

Trial of the use of masks in the gynaecological operating theatre

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Summary

A randomly controlled trial was performed on 41 women having gynaecological surgery in which the team of surgeons and nurses wore or did not wear masks. After major abdominal surgery, 3 of 5 patients in the unmasked group developed wound infections whereas no infection was observed in the 4 patients of the masked group. A greater number of *Streptococci* were also found by settle-plates on the operating table in the unmasked group. No infection was recorded after minor or vaginal surgery.

Introduction

Following Orr's data that abandoning masks did not increase infection rates (1), it was decided to re-examine the suggestions to see if the recommendations were applicable to gynaecological surgery. The operating lists of one surgical team were randomly allocated to a masked or unmasked group over two months. The outcome was measured by the number of wound infections, and bacterial counts obtained on settle-plates and from air sampling during operation. The efficacy of masks to reduce wound infection has been doubted on many occasions (2,3). Conversation during operation was restricted in the study by Orr (1). We chose a surgical team known for its volubility and high conversational capacity to see whether the conclusions by Orr were valid. The ethical committee gave permission for this trial provided an independent microbiologist could monitor results and recommend discontinuation of the trial if adverse effects were found.

Materials and methods

Over 7 weeks the gynaecological operation lists were carried out alternatively by masked and unmasked staff. In this time 41 women were operated upon and 25 from 4 lists entered the theatre staffed by a masked team whilst 16 from 3 lists arrived to an unmasked team. After cleaning the skin and towelling off the area, blood agar plates (Oxoid) in sterile containers were exposed. In the abdominal cases these were placed above the wound on the chest, immediately below the wound and on the instrument trolley of the scrub nurse. At vaginal surgery a blood agar plate was placed on the abdomen whilst a second plate containing a selective medium for streptococci (Mitis Salivarius agar, Oxoid) was placed on the lap of the surgeon below the operating area, a

third was on the instrument trolley. All plates were exposed for the whole operation.

For the first vaginal and major operations of the list, air sampling was performed. The centrifugal air sampler (Biotest RCS) was held 2 feet above the vaginal, or 1 foot above and 2 feet away from the abdominal wound, so that the surgeons and nurse involved in the operation were not disturbed. Both blood agar and Mitis Salivarius agar strips were used. All culture plates and strips were incubated for 48 hours at 37°C in jars containing additional 5–10% CO₂.

The total numbers of bacterial colonies cultured and that of *Streptococci* were counted. Before each operating list, throat and nasal swabs from all medical and nursing staff of the operating team were obtained and cultured for the presence of *Strep pyogenes* and *Staph aureus*. The laboratory work was carried out by a member of the staff who was not aware of the group allocation of the specimens obtained.

No restrictions were made on the theatre technique or behaviour of the staff. The surgical team was renowned for their loquacity. All patients were examined daily until their discharge from the hospital.

Results

Tables I and II summarise the results. The abdominal surgery is divided into major cases and minor cases, mostly laparoscopies which took only a few minutes. Vaginal surgery included curettage, cautery of the cervix and repairs. Three women developed wound infections within the first postoperative week; all had been operated on by the unmasked group. Two patients (a hysterectomy and an excision of a uterine septum) developed abdominal wound infections seriously enough to warrant antibiotic therapy. Their wound swab grew *Staph aureus* but in neither case was it a strain which corresponded to those isolated from the staff. The third patient developed pyrexia 2 days after total abdominal hysterectomy. Vault haematoma was diagnosed on the fourth day and *Gardnerella vaginalis* was isolated from a high vaginal swab. The patient responded to hot lactic acid vaginal douches and a course of Flagyl and ampicillin.

Of the seven medical and nursing staff taking part in the operation, the same strain of *Staph aureus* was isolated from one member on two separate occasions, and appeared to be different by phage typing from those of wound swabs. No

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TABLE I Results obtained on settle-plates exposed during operation

Operation	Masked or unmasked	Averaged bacterial counts (cfu */m ² /min)						Mean duration of Operation (min)	Number of cases
		Upper abdomen		Lower abdomen		Trolley			
		Total	Strept†	Total	Strept.	Total	Strept.		
Major	Masked	129	0.43	56.9	0	49.5	1.4	69	4
Abdominal	Unmasked	100	1.83	110.7	3.2	26.9	0.43	56	5
Minor	Masked	179.5	3.2	151.5	1.6	8.6	0	8	10
Abdominal	Unmasked	170.9	10.5	176.3	5.3	21.5	0	10	5
Vaginal	Masked	250.5	0.75	259‡	—	45.15	0	16	11
	Unmasked	275.2	0	394.5‡	—	87.01	0	18	6
Total masked		25							
Total unmasked		16							

‡ These counts were obtained on the selective plates placed on the surgeon's lap.

* cfu—Colony-forming unit.

† Strept—Streptococci.

TABLE II Results obtained by the centrifugal air sampler

Operation	Masked or unmasked	Number of Patients sampled	Blood agar		Selective agar	
			Total volume of air sampled	cfu*/100 L	Total volume of air sampled	cfu/100 L
Vaginal	Masked	3	240	190	240	105
	Unmasked	2	160	130	Not tested	Not tested
Major	Masked	4	520	154	240	66
Abdominal	Unmasked	2	240	96	240	53

* cfu—Colony-forming unit.

Strep pyogenes was isolated. The colony counts on the plates in relation to various operations is shown in Table I.

Generally, the total numbers of Streptococci obtained was greater in the unmasked group. All isolates were either α -haemolytic or non-haemolytic. The lower plates, under the surgeon's nose and mouth, contained consistently more organisms when the mask was not worn. Table II shows the air sampling results. All the masked groups had a higher concentration of organisms found per litre of air, contrary to most of the findings by the settle-plates for the two groups.

The trial was discontinued after the third case of post-operative infection in the unmasked group was diagnosed.

Discussion

Contrary to Orr's result, we found an increased infection rate after major abdominal surgery when the surgical team did not wear masks (3/5 vs 0/4). By using settle-plates at the operative site and air sampling during operation, we attempted to find out whether speaking without a mask during operation would contribute a measurably greater number of bacteria to the immediate environment of the patient. Such sampling methods can give variable results depending upon many factors, eg the number of people around, their activities, doors opened or closed. Minor surgical procedures which takes less time to complete create more activities in the operating theatre than major ones within the same time span. This may explain why the bacterial counts obtained for vaginal or minor abdominal surgery were higher than those for major surgery. We tried to standardise the test conditions by using the centrifugal air sampler during the first vaginal and major abdominal operation of each list. There were 7 or 8 people in the theatre. Settle-plates were used during each operation throughout the study.

The discrepancy in the results obtained by the two methods might well be due to:

(1) The small sample size, particularly for air sampling.

- (2) The two methods may be measuring differing sizes of bacteria carrying particles.
- (3) Air from different parts of the theatre was being sampled.

Nevertheless, it is important to note that plates directly under the face of the unmasked surgeons during abdominal surgery had an increased total bacterial count including Streptococci which presumably were of oral origin, than those in the masked group. Our results suggest that the wearing of masks by a voluble surgical team appears to be prudent practice during abdominal surgery, although it is unproven that the direct droplets from speech actually contributed causatively to the three infections in our study. In the study reported by Orr, conversation was restricted during operation.

Another variable which needs examination is whether it is important for a bearded surgeon to wear a mask for it may reduce the number of dust particles falling from the beard to the operative area.

In spite of the small number of patients involved and the equivocal bacteriological findings, we feel our results should be known to a wider group of surgeons.

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References

- Orr NWM. Is a mask necessary in the operating theatre? *Ann R Coll Sur Engl* 1981;63:390-2.
- Hushfield JW, Lambe PJ. Surgical masks, an experimental study. *Surgery* 1941;9:720-30.
- Ford CR, Peterson DE. The efficiency of surgical face masks. *Amer J Surg Path* 1963;106:954-7.