Cardiac Arrest among Geriatric Patients*

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Summary: In a review of 292 hospital patients who had cardiac arrests over a period of two and a half years patients aged 60 and over were contrasted with those under 60, based on a 50-item clinical questionnaire completed at the time of the episode. Survival rates were identical (23%) in these two groups. On contrasting patients who survived with those who did not it was again found that age did not influence outcome. Patients with multiple arrests or without cardiographic evidence of ventricular standstill were much more likely to recover. Whether or not a doctor initiated therapy did not affect survival.

Introduction

Many reports concerning cardiac arrest have been published since Kouwenhoven, Jude, and Knickerbocker (1960) first described closed chest cardiac massage. Most of these studies have discussed results of resuscitation programmes in various hospitals. In view of the wealth of literature on the subject it is surprising that attention has not been specifically directed toward age as a factor in occurrence and outcome from cardiac arrest. The sole reference known to us concerning the relationship of age to outcome of resuscitation appeared in an article by Ayers and Doyle (1964) stating, "the ideal candidate for cardiac resuscitation is young and healthy."

This report focuses on age and cardiac arrest. Cardiac arrest means a sudden unexpected cessation of the normal heart beat, representing the most urgent type of medical emergency, where there is no chance of saving the patient unless effective treatment is initiated within minutes. Recovery from cardiac arrest is defined as restoration and maintenance of a normal heart beat so that the patient either was discharged from hospital or had died from some other cause during the same admission.

To determine the effect of age on arrest three questions were asked. (1) Do arrests among geriatric patients differ from those occurring among younger patients? (2) If differences occur, are they related to the arrest itself—that is, to cause, treatment, survival, or technical problems? (3) If differences occur, are they related to characteristics of the patients such as diagnoses and on-going treatment regimens?

Method

From January 1967 to July 1969 292 men who had cardiac arrests requiring resuscitative efforts were studied. They were patients in a 1,000-bed general medical Veterans Administration Hospital. A 50-item questionnaire was completed by the charge physician and nurse immediately after each resuscitative procedure. Information was obtained concerning the patient, and the arrest, including such variables as age, cardiographic diagnosis, concomitant medical diagnoses, time and place of arrest, number of previous arrests, treatment, and technical problems encountered in managing the arrest. Data were punched on to I.B.M. cards and computer-analysed with

multivariate statistical techniques. Patients were divided into two groups—those aged 60 and over and those under 60—to determine if the two age groups were significantly different. In a second analysis patients were also divided into two groups—those who survived and those who expired after the arrest. On the latter analysis age was entered as one of the items.

Results

Of the 292 patients studied, 130 were aged under 60 and 162 were 60 or older; 69 (23%) recovered from the arrest and 223 (77%) died. The characteristics of the total sample are considered first, then the factors related to age, and, finally, the factors related to recovery from arrest.

Total Sample

The average age of the patients was 60. A total of 330 arrests occurred in the 292 patients. Even though this averages slightly over one arrest per patient, the great bulk of the patients actually experienced only one arrest. As already mentioned, recovery occurred in 23% of the patients who sustained arrests. If, on the other hand, recovery rates are based on the arrests themselves, rather than on the ultimate outcome for each patient—as might be done, for example, in evaluating efficiency of resuscitative efforts—rates for recovery per resuscitation rise to 31%. As both types of figures are used rather loosely in the literature it is difficult to compare results from different series.

Age-related factors

A number of selected variables to compare the two age groups are listed in Table I. The difference between groups, based on all the variables used together, approached statistical significance but did not quite make the 0.05 level. It is

TABLE I.—Comparison of Selected Variables in 292 Cardiac Arrest Patients According to Age

Variables	Under age 60		60 and over		t Test
	Mean	S.D.	Mean	S.D.	
Related to arrest:					
Outcome-expired ..	0.77	0.42	0.77	0.43	0.08
No. of arrests per patient ..	1.17	0.55	1.14	0.51	0.54
Minutes till treatment ..	0.76	1.98	1.15	4.87	0.86
Occurring night shift ..	0.31	0.46	0.23	0.42	1.53
Month of year ..	6.34	6.01	6.28	6.12	0.36
Occurred on medical ward ..	0.65	0.50	0.70	0.46	0.71
Arrest diagnosed by physician ..	0.54	0.50	0.62	0.48	1.47
E.C.G. { Standstill ..	0.24	0.43	0.22	0.42	0.45
Fibrillation ..	0.23	0.42	0.28	0.45	0.91
Mechanical arrest ..	0.07	0.26	0.03	0.16	1.84
Initiated by physician ..	0.60	0.50	0.66	0.48	1.06
Treatment { No problems ..	0.56	0.50	0.53	0.50	0.46
Adrenaline ..	0.67	0.47	0.61	0.49	1.07
Bicarbonate ..	0.62	0.51	0.58	0.50	0.64
Associated diagnoses:					
Myocardial infarction ..	0.39	0.49	0.52	0.50	2.29*
Chronic cardiac ..	0.05	0.21	0.06	0.23	0.36
Haemorrhage ..	0.05	0.21	0.07	0.26	0.98
Neurological ..	0.03	0.17	0.00	0.00	2.26*
Liver disease ..	0.04	0.19	0.00	0.00	2.54*
Cancer ..	0.12	0.33	0.04	0.19	2.89†
Infection ..	0.05	0.21	0.01	0.11	1.76
Terminal ..	0.06	0.24	0.04	0.19	0.97
Postoperative ..	0.13	0.34	0.05	0.22	2.49*

*P < 0.05 on univariate t test.

†P < 0.01 on univariate t test.

Note: Multivariate difference between age group was P < 0.06. Most items are scored 0 = no and 1 = yes, so that answers can also be read as percentages.

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interesting that both age groups had almost identical rates of survival (23%). The number of arrests, minutes until resuscitation, place of arrest, and the persons diagnosing and treating the arrests were essentially the same. Further examination showed no difference between the age groups related to time of day the arrest occurred (the average being between 12 noon and 1 p.m. for each), to time of year (average around June to July), or to occurrence in the operating-room, recovery room, or surgical ward. As shown in Table I, most of the arrests occurred on medical wards. Furthermore, electrocardiographic findings were not different for the two age groups, with most showing ventricular standstill or fibrillation. Treatment was about the same for each age group, no more problems being encountered in the older than in the younger patients. In fact, the only significant differences between the age groups were in the associated diagnostic problems occurring within the two groups. At the 0.05 level more of the older patients had myocardial infarctions and more of the younger group had neurological problems, liver disease, and were postoperative patients. The only difference at the 0.01 level was the diagnosis of internal cancer in patients under 60.

Factors related to survival

The same variables as they related to survival and non-survival are shown in Table II. Age was analysed as an item but showed no significant difference when patients who recovered from cardiac arrest were compared with those who did not. In this analysis overall group difference between survivors and non-survivors was highly significant at 0.0002. In studying individual item differences it was noted that one of the highly significant items was related to treatment with adrenaline, and that this treatment was predominantly used when resuscitative efforts were failing. To correct for any treatment-related factors another analysis was made, dropping all items related to treatment. Differences between survivors and non-survivors were still highly significant at 0.002.

TABLE II.—Comparison of Selected Variables in 292 Cardiac Arrest Patients According to Survival.

Variables	Recovered		Died		t Test
	Mean	S.D.	Mean	S.D.	
Related to arrest:					
Age at time of arrest ..	60.60	15.00	61.24	12.61	0.35
No. of arrests per patient ..	1.41	0.86	1.07	0.32	4.82†
Minutes till treatment ..	0.83	3.79	1.03	3.89	0.38
Occurring night shift ..	0.28	0.45	0.26	0.44	0.25
Month of the year ..	6.68	8.68	6.13	4.93	0.66
Occurred on medical ward ..	0.65	0.48	0.69	0.46	0.60
Arrest diagnosed by physician	0.57	0.50	0.59	0.49	0.39
E.C.G. { Standstill ..	0.12	0.32	0.26	0.44	2.52*
Fibrillation ..	0.22	0.41	0.27	0.44	0.86
Mechanical arrest ..	0.03	0.17	0.05	0.22	0.71
Initiated by physician ..	0.67	0.48	0.62	0.49	0.65
Treatment { No problems ..	0.52	0.50	0.55	0.50	0.40
Adrenaline ..	0.43	0.50	0.70	0.46	4.03†
Bicarbonate ..	0.57	0.53	0.60	0.49	0.48
Associated diagnoses:					
Myocardial infarction ..	0.46	0.50	0.46	0.50	0.09
Chronic cardiac ..	0.10	0.30	0.04	0.19	2.17*
Haemorrhage ..	0.06	0.24	0.06	0.24	0.14
Neurological ..	0.01	0.12	0.01	0.12	0.06
Liver disease ..	0.00	0.00	0.02	0.15	1.25
Cancer ..	0.04	0.21	0.09	0.28	1.15
Infection ..	0.06	0.24	0.02	0.13	1.78
Terminal ..	0.04	0.21	0.05	0.22	0.20
Postoperative ..	0.03	0.17	0.10	0.31	1.93

*P < 0.05 on univariate t test.

†P < 0.01 on univariate t test.

Note: Multivariate difference between survival and non-survival was P < 0.0002. Most items are scored 0 = no and 1 = yes, so that answers can also be read as percentages.

The most important discriminant between the groups was the number of arrests per patient, with almost all of the multiple arrests occurring in patients who survived. Therefore a patient experiencing other than his first arrest was quite likely to survive the arrest itself. E.C.G. diagnosis of ventricular standstill was associated with failure to recover, whereas diagnosis of concomitant chronic cardiac condition related to survival. None of the items associated with time and place of arrest or with who

diagnosed or first initiated treatment was significantly different.

Only those diagnoses that occurred frequently are included in Table II. All diagnosed cardiac conditions (accounting for slightly over 50% of the sample) are shown. The more common non-cardiac diagnoses listed accounted for an additional 34% of the sample. About 15% of the patients had a variety of other conditions associated with the arrest, such as pulmonary embolus, acute respiratory infection, chronic pulmonary disease, kidney disease, and iatrogenic causes, that are not shown in Table II as the numbers in these diagnostic categories were so small. Only three patients in the entire series had the diagnosis "arrest of completely unknown aetiology."

Discussion

With assistance from computers it is possible to analyse large amounts of data on many patients. Sometimes interesting and surprising findings are uncovered in research that at first may seem questionable from a clinical standpoint. Generally, as one shuttles back and forth from raw data to statistical results, conclusions are reached that are in harmony with clinical judgement. In this study there was no significant relationship between age and outcome in several hundred patients with cardiac arrest. This may seem strange, since age must of course ultimately bear some relation to death. The immediate effect of age, however, was not an important discriminant between groups who were successfully resuscitated and those who were not.

In spite of conclusively finding no correlation between age and outcome in hundreds of patients with cardiac arrest, the possibility of a preselected and perhaps biased sample must be considered. Even though patients were reviewed simply on the basis of whether or not they recovered from a given arrest, it should be remembered that we are not dealing with random assignment to groups as in an ideal experimental design. There are many opportunities for inherent and unrecognized bias to play a part in patient-selection and ultimate outcome. For example, the unspoken decision of the first individual on the scene of the arrest, or that of the physician who later takes charge of resuscitation, whether resuscitation is morally and ethically right for the given patient, can obviously affect who is selected or how vigorously resuscitation is pursued. These are unmeasurable factors and, by and large, uncontrollable in both the clinical and the investigational sense. They are mentioned in order that their potential role and effects are not forgotten.

Another significant finding that may be surprising is the fact that there was no difference in outcome whether or not resuscitation was initiated by a physician. This speaks well for the potential of efforts being developed in some communities to have non-medical teams of specially trained personnel available as the first team for resuscitative efforts.

In considering why certain morbidity might be associated with survival several explanations are possible. Patients who have had more than one arrest could form a unique subgroup in that, once identified as having had an arrest, they would probably be followed more carefully in terms of subsequent similar problems. In addition, the conditions underlying multiple arrests were more often amenable to resuscitative efforts. Finally, patients with chronic cardiac conditions had probably developed better collateral circulation than those whose arrest was the first indication of heart trouble, and this could account for their better outcome.

Conclusion

In a sample of 292 patients referred and treated for cardiac arrest age did not play a part in the immediate outcome. In fact, identical recovery rates occurred in groups of patients aged under 60 and those over 60. The only differences

regarding age related to medical diagnoses or other associated conditions. Survival was actually linked to having more arrests, chronic cardiac conditions, or certain types of arrhythmias. It might therefore be surmised that recovery from cardiac arrest is related to inherent resistance of the patient and the severity of underlying morbidity rather than to age. This gives additional support to our general hypothesis that survival into geriatric age is an indication of physical toughness rather than frailty (Linn, Linn, and Gurel, 1969). So-called "old age" is therefore not itself a contraindication to cardiac resuscitation or, for that matter, to any other kind of therapy.

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Children's Hospital Admissions and Mother's Menstruation

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Summary: Of 100 children's emergency admissions to hospital nearly half (49%) were admitted during the mother's paramenstruum. There was a statistically significant association between the mother's menstruation and the child's admission both for accidents and for illnesses. The eldest child in the family appeared to be most affected.

Introduction

The relation of minor ailments, especially coughs and colds, in children to the mother's menstruation has been demonstrated. Half of all children's attendances at one general practitioner's surgery occurred during the mother's paramenstruum. There were also reports of children whose recurrent coughs and colds coincided with mother's menstruation and occurred each month (Dalton, 1960, 1966). This survey was undertaken to ascertain whether there was a correlation between the mother's menstruation and any illness or accident of sufficient severity to require her child's emergency admission to hospital.

Methods

Mothers of children admitted as emergencies to the children's ward (30 beds) of a general hospital in North London were interviewed when they were visiting their children. Particulars were obtained of the mothers' age, parity, type of pregnancy, and puerperium, also the length of their menstrual cycle, duration of menstrual loss, presence of premenstrual symptoms or dysmenorrhoea, and, finally, the date of their last menstruation. A calendar was available to verify that the date of the last menstruation coincided with the stated day of the week. As a full medical history was taken from every mother it was unlikely that any of them realized that the prime purpose of the interview was to ascertain the date of menstruation. The answers could therefore be considered reliable, bias being reduced to a minimum.

Results

Of 100 mothers interviewed 18 had amenorrhoea exceeding 28 days (amenorrhoea up to 35 days, confirmed pregnancy 2, puerperium 7, menopause 1, hysterectomy 1, unable to re-

member 2). The other 82 were menstruating regularly with a cycle of 21 to 35 days; indeed, 62 mothers claimed a regular 28-day cycle. Their child's admission had occurred when 23 mothers (28%) were in their first four days of menstruation and when 17 (21%) were expecting their menstruation within four days (see Chart). Thus nearly half (49%) of the

Children's hospital admissions and mother's menstrual cycle.

children's admissions occurred during the mother's paramenstruum (premenstruum and early menstruation) at a time when she might be influenced by premenstrual tension. These rates should be compared with the expected incidence of 14% in one of the seven four-day phases of the menstrual cycle. The probability of such a distribution occurring by chance is less than 1 in 1,000 ($\chi^2=16.5$ on 1 D.F.) and therefore suggests that the association between the mother's menstruation and the child's admission is highly significant.

The two women unable to remember their menstrual dates were not menstruating, but may have been either in their intermenstruum or premenstruum. If they had been allocated to the intermenstruum the results would not have been appreciably altered and would not have affected the significance of the results obtained. The five women with amenorrhoea between 29 and 35 days were either in their premenstruum or were in early pregnancy. Mothers who were in their fifth or sixth day of menstruation and still having a menstrual loss were classified under days 5-8. These mothers would have passed their days of heaviest menstrual loss and the time of premenstrual tension.

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