

Flying squad response to out-of-hospital cardiac arrest — a decade of experience

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SUMMARY

The Flying Squad (MEDIC I) based at the Royal Infirmary, Edinburgh, commenced operation in 1980. The MEDIC I response to out of hospital non-traumatic cardiac arrest over the past decade is reported.

On-scene resuscitation was attempted in 384 patients. A total of 149 (39%) patients were successfully resuscitated and transferred to hospital. Thirty-six (9.4%) patients survived to discharge from hospital. Patients receiving basic life support prior to the arrival of MEDIC I and in ventricular fibrillation had a survival rate of 14.5% (25/174). During 1988–89, 21 patients were initially attended by ambulance crews equipped with semi-automatic external defibrillators and eight (38%) of these patients survived.

The response of a hospital-based flying squad to support trained ambulance crews, especially when equipped with a defibrillator may provide an economically and operationally feasible alternative to training all first responders in the full range of paramedic skills.

INTRODUCTION

Hospital-based accident flying squads have provided pre-hospital care in the United Kingdom since 1955 (Collins, 1966). The flying squad based at Edinburgh Royal Infirmary, MEDIC I, commenced operation in 1980 and since that time has responded to over 1,000 call-outs. The profile of MEDIC I response to medical and surgical emergencies over the past decade has been reported previously (Steedman,

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1988; Dark *et al.*, 1990). Objective analysis has shown that this service makes a positive contribution to trauma care (Steedman, 1990). While originally intended primarily for out-of-hospital trauma care, the flying squad has been increasingly called upon as a secondary response unit for major medical emergencies.

Out-of-hospital care for medical emergencies varies throughout the world. The type of care available is as much due to historical accident as to economics or planning. A single tier response is the general rule in the U.K. The value of a two-tier response is unclear with recent experience of one mobile coronary care unit proving disappointing (Bett, 1989). However, the introduction of a two-tiered response in Seattle, albeit of a different nature has been encouraging (Weaver *et al.*, 1988).

Previous commentators have reported on their flying squad's response to medical emergencies (Barton & Pritty, 1990). We report on a decade of experience of Edinburgh's MEDIC I response to out-of-hospital non-traumatic cardiac arrests.

MATERIALS AND METHODS

The study period covered December 1980 – January 1990. Following each call-out a log sheet is completed by the flying squad team leader. A review of these sheets, the A&E records and hospital in-patient notes was undertaken for all patients sustaining out-of-hospital non-traumatic cardiac arrest. Patient data collected included age, sex, date and time of incident, presenting arrhythmia on arrival, location of collapse, nature of first tier ambulance responder and seniority of the MEDIC I team leader. All patients were followed up to hospital discharge or death. Survivor neurological status was obtained from discharge summaries and out-patient review records.

The Royal Infirmary, Edinburgh, is sited close to the city centre with the city boundary at a radius of approximately 4 miles. The team consists of a senior member of medical staff, of either consultant or registrar grade, a senior house officer (SHO) and one or two experienced members of nursing staff. The vehicle is a specially modified ambulance operated in conjunction with the Scottish Ambulance Service. The flying squad provides a 24-h service to the City of Edinburgh and the Lothian, Border regions with a population of 1.5 million. MEDIC I can be mobilized following alert by the Ambulance, Police or Fire Service or by a general practitioner (GP). The alert may be relayed either via a direct radio link from Ambulance Control or by telephone to the A&E Department.

The equipment available in MEDIC I for response to cardiac arrest, includes the facility for endotracheal intubation and ventilation, a Michigan Instruments thumper model 1004 (Michigan Instruments, Grand Rapids, MI, U.S.A.), central and peripheral venous cannulation, a Hewlett Packard monitor defibrillator (Hewlett Packard, Medical Instruments Group, Andorex, MA, U.S.A.) and all requisite drugs and anaesthetic equipment. The vehicle has the capacity to transfer one patient. In 1988, the 'Heart Start Scotland' campaign was launched; This collaborative venture between the Scottish Ambulance Service and the British Heart Foundation had the aim of equipping all ambulances and operational support

units with semi-automatic external defibrillators (Laerdal Heart-Start 2000, Laerdal Medical Ltd, Orpington, Kent, U.K.). The effect of the introduction of advisory defibrillators for ambulances in our area and MEDIC I response is recorded.

RESULTS

There were 388 call-outs. The annual number of calls has steadily increased since the introduction of MEDIC I, reaching a peak of 91 calls during 1987. The frequency of call-outs has not been significantly influenced by the introduction of the 'Heart Start Scotland' scheme with 82 and 74 calls respectively in 1988 and 1989. Seventy-two (19%) calls were to loci outwith the city boundary. The team was led by a consultant in 30% (116/388) of calls.

There were 282 male and 106 female patients with a mean age of 56 years (range 7 weeks – 91 years). Four patients were pronounced dead on arrival of MEDIC I when clarification of the history dictated that continued resuscitation was inappropriate and no treatment was therefore administered by the squad. Of the remaining 384 patients in whom resuscitative measures were instituted, 149 (38.8%) patients were successfully resuscitated and transferred to hospital. Twenty-eight (7.3%) patients died in the A&E Department and 121 (31.5%) patients were admitted to an in-patient unit. Thirty-six patients (9.4%) survived to discharge from hospital. Thirty-five (97%) of the survivors had collapsed within the city boundary. Thirty-two survivors (89%) had no long-term neurological deficit. All survivors had a witnessed cardiac arrest.

The primary arrhythmia recorded on arrival of MEDIC I is given in Table 1. Five patients had sinus rhythm with a palpable pulse, three of whom survived to discharge from hospital. Four of these patients had been defibrillated prior to the arrival of MEDIC I. One patient had collapsed with loss of consciousness and pulses in the presence of a GP and ambulance crew and responded to a precordial thump. The primary arrhythmia was ventricular fibrillation in 30 (83.4%) survivors. No patient presenting in asystole survived.

Table 1. Primary arrhythmia on arrival of MEDIC I and outcome.

Primary arrhythmia	On arrival at scene No. (%)	Survival to –	
		In patient admission No. (%)	Discharge No. (%)
Ventricular fibrillation/ tachycardia	183 (47.7)	77 (63.6)	30 (83.4)
Asystole	156 (40.6)	23 (19.0)	0 (0)
Bradycardia	36 (9.3)	14 (11.6)	3 (8.3)
Sinus rhythm	5 (1.3)	5 (4.1)	3 (8.3)
Unrecorded	4 (1.1)	2 (1.7)	0 (0)
	384 (100)	121 (100)	36 (100)

Of the 183 patients whose presenting arrhythmia was ventricular fibrillation on arrival of MEDIC I, 174 (95%) had received basic life support alone from the ambulance attendants and 25 (14.5%) survived. During 1988–89, 21 patients received a first tier response from an ambulance equipped with a semi-automatic external defibrillator. Ventricular fibrillation was the primary arrhythmia on arrival of MEDIC I in nine of these patients and eight patients (38%) survived to hospital discharge.

DISCUSSION

Although most flying squads are designated by the prefix 'accident' a considerable proportion of their workload is of medical cases. For example the medical component of the Derby Royal Infirmary Flying Squad in 1986 was 50% of their workload (Barton & Pritty, 1990). The Edinburgh Flying Squad was established in 1980 principally to respond to trauma. Calls to non-traumatic emergencies have increased with a steady rise in the number of cardiac arrest calls. Our overall survival rate for cardiac arrests of 9.4% compares favourably with reports from other flying squads where survival rates vary from 0% (Rowley & Collins, 1979) to 4% (Harrop & Bodiwala, 1983).

The two most significant prognostic factors in patients with cardiac arrest are the time lapse to cardiopulmonary resuscitation and the first direct current counter-shock (Cummins & Eisenberg, 1985). Therefore, it is not surprising that the survivors had all sustained a witnessed cardiac arrest. The delay inherent in responding to calls outwith the city boundary resulted in very limited success. Local ambulance crews equipped with semi-automatic external defibrillators, supported if appropriate in unstable patients, by an hospital-based flying squad, could improve outcome.

The Department of Health and Social Security has recommended advanced training for ambulance crews in which the skills of defibrillation, endotracheal intubation and drug administration are taught (DHSS, 1984; ASTC, 1987). In Nottinghamshire this official training programme was considered too complex and a simplified scheme for managing cardiac arrest, using a defibrillator alone was introduced. This allowed the training of more crews than would otherwise have been possible and Rowley *et al.* (1987) considered the overall benefit to be greater.

The success of a single tier response system without full paramedic skills has been confirmed by the recent reports on the 'Heart Start Scotland' campaign. Ambulance crews had received an 8-h training programme in cardiopulmonary resuscitation (CPR) and in the use of semi-automatic external defibrillators but with no training in further advanced techniques. During the first year of the scheme defibrillation was indicated and administered in 602 patients and 75 (12.5%) were subsequently discharged (Cobbe *et al.*, 1991).

The costs of extended ambulance training have resulted in a slow, piecemeal development of advanced pre-hospital resuscitation (Cobbe *et al.*, 1991). To retain such advanced skills ambulance crews require regular refresher training leading to additional costs (Stults *et al.*, 1984). Although the equipment and techniques involved in on-site resuscitation have become progressively more sophisticated, it

is relatively inexpensive to equip a hospital-based flying squad (Steedman, 1990).

Although we have only been able to include results for 1988–89, when the primary tier response by ambulance crews equipped with semi-automatic external defibrillators are supported by the secondary MEDIC I response, the survival figures are encouraging. The use of such a secondary response team with ability to perform advanced techniques has been shown to contribute independently to survival following out of hospital cardiac arrest (Weaver *et al.*, 1988). The Seattle scheme has demonstrated that a first tier emergency medical technician trained in basic CPR and defibrillation, supported by a second tier response of advanced cardiac life support can produce optimal results (Weaver *et al.*, 1986).

We continue to monitor the MEDIC I response to out-of-hospital cardiac arrest following the introduction of semi-automatic external defibrillators and more recently paramedic training. However, early response by ambulance crews, equipped and trained in use of advisory defibrillators supported by hospital-based flying squads is an operationally feasible and economic alternative to the widespread introduction of paramedic programmes.

REFERENCES

- ASTC (1987) Ambulance Staff Training Committee. *Extended Training in Ambulance Aid*. Bristol. NHS Training Authority.
- Bett J. H. N. (1989) Experience with a mobile Coronary Care Unit in Brisbane. *Annals of Emergency Medicine* **18**, 969–974.
- Barton D. & Pritty P. (1990) Flying Squad response to medical emergencies. *Archives of Emergency Medicine* **7**, 28–34.
- Cobbe S. M., Redmond M. J., Watson J. M., Hollingworth J. & Carrington D. J. (1991) 'Heart Start Scotland' – initial Experience of a national scheme for out of hospital defibrillation. *British Medical Journal* **302**, 1517–1520.
- Collins J. (1966) Organisation and function of an accident flying squad. *British Medical Journal* **2**, 578–580.
- Cummins R. O. & Eisenberg M. S. (1985) Cardiopulmonary resuscitation – american style. *British Medical Journal* **291**, 1401–1403.
- Dark P. M., Little K., Steedman D. J., Gordon M. W. G. & Robertson C. E. (1990) An objective analysis of an accident flying squad. *Scottish Medical Journal* **35**, 73–76.
- DHHS (1984) Department of Health and Social Security. *NHS Ambulance Service: extended training for ambulance staff*. DHSS, London (DA(84)12).
- Harrop S. N. & Bodiwala G. G. (1983) Leicester Flying Squad. *British Journal of Accident and Emergency Medicine* **1**, 11–15.
- Rowley J. M., Mounser P., Garner C. & Hampton J. R. (1987) Advanced training for ambulance crews, implications from 403 consecutive patients with cardiac arrest managed by crews with simple training. *British Medical Journal* **295**, 1387–1389.
- Rowley D. I. & Collins I. (1979) Role of an accident flying squad in medical emergencies. *Resuscitation* **6**, 243–248.
- Steedman D. J. (1988) *Profile of an accident flying squad: Analysis by injury severity scoring systems*. M.D. Thesis, University of Edinburgh.
- Steedman D. J. (1990) Medical teams for accidents and major disasters. *Injury* **21**, 206–208.
- Stults K. R., Brown D. D., Schug V. L. & Bean J. A. (1984) Prehospital defibrillation performed by emergency medical technicians in rural communities. *New England Journal of Medicine* **310**, 219–223.
- Weaver W. D., Copass M. K., Hill D. I., Fahrenbruck C., Hallstrom A. P. & Cobbe L. A. (1986) Cardiac Arrest treated with a new automated external defibrillator by out of hospital first responders. *American Journal of Cardiology* **57**, 1017–1021.
- Weaver W. D., Hill D., Fahrenbruck C., *et al.* (1988) Use of the automatic external defibrillator in the management of out of hospital cardiac arrest. *New England Journal of Medicine* **319**, 661–666.