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MEDICAL SPECIALITIES

Medical specialities are usually based on ailments connected with organs, as in the case of the eye or the heart; on regional, proximity as in the organs of the chest, functional interdependence as in the brain and the nerves; or on single specific diseases such as tuberculosis, leprosy, venereal diseases, etc.

When the anatomy, physiology, pathology, and treatment of one particular organ, or the aetiology, pathogenesis and treatment of a specific disease are studied in much greater detail than is possible in the study of medicine as a whole, it constitutes a true compact speciality with well denned boundaries. When a speciality is based more on regional proximity and less on function, it tends to be rather a surgical than a physiological or medical speciality. For example there is hardly any functional relation between the heart and the thoracic part of the Oesophagus. However, since they are both situated in the thoracic cavity, they are considered within the legitimate province of the chest specialist, especially the thoracic surgical specialist. A cancer of the lung and a fish bone stuck in the oesophagus have very little in common except that the surgeon may have to open the chest in order to deal with either of them. The relation between the heart and the lungs, however, is not merely a matter of regional anatomy but one of closely inter-related function as is shown by such terms as "Cardio-respiratory function" in Physiology and "Cor-Pulmonale" in Pathology. As the article and extract on "Cor-Pulmonale" published in this issue of the Journal will show, heart specialists and lung specialists cannot afford to ignore each other.

MEDICAL SPECIALITIES

The relation between chest and tuberculosis as specialities, is based on the fact that the organ that is by far the most effected by tuberculosis is the lung, which is a chest organ. Tuberculosis was and still is, a major speciality in this country. The advent of the effective anti-tuberculosis drugs has made it possible for non-specialists and even laymen including the patients themselves, to attempt treatment of tuberculosis cases more than before. This has made tuberculosis a less remunerative field for specialist private practice. This change is only in the field of treatment. However, considering the vast amount of scientific study of the disease that is yet to be done in its pathogenesis, epidemiology and other aspects, and as long as the numbers that have to be dealt with are in millions, constituting social and national health problems in the less developed countries of the world, tuberculosis will remain as a speciality by itself, and not merely as one of the diseases of the chest.

— *T. J. Joseph*

Anaesthesia in Thoracoplasty

(A statistical analysis and a plea for regional anaesthesia)

By

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AND

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One of the commonest operations done for tuberculosis of lung is thoracoplasty. This operation, although having definite indications and contra-indications has not lost much ground in our country so far because of the few facilities available for lung resections. Besides, all our cases are not fit for such radical procedures.

Thoracoplasty, as advocated today was undertaken by Alexander in 1925 and O'Brien and Carter in 1933. In this surgical manoeuvre, the approach is posterolateral and it is done in more than one stage. In the first stage, the greater part of the first three ribs is removed and in subsequent stages variable parts of two or three ribs at a time are resected. Transverse processes are removed below the first rib to obliterate the costovertebral gutter and apicolysis done when thought necessary.

REQUIREMENTS OF ANAESTHESIA IN THORACOPLASTY

1. Usually these patients will have suffered for many months and are, therefore, weak and debilitated.

2. A number of them may have lots of secretions; so, if they are deprived of their protective reflexes like cough reflex one is liable to expose them to danger of atelectasis if the secretions are not properly sucked out. Also there is the danger of dissemination of secretions to other healthy parts of the lung.

3. The operation may take two hours or over; so the anaesthesia for such a lengthy procedure should be comparatively safe.

4. The anaesthesia should not enhance the handicap already present due to disease of the lung as well as due to the position in which operation is to be performed.

5. The anaesthetist has to bear in mind that respiratory excursions without paradoxical movements after apicolysis are absolutely essential immediately after operation.

6. Adequate oxygenation is essential during, as well as after, the operation.

There have been many trends in the anaesthesia for this operation. Some have used nitrous oxide, oxygen and minimal chloroform in early periods. Halton used intravenous anaesthesia while Murphy and Beecher advocated Ether. The

unilateral spinal was used by Shields and Wesley Bourne. In fact the Ethrington-Wilson technique of unilateral spinal block was much in vogue at one time. In our series of study of 400 cases (details given below) 47 cases were conducted under unilateral spinal using light Nupercaine (1 in 1500) with patient lying on sound side in lateral position. We concur with the opinion of Miller that with unilateral spinal for thoracoplasty the fall of blood pressure is profound and is its greatest drawback. Secondly coughing is not effective and is accompanied by some amount of paradoxical movement. In all our series of spinals, we used Ephedrine gr. f I/M prior to the administration of anaesthesia, but still there was fall of blood pressure which in some cases required prolonged use of vasopressor drugs in addition to blood transfusion. Hence we also decided not to use this technique.

In VJ. Hospital, Amritsar, and R.B. Sir Gujjannal Kesradevi T.B. Sanatorium, Amritsar, anaesthesia was administered to 400 cases of thoracoplasty and allied operations from 1948 to August 1957 as given below :—

Fig. 1
(Chart year wise)

In these cases, the following anaesthesia was given:—

I. Regional Anaesthesia:		348 cases
(i) Regional anaesthesia alone	319	
(ii) Regional anaesthesia supplemented with I/V pentothal	10	
(iii) Regional anaesthesia supplemented with Ether	19	
II. Pentothal nitrous oxide, oxygen and Ether	3	„
III. Endotracheal Ether	2	„
IV. Spinal analgesia	47	„
	Total	400 cases

The above analysis shows that most of our cases were conducted with regional anaesthesia. Out of the total of 400 cases, regional anaesthesia was given in 348 cases. Out of 348 cases, only 29 cases required a supplementary anaesthesia either in the form of sodium pentothal or ether showing thereby that only 8 % of the cases were partial failures while 92% were enabled to undergo this surgical procedure without any difficulty.

Although there are many prejudices against regional anaesthesia for thoracoplasty, yet we preferred it as a good choice.

THE ADVANTAGES OF REGIONAL ANAESTHESIA

1. Consciousness helped us to get full cooperation from the patient.
2. Respiratory movements were minimal.
3. Paradoxical respiration was minimal.
4. Diathermy could be used which was a great help to lessen bleeding.
5. Bleeding was greatly reduced in our cases because of local infiltration, making blood transfusion less essential.
6. Dissemination was minimal.
7. Use of semi-prone position with regional anaesthesia did not hamper the smoothness of respiration.
8. No irritants to the respiratory tract were used.
9. Condition of patient was more often satisfactory at the end of operation as blood pressure, pulse and respiration were well within normal limits.
10. Postoperative nursing was made easy as the patient was cooperative and did not need as much supervision as was required in an unconscious patient after general anaesthesia.

ASSESSMENT OF PATIENT FOR OPERATION

In our series, we had the following routine:—

1. All the patients were examined a day before operation by the Anaesthetist for assessment of the risk for surgery, to win the confidence of the patient and to explain the procedure to him.

2. Blood pressure, pulse rate, respiratory rate and temperature were checked up and a thorough physical examination done.

3. Vital capacity: In all cases, we took a vital capacity of over 1500 cc to be the condition for fitness of cases for operation.

4. Breath holding time:—A breath holding time of 30 seconds or over was desirable. Although different anaesthetists take its reliability differently, yet 30 to 45 seconds was considered good. Above 45 seconds as very good and below 30 seconds as poor surgical risk.

5. Total R.B.C. count, bleeding time and coagulation time noted and anaemia as such excluded. Haemoglobin less than 10.0 grammes was a contra-indication for surgery.

6. Examination of urine done and any abnormality corrected.

7. Erythrocyte sedimentation rate of patient:—A rising E.S.R. was taken into consideration rather than a high E.S.R. Majority of our cases had settled to near normal limits before operation.

8. Bronchoscopic examination prior to the operation was undertaken in quite a number of cases to exclude bronchial tuberculosis.

9. Grouping and matching for blood was always done and blood kept handy so that it could be started immediately when necessary.

10. Age and sex was no consideration for the fitness of a case for thoracoplasty or regional anaesthesia in our series. Following is the analysis of our patients regarding sex:

Male	...	250 cases
Female	...	150 „
Total	...	400 cases

Age periods:- Fig. 2. (See page 38)

From the analysis, it is clear that 296 cases fall in the category of less than 30 years, i. e., 74% of the total.

It is worth noting that all the cases between the age of 10 to 15 years (seven in number) were conducted under regional anaesthesia alone. The youngest of our patients was 13 years old and he cooperated very well under regional anaesthesia (Chart No. I). As he was showing a rise of pulse rate and fall of blood pressure, he had to be given a bottle of blood; operation lasted for 1 hour and 48 minutes.

CHART I

Name:—K. G. Age:—13 years. Sex:—Male. Date:—16-2-1952.

Diagnosis — Pulmonary tuberculosis.

Operation:— Thoracoplasty (Stage I).

Premedication:— *Soneryl* Tab. 2 at 11.30 a.m., Morphia gr. 1/6, Atropine gr. 1/100 (12 noon).

Anaesthesia:— Brachial block—10 cc x 2% ... 200 mg.

Paravertebral block—25 cc x 2% ... 500 mg.

Infiltration in the line of incision—
100ccx 1/2% ... 500 mg.

Total amount of procaine hydrochloride: ... 1200 mg.

Anaesthesia started:—1.30 p.m.

Operation started:— 2.22 p.m.

Operation finished:— 4.10 p.m.

AGE GROUP

11. Assessment of the T.B. of other regions of the body—None existed in our series.

General preoperative preparation

Most of our patients were sanatorium cases, so it was a routine to operate them there. The surgeon and anaesthetist were required to go there according to the pre-arranged programme.

Premedication

As we used regional anaesthesia in most of the cases, the premedication consisted of a barbiturate supplemented with a dose of morphine sulph. plus a dose belladonna group of drugs.

/ Group—237 cases.

- (i) Soneryl tablets (O. 1 G each)—2 tablets at bed time previous night,
- (ii) Soneryl tablets 2—two hours before operation.
- (iii) Morphine sulph. gr. $\frac{1}{4}$ s/c
 Atropine sulph. gr. 1/100
 Sig.—1½ hours before operation

II Group—78 cases

- (i) Luminal sodium 2 gr. I/M.
Sig.—2 hours before operation
- (ii) Morphine sulph. gr. $\frac{1}{4}$ s/c
Atropine sulph. gr. 1/100
Sig.— $1\frac{1}{2}$ hours before operation

III Group—31 cases

- (i) Luminal gr. 2 I/M.
Sig. two hours before operation
- (ii) Morphine sulph gr. $\frac{1}{4}$ s/c
Hyoscine hydrobromide gr. 1/100
Sig.— $1\frac{1}{2}$ hours before operation

IV Group—54 case

- (i) Morphine sulph gr. 1/6 s/c
Atropine sulph gr. 1/100
Sig. $1\frac{1}{2}$ hours before operation.
- (ii) Pethidine hydrochloride 100 mg. I/M
Sig. $\frac{1}{2}$ hour before operation

In Summer it was advisable a routine to give hyoscine hydrobromide in place of atropine sulphate.

In cases in which the premedication had been given earlier than 4 hour before the time of operation, a smaller dose was repeated intravenously.

The patients cooperated very well under the effect of premedication.

As a routine glucose 5 % was started as intravenous drip before the operation for fluid therapy and specially for a quick change over to blood if need be.

Actual technique of regional anaesthesia

The patients were usually operated in lateral or semiprone position. The standard technique of regional anaesthesia was followed depending upon the stage of operation.

In our series of 400 cases, the stages and types of operations were as under:—

Year	1st stage (Ribs I, II & III resected with apicolysis)	2nd stage (Ribs IV, V & VI resected)	3rd stage (Ribs VII & VIII resected)	Anterior thoracoplasty	Miscellaneous like Plombage or Schede's
1948	5	2	3	2	
1949	5	2			--
1950	30	15	6	3	
1951	26	21	6	—	2
1952	36	27	5	—	—
1953	22	13		—	3
1954	36	21		—	4
1955	17	19		—	1
1956	10	7	—	—	—
1957	28	23	—	—	—
Total	215	150	20	5	10

The technique was as under:—

1. *Brachial block*:—In this, the usual method of supraclavicular route of taking a point one finger breadth above the mid point of clavicle and lateral to the external jugular vein and just outside the subclavian artery pulsation was taken and an intradermal wheel raised with a gauge 26 needle. Through this wheel a gauge 22 needle X 2½ long on a loaded syringe was advanced backwards, downward and inwards of course the operator standing at the head of the table. Often paraesthesia could be elicited and 15 to 20 ccs of the solution injected. In case paraesthesia could not be elicited 30 cc of 2% Novocaine solution was injected on the upper surface of the first rib to soak the plexus.

2. *Paravertebral block*: In our series of 348 cases, we used the paravertebral block. We have dissected out the thoracic nerves in cadavers as they emerge from the spinal cord and traced them to the angle of rib (labelled photos) and found that each thoracic nerve after its emergence from the intervertebral foramen, divides into anterior (5) and posterior divisions (3) after giving a meningeal branch. The posterior supplies the muscles of the back and skin whereas the anterior after giving a ramus communicates to the sympathetic ganglion, passes forward between the ribs and the inter costal muscles. In the region of the space adjoining the vertebra, the so-called paravertebral space, the anterior division gives off on branch, therefore, if one can soak the nerve there, the anaesthesia is perfect. The nerve lies midway between the transverse process of two vertebrae and may lie superficial or sometimes deep to the intercostal vessels and then passes towards the rib above it and enters the costal groove. Near the angle of the rib it gives off a branch called '*Collateral Branch*' (4), which is an important branch because if one is able to soak the main nerve before this branch has taken off, then anaesthesia will be perfect, but if the nerve has already taken off and does not get soaked, then the patient may keep complaining of the pain. This branch has no hard and fast distance of cleavage from its main trunk hence paravertebral analgesia to be successful, must be truly paravertebral.

The thoracic nerve lies first between the posterior intercostal membrane and pleura and then between the internal and the innermost intercostal muscles and anteriorly it becomes superficial.

Landmarks and actual process

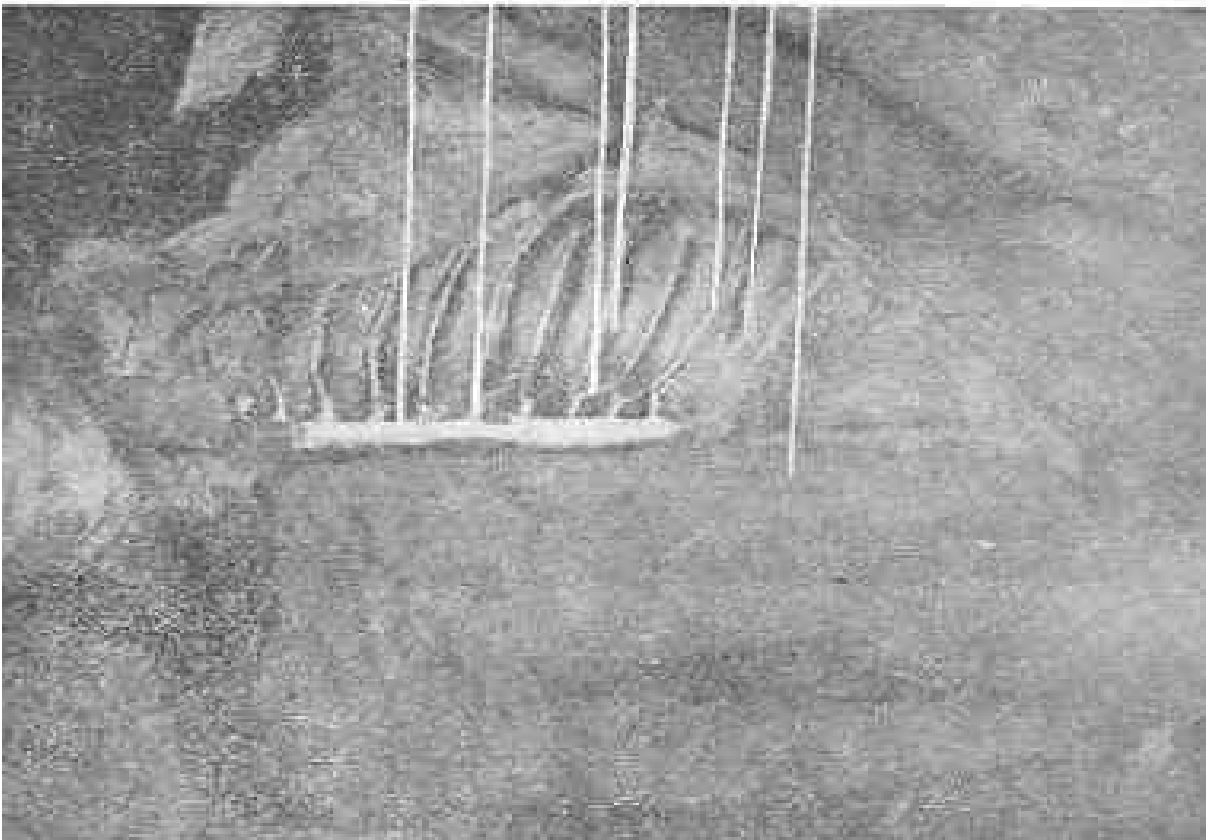
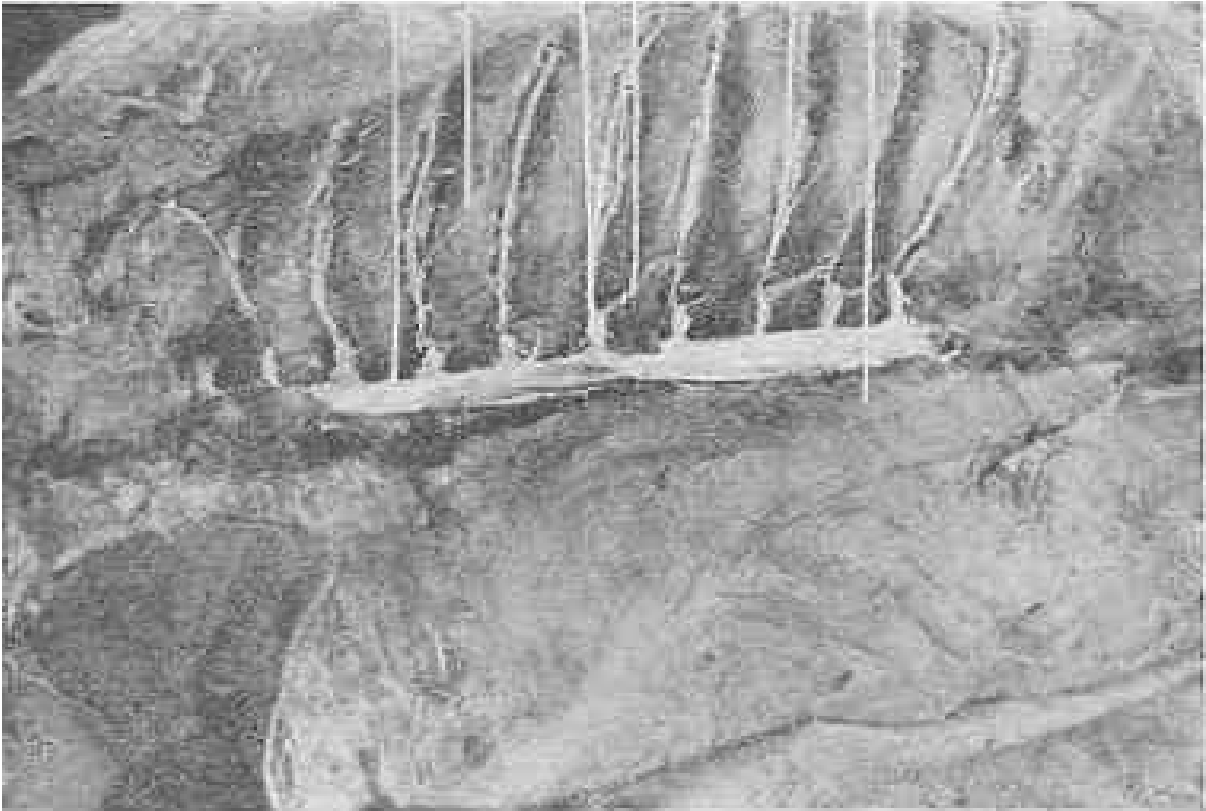
(1) The spinous process of the thoracic vertebrae are not horizontal, but incline downwards with the result that the spinous processes are not natural landmarks for the homologous vertebrae. The foramen for the first thoracic nerve is found opposite the spinous process of C7 (See 10 in Photos) and foramen for the 5th thoracic nerve is found opposite 4th thoracic spinous process. Hence we do the paravertebral block by counting from the process of C7 or 12th rib; we made provision for the inclination of spinous process.

(2) The lateral margin of the intervertebral foramen is approximately 3 cm. from the midline and that is why we took 4 cm. as our point for raising the wheats so as to be able to hit the nerve in paravertebral space away from intervertebral foramina.

(4) Through the wheel, needle was inserted vertically towards the transverse process and needle point was made to touch it. It either touched the lateral tip of transverse process or the costotransverse junction. The needle was withdrawn slightly and directed to slide at the upper border of the transverse process and after going ½ cm deep we knew we were at the nerve by eliciting Paraesthesia in some cases. Repeated aspiration, while injecting the solution was done to safeguard the danger of injecting the drug in the subarachnoid space through the projections of

1. Spinal Card.
2. Spinal Ganglion lying in Inetr- vertebral Formen.
3. Posterior Primary Division.
4. Collaterior Branch.
5. Antrior Primary Division.
6. **Latismus Dorsi Muscle.**
7. Skin.
8. Nerve Lying Inferior to Intercostal Vessels in Costal Groove.
9. articular Process.
10. Sinous Proces sof 7th Cervical Vertebra Opposite Which Lies 1st Thoracic Nerve.

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thea along the spinal nerves. This was repeated for all the nerves which had to be blocked.

(4) Local infiltration along the line of incision. This is a very important part of the technique. Line of incision deep to transverse processes is thoroughly infiltrated and liberal amounts of solution used.

(5) Some solution was kept at hand if needed for the surgeon to inject during operation, as the nerves got exposed. This was rarely needed.

In all our cases, we had the following routine

- (i) We used procaine hydrochloride as the drug of choice.
- (ii) For wheal raising and infiltration, we used J % novocaine solution.
- (iii) For nerve block like paravertebral & brachial block, we used 2% - novocaine.
- (iv) In all our cases, adrenaline hydrochloride 1 in 200,000 solution was added. This ratio being achieved by adding £ cc of 1 in 1000 solution of adrenaline in 100 cc of procaine solution. The idea of adrenaline being—
 - (a) to prolong the effect of anaesthesia.
 - (b) to lessen bleeding.
- (v) For brachial block, 15 cc to 30 cc of 2 % procaine solution was used.
- (vi) For paravertebral block, 5 to 8 cc of 2 % solution of procaine was injected into each space.

Total procaine used varied from case to case with a maximum of 2.0 G (2000 mg.)

Brachial Block 30 ccx 2%	— 600 mg.
Paravertebral Block 40 cc x 2%	— 800 mg.
Infiltration 120ccx J%	— 600 mg.
Total	2000 mg

The amount of drug commonly used was 1300 mg.

Brachial Block 15 ccx 2%	— 300 mg.
Paravertebral: 30 cc x 2%	— 600 mg.
Infiltration: 80ccx J%	— 400 mg.
Total	1300 mg.

(vii) The usual time taken in administering anaesthesia was 20 to 30 minutes in our cases. The effect lasted usually 3 to 3J hours and even over.

Management during operation

Vital signs were recorded in all cases every ten minutes and even more often if necessary. All efforts were made to keep the patient within normal or near normal physiological state by replacing fluids, relief of pain and apprehension, and by giving oxygen when necessary.

Out of 348 cases operated under regional analgesia only 29 cases required supplementary anaesthesia e.g., Pentothal sodium in 10 cases and Ether in 19 cases. Seven cases required anaesthesia under vision by the surgeon. Some patients groaning specially when scapula was pulled and they got the infiltration under the scapula with good results. A number of cases who showed excitement and rise of pulse rate were quite well managed by giving morphine sulph. gr. 1/6 or pethidine hydrochloride 25 to 50 mg. I/V. One of the charts shows a typical effect. The blood pressure remained unchanged while the pulse rate settled down (Chart of Giano—II).

In a majority of our cases of regional analgesia, no blood was needed during operation. In fact the blood pressure was well maintained. Chart No. III shows a case in which the preoperative blood pressure was 115/75 and pulse 96/mt. After the anaesthesia had been given, the blood pressure was 150/90 and pulse 120/mt. This was due to the effect of adrenaline hydrochloride in the procaine solution. The pulse and blood pressure settled down gradually and within 10 minutes of finishing the anaesthesia B.P. was 110/70 mm. Hg. and pulse rate was 98 per minute and showed no marked variation in cases in which there was not much bleeding.

Some of the patients who showed sustained fall of blood pressure during the operation, one bottle of blood of 350 cc on an average was given. In a few cases the blood pressure showed a great fall and the blood transfusion was supplemented with one of vasopressor drugs like Methedrine 10 mgs. I/V. This was done when systolic pressure fell below 75 mm. of Hg. Chart IV is given to show such a case. In this case (he blood pressure originally was 150/90 and pulse 110. After the start of operation the blood pressure fell gradually and it was not recordable and pulse also imperceptible. Then blood 2 bottles (350 cc each) was given and after 50 minutes pulse was 120/mt. and blood pressure 110/70. Post-operatively he did well.

In three cases, the hypotension during surgery was probably the cause of bleeding in post-operative period, as, when again the blood pressure rose up, the wound had to be reopened and bleeding points again ligatured. Of course, the regional anaesthesia as such had no part to play in the fall of blood pressure.

Paradoxical respiration: This shock producing complication was not so common. In 37 cases of the series, there was a tear in the pleura—small or large tear due to thickened pleura adherent to the rib but tear was stitched. In fact, in cases in which the vital capacity was good, it well compensated for this pleural injury.

POST-OPERATIVE MANAGEMENT

1. Record of blood pressure and pulse. If the blood pressure fell or a fallen blood pressure did not come up, blood was given. In some cases, methedrine 10 to 15 mg. I/V and glucose 5% was given.

2. Paradoxical respiration was the most embarrassing complication and it was sometimes serious. We had 4 deaths in our series and all manifested paradoxical respiration. One died within 3 hours of operation, 2nd died "after 2 days, 3rd died after 4 days and 4th died after 7 days.

In quite a number of cases, paradoxical breathing was present for a day or more and was treated by giving oxygen, morphine or pethidine and sandbags on affected side and they yielded to this treatment.

3. Coughing was encouraged to avoid atelectasis.

CHART II

Name:—Q. Age:—22 years. Sex:—Female. Date:—24-1-53.

Diagnosis:— Pulmonary tuberculosis.

Operation:— Thoracoplasty (Stage I).

Premedication:— Morphia gr. J, Atropine gr. 1/100 at 9.0 a.m.

Anaesthesia:— Brachial block 11 cc x 2% ... 220 mg.
 Paravertebral bloc ID to 7D 35cc x 2% ... 700 mg.
 Midsternal infiltration 15 cc x J% ... 75 mg.
 Infiltration in the line of incision 130 cc x J% ... 650 mg.
 Total dose of procaine hydrochloride ... 1640 mg.

Anaesthesia started:—10.30 a.m.

Operation started:— 11.00 a.m.

Operation finished:— 12.20 p.m.

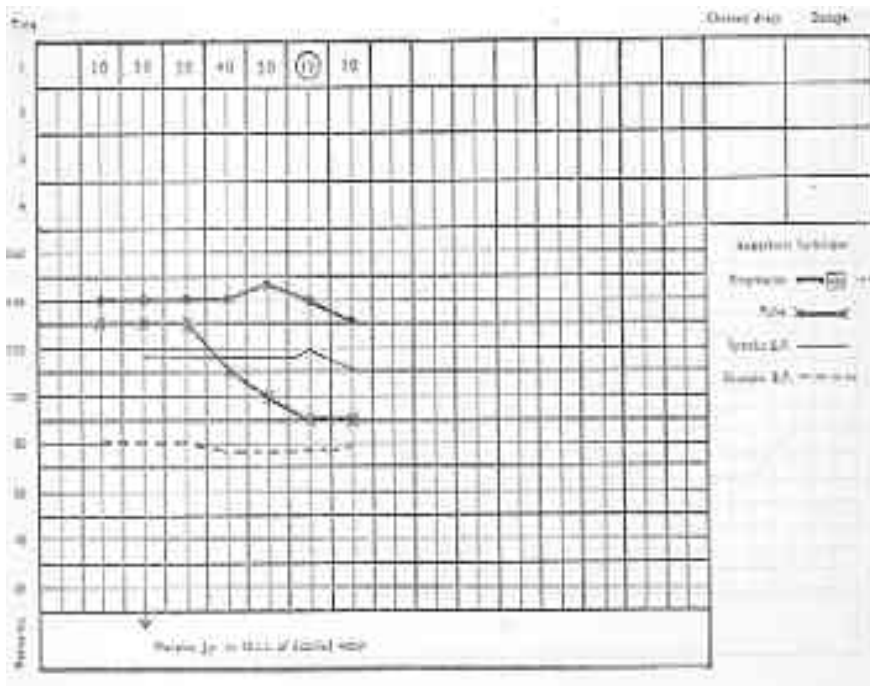


CHART IV

Name:—H. R. Age:—33 years. Sex:—Male. Date:—12-12-1952.

Diagnosis:— Pulmonary tuberculosis.

Operation:— Thoracoplasty (Stage I).

Premeditation:— Morphine Sulph gr. J, Atropine Sulph gr. 1/100 9a.m.

Anaesthesia:— Brachial block—10 cc x 2% ... 200 mg.

Paravertebral block—30 cc x 2% ... 600 mg.

Infiltration in the line of incision—
110 cc x 1% ... 550 mg.

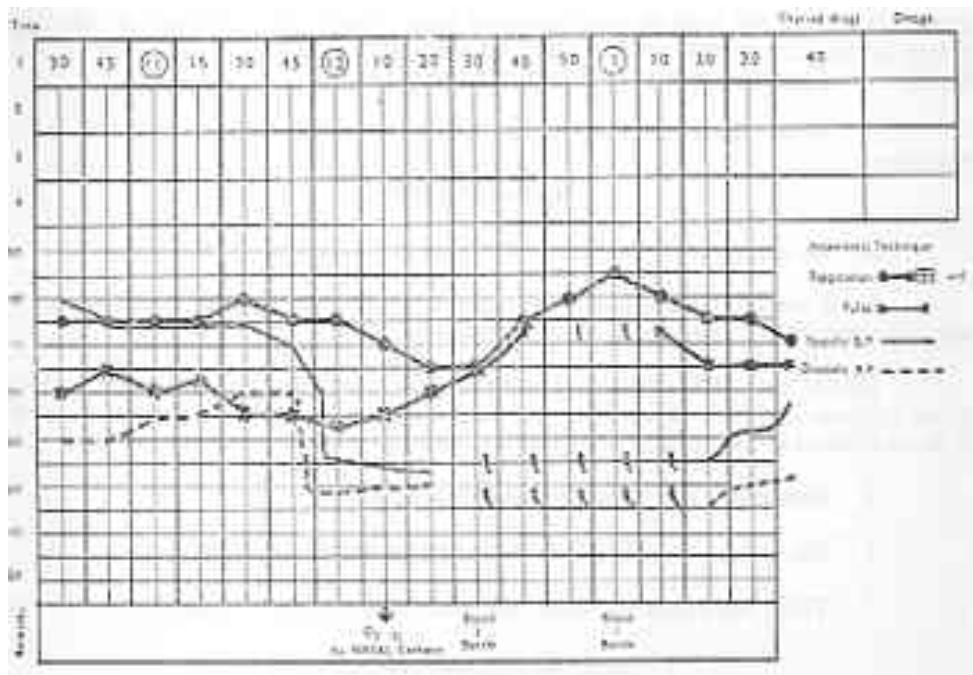
Midsternal infiltration—15 cc x 1% ... 75 mg.

Total dose of procaine hydrochloride: ... 1425 mg.

Anaesthesia started:—9.40 a.m.

Operation started:— 11.5 a.m.

Operation finished:—12.50 p.m.



Complications

A number of complications noted by other authors have been reported in the literature, but we were fortunate enough to get away with only a few of them.

1. Accidental injection of drug in the S/Arachnoid space—none in our cases. Repeated careful aspiration during injection and carefully selected anatomical landmarks help one in avoiding this complication.

2. Novocaine poisoning—as shown by the injection of novocaine in the vein and causing convulsions—none in our series.

3. Injury to pleura—not noticeable, but it is not serious.

4. Injury to diaphragm—none noted.

5. Accidental penetration of needle into the splenic vein after piercing diaphragm in left sided thoracoplasty. This complication has been mentioned in literature in one case and in that case splenectomy was needed because of tear of vein and haemorrhage—none in our series.

6. Post-operative retention of urine—seen in a few cases who were given spinal, but of no significance with regional analgesia by paravertebral block.

7. Paralytic ileus—one patient developed it and he was treated with morphia.

8. Spasm of the vessels of the arm—one of the patients complained of pain and weakness of the arm on the operated side. There was no pulse in the radial artery for about a month in that case and there was cyanosis of the limb. Stellate Block was done twice in that case and pulse returned.

9. Wrist drop—in two cases. Cock up splint given and the patients recovered.

CONCLUSION

1. An analysis of 400 cases of thoracoplasty is presented.

2. A method anaesthesia is presented which fulfills all the requirements considered essential for anaesthesia in thoracoplasty.

Efforts have been made to prove that in a properly prepared case a correctly given regional analgesia is ideal for thoracoplasty particularly in our country where it is so difficult to get trained anaesthetists and the number of patients is so great.

3. Bleeding is less under regional anaesthesia.

4. No special complications in this series were noticeable.

5. There were only 4 deaths, but none attributable to anaesthesia as such.

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Cor Pulmonale in Pulmonary Tuberculosis

A preliminary report on 66 patients

BY

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Till recently pulmonary tuberculosis had not been regarded as an important cause of Cor pulmonale. Most of us had not seen more than one or two cases of pulmonary tuberculosis die of right heart failure. During the last five or six years, however, we have seen this complication occur more and more frequently in tuberculosis patients and in this Institution, we have seen it often enough to sit up and take notice.

MATERIAL AND METHODS

The definition of Cor Pulmonale not being fully agreed upon, it would probably be best to make our criteria of diagnosing this condition clear. We have stuck to White's original definition, except that congestive heart failure has not been considered an essential component of "the picture, in view of more modern views. We are not in agreement with the school that considers every case of pulmonary hypertension as Cor Pulmonale, be it due to left sided heart diseases even (Brill, 1958). Our main bases of diagnosis have been, (i) no evidence of other heart disease, (ii) definite right heart failure or (iii) at least two of the *common clinical features* and/or (iv) unequivocal electrocardiographic evidence. No patient has been diagnosed as having Cor Pulmonale on just one finding, unless unequivocal.

The cases reviewed in this report have all been discovered in the routine course of observation, and are not the result of a deliberate survey. Our usual case, apart from the grossly evident ones, has been found during a somewhat perfunctory examination of the heart or during an electrocardiographic examination for some other suspicion, and as such, this report in no way deals with the incidence of this condition.

All cases reported had a thorough clinical, radiological and electrocardiographic examination, the two former being in serial in most cases. Most of these cases were discovered during the last year and a half and, excluding the deaths, the period of observation has ranged between one month and four years, averaging a little less than one year.

OBSERVATIONS

The findings are recorded in Tables 1 to 8.

TABLE 1

Age Incidence

<i>Age Group</i>	<i>Male</i>	<i>Female</i>	<i>Total</i>
Below 10 years	1	1	2
11 to 20 „	4	7	11
21 to 30 „	15	16	31
31 to 40 „	6	1	7
41 to 50 „	8	1	9
Over 50 years	5	1	6
Total...	39	27	66

Of a total of 66 patients, men numbered 39 and women 27, the largest incidence in either being between the ages of 21 and 30 years. Among women, 22 of the 27 were between 16 and 30 years, whereas, in men, the higher age groups also contributed a fair proportion of cases. Our youngest patient was a girl 6 years old, and our oldest, a man of 66.

TABLE II
Duration of Lung Disease

<i>Duration</i>	<i>Number</i>
Less than 1 year	10
1 to 2 years.	21
2 to 3 „	11
3 to 4	9
4 to 5 „	5
More than 5 years	10
Range: —	6 months to 28 years.

The total known duration of disease before the diagnosis of Cor Pulmonale again shows extremes of 6 months and 28 years. As is seen in Table II the largest number of cases, about 30% had suffered from more than one, and less than two years.

TABLE III

<i>(a) Extent of lung disease</i>			
Red. Involvement less than 1 lobe (Total area) ...			24
„ „ more than 1 lobe and less than one lung field ...			27
„ „ more than one lung field ...			15
<i>(b) Type of disease</i>			
Giant Cavities ...	...	...	21
Diffuse Fibrosis ...	...	...	24

Radiological involvement (Table III) of more than one lung field was present in less than one-fourth of the cases, giant cavities and/or diffuse, discrete

fibrosis having each been present in roughly one-third of the cases. The majority of the patients showed a total lung involvement less than one lung field in area.

TABLE IV

Other Clinical Features

Dyspnoea	39 cases
Palpitations	21 ..
Rhonchi	17 ..
Prolonged exp. and other evidence of Bronchospasm	36 ..
Clubbing	13 ..
Cyanosis	14 ..
No symptoms	21 ..

Symptoms suggestive of heart involvement were absent in 21 of the patients, (see Table IV) and suggestive clinical signs were present in 10 of them. The most constant physical sign leading to consideration of Cor Pulmonale in these patients

TABLE V

Heart Findings

<i>(a) Clinical</i>		
Failure	16	Cases
Parasternal Pulsation	34	..
Loud P ₂ (with or without pathological split)	50	..
Diastolic Murmur	6	..
Systolic Murmur	13	..
Poor Heart Sounds etc.	10	..
No. findings	10	..
Loud A ₂	1	..
Pericardial fluid	2	..
<i>(A) Radiological</i>		
Enl. of P. A.	35	..
Enl. Heart shadow or only R. V. enlargement	21	..

was a loud pulmonary second sound, seen in 50 patients, about thirty of them showing a pathological splitting. Parasternal heave was fairly common, occurring in about half of the cases, but was not so well developed in all of them. Radiological

appearances were of least help. Although 35 of the cases are shown as having enlarged pulmonary artery shadows, in over half of them, this conclusion was arrived at on examination of serial skiagrams after the diagnosis of Cor Pulmonale and was too minor to have been noticed unless specifically looked for. Even a biased observer might have missed it in a single film. The same is true of enlargements of the cardiac silhouette. (see Table V).

The electrocardiogram was the best diagnostic help. All the cases gave electrocardiographic evidence suggestive of Cor Pulmonale.

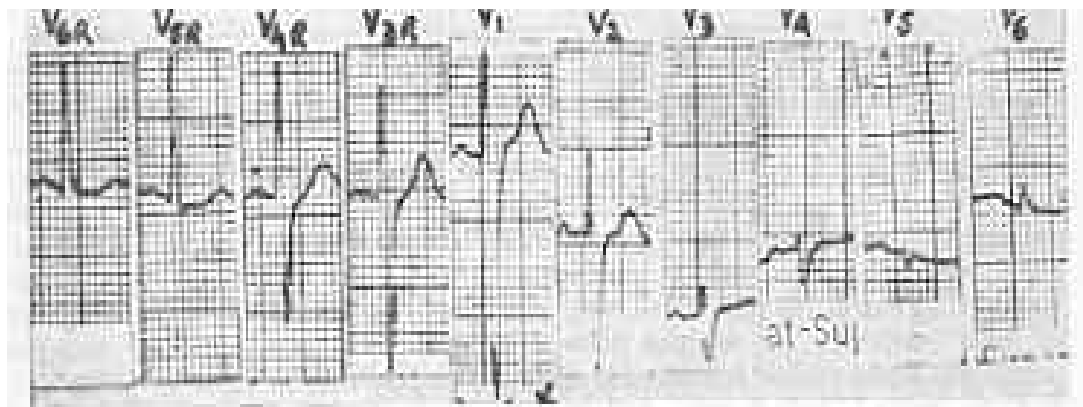
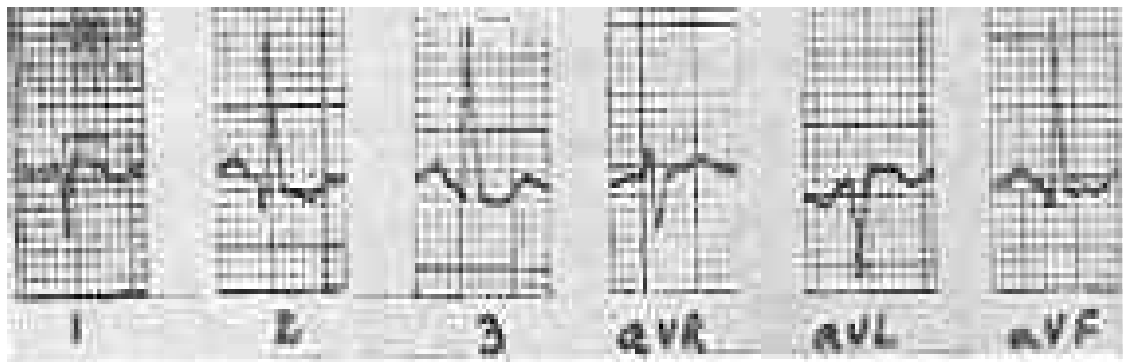
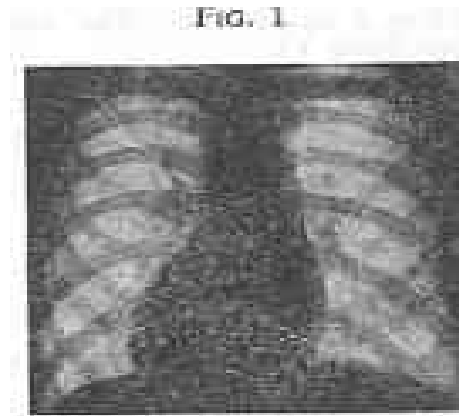
TABLE VI
Electro Cartographic Findings

P Pulmonale	...	64	Casec
in limb leads only	...	18	„
in chest leads only	...	6	„
in both	...	40	„
Right vent. Hypertrophy	...	39	„
R. Bundle Branch Block	...	11	„
Negative T in more than 2 leads	...	26	„
Very high T in chest leads	...	5	„
Extra systoles	...	6	„
Poor voltage	...	8	„
Dextrocardia	...	1	„
Total cases examined	...	66	„

Pulmonale was present in 64 of the 66 cases (97%), Right Ventricular Hypertrophy (R. V. H) of various grades in 39 cases, and Right Bundle Branch Block (RBBB) in 11. Negative T waves in 2 leads or more were seen in 26 cases, and extraordinarily high, symmetrical, T waves in 5 cases. Generalised poor voltage was seen in 8 cases of whom 2 did not show any evidence of failure. We have one case of Cor Pulmonale in a true dextrocardiac. This patient had a left pleural effusion three years ago, with a small parenchymal focus in the left upper zone. Recently, on one of his routine followup visits, he complained of slight dyspnoea on brisk walking. Examination showed a moderately accentuated P_g and the pulmonary artery shadow is somewhat more pronounced than in previous skiagrams. E. C. G. shows a high R wave and a spiky P in V_2 (the equivalent of V_4 in a levocardiac), both evidences of R.V.H. (Fig. 1).

TABLE VII
Causes of Death

Congestive Heart Failure	...	11
Tuberculosis	..	4
Other causes	...	3
(Diabetic Coma 1, B. F. fistula 1, after Monaldi 1)		



Legend to Fig. 1.—Case of dextrocardia with Cor Pulmonale. Note slight exaggeration of Pulmonary artery shadow, and P Pulmonale and high R waves in V_5 .

18 of our patients died, 11 in failure, 4 as a result of the primary affection, the cardiac condition not being considered contributory, and three of various other immediate causes. One of these latter died in diabetic acidosis, one as a result of bronchopleural fistula following right pneumonectomy, and the third within a few hours after the institution of a Monaldi drainage for a giant cavity. We had the opportunity of an autopsy in one of our failure cases. This patient had a fairly extensive disease in both upper and mid-zones and Cor Pulmonale had been diagnosed before the onset of failure on the basis of unequivocal signs of R.V.H. i. e. a loud and split P₂ and a parasternal heave. E. C. G. showed very low voltages in all leads, P pulmonale in multiple leads and RBBB with negative T waves in V₁ to V₄. Within a few days he showed a rapidly developing C. H. F., which ended up in full, non pulsatile neck, veins, impalpable cardiac pulsation and poorly heard heart sounds. Two days later he died, total duration of life after failure came on being about 10 days. Mersalyl was exhibited, but to no effect. On autopsy, a large amount of clear, almost colourless, fluid, transudate in nature, was found in the pericardial sac; the heart weighed 365 Gms., pulmonary artery was dilated, being wider than the Aorta, and the right atrium showed moderate hypertrophy. (Fig. 2)

Treatment given for failure has been indicated in Table 8.

TABLE VIII

Therapy in Failure Cases

<i>Treatment</i>	<i>No. treated</i>	<i>Improvement in</i>
Mercurials	2	Nil
Digoxin	1	Nil
Aminophylline with Digoxin	7	Nil
Aminophylline and penicillin	1	1
Digoxin with Pen.	1	1
Dig., Aminoph. and Pen.	4	4

Wherever digoxin given, mercurials and/or Diamox also given.

As can be seen, Penicillin was the common factor among the cases that showed improvement in failure, although, out of these six cases, two died later, one as a result of a Monaldi drainage and the other in a recurrence of C. H. F. once Penicillin had been stopped. One of our patients came out of failure, and is still alive after ten months, with no recurrence, after treatment with Penicillin and aminophylline alone.

DISCUSSION

In the standard text books the aetiological factors in Cor Pulmonale have been listed, in the standard text books, as Chronic Bronchitis with Emphysema, Primary Pulmonary Hypertension, Pneumoconiosis, Bronchial Asthma with

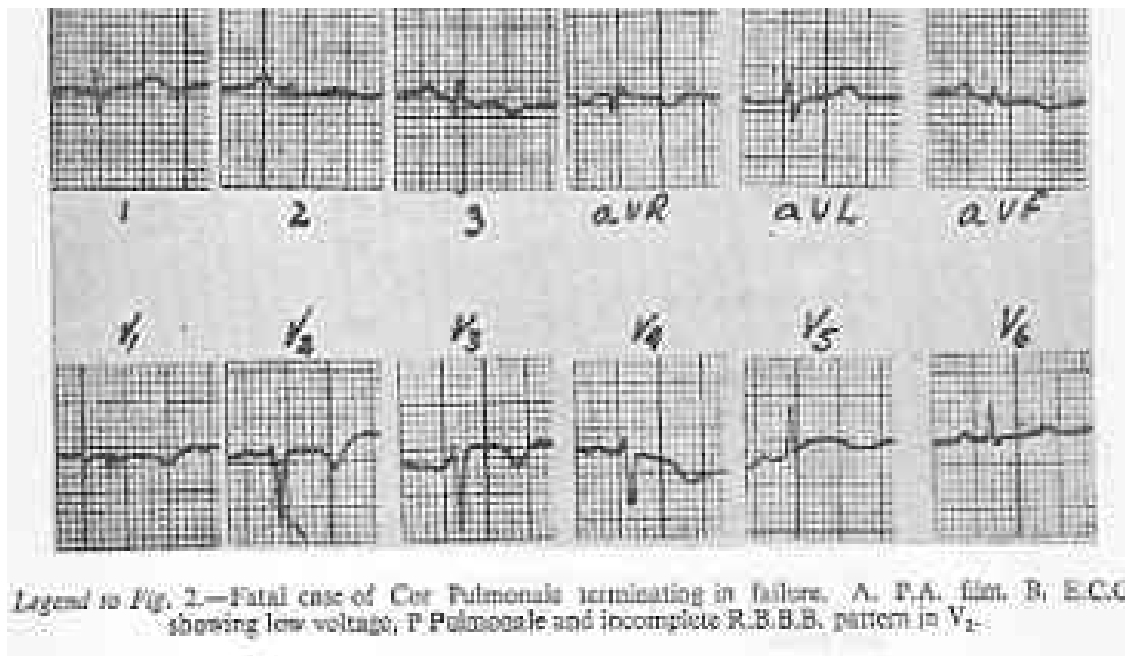
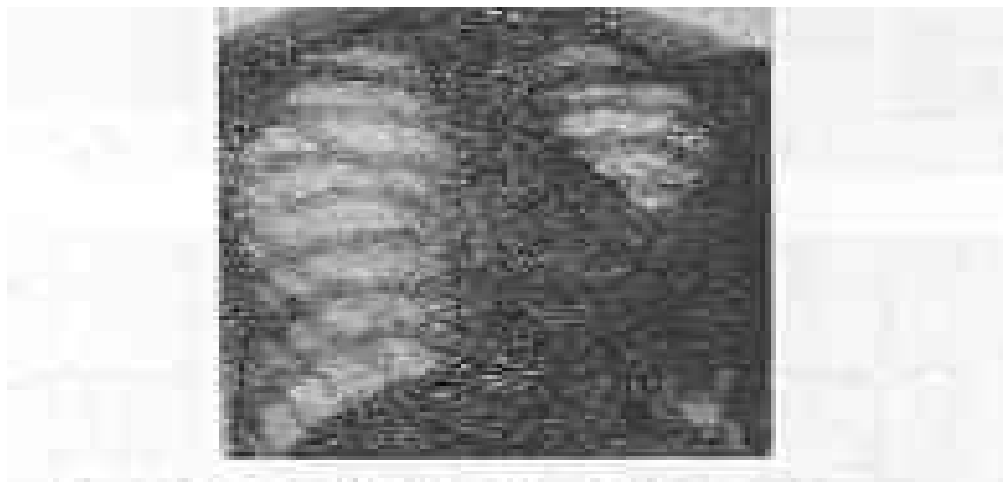
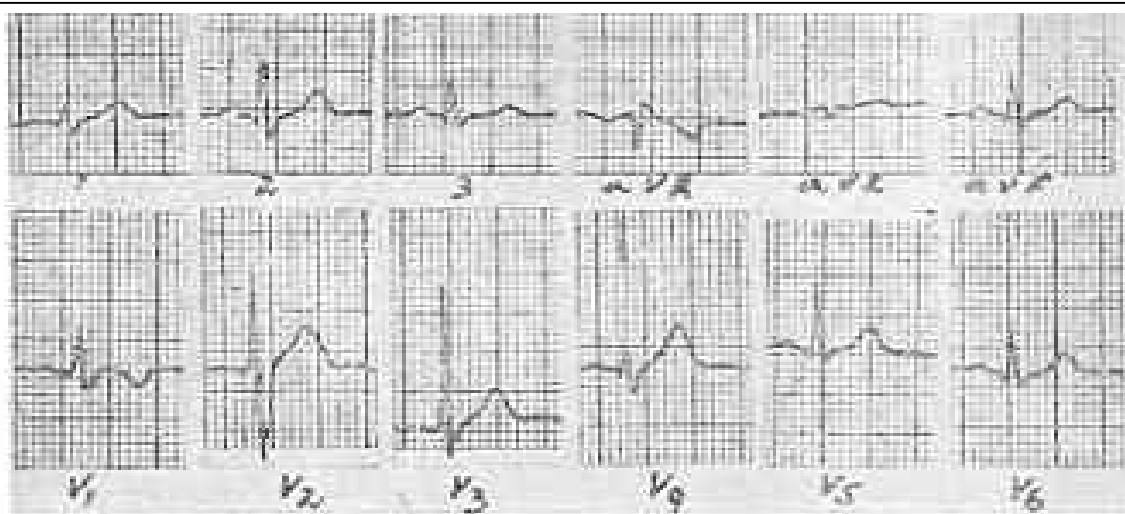
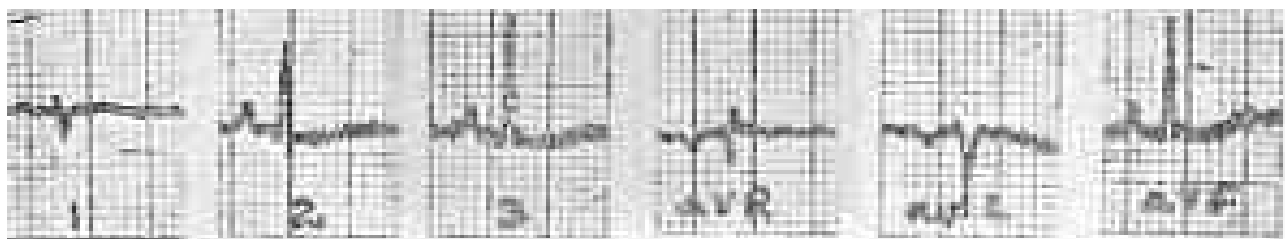
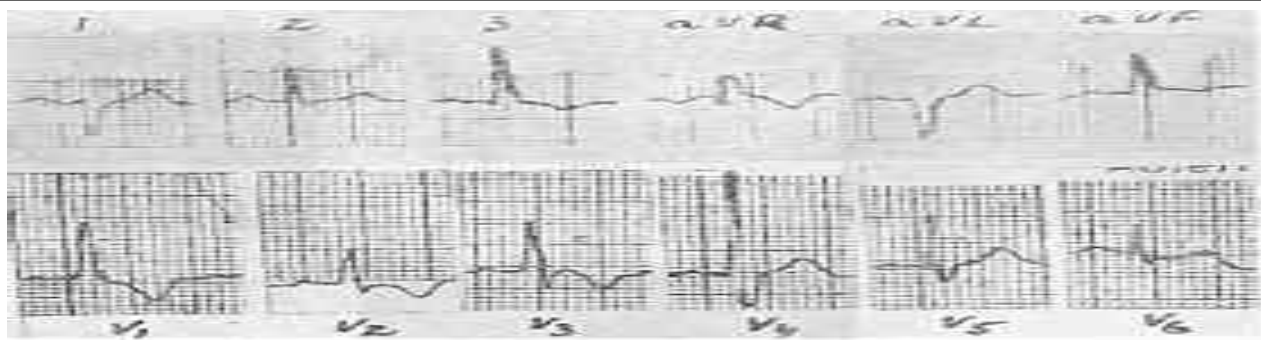
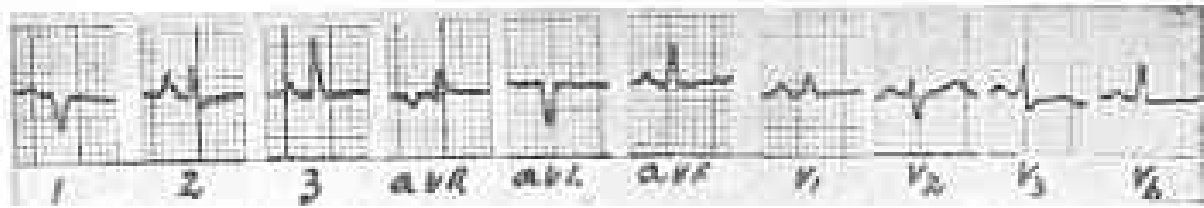


FIG. 3



Legend to Fig. 2.—P.A. films of 3 different cases, showing: A. apart from giant cavity, scattered fibrosis; B. giant cavity, emphysema on contra-lateral side. Diffuse nodular and linear cavities seen in skiagram have not come out in photo; C. Diffuse fibrosis and moderate enlargement of pulmonary artery segment.

FIG. 4



Legend to Fig. 6.—T.C.G.s of 4 patients showing: A, low voltage, P pulmonale, R.V.H.; B, marked R.V.H. with negative T wave; C, P pulmonale and D, R.V.H. (this patient was discovered due to a radiological enlargement of the right heart border, no clinical signs).

FIG. 5

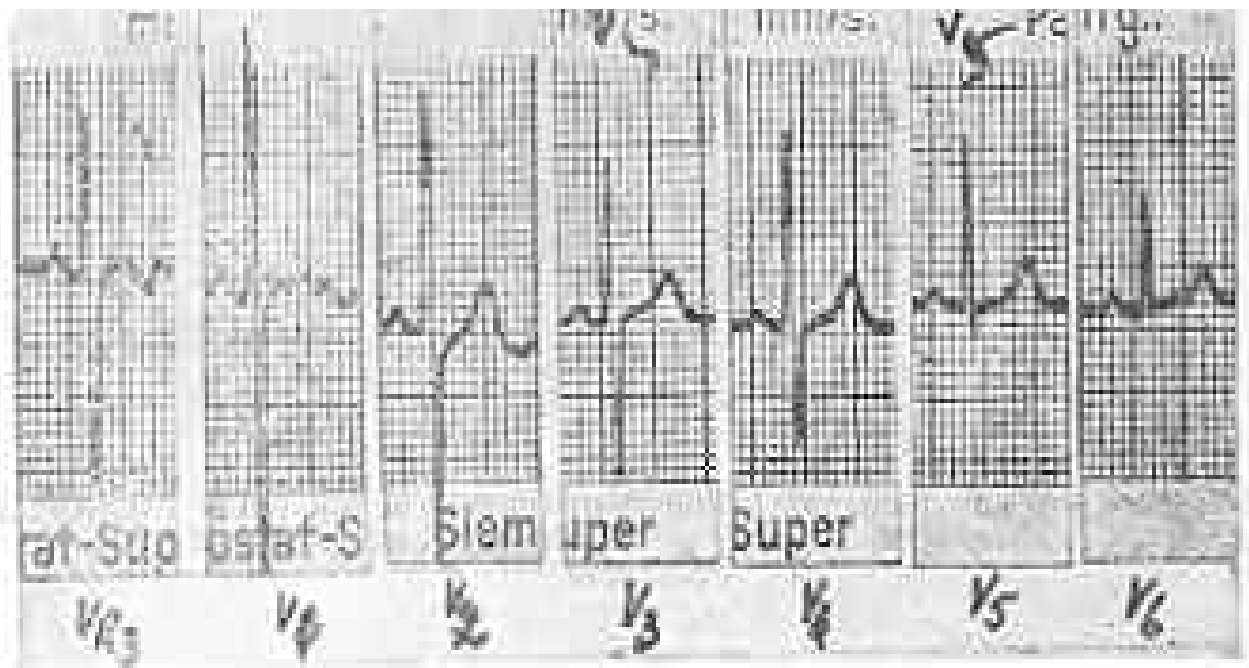
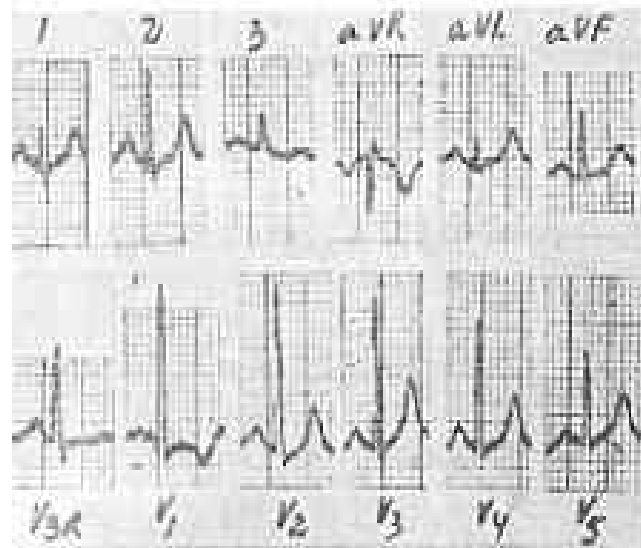
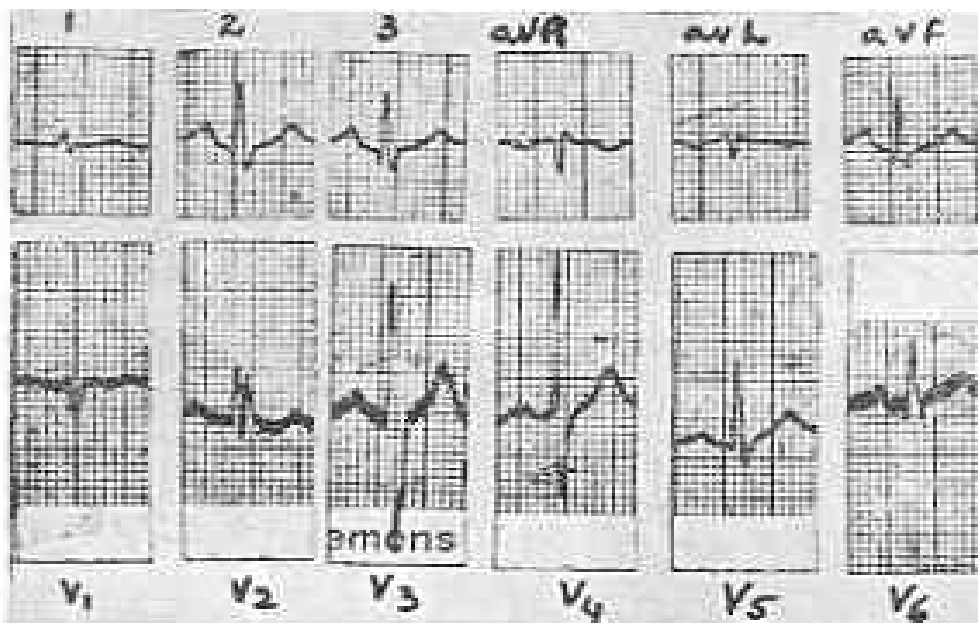
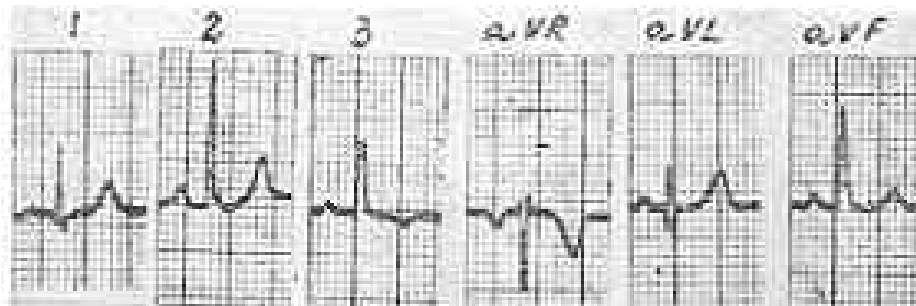
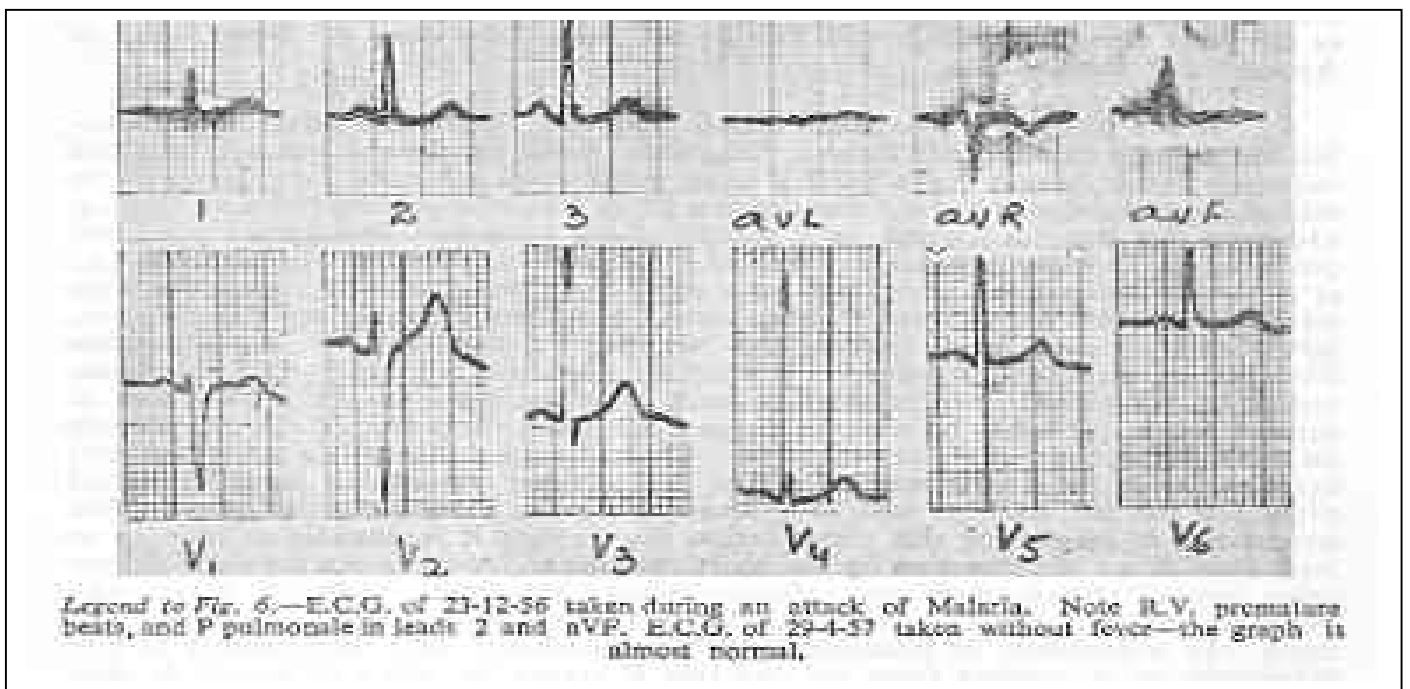
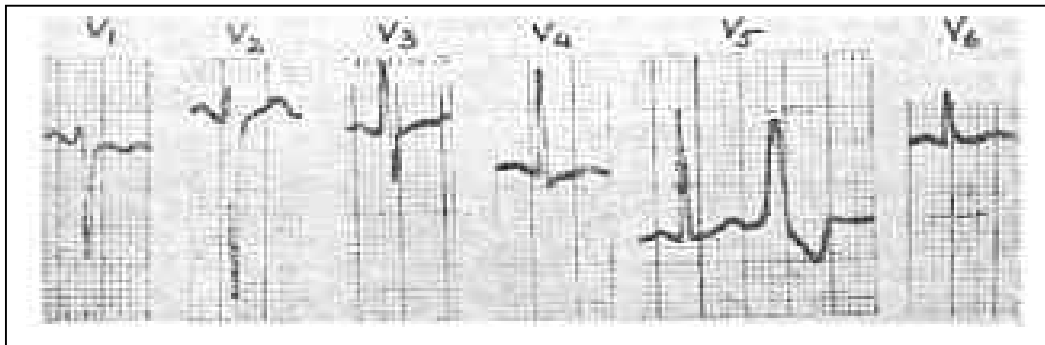
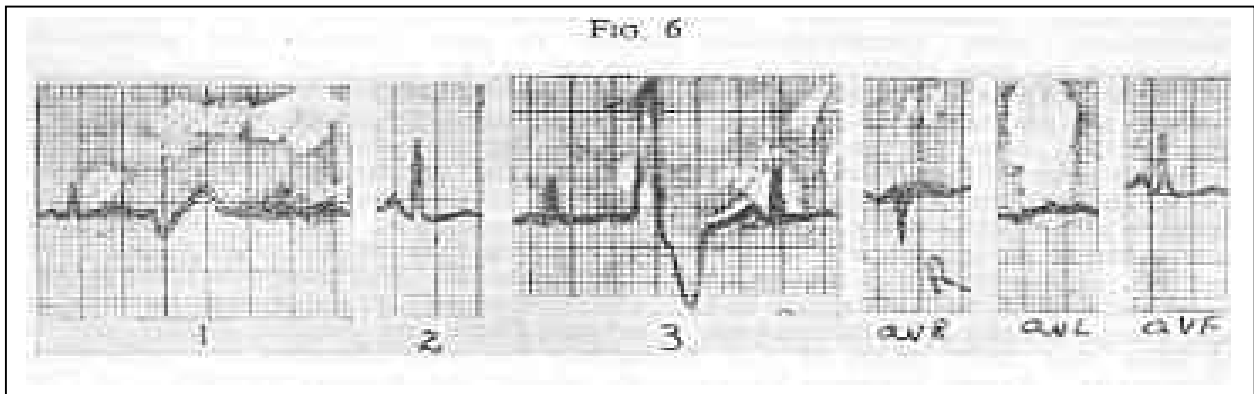


FIG. 5 (continued)



Legend to Fig. 5.—A. & B. E.C.G.s of 2 children, both showing R.V.H. and P Pulmonale, both well seen in V₁R. C. Man of 60, E.C.G. for a ?? myocardial infarction, shows R.R.B.R. in V₁ and P pulmonale.



Emphysema, Emphysema due to other causes, conditions like Sarcoidosis diffuse carcinomatosis, Hamman—Rich syndrome, Honey-comb lung, and Pulmonary Tuberculosis, after thoracoplasties, etc. It is only recently that pulmonary tuberculosis has been mentioned in the literature as an important cause, although even in 1946, Spain and Handler had reported a series of 60 cases of Cor Pulmonale in which the majority had tuberculosis as the primary pathology. Walzar and Frost (1954), reporting an autopsy series, considered tuberculosis as the most important cause of Cor Pulmonale, having contributed no less than 60% of their cases. Their material, of course, was biased in that tuberculous individuals formed a disproportionately large number of their autopsies, but significance must be attached to the incidence of 51 % Cor Pulmonale in tuberculous patients autopsied by them. Impressive again are the figures of Kozlowski and Maldyke (1955) who found histological cardiac damage in 81 % and full-fledged Cor Pulmonale in 10% of their autopsies among the tuberculous. Corbetta, Pozzi, and Scoccia (1955) are of the view that early stages of Cor Pulmonale are very common in pulmonary tuberculosis. Recent literature has variously placed the autopsy incidence of Cor Pulmonale at 4 to 40% in pulmonary tuberculosis cases. Our own material has only been found at the bedsides, and that too, not while looking for it. As this was not a survey it would be useless to compare our figures with the others but one point is clear, i.e. Cor Pulmonale exists in our patients of pulmonary tuberculosis, and may even be said to be fairly common.

Regarding diagnosis, our experience is similar to that of Walzer and Frost, and of Corbetta, *et al. i. e.*, Cor Pulmonale is not easily diagnosed clinically. As is evident from table V, accentuated P_2 was the most common clinical finding, but the one greatest help to diagnosis in our series was the E. C. G. Our E.C.G. figures are fairly close to those of Paul Wood (1956), who found P pulmonale in 85% of his cases to our 97% and R.V.H. in 35% to our 65%. The higher incidence of positive electrocardiographic findings in our series is probably due to the fact that ours is a purely clinical series. Our cases have shown P pulmonale as the most constant finding, and this agrees with the views of Wood, and of Appezeller & Benz (1956).

It can be regarded as fairly certain that Cor Pulmonale exists as a complication in tuberculous individuals. Diagnosis based on clinical examination and radiology is not always easy, and a large proportion of cases are likely to be missed. As mentioned above, accentuation of P_2 was our principal clinical finding, and even this was not present in a quarter of the patients. Parasternal pulsation, probably the most reliable, sign of R.V.H., was seen only in half the patients, i.e., at least half the patients could not have been diagnosed clinically, especially when we remember that accentuated P_2 may mean, apart from pulmonary hypertension, just a shift of the heart nearer the anterior chest wall, or an idiopathic dilatation of the pulmonary artery. It must be emphasised that early Cor Pulmonale cannot be diagnosed or eliminated without having recourse to the E.C.G., and as such, it would probably be wise to subject all cases suspected of Cor Pulmonale on clinical grounds to this investigation. Clinical suspicion depends upon a careful examination of the cardiovascular system in all our tubercular cases, repeated every few months, patients with long standing disease being naturally suspect. The importance of diagnosing this complication lies in that it is possible to halt, or at least slow down deterioration in the heart condition. As seen among our failure cases, control of secondary lung infection is most important, and this alone may suffice in the management of these patients. The literature is unanimous in emphasising the importance of infection in the pathogenesis and development of Cor Pulmonale, as is evident from the fact that it occurs far more frequently in emphysema following chronic bronchitis than in one resulting from bronchial asthma. Our experience with non-tuberculous patients is also in agreement. In patients

with a compensated Cor Pulmonale, a minor attack of acute bronchitis may be full of danger and should be treated vigorously with appropriate chemotherapy.

According to Richards and Fishman (1956), the important factors in the pathogenesis of Cor Pulmonale are:—

- (i) decrease in parenchymal elasticity due to chronic inflammatory process, leading to impaired gas exchange, and also, interference with the normal rhythmic changes in pulmonary vascular capacity and pressure secondary to changes in intrathoracic pressure;
- (ii) a restriction of the pulmonary vascular bed in its cross-section, total extent, and distensibility;
- (iii) obstruction to air flow through bronchospasm, exudates, etc.

All these cause hypoxia and hypercapnia, which lead to increased cardiac output. The already less distensible pulmonary vasculature cannot cope with the increased cardiac output, resulting in pulmonary hypertension. Infections increase the demand for oxygen and further impair the alveolar gas exchange by exudates and bronchiolar obstruction, so accentuating this mechanism.

In our series, diffuse, discrete fibrosis, in otherwise normal looking lungs has been found radiologically in about one-third of all cases, and prolonged expiration over large areas (as an evidence of bronchostenosis) has been seen in just over half. Fall in 3 second vital capacity has been seen in a large proportion of our surgical cases whose respiratory functions were tested, and was present in several showing Cor Pulmonale, but there have been few cases showing poor arterial oxygen saturation (Jain, 1957). It is agreed by almost everybody that radiologically clear areas of the lungs in patients of pulmonary tuberculosis frequently harbour small, scattered, tubercular lesions, not large enough to cast their shadows. Could it be that these small foci of disease are responsible for widespread pulmonary vascular sclerosis of a sufficient degree to raise significantly the pulmonary vascular pressure? The explanation is tempting enough if we forget that there appears to have been a real increase in the incidence of Cor Pulmonale in tuberculous individuals. It may be considered fairly obvious that chemotherapy and the consequent prolongation of life in these patients have some influence in this matter. How they act, is difficult to say. The very fact of longer life may allow the right heart to hypertrophy, against a mild to moderate, long continued, strain of pulmonary hypertension. Another explanation, or part of it, may be that our present-day chemotherapy causes fibrosis, hyalinisation and vascular sclerosis to develop in diseased areas, the small, discrete but widespread lesions being important in this respect. Would the administration of steroids along with chemotherapy help to avoid this?

Can it be that tuberculosis *per se* had nothing to do with the developments of Cor Pulmonale, and it was only a concurrent emphysema that led to it? This series provides no complete answer to this. The fact that evidence of bronchospasm was present in only half the patients, as also that other usual clinical features of emphysema were absent in the majority, tend to go against this possibility. Also, only 8 of our patients showed generalised poor voltage in E. C. G. (table VI) to Woods' 40% (in a series based mostly on emphysematous patients) and heart sounds were poor in only 10 of our cases, whereas they are found to be so in almost all emphysematous subjects. Similarly, our age incidence, especially when broken up according to sex, is more in conformity with that of tuberculosis than of emphysema. We are hard put to think of an adequate

explanation for the figures relating to duration of pulmonary disease before diagnosis of Cor Pulmonale. These roughly approximate with the average duration of illness in patients admitted to our hospital, which may signify nothing more than coincidence.

SUMMARY

66 cases of clinically diagnosed Cor Pulmonale in patients of pulmonary tuberculosis have been reviewed. The importance of electrocardiographic examination has been stressed. The possible reasons for an increase in the incidence of Cor Pulmonale in pulmonary tuberculosis have been discussed.

The importance of control of secondary lung infection in compensated cases has been stressed, and the possibility of slowing down, or stopping, deterioration has been emphasised.

Acknowledgements

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Respiratory Function in Cases of Chronic Pulmonary Tuberculosis

(Study of about 8,000 cases)

By

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This article gives the results of inquiries about a series of 8,147 patients studied with the method of Knipping-Scoz-Di Maria.

Respiratory function studies in the Institute "Carlo Forlanini" Rome, the school of Omodei-Zorini follows a method based on the measurement of ventilation and oxygen consumption atmospheres of different oxygen concentration controlled by the determination of oxygen in arterial blood.

This method is the effect of the development and the perfection of that, which has been started in the school of Omodei-Zorini in 1939 by Giuseppe Scoz, basing on works of Knipping, which consisted of controlling the respiratory function of a patient by making him breathe in an atmosphere of a normal O₂-concentration and after this, in one with a higher and finally in one with a diminished O₂-concentration (15%). This latter method should be able to substitute the test during the work of Knipping's method.

Later on (after 1949) we argued that an inquiry of the respiratory function in order to be able to satisfy the need of clinical practice, must be in a position to satisfy the following three requirements.

1. It must be able to state, whether there is a respiratory insufficiency or not. Moreover the method must give the possibility to certify, whether the mechanism of introduction, absorption and distribution of oxygen from outside to the tissues (and that of CO₂, in the reverse direction) is working normally.

2. In case of a respiratory insufficiency the method must enable to value and verify, whether the functional damage is depending on troubles of the ventilation, permeability, hematic perfusion or whether there are several factors acting together.

3. The above mentioned method must finally permit, if it is possible, to value the extent of the deficit, the possibility of its compensation and the functional reserves by which the organism could face it.

After this, we considered further necessary the introduction of the determination of the arterial oxymetry in the spirometric method used by Knipping and Scoz. This would permit to extend the investigations beyond the alveolar barrier and therefore to value the degree of the damage, to control the spirographic method and to state the pathogenesis of the observed eventual deficit.

We are working with the test of respiration in an atmosphere of 15% O₂ as proposed by Scoz, but we are not convinced, that this would be able to substitute completely the respiration in an oxygen-poor atmosphere, whose results as is our opinion, cannot be compared with the functional results in a test during work. The reasons are the following:

1. During the respiration in 15% O₂ we will have an alveolar pO₂, which is still sufficient to assure a certain gradient of alveolar pressure, a fact, which could hide eventual respiratory insufficiency.

2. During the work we have a production of CO₂, which influences both the ventilation and the dissociation curve of haemoglobin.

3. During the work a faster circulatory activity is developed than during the simple respiration in an atmosphere of 15% O₂. This circulatory activity can, there is no doubt, be an element of compensation, which has to be valued adequately.

That method shown by us is that presently used at the Institute Forlanini and consists in the following phases:

1. Test for the volumetric inquiry and for the valuation of the thoraco-pneumonic dynamics:

Determination of the V. C. and its components.

Determination of the Maximal Ventilation.

Determination of the Index of Tiffenau.

2. Tests for the inquiry on the condition of haematosi:

Arterial oxymetry (with prick of the femoral artery) during the respiration in an atmosphere of 21% O₂.

Determination of consumption of O₂ and ventilation during the respiration in an atmosphere of 21% O₂ during 4 minutes.

Determination of consumption of O_a and ventilation during the respiration in an atmosphere of 15% O₂ during 4 minutes.

Determination of consumption of O₂ and ventilation in an atmosphere of 50% O₂ for 4 minutes with puncture of the femoral artery in the 3rd minute of the test.

Valuation of the relation: ventilation m/O₂ m, (equivalent of ventilation) out of the results in the test during respiration in an atmosphere of 21% and 15% O₂.

During the work

(the test during work begins three minutes before the spirometry and is detained during that latter).

(a) respiration in atmosphere of 21% O₂ (3 min.).

(b) respiration in atmosphere of 15% O₂ (3 min. with control of arterial oxymetry).

- (c) respiration in atmosphere of 50% O₂ (3 min.).
- (d) valuation of the equivalent of ventilation with the results found in the test of respiration in 21 % and 15 %.

Subjects for which during this method the consumption of O₂ and the ventilation remain nearly equal differences up to 10% are not to be considered) in the three different atmospheres belong to the group of *normal* or *sub-normal individuals*.

As individuals with an *compensated insufficiency* have been considered those, which ventilation only, or as well ventilation as the consumption of O₂ in an atmosphere of 15% increased for more than 10% and those individuals which showed an increase of the ventilation in 21 % O₂ which was superior to that in a respiration in 50% O₂. Finally those have been considered as evidently insufficient with decompensation, which showed a diminution of the consumption of O₂ of more than 15 % during the test in rest in an atmosphere of 15 % O₂—as latent decompensated those in which the phenomenon appeared during work.

The proportions of the rate of saturation of the arterial O₂ in the different atmospheres confirmed the deficit, indicated its entity and helped to interpret its pathogenetics.

By the help of these methods more than 8,000 cases with chronic tuberculosis of the lungs have been examined. The results are the following:

Respiratory Function in Cases of Chronic Cavitory Tuberculosis of the Lungs Determined by the Method of Knipping-Scoz-Di Maria in 8,47 Clinical Cases

In the first Table we show the total results of tests done in the period from 1946-1956 (June). Part of them gives only the results of the test during rest (ca 2,000) another the results of the test during work (ca 1,000) and the remainders are those, which were done as well in rest as in work. They represent the dates we obtained while the method was going to be perfected.

TABLE I

	during rest	during work
Normal ...	31.4%	6.1%
Sub-normal ...	14.5%	8.2%
Discreet insufficiency, compensated	38.1%	44.2%
Insufficiency not compensated	15.8%	41.3%
Total ...	99.8%	99.8%

After having examined the dates we found in the test during rest a remarkable number of cases remaining in the limits of normality (46%).

The other part (54%) contains the patients suffering of respiratory insufficiency already during rest, but nearly all with signs of compensation.

The trial during work shows, however, a latent deficiency not being found
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during rest. In fact this test reveals another relation between the dates for the different groups:

The number of normal and sub-normal subjects is diminished from 46% to 14%, while that of the insufficients is increasing from 54% to 86%.

The greatest significance have therefore the datas we got testing about 4,000 patients during rest and work as we illustrated before.

TABLE 2

Normal during rest and work	498 = 12.1%
Normal during rest, insufficient during work	686 - 16.6%
Insufficient but compensated during rest, uncompensated during work	1,091 = 26.5%
Insufficient during rest, no aggravation during work	1,436 - 34.9%
Insufficient during rest, improvement during work	399 = 9.7%
Total ...	4,120 = 99.8%

These data show that the percentage of patients which have slight symptoms of insufficiency during rest which aggravate during work (26.5%) is higher than that of patients normal during rest and slightly insufficient during work (16.6%).

The highest percentage belongs always to the group of patients with symptoms of insufficiency during rest which do not aggravate during work (35%).

These individuals seem to have the possibility to adjust themselves to the lowest consumption of O₂ they need during muscular activity.

A small number of cases (10%) although showing signs of insufficiency during rest, improves more or less sensible during work. This seems to be a contersense, but found its explication in the interpretation of this phenomenon by Provenzale as we mentioned above.

It is caused without doubt by a transitory improvement due to greater absorption of oxygen in consequence of the increased ventilation of the lungs and by a more adequate correspondence with distribution of the partial-pressure of gas in the alveoli. Therefore exists the possibility of a maximal absorption of O₄ during the phase of the maximal ventilation.

We are faced with a phenomenon of a possibility for compensation by the organism as it is shown by the increasing saturation of the arterial blood with O₂ during this phase.

To complete this inquiry about the respiratory function in cases of chronic cavitary tuberculosis of the lungs we add the data got in 1,174 determinations of arterial oxymetry. The deduction was done at the A. femoralis.

The determination showed the following results (during rest with respiration in a normal atmosphere):

Normal	...	...	...	50.54% (saturation between 97 and 92%)
Dissaturation: slight	...	...	...	19.32% („ „ 92 „ 88%)
remarkable				20.20% („ „ 88 and less)
During work and respiration in an atmosphere of 15% O ₂ :				
Normal	...	...	...	32.20%
Dissaturation: slight	...	...	...	40.30%
remarkable				28.40%

The disturbance* of the respiratory function in cases of tuberculosis of the lungs is produced by different causes created by the illness itself. As the most important we have to judge the hypoventilation which has its origin in the pleuroparietal and broncho-bronchiolar alterations and their influence towards the dependent parts of the lungs.

Another cause: the deficit by increase of the “dead space” due to the lesions by caverns or by an emphysematic state—than the deficit due to effective lack of active parenchyma in extended and destructive forms and finally that deficit due to cardio-circulatory trouble.

Following these experiences we have to infer that those individuals whose deficits of the oxyhaemoglobin saturation were eliminated or positively influenced during the respiration in oxygen have a better prognosis than those which did not show any modification of the percentage of arterial oxygen.

SUMMARY

This gives the results of an inquiry of the respiratory function in more than 8,000 patients with chronic tuberculosis of the lungs. In a high number of the cases was found a respiratory deficiency which nearly always depended on a hypoventilation. Very often this deficiency could not be compensated.

The A. A. describe the method which was adopted for the inquiry: comparison of the ventilation and the consumption of oxygen in atmospheres with different concentrations of O₂ (21 %, 50%, 15 %) during work and rest combined with arterial oxymetric controls.

The A. judges this method as reliable and particularly useful for patients which cannot stand fatiguing tests of work.

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ABSTRACTS

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An evaluation of Tuberculosis Case finding by Tuberculin testing and some observation of Histoplasma sensitivity among young school children

Observation of tuberculin and histoplasmin test done yearly on Kindergarten children in Kansas city for the past ten years along with conversion rates for the two antigens for both the White and Negro races are reviewed.

It was observed that neither the tuberculin prevalence rate nor the conversion rate to tuberculin in the non-reactors showed any tendency to fall to the ten years of observation either in the Whites or Negroes.

Tuberculin Test of contacts children gives better results than by mass roentgenotherapy and also decreases the total exposure of a population to ionizing radiation. The cost of finding a case of tuberculosis by this method is approximately the same as for the mass roentgenographic method.

(Wood E. Lawrance; Furcotow L. Michael and Wittis J. Myron: *Amer. Rev. T. B. Vol. 78, No. 5, November, 1958.*)

Report on Edinburgh X-ray Campaign 1958

It was possible to have chest x-ray of 84.4 percent of the population. 423 new patients with active pulmonary tuberculosis were detected, the incidence in males being 2.17 and in females 1.01 per cent and highest in males over 60 years being 3.30, though the incidence of Carcinoma is also high in elderly males being 2.34. The importance of such a campaign is justified for finding tuberculosis and other chest diseases particularly in communities where disease appears to be coming under control from the point of view of its complete eradication.

(Settler, H.E.; Welstead, A.G.; Williamson, J.: *Tuber. Lond.: (1958); 39, 339.*)

Multiple Puncture Depot Tuberculin (PPD) Cream Test in Man

92 per cent gave positive reactions to the most satisfactory depot P.P.JX 'Encerin' Cream (5 mgm/g), compared with 80 per cent of positive reactions to the Mantoux tests. Depot PPD cream gave positive reactions in Mantoux negative patients with Sarcoidosis and in tuberculin

desensitized patients, who did not react to Mantoux test with 10,000 tuberculin units of Old Tuberculin. There were no reactions with depot PPD.

(J. Pepy's; R. A. Brace; and D. G. James. *Tuber., Lond. (1958), 39, 283.*)

The Clinical significance of Cor Pulmonale in the reduction of Cardiac-pulmonary Reserve Following Extensive Pulmonary Resection.

The functional capacity is related to the age; maximum breathing capacity; maximum mid expiratory flow and the level of pulmonary artery pressure both at rest and during exercise. It is inversely related to residual volume.

Functional capacity is related to the effects of pulmonary Hypertension more than alterations in arterial oxygen saturation. Pulmonary artery pressure—pulmonary blood flow relationship in the remaining lung after pneumonectomy was different compared with that of normal lung indicating limitation in the expansibility of the vascular bed.

(Harrison, R. W.; Adams, W. E.; Long, E. T.; Burrows, B.; Reimann, A.: *Jour. Thorac. Surg. Vol. 36, No. 3, September, 1958.*)

Bacteriologic and Clinical significance of the Catalase activity of Mycobacterium Tuberculosis.

Though a co-relation could be demonstrated between Catalase activity, resistance to isoniazid and virulence for the guinea-pig, there was no co-relation between Catalase activity, resistance to isoniazid, virulence for the guinea pig and Cyto-chemical reactions.

Patients excreting Catalase negative guinea-pig avirulent strains were found to have favourable clinical course while those excreting catalase positive guinea-pig avirulent strains showed profusion of disease or death.

(Schweiger Otto and Vandra Edit: *Amer. Rev. Tub. Vol. 78, No. 5; 1958.*)

Effect of Glucose on Tuberculin Reaction in Tissue Cultures

Sensitive monocyte cells maintained in tissue culture and obtained from peritoneal exudate of

tuberculin positive guinea-pigs on exposure to P.P.D., showed progressive vacuolation of the cytoplasm while normal cells obtained from normal guinea-pigs were not affected by the same concentration of antigen.

Glucose utilization of sensitized cells is not affected by P.P.D. In Vitro, glucose delays the appearance of tuberculin reaction. It also prolongs the sensitivity period of sensitive monocytes in tissue cultures.

(Kapral A. Frank and Stinbering R. Warren: *Amer. Rev. Tub. Vol. 78, No. 5; November, 1958.*)

Intracranial Calcification following Tuberculous Meningitis in Children.

Pathologic Intracranial calcification was seen during life in 63 out of 130 children (48.4 per cent) who recovered from tuberculous meningitis. In 2 out of 10 who died showed intracranial calcification and even ossification.

49 cases showed calcification in basal meninges while the remaining 17 showed intracerebral calcification. The calcification in basal meninges progressively increased with increase in the stage of the disease and the incidence was less in those who were treated with Isoniazid-streptomycin and P.A.S. and those who had intrathecal injections with Tuberculin and Streptokinase compared with those who had treatment with Streptomycin alone or Streptomycin and P.A.S.

Intracerebral Calcification was independent of the stage of disease and of treatment. The incidence of Calcification was high in 21 children with neurologic sequelae than in the remaining 109 who had no such sequelae.

(John Lorber: *Amer. Rev. Tub. Vol. 78, No. 1 1958*)

Observations on Ambulatory Tuberculous patients with Pulmonary Cavities and Non-infectious sputum (The open negative syndrome)

84 out of 94 ambulant patients with tuberculous cavities stable roentgenographic findings and sputum free of tubercle bacilli remained arrested after a follow up of approximately two and a half years.

10 cases had reactivation out of which one died. The relapse rate was 4 per cent with thin walled cavities and 19 per cent among others thus showing a serious prognosis regarding reactivation in thick walled cavities.

(Breuer Joseph; Abeles Bans. Chaver D. Aaron; and Robins B. Arthur: *Amer. Rev. Tub. Vol. 78, No. 5, November, 1958.*)

The Niacin Test for differentiating Human Tubercle Bacilli from Mother ycobacteria.

Production of Niacin was positive on all the cultures of human strain TB incubated for five to

eight weeks, but were negative with other strains of bovine and avian tubercle bacilli.

(S. Glain and J. B. Selkon. *Tuber. Land.: (1958), 39, 396*)

Treatment of Drug-resistant cases of Pulmonary Tuberculosis with Cycloserine and Pyrazinamide

39 per cent of patients treated with Cyclosterine and 43 per cent of those treated with Pyrazinamide among a group of patients with strains of Tubercle bacilli resistant to two or more »f the common drugs, became negative.

Toxic effects were less with cycloserine than with Pyrazinamide.

(J.A. Ritchie, A.E.R. Campbell; J. Cuthbert and L.G. Bruce. *Tubercle, Land.: (1958), 39, 289.*)

soniazid Treatment for early Pulmonary Tuberculosis.

79.1 % cases of active early minimal Pulmonary Tuberculosis discovered during mass chest survey improved with I.N.H. without bed rest. 3.2% became worse and the rest remained stationary.

(Kuo Teh Lung, Chang Jo-CH'v and Chu Tsung-Yao. *Chinese Med. Jour., 76, 401-405. April, 58.*)

Clinical use of a single Daily Dote of Para-Aminosalicylic Acid in association with Isoniazid.

A daily dose of 5 gm. of P.A.S. (7 gm. of sodium or Calcium Salt) and 150 mgm of Isoniazid twice daily is not only equally effective compared to divided dosage of 3 gm. P.A.S. three or four times daily, but is also economical and less irritating to the gastrointestinal tracts.

(Bridge, Ezra; V. Can; T. David: *Amer. Rev. Tub. Vol. 78, No. 5: November, 1958.*)

A Study of 'Tebafen' in Chronic Pulmonary Tuberculosis.

Results of treatment in 25 patients with positive sputum with Tebafen (G.T.3), a combination of Isoniazid and nicotinaldehyde thiosemicarbazone (T.S.C.) showed clinical improvement in 21 patients and radiographic improvement in 3. In 35 per cent sputum was negative and 47 per cent developed resistance to I.N.H. after one year.

The use of Tebafen as opposed to Isoniazid alone is recommended to diminish resistance to isoniazid. Results with it are comparable to these with more Toxic combination containing Cycloserine or Pyrazinamide.

(Cuthbert, R.J. Alison, M.T.; Drimmie and K. R. J. J. rquhart, *Tub. Land., (1958), 39, 360.*)

ABSTRACTS

Comparison of Tetracycline Absorption and Clinical Efficacy of several Para-Aminosalicylic Acid Preparations in Three Hundred Tuberculous

Administration of P.A.S.-ion exchange resin complex, sodium para-aminosalicylate, Calcium para-aminosalicylate or Potassium Para-aminosalicylate showed that all the four preparations were uniformly effective in preventing or postponing the development of resistance to isoniazid or other anti-microbial agents.

There was no co-relationship between the absorption and the para-aminosalicylate content of the preparation. The gastrointestinal toleration was maximum after P.A.S.-resin complex.

(*Summer, S. Cohen; Wen, Y. Yue and Shitt, H. Tsai. Amer. Rev. Tub. Vol. 78, No. 6, 1958*)

Pneumonectomy in the Treatment of Pulmonary

The sixty day operative mortality after Pneumonectomy was 10.8 (11 cases) per cent in 110 cases. Of the rest 90 cases, 2-7 years follow up showed that 65 patients were alive with inactive disease, 4 had an active process, 7 were untraced and 14 died.

Cardio-respiratory failure was the most common cause of early death and Tuberculosis complications were frequent cause of late mortality.

(*T. W. Shield*; W. M. Lees and R. T. Fox: Amer. Rev. Tub. Vol. 78, No. 6, Dec. 1958.*)

Pulmonary Resection for Tuberculosis under Protection of Viomycin, Promizole and Pyrazinamide.

35 Pulmonary Resections done in 32 patients in whom the bacilli were resistant to Streptomycin, P.A.S. and isoniazid under cover of Viomycin combined with promizole or pyrazinamide showed no spread, broncho-pleural fistula or Empyema in 28 cases; the remaining 4 died, the deaths being unrelated to drug coverage. Of the 28 survivors, 22 never showed post-operative activity; in the remaining six, two had early, and one late reactivation, and three had late bacteriological relapse but subsequently became negative. Viomycin combined with either promizole or pyrazinamide appears to offer satisfactory temporary protection for excisional surgery in tuberculosis in cases with

resistant bacilli to streptomycin, P.A.S. and isoniazid.

Of the promizole and pyrazinamide, the latter seems to be more potent.

(*Webb, Wals, R.; and Sparkuhl, Koituntin: Diseases of the Chest: Vol. XXXIV, No. 5, 1958.*)

Technical Considerations in Decortication of the Pleural Compartments of Pulmonary Tuberculosis.

The overall mortality after decortication is as low as 2.9 per cent; and 77 per cent show relief of symptoms such as thoracic discomfort, dyspnoea, removal of source of actual or potential infection, and adequate hemi-thoracic restitution.

The indications for resection are unexpandable lung due to long term pneumothorax, primary pleural effusion, false re-expansion, pyogenic, pure or mixed tuberculous empyema and decortication incident to resection.

Decortication with or without parietal pleurectomy is safe and is an effective procedure in treating pleural complications.

(*Samson, Paul, C.; Men-ill Duane L.; Dugen J. David; Shabart J.; E. James, Yee; Barber, Louis, M.: Jour. Thor. Surg.; Vol. 36, No. 3, Sept, 1958.*)

Full Term Delivery following Major Thoracic Surgery.

The results following thirtytwo deliveries in 29 patients who had major thoracic operation for Pulmonary Tuberculosis before or during pregnancy showed no change in the disease in 25 instances, improvement in 5 patients in whom the disease was active during pregnancy and progression of the disease in 2 instances.

These results compare favourably with those in non-pregnant tuberculous patients with similar disease and show that pregnancy may safely be undertaken following major thoracic surgery.

The Major Surgery may be carried out during the first and second trimester of pregnancy. There is danger in premature labour if done during the third trimester.

(*Schaffner George; Biru Bourn J. Stanley; Douglas, Gordon, R.: Amer. Rev. Tub., Vol. 78, No. 5, November, 1958.*)