SCIENTIFIC LETTER

Safety of aeromedical repatriation after myocardial infarction: a retrospective study

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Heart 2006;**92**:1864–1865. doi: 10.1136/hrt.2006.094607

UK residents make over 64 million visits abroad each year, with European Union countries accounting for 70% of destinations.[1] Unfortunately taking a holiday is associated with an increased risk of having a myocardial infarction.[2] Current guidelines recommend a delay of up to 21 days after uncomplicated myocardial infarction before commercial air travel.[3]

The main concern for transportation of cardiac patients is the effect of hypoxia at altitude. Aircraft are pressurised to achieve cruising altitude cabin pressures equivalent to 2440 m above sea level and at these pressures oxygen tension decreases 60% to a PaO_2 of 55 mm Hg, which results in a haemoglobin saturation of about 90% in patients with normal cardiorespiratory function.[4] This presents no problem for healthy people but may be detrimental to patients with cardiac ischaemia. Hypoxia results in tachycardia with increased cardiac output and subsequent decrease in ischaemic threshold.[5] Cardiac ischaemia may also be aggravated by raised catecholamines caused by patient anxiety. Transportation of a patient with a recent acute coronary syndrome in a hypoxic environment is therefore potentially hazardous.

Two small studies have examined the safety of transporting patients by commercial aircraft after myocardial infarction[6 7] but to date there are little data on repatriation under 14 days after a myocardial infarction. Early repatriation may have beneficial social, economic and medical outcomes with patients returning to their home country.

We report a study to investigate whether early air transportation after myocardial infarction can be undertaken safely.

METHODS

We retrospectively analysed all aeromedical repatriations by commercial airlines after acute myocardial infarction undertaken by Healix International, a medical repatriation company based in London, UK from 1 April 2004 to 30 November 2005. The comprehensive transportation medical reports of all patients were reviewed and data were collected on age, sex, clinical diagnosis, time from presentation to repatriation, duration of flight(s), distance travelled and complications, such as angina, hypotension, hypoxia and arrhythmias. A doctor with full monitoring and defibrillation equipment escorted all patients during repatriation.

Data were initially entered on to a case record form and then double entered on to a computerised database. Proportions were compared by Fisher's exact test. Differences between groups were assessed by an unpaired two-tailed t test. All data were expressed as mean (SEM). A value of $p < 0.05$ was considered significant.

RESULTS

During the period under consideration, 213 patients were transported on a commercial airline with a doctor escort after a myocardial event. ST elevation myocardial infarction (STEMI) was diagnosed in 157 (73.7%) patients and non-ST elevation myocardial infarction (NSTEMI) in 56 (26.3%). Patients with STEMI and NSTEMI had a similar age distribution but more patients with STEMI were men. Peak troponin T concentrations and the rates of revascularisation did not differ between the groups depending on type of myocardial infarction (table 1).

Table 1 Characteristics of patients with STEMI and NSTEMI repatriated by commercial airline

Variable	STEMI (n = 157)	NSTEMI (n = 56)	p Value
Age (years)	62.2 (0.86)	64.4 (0.86)	0.19
Men/women	132/25	35/21	0.001
Troponin T (μg/l)	7.04 (1.24)	6.35 (1.49)	0.72
CABG	12	4	1.00
PCI	61	15	0.14

Data are mean (SEM) or numbers.
CABG, coronary artery bypass grafting; NSTEMI, non-ST elevation myocardial infarction; PCI, percutaneous coronary intervention; STEMI, ST elevation myocardial infarction.

Table 2 Characteristics of patients repatriated ⩽14 days (group A) and >14 days (group B) after presentation

Variable	Group A (n = 149)	Group B (n = 64)	p Value
Age (years)	61.2 (1.24)	66.1 (0.94)	0.004
Men/women	117/32	50/14	1.00
Flight time (min)	248.6 (13.8)	358.2 (45.0)	0.03
Distance (km)	2613.5 (194.4)	3901.5 (514.9)	0.004
Troponin T (μg/l)	7.9 (2.07)	6.1 (1.0)	0.36
STEMI/NSTEMI	110/39	47/17	1.00
CABG	4	12	0.0002
PCI	59	17	0.09

Data are mean (SEM) or numbers.
CABG, coronary artery bypass grafting; NSTEMI, non-ST elevation myocardial infarction; PCI, percutaneous coronary intervention; STEMI, ST elevation myocardial infarction.

Patients were transported 6–38 (mean 12.9 (SEM 0.3)) days from presentation. One hundred and forty-nine patients (70%) were repatriated ⩽ 14 days (10.6 (0.16) days) from presentation (group A) and 64 (30%) > 14 days (18.9 (0.57) days) from presentation (group B). In group A 110 (73.8%) patients had STEMIs and 39 (26.2%) NSTEMIs. In group B 47 (73.4%) patients had STEMIs and 17 (26.6%) NSTEMIs.

Table 2 shows a similar sex ratio in each group, although patients in group B were slightly older. The flight time and distance travelled were significantly higher for patients in group B. Troponin T concentrations did not differ between

Abbreviations: CABG, coronary artery bypass grafting; NSTEMI, non-ST elevation myocardial infarction; PCI, percutaneous coronary intervention; STEMI, ST elevation myocardial infarction

the two groups. More than 70% of patients in group A were brought home within 10 days with 10% being repatriated within a week.

Overall revascularisation rates by coronary artery bypass grafting (CABG) or by percutaneous coronary intervention (PCI) were similar in both groups, with 63 (42.3%) patients in group A and 29 (45.3%) in group B undergoing revascularisation before repatriation. Significantly more patients in group B underwent CABG but PCI rates were similar.

No serious complications occurred during repatriation. No significant hypotension or arrhythmias were observed during flight. Sixteen patients (10.7%) in group A had asymptomatic hypoxia with pulse oximetry $< 92\%$ at altitude and were given prophylactic oxygen compared with 15 (23%) in group B ($p = 0.01$). Three patients experienced angina in group A, which was not associated with hypoxia and was relieved by sublingual glyceryl trinitrate. No patient in group B had angina.

Ten patients (17.9%) with NSTEMI had asymptomatic hypoxia compared with 21 (14.1%) with STEMI. No patients with prior NSTEMI had angina during the flight. All three patients who experienced angina had had a prior STEMI and one patient had undergone PCI before repatriation.

DISCUSSION

Patients repatriated early had significantly higher flight time and distance travelled, which were associated with a higher incidence of hypoxaemia. This may reflect a more prolonged exposure to reduced cabin pressure. However, no patient had symptomatic hypoxia, and the oxygen saturation was readily corrected with supplementary oxygen. No differences were observed between the patients with STEMI and those with NSTEMI. Revascularisation before repatriation does not appear to alter outcome during flight.

Roby *et al*[8] suggested that hypoxia may be associated with transient ST depression at altitude, but in the present study no patient with hypoxia developed angina. It is unclear whether supplemental oxygen confers any medical benefit to patients in flight.

Aeromedical transportation of patients after myocardial infarction can safely be undertaken earlier than 14 days after initial presentation with myocardial infarction with an appropriately trained medical escort. Repatriated patients who have had a myocardial infarction have a very low incidence of transfer-related complications.

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