

A STUDY TO COMPARE THE VENTILATION PATTERNS PRODUCED WITH INTERMITTENT POSITIVE PRESSURE BREATHING TO THOSE PRODUCED BY DEEP BREATHING*

C J Eales (M Sc (Physiotherapy), Senior Lecturer,
Department of Physiotherapy, University of the Wit-
watersrand)

A Shapiro (B Sc Physiotherapy)

D Edelman (B Sc Physiotherapy)

D Cohen (B Sc Physiotherapy)

ABSTRACT

Much research has been done on IPPB and to date little evidence has been provided to support the use of this modality. Our study was designed to investigate the ventilation pattern produced by IPPB with deep breathing compared to deep breathing only in patients who have had suspected pulmonary emboli. Ventilation images of the lungs obtained through the inhalation of the radio-active gas Krypton were used for this comparison. Twenty-three subjects were randomly assigned to one of two groups. Group A comprised 12 subjects who received the radio-active gas via IPPB. The 11 subjects in group B received the radio-active gas via the routine circuit, while doing diaphragmatic breathing.

The data were analysed using the Mann-Whitney U-test. It was shown that in patients with suspected pulmonary emboli there is no evidence that IPPB would increase alveolar ventilation more than deep breathing exercises would.

ABSTRAK

Baie navorsing op IPDV is reeds gedoen maar min positiewe bewyse wat die gebruik van hierdie modaliteit ondersteun, is gevind. Die studie het die verskil in ventilasiepatroon tussen diep asemhalingsoefeninge alleen en IPDV met diep asemhalingsoefeninge in pasiënte met vermoedelike pulmonale emboli ondersoek. Ventilasiëbeelde van die longe verkry deur die inhalasie van radio-aktiewe Kryptongas is gebruik om die verskil aan te dui.

Drie-en-twintig proefpersone is onewekansig aan een van die groepe toegewys. Groep A het bestaan uit 12 proefpersone wat die radio-aktiewe kryptongas deur middel van IPDV ontvang het. Die 11 proefpersone in groep B het die radio-aktiewe gas tydens diafragmatiese asemhaling via die gewone baan ontvang.

Die data is met behulp van die Mann-Whitney U-toets verwerk. Die resultate het getoon dat die alveolêre ventilasie in pasiënte met vermoedelike emboli nie dieper was met IPDV as met diep asemhalingsoefeninge nie.

INTRODUCTION

Breathing makes use of a co-ordinated action of muscles to transfer volumes of gas into and out of the lungs. While this process is occurring the smallest possible amount of oxygen must be used so that the remainder of the oxygen is available for use by the rest of the body. The respiratory system is then effective¹. From the term "deep breathing" it is understood that by voluntarily moving regions of the wall of the thoracic cage, underlying lung tissue is appropriately aerated. Local aeration is normally affected by gravity. In standing the basal alveoli, i.e. the dependent areas of the lung will be preferentially aerated⁴. For the purpose of this study diaphragmatic breathing was taught as a means of enabling the patients to take a deep breath.

Intermittent positive pressure breathing therapy (IPPB) is the repeated administration of a series of augmented inhalations of variable volume delivered by the subject exhaling to atmospheric pressure¹. Claims have been put forward that IPPB is a form of assisted breathing which can be a valuable adjunct to physiotherapy in the treatment of respiratory disease. It is said to provide more

effective aeration of the alveoli, to aid the removal of secretions from the lungs and is a means of administering drugs directly to the airways². On reviewing the literature on IPPB it is apparent that the clinical value as well as the therapeutic effects of IPPB remain controversial¹. Many authorities have expressed doubt regarding the above claims. Welch *et al* actually felt that one of the vital factors when assessing the value of IPPB, should be the competence, enthusiasm and reliability of the therapist delivering the IPPB⁵.

IPPB is still frequently used in clinical situations by therapists who firmly believe that it is of great clinical value. A study was designed, by members of the Physiotherapy Department of the University of the Witwatersrand in conjunction with the Department of Nuclear Medicine of the same University, to determine whether IPPB would result in more effective alveolar ventilation than that which would occur during deep breathing only.

The common pathology that we expected to encounter during our research was that of pulmonary embolism, as the subjects we used were patients who had been referred to the Department of Nuclear Medicine for ventilation/perfusion scanning, for suspected pulmonary emboli.

The acute response of a pulmonary thrombo-embolus is complete or partial obstruction. This has both respiratory and haemodynamic consequences. An intra-pulmonary dead space forms as the embolic obstruction produces an area of lung where ventilation occurs but perfusion ceases. This ventilation has no value as the non-perfused area of the lung cannot participate in the gas exchange process. As a result of the cessation of blood flow to a zone, constriction of airspaces and airways in the affected zone occurs.

Surfactant is a surface active lipoprotein required to maintain alveolar stability. Pulmonary embolism leads to a reduction in the surfactant and alveolar collapse ensues. Frank atelectasis can be detected at 24 to 48 hours after interruption of blood flow. Arterial hypoxaemia is a further common consequence of pulmonary embolism. Infarction (death of lung tissue) rarely accompanies embolic occlusion.

As IPPB and deep breathing are often used in the clinical situation for the treatment of atelectasis, the patient sample used for this experiment was ideal.

METHOD

The subjects were patients who presented at the Nuclear Medicine Department of the Hillbrow Hospital for routine ventilation/perfusion scanning after suspected pulmonary embolism. Patients for whom IPPB would be contra-indicated were excluded from the study. Any subject unable to comply with the experimental procedure, e.g. amputees who could not manage to stand upright during the procedure, were also excluded from the study.

Suitable patients were randomly allocated to one of two groups. Group A comprised 12 patients who received the radioactive gas (Krypton - 81m) via IPPB. The 11 subjects in Group B received the radio-active gas via the routine circuit while doing diaphragmatic breathing.

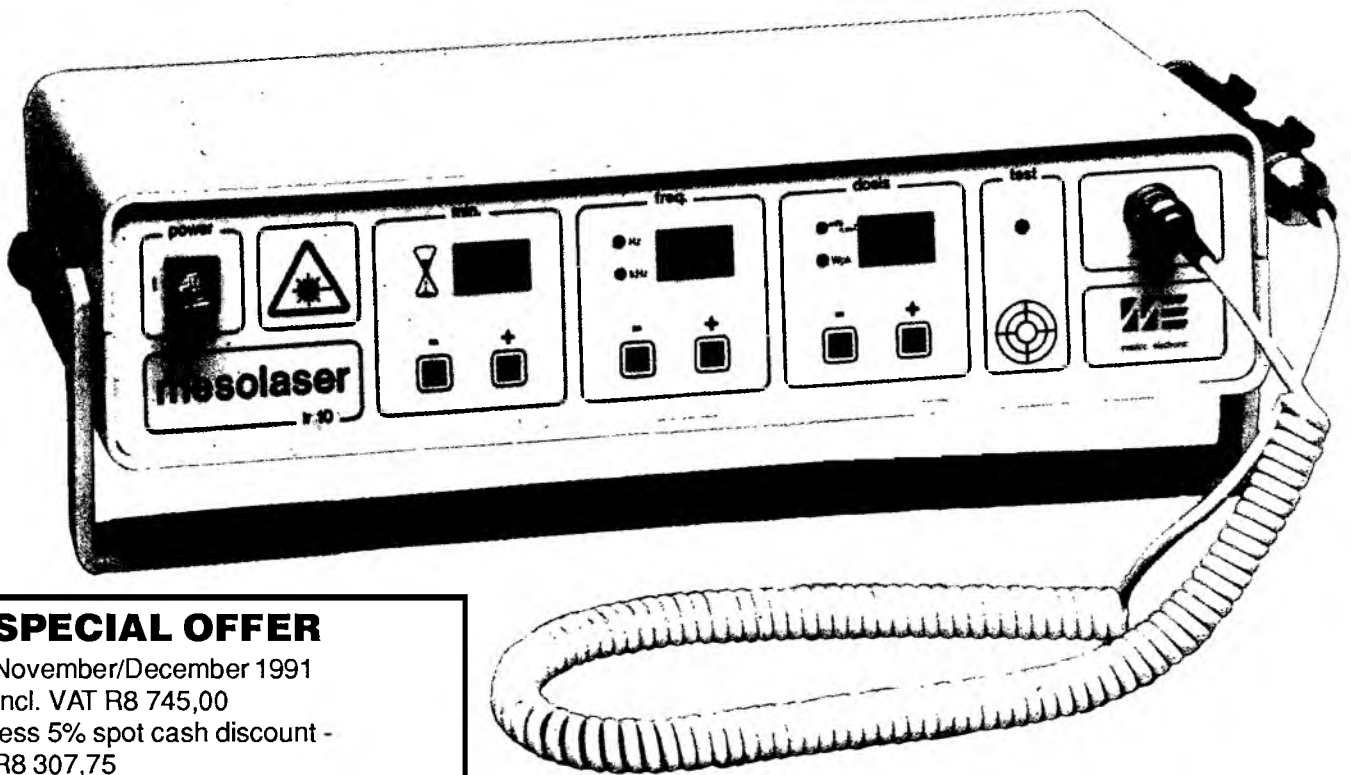
The Krypton-81m generator and circuit were set up as routine (see Fig 1).

Patients in group A inhaled the radio-active gas through the Bird Mark 7 circuit. A thin tube delivering the Krypton-81m gas was attached from the generator to the elephant tubing of the Bird Mark 7 circuit at its distal end, facing the direction of the air flow (see Fig 2).

* Received February 1991. Returned after corrections August 1991.

Mesolaser IR 01

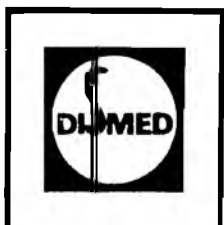
LICENSED BY THE DIRECTOR GENERAL OF RADIATION CONTROL



SPECIAL OFFER

November/December 1991
Incl. VAT R8 745,00
less 5% spot cash discount -
R8 307,75
Delivery free RSA

- A powerful portable Ga As infra-red laser, which uses the most up to date microcomputer technology
- The wave-length of 904 nm guarantees an optimal penetration depth.
- Variable peak power from 0 to 30 Watt in steps of 1 Watt.
- Capable of changing the frequency from 1 Hz to 5000 Hz.
- Tip-touch sensor system for activating the laser beam.
- Measurement of the infra-red radiation using an optical sensor.
- Time clock which works only when the laser beam is activated.
- Safety glasses designed for laser therapy, consisting of interference filters. These keep the visual spectrum at 95% of normal.
- Unit built to comply with the international safety regulations IEC 601.



MEDICAL DISTRIBUTORS (PTY) LTD
(EDMS) BPK

REG. NO. 57/01868/07

(011) 29-6931
(031) 37-1501

(021) 47-4440
(012) 346-1279

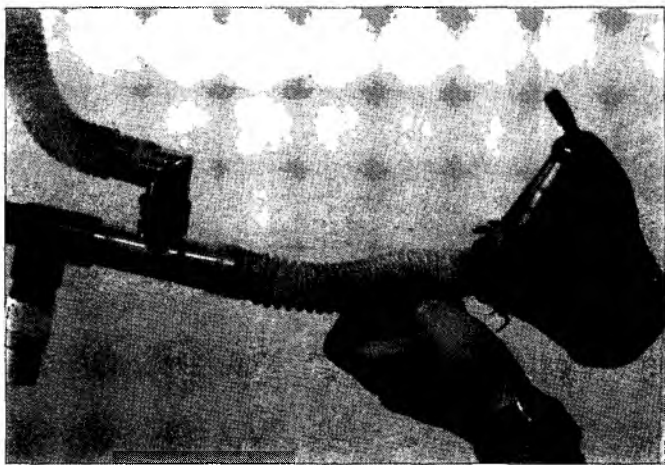


Fig 1: Krypton-81m generator and circuit

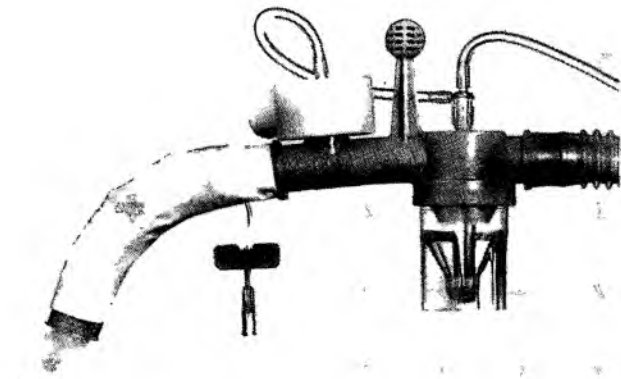


Fig 2: Modified Bird Mark 7 circuit for inhalation of Krypton 81-m

A tap, responsible for driving the generator, regulated the amount of Krypton-81m gas entering the Bird Mark 7 machine. The following experimental procedure was adhered to:-

1. The subjects were instructed how to use the Krypton delivery circuits (routine or with IPPB) and then given an opportunity to practice using the circuits before the inhalation of the radio-active gas.
2. All subjects were taught diaphragmatic breathing.
3. All subjects were instructed to take three breaths during each viewing when told to do so.
4. The inhalation of the radio-active gas then took place. Each subject was positioned in standing with the mouth level with the delivery system. The arms rested against the gamma camera. The positioning of the subjects was essential for the standardisation of the imaging due to the possibility of varying patterns being produced with different positions.

Subjects in Group A (A Krypton-81m delivered via IPPB) had nose clips on and breathed through a mouthpiece.

Subjects in Group B (routine administration) breathed through a close fitting face mask. The mouthpiece used for subjects in Group A were changed for each subject while the face mask was cleaned with disinfectant between successive subjects in Group B.

5. During the Krypton-81m inhalation, ventilation images were obtained using the gamma camera. An anterior and posterior view were taken of each subject. Each view lasted as long as it took for 600,000 counts to be picked up by the computer. The digital image was displayed on a screen and was stored on floppy diskettes for subsequent analysis. The total counts over the whole area of the lung and the counts/pixel for each region of interest was determined using computer linked facilities.

RESULTS

1. A comparison between the counts/pixel of subjects using IPPB (Group A) and subjects doing deep breathing (Group B) was made in subjects whose ventilation scans were normal.

NORMAL SUBJECTS ANT.VIEW:COUNTS/PIXEL

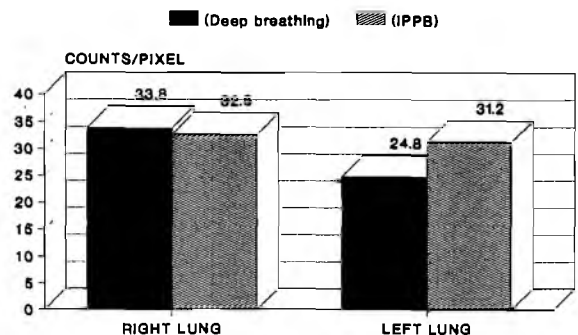


Fig 3: Comparison of counts/pixel in the anterior view of normal subjects.

This figure depicts results of anterior views of subjects with normal ventilation scans.

Similar results were achieved with posterior views.

No significant difference was demonstrated between the patients doing IPPB and those doing deep breathing. (p0.25)

2. A comparison was also made between the counts/pixel produced in those patients with pathology when using either IPPB or deep breathing.

SUBJECTS WITH PATHOLOGY ANT.VIEW:COUNTS/PIXEL

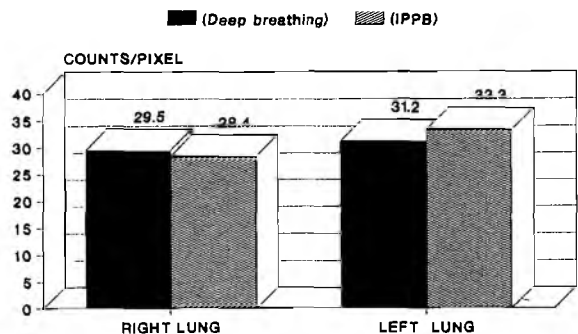


Fig 4: Comparison of counts/pixel in the anterior view of subjects with pathology.

Once more, no significant difference was demonstrated between the two modalities. (p0.25) Similar results were obtained for posterior views.

DISCUSSION

Our results demonstrate that there was no significant difference between deep breathing and IPPB in improving the alveolar ventilation of patients with normal lungs as compared to those patients in whom pulmonary emboli had been diagnosed. It is therefore not important which modality is used in the treatment of atelectasis which commonly occurs as a result of embolic disease. Certain considerations should be taken into account however when deciding on the treatment modality.

The administration of IPPB is costly. In practice it takes considerable time to set up the equipment and to teach the patient the

continued on page 67...



KANTON
AARGAU



Kantonsspital
Aarau
Schweiz

Um unser Team zu vervollständigen suchen wir zum baldmöglichen Eintritt

Dipl. Physiotherapeuten/innen (Krankengymnasten/innen)

welche bereits über einige Berufserfahrung verfügen und die gewillt sind, ihren Beruf mit Freude und Einsatz auszuüben.

Wir sind gerne bereit, Ihnen schriftlich oder telefonisch auf all Ihre Fragen, sei es bezüglich Arbeitszeit, Einsatzmöglichkeiten, usw. Auskunft zu geben. Ihre telefonischen Anfragen werden über die Nummer 064/21 41 41 an uns weitergeleitet.

Ihre schriftliche Bewerbung mit den üblichen Unterlagen richten Sie bitte an Verwaltung Kantonsspital Aarau CH-5001 Aarau/Schweiz

WORK IN THE UNITED STATES

PHYSIOTHERAPISTS

EXCELLENT JOBS

We handle all licensure and visa paperwork. Minimum commitment of one year required. TRN fees paid by employer Write or phone collect:

THERAPY RESOURCE NETWORK

P O Box 5430 Plymouth, Michigan 48170, USA
Phone (313) 455-6660

CAMBRIDGE COLLOCATION: EUROPEAN MEDICAL AND PROFESSIONAL RECRUITMENT

Physiotherapy vacancies in the UK: we have vacancies for physiotherapists in the private health sector in the UK. Excellent salaries and working conditions.

Please contact: Maureen Johnston Brown or Margaret Lamb, Cambridge Collocation, 191 Huntingdon Road, Cambridge CB3 0DL, England.

Telephone: (0)223 276891

Fax: (0) 223 276871

Employment Agencies Act 1973 Licence No SE 118181 VAT No 538357911

PATIENT FRIENDLY ELECTROSTIMULATION.

- Two channel constant voltage stimulation
- 3 current forms : continuous, spectrum, burst
- Biphasic current (prevents galvanic skin effects)
- Pulse duration and frequency independently adjustable
- Wide variety of electrodes available



Endomed CV405



Optimal patient comfort!

LICENSED BY THE SOUTH AFRICAN RADIATION CONTROL BOARD



**MEDIO
TRONICS** (PTY) LTD
REG No 90/04286/07

| | |
|-----------|--|
| Sandton | Tel. (011) 803-9320/1 Fax. (011) 803-7085 |
| Cape Town | Tel. (021) 946-4560 Fax. (021) 948-8401 |
| Durban | Tel. (031) 561-2798 Fax. (031) 561-4657 |

* SPECIALIST SUPPLIERS TO THE PHYSIOTHERAPY PROFESSION

THE ELEVENTH INTERNATIONAL CONGRESS OF WCPT

The Barbican, London, was the venue of Congress which attracted over 2000 participants. With thirteen concurrent sessions operating from 09h00 to after 17h00 in venues all over the centre, participants had to rush from place to place in an endeavour to hear those sessions that they had marked on their programmes. As many of the sessions overlapped and as no lunch or tea-breaks were provided, one often found oneself trying to split oneself in half in order to hear the key-note speakers as well as those papers of one's own special interest.

The Scientific programme comprised scientific paper sessions – oral and poster, audience participation sessions and clinical presentation sessions. It will be impossible to summarise the over 500 paper and poster presentations which covered a wide spectrum of subjects. Some comments of relevance to us will be extracted from the key-note and lead speakers.

There were four key-note papers in the four main themes of congress namely Clinical Practice, Competency to Practice, Health Education and Resource Management. In addition there were four lead speakers in the areas of neurology, paediatrics, orthopaedic manipulative therapy and respiratory care. These were all of a high standard and gave much food for thought.

Dr Jane Mathews, past president of American Physical Therapy Association gave a thought provoking address on "Shaping the future of physical therapy practice in the 21st century". Although there is a shortage of physiotherapists in many countries, she stressed that some of the shortages were only apparent and that physiotherapists were not being employed effectively in decision-making and consultation settings, and that different countries had developed different skills to cope with their own problems and urged us to make the maximum use of our potential in order to deliver relevant health care.

Professor Ruth Grant of the University of South Australia in her paper on "Obsolescence or life long education" challenged all physiotherapists to establish whether their continuing education programmes did result in improvement in competence or a change of practice. She felt that many programmes concentrated on input and did not evaluate outcome. Professor Grant stressed the need for developing problem-identification and problem-solving skills in order to prepare students for independent, first contact practice.

Professor Keith Tones of Leeds Polytechnic stressed the major role the physiotherapist has in educating patients, their carers and the public at large in health promotion. This will require skills in teaching, counselling, consulting and empowering clients.

The final key-note lecture on "Economics, the road to better physiotherapy" was delivered by Professor Gavin Mooney of the University of Aberdeen. His main theme was the importance of using resources in such a way as to provide a healthy population.

Professor Lance Twomey from Australia, the lead speaker in orthopaedic manipulative therapy, spoke on the age of reason in musculo-skeletal physiotherapy. He stressed the need for movement following injury to prevent atrophy and degeneration of articular

...continued from page 65

correct usage. An oxygen source must be available and oxygen is an expensive modality. The venue of IPPB administration is limited to places where oxygen under pressure is available to drive the machine.

In contrast, deep breathing exercises require no special equipment. Thus, to warrant the use of IPPB above the use of deep breathing exercises, evidence of the increased beneficial effects of IPPB must be proven. Our research showed no such benefit.

Thus, contrary to the claims put forward to support the use of IPPB to increase alveolar ventilation², we feel that deep breathing exercises would be just as effective.

cartilage and underlying bone. He warned against bedrest, analgesics, corsets and rest in the treatment of back injuries and recommended 8–10 hours of daily intensive physiotherapy for 3–4 weeks for chronic injury.

The lead speaker in neurology was Carolyn Gowland from McMaster University who spoke of the need to demonstrate the effectiveness of treatment and urged research in this area as well as objective clinical studies. The use of valid measurement and the design of measurement tools is essential.

David Scrutton of London continued the above theme and urged the replacement of technique-dominated treatment in paediatrics for aim-oriented management. Although he did not suggest that current treatment methods should be discarded, he urged us to become more analytical and critical of our techniques.

Barbara Webber of Brompton also stressed the need for research as well as the critical evaluation of research literature in chest physiotherapy so as not to be tempted to extrapolate findings to a broader spectrum of patients than those used in the study.

The audience participation sessions attracted much interest as delegates were able to discuss non clinical issues of international interest in an open forum. Topics discussed or debated with insight and often with humour, were:

- All physiotherapists who teach should be actively involved in clinical practice.
- How are the needs for physiotherapy identified and met world-wide?
- Do physiotherapists involved in undergraduate and post-graduate physiotherapy education require a qualification in education?
- How is specialisation defined and does it benefit the patient? How can specialists be developed and recognised?
- Assistants/Aides should be multi-disciplinary workers. What are the implications for training in different countries?
- On what basis has the role of the physiotherapist changed in different countries in the past 10–15 years.

The clinical presentation sessions covered subjects such as ankylosing spondylitis, head injuries, spinal injuries, conductive education, cystic fibrosis, chest physiotherapy in children, muscular dystrophy and burns.

Finally in addition to all the above, several special interest group meetings were held as well as discussion sessions on a variety of subjects. It would be most helpful if those South African delegates who attended these meetings would provide the NEC with short reports and for possible inclusion in our journal. The sessions are:

- Forum on physiotherapy research.
- Working in developing countries.
- Planning session for the Private Practitioners' Congress in Hong Kong in 1992.
- Manpower planning for physiotherapy – should WCPT be involved and how?
- Review of WCPT workshops on treatment of CP/role of CBR.

J C Beenhakker; S Irwin-Carnuthers ♦

CONCLUSION

In patients with suspected pulmonary emboli there is no evidence that IPPB will increase alveolar ventilation more than deep breathing exercises.

REFERENCES

1. *Respiratory Care: A guide to Clinical Practice*. Ed Burton GG, Hodgkin JE. 2nd ed. JB Lippincott Company, Philadelphia, 1984:530.
2. Downie PA, ed. *Cash's Textbook of Chest, Heart and Vascular Disorder for Physiotherapists*. 3rd ed. J Fletcher and Son, Norwich, 1983:183.
3. Pierce AK ed. *Conference on the Scientific Basis of Respiratory Therapy*. Temple University Conference Centre of Sugarloaf, Pennsylvania, *Am Rev Respir Dis* 1974;110(6):part 2.
4. JB West. *Ventilation/Blood Flow and Gas Exchange*. 3rd ed. Blackwell Scientific Publications, 1978:39.
5. Welch MA et al. *Methods of Intermittent Positive Pressure Breathing*. *Chest* 1980;78:463. ♦