Oxygen therapy in myocardial infarction

R. LANCASTER*
M.A., M.R.C.P.

M. W. McNICOL
M.D., M.R.C.P.

Cardiothoracic Department, Central Middlesex Hospital, London, N.W.10

HIGH concentration oxygen therapy is often required after acute myocardial infarction, as hypoxia is common and may be resistant to oxygen therapy (MacKenzie *et al.*, 1964; McNicol *et al.*, 1965). While 100% oxygen is probably the treatment of choice, the apparatus for its administration, a tight-fitting face mask with valve box and reservoir or demand valve, is poorly tolerated and requires constant supervision. Of the other methods of high concentration oxygen therapy available, none is ideal. Disposable plastic face masks are widely used, but are poorly tolerated by the patient and unstable on the face. The M.C. mask was introduced by Catterall (1960) as a means of giving oxygen at low flow-rates. A recent study has shown it to be efficient at high flow-rates also, in cases of respiratory disease, if there is no carbon dioxide retention (Catterall, Kazantzis & Hodges, 1967). It is well tolerated, stable and requires little supervision. This paper reports an assessment of its efficiency as a method of high concentration oxygen therapy in patients with myocardial infarction.

The patients

The patients were men aged 36-68 years. Fifteen had unequivocal evidence of infarction. In five (4, 7, 12, 15 and 16) who had episodes of myocardial ischaemia clinically, infarction was not proven. All were studied within 48 hr of admission to hospital and in twelve patients there was evidence of left ventricular failure at the time of study.

Methods

Oxygen therapy

Oxygen was administered by M.C. mask. Arterial blood samples were taken breathing air and after breathing oxygen for 20 min at both 6 and 10 l/min. In ten patients oxygen tensions were measured after breathing 100% O₂ for 10 min via valve box and reservoir bag.

Arterial samples were taken via an indwelling Teflon arterial cannula (Longdwell, Becton-Dickinson) in the brachial artery. The samples were taken into all-glass syringes, the dead space being filled with heparin (5000 u/ml). Analysis was carried out immediately.

Arterial oxygen tension was measured with a polarographic electrode (Radiometer, Copenhagen). The electrode was calibrated before each reading. Tonometry showed that this electrode has a gas-blood difference of 2 mmHg at oxygen tension 150 mmHg and 54 mmHg at oxygen tension 700 mmHg. Pco₂ was measured with a Severinghaus CO₂ electrode.

Results (Table 1)

At an oxygen flow rate of 6 l/min all patients had an oxygen tension of over 100 mmHg. At 10 l/min all patients had an oxygen tension over 50 mmHg; 88% over 200 mmHg and 24% over 300 mmHg. The oxygen tension after 100% oxygen is also shown and the 'efficiency' of the mask

TABLE 1

Patient No.	Air	6 l/min	10 l/min	100 %
1	62	146	—	—
2	62	154	—	—
3	58	178	—	—
4	98	—	375	—
5	43	—	354	—
6	61	—	332	—
7	79	221	254	—
8	104	212	262	—
9	67	182	276	400
10	37	122	190	—
11	67	132	158	—
12	75	226	260	375
13	78	292	296	435
14	82	220	280	336
15	84	224	282	455
16	85	214	267	424
17	65	172	234	490
18	90	203	282	550
19	76	178	224	420
20	89	190	320	415
Mean	73	192	272	430
SD	±16	±40	±51	±56

*Present address: Department of Medicine, The Middlesex Hospital, London, W.1.

gauged by comparing this with oxygen tension obtained after 10 l/min via the M.C. mask (Table 2). Using the M.C. mask at 10 l/min, the oxygen tension was 65% that achieved after breathing 100% oxygen.

TABLE 2

Pao₂ after using M.C. mask at 10 l/min compared with Pao₂ after 100% oxygen

Patient No.	Efficiency (%)	
9	276/400	69
12	260/375	69
13	296/435	68
14	280/336	84
15	282/455	62
16	267/424	63
17	234/490	48
18	282/550	51
19	224/420	55
20	320/415	77

Mean efficiency = 65%; SD = ± 9.7 .

Fig. 1 shows the relationship between Pao₂ and oxygen flow rate. The mean rise in oxygen tension was 20 mmHg/l/min increase in oxygen flow-rate but the scatter was wide, especially at the higher flow rates.

Pco₂ showed no consistent change.

FIG. 1.

Discussion

The results show that the M.C. mask is an efficient method of giving high-concentration oxygen. At a flow rate of 10 l/min arterial oxygen

tension exceeded 150 mmHg in all patients. This oxygen tension is high enough to ensure full saturation of the haemoglobin.

Many of the patients studied had a low Pao₂ breathing air, indicating impaired lung function, the result of myocardial infarction. In some, this was severe. These cases are frequently resistant to oxygen therapy (McNicol *et al.*, 1965), but in all our cases the haemoglobin was fully saturated at 10 l/min.

The difference between 50% and 100% 'efficiency' is only in terms of dissolved oxygen and in absolute amounts, is small (less than 1 ml O₂/100 ml blood). It has not been established that such a difference is significant.

From these results, we think that, at present, the M.C. mask, which is acceptable on clinical grounds, is efficient enough as a means of high concentration oxygen therapy to justify its general use in myocardial infarction.

Summary

The 'efficiency' of the M.C. mask as a means of giving high concentration oxygen after myocardial infarction was assessed. Arterial oxygen tensions were measured at flow rates of 6 and 10 l/min using the M.C. mask, and were compared with oxygen tension after breathing 100% oxygen. At 6 l/min the oxygen tension was over 100 mmHg in all cases and at 10 l/min over 150 mmHg in all cases. At 10 l/min the 'efficiency' of the M.C. mask was 65% that of 100% oxygen. It is concluded that the M.C. mask is effective and probably the best available method of routine high concentration oxygen therapy in myocardial infarction.

References

- BALL, J.A.C. (1961) The administration of oxygen. *Lancet*, i, 591.
- CATTERALL, M. (1960) A new mask for delivering oxygen or other gases. *Brit. med. J.* i, 1941.
- CATTERALL, M., KAZANTZIS, G. & HODGES, M. (1967) The performance of nasal catheters and a face mask in oxygen therapy. *Lancet*, i, 415.
- MACKENZIE, G.J., FLENLEY, D.C., TAYLOR, S.H., McDONALD, A.H., STAUNTON, H.P. & DONALD, K.W. (1964) Circulatory and respiratory studies in myocardial infarction and cardiogenic shock. *Lancet*, ii, 825.
- McNICOL, M.W., KIRBY, B.J., BHOOLA, K.D., EVEREST, M.E., PRICE, H.V. & FREEDMAN, S.F. (1965) Pulmonary function in acute myocardial infarction. *Brit. med. J.* ii, 1270.