

more difficult the nearer the patient is to term; consequently the risk to the patient is greater near term. (3) The foetal mortality is related to the severity of the appendicitis rather than to the duration of the pregnancy. Abortion or premature labour has little adverse effect on the maternal prognosis. (4) Previous appendicitis with adhesions will adversely affect the prognosis of subsequent appendicular inflammation in pregnancy. When appendicitis is diagnosed in a woman the appendix should be removed. (5) The treatment of choice is appendicectomy, without interference with the pregnancy.

I thank my consultant colleagues for their permission to refer to the case-records of their patients, and for the help and advice of Sir Andrew Clay and Miss U. M. Lister in the preparation of this article.

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## A NEW MASK FOR DELIVERING OXYGEN OR OTHER GASES

BY

MARY CATTERALL, M.B., B.S., D.M.R.T.

Research Assistant to the Departments of Medicine and  
Thoracic Surgery, General Infirmary at Leeds

The M.C. mask, described below, differs from other masks in that, by virtue of its shape and volume, a valve effect is obtained without the presence of a mechanical valve. Thus there is no rebreathing of carbon dioxide, and a cone of inflowing gas is delivered direct to the region of the patient's nostrils or mouth. The concentration of the inflowing gas can be regulated by the rate of flow from the delivery cylinder. A flow of 2 litres of oxygen a minute gives an average concentration of 35%.

The mask is comfortable, very portable, and does not interfere unduly with talking. It is suitable for the conscious or the unconscious patient and can be worn in the sitting or lying position. As it is made in a cup shape of semi-rigid plastic, it can be held to the face by ambulatory patients who require oxygen quickly for the making of some effort. It is suitable for the administration of other gases—for example, self-administered anaesthesia in labour. It is so constructed as to avoid

the disadvantages of the polymask described in a previous paper (Catterall and Snow, 1960).

The mask is shown in the diagram, and the main part of it consists of a cup-shaped member of semi-rigid plastic through the centre of which runs the gas-delivery tube of the same material. The inner end of this extends to a point in the same plane as the rim of the cup-shaped member, which is in contact with the

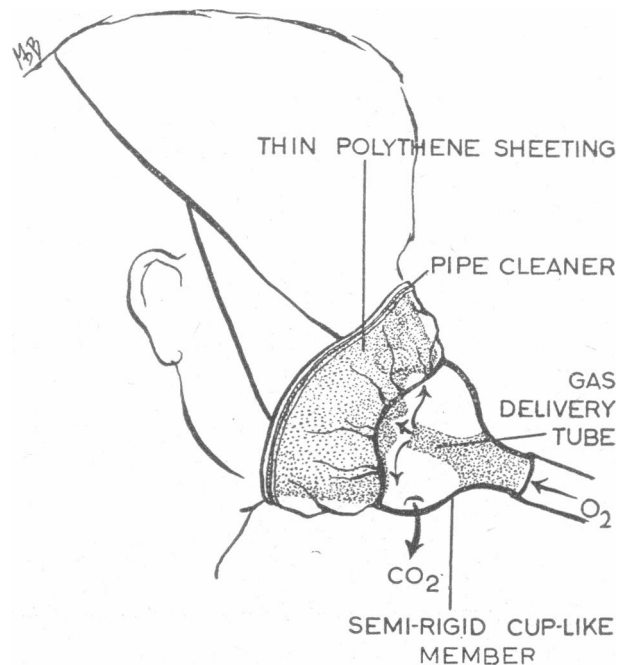


Diagram showing M.C. mask in position.

nose and the chin. It is therefore in close proximity with the patient's upper lip, to which the inflowing gas is directed. The outer end of the gas-delivery tube extends sufficiently beyond the dome of the cup-shaped member to attach to it the supply tubing from the gas cylinder.

The sides of the rim are made deeper than the parts which touch the nose and the chin to provide more stability when the mask is worn.

A small hole is situated in the cup-shaped member about halfway between the rim and the gas-delivery tube; this is for the emergence of expired carbon dioxide and, at low rates of flow, for the inspiration of room air.

The cup-shaped member is kept in place by a skirt of thin plastic sheeting in the hem of which is a pipe cleaner. This is moulded over the bridge of the nose and the cheeks and beneath the chin. The covering of cotton fibres prevents any cutting in of the wire to the skin. Adjustable straps around the head fix the mask in position.

### Principle of the M.C. Mask

The inflowing gas is delivered very close to the upper lip, which it strikes, and is deflected upwards to the nostrils and downwards to the mouth. In addition to this, on inhalation the inflowing gas is drawn towards the mouth or nostrils. Thus a central cone is produced which contains a high concentration of the inflowing gas. Around this, the atmosphere within the cup-shaped member contains smaller concentrations of the gas, until at the periphery, immediately proximal to the hole

for expiration, approximately room air is present. Obviously, if the rate of oxygen flow is only 2 litres a minute and the subject has a minute-volume of 8 litres, room air will be drawn in also and will dilute the 2 litres of 100% oxygen, giving an inspired atmosphere of 40% oxygen.

Since the volume of the mask is so small, and its walls are semi-rigid, a dead space is not built up, all the air inside the mask being in a constant state of organized movement. The pattern of this movement is dominated by the fact that the end of the gas-delivery tube reaches up to the plane of the rim of the semi-rigid member and thereby delivers the gas to the immediate site of inhalation.

The mask was tested for the oxygen and carbon dioxide concentrations inside it.

### Results

Values for carbon dioxide were less than 1% in all samples, and with prolonged wearing there was no further accumulation and no rebreathing occurred. Tests for oxygen concentration at the patient's mouth were carried out on 21 different wearers and with flow rates of oxygen from the cylinder of 2 litres a minute and 4 litres a minute. Analyses were made by a Beckman oxygen analyser. The results obtained showed that when the oxygen was leaving the cylinder at 2 litres a minute the average concentration at the patient's mouth was 35%. When the oxygen was leaving the cylinder at 4 litres a minute the average concentration at the patient's mouth was 48%.

Alveolar samples were analysed in the same way when the rate of flow of oxygen was 4 litres a minute. The results are as follows:

Time of Administration	Oxygen in Alveolar Sample
5 minutes	28%
10 "	30%
15 "	34%
30 "	35%

### Summary and Conclusions

A new mask for delivering oxygen or other gases is described in which there is a valve effect within the mask though no mechanical valve is present. The inflowing gas forms a cone of high concentration, and the expired gas is blown outside this cone to the periphery of the mask.

There is no measurable rise in carbon-dioxide concentration with a flow of 2 litres of gas a minute, because the small volume of the mask prevents the formation of a dead space and therefore prevents rebreathing. The shape of the mask and the position of the end of the gas-delivery tube ensure that there is a continuous and organized movement of the gases inside the mask.

The effective delivery of oxygen to the patient at low flow rates is important, especially in domiciliary practice where economy of oxygen is essential. It is generally agreed that an oxygen concentration of 30-40% in the inspired air will fully saturate the arterial blood in most cases. The results obtained with the M.C. mask show that its size and design enable such an oxygen concentration to be delivered to most patients with a flow of oxygen from the cylinder of 2 litres a minute.

A patent application for this mask has been filed and the rights are being assigned to the National Research Development Corporation, to whom inquiries should be addressed.

My thanks are due to Mr. Michael Snow for his great help in taking the gas samples and analysing them. I also thank Miss Mary Brown for the diagram.

### REFERENCE

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## Medical Memoranda

### "Vacuum Cleaner Injury" of the Penis

Many forms of penile injury have been described after attempts to induce erotic stimulation. Strangulation by rubber bands, metal rings, and string are the commonest, producing oedema and sometimes even retention of urine and gangrene. Three patients with similar penile injuries produced by a vacuum cleaner are here described.

#### CASE HISTORIES

*Case 1.*—A widower aged 57 attended hospital on October 17, 1957, because of penile lacerations. He had been greatly incapacitated for a number of years with chronic bronchitis and emphysema. Returning from having a few drinks in a public-house and seeking erotic satisfaction, he introduced his penis into the end of a vacuum cleaner tube and switched on the machine. However, pain soon caused him to stop, and then he found his penis was congested and bleeding. On examination the glans penis was extensively lacerated, the lacerations appearing almost "explosive" in nature. The urethra was not involved. The lacerations were sutured with catgut, and a soft rubber catheter was introduced for several days. Recovery was uneventful.

*Case 2.*—A 28-year-old bachelor attended hospital on September 11, 1957, with similar extensive lacerations of the glans penis extending into the external urethral meatus. The prepuce was also lacerated. He had produced the injuries in exactly the same manner as the previous patient. Circumcision was performed, the lacerations of the glans were sutured with catgut, and a self-retaining urethral catheter was introduced. Healing was satisfactory without any sign of stricture.

*Case 3.*—A widower aged 75 attended hospital on August 7, 1959, in great mental distress and complaining of pain, swelling, and laceration of the penis. He stated that while cleaning the stairs his penis had accidentally slipped into the end of a Hoover "dustette" vacuum cleaner. However he then attempted to obtain erotic stimulation by switching the motor on and off. On examination two irregular circumferential lacerations were present in the prepuce, each about 1.5 cm. long, and there was a similar laceration on the dorsum of the glans penis. The glans and prepuce were oedematous. Micturition was normal. The lacerations were not extensive enough to warrant suture or circumcision, and healed satisfactorily in two weeks.

#### COMMENT

The method of masturbation used by these patients was rather ingenious but had disastrous results. They attempted to simulate an active sexual partner by introducing the penis into the tube of a vacuum cleaner and switching on (and in one case on and off) the suction power of the machine.

No similar case has been found in the literature.

We thank Mr. H. K. Vernon, Mr. G. O. Jelly, and Mr. J. H. Tasker for permission to publish these case notes.

MILES FOX, M.B., F.R.C.S.,  
Senior Registrar, St. Peter's Hospital, London, W.C.2.  
E. L. BARRETT, M.B., Ch.B.,  
Registrar, Ancoats Hospital, Manchester.