Renewed complaints in patients after coronary artery bypass grafting
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Document Version
Publisher's PDF, also known as Version of record

Publication date:
1988

Citation for published version (APA):

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SUMMARY

Up to the present, coronary angiography is still the gold standard in the field of pre-operative cardiac examination.
In this study, 303 patients with renewed complaints after undergoing coronary artery bypass grafting (CBAG) were examined in order to establish what abnormalities existed in the coronary arteries, as well as in the venous and arterial bypasses and in the left ventricle function.

With the aid of forms developed for this purpose these data were made suitable for computer data analyse. The numerous data obtained in this way were assessed with reference to the international literature.

Chapter 1 contains the introduction. The first objective was to investigate whether changes have occurred in the native coronary arteries which have been bypassed. The graft patency related to several factors was also evaluated.
The second objective was to investigate what factors are of influence in relation to the difference in graft patency, found in two groups of patients operated upon whereby for each group of patients a different operation technique has been used.
To investigate the availability of the computer data analysis, designed for this study, was the third objective.
Left ventricle evaluation, post-operatively, has been carried out.
Several chapters are devoted to the anatomy, haemodynamics, coronary angiography and radiological aspects, in order to create a short manual for the radiologist interested in cardiology.

Chapter 2 deals with the anatomy and pathology of the coronary arteries together with the various anatomical variations, both congenital and obtained. A few pages are devoted to coronary artery disease and the different theories dealing with the development of arteriosclerosis.
Some haemodynamically aspects of the coronary arterial circulation are mentioned.

In chapter 3 a short historical review of coronary angiography has been given. It also deals with the technical aspects of coronary angiography such as the equipment, the procedure of coronary angiography, used contrast media, the various exposure techniques, cinematographic backgrounds, radiation protection and interpretation of the coronary angiogram.

Chapter 4 deals with material and methods. Computer specifications are described, together with the anatomical and computer form, while examples of monitor-screen forms are given.
Data from routine clinical investigation are mentioned and compared with data from the international literature. According to the NYHA classification 44% of our patients belong to NYHA II, 10% to NYHA II-III, 34% to NYHA III and 12% to NYHA IV.
The average age was 56.2 years, a male/female ratio of 6:1. Operation mortality (i.e. mortality within 30 days after the operation) was 3.0%.

Within 1 year after the CABG 51% of our patients underwent a renewed coronary angiogram in order to explain the recurrence of angina and in 10% of our group this was carried out within 2 weeks, post-operatively, which was 2.2% of the total CABG patients at the time of this study.

In chapter 5 the progression of the stenoses found pre-operatively is studied. Left main abnormalities were found in 2%, one-vessel disease in 7%, two-vessel disease in 23% and 68% showed three-vessel abnormalities. A pre- and post-operative division of the abnormalities both in the left and right coronary artery has been given. Pre-operatively, 37% of the LCA stenoses was smaller than 50%, while this percentage was 11%, post-operatively. In the RCA pre-operatively, this number was 47% while this was 20%, post-operatively. Pre-operatively, the number of occlusions was 13%, while this percentage has been increased to 34%, post-operatively.

In detail, the progression of the stenoses groups were studied. In those segments to which a bypass had been stitched the progression is high. This is also the case in the segments, just proximal to the anastomosis. (LAD mid./RCA mid., MOCX).

In the A-3 (50-74%) group, 35% of the stenoses in LAD mid. changed into complete obstructions, post-operatively, while these figures were 50% and 25% in the MOCX and RCA mid., respectively.

In the A-4 (75-90%) group, post-operatively, the LAD mid., RCA mid. and MOCX were occluded in 77%, 71% and 53%, respectively. The tide-phenomenon appears to play an important part in the progression of stenoses.

With regard to the NYHA classification the total number of stenoses, greater than 50%, appears to be present especially in the NYHA IV, while the progression of stenoses increased most in NYHA II. Pre-operatively, most of the occlusions were found to be present in NYHA IV, post-operatively however in NYHA III.

The progression of the stenoses is closely related to the severity of complaints, as subdivided into the NYHA classification.

The left ventricular function was also investigated and some examples, to illustrate the possibilities of computer data analysis, are given. A total of 2089 left ventricular segments were studied. Pre-operatively, 66.5% of these segments were normal, while this percentage was 48%, post-operatively. Hypokinesia was found to be present in 29%, pre-operatively, and increased to 37%, post-operatively. Akinesia increased from 4% to 13%. None of the abnormal segments became normal, post-operatively.

Each segment could be related to the coronary abnormalities as well as to the graft patency. For example, in akinesia of segment 3 (apex cordis), found per-operatively, it became obvious that the graft patency later on was much lower than the overall graft patency, 45% and 73.2% respectively.

In akinesia of the apex, post-operatively, the coronary arteries showed a progression of the stenoses prox. These data can be used to predict such a patient or not.

In this study it became clear that in NYHA II the preference to use both Sn and IMA grafts as well as the Y-grafts and S-grafts to the LAD mid. is most important. The flow rate of the bypass grafts was investigated and in our group the most important factor influencing the patency rate was arteriosclerosis in the coronary arteries, the side branches of the grafts and the clips.

The flow rate per year, post-operatively, was 87.5% for the S-grafts and 89% for the Y-grafts.

Chapter 6 describes in detail the patency rate of the grafts and time relation. An overall patency rate appeared to be 70.8% for the S (S+S) grafts and 89% for the Y-grafts and 89% for the Y-grafts.

The graft patency data were compared to the international literature. In NYHA II and III the overall flow rate per year, post-operatively, was 87.5% for the S (S+S) grafts and 89% for the Y-grafts. The presence of stenoses and the severity of symptoms were investigated and in our group the most important factor influencing the patency rate appeared to be arteriosclerosis in the coronary arteries, the side branches of the grafts and the clips.

The progression of the stenoses in NYHA II and III was related with NYHA II and III, respectively.

During this study it became clear that during the follow-up the side branches of the grafts between these clips the graft patency of the peripheral grafts showed a significantly higher. The flow rate per year, post-operatively, was 87.5% for the S (S+S) grafts and 89% for the Y-grafts.

It is recommended that in cases of severe angina and coronary artery disease the preference to use both Sn and IMA grafts as well as the Y-grafts and S-grafts to the LAD mid. is most important.

The progression of the stenoses prox. These data can be used to predict such a patient or not.
progression of the stenoses especially in the MOCX, followed by the LAD prox. These data can be of help in making a decision whether to operate on such a patient or not.

In this study it became obvious that the use of Sn-grafts and IMA grafts has the preference to the use of S-grafts because of the higher patency rate of both Sn and IMA grafts.

The flow rate of the blood in the grafts measured per-operatively was also investigated and in our material it became obvious that flow rate was not the most important factor in graft patency. The severity and progression of arteriosclerosis in the coronary vascular segments to which these grafts were stitched was of more importance.

Chapter 6 describes in greater detail the graft patency, both typing of graft and time relation. An overall-patency of 73.2% was found. This was found to be 70.8% for the S (S=single) grafts, 90% for Sn (Sn=Snake), 100% for the Y-grafts and 89% for the IMA (internal mammary artery).

The graft patency data, found in this study, were compared with the data in the international literature. Graft patency was also subdivided into patency rate per year, post-operatively. One year after the CABG a patency rate of 87.5% was found, decreasing to 77.3% at the end of the fourth year, post-operatively. The presence of stenoses in the grafts itself was studied, both for graft type and stenosis code. In the S grafts 13% showed a stenosis, greater than 50%, while in the Sn graft this percentage was 27%. In the IMA graft no stenoses were found, except for one occlusion. The graft patency rate appeared to be higher in those grafts, stitched to the LAD.

The graft patency was also related to the NYHA classification, post-operatively and graft patency was significant lower in NYHA IV patients, compared with NYHA II and III patients. The figures were found to be 42%, 80% and 77%, respectively.

During this study it became obvious that the use of metallic clips, to tie off the side branches of the venous graft, influenced the graft patency. By using these clips the graft patency was found to be 61%, while using suture material for closing the side branches, this percentage was 79%, which is significantly higher. The flow rate measured in these grafts was of no direct influence. It is recommended that the clips technique should not be used.