Revista Educação, Meio Ambiente e Saúde ISSN: 1983-0173

Transporte aeromédico: uma perspectiva histórica

Aeromedical transport: Historical perspective

Transporte aeromédico: una perspectiva histórica

Aldir da Silva Junior[1], Beatriz N. Bahia[2], Cezar Cheng[3], Viviane Reis F. da Silva[4], Clenya Rejane Barros de Lima[5], Carlos A. N. Guerra Junior[6], Roberto Carlos Lyra da Silva[7], Carlos Roberto Lyra da Silva[8]

[1] Doutorando do PPGENFBIO/UNIRIO, Rio de Janeiro-RJ. E-mail: aldir_silva@yahoo.com.br
[2] Enfermeira. Hospital dos Servidores do Estado, Rio de Janeiro-RJ
[3] Analista de CT no Instituto Nacional de Câncer, Rio de Janeiro-RJ.
[4] Enfermeira da Secretaria Municipal de Saúde do Rio de Janeiro, Rio de Janeiro-RJ.
[5] Docente do curso de Ciência da Computação, Universidade Estadual de Roraima, Boa Vista-RR.
[6] Enfermeiro. Gerente de operações médicas a bordo de navios, Rio de Janeiro-RJ
[7,8] Docente do Programa de Pós-Graduação em Enfermagem e Biociências, Universidade Federal do Estado do Rio de Janeiro, Rio de Janeiro-RJ.

RESUMO

Tendo em vista o caos urbano nos grandes centros cuja densidade demográfica é elevada e, consequentemente, é intenso o tráfego de automóveis, o tempo-resposta dos profissionais de saúde que atuam no ambiente pré-hospitalar vem aumentando gradativamente ao longo da última década. Esse tempo despendido no atendimento pré-hospitalar (APH) é composto por várias etapas de cuidado. As Forças Armadas realizam ao longo dos anos atividades humanitárias junto às populações em vulnerabilidade social que necessitam de atendimento, seja levando profissionais de saúde para locais onde há carência ou removendo os pacientes para os grandes centros urbanos. Diante desse cenário, torna-se imprescindível o Serviço de Evacuação Aeromédica para salvar vidas em risco de morte. Esta modalidade de atendimento teve início em períodos de guerra, quando foi registado o primeiro relato deste tipo de transporte na Guerra Franco-Prussiana em 9 de julho de 1870 a 10 de maio de 1871. com a invasão da cidade de Paris (França), soldados, civis e feridos foram retirados dos locais por meio de balões e deslocados para onde pudessem receber atendimento em saúde. Est estudo teve como objetivo contextualizar o transporte aeromédico na perspectiva histórica, para tanto, utilizou-se a revisão bibliográfica.
Descritores: Transporte aeromédico, Evacuação aeromédica, Atendimento pré-hospitalar.

ABSTRACT

In recent years, the response time of health professionals working in pre-hospital care has been increasing due to high population density and intense car traffic in large cities. Pre-hospital care involves several stages of care, and the Armed Forces have been providing humanitarian aid to socially vulnerable populations by taking health professionals to places where there is a shortage or by transporting patients to large urban centers. In such situations, the Aeromedical Evacuation Service plays a crucial role in saving lives at risk of death. This type of care originated during times of war, such as the Franco-Prussian War from July 9, 1870 to May 10, 1871, when balloons were used to transport soldiers, civilians, and the wounded from the invaded city of Paris to receive medical care. The aim of this study is to provide a historical perspective on aeromedical transport through a literature review.
Descriptors: Aeromedical transportation, Aeromedical evacuation, Pre-hospital care, Air ambulance

RESUMEN

Ante el caos urbanístico de los grandes núcleos donde la densidad de población es elevada y, en consecuencia, el tráfico rodado es intenso, el tiempo de respuesta de los profesionales sanitarios que trabajan en el entorno prehospitalario ha ido aumentando progresivamente en la última década. Este tiempo de atención prehospitalaria (APH) se compone de varias etapas asistenciales. A lo largo de los años, las Fuerzas Armadas han realizado actividades humanitarias con poblaciones socialmente vulnerables y necesitadas de atención, ya sea llevando profesionales de la salud a lugares donde hay escasez o trasladando pacientes a grandes centros urbanos. Ante este escenario, el Servicio de Evacuación Aeromédica es esencial para salvar vidas en riesgo de muerte. Este tipo de asistencia comenzó en tiempos de guerra, cuando se registró el primer informe de este tipo de transporte en la Guerra Franco-Prusiana, del 9 de julio de 1870 al 10 de mayo de 1871. Con la invasión de la ciudad de París

(Francia), soldados, civiles y heridos fueron sacados de la zona utilizando globos y trasladados a lugares donde pudieran recibir asistencia sanitaria. El objetivo de este estudio fue contextualizar el transporte aeromédico desde una perspectiva histórica, mediante una revisión bibliográfica.
Descriptores: Transporte aeromédico, Evacuación aeromédica, Atención prehospitalaria, Ambulancia aerea

INTRODUCTION

In Brazil, pre-hospital care (PHC) has been around since the late 19th century and was primarily managed by the security sector. The main objective was to provide pre-hospital care services to the population as soon as possible.

However, with the increase in demographic density and car traffic in large urban centers, the response time of health professionals working in pre-hospital care has become a problem that needs to be addressed urgently.

The time spent in pre-hospital care (PHC) involves several stages of care, including activation of the response, time on the scene, and transport intervals. To ensure speed and efficiency in emergency care, pre-hospital care is categorized into two modalities: Basic Life Support (BLS) and Advanced Support to Life (SAV). The former involves preserving life without invasive procedures, while the latter requires advanced training for highly complex invasive procedures that require medical assistance and maneuvers. Unfortunately, traffic accidents in Brazil are a significant concern, leading to 45,000 deaths per year and an economic cost of R$50 billion, according to the Institute for Applied Economic Research (IPEA, 2020).

In 2017, traffic accidents were the main cause of death for children aged between 5 and 14 years old. Traffic conditions in Brazil, especially in large urban centers, are a significant barrier to the success of pre-hospital care; air ambulance is seen as a viable alternative. It can increase the chances of survival for people involved in car accidents, as it can travel long distances in a reduced time. Therefore, this work aims to provide historical context to aeromedical care, from its creation to the present day (VELASCO et al., 2019).

METHODOLOGY

This bibliographic literature review study was developed in two stages: establishing the theme, mining the literature review, recording data and content, structuring the text and synthesizing knowledge.

Information retrieval was carried out in the Scopus database in March 2022, using the descriptors contained in the string: TITLE (air AND ambulances) AND (EXCLUDE (DOCTYPE , "le") OR EXCLUDE (DOCTYPE , "no") OR EXCLUDE (DOCTYPE , "cp")) AND (EXCLUDE (DOCTYPE , "ch") OR EXCLUDE (DOCTYPE , "ed") OR EXCLUDE (DOCTYPE , "bk")) AND (EXCLUDE (DOCTYPE , "sh")).

Scopus is indeed one of the largest abstract and citation databases of peer-reviewed literature available today. It boasts over 22,000 titles from more than 5,000 publishers

worldwide, and covers a wide range of subject areas including science, technology, medicine, social sciences, and Arts and Humanities. Additionally, it contains more than 55 million records dating back to 1823, 84% of which have references dating back to 1996.

RESULTS AND DISCUSSION

The search returned 258 documents, with an average number of years since publication of 19.5 papers published per year. The average number of citations per document was 5.07. Regarding authorship and co-authorship, 725 researchers were reported. As for documents with single authorship, 83 (32.17%) were recorded without co-authorship.

Most documents recovered were of the original research article type, 245 (94.18%), and review documents totaled 13 (5.82%). A total of 12 different languages were found in the recovered documents. The English language 229 (88.75%) was the most common. No documents in Portuguese were recovered. A total of 29 countries contributed to the publication of the retrieved documents.

In 1933, Austria established the first aeromedical removal service, which later evolved into the Royal Flying Doctor Service (FLEXER, 1987; GRIMES; MANSON 1991). The development of aircraft for healthcare gained popularity in different parts of the world due to various conflicts after the historic milestone of the First World War. Immediate assistance was required for pilots injured in combat (PFLUGMACHEN apud MOECKE et al., 1987). Figure 1 displays Rudimentary air transport in World War I

Figure 1 - France 1917 - Rudimentary air transport in World War I

Source: https://www.pilotopolicial.com.br/transporte-aeromedico-evolucao-e-historia/

In times of war, it is crucial for a nation to have an Aeromedical Evacuation Service that can save the lives of those at risk of death. As per Flexer (1987), this service originated during war times, with the first recorded report of air medical transport dating back to the Franco-Prussian War that took place between July 9, 1870 and May 10, 1871 (GRIMES; MANSON, 1991). During the invasion of Paris, balloons were used to evacuate soldiers, civilians, and injured people to secure locations for medical care. Figure 2 depicts one such balloon that was used during the Franco-Prussian war of 1870-1871.

Figure 2 - During the Franco-Prussian War (1870-1871), a balloon was used by the Napoleonic force at St. Pierre Square..

Source: https://www.pilotopolicial.com.br/transporte-aeromedico-evolucao-e-historia/

With the escalation of wars and conflicts worldwide, the use of planes became a crucial component of aeromedical removal during World War II, which lasted from 1939 to 1954. This period marked a significant shift in the way injured individuals were transported. As per Gentil's (1997) account, cargo planes with three beds on each side were used to transport casualties. These patients were assisted by specialized nursing professionals called "Flight Nurses." These nurses were part of the health team linked to the Armed Forces, Army, and

Navy. In total, there were around 69,000 Flight Nurses. Figure 3 illustrates how the military transported the injured in combat by plane.

Due to the introduction of air medical transport in war zones, medical care strategies underwent significant changes. As a result, there was no longer a necessity for hospitals to remain in the combat zone. Instead, they were relocated to cold (safe) areas, where they could function as a base for the removal of injured individuals.

Figure 03 - Plane used in World War II to remove casualties

Source: https://www.pilotopolicial.com.br/transporte-aeromedico-evolucao-e-historia/

The Geneva Conventions were a series of treaties drawn up to define the standards for international laws relating to International Humanitarian Law. These treaties, which were unprecedented, established the rights and duties of people, combatants or not, in times of war. Henri Dunant, the creator of the Red Cross, played a significant role in the development of these conventions after witnessing the horrors of the Battle of Solferino. Today, the Red Cross continues to voluntarily help those in need of support without any financial intention. The organization is responsible for alleviating human pain without establishing any difference between sufferers and must act in times of war and peaceful eras alike, always for the benefit of those affected by the consequences of wars and states of violence and repression. In addition to this, the Red Cross also establishes actions to improve health, prevent the emergence of illnesses, and alleviate the pain of victims of calamitous situations. The use of helicopters was another milestone in war areas that speeded up the care and rescue of injured people in difficult-to-access areas. The current conception given to the helicopter with a

central rotor and tail was developed in 1939 by Igor Sikorsky, which immediately entered the aeromedical transport environment due to its versatility.

Figure 4 - Igor Sikorsky testing his first helicopter model

Source: https://www.pilotopolicial.com.br/transporte-aeromedico-evolucao-e-historia/

The use of helicopters in war environments has become a crucial tool for evacuating injured individuals from conflict areas. During the Vietnam War in 1962, helicopters were the best option for military and casualty transportation due to the rugged terrain, dense forests, and epidemics prevalent in the area. The most commonly used helicopters were the H1, which had two pilots, an internal stretcher, and a team consisting of an assistant, such as a doctor or nurse, to rescue the injured in missions with little security and exposure to enemy artillery.

In 1988, the Military Fire Brigade of the State of Rio de Janeiro, in partnership with the General Coordination of State Air Operations, began a pioneering pre-hospital rescue program in Brazil using a rotary-wing air service. At first, the service consisted of two Type HB – 350 single-turbine aircraft. One of the aircraft had a basic configuration and was manned by a specialized nursing technician (emergency medical technician - EMT) and a nursing assistant. The other aircraft had an advanced configuration with a doctor and a nursing assistant (NAZÁRIO, 1999).

Although the team's configuration emerged in the late 1980s, current legislation (COFEN Resolution no. 0656/2020) regulates the role of nurses in direct assistance and in the management of mobile pre-hospital and inter-hospital care in an air ambulance.

In Brazil, aeromedical evacuation is a free and humanitarian service provided by the Brazilian Air Force and the Military Police/Fire Department of the country's main urban centers. These institutions are responsible for primary removals (at the source of the event/accident), rescue and eventually secondary removals (after being treated in a hospital unit), which are in-hospital. Therefore, intra-hospital transport is not the core activity of these institutions. There has been a movement towards implementing private air ambulance services, performed mainly by air taxi companies.

In the context of war, two types of Aeromedical Evacuation – (EVAM) doctrine have emerged: Medical Evacuation (MedEvac) and Casualty Evacuation (CasEvac). MedEvac refers to rescue, extraction, and medical care operations for those injured in combat or in accidents due to natural disasters. This is done using vehicles specially dedicated to this purpose, such as medical aircraft, ambulances (civilian or military), or unarmed military helicopters equipped for this type of rescue (known as air ambulances) (BORGES et al., 2020). This term also applies to removing wounded to hospital ships on some coasts near the operational theater. Extraction equipment suitable for MedEvac typically has all the necessary equipment to deal with 90% of traumas occurring in combat and natural disasters, from minor surgeries to blood transfusions.

Figures 5a and 5b show, respectively, the aircraft in MedEvac and CasEvac.

Figura 5a - MEDEVAC - UH -60 Black Hawk

Figura 5b - CASEVAC - USAF - HH60 G PAVE HAWK

Source: https://csarpararescue.wordpress.com/2012/01/17/casevac-e-medevac-entendendo-as-principais-formas-de-resgate-em-combate/

CasEvac refers to the extraction of wounded individuals in combat situations using non-traditional means. It involves transporting victims to medical facilities or initial treatment in the combat zone without the presence of crew specialists in medical aid, and without medicalization of the victims. The concept was introduced by Stang in 2007.

The use of STOL aircraft such as the Fieseler Fi 156 or Piper J-3 dates back to the Second World War and was the first modern CasEvac method used in the European theater.

However, CasEvac became a necessary operation after the Geneva Convention, when MedEvac was not possible.

In conflicts like Afghanistan and Iraq, CasEvac has proven to be highly effective in extracting casualties from "hot zones" as helicopters or rescue vehicles can be easy targets for paramilitary groups and insurgents who do not respect conventions and treaties.

CONCLUSION

This review helped us understand the significance of aeromedical transport, its origins, and the role it plays in providing pre-hospital care to people in urban and war-torn areas. Fixed or mobile wing aircrafts are an excellent choice for pre-hospital care as they are not only fast, but also equipped with mechanical ventilators, infusion pumps, defibrillators, and highly specialized staff.

However, the high cost of aircraft maintenance is a major obstacle to their use worldwide. Currently, air ambulance services in Brazil only cater to a small proportion of the population for either cultural or financial reasons. Nevertheless, it is the most efficient option when land mobility is impossible, especially for seriously ill and injured people.

There are still some unanswered questions regarding the flowchart of aeromedical evacuation requests and their communication, measures for aircraft planning and configuration, efficient communication of care during aeromedical evacuation, usability of applications by MedEvac and Computer Science professionals, and cost-effectiveness studies to demonstrate the efficiency of these modes of transport and medical care.

REFERENCES

BORGES, Letícia Lima et al. Enfermagem Militar na "Operação Regresso ao Brasil": evacuação aeromédica na pandemia do coronavirus. **Rev. Bras. Enferm**. 73 (suppl 2). 2020. Disponível em: https://doi.org/10.1590/0034-7167-2020-0297. Acesso em: 17 de set. de 2023. Brasil. 2. **Aspectos Econômicos. 3.Aspectos Sociais**. I. Instituto de Pesquisa Econômica Aplicada. Disponível em: https://www.ipea.gov.br/atlasviolencia/arquivos/artigos/7018-td2565.pdf. Acesso em: 17 de set. de 2023.

CHAVES FS, Silva SOP, Lima CB. Atendimento pré-hospitalar à vítima de trauma com fratura de membros: uma análise da atuação do enfermeiro. **Temas em saúde**. 2017; 17(3):78-88.

COFEN - Resolução COFEN nº. 0656/2020: Código de Ética dos Profissionais de Enfermagem. Brasília, 2007. Disponível em: http://www.portalcofen.gov.

CUNHA, M. N. F. da; VIEIRA, S. C. Cruz Vermelha: breve análise histórica de uma organização sui generis. **R. Curso Dir. UNIFOR**, Formiga, v. 7, n. 2, p. 00-00, jul./dez. 2016.

Disponível em: file:///C:/Users/profu/Downloads/419-Texto%20do%20artigo-2149-1-10-20170216.pdf . Acesso em: 17 de set. de 2023.

FERRARI, Douglas. Transporte Aeromédico: Evolução e História. c2005. Disponível em: http://www.medicinaintensiva.com.br/transporteaeromedico.htm. Acesso em: 17 de set. de 2023.

FLEXER, M. The helicopter ambulance service. In: **international aeromedical evacuation congress**, Zurich, Switzreland.1985. Anais Zurich, Switzerlands Eigenverlag der Schweizerischer Rettungsflugwatch (REGA), 1987. p. 61-71.

GENTIL, Rosana Chami. Aspectos históricos e organizacionais da remoção aeromédica: a dinâmica da assistência de enfermagem. **Rev. esc. enferm. USP.** v. 31, n. 3. Dez 1997. Disponível em: https://doi.org/10.1590/S0080-62341997000300008. Acesso em: 17 de set. de 2023.

GRIMES, M.; MANSON.J - Evolutio of flight nursing and the national flight nurses association. **J.Air Med. Transp**., n.10, p.19-22, 1991.

MOECKE,H.'et al. Die entwicklung des ambulanzflugwesens bis zum 1. Internationalen luftrettungskongress in Paris 1929. In: **international aeromedical evacuation congress**. Zurich, Switzerland, 1985. Anais. Zurich, Switzerland, Eigenverlagder Scheizerisch er Rettungsflugwacht (REGA), 1987.p 2-3.

NAZÁRIO, N. O. **Fragmentos de uma construção do assistir em situações de emergência/urgência**. Florianópolis (SC): Insular; 1999. 134 p.

PATEL, A. B. et al. A validation of ground ambulance pre-hospital times modeled using geographic information systems. **International Journal of Health Geographics**, London, v. 11, art. 42, 2012.

VELASCO, Irineu Tadeu et al. Suporte avançado de vida. In: **Medicina de emergência: abordagem prática**. 14. ed. Barueri, SP: Manole, 2019. v. 14, cap. Seção 1, p. 84-101. E-book (1766 p.).