

# Recent Experiences in the Respiratory Unit of the Johannesburg Hospital\*

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## SUMMARY

The importance of respiratory disease in medicine is emphasized. One hundred and thirty-five cases were referred to the Respiratory Unit in a 5-month period. These cases have been analysed in terms of age, sex and major disease. Fifty-six patients, of whom 47 had intermittent positive pressure respiration, required treatment in an intensive care unit. Twenty-two patients died in the intensive care unit—a mortality rate of 39%.

Also discussed and briefly illustrated are problems of intermittent positive pressure respiration, tracheostomy and endotracheal intubation, cardiac arrhythmias, oxygen toxicity, fat embolism and tetanus.

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The staff of the Respiratory Unit of the Johannesburg General Hospital are consulted by members of other disciplines in the Johannesburg Hospital complex for advice on and management of cases of respiratory disease. This report analyses the cases referred over the last 5 months of 1970 and records some of the experiences gained by the Unit in recent years.

Respiratory disease forms a very important part of all hospital admissions. In a general medical ward at the Johannesburg Hospital from March 1968 to February 1969, 22% of all patients admitted suffered from chronic lung disease: when acute respiratory conditions were included, the figure rose to 36%. In an analysis of cases

admitted to a different medical ward from 1 April to 31 July 1968, no fewer than 39% of all admissions suffered from diseases involving the respiratory system. According to Ridehalgh<sup>1</sup> in Britain, diseases of the respiratory system, and general disorders presenting with respiratory symptoms, occupy at least 25% of the time of general practitioners, and many of these cases demand hospital care.

One hundred and thirty-five cases, 85 males and 50 females, were referred to the Respiratory Unit in 5 months. (It must be stressed that this number excludes those cases in general medical beds who are under the care of physicians attached to the Respiratory Unit, and also cases attending the Respiratory Unit outpatient service.) Almost half the cases were primarily surgical (Table I). Children

TABLE I. ANALYSIS OF REFERRED CASES

	Number	Male	Female	Total
Medical ... ..	43	29	14	72
Surgical ... ..	42	21	21	63
	—	—	—	—
<b>Total ... ..</b>	<b>85</b>	<b>50</b>	<b>35</b>	<b>135</b>
<b>Age distribution</b>				
14 - 25 years ... ..	15	8	7	23
26 - 50 " ... ..	28	14	14	42
51 - 75 " ... ..	37	24	13	61
76+ " ... ..	5	4	1	9
Urgent ... ..	53	26	27	79
Non-urgent ... ..	32	24	8	56

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under the age of 14 years are seen by the paediatricians at a different centre. Most of the patients were between 26 and 75 years of age. Acute emergencies comprised just under 60% of all cases; and 6 non-urgent and 27 urgent cases were referred from outlying hospitals. During this time almost 25% of all consultations were from outlying hospitals.

### TYPES OF CASES REFERRED

The consultations have been divided into 2 major groups, surgical or medical, depending upon the source of the request. Only the major presenting condition is tabulated and no case is listed under more than one heading.

TABLE II. MEDICAL CONSULTATIONS

	M	F
Bronchitis and emphysema	15	7
Asthma	1	8
Bronchial carcinoma	2	1
Pneumonia	4	3
Tuberculosis	2	2
Noxious fumes	4	0
Diffuse infiltrate	1	1
Pulmonary embolism	0	1
Other disease		
Primary cardiac	4	1
Primary neurological	4	1
Uraemia	2	1
Lymphoma	2	0
Collagenosis	0	2
Miscellaneous	2	1
Total	43	29

Almost one-third of the medical consultations (Table II) were patients with chronic bronchitis and emphysema, nearly always in cigarette-smokers. Asthma of severe degree, seen more frequently in females, appears to be becoming more common and is an important cause of death. Only 3 cases of bronchial carcinoma were seen. Acute lobar and bronchopneumonia due to different organisms was found to be life-threatening in some instances. Tuberculosis must be excluded in every case of chronic lung disease and was detected every now and then in the general medical wards. Two men were gassed with chlorine while working for a swimming-pool company and 2 men inhaled fumes of sulphuric and phosphoric acids in an industrial plant. All 4 recovered completely. Left-sided heart failure occasionally presents as primary lung disease. The neurological cases referred included cerebrovascular accidents and the Guillain-Barré syndrome. One patient developed diffuse interstitial pulmonary infiltration after a lymphangiogram for the staging of a lymphoma. The Respiratory Unit was rarely asked to see patients with pulmonary embolism, not because this condition is uncommon, but because, like pneumonia, it is usually treated by a general physician.

Only critically ill cases with chest trauma or fat embolism were referred to the Respiratory Unit by the surgeons (Table III). More than a third of the cases were

TABLE III. SURGICAL CONSULTATIONS

	M	F
Chest trauma	13	3
Fat embolism	8	2
Pre-op. assessment	11	6
Post-op. complications	3	6
Quadri- or paraplegia	4	0
Head injury	2	1
Burns	1	2
Tetanus	0	1
Total	42	21

referred for assessment of operative risk and management of postoperative complications of pneumonia, atelectasis, pulmonary embolism and respiratory depression. Injuries to the spinal cord compromised respiration in 4 of the referred cases. One patient developed pulmonary oedema following a head injury. Both female burn cases were due to cigarette-smoking while in bed. Tetanus occurred in a patient who had had a renal transplant; she recovered fully.

### MEDICAL CASES IN THE INTENSIVE CARE UNIT

Twenty-one medical cases were treated in the Respiratory Intensive Care Unit (Table IV), males staying an average

TABLE IV. MEDICAL CASES IN INTENSIVE CARE UNIT

	M	F
Total number	12	9
Average time (days)	19.9	13.3
IPPR	11	7
Deaths	5	5
Chronic lung disease	4	2
Pneumonia and shock	1	1
Asthma	0	1
Cervical cord tumour	0	1

of 20 days and females an average of 13 days. The difference is due to the fact that 2 males spent very long periods in the Unit, one being a case of Guillain-Barré syndrome and the other being an old man with chronic bronchitis and emphysema complicated by bronchopneumonia. Both cases recovered. Eighteen cases required intermittent positive pressure respiration. Ten of the 21 patients died, but these generally presented complex problems. Of the 6 with chronic lung disease, for instance, 2 had ischaemic heart disease, 2 had had cerebrovascular accidents and 2 had marked pulmonary hypertension. The 2 pneumonia patients that died were both hypotensive on admission. The patient with asthma was recovering well

but collapsed suddenly while steroid therapy was being reduced. The case with a cervical cord tumour presented as a quadriplegia with inappropriate antidiuretic hormone secretion and could not possibly have survived this illness.

### SURGICAL CASES IN INTENSIVE CARE UNIT

Thirty-five surgical cases were managed in the Intensive Care Unit, of which 29 required intermittent positive pressure respiration (Table V). There were 12 deaths, fat

TABLE V. SURGICAL CASES IN INTENSIVE CARE UNIT

	M	F
Total number	24	11
IPPR	19	10
Deaths	7	5
Trauma and fat embolism	3	1
Other trauma	2	1
GIH and COAD*	2	0
Burns, post-op. coma, atelectasis	0	3

\*Gastro-intestinal haemorrhage associated with chronic obstructive airways disease.

embolism accounting for 4. Head injuries contributed to some of the traumatic deaths. An earlier observation that death from chest trauma is rare in the absence of head or abdominal injuries was confirmed.<sup>2</sup> Gastro-intestinal haemorrhage complicating chronic obstructive airways disease accounted for 2 of the deaths. Two other patients that died were referred to the Respiratory Unit only after cardiac arrest had occurred, and they had been resuscitated.

### IPPR, TRACHEOSTOMY AND ENDOTRACHEAL INTUBATION

The Respiratory Unit is consulted about almost all cases requiring respirator therapy in the Johannesburg General Hospital and some of its associated hospitals. Any patient with respiratory failure will benefit on a short-term basis from assisted ventilation, but it is necessary to be able to prognosticate which patients will benefit in the long term. A general rule employed in the selection of patients with chronic pulmonary disease for assisted ventilation has been a clinical assessment of effort tolerance: if disability was such that the patient could not leave his home, assisted ventilation was withheld. Other medical, psychological and socio-economic factors were also taken into account. Justification for this view was found in a report from Denmark<sup>3</sup> which showed that no patient who had previously been house-bound, was alive 3 years after treatment with tracheostomy and IPPR. There are many exceptions to this rule, the most important one being the lack of an adequate history at the time emergency treatment has to be instituted.

Having decided that IPPR is warranted, an endotracheal tube should be inserted. This is easier and safer than

tracheostomy. It allows at least 48 hours in which to transport the patient to a major centre or to do an elective tracheostomy which has a much lower morbidity and mortality rate than the emergency procedure. Tracheostomy has many complications and cannot be regarded as a minor procedure. Complications, especially tracheal stenosis, may occur during the operation, in the days immediately following it and up to many months later.

Endotracheal intubation, like tracheostomy, has many complications, but there is one major complication which is easily avoided. This is the tendency for the tube to slip down the right main-stem bronchus and obstruct the left main-stem bronchus. Even the right upper-lobe bronchus can become obstructed. This results in atelectasis of the obstructed lung, a most serious complication in a case requiring IPPR. The tip of the endotracheal tube in an adult should not extend beyond the 3rd thoracic vertebra.<sup>4</sup> A postintubation chest radiogram should be taken as a routine to check the position of the tube tip, and at the same time a permanent reference point should be placed on the tube so that there will be a definite relationship between it and the patient's teeth or some other fixed point. While an endotracheal tube is in place, repeated checks for its position must be made. Diminished breath sounds over the left lung suggest that the tube has slipped down the right main-stem bronchus.

### CARDIAC ARRHYTHMIAS IN PATIENTS REQUIRING RESPIRATORY INTENSIVE CARE

It has been well recognized that death has occurred during or soon after tracheal aspiration of secretions. In one patient with a crushed chest a long period of asystole occurred immediately after suctioning. After the patient had been given atropine, asystole did not occur, although bradycardia was not abolished. A similar beneficial effect could be produced by intratracheal spraying with Xylocaine (lignocaine) before suctioning.

Shim *et al.*<sup>5</sup> demonstrated the value of pre-oxygenation by breathing 100% oxygen for 5 minutes in preventing suction-induced arrhythmias. Without pre-oxygenation such arrhythmias included frequent premature atrial contractions, nodal tachycardia, transient sinus arrest, incomplete heart block, and frequent premature ventricular contractions. They also recommended that the time of suctioning be limited to 10 seconds.

Ayres and Grace<sup>6</sup> reported that hyper- or hypoventilation resulted in arrhythmias refractory to drugs and cardioversion unless the inappropriate ventilation is first corrected. Their review of experimental work showed that the rate of spontaneous depolarization of automatic cells is increased by hypoxaemia, catecholamines, hypokalaemia, digitalis and alkalosis. Alkalosis alters the oxygen affinity of haemoglobin in such a way that delivery of oxygen to the tissues is reduced and it also reduces the activity of calcium ions which may play an important part in coupling excitation to contraction.<sup>7</sup> Almost any alteration of the myocardial cellular milieu may induce abnormalities in

cardiac rhythm.<sup>6</sup> Thus careful monitoring of blood gases, pH and electrolytes is essential to avoid arrhythmias and cardiac arrest in patients being treated on respirators.

## OXYGEN TOXICITY

Respiratory and other types of intensive care frequently require the use of oxygen therapy. Oxygen must be regarded as a drug which may be administered in various ways, which has an optimum dosage which may vary in different conditions, and which has side-effects and toxic effects.

### Case Report

The following is a brief case report of a patient who developed oxygen toxicity of the lung. He developed the Guillain-Barré syndrome with quadriplegia and respiratory failure, and was tracheostomized and given IPPR with a pressure-limited respirator. He never improved and remained totally paralysed until his death 467 days later. On admission, his chest was normal clinically and on X-ray. At various times, infection, atelectasis and pulmonary emboli were diagnosed and treated. Later it was suspected that he had developed oxygen toxicity. Measurement of the inspired oxygen concentration was found to be 90% instead of the 40% the respirator was supposed to be delivering. It became more and more difficult to oxygenate and ventilate him adequately and after more than a year of IPPR his arterial carbon dioxide tension began to rise and he died in respiratory failure. The chest radiogram a few days before his death showed widespread bilateral infiltrates. Postmortem examination of the lung revealed evidence of oxygen toxicity, with congestion, oedema, haemorrhage, fibrin exudation, fibroblastic proliferation, fibrosis and prominent alveolar lining cells.<sup>8</sup>

It is important to realize that this so-called oxygen pneumonitis is sometimes reversible, provided the inspired oxygen concentration can be lowered to 45% or less without resulting in intolerable hypoxaemia.<sup>9</sup> Even more important is the fact that oxygen toxicity can be prevented by carefully monitoring inspired oxygen concentration and keeping it below 50%.

## FAT EMBOLISM

Fat embolism is an important cause of death from trauma.

### Case Report

An 18-year-old girl sustained multiple fractures when knocked down by a motor vehicle. A chest radiogram on admission was normal. The following day petechiae were observed and the day after she had become drowsy, confused and dyspnoeic. At this stage the chest radiogram revealed scattered, ill-defined bilateral shadows. There were clinical signs of pulmonary hypertension and she had developed fever, anaemia and hypoxaemia with an arterial oxygen tension of 37 mmHg. In spite of oxygen therapy she deteriorated and the following day was intubated and IPPR was instituted with an Engström respirator. There was temporary improvement but some hours later her

blood pressure began to fall. Hypoxaemia worsened and could not be corrected despite therapy with 100% oxygen and positive end-expiratory pressure. On the morning of her death 5 days after her accident the chest radiogram revealed widespread, mottled shadows and a pneumomediastinum. At postmortem there was evidence of fat embolism and also large thrombi in the inferior vena cava and both pulmonary arteries. Histology suggested the possibility of disseminated intravascular coagulation.

Probably the best means of confirming a clinical diagnosis of fat embolism is the detection of fat globules 10-20  $\mu$  in diameter in the circulating blood.<sup>10,11</sup> Therapy of fat embolism is unsatisfactory and has included heparin, alcohol, low molecular weight dextran, steroids, clofibrate, oxygen, hypothermia and IPPR. Correction of hypoxaemia is of paramount importance with or without IPPR.

## TETANUS

Tetanus is infrequently seen at the Johannesburg Hospital but one case was of considerable interest.

### Case Report

A 38-year-old woman was referred to the Respiratory Unit after complaining of backache and stiffness in the mouth, followed the next day by an episode of generalized muscular spasm together with deep cyanosis. The patient was tracheostomized, curarized and managed with IPPR. Some days later she developed wide fluctuations in blood pressure, tachycardia, salivation and a recurrent erythematous rash. Within minutes the blood pressure varied from hypotensive to hypertensive levels. On a regimen of propranolol and bethanidine the blood pressure was stabilized. Catecholamine levels in urine were as high as those found usually in phaeochromocytoma but were probably derived from the sympathetic nervous system and not the adrenal medulla. This type of sympathetic hyperactivity in tetanus was recently described in a series of papers from Oxford.<sup>12,13</sup>

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