CLINICAL NOTE

In-flight electrical therapy

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We report 2 cases in which electrical therapy was applied in flight. After a 55-year-old man with acute coronary syndrome with ST elevation was initially stabilized, he experienced ventricular fibrillation in flight and was given 4 shocks between 200 and 360 J. A 78-year-old man with an electrocardiographic diagnosis of slow atrial fibrillation, related to use of β-blocker eye drops, was treated with a temporary pacemaker in flight. Both cases were managed in an Agusta A109-E helicopter built in 2003 (250 flying hours per year) and equipped with a monophasic monitor-defibrillator (Responder 3000, Marquette-Hellige). No interference from the helicopter's electrical equipment was detected during therapy or afterwards. Both patients completed treatment in the corresponding tertiary care hospital and were discharged in the following days. [Emergencias 2009;21:471-473]

Key words: Electrical therapies. Helicopter. Defibrillators.

Introduction

There is considerable controversy regarding the use of electrical therapy devices in emergency helicopter transport[3,5-9]. The discharge of a considerable amount of electrical energy inside a helicopter requires extreme security measures, paying particular attention to the proximity of the patient and crew, the apparatus delivering that energy and its impact on helicopter electronics and avionics helicopter. To date, the relevant medical literature supports the use of in-flight electrical therapies, but we have not found detailed descriptions, only confirmation of these facts[13-15]. We present two cases of in-flight attention, one involving defibrillation and the other an external pacemaker. Neither intervention affected flight control.

Case 1

A 55 year-old man with a history of type 2 diabetes mellitus and hypertension consulted a primary healthcare centre in a mountainous rural area for chest pain of 15 minutes evolution. Electrocardiography showed acute coronary syndrome with ST elevation. The medical emergency helicopter team arrived 75 minutes after onset of the pain. Cardiac electrical rhythm corresponded to atrial fibrillation with ventricular response of 120 beats/minute. The patient showed anxiety and intense chest pain, without clinical manifestations of heart failure. Systolic blood pressure was 90 mmHg, temperature 36.6ºC and oxygen saturation 92%. He received initial treatment with oral acetilsalicyclic acid and one dose of intravenous nitroglycerin. Then he received oxygen therapy, saline overload, intravenous amiodarone and sedoanalgesic therapy with midazolam and fentanyl.

After clinical improvement, the patient was transported by helicopter to the nearest tertiary hospital (a 30-minute flight/130 km) for definitive treatment. After 4 minutes, he presented ventricular fibrillation. Given that the mountainous terrain impeded an emergency landing, the health team initi-

ated advanced life support in the attention cabin (Figure 1), including defibrillation with 4 shocks of 200-360 J. The patient's vital signs recovered 5 minutes later.

The patient was again stabilized with tracheal intubation, inotropic support and synchronized cardioversion atrial fibrillation with ventricular response of 110 beats per minute. No new complications appeared before arrival at the hospital, where he received thrombolytic therapy with tecneteplase, enoxaparin and abciximab. A week later he was discharged from hospital with normal left ventricular function and no valve or wall abnormalities.

Figure 1. Attending cabin with monitor-defibrillator.

Case 2

This was a 78 year-old man with a history of hypertension, paroxistic atrial fibrillation and transitory ischemic accident. Habitual medication included clopidogrel, transdermal nitroglycerin, torsemide, buflomedil hydrochloride, levunolol 0.5% eyedrops. The patient had lost consciousness at home in a distant rural area approximately 45 minutes from the nearest reference hospital and out-of-hospital emergency services, and therefore required the services of a medicalized helicopter. On our arrival, we observed intense vagal symtoms with decreased level of consciousness. The electrocardiogram showed atrial fibrillation of 30-40 beats per minute, with no response to intravenous atropine, which improved after saline overload. Helicopter transfer was initiated with oxygen therapy, fluid therapy and hemodynamic monitoring.

Ten minutes after take-off, he presented an intense vagal episode and systolic blood pressure below 80 mmHg. Stimulation was initiated with an external pacemaker set at 60 beats/minute and 80 mA to achieve hemodynamic stabilization. On arrival at the tertiary hospital, he was fitted with a transitory pacemaker without complications; evolution was favourable and sinusal rhythm established, which allowed device withdrawal three days later. The diagnosis was symptomatic slow atrial fibrillation secondary to treatment with levunolol eyedrops.

Discussion

Civil service emergency helicopters began operating in Denver 1972. The demand for this type of service increased significantly in the 1980s, especially with increased use of coronary angioplasty techniques[3]. Health emergency helicopter transport allows for rapid intervention over relatively short distances (generally less than 300 km) and difficult terrain.

Published work on short flights provides most valuable information[4-9]. Firstly, several studies show that helicopter transport is safe, although none has demonstrated a beneficial effect for heart patients. Although the main advantage is possibly speed, the timely restoration of blood flow in occluded coronary arteries must lead to improved outcome.

In addition, patients with associated cardiogenic shock show improved long-term outcome after rapid transfer to tertiary hospitals able to provide advanced procedures, such as percutaneous transluminal coronary angioplasty[10].

Helicopter transport extends the capability of available regional health resources for these patients and allows the whole population in the area to receive equal treatment options, regardless of their geographical location.

After performing a MEDLINE search (keywords: defibrillation, helicopter, HEMS) on electrical therapies and medical helicopter transport, the result was a very limited number of publications. Two real cases of in-flight defibrillation in 1983 are reported[11]. In 1989, Dedrick[12] showed defibrillation, both on land and in flight, to be a safe procedure, provided that the standard safety precautions are followed. The article also confirmed the performance of defibrillation without incident by 60 teams, but did not include information on the number of patients or their characteristics. Werman in 1999 also confirmed the use of defibrillation in flight but again no data were provided[13].

There have been several experimental studies[14] with different models of helicopters and defibrillator devices; electrical interference has not been described nor alterations in helicopter or device systems. These tests were conducted with engines

off and running, and in the latter case both on land and in flight. The electrical and magnetic fields included energy levels from 100 to 360 J and impedance of 50 to 70 Ohm. We have found no references about the use of defibrillators with biphasic waveforms.

We use a Responder 3000® monitor-defibrillator with external pacemaker function providing similar levels of energy and impedance used in previous experimental tests[15]. In addition, defibrillation testing was performed with the monitor-defibrillator Lifepack 10® in the Agusta 109-E® helicopter during the certification process as stated the user manual[16].

All this information indicates the need for further research to optimize patient and crew safety. We believe that in-flight electrical therapy has proved safe and effective, but the current legal regulations do not define the requirements for helicopters and electrical therapy devices.

All developments in this field are based on tests performed by private manufacturers and by health teams themselves. We also believe guidelines should be elaborated by the competent medical and aviation authorities, with the various medical and/or rescue emergency helicopter services in Spain, in order not to depend on private testing and to clarify any controversy about in-flight electrical therapy.

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Terapias eléctricas en vuelo

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Presentamos dos casos de terapias eléctricas instauradas en vuelo. El primer caso es un varón de 55 años con síndrome coronario agudo con elevación del ST. Tras la atención inicial sufre un episodio de fibrilación ventricular en vuelo que precisa de cuatro descargas entre 200 y 360 J. En el segundo caso se describe el uso en vuelo de un marcapasos transitorio en un varón de 78 años con diagnóstico electrocardiográfico de fibrilación auricular lenta que resultó ser secundario a un tratamiento con colirio beta-bloqueante. En ambas atenciones participó un helicóptero A109-E® (año de fabricación: 2003, horas de vuelo/año: 250), fabricado por Agusta, equipado con un monitor-desfibrilador (monofásico) Responder 3000®, fabricado por Marquette-Hellige. No se detectaron interferencias con el equipo electrónico del helicóptero ni durante el uso de dichas terapias ni en los minutos posteriores. Ambos pacientes recibieron tratamientos definitivos en su hospital terciario correspondiente, y pudieron ser dados de alta hospitalaria en los días siguientes. [Emergencias 2009;21:471-473]

Palabras clave: Terapias eléctricas. Helicóptero. Desfibrilador.