Swiss Armed Forces trains pilots for emergency evacuation of horses by helicopter

L'armée suisse forme des pilotes à l'évacuation d'urgence de chevaux par hélicoptère

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Abstract

Six horses were successfully transported by helicopter for 45 minutes using a horse rescue and transport net. An attempt to transport three horses at the same time was also successful. The critical factors for helicopter transport are a well-trained and experienced team, adequate sedation and impeccable flight equipment.

Keywords: horse, rescue net, helicopter, speed, flight blanket, sedation

Résumé

Six chevaux ont été transportés avec succès par hélicoptère pendant 45 minutes à l'aide d'un filet de sauvetage et de transport pour chevaux. Une tentative de transport de trois chevaux en même temps a également été couronnée de succès. Les facteurs critiques pour le transport par hélicoptère sont une équipe bien formée et expérimentée, une sédation adéquate et un équipement de vol irréprochable.

Mots-clés : cheval, filet de sauvetage, hélicoptère, vitesse, couverture de vol, sédation Introduction

The Swiss Armed Forces has a corps of troops called Train troops in its logistic units. These three formations called columns are engaged with horses for transport in the mountains (from 1500 meters and higher) for the benefit of other troops such as the mountain infantry or transmission for their equipment. Each train column has about 100 horses that transport goods either on their backs (as pack animals) or hitched to a cart (Figures 1 and 2). Loads on their backs can be up to 100 kg and loads on a cart can be up to 300 kg. The use of mules as pack animal is also a skill of the Swiss Armed Forces that has been passed down from generation to generation (Figure 3).

For more than 70 years, horses, mules and donkeys have been rescued by helicopter from emergency situations.[1] The animals are often injured or even lying down when they should be transported. In addition, they are in impassable terrain that cannot be reached by a normal ambulance [1]. Therefore, in mountainous areas, helicopter rescue is the only possibility to save horses quickly [1, 2, 3.] [2] In these situations, we encountered a wide variety of scenarios: animals had to be rescued from ditches and ravines, were stuck on a steep slope, had got caught in a river bed or had to be transported from an inaccessible alp to the valley[3].

Figure 1: Use of pack horses in the Swiss mountains – These horses belong to the Train troops (Source: S. Montavon – Swiss Armed Forces)

For transport, horses are equipped with flight gear, with the suspension harness being the most important element. The design of this harness must guarantee absolute safety. The harness must not tear or slip off the animal's body. In addition, it should not cause constrictions, which can lead to pain and stress during the flight. Furthermore, the handling should be as simple as possible, so that a quick fitting is possible in emergency and extreme situations[4, 5, 6, 7 and 8]. In Switzerland and in the Swiss Armed Force, the animal rescue and transportation sling[4], (ARTS), has be-

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[3] Unpublished article: Master thesis: "How equines are flown in Switzerland - An evaluation of the helicopter operations of the Large Animal Rescue Service Switzerland and Liechtenstein (2000-2020)", Larissa Carlen, 2019.

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come established due to its clear advantages[iii].

The ARTS sling was successfully used in 37 civil rescue flights with a total of 41 equidae[iii]. No complications occurred that could be linked to the transportation sling. It was convincing in terms of safety, reliability, fitting and design. The animal rescue and transport sling (ARTS) is therefore the method of choice for air transport of horses on both the civil and military fronts (Figures 4 and 5).

So far, the horses have been transported for a maximum of 20 minutes at a maximum speed of 60 km/h during civil rescue operations[iii]. For rescues from regions that are difficult to reach, such as remote alps, and in situations where rapid surgical care is indicated, it is necessary to be able to transport horses over longer distances at higher speeds. For the further optimization of such flight missions, the question thus arose as to how long and at what maximum speed horses can be transported in military flight missions. According to our hypothesis, horses can be flown for 45 minutes at speeds of up to 140 km/h without significantly affecting their general body condition. This assumption is based on Swiss geography. It would allow an injured horse to be transported to a clinic facility from all parts of the country. Another question to be answered was whether an additional insulation system is needed for the animals during long-term transports. According to our hypothesis, a flight blanket can reduce the drop in rectal body temperature during a long-distance flight and should therefore be used in such cases. The last question was whether the standard protocol for sedation in transport flights can also be used for longer flights at higher speeds or whether adaptations were necessary.[5] To answer these questions, several test flights were conducted with the Swiss Armed Forces in order to verify these hypotheses and to train their pilots and the Load Mastering Team. The documentation of heart rates and rectal temperatures allowed the assessment of the general body condition of the horse.

Figure 2: Use of a mule hitched with a cart in the Swiss forests – These mules belong to the Train troops (Source: S. Montavon – Swiss Armed Forces)

Figure 3: Use of mules in the Swiss forests – These mules belong to the Train troops (Source: S. Montavon – Swiss Armed Forces)

Figure 4: The Animal Rescue Transportation Sling in correct position (Source: M. Haab – Vetsuisse Zürich

Material and methods

Six Swiss warmblood geldings from the Swiss Armed Forces and stabled at the National Equine Center of Bern[6] were available for the flights. The horses were between three and thirteen years old (mean = 7.16). The flights were conducted in a sparsely populated mountainous area at an altitude of 1000 meters. The flights took place on two consecutive days. The weather was mostly sunny and there was a slight breeze. Temperatures ranged from -3 in the morning to +12 degrees in the afternoon. A total of six flights of 45 minutes each were carried out. During these flights, the horses sometimes accelerated to over 138.9 km/h (75 knots). During each flight, the horses wore the complete flight equipment, which consisted of a flight bonnet[7] , the flight halter[vii], the flight blanket and the ARTS sling (Figure 6). Four of the six horses were additionally equipped with a flight blanket[vii]. Finally, a flight with three horses simultaneously was performed. These three horses had already made an individual flight the day before. This last test was performed with the ARTS but without blanket, without heart rate measurement, without rectal temperature measurement. The three

[5] Unpublished article: „Die Rettung/Bergung von verunfallten Pferden und anderen Grosstieren", in Proceedings: Zürcher Fortbildungsabend - Bergung und Transport von Pferden und Rindern, Vetsuisse Fakultät Zürich, Anton E. Fürst, Prof. Dr. med. vet. DECVS, 2019

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Figure 5: Use of the Animal Rescue Transportation Sling during the homologation by the Swiss Armed Forces authorities (Source: S. Montavon – Swiss Armed Forces)

Figure 6: The complete flight equipment, which consist of a flight bonnet, the flight halter, the ARTS Sling and the blanket (Source: Department für Pferdechirurgie – Vetsuisse Zürich)

horses were not tied together. All three horses were equipped in addition with transport boots because they were shod.
All horses received an indwelling venous catheter[8] through which the sedatives were administered. Parameters at rest such as behaviour, mucous membrane colour, capillary filling time, heart rate, respiratory rate and rectal body temperature were documented. In addition, the animals were equipped with a portable Holter ECG[9] and a rectal probe , which enabled continuous recording of heart rates and rectal temperatures.

Figure 7: The Aérospatiale AS 332M1 Super Puma (TH06) helicopter (Source: D. Ackermann – Swiss Armed Forces)

Sedation

The horses were prepared identically for the flights. The venous indwelling catheter was placed. Subsequently, 0.03 mg/kg acepromazine[10] was applied intravenously (approx. 30 minutes before the start of the flight). The animals were sedated with a total dose of 0.02 mg/kg detomidine[11] and 0.02 mg/kg butorphanol[12] intravenously [9, 10, 11 and 12] . The total amount was divided into several doses for this purpose. After the horse was led into the stable lane, 0.005 mg/kg detomidine and 0.005 mg/kg butorphanol were administered intravenously. The horse was then led to the airfield. At the airfield, the next intravenous sedation was given with 0.005 mg/kg detomidine and 0.005 mg/kg butorphanol. Then, the flight equipment and the rectal temperature probe were mounted. Subsequently, 0.01 mg/kg detomidine and 0.01 mg/kg butorphanol were administered intravenously to the horses. Finally, about ten minutes before take-off, 0.01 mg/kg Detomidine was administered intramuscularly.

Helicopters

The Aérospatiale AS 332M1 Super Puma (TH06) helicopter[13] of the Swiss Armed Forces was used for the tests (Figure 7). The helicopter contained a pilot, a co-pilot and a flight assistant. So that the behaviour of the horses could be well assessed during the flight, a second Swiss Armed Forces helicopter accompanied the transport flights at a safe distance. This was an Airbus Eurocopter EC 635[14]. It also contained a pilot, a co-pilot, a person who recorded photos and videos, and a GTRD employee or a veterinarian. The latter documented the horse's behaviour and movements during the flight as well as the speed flown. This way, the flights could have been interrupted in time in case of defensive movements or other conspicuous features. In addition, two flight assistants (also called Load Mastering Team), three veterinarians as well as four large animal rescue paramedics of the GTRD were available on the

[8] Secalon-T TM, LUER-LOK TM, MERITMEDICAL®, 1600 West Merit Parkway, South Jordan UT 84095, USA
[9] Televet 100, Engel Engineering Service GmbH, Heusenstamm, Germany
[10] Prequillan ad us. vet., solution for injection
[11] Domosedan ad us. vet., solution for injection
[12] Morphasol 10 ad us. vet., solution for injection
[13] Aérospatiale AS 332M1 Super Puma (TH06), Aérospatiale, Paris, France
[14] Airbus Eurocopter EC 635, Airbus Helicopters, Maginane, France

Figure 8: A normal and quite behavior of the horse in the air – relaxed and slight leg movements (Source: D. Ackermann – Swiss Armed Forces)

Figure 9: Successful attempt to fly three horses simultaneously (Source: Angelika Nido, CH- 8304 Zürich)

ground for communication, preparation and landing of the animals. Based on a previous experiment, an underload rope length of 25 meters was used for the flights.[15] The flights took place in circles around the test site so that an emergency landing was possible at any time. No inhabited areas or car roads were flown over. The flight altitude was around 250 meters and the flight speed averaged 50 knots (= 92.6 km/h). In the case of several horses, the speed was increased in phases to up to 75 knots (= 138.9 km/h) and the behaviour of the animals was observed during this time. After 45 minutes, the horses were dropped back at the airfield by radio agreement. A few minutes after landing, the vital signs were measured. Afterwards, the flight halter, flight bonnet and ARTS were removed. This entire process was documented in time. Standard terms were defined for the horses' behaviour, with "calm and alert" as the normal state. The behaviour was evaluated on the ground and in flight. In the air, mainly the movements of the legs were assessed.

Results

Behaviour:

In the box, all six horses (n=6) showed calm and alert behaviour. After the first sedation, all horses (n=6) were lightly sedated and were led to the airfield in this condition. At the airfield, four (n=4) horses were well sedated (no skin reaction to touch). Two horses (n=2) were still considered lightly sedated (slight skin reaction to touch). During lift-off, one horse (n=1) showed medium movements of the legs, the other horses showed none to slight movements. During flight phase, three horses (n=3) had slight movements of the legs. The other horses (n=3) had slight to moderate movements (Figure 8).

When accelerating to 70 knots (= approx. 130 km/h), it could be observed from the accompanying helicopter that the transport was stable and smooth. From an acceleration to 75 knots (= approx. 140 km/h), the forces acting on the underload rope were visibly increased, causing a slight swaying. The horses became more restless, which was mainly evident in larger movements of the legs and a slight lifting of the head.[16] After landing, the majority of the horses were in a well sedated condition and did not move their legs at all to slightly.

Heart rate:

For five horses (n=5) the ECG was correctly recorded and stored. The average heart rate over all phases was calculated for each horse. The lowest value is 29 and the highest 53 beats/minute (normal heart rate is between 28 and 32). All horses (n=5) had 2nd degree AV blocks. No pathological arrhythmias were found in any horse (n=0).

Temperature:

In all 6 horses (n=6), rectal body temperatures were recorded and stored via the temperature logger. The temperature was measured just before the lift off and during the flight. A mean value was calculated for each phase and a mean value for each horse over all phases. Looking at the flight phases, no conspicuous features could be detected. All calculated mean values are within the normal range. The lowest value is 37.4° and the highest 38.0° (normal rectal temperature is between 37.0° and 38.5°).

Finally, it was also possible to fly three horses simultaneously. The sedation protocols were identical so that no bad behaviour signs could be noted. It should be mentioned that for the team of pilot's,

Figure 10: Excellent communication and coordination between the ground crew and the pilots is a key success factor in such a mission (Source: Angelika Nido, CH- 8304 Zürich)

[15] Unpublished data in progress, April 2019

[16] Personal communication: Major Marco Gerig, Swiss Armed Forces, Air Force, Operational Test and Evaluation (OEE), December 2022

weight calculations were necessary and that the mass of the horses to be transported and the volume and weight of the fuel are in competition. It is therefore important to plan the distances and flight times exactly in relation to the masses to be transported. For the helicopter model used by the Swiss Armed Forces (Aérospatiale AS 332M1 Super Puma (TH06), the transport of three horses at a time was realistic and possible (Figure 9).

Discussion and recommendations

The study has shown that horses with good sedation, proper flight equipment and a well-trained and experienced team, can be flown for 45 minutes in the ARTS. Based on the observations from the accompanying helicopter, the recommended maximum flight speed was set at 130 km/h (= approx. 70 knots). As soon as it was flown faster, the load started to oscillate slightly, which in turn caused the animals to become restless. They showed larger movements of legs and head and seemed to become more superficial under sedation[xvi]

The sedation protocol used proved to be very good. All horses were optimally sedated. The sedatives detomidine (0.005-0.02 mg/kg) and butorphanol (0.01-0.02 mg/kg) have been recommended in the American literature for sedating horses for transport flights since 1993 [9]. The flight equipment, which consists of the animal rescue and transport sling (ARTS), the flight halter and the flight bonnet, proved once again to be absolutely safe and easy to handle. The most important element, the animal rescue and transport sling, has been used for Swiss rescue missions with large animals for more than 20 years [2,4]. As the newest element of flight equipment, this study was the first to use a flight blanket[vii] was tested. It is a blanket with a neck section made of recycled PET, which is available in different sizes. All buckles were replaced by Velcro fasteners to avoid the formation of pressure points. The blanket was used in four out of six flights. Without the blanket, a drop in body temperature was recorded. Factors such as outside temperature, flight speed, wind chill and sedation also have an influence on the drop in body temperature. By covering the coat with a flight blanket, it can be assumed that the wind chill effect can be reduced and thus a drop in rectal body temperature can be counteracted.

Conclusion

6 horses could be successfully transported by helicopter for 45 minutes in the animal recovery and transportation sling (ARTS). An attempt to fly 3 horses at the same time was also possible. Crucial for such a transport is a well-trained and experienced team, adequate sedation and flawless flight equipment (Figure 10).

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Declaration of Ethics

The Author has adhered to the Principles of Veterinary Medical Ethics of the AVMA. Special authorization for this study has been obtained from the Swiss federal veterinary authorities.

Conflict of Interest

The Autor has no conflicts of interest

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