

# THE SURGICAL TREATMENT OF CARDIAC PAIN.\*

By JAMES PATERSON-ROSS, M.S.(Lond.), F.R.C.S.Eng.

Professor of Surgery, University of London.

(ABRIDGED)

THE work described is the work of a team, originated and directed by Dr Geoffrey Bourne, Assistant Physician on the Staff of St Bartholomew's Hospital. After studying a large series of cases of angina he selects the cases suitable for medical treatment, psycho-therapy and surgical treatment—only the "leavings" come to the surgeon. The surgical treatment is shared by Mr J. E. H. Roberts, who is interested in chest surgery and undertakes the cardio-omentopexy operations, and Professor Paterson-Ross who does the operations on the thyroid and also some on the sympathetic system.

## Dr Bourne's Classification of Cardiac Pain (4 groups).

1. *The Pain of Coronary Thrombosis*.—Severe—sudden onset—tending to diminish and finally disappear in the course of days. Important feature is that it is not relieved by amyl nitrite, requiring morphia for its relief, which may be a helpful diagnostic feature.

2. *Angina of Effort*.—This may be preceded by 1, but occurs quite apart from any preceding coronary thrombosis. The important point here is the exact relationship between the pain and the work of the heart, the same amount of exertion always producing the pain. The pain is relieved by rest—never comes on when patient is at rest—may be precipitated by a meal or by cold. Tenderness in front of the præcordium is very rare.

3. "*Spasmodic*" *Angina*.—Frequently super-added to 2. Never found in people who have not experienced the angina of effort. So severe that patient feels he is going to die and does not care if he does. Rest has no effect—it may come on when patient is at rest and once it starts has to run its course, unless stopped by amyl nitrite. It may come on some hours after strenuous exercise. There is often præcordial tenderness.

4. *Angina Innocens*.—This term, which has been criticised, is meant to indicate that the course of the disease is benign—usually no organic disease of the heart—people do not

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die of it. It may occur during exertion or after a tiring day, but if the patient is enjoying himself he seems to be capable of a considerable amount of work without any pain. It seems to be related to the psychological state of the patient. Pain is præcordial and commonly central. It persists longer than the other forms, and is associated with palpitation, giddiness and syncopal attacks. Since it may be brought about by standing rather than by walking, it appears to be part of some neuro-circulatory disorder. The patient becomes conscious of a function of the body of which he ought to be quite unconscious.

From the point of view of surgical treatment, no further attention is given to coronary thrombosis or angina innocens. Angina innocens is important for differential diagnosis—this is very difficult and requires a lot of experience.

Pathologically, in angina of effort, 90 per cent. of the patients have demonstrable myocardial disease. This condition is like intermittent claudication of the limbs and results from ischæmia of the heart muscle. Blood supply to the heart muscle is poor. The amount of myocardial damage may be shown by the amount of dyspnœa associated with the pain—an important question is whether the patient suffers more from shortness of breath or from pain. Considering that the nutrition of the heart is of primary importance, it is easily understood that anæmia may make the pain worse. The fact that spasmodic angina may occur when at rest, and be preceded by emotion, suggests an element of spasm super-added to disease of the coronary arteries. The prognosis is decidedly worse in this group than in pure angina of effort.

Another important factor is the nervous factor. Post-mortem records show that 20 per cent. only of the patients with coronary disease had previously suffered from pain, so that the patients who suffer from pain must have some special sensitivity in the nervous system.

Another factor is the psychological factor, as distinct from the nervous factor. Investigation of a series of cases with pain and a series of cases without pain showed that 65 per cent. of those without pain were psychologically well-balanced, and only 15 per cent. of those with pain were psychologically well-balanced.

The cases for surgical treatment require very careful selection, and operation is only carried out on cases of angina of effort and spasmodic angina when the pain is severe enough to demand it—when it persists in spite of medical treatment or psycho-therapy—and provided the heart lesion is not so severe as

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to make it unlikely the patient will survive operation for long enough to enjoy his relief from pain. This is very difficult to assess.

The surgical treatment of angina comes under two headings : (1) treating the cause of pain and (2) relieving symptoms. Treatment of the cause is an attempt to restore the balance between the work of the heart and its nourishment, either by increasing the blood supply or diminishing its work. Increasing the blood supply seems at first almost impossible, but it has been carried out successfully, it is believed, by grafting operations by two different methods.

The first is Beck's operation, which consists in removing part of the bony chest wall and laying a graft of pectoral muscle on to the front of the heart. This is a big operation and liable to be associated with a good deal of shock, besides presenting technical difficulties. In 1936 Beck published 11 cases with 6 successful results.

The other operation is that of O'Shaughnessy, and the principle here is to bring up omentum through the diaphragm and graft it on to the front of the heart. This also is a big operation—bigger than total thyroidectomy, but not so difficult as that for diaphragmatic hernia. It should be reserved for patients who are younger and in better condition than those who can be exposed to the risks of total thyroidectomy. Mr Roberts has done 4 cases like this, all with good immediate results.

Decrease in the work of the heart may be brought about by lowering the general basal metabolic rate. Subtotal thyroidectomy resulted in temporary improvement with subsequent relapse. Total thyroidectomy was first carried out for congestive heart failure and the patients had to be rendered myxœdematous, and the procedure would have fallen into disuse had it not been noticed that pain was relieved. The important point about this operation in anginal cases is that, whereas the improvement in heart failure is proportional to the fall in the basal metabolic rate, in anginal cases the patients get relief of pain without being made myxœdematous, and thyroid can be given to keep them well without causing recurrence of pain.

Professor Paterson-Ross has performed this operation of total thyroidectomy eight times. All the patients had angina of effort and four had in addition spasmodic angina. In seven cases the pre-operative B.M.R. was sub-normal. Before operation the patients were tested—some with thyroxin, which produced pain ; three with adrenalin, when 1 minim of 1/1000

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adrenalin injected subcutaneously had no effect, 2 minims had no effect, but 3 produced a typical attack of angina. After operation 5 minims had no effect.

Results of operation—all did well immediately after operation and were able to resume ordinary activities. One has since died in a typical attack of coronary thrombosis—and it is felt that to avoid this catastrophe cardio-omentopexy would be a better operation to carry out. Another patient recently reappeared, eighteen months after operation, in an attack of coronary thrombosis. In both these cases the coronary thrombosis was painful. One man had to have an operation for piles after total thyroidectomy. He bled severely, became very anæmic and his angina returned. When his hæmoglobin returned to normal he became free from angina and has remained so since.

Two other points in connection with total thyroidectomy are (1) the dangers of the operation itself, and (2) the relief obtained so soon after operation. The two main risks are the risk of injuring the parathyroid bodies and injuring the recurrent laryngeal nerve. If local anæsthesia is used it is important to use only a small quantity of adrenalin. The technique is so far the same as for subtotal thyroidectomy. On the right side the recurrent laryngeal nerve frequently lies *in front* of the inferior artery.

### Theories with Regard to the Relief of Pain.

As a rule pain is relieved immediately after operation, long before thyroidectomy can have any effect on metabolism. This may be associated with the low B.M.R. these patients have to begin with. Cutler suggests that the cutting off of thyroxin lowers sensitivity to circulating adrenalin, but Blumgart lays the whole blame on the damage done during the operation to a sympathetic plexus which lies directly behind the posterior lobe of the thyroid gland which blocks afferent cardiac nerve fibres. He suggests there is a primary nervous factor active directly after operation and later on a metabolic factor, but Professor Paterson-Ross finds the nervous plexus theory hard to accept.

### Treatment of Symptoms.

This includes sympathetic ganglionectomy, and the local injection of sympathetic ganglia and rami communicantes. The effect of stimulation of the cardiac branches from the

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cervical sympathetic is to accelerate the heart-beat and to dilate the coronary arteries. The actual path of most pain impulses is through the middle and inferior cervical ganglia and five upper thoracic ganglia, therefore removal of the stellate ganglion would block most of the impulses, and if thoracic rami communicantes are to be blocked, alcohol injection is better than surgery. Injection of alcohol may be undertaken without a general anæsthetic and is therefore available for patients who cannot stand a large operation. Removing the ganglia or injecting with alcohol will spare the heart to some slight extent because the rate is diminished—the heart-beat becomes slower with removal of each stellate ganglion when operating for Raynaud's disease.

## Summary.

All these methods of surgery are of use under certain circumstances. When the patient is fairly young and the heart not too badly damaged he can stand the operation of cardio-omentopexy, which is probably the best because it gives the heart a fresh blood supply. Those who are not well enough to stand that operation should be treated by total thyroidectomy rather than sympathectomy because it spares the heart more; whereas the patients who are not fit to stand total thyroidectomy should be operated on either by ganglionectomy or by alcohol injection. Finally, it should be considered justifiable to rid the patient of his pain even though pain is sometimes regarded as a danger signal.

## DISCUSSION.

*Sir David Wilkie* said—I have perhaps one qualification to speak first on this subject to-night—I think I am the only person in the room who has the singular honour to be a perpetual student of St Bartholomew's Hospital, and therefore when we have the Professor of Surgery from St Bartholomew's addressing this Society, the perpetual student may claim the right to speak first. I am sure you will all agree that we have had to-night a very interesting subject put before us in a lucid and reasonable way, by one who is tackling it by the proper method—getting together a team of men, each of whom is an expert in his own particular branch, and having the cases very carefully observed and followed up by men who have time to do it, so that in time a body of evidence may be collected which will be a guide to all other surgeons. I think St Bartholomew's Hospital has given us an example of that before in the treatment

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of breast carcinoma by radium—a very carefully conducted clinical experiment, which was carried on for a number of years and furnished data on which we can rely.

This subject interests me in two of its sections. In regard to the latter part—gastrectomy—I have had practically no experience and am not qualified to speak. In regard to the first part, I have in no case carried out a cardio-omentopexy; but it is very interesting and agreeable to me to find that an operation of this kind which was experimentally worked out in the laboratory of the College of Physicians of Edinburgh about twenty-seven years ago has now a field of clinical usefulness. It was found experimentally that if wrapped in omentum, certain abdominal organs could be entirely deprived of their blood supply, without leading to a fatal result. In abdominal surgery the method has not proved of any significant value, and I think in the case of the intestine one would be unwise to trust the omentum to furnish even a small part of its blood supply. O'Shaughnessy told me some years ago that he was going to try this out in the case of the heart, and his boldness has been rewarded. The interesting thing about this operation is the fact that it has such a small mortality. One would imagine that these patients were particularly bad subjects for a major operation, more especially for one that interferes with the action of the lung and the action of the diaphragm, and yet the mortality has been singularly low. I think it is a little early yet to say what the results will be, but apparently in a certain number of cases men who were totally unfit for work have been restored to working life again.

In regard to the operation of removal of the thyroid gland, I can speak from a very small experience, having had only three cases—all moderately successful. The interesting thing in cases of cardiac pain is that total removal of the thyroid gland seems to give an immediate result which is better than the ultimate result. That is why Blumgart's explanation that there has been some interference with nerve fibres is in all probability correct. I think Professor Ross did not mention part of the explanation, that in the original cases, in which they did subtotal thyroidectomy, they got very much less relief. In one of my cases I removed both lateral lobes but left all the isthmus and the pyramidal lobe. There the immediate result was just as marked as in the case of total removal, and, as one had removed the posterior part of both lateral lobes, probably one had removed the cardiac nerve fibres as well.

It is quite obvious that these cases will have to be very carefully studied, and those who are interested in cardiology in a medical capacity should, I think, take part in this study, so that we may not subject patients to these critical operations (critical in the sense that we want accurate scientific proof) without having them fully investigated before and after operation. I would put forward the suggestion that we might in Edinburgh adopt the plan which has

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been carried out in St Bartholomew's, and have a small group to study this question, so that in a few years we may have results which will be a reliable guide to those who have to deal with such cases.

I think I must be expressing the feeling of all present here when I say to Professor Paterson-Ross that, not only has his address to us been a joy to listen to and a stimulus, but we all feel proud that a Scotsman, now Professor of Surgery in St Bartholomew's, should be taking a leading part in conducting the team which is investigating these problems.

*Dr Rae Gilchrist* said—In this rather particular and limited line of treatment the selection of suitable cases counted enormously. Too much emphasis could not be placed on this aspect of the subject. In the past few years, out of some hundred cases of angina which I personally have seen, only perhaps ten or twelve—taking a very conservative view—were regarded as suitable for operative treatment, and for these the operation which Sir John Fraser performed was ganglionectomy. On looking back on these cases now, I can say that more than half of them certainly received a decided amount of benefit. They were true organic anginas of effort complicated by a "spasmodic" element. The results were tested out systematically by estimating the amount of foot-pounds of work necessary to produce pain, and we found that in three or four of the patients the response to effort was definitely improved after operation, the tendency to pain was distinctly reduced, and the range of activity was correspondingly increased. All these patients had demonstrable organic disease of the heart associated with a vasomotor element.

Of the other methods of treatment which Professor Paterson-Ross has mentioned to-night, I have little or no experience. My impression is that the procedure of alcohol injection is perhaps not quite so easy and simple as might be anticipated, and I think it is true that White himself has had difficulties and disappointments, the most noticeable being a tendency for the patient so treated to have a constant hyperaesthesia, attributable to a local alcoholic neuritis, replacing the occasional attacks of pain.

Another point which has greatly impressed me, and to which Sir David Wilkie referred, is how very satisfactorily these patients with advanced cardiac disease stand the operation. In Sir John Fraser's hands the operative mortality has been nil, and in subsequent years only two have thereafter died, both of coronary thrombosis, which is of course not preventable.

According to Mackenzie, pain was to be regarded as a warning symptom, and he disapproved of surgical measures because in removing the pain one was removing a danger signal. I think our experience has shown that removal of the pain is never absolutely complete and that these patients have in place of it what we might call substitution symptoms—a sense of oppression, a feeling of emptiness in the epigastrium, and various other symptoms which

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only appear when they overstep the mark. My own view is that there is a very definite place for the surgical treatment of the severer forms of angina provided that thorough medical treatment has had a fair trial, and I can say definitely that of the small number of cases I have seen some have had decided benefit from surgical interference. There is one further point in regard to thyroidectomy. My impression was that the Boston workers were not quite so optimistic now about their results as they were originally, that they found that a number of their patients oscillated between the chronic ill-health of advanced myxœdema on the one hand and angina induced by small doses of thyroid on the other. I have heard a leading authority express the opinion that the regulation of thyroid doses in patients who have had a total thyroidectomy may be exceedingly difficult.

*Dr Fergus Hewat* said—I have had three opportunities of co-operating with my surgical colleagues in well-marked cases of angina. The first case was in my Ward in 1935. He was a relatively young man (46), with a negative Wassermann reaction. One of my surgical colleagues was surgically interested in angina, and the patient was in such desperate misery that he was willing to undergo any form of treatment that was thought advisable. I took the conservative line of asking my cardiological colleague, the late Dr George D. Mathewson, to see the case with me and he agreed that we might suggest surgical interference. The stellate ganglion was removed. The operation was beautifully executed, but unfortunately the patient died immediately after the operation was completed. Post-mortem examination showed very marked coronary sclerosis. This gave my conservative nature a further set-back in considering surgical interference in angina. About a year ago a patient, 58 years of age, suffering from pronounced angina, was treated along the usual medical lines, and while he was quietly at rest in the Ward he was comfortable ; but as soon as he went home the symptoms recurred on the slightest effort. I therefore thought nothing more could be done for him. A little later, however, after considering Mr O'Shaughnessy's omentopexy operation, I arranged for Sir David Wilkie to see the patient in my Ward and he suggested thyroidectomy as being the most suitable operation in this particular case. The operation was entirely successful. The patient has been free of anginous pain except on reasonable effort, although he is not able to be back to work, and the electrocardiograms show no particular change. Dr Kelman Robertson sent me a second case of angina, very similar to that already described, and again I asked Sir David Wilkie to see the patient with a view to performing a thyroid operation. This has been done, with similar results, in that the patient is much freer of pain, although no particular change has taken place in the electro-cardiograms. I am now beginning to have a little more courage in suggesting some form of surgical relief in angina, as I have been impressed by the symptomatic relief which these two patients have certainly received.

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*Dr I. G. W. Hill* said—I have been interested for some years in the question of angina pectoris and have had the opportunity of studying a number of surgically treated cases. I think there are one or two points which might be raised in connection with this discussion.

One case which impressed me—a case I saw abroad—was that of a woman with marked angina pectoris—so severe that any excitement, or merely sitting up in bed, provoked extreme pain. The case was one of luetic aortitis. This woman was subjected to paravertebral injection of alcohol on one side, and the result was immediate relief of the pain for a period of some weeks. Three weeks later she was given a similar injection on the other side and again relief was obtained, but a short time afterwards she sat up in bed one day and died. At the autopsy it was found that she had complete occlusion of one coronary artery at its orifice and only bristle patency in the other. There was no possibility of vaso-dilatation increasing the coronary flow. I suggest that that instance is a sound argument that by the injection of alcohol you are merely getting rid of the pain and not improving the blood supply of the heart muscle.

Other evidence of that nature is obtained from electrocardiographic investigation. There are definite changes in the electrocardiogram in many cases of coronary artery disease during attacks of pain, whether these are spontaneous or induced by exercise. There is a definite relationship between the pain, the amount of work done and the changes in the electrocardiograms. In one case, if one gave the patient half the amount of work to do he got no pain, but there were changes in the electrocardiogram similar to those during attacks of pain. The pain and these changes were not exactly synchronous, but ran a parallel course. After total thyroidectomy in this case the pain disappeared but the changes in the electrocardiogram persisted. The operation is one which is palliative rather than in any way influencing the circulation in the heart muscle.

One other point, which is familiar to all physicians, but which may be brought up for the benefit of the surgeons, is the remarkable spontaneous improvement that does occur in some cases of angina pectoris. Though the general tendency is downhill, there are particular cases in which the pain spontaneously lessens in severity. I could cite a case in Professor Dunlop's Ward in the Royal Infirmary of a man who had had a coronary thrombosis in November 1936. He first came under my observation in June of this year, when he was suffering from severe angina of effort. He was treated in the usual way with nitroglycerine, and after a period of one month's rest in bed he went home. Since then we have seen him at various intervals and we have subjected him to a number of experiments. To begin with, 6000 foot-pounds of work done in two minutes produced pain with clockwork regularity. When nitrite was given the amount of work necessary to produce pain was raised to about 8000 foot-pounds. When he came to the ward the other day we found he could

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do 11,000 foot-pounds in rather a shorter time, without nitrite and without pain. He had therefore attained almost 100 per cent. improvement in his exercise tolerance. Had he been subjected to surgical treatment he would undoubtedly have been claimed as a successful case.

*Professor Paterson-Ross*, in reply, said—The main thing I have to say is to thank all of you for coming and listening to this paper. I appreciate what Sir David Wilkie has said about the work of the team, and I do wish to make it clear that it is not my own work but the work of the team which I am happy to be able to come and tell you about. It is very important that we should try to combine in those subjects which are too difficult for one person's experience to cope with.

There is not very much to answer, but I am glad of this chance to say one or two things I had left out. The point which Sir David Wilkie made about the relief obtained by removing just the lateral lobes of the thyroid gland is to me of very great interest indeed; and, in connection with Blumgart's explanation, perhaps I would have been more correct to say, not that I do not believe in the nerves but that I do not quite see how the nerves are blocked by the operation. It is very hard to explain the relief after partial removal of the thyroid, and I take it that in those cases permanent relief will be incomplete because of the persistent outpouring of thyroxin from the remaining part of the gland.

With regard to alcohol injection, I actually have something written down about the neuritis in the intercostal nerves. I did not mean to convey the impression that the injection of alcohol was an easy thing to do. There is no doubt it is a difficult thing to be quite sure of placing the alcohol correctly, although with practice I think it becomes easier. The neuritis, which occurs, I suppose, in all cases, is as a rule transitory, and my impression is that the patients prefer to have this neuritic pain to the anginal pain, and that it gradually disappears in the course of two or three months. I personally always prefer cutting things out to injecting alcohol, but I feel that some people who would not perhaps stand an operation and a general anæsthetic would stand alcohol injection, which could be done under a local anæsthetic.

I agree that these patients, although they have organic changes in the heart, do stand operation extraordinarily well, and perhaps we should be a little bolder in future in the cases which fail to respond to the best that medicine can offer them.

**Meeting**—19th January 1938.

MR W. J. STUART, President, in the Chair.

The following were admitted Members of the Society:—Arthur Browning, M.B., Ch.B.; George L. Reid, M.B., F.R.C.S.Ed.