruction.[4] A Russian program to train physicians for high altitude scenarios during the Soviet-Afghan War consisted of 900 hours of training – 108 with medical topics (roughly 1/3 theoretical and 2/3 practical training) and 792 hours devoted to mountaineering training with only 47 hours of theory.[35]

Conclusions

> *Mountain and cold-weather warfare has a long history, and that history clearly demonstrates that those who ignore it are doomed to fail when fate places them in such an environment.*[16]

The task of mountain troops is to fight in some of the world's most forbidding terrain, against and among mountain people.[25] The frequency of mountain warfare has increased significantly. There is no other kind of warfare in which environmental factors influence tactics as much as in mountain warfare. This is incomprehensible to anyone who has not experienced those

hardships personally himself. However, the long history of mountain warfare undoubtedly reveals its unique characteristics and can give an impression of the particular issues.

1. High mobility required.
2. Limited logistic support.
3. Limited communications.
4. Harsh environmental conditions.
5. Rugged, steep and partly impenetrable terrain.
6. Specific medical conditions with high numbers of casualties.

To meet those challenges, special considerations have to be made for combatants as well as for support units, which have to be able to follow the fighting forces in order to fully support them:

1. Light and rugged mountain equipment.
2. Special mobility training.
3. Special mountain tactics training.
4. Special medical training and equipment.
5. Adjusted medical evacuation strategies (improvised casualty evacuation, prolonged field care):
   - thorough personnel selection;
   - use of air assets (as long as feasible due to enemy and environmental conditions);
   - use of pack animals;
   - use of porters.

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