atypical chest pain on exercise as well as at rest. Her stress test was positive, but she rejected coronary angiography. She was eventually seen by a psychiatrist.

Her BSPM examination revealed extensive ischaemia on repolarization isopotential maps probably of syndrome X origin.

Nitrates and beta-blockers were prescribed and after 2 weeks of this therapy there was substantial regression of her condition. However, regression of ischaemia in the coronary microcirculation was gradual, but within a year these signs disappeared almost completely.

For the BSPM, we used 80 unipolar electrodes placed at regular intervals on the anterior and posterior chest wall. Figure 1 represents a normal repolarization map, with the anterior chest wall situated on the left half of the map and the posterior wall on the right. For better orientation, six standard precordial electrodes, V₁ to V₆, are depicted in the form of small black squares.

Figure 2 shows the BSPM findings before treatment and Fig. 3 one year later. The substantial improvement is quite apparent.

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References

Myocardial reperfusion injury: experimental evidence and clinical relevance

We agree with the general conclusions that reperfusion injury is a clinically relevant phenomenon and that continuing research directed at the manifestations of myocardial reperfusion injury may have considerable therapeutic implications[1]. However, we would question the view that reperfusion arrhythmias are of small significance in patients undergoing reperfusion therapy.

The incidence of reperfusion arrhythmias in man is low compared to animal studies for the reasons pointed out by Hansen, in particular the duration of antecedent ischaemia[2]. The major focus of treatment of acute myocardial infarction these days is rapidity of opening occluded coronary arteries, which is likely to increase the number of reperfusion arrhythmias on the basis of the bell-shaped curve. However, as Hansen indicates, most large-scale studies of intravenous thrombolysis for acute myocardial infarction have shown a lower incidence of ventricular fibrillation in the active treatment group compared with placebo or control, even though thrombolysis is associated with a far greater likelihood of reperfusion.

Before we dismiss reperfusion arrhythmias following thrombolysis as clinically unimportant, it should be pointed out that most thrombolytic trials were not designed primarily to assess the impact of thrombolysis on serious rhythm disturbance, particularly during the early stages of hospitalization. Data are generally not available or, more commonly, have been pooled over a long time period. One trial that assessed the effects of thrombolysis on early and late rhythm disturbance was the German APSAC trial comparing intravenous streptokinase with heparin, given within 4 h of the onset of symptoms[3]. In the first 24 h of treatment the incidence of ventricular fibrillation in the thrombolytic group was 6-8% compared with 4-6% in the heparin group, but the difference was lost after the first 24 h (2.5% vs 2.7%), giving an overall incidence of 8.0% and 7.3% respectively. Similarly, in the ISAM thrombolytic trial, the incidence of ventricular fibrillation in patients receiving thrombolysis was 3.6% in the first 3 h after start of treatment compared with 3.4% in the placebo arm, falling to only 0.7% in the thrombolytic arm compared...
with 1.9% in the placebo arm[4]. These results suggest that significant early reperfusion arrhythmias are more common than expected from cursory analysis of the major thrombolytic trials.

The importance of the 'door to needle' time from when the patient reaches medical assistance until he/she receives thrombolyis is well established[8]. Pooled results from five published trials of pre-hospital thrombolysis suggest a 17% reduction in short-term mortality with pre-hospital thrombolysis[6-10]. Dr Hansen speculates that pre-hospital thrombolysis may increase the incidence of reperfusion arrhythmias. There is in fact good evidence that this is the case. The European Myocardial Infarction Project (EMIP) group study of pre-hospital versus in-hospital thrombolysis for acute myocardial infarction demonstrated an increased incidence of ventricular fibrillation in patients receiving thrombolyis prior to reaching hospital (2.5%), compared with an incidence of 1.6% in patients not receiving treatment until they arrived later in the hospital[6]. This has obvious implications for the training of general practitioners and paramedics and the availability of monitoring and defibrillation equipment[11]. Many general practitioners, although recognizing the benefits of early treatment, are unwilling to give thrombolysis out of hospital[12], and yet it is here that two thirds of deaths from myocardial infarction occur[13].

Experimentally the incidence of reperfusion arrhythmias is greater the more rapid the reperfusion process. When the concept of thrombolysis for acute myocardial infarction was in its infancy and thrombolytics were given directly into the occluded coronary artery it was noted that restoration of coronary blood flow frequently induced ventricular arrhythmias[14-17]. Primary angioplasty, which might be expected to produce very rapid reperfusion, has recently been tested as a first-line treatment for myocardial infarction. The PAMI study demonstrated a much higher incidence of ventricular fibrillation in the angioplasty group compared with those patients receiving tPA (6.7% vs 2.0% respectively, P=0.02)[18], suggesting that rapid reperfusion in man is associated with an increased incidence of ventricular fibrillation, similar to animal models. The argument that these patients are in hospital and therefore the development of ventricular fibrillation is less of a concern is neither intellectually appealing nor practically comforting.

Finally, at the cellular level we would consider that mechanisms other than oxygen free radical injury may be implicated in the development of reperfusion arrhythmias. These would include potassium undershoot i.e. temporary local extracellular hypo-kalaemia, or adrenergic mechanisms[19].

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References


Myocardial fibrosis and hyperaldosteronism

The important role of the renin-angiotensin-aldosterone system in the regulation of myocardial fibroblast function in the extracellular matrix in hypertension and heart failure has been emphasized in a supplement of this Journal[20]. However, the separate role of aldosterone is frequently...