

Successful hand replantation in a seafarer after long-distance helicopter evacuation. A case report

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ABSTRACT

After sustaining a clean-cut mid-carpal hand amputation on a tanker 120 miles north of Lanzarote, a 28-year-old seafarer was evacuated by helicopter to a microsurgical unit in Gran Canaria. The amputated hand was cooled according to precise instructions. The 6-hour flight time included two refuelling stops and transfer time. The hand had been revascularized thirteen hours after the accident and was still well circulated at repatriation 3 weeks later.

Key words: hand replantation, seafarer, evacuation

INTRODUCTION

The Canary Islands are located 100 km off the coast of north-west Africa, and are inhabited by 2 million people. The only microsurgical unit within this Atlantic area is the Plastic Surgery Department of Dr Negrin Hospital in Gran Canaria.

We report a successful hand replantation in a seafarer after an emergency long-distance helicopter evacuation.

CASE REPORT

On 9 March 2009, a 28-year-old seaman suffered a clean-cut amputation of his left hand while manipulating a pump on a tanker 120 miles north of the Canary island of Lanzarote. Another seaman sustained an open metacarpal fracture during the same accident. The shipping company contacted directly “Salvamento Marítimo” (the National Rescue and Maritime Security National Society), which is the Spanish institution responsible for air-sea evacuation and rescue. According to their instructions, the amputated hand was stored inside a plastic bag on ice in an isothermal box. A Sikorski helicopter with medical staff from the Canarian Health Service was sent from Gran Canaria to Lanzarote where it stopped to refuel. Including 20 mi-

minutes hovering over the ship for transfer of the two patients, the flight time from Lanzarote to the ship and back was about 3 hours, which is just within the helicopter’s range of action (Table 1).

On arrival at the hospital in Gran Canaria the patient was in pain but haemodynamically stable. The hand was successfully replanted. Nerve and vein grafts were necessary. Revascularization was established approximately thirteen hours after the accident. Despite prophylactic antibiotics, a small pocket of pus was evacuated a week later from the dorsum of the hand, and *Enterobacter cloacae* and *Klebsiella oxytoca* were isolated from the material. Recovery was otherwise uneventful until repatriation 3 weeks after revascularization. Medical follow-up data after repatriation are not available.

DISCUSSION

A young crew member sustained an accidental hand amputation 120 sea miles north of Lanzarote, a Canary Island. Following the Spanish Search and Rescue Program, the injured seafarer was evacuated by helicopter and his hand was successfully replanted.

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Table 1. Timetable

10.00 am	The accident occurred, hand amputated
10.20	Emergency call
10.30	Helicopter take-off
11.40–12.00	Refuelling stop in Lanzarote
13.15	Helicopter on the ship
13.15–13.35	Rescue time
13.35	Helicopter departure
14.50–15.10	Refuelling stop in Lanzarote
16.20	Helicopter arrival at Hospital in Gran Canaria
16.40	Start of surgery
23.00	Revascularization
02.30 a.m.	End of surgery

According to the Hamburg Convention, the Search and Rescue Zone given to Spain regarding the Canary Islands Area encompasses one million square kilometres. The agency in charge of this duty is the National Rescue and Maritime Security Society („Salvamento Marítimo”) of the General Directorate of the Merchant Marine, Ministry of Promotion. Two Sikorski helicopters with a range of 150 sea miles are always on duty [1]. Between 2000 and 2008, the mean number of annual evacuations due to medical problems was 21.4 [2].

When the distance to reach the patient is more than 150 sea miles, the help of the 802nd Search and Rescue Squadron of the Spanish Air Force is requested. Their Super Puma helicopters equipped with additional fuel tanks have considerably greater range. Taking into account the large area of the responsibility zone, there are frequently combined actions of both “Salvamento Marítimo” and the Spanish Air Force.

The accident site was still within the Spanish Search and Rescue Zone but very close to the Maritime Rescue Coordination Centre (MRCC) of the Casablanca zone. There are partnership agreements with Morocco regarding their zone, allowing them to alarm directly the Spanish National Centre in Madrid. The lack of microsurgical facilities in the southern part of its corresponding nearby continental area may make this option the only possible one when emergency microsurgery is needed.

In this case, the emergency call was made directly to Salvamento Marítimo by the shipping company, and ten minutes later the emergency helicopter was in the air (see Timetable). Unavoidable delays were caused by two refuelling stops and evacuation of the second injured crew member, but these were counterbalanced by the prompt alert activation, the speedy action of the emergency helicopter

and the effective telecommunication system which allowed good coordination of the action between the ship, rescue team, and receiving hospital.

Rescue and evacuation teams routinely work in other Western countries in remote dense shipping traffic areas, mainly fishing areas. The Royal Norwegian Air Force carried out more than 175 missions in the Barents Sea between 1994 and 1999. Thirty-five percent of the missions were carried out in darkness. One-half of the patients evacuated from the sea had accidents and injuries. The most common cases were fractures, amputations, and soft-tissue injuries [3].

Evacuations following crew accidents occur more often from fishing boats than from other types of ships or from offshore structures. Seventy-seven percent of crew evacuations due to trauma in Danish waters are from fishing boats [4]. Describing work-related diseases and injuries on an oil-rig, Valentice et al. reported that the body parts most frequently affected were hands and fingers, and they also reported a hand amputation [5]. The described work injuries occurred in the morning, as in our case, or after the main meal of the day. Vuksanovic et al. [6] reported that accidents and injuries were predominant among seafarers, followed by cases of gastro-intestinal, respiratory, and musculoskeletal disorders.

Studying the mortality from diseases among seafarers in British merchant shipping between 1976 and 1995, Roberts concluded that seafarers are at special risks from acute illnesses since they lack direct access to specialist medical care [7]. In such cases, evacuation of patients from ships at sea may be life saving.

Clean-cut amputations are the best suited for replantation, while degloved or crushed extremities are difficult, if not impossible, to reattach. Variables that may determine the outcome of a replantation attempt are ischaemia time (time without blood flow), storage conditions (warm or cold), and level of amputation. The more proximal the level of amputation, the less ischaemia time is permitted. The amount of muscular tissue in the amputated part is critical due to the vulnerability of muscular tissue to ischaemia. There are reports of successful finger replantations as late as 24 hours after the accident, while a forearm requires revascularisation within the first 6 hours of cold ischaemia [8]. After this limit, an elementarization is advocated – that means removal of all but only the most essential muscles, leaving just basic flexors and extensors [9]. In our case, the mid-metacarpal level, with scarce muscular tissue, allowed replantation after thirteen hours of ischaemia time.

To keep the amputated part cool during ischaemia time is mandatory if replantation is to be attempted. The hand should be stored on ice, inside a plastic bag, avoiding direct contact. In our case, precise instructions promptly gi-

ven to the ship on how to manage the amputated hand made replantation possible.

Hand amputations at mid-metacarpal level give a good functional prognosis [10, 11]. In such cases, if possible, replantation should always be attempted. Sensitivity recovery is relatively short. However, the patient needs a specific rehabilitation schedule, and further surgical corrections may be necessary.

CONCLUSIONS

Revascularization of the amputated hand of a seafarer thirteen hours after the accident was successful. If possi-

ble, replantation of amputated hands should always be attempted, in cases of microsurgical emergencies when time really matters. Coordination between the radiomedical centre, rescue team, involved ship, and receiving surgical staff is crucial to keep the ischaemia time to a minimum.

The paramedical staff on all ships involved in long-distance voyages should know how to act in such types of accidents.

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Figure 1. Amputated hand at arrival to hospital



Figure 2. The hand, ten days after replantation

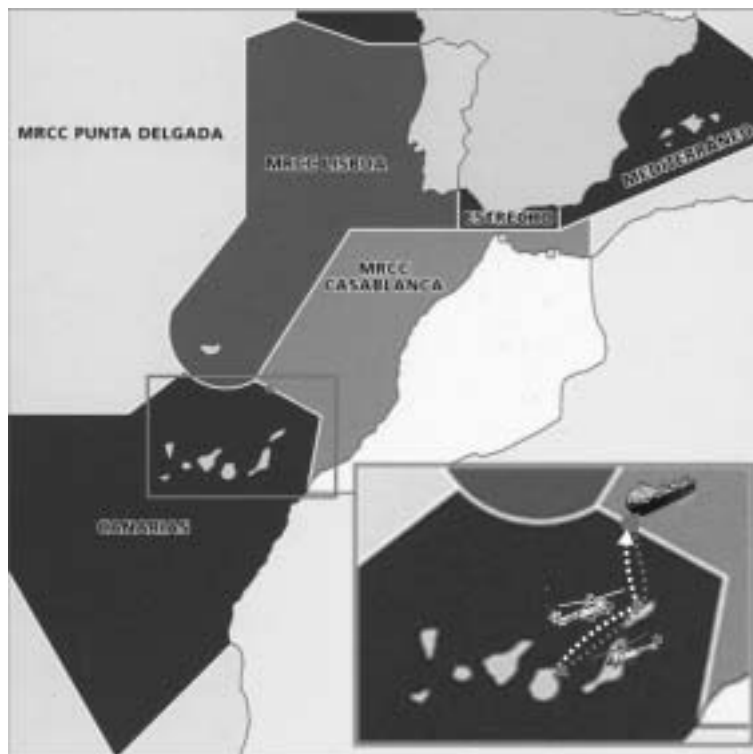


Figure 3. Map of the action area. Position of the ship 120 miles N of the island of Lanzarote. Distance covered by the helicopter. Refuelling stop in Lanzarote. Receiving Hospital in Gran Canaria

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HAND AMPUTATION AT SEA

Comment re: Successful hand replantation in a seafarer after long-distance helicopter evacuation. A case report

‘Any fool can cut off an arm or a leg but it takes a surgeon to save one’

(George C. Ross, 1843–1892) [1]

This issue of International Maritime Health brings a remarkable story of successful revascularization of a severed hand after thirteen hours. After more than four decades of successful hand replantations, another such case report hardly warrants publication. However, this case is of special interest to the maritime community as a young seafarer’s hand may have been saved against all odds. All parts of a well-organized telecommunication and rescue service worked the way they are supposed to, which one at sea can not always take for granted. Crucial factors for success were fast call for help, prompt and detailed advice to the ship on how to handle the amputated part – and the patient – until rescue and hand replantation, correct implementation of the instructions, air rescue without unneces-

sary delay, and expert microsurgical service at the receiving hospital.

Revascularization is a condition for salvaging the hand, but it is important to keep in mind that it is only the first part of a long chain of conditions to ensure a useful result. As the seafarer was lost to follow-up after repatriation, we do not know the final result: Does he have a well-functioning hand with normal sensitivity or a useless claw? A well-shaped stump may be more practical than a cold hypersensitive hand with five stiff fingers. A recent study of 81 adults 6–10 years after finger replantation/revascularization showed that 80% of the respondents were cold hypersensitive; 20% were severely or extremely so. Of the 74 patients employed at injury, 7% had changed work and 4% were not working due to cold hypersensitivity [2]. Therefore, the buck doesn’t stop at repatriation of the seafarer; it is equally important to have a good referral system in place to ensure that he gets expert follow-up care at home. Secondary procedures such as tenolysis, joint mobilization or toe transfers may be needed to restore dexterity to the healed yet dysfunctional hand [3]. Patient satisfaction hinges on his or her level of expectation as defined and explained in the preoperative discussion and informed consent [1]. Fortunately, long-term results of transmetacarpal replantation shows that the majority will have a good subjective and satisfactory functional end result and most patients can resume their old occupation or be employed after re-education [4]. But even under the best of circumstances, recovery will be physically and mentally hard. Intensive, long-term physiotherapy is needed, and a continuous positive attitude and steadfast efforts by the patient will be decisive for a valuable end result.

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