AEROMEDICAL EVACUATION OF VIETNAM'S LEVEL-2 FIELD HOSPITAL IN THE UNITED NATIONS MISSION IN SOUTH SUDAN: A RETROSPECTIVE STUDY

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Abstract

Objectives: To describe the characteristics of aeromedical evacuation (AE) operations in the United Nations Mission in South Sudan (UNMISS) carried out by Vietnam's Level-2 Field Hospital (L2FH). ***Methods:*** A retrospective, descriptive study on the data from all AE activities of the Aeromedical Evacuation Team (AMET) of Vietnam's L2FH from October 2018 to March 2022 in Bentiu, South Sudan. ***Results:*** 31 AE patients were collected with 1 case of casualty evacuation (CASEVAC), 14 cases of emergency medical evacuation (MEDEVAC), and 16 cases of non-emergency MEDEVAC. The mean age was 38.8 ± 8.4 years old, and the majority were male (83.9%). Patients were mainly from troop-contributing countries (TCCs) (67.7%). All cases belonged to the non-battle injury group, the majority was illness (93.5%). 6 infectious cases underwent AE, of which 2 patients were diagnosed with suspected severe COVID-19. Most patients needed medical officer escorts (29/31). The mean time from AE approval to patient referral for emergency MEDEVAC was 1.8 ± 0.4 hours, and for non-emergency MEDEVAC was 12.5 ± 7.9 hours. All cases were successfully transferred without any complications during AE. ***Conclusion:*** All patients under AE were not due to combat injury and mainly belonged to internal medicine disease, which raises the importance of training and experience exchange in both trauma and non-trauma air transport.

Keywords: Aviation medicine; Aeromedical evacuation; United Nations Mission in South Sudan (UNMISS); Vietnam's Level-2 Field Hospital; CASEVAC; MEDEVAC.

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INTRODUCTION

Aeromedical evacuation is one of the most important medical activities in the United Nations (UN) Missions to ensure timely implementation of emergency transportation for UN personnel and those involved who are injured/ill during the operations. In the UNMISS, AE is carried out according to the standard operation procedure (SOP) of the UN, in which the AMET of L2FH is directed by the Chief Medical Officer (CMO) to perform this task [1]. To the best of our knowledge, no research has been done on the issue of AE under Vietnam's peacekeeping force. This study aims: *To supplement the theory of Military Medical Management and Aviation Medicine and contribute to improving the quality and operational efficiency of Vietnam's L2FH.*

MATERIALS AND METHODS

Vietnam's L2FH has replaced the UK L2FH since October 2018, performing medical examination and treatment tasks for about 2000 UN soldiers and staff in Bentiu and surrounding areas. This is a descriptive, retrospective study of all AE activities conducted by the AMET of Vietnam's L2FH from October 2018 to March 2022. The data was retrospectively collected from the electronic and handwritten records stored in the deployed L2FH headquarters and used for research purposes only.

** Features of AE in the UNMISS:*

AE at the UNMISS includes two forms: CASEVAC: Evacuation of the casualty/casualties from the site of injury/illness to the closest medical facility and MEDEVAC: Evacuation of ill or injured patients between two medical facilities, either within or outside of the mission area [2, 3].

The term "emergency MEDEVAC" means for the evacuation of seriously ill or injured patients who need to be evacuated to the next level of care as soon as possible, using the most suitable aircraft available near the patients, a diverted aircraft, a specially activated UN flight or commercial air ambulance for that specific reason. On the other hand, "non-emergency MEDEVAC" means a situation in which patients are not responding to treatment at the originating medical facility or the treatment required is not available at the originating medical facility; therefore, they will be transferred to the next available schedule or diverted flight.

** AMET:*

According to UN mandates, every level 2/3 field hospital should have an AMET module that will always be available for the evacuation of casualties/ patients [4]. Vietnam's L2FH has an AMET with 6 members trained in UN air evacuation standards. There are two subteams; each team has 3 members, including one doctor and two nurses.

** Transportation assets:*

Types of aircraft at Bentiu: Rotary aircraft, including 2 Mi-8 helicopters, with a helipad about 500m from Vietnam's L2FH, and Fixed-wing aircraft, including Dash 8, An-26, ATR-72, and L-410. These fixed-wing aircraft used for UN regular flights are available every week from Monday to Friday.

** AME procedure:*

The AME procedure that we are implementing was issued by the UN [3]. The AME process is initiated by UN staff at the point of injury/illness (POI) or by Senior Medical Officers (SMO) in medical facilities. All CAS/MEDEVACs are subject to approval from the CMO, which is then conducted through the MEDEVAC Group (including relevant agencies such as the Air Operations Duty Office, Joint Operations Center, and Movement Control Passenger Booking Unit). For a flight to L3/4FH (outside South Sudan), a permit from the Medical Services Department (MSD) at the UN headquarters is required. When an emergency transfer is required, the Director of Mission Support will authorize medical evacuation pending authorization from Health Services.

** Statistical analysis:*

Descriptive statistics were provided. Continuous data are reported as mean ± standard deviation and categorical variables as numbers (proportion).

RESULTS

After three rotations deployed from October 2018 to March 2022, there were 31 AE cases performed by the AMET of Vietnam's L2FH. There was 1 case of CASEVAC (3.2%), 14 cases of emergency MEDEVAC (45.2%), and 16 cases of non-emergency MEDEVAC (51.6%). The mean age was 38.8 ± 8.4 years old, and the majority was male (83.9%). Patients were mainly from TCCs stationed in Sector Unity (Bentiu) (67.7%). Most of them were from Mongolia (n = 11), followed by Ghana (n = 4), Pakistan (n = 3), and India (n = 3). Half of the non-TCCs cases were UN staff with the nationality of South Sudan (5/10).

Table 1. Characteristics by types of flight.

Characteristics	Routine flight (n = 16)	Special flight (n = 15)	All types (n = 31)
Male, n (%)	14 (87.5)	12 (80)	26 (83.9)
Age, mean ± SD	37.9 ± 7.1	39.7 ± 9.8	38.8 ± 8.4
TCCs, n (%)	11 (68.8)	10 (66.7)	21 (67.7)
Illness, n (%)	14 (87.5)	15 (100)	29 (93.5)
Internal medicine, n (%)	13 (81.3)	10 (66.7)	23 (74.2)
Infectious disease, n (%)	3 (18.8)	3 (20)	6 (19.4)
Medical officer escort, n (%)	14 (87.5)	15 (100)	29 (93.5)
Night flight, n (%)	0 (0)	2 (13.3)	2 (6.5)
Intervention, n (%)			
Oxygenation	4 (25)	10 (66.7)	14 (45.2)
Vasopressor usage	0 (0)	3 (20)	3 (9.7)
Blood transfusion	1 (6.3)	0 (0)	1 (3.2)

(SD: Standard deviation)

All cases belonged to the non-battle injury group, the majority was due to illness (93.5%). There were only 2 cases (6.5%) of eye and limb injuries due to occupational accidents. At the time of transportation, the proportion of patients with internal medicine diagnoses was 74.2%, including respiratory (n = 6), cardiovascular (n = 6), neurology (n = 5), renal medicine (n = 5), and psychiatry (n = 1). The main surgical diagnosis was gastrointestinal disease (n = 6), in which there were 2 cases of severe intestine necrosis after appendicectomy at another medical facility. There were 6 cases of the infectious group who were under AE, of which 2 patients were diagnosed with suspected severe COVID-19, and 1 patient was suspected of bacterial meningitis. Most patients needed medical officer escorts (29/31 cases).

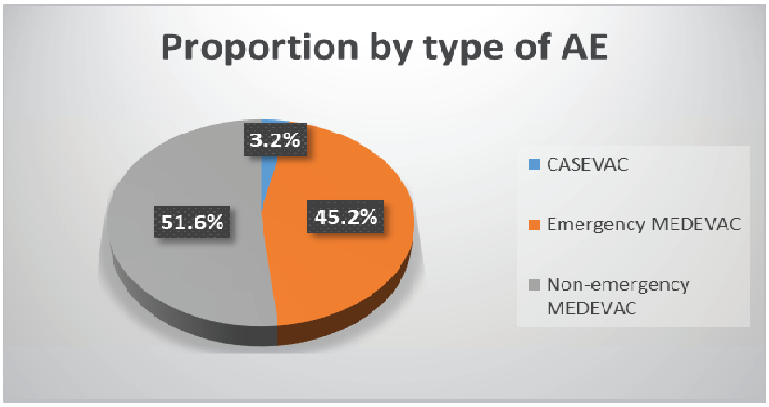

Figure 1. Proportion by type of AE.

Among 30 MEDEVACs, 25 patients were treated at Vietnam's L2FH with a median duration of 1 (1 - 3) day. The mean time from AE approval to patient referral for emergency MEDEVAC was 1.8 ± 0.4 hours, and for non-emergency MEDEVAC was 12.5 ± 7.9 hours. The type of aircraft commonly used in CASEVAC and emergency MEDEVAC was the Mi-8 helicopter (n = 12). The types of fixed-wing aircraft used include Dash 8 (n = 11), AN-26 (n = 5), ATR-72 (n = 2), and L-410 (n = 1). The mean duration of the flight (from Bentiu to Juba) by helicopter was 2.7 ± 0.2 hours, and by fixed wing was 1.7 ± 0.2 hours.

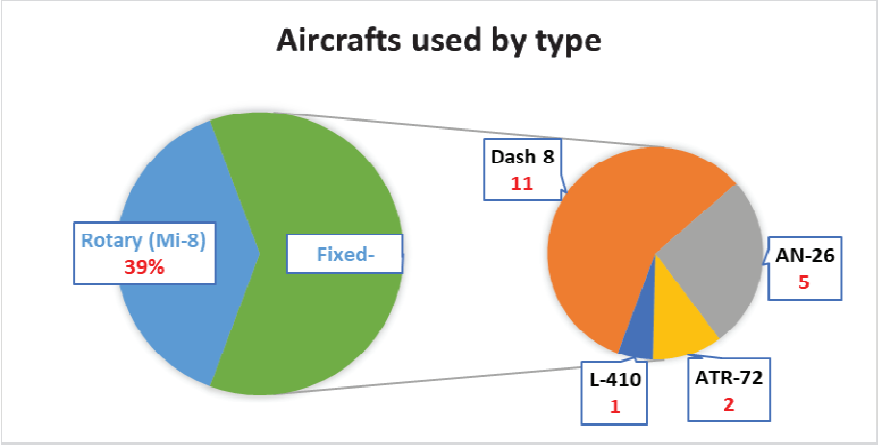

Figure 2. Aircrafts used by type.

During patient transport, the main intervention was oxygenation (n = 14), followed by vasopressor usage (n = 3), and blood transfusion (n = 1). More than half of the patients in this group (55.6%) were referred to L3/4FH outside South Sudan for further diagnosis and treatment. All cases were successfully transferred without any complications during AE.

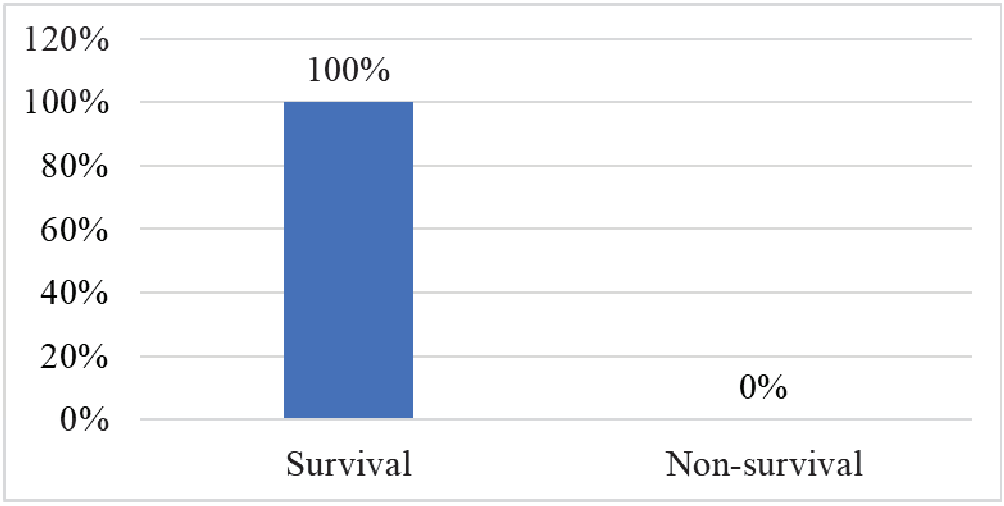

Figure 3. Aeromedical evacuation outcome.

DISCUSSION

AE is one of the essential parts of the UN health care system. This task requires the correct coordination of many agencies and units in the mission, the decision of the CMO, and the effective teamwork of the AMET. Our study showed that the mean age of patients was 38.8 years old, similar to AE research of UK L2FH (36 years old) from June 2017 to October 2018 [5]. Male patients also accounted for the majority due to the gender structure of UN staff being predominantly male. Most of the patients under AE were not due to combat injury, in which internal medicine diseases were predominated. This can be explained by the fact that the war situation in South Sudan has gradually stabilized. The majority of patients with AE required medical officer escorts (93.5%), indicating a very high need for the presence of a doctor as well as a high demand for emergency expertise, and understanding of physiological and pathological changes in AE. This shows the need for intensive training for doctors, nurses, and paramedics participating in AE, especially focusing on internal medicine illnesses and non-battlefield trauma.

In this study, 6 infectious disease patients received AE, while the AMET of UK L2FH did not transport any infectious patients. During the deployment of Vietnam's L2FH, the COVID-19 pandemic was outbreaking globally, meanwhile, South Sudan, with its multinational environment, was also a hot spot in terms of the number of COVID-19 patients. We

applied the SOPs for transporting AE COVID-19 patients according to the UN protocol [6], ensuring good disease prevention as well as patient safety during transportation. However, transporting COVID-19 patients is complicated. In the study by Jean Turc et al., patients with mild and moderate COVID-19 ARDS were transported with an Airbus A330 Multi-Role Tanker Transport plane equipped with the MoRPHEE (Module de Réanimation pour Patient à Haute Elongation d'Evacuation) system, named a "flying ICU" facility that also complies with international aviation security regulations [7]. Madeleine Beaussac et al. also showed that transporting COVID-19 patients requires more oxygen consumption than expected [8]. This demonstrates the need to equip both the escorts and the aircrew with specialized knowledge and medical supplies related to the transport of infectious patients, as well as the exchange of knowledge and experience between the AMETs of the L2/3FH, which is crucial in the situation of limited resources at the UN missions.

Most patients belonged to TTCs, which is consistent with the large number of TTC soldiers compared to individual officers. This result is similar to the UK L2FH study and poses two issues: (1) The selection and health screening of TTC units according to UN standards, and (2) the AE training in the multinational environment, especially a good understanding of countries working in the mission. Some of the AE patients in our study cannot communicate in English, leading to many communication difficulties during AE. We have provided several solutions such as requesting the unit to arrange an interpreter and preparing some question forms suitable for the patient's medical condition in bilingualism (the patient's native language and English). In addition, clinical observations during flights are also very necessary (status, concentration, skin color, and mucous membranes).

In our study, the mean time from AE approval to patient referral for routine AE is much longer than that for urgent AE (1.8 ± 0.4 hours compared to 12.5 ± 7.9 hours). This is because there is only one routine flight from Bentiu to Juba every weekday, so most patients will be hospitalized overnight and transferred the next day. We cooperated well with UN agencies and successfully performed two-night flights by helicopter, ensuring the safety and timely transport of patients to higher medical facilities. In addition, there was 1 case where the routine MEDEVAC had to be delayed for more than 24 hours because of bad weather and

had to use a helicopter to transport from Bentiu to Juba. In addition to the effects of air transportation such as vibration, noise, pressure change, etc. [9], AE at the UNMISS suffers from many other disadvantages. The infrastructure is still underdeveloped. In the rainy season, the roads and the airport are muddy and flooded, AMET may not be able to reach the patients or take them to the airport, or the plane may be unable to land. Language barriers with patients who do not speak English sometimes cause medical escorts to have difficulty taking care of them. The "no flights on Saturdays" policy of UNMISS is also a consideration for medical staff when planning MEDEVAC/CASEVAC. In addition, bad weather can also delay AE, so primary medical facilities must always be ready for this situation. This poses a lesson for primary healthcare facilities in terms of AE training during night flights, as well as being prepared for a situation when a patient needs to retain treatment longer than expected due to a flight delay.

CONCLUSION

AE is a vital medical activity in UN health care policy. This paper raises the importance of AE training on both battle and non-battle illness, especially on infectious diseases. We hope that future AE training will focus more on the characteristics and structure of each UN mission in the current multinational working environment.

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