

Acute Myocardial Infarction — Which Subset of Patients can be Managed Safely in the Ward

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SUMMARY

A trial was done to find out which subset of acute myocardial infarction patients could be managed safely in the ward. A total of 45 consecutive patients were included in the study and electrocardiographically monitored for the first 24 hours to look for life threatening arrhythmias (LTA). These were correlated with the site of infarction and Killip Class at presentation. A total of 16 episodes of LTA in 13 patients were recorded. The incidence of LTA was 5%, 20%, 33% and 89%, respectively in Killip classes, I, II, III and IV. The mortality was 77% in class IV, while there was only one death in the 36 patients in Killip classes I-III. Out of 15 patients with extensive anterior infarction, 6 (40%) had an LTA, 4 (29%) out of 14 patients with an antero-septal infarction had an LTA while 3 (30%) out of 10 patients with an inferior infarction had an LTA. Only one out of eight patients each with an inferior or antero-septal infarction in Killip class I had an LTA. In summary, a subset of patients, who were in Killip class I and had an inferior or antero-septal infarction, was identified. These patients can be managed safely in the general ward.

INTRODUCTION

The idea to carry out this study emerged when it was realized that the number of patients presenting to the emergency room with suspected acute coronary insufficiency exceeded the number of beds available in the coronary care unit. Many a time, it became difficult to decide whether to shift a patient from coronary care unit to a general ward to accommodate a new patient or to admit the new patient directly to the general ward.

As the number of doctors is increasing and health facilities are being extended, the general awareness of public about disease processes has improved considerably. Ours is a poor country and in the face of limited financial resources we cannot possibly provide a monitored bed for all patients with suspected acute myocardial infarction.

In view of these practical every day problems, it was decided to carry out a study to identify a subset of patients who were less likely to suffer from complications and, hence, could be managed in the general ward throughout their hospital stay.

The potentially treatable complications for which the coronary care units came into existence

were life threatening arrhythmias (LTA)^{1,2}. An effort was made to correlate the incidence of these arrhythmias with risk factors, size of infarct, site of infarct and clinical presentation to identify patients who could be expected to have an uneventful recovery even in a general ward.

PATIENTS AND METHODS

Patients who presented with history suggestive of acute myocardial infarction to the emergency room of Shaikh Zayed Medical Complex were shifted to the coronary care unit. Forty five consecutive patients who fulfilled the diagnostic criteria for acute myocardial infarction were included in the study. These patients were monitored continuously for the next 24 hours.

Inclusion criteria

For inclusion in the study, patients were required to fulfil two of the following three criteria:

1. History of severe or prolonged, typical, chest pain.
2. Rise of creatinine phosphokinase (CPK) and aspartate amino-transferase (AST) in the typical pattern.

- Electrocardiographic (ECG) changes of acute myocardial infarction as described by Goldschlager and Goldman³.

Exclusion criteria

Patients were not included in the study if they presented more than 24 hours after the onset of symptoms or had advanced renal or hepatic failure.

Mode of study

These patients were monitored continuously for 24 hours from the time of their admission. The monitors were connected to a central display unit (Model Siemens Sirecust 455) which had a built-in rate alarm with facilities for automatic, half minute, permanent record when the heart rate crossed the alarm limits. The lower limit was set at 60 and upper limit at 100 beats/minute. The central display unit was continuously monitored by either the doctor on duty or a specially trained staff nurse. Furthermore, a rhythm strip was recorded after every half hour and the time noted by the recording system.

A detailed history was taken at the time of admission and noted in a specially designed proforma. Following points were specifically noted:

- Mode of presentation
- History of cigarette smoking
- Previous history of rhythm disturbances
- Previous medications
- Past history of diabetes mellitus, hypertension or ischemic heart disease.
- Family history of diabetes mellitus, hypertension or ischemic heart disease.

At least once daily, a thorough physical examination was carried out with special emphasis on cardiovascular system and results noted. The patients were stratified into Killip classes I-IV according to the clinical findings⁴.

This classification is detailed below:

- Killip Class I: No pulmonary rales or third heart sound.
- Killip Class II: Pulmonary rales upto halfway up the lung fields \pm third heart sound.
- Killip Class III: Pulmonary rales more than halfway up the lung fields + third heart sound.
- Killip Class IV: Cardiogenic shock.

One set of cardiac enzymes, CPK and AST, were done daily. Renal status and serum electrolytes

were checked at the time of admission and repeated if required.

Chest x-ray was done at the time of admission and repeated if required.

A standard twelve lead ECG was done at least once daily in the morning. The rhythm strips were analyzed later and findings confirmed by a consultant. The patients were followed till their discharge from the hospital. A record of treatment during the hospital stay was kept.

RESULTS

A total of 45 patients were included in the study. Eighty nine percent of these were males and 11% females (Table 1). The average age of the patients was 56 years varying from 25 to 85 years. The average time of presentation being 8 hours and 45 minutes, earliest arrival was within 30 minutes and patients presenting upto 24 hours after the onset of their symptoms were included. Eighty six percent of the patients presented with chest pain which radiated to the left arm in 47%.

Table 1: Sex distribution.

Sex	Number	Percent
Male	40	89.0
Female	5	11.0
Total	45	100.0

Site of infarction

Fifteen patients had extensive anterior infarction, 14 anteroseptal and 10 inferior wall infarction. The number of patients with inferolateral, anterolateral and sub-endocardial infarction was only 4. In two patients the site of infarct could not be determined (Table 2).

Killip Class

Fifty one percent of the patients were in Killip class I, 22% were in class II and 20% in Killip class IV (Table 3).

Twenty percent of the patient with extensive anterior infarction, 56% of patients with anteroseptal and 80% of the patients with inferior wall infarction were in Killip class I.

Out of nine patients in Killip class IV, 6 (66.6%) had extensive anterior infarction.

Table 2: Site of infarction.

Site	Number	Percent
Extensive anterior	15	33.0
Antero-septal	14	31.0
Inferior	10	22.0
Others	4	9.0
Undetermined	2	5.0
Total	45	100.0

Table 3: Killip class.

Class	Number	Percent
I	23	51.0
II	10	22.0
III	3	7.0
IV	9	20.0
Total	45	100.0

Risk factors

Thirty three percent of these patients were suffering from diabetes and 29% had hypertension. The prevalence of smoking was 53%. Previous history of ischemic heart disease was present in 44% and half of these were on treatment (Table 4).

Table 4: Risk factors for I.H.D. (n=45)

Risk factors	Number	Percent
Diabetes mellitus	15	33.0
Hypertension	13	29.0
Smoking	24	53.0
Prior history of I.H.D.	20	44.0

Incidence of arrhythmias

There were a total of 60 different kinds of

arrhythmias in 36 of the 45 patients in the study. Thus, 80% of the patients had one or more different arrhythmias during the first 24 hours after admission. The most common arrhythmia was premature ventricular contractions (PVCs) which occurred in 31 patients. Other non-life threatening arrhythmias were much less common (Table 5).

A total of 16 episodes of life threatening arrhythmias (LTA) were seen in 13 patients. These included ventricular fibrillation in 7 patients, ventricular tachycardia in 3 and complete heart block in 6 patients. Thus, 29% of the study population had an LTA.

Table 5: Incidence of arrhythmias (n=45)

Arrhythmias	Episodes	Patients	Percent
All arrhythmias	60	36	80
LTA	16	13	29
Ventricular fibrillation	7		
Sustained ventricular tachycardia	3		
Complete heart block	6		
Atrial fibrillation	5		
Supraventricular tachycardia	1		
Premature ventricular ectopis	31		
Non-sustained ventricular tachycardia	7		

Two of the patients with LTA were in Killip class I, two in class II, one in class III and eight in class IV (Table 6). Thus 9% of the patients in Killip class I had an LTA, 20% in class II had an LTA, 33% in class III had an LTA, while 89% of those in class IV had an LTA.

Table 6: Relationship of Killip class and LTA (n=45).

Killip class	Total patients	Patients with LTA	%
I	23	2	9
II	10	2	20
III	3	1	33
IV	9	8	89

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As far as site of infarction is concerned, out of 15 patients with extensive anterior infarction, 6 (40%) had an LTA. Of 14 patients with an antero-septal infarction, 4 (29%) had an LTA. Three (30%) out of ten patients with an inferior infarction had an LTA (Table 7).

Table 7: Relationship of site of infarction and LTA (n=45).

Site	Total patients	Patients with LTA	%
Extensive anterior	15	6	40
Antero-septal	14	4	29
Inferior	10	3	30
Others	6	-	-

Correlating the incidence of LTA with Killip class and site of infarction, it was observed that out of 8 patients of antero-septal infarction in Killip class I, only one had an LTA. The same figures were true for inferior infarctions in Killip Class I. On the other hand, five out of six patients with extensive anterior infarction and Killip class IV had an LTA while both patients with an inferior infarction had an LTA as did the only patient with an antero-septal infarction (Table 8).

Table 8: Relationship of Killip class, site of infarction and LTA (n=45).

Killip class	I	II	III	IV
Site of infarct	LTA	LTA	LTA	LTA
Extensive anterior	3 -	4 -	2 1	6 5
Antero-septal	8 1	4 2	1 -	1 1
Inferior	8 1	- -	- -	2 2
Others	4 -	2 -	- -	- -

Mortality

Overall mortality during the hospital stay was 18% with 11% occurring in the setting of the coronary care unit (Table 9).

Patients in Killip class I to III had no mortality in the coronary care unit whereas one death (3%) occurred during their ward stay. Patients in Killip class IV had a mortality of 55% during coronary care management and further 22% in ward. Out of the nine patients in Killip class IV, eight had an LTA and of these, only one survived.

Table 9: Mortality and relationship to Killip class (n=45).

Killip class	I	II	III	IV
Number	23	10	3	9
CCU mortality	-	-	-	5 (55%)
Ward mortality	-	1 (10%)	-	2 (22%)
Total in-hospital mortality	-	1 (10%)	-	7 (77%)

DISCUSSION

Following the original description of coronary care units, their multiplication was unusually rapid. They were credited to have reduced the death rate in patients with acute myocardial infarction by 30%⁵. Similar results were reported by Lown et al. and the reduced mortality was said to have resulted through control of arrhythmias⁶.

Subsequent studies showed conflicting results with some reporting reduction in mortality while other studies failed to show any difference in mortality between home care and coronary care management^{7,8}. The results of these studies were open to doubt as the trials were not properly randomized⁹.

A large study was carried out in 18 hospitals across Australia in which these hospitals were stratified into four levels depending on the facilities available in their coronary care units. These facilities varied from the most elaborate monitoring equipment and trained staff (level I) to units with only portable monitors and comparatively inexperienced staff (level IV). The hospital mortality was shown to be 21% at all the four levels¹⁰. Mortality in coronary care units was 17% as compared to 31% in general ward. This difference was not statistically significant if bias in selection and diagnosis was removed¹¹.

Though these studies failed to resolve the issue of coronary care units, they have served a very important function by drawing attention to fact that coronary care units can have no significant impact on mortality in low risk group patients.

The different parameters used to stratify patients into groups which are more prone to develop subsequent complications include site of infarct, presence of intraventricular conduction defects, presence of hypotension or persistent tachycardia, cardiac enlargement and pulmonary rales above the tip of scapula^{4,12-17}. These criteria can help to formulate admission policies in coronary care units.

Patients who were pain free, with no signs of failure or ventricular ectopy were found to have no mortality during their stay in coronary care unit¹⁸.

A study from Spain¹⁹ compared 329 patients with acute myocardial infarction admitted in the coronary care unit with 91 patients admitted in the cardiology ward. It found that patients without shock, with Killip class I or II and those older than 70 years had a slightly lesser mortality when treated in the cardiology ward. In contrast, patients with shock and Killip class III or IV had a lesser mortality when cared for in the coronary care unit.

If the initial admission electrocardiogram is negative in a patient with suspected acute myocardial infarction, the risk of developing subsequent infarction is only 10% and chances of developing life threatening complications only 0.6%^{20,21}.

In this study, there was a clear correlation between the clinical presentation i.e. Killip class and the incidence of LTA as well as mortality. The incidence of LTA was 5%, 20%, 33% and 89% respectively in Killip classes I, II, III and IV. The mortality was 77% in class IV while there was only one death in the 36 patients in Killip classes I-III.

The site of infarction, when taken in isolation, did not have a significant correlation with the incidence of LTA or with mortality. The site of infarction was important only in so far as a large infarction predicted a worse Killip class and thus enhanced the incidence of LTA as well as mortality.

In summary, it has been shown that electrical complications and mortality depend more on the clinical condition as assessed by Killip classification than the site of infarct. Patients who have inferior wall infarctions have been shown to be predominantly in Killip class I (80%) at the time of

admission. These patients have infrequent complications and can be managed in intermediate coronary care unit or even in a general ward thus reducing the burden on coronary care units. Patients with an antero-septal infarction, if in Killip class I, may also be considered for such management.

REFERENCES

1. Julian DG. History of coronary care units. *Br. Heart J* 1987; 57: 492-502.
2. Lown B, Fakhro AM, Hood WB, Thorm G. The coronary care unit. New perspectives and directions *JAMA* 1967; 199: 188-298.
3. Goldschlager N, Goldman MJ, Coms. In: *Electrocardiography: essentials of interpretation*. 1st ed. California: Lange, 1984.
4. Killip T. and Kimball JT. Treatment of myocardial infarction in a coronary care unit. A two year experience with 250 patients. *Am J Cardiol* 1967; 20: 457.
5. Julian DG. Coronary care and the community. *Ann Intern Med* 1968; 69: 607-613
6. Lown B, Klein Md, Herschberg P. Coronary and precoronary care. *Am J. Med* 1969;46: 705-24.
7. Martin SP, Donaldson MC, London Cd, Peterson OL, Cotton T. Inputs into coronary care during 30 years. A cost effectiveness study. *Ann Intern Med* 1974; 81: 289-293.
8. Mather HD, Morgan DC, Pearson NG, et al myocardial infarction: A comparison between home and hospital care for the patients. *Br Med J*. 1976; 1: 925-929.
9. Editorial. Myocardial infarction. unit care or home care. *Ann Intern Med* 1978; 88: 259-261.
10. Reznik R, Ring I, Fletcher P, Berry G. Mortality from myocardial infarction in different types of hospitals. *Br. Med J* 1987; 294:1121-1125.
11. Reznik R, Ring I, Fletcher, P Siskind V. Differences in mortality from acute myocardial infarction between coronary care unit and medical ward. *Br. Med J*. 1987; 295: 1437-1440.
12. Gottlieb SH, Gottlibe PO. Death after myocardial infarction, inter-relation between left ventricular dysfunction, arrhythmias and ischemia. *Am J. Cardiol* 1988; 61: 7B-12B.
13. Grande P, Pederson A. Myocardial infarct size: Correlation with cardiac arrhythmias and sudden death. *Eur Heart J* 1984; 5: 622-627.
14. Hands ME, Lloyd BI, Robinson JS, Klerk N, Thompson PL. Prognostic significance of electrocardiographic size of infarct. *Circulation* 1986; 73:855-891.
15. Harrison BC, Rapaport E, Thibault GE, Cost containment issues in acute myocardial infarction. *Am J Cardiol* 1985; 58: 1581-1585.
16. Hauer RN, Lie K, Durrer D. Long term prognosis in patients with bundle branch block complicating acute

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- myocardial infarction. *Am J Cardiol* 1982; 49: 1581-1585.
17. Hindman MC, Wagner GS, Jaro M, et al. The clinical significance of bundle branch block in acute myocardial infarction. *Circulation* 1987; 58: 689-99.
 18. Fuchs R, Scheidt S. Improved criteria for admission to cardiac units. *JAMA* 1981; 246: 2037-2041.
 19. Anguita M, Bueno G, Lopez-Grandados A, et al. Patients with an acute myocardial infarction treated in a coronary unit or in a general cardiology ward: a comparative study. *Rev Esp Cardiol* 1993; 46: 735-42.
 20. Slater DK, Htanky MA, Mark DB, Harrel FEM, Pryor DB, Calif RM. Outcome in suspected acute myocardial infarction with normal or minimally abnormal admission electrocardiographic findings. *Am J Cardiol* 1987; 60: 766-770.
 21. Brush JE, Brand DE, Acamporad, Chalmer B, Wackers FJ. Use of initial electrocardiogram to predict in hospital complications of acute myocardial infarction. *N Eng J Med* 1985; 312: 1137-41.

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