

Lecture delivered at Post-Registration Course at S.A.S.P. National Council Meeting in Port Elizabeth, May, 1968.

Physiotherapy and the South African Heart Transplant

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Since the 18th Century man has been intrigued with the possibility of organ transplantation. In ancient times the desire was to join portions of various beings, not only to counteract disease, but to create such mythical creatures as the Sphinx and the Mermaid. The climax of such dreams was the transplantation of the heart which is so unique an operation that the concept of even the most basic and routine treatments took on a quite different aspect and perspective. It is because of this that the Physiotherapeutic aspects of the Second South African Heart Transplant is presented.

P.B. aged 58 was admitted to a Medical Ward of Groote Schuur Hospital on the 14th December, 1967 with a 12 year history of heart disease. On admission the patient presented with intractable congestive cardiac failure due to severe ischaemic heart disease. Cardiomegaly, systemic venous hypertension and bilateral basal crepitations were present. He was orthopnoic and complained of paroxysmal dyspnoea.

The patient was in an extremely poor physical and mental state, appearing drowsy and "dull". A marked feature was the patient's inability to open his eyes normally. This appearance reminded one of a patient suffering from Myasthenia Gravis. For several weeks the patient had been recumbent in a high Fowlers position and was unwilling to turn or be turned on to his side, even for treatment to back and pressure areas. He could not brush his own teeth, wash his face or blow his nose and after using the bedpan, a recovery period of up to an hour was needed. He was so weak that he could not hold up a newspaper nor had he the concentration necessary to absorb what he had read. He could not complete a normal average sentence in one breath. Furthermore his general condition was rapidly deteriorating.

PRE-OPERATIVE AIMS

The pre-operative aims of physiotherapy are identical with those of any patient awaiting a routine open-heart procedure and include a number of essential requirements:

- (1) One must get to know the patient, gain his confidence, and explain in detail the importance and reasons for physiotherapy. The complications that can occur if the treatment is ineffectual should be clearly understood.
- (2) To clear the lung fields, maintain a good airway and improve ventilation.
- (3) To teach correct diaphragmatic and localised breathing.
- (4) To teach effective coughing and how to support the wound when doing so.
- (5) To prevent circulatory complications.

A few days prior to operation the patient is told in great detail how he will find himself on returning from the theatre. This is done in order to allay any fear that might result, which in turn might forfeit his co-operation. The incision and the position of the chest drains are indicated to him. The fact that he will be nursed flat on his back and in an oxygen tent is explained to him. In the same way the patient is told about:

- Naso-gastric suction.
- Intravenous therapy.
- Urinary catheterization.
- Indwelling rectal thermometer.
- A femoral vein cut-down.
- Electrocardiographic monitor.

The response to treatment was exceptionally poor because of the patient's general condition. A mere explanation of the reasons for physiotherapy was more than he could absorb in one session. He was only capable of 5-6 inspiratory and expiratory movements, and became distressed after only 2 Plantar and Dorsiflexion movements of his feet. As a consequence, physiotherapy lasted the best part of an hour whereas this should normally have taken 15-20 minutes. Frequent and lengthy rest periods were required and even then, treatment was inadequate. The slightest signs of distress were easily observed by:

An increase in the rate of respiration.

A decrease in depth of inspiration.

An increase in pulse rate.

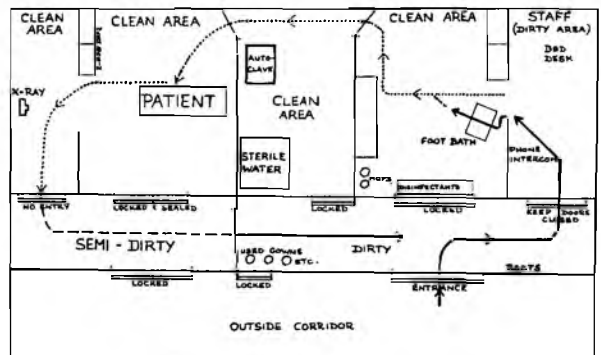
A slight tinge of cyanosis of the lips.

On the 27th December, 1967 a diagnosis of Pulmonary Embolus was made which was thought to account for the sudden collapse with unrecordable blood pressure on the 23rd December. During this period the patient was drowsy and not quite "with it", due mainly to heavy sedation. He also expectorated a few plugs of altered blood, despite there being no evidence of deep vein thrombosis. There was a further decrease in air entry at the left lung base and an increase in crepitations, with a dull aching pain in the left lower chest anteriorly. There was no uninitiated coughing but decreased air entry persisted at the left lung base. As vigorous a physiotherapy session as the patient could tolerate was productive of some altered blood in the sputum. As could be expected, the patient was extremely distressed after such a session but in view of the result, the method of treatment was not altered.

X-rays of the chest at this stage revealed an opacity in the left lower lobe with an effusion. It was in this condition that the patient was taken to theatre on the 2nd January, 1968.

It is important to describe briefly the suite that the patient was nursed in post-operatively and why this was done.

The Theatre Suite in which the patient was treated from the time of leaving the Operating Theatre until discharge. The arrows indicate the route taken by all members of the team entering the patient area. Visitors, limited to the patient's wife and very few others were only permitted into the Buffer area (semi dirty area) and conversed with the patient with the use of the intercom and viewed him through the "locked and sealed door".



Post-operatively, patients with transplanted organs are placed on high doses of immuno-suppressive drugs to help prevent rejection. At the same time the drug regime makes the patient far more susceptible to infection because of suppression of the normal immune mechanism. The slightest bacterial infection may spread widely and with serious consequences, whereas the same infection in a person not on immuno-suppressive drugs would probably be held in check easily.

It is for this reason that the patient is nursed in as bacteria free an environment as possible and must remain so for the entire period of hospitalization or until the immuno-suppressive drugs have been reduced to a safer level, when he can then go back to a normal "Home" environment. It must be remembered that hospitals in general are often reservoirs of resistant bacteria and therefore the sooner the patient can go home the better.

The Transplant Unit in which the patient was nursed, and the way in which he was cared for, was supervised in part by the Bacteriology department of Groote Schuur Hospital.

A little-used theatre suite was made available for the care of the transplant patient and a routine was laid down to keep the unit as free of bacteria as possible. Some of these measures included the following:

(1) Careful attention to the number of nursing personnel required for both day and night duty, for patient care proper and to act as "runner nurses".

(2) The number of staff attending to the patient was kept to an absolute minimum—only those persons essential to the care of the patient were allowed into his area.

It was for this reason that the "Physiotherapy" carried out in the case of the first heart transplant, was carried out by the Sisters specialising the patient and not by a physiotherapist. As a result of the Pneumonia he so regrettably succumbed to, intensive physiotherapy was requested for the second heart transplant and treatment was commenced more than two weeks prior to surgery.

It is interesting to record, that all X-rays were taken by the same radiographer and similarly the three physiotherapy sessions in 24 hours were done by one physiotherapist. These physiotherapy sessions were reduced after 23 days to twice daily, then once daily and finally to six times per week to allow the patient as well as the physiotherapist one day of rest!

(3) All staff who attended the patient had swabs taken from the nose, mouth, throat and rectum for bacteriological examination to determine if they were carriers of potential pathogens. These swabs were repeated weekly. The patient had similar swabs taken pre- and post-operatively. If at any stage a member of staff developed e.g.: Herpes of the lip, a boil, a cold or a sore throat they were immediately removed from the unit and investigated bacteriologically.

Visitors were strictly limited and were only able to view the patient through a glass partition in the buffer zone outside the patient area.

(4) All walls and floors in the unit were treated at regular intervals with a suitable phenolic disinfectant, using only autoclaved buckets, mops and paper towelling. Where possible all apparatus used near or on the patient was thoroughly cleaned, autoclaved or boiled before entering the unit and thereafter damp dusted with a disinfectant.

(5) All linen was autoclaved. The bed linen was changed six hourly, care being taken not to disturb the air excessively. The patient was washed daily with a Hexachlorophene compound, careful attention being given to the perineum and genital areas, which were washed with soap and water and dusted with Hexachlorophene and Mycostatin powder. The hair was washed with a mixture of Cetrimide and Chlorhexidine.

(6) The diet kitchen prepared each meal initially in a pressure cooker which entered the unit sealed, the

outside having been cleaned with a disinfectant. The outside of the sealed milk bottles were treated in a similar fashion.

(7) All staff entering the unit to attend to the patient left their coats etc., in the passage outside the doctors' change room. In the change area sterile masks, caps and over shoes were donned. The hands were then scrubbed as for a surgical procedure, sterile gowns and gloves put on and then only after passing through a clean buffer zone did one enter the patient's room.

It will be appreciated that once one had entered the patient area one's steps could not be retraced. If one had already left the patient's room one could not re-enter without going through the whole scrubbing up process again. For this reason a runner nurse circulated in the gowning area where all the autoclaved equipment, ready to enter the unit, was stored. Her duties entailed amongst other things, receiving the food and keeping the area other than the patient's actual room scrubbed and cleaned at regular intervals.

(8) After any and every form of attention to the patient, the gloved hands were rinsed in a specially prepared disinfectant. (This was of great importance to physiotherapists who normally alternate breathing with leg exercises throughout a treatment and therefore of necessity much time was spent in rinsing the hands.)

POST OPERATIVE TREATMENT

The first and foremost aim in the post-operative physiotherapy regime was to prevent pulmonary infection. Because of the risk of infection strict precautions were taken to keep the patient area as free of bacteria as possible. For the same reason every possible precaution was taken to avoid pulmonary complications, and as a result, perhaps more physiotherapy was given to this patient than was entirely necessary. Further aims were:

To prevent circulatory complications.

To increase the exercise tolerance as well as range of movement and muscle power.

As a result of many weeks in bed with consequent inactivity, there was a marked decrease in the range of movement in the ankles and some limitation of hip extension. Muscle power, needless to say was very poor through disuse.

Post-operative physiotherapy was commenced approximately 5 hours after the patient had returned from the theatre. A post-operative injection of Pethedine had been given but, despite this, the patient was fully conscious and alert, so that his first comment on seeing the physiotherapist was "don't expect me to breathe or cough without giving me something to drink first". This was so typical of any post-operative case that it was hard to believe that there was another heart beating in the patient's chest. It was also noted with interest that for the first time the patient was able to open his eyes normally.

Physiotherapy sessions were synchronized with treatment to the back and pressure areas and with the changing of the bed linen, this to minimize any disturbance to the patient. Routine quarter hourly observations initially gave the patient no rest at all, but when these were reduced to hourly and then two hourly intervals, the patient was allowed to sleep.

For the first six post-operative days crepitations and a marked decrease in air entry persisted at the left lung base, and in addition bronchial breathing was noted for the first time. (It must be appreciated that on the 23rd December the patient had suffered a Pulmonary Embolus with consequent lung damage so that at the time of surgery the patient was not a good anaesthetic risk. However, because of the rapid deterioration in his condition transplantation became the only hope of survival.) On the 7th post-operative day for the first time the lung bases were free of crepitations and air entry had improved. From this time on daily X-rays showed a further decrease in the areas of infarction. A continued improvement in lung function, both clinically and physically, was noted.

X-ray Findings

- (a) Pre-operative X-ray of 27th December, 1967 reveals an opacity in the Left Lung Base with effusion and congestion of the lung fields.



- (b) The picture of 29th January, 1968 shows resolution of the opacity and effusion at the Left Lung Base and relief of the congestion. The lung fields are clear. Increase in "heart size" noted and resulted in aspiration of 345 cc. of fluid from the pericardial sac.



- (c) By 29th February, 1968 the lung fields remained perfectly clear with complete resolution of all changes at the left lung base.

Despite relatively vigorous physiotherapy immediately post-operatively, namely, side-lying, vibrations with breathing and coughing, it was found that the bronchial secretions were very viscid and difficult for the patient to expectorate. The patient was fully co-operative but his coughing ability poor and the suggestion was made by the physiotherapist to use the Bird Respirator with a mucolytic agent. The Bird Respirator was used on the 4th post-operative day not with a mucolytic agent but with a specially prepared solution of 8 cc. of Mycostatin, (50,000 units per cc.) as a result of the culture and sensitivity of the previous days sputum specimen. The Bird was set at a sensitivity of 5, inspiratory pressure of 15 and flow rate of between 7 and 10. The Mycostatin took the best part of 20 minutes to nebulize which made it a rather tiring session, but the chest cleared within 2 days and the subsequent sputum specimens were negative. The Bird was therefore discontinued for fear of auto-re-infection, but the value of the Bird, even for this short period, was most convincing. It should be stressed that it is essential that the Bird apparatus or any other respiratory equipment be as completely free of bacteria as possible.

As is routine with any post-operative open heart patient the treatment was started in an oxygen tent and with no hip or knee movements until removal of the venous line. For the first day the patient was kept supine and on the second day put into partial side-lying and only on the third day was he allowed to turn himself to full side-lying. The chest drains, the urinary catheter, naso-gastric suction, rectal thermometer and venous line were removed on the second and the oxygen tent on the 4th day. The monitor was kept on longer than for a routine open heart procedure. The bed

was slowly elevated until on the 6th day the patient sat up with his feet over the side of the bed for the first time. On the 12th day he stood for the first time and took two steps to a chair where he enjoyed his first meal sitting out of bed. Throughout the post-operative period the patient had an outstandingly good appetite.

It might be of interest here to know that everything excreted and expectorated by the patient was sent to the laboratory for analysis. Swabs were taken from the patient daily and the chest drains and urinary catheter on removal, were sent for culture, as was the dressing when this was removed. These measures were thought necessary to detect any possible infection.

A slow but gentle progression of routine bed exercises, with special emphasis on the legs, and activities of daily living was instituted as follows:

Each exercise was increased in the number of times done. New exercises were included.

Very gently resistance and/or longer leverage was added where possible.

General activities included:

From being turned to turning himself.

To sitting up with pillows to sitting with legs over the side.

To standing and taking two steps to a chair.

To increase the distance walked.

To putting on his pyjama jacket and dressing gown.

To shaving, to brushing his teeth to washing his hands and face.

To taking off shoes and at a much later stage, to putting them on.

To lifting up a stool and moving it to a desired position.

To climbing stairs, bed steps having been specially cleaned and brought into the unit for this purpose.

The leg exercises given were chosen to aid the circulation, to increase joint range and were worked against gravity, where possible, to strengthen the muscles at the same time. At one stage post-operatively there was some discussion as to the reason for the weakness of the legs, complained of by the patient. A suggestion of steroid myopathy was made, but from the physiotherapist's point of view this weakness could have been due to disuse atrophy. It was at this stage that a pre-operative muscle power chart would have been of great value. It should, in future, be a routine procedure for any transplant patient to have such an assessment pre-operatively, even if the testing has to be spread out over many days because of the patient's general physical condition. As a result of this discussion the first muscle chart was only started on the 5th February, 1968, and subsequent ones done after his discharge from hospital on the 21st and 28th March, 1968. The results tend to suggest a disuse atrophy rather than a steroid myopathy, as most muscle groups had improved considerably. Residual weakness of 3 or 3+ grading have persisted in only three groups of muscles:

The hip abductors and adductors.

The hip extensors.

The quadriceps.

It is for this reason that the patient still has a "waddling gait" and finds difficulty in managing stairs unaided. There is a persistent flexion contracture of the hips but up to the time of discharge the patient had not been put into prone lying. The abductors were difficult to strengthen as a side-lying position was most unstable in bed and the effort to maintain the position, more than was warranted. Apparatus such as slings and springs were not permitted into the unit.

The patient himself was a most delightful and co-operative person to treat but his one aim and ambition was to be able to do things for himself, and be independent and it was difficult to insist on his doing more exercises at the expense of the activities of daily living that he had for so long not been able to do. Here again one was working in the dark,

not knowing what to expect of a heart transplant patient and how far in fact one could push such a patient.

One has also learnt from this patient the necessity to have a form of exercise tolerance test which once again was only started three weeks post-operatively and which in future should be done, as a muscle power chart, pre-operatively. One exercise should be taken, preferably against gravity, such as hip and knee flexion and extension and the pulse, respiration and blood pressure taken before

Muscle Charts of the Upper and Lower Extremities.

- (a) The upper extremity showed rapid improvement in strength to near normal and no further testing was done.
- (b) The lower extremity showed marked weakness in several Muscle Groups. Repeated assessments revealed a slow but steady improvement in muscle power. As a result of these findings, concentrated exercise was given to the weakest groups.

MUSCLE CHART—5.2.68
UPPER EXTREMITY

	Left	Right
Pectorals	3	3
Deltoid	3+	3+
Internal Rotators Shoulder	3-	3-
External Rotators Shoulder	3-	3-
Biceps	3+	4
Triceps	3-	3+
Pronator	3+	3+
Supinator	3+	3+
Wrist Flexors	4	4
Wrist Extensors	4	4
Flex. Dig. Prof. and Subl.	4	4
Ext. Dig. Prof.	3	3
Opponens and Interossei	3+	3+

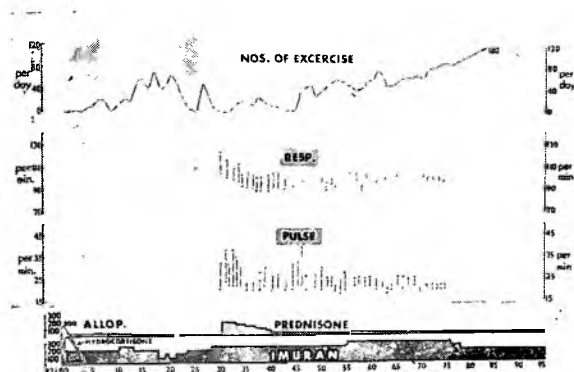
MUSCLE CHART
LOWER EXTREMITY

LEFT				RIGHT		
5.2.68	21.3.68	28.3.68		5.2.68	21.3.68	28.3.68
2-	2-	2+	Gluteus Maximus	2-	2	3-
3-	3+	4-	Hip Flexors	3-	3+	4-
2+	3-	3	Hip Abductors	2+	3-	3-
2-	2	3-	Hip Adductors	2-	3-	3-
2+	3+	4	Internal Rotators	3-	4	4
2+	3+	4	External Rotators	3-	4	4
3-	3+	4-	Quadriceps	3-	3+	4-
2+	3-	3+	Hamstrings	3-	3+	4-
3-	3	4	Calf	3-	3+	4
3	4	5	Tibialis Anterior	3	4	5
3-	4	4	Tibialis Posterior	3-	4	4
3+	4	5	Peronei	3+	4	5
3+	4	4+	Extensor Digit.	3+	4	4+
3+	4	4+	Flexor Digitorum	3+	4	4+

and after the exercise. This exercise must be done until the patient is exhausted and the number of times and response noted. In this way some idea of the exercise tolerance can be assessed. It must, however, be remembered that as the patient becomes more active in himself and does more in the way of activities of daily living, this can only be an indication as to his exercise tolerance. One's general impression of the capabilities of the patient day by day will still be the most reliable source of information. A chart of joint range could be included in the muscle chart if desired.

At one stage a definite period of decrease in effort tolerance was noted which co-incided with an increase in temperature, respiratory rate and pulse rate. There were changes in several biochemical tests, with an increased E.S.R. and white blood cell count, and changes in the electrocardiographic voltage. It was established that rejection was taking place and immediate treatment was carried out in the form of increased steroid dosage. This lowered the patient's resistance to infection and therefore physiotherapy was once again increased to 3 sessions in 24 hours, for a short period. The response to the steroid increase was dramatic and the patient's general condition slowly improved and continued to improve steadily until the time of his discharge.

A daily exercise tolerance graph was commenced after a marked decrease in effort tolerance preceding the period of rejection had been noted. It was decided that as all aspects pertaining to rejection had to be considered, this test might have its value.



The patient was discharged on the 16th March, 1968, well enough to walk out of the hospital to the waiting car. This was a dramatic and emotional day for all, and no one was happier than the team members to see the patient go home to a normal environment.

From his home the patient attends the Hospital regularly and is examined by the cardiologist in a room in the out-patients department where no other patients are seen. Blood is still taken twice weekly for laboratory tests. He is seen by his physiotherapist weekly to assess his progress. Normally any other patient with such a residual muscle weakness would attend the Physiotherapy out-patient department for further rehabilitation but in the case of the patient, who is not yet allowed free contact with people, it is hoped that he will continue with his physiotherapy on his own. From time to time new exercises will be given and for example, home made sand bags suggested to help strengthen the quadriceps.

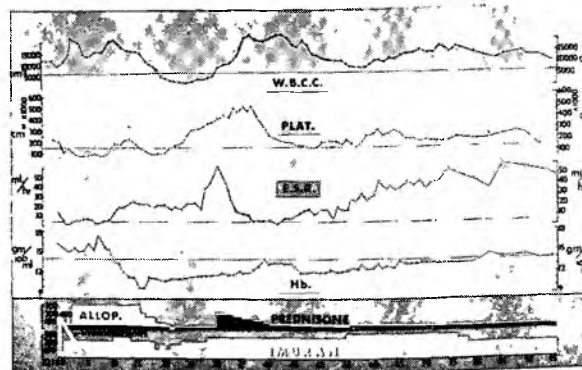
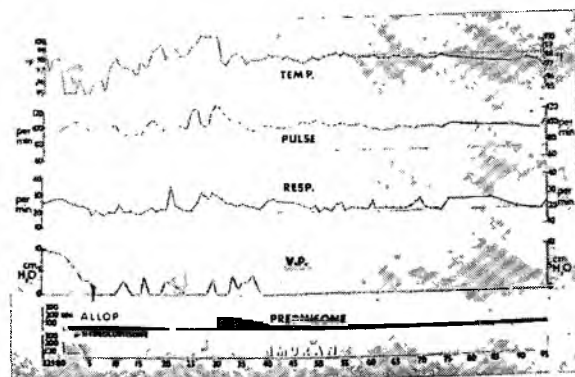
Meetings were held at first daily and then twice weekly until the patient was discharged from the hospital and since his discharge once weekly. These meetings are attended by between 20 and 26 people who are all concerned directly or indirectly with the patient. Many of the doctors at these

meetings have never seen the patient but are responsible for various biochemical and other tests done. The only people in daily and direct contact with the patient, other than the sisters specialising the patient were:

- The cardiologist.
- The surgical registrars.
- The electrocardiograph technician.
- The bacteriologist.
- The radiographer and the physiotherapist.

Discussion by the members of the team of all the various investigations and treatment pertaining to the patient was very stimulating and indicated very clearly the important and essential role that physiotherapy must play in such a case.

Many Biochemical Tests were performed to try and establish a means of detecting rejection. These are but 2 of the examples. It can be seen that when it was established that rejection was taking place, the dosage of Prednisone was drastically increased for a short period.



ACKNOWLEDGEMENTS

I am grateful to all members of the team for their help and co-operation, to the Department of Surgery, the Cardiac Clinic, Department of Medicine and the Department of Bacteriology, University of Cape Town, for all the help and guidance. My special thanks to Dr. A. A. Forster for the interest, encouragement and ever willing help in preparing this paper and Dr. J. G. Burger, Medical Superintendent of Groote Schuur Hospital for permission to publish.

REFERENCE

S.A. Medical Journal, Vol. 1, No. 48. 30th December, 1967.