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Heart Team decision making and long-term outcomes for 1000 consecutive cases of coronary artery disease

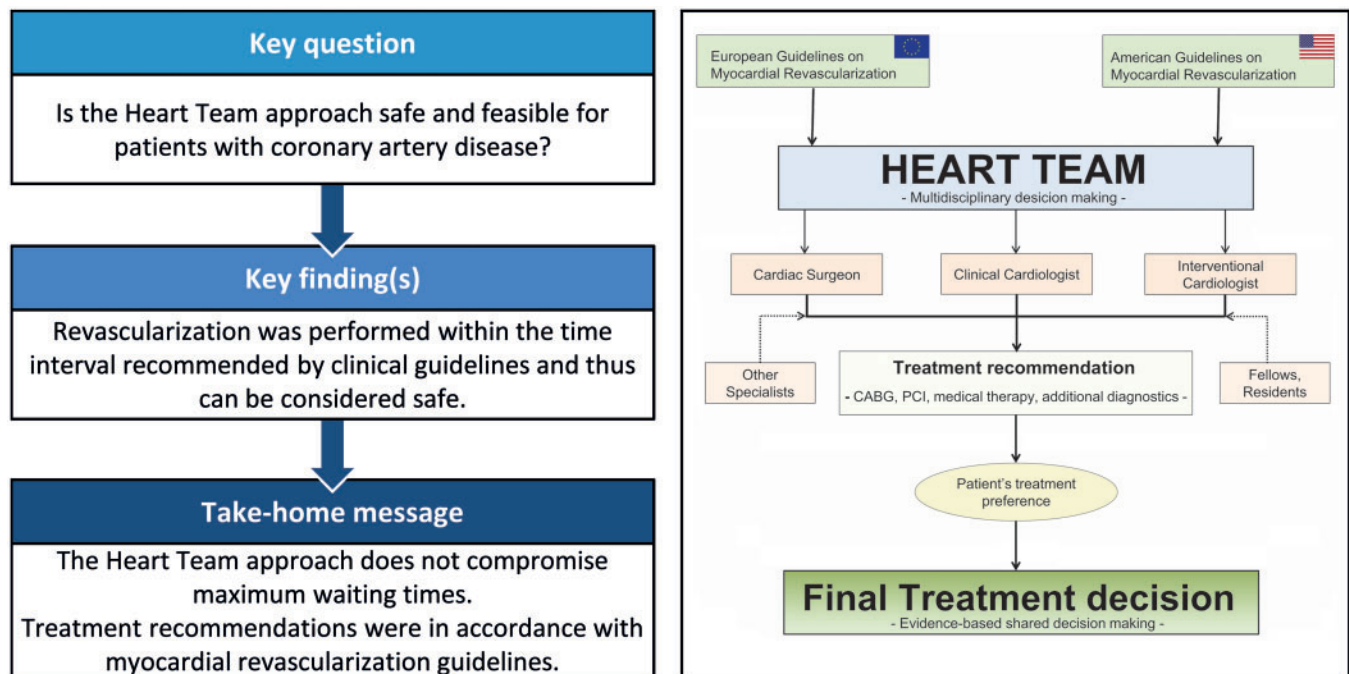
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Abstract

OBJECTIVES: The Heart Team has been recommended as standard care for patients with coronary artery disease (CAD). However, little is known about the real benefits, potential treatment delays and late outcomes of this approach. Our goal was to determine the safety and feasibility of multidisciplinary Heart Team decision making for patients with CAD.

METHODS: We retrospectively assessed 1000 consecutive cases discussed by the Heart Team between November 2010 and January 2012. We assessed (i) time intervals between different care steps involving the Heart Team; (ii) the distribution of patients according to the complexity of their CAD; and (iii) the 5-year survival as estimated from Kaplan–Meier curves.

RESULTS: Of 1000 case discussions, 40 were repeat cases, resulting in 960 unique cases. The mean age was 65 years, 73% were men, and 29% had diabetes. Native vessel disease was present in 86.4%, of which 69% had simple 1-vessel disease (1VD) or 2-vessel disease (2VD), and 31% had complex left main (LM) or 3-vessel disease (3VD). The time interval between referral by a community hospital and final treatment was less than 6 weeks for 90% of cases. Treatment decisions were delayed in 35% of cases due to a need for additional diagnostic information. For simple 1- or 2VD with or without proximal left anterior descending artery involvement, treatment was medical therapy in 6% and 12%, respectively; percutaneous coronary intervention (PCI) in 88% and 85%, respectively; and coronary artery bypass grafting (CABG) in 6% and 3%, respectively. For 3VD disease, treatment was equally split between CABG and PCI (46% for both). PCI was preferred for isolated LM or LM with 1VD (81% vs CABG 16%), whereas CABG was preferred in LM with 2- or 3VD (71% vs PCI 19%). The 5-year mortality rate was 16% for 1- or 2VD, 17% for 3VD, 3% for isolated LM or with 1VD and 27% for LM with 2- or 3VD.

CONCLUSIONS: In this single-centre analysis, the Heart Team approach was feasible, with decision making and treatment by the Heart Team following within a short time after referral. However, the timing of treatment could be further optimized if adequate information and imaging were available at the time of the Heart Team meeting. The final treatment recommendation by the Heart Team was largely in accordance with clinical guidelines.

Keywords: Coronary artery bypass grafting • Percutaneous coronary intervention • Guidelines • Heart Team • Decision making • Delay • Survival

INTRODUCTION

Decision making about the most optimal treatment for patients with coronary artery disease (CAD) remains a difficult task, particularly since interventional cardiologists, clinical cardiologists and cardiac surgeons are increasingly targeting the same patient population for medical therapy, percutaneous coronary intervention (PCI) and coronary artery bypass grafting (CABG).

Moreover, the focus on patient groups with a higher risk for adverse outcomes due to advanced age or comorbidities represents a complex new reality in cardiovascular care. These elements have contributed to the need for collaboration among different specialists. Over the last decade, since the publication of the Synergy Between Percutaneous Coronary Intervention With Taxus and Cardiac Surgery (SYNTAX) trial, a multidisciplinary Heart Team approach has been promoted to provide more patient-centric, evidence-based health care [1].

The Heart Team for CAD established its roots during the conduct of randomized trials. Since the SYNTAX trial, the Heart Team approach has become standard in trials involving complex cardiac conditions with the aim of ensuring accurate patient selection and estimating clinical equipoise between treatments to allow randomization [2]. Consequently, there is growing awareness that a multidisciplinary approach to medicine improves the level of care by avoiding individual physician factors [1].

Heart Team decision making has received a Class 1C recommendation in European and American guidelines on myocardial revascularization [3, 4]. Despite the assumed advantages of the Heart Team approach over decision making by the individual physician, studies to support this statement are limited. As a result, the Heart Team approach has not yet been widely implemented. The reasons for this are multifactorial, including, amongst others, that (i) some consider that the concept introduces delays in decision making; (ii) meetings held outside the tertiary treating hospitals might not be reimbursed by local health care systems; and (iii) it remains unclear whether decision making is indeed improved by multidisciplinary discussions.

This study evaluates the process of discussing cases by a Heart Team to determine (i) the feasibility of having a Heart Team; (ii) the time interval from referral to treatment; (iii) treatment choices made by the Heart Team; and (iv) real-world long-term results of treatments suggested by the Heart Team. With these data, our goal was to provide additional understanding of Heart

Team decision making that would further support this approach in other institutions and in future clinical guidelines.

METHODS

Study design

This was an observational, retrospective study that included 1000 consecutive cases of patients with CAD discussed by the Heart Team at the Thoraxcenter of the Erasmus University Medical Center between November 2010 and January 2012. Approval from the institutional review board was obtained for this study, and patient informed consent was waived.

Heart Team meetings

The Heart Team meeting takes place daily at 8:30 am, with 30 min allocated for each meeting. The Heart Team comprises a cardiothoracic surgeon, a clinical cardiologist and an interventional cardiologist. In addition, residents of the cardiology or cardiothoracic surgery department, researchers and other health care professionals attend these meetings regularly, which contributes to gaining experience in clinical shared decision making.

At the Heart Team meeting, patients with CAD (with or without concomitant valvular disease) potentially requiring coronary revascularization are discussed. These cases are referred to the Heart Team meeting by cardiologists from community hospitals or cardiologists from our own institution. All patients diagnosed with CAD in our institution, regardless of the complexity of the coronary lesions, are referred for discussion by the Heart Team, except for those patients who undergo an *ad hoc* PCI procedure. Patients with heart failure, complex valve disease or congenital heart disease are referred to other specialized multidisciplinary teams for additional discussion.

Patient information provided to the Heart Team is listed in an institutional letter ([Supplementary Material](#), Appendix Fig. S1). To ensure that the relevant data are available during the meeting and for reasons of time management, this letter contains baseline characteristics and risk scores determined prior to the Heart Team meeting. During the Heart Team meeting, the coronary angiographic and cardiac echocardiographic images are assessed by the Heart Team. The SYNTAX score was calculated during the

meeting only for a select group of patients with complex CAD to aid the team in making a final treatment decision [1]. The decisions made by the Heart Team include CABG, PCI, medical therapy, the need for additional diagnostic information, or the need for input from a different specialty. If additional diagnostic information or input from a different specialty is required, the patient may be discussed again in the Heart Team meeting after this new information becomes available. The decisions for each case are made jointly and are based on the most recent evidence-based treatment recommendations available. After a treatment decision is reached, it is registered on the institutional letter, and the patient and referring cardiologist are informed about the treatment decision and the reasons for that particular decision. The patient's preference is taken into account, and an open, non-autocratic discussion takes place. Patient consent is obtained and, when applicable, the patient is scheduled for the procedure.

Data collection

All cases discussed in the Heart Team meetings are systematically registered in a computerized institutional database. Patients included in this study were extracted from the database. Data were extracted by retrospectively reviewing the institutional letter, the referring letter from the cardiologist and the medical records in our electronic patient information system. In 23 cases, the final treatment received by the patient was missing from our electronic patient information system, which required us to contact the referring community hospital. Information on the vital status of studied patients for up to 5 years was obtained either through the hospital records or the Dutch Civil Registry.

Definitions

Patients with a body mass index $>30 \text{ kg/m}^2$ were considered obese. A creatinine level $>200 \mu\text{mol}$ indicated renal impairment. Patients were considered to have hypertension or dyslipidaemia if they were receiving medication to treat it. Left ventricular function was considered normal if the left ventricular ejection fraction (LVEF) was 50–70%, and mild, moderate or severe if the LVEF was 40–49%, 30–39% or $<30\%$, respectively. Summary scores to estimate the procedural risk (e.g. additive EuroSCORE and logistic EuroSCORE) were calculated retrospectively from the information on the institutional letter if the score was not already available.

The clinical presentation of patients ranged from asymptomatic to recent myocardial infarction or out-of-hospital cardiac arrest. These definitions were based on European guidelines [3].

A coronary lesion was considered significant if a $>50\%$ stenosis was present in a vessel with a diameter of $>1.5 \text{ mm}$. Patients were divided into 3 different groups, depending on the type of CAD. The first group comprised a mix of patients: (i) patients with non-significant CAD (the Heart Team found the coronary lesions to be not significant after analysing the coronary angiogram); (ii) patients with unclear involvement of coronary arteries (e.g. due to insufficient information on the coronary angiographic images provided); and (iii) patients with stenosis of the coronary artery from a cause other than arteriosclerosis; for example, spasm or malformation. The second group comprised patients with native vessel CAD. The third group included patients previously treated with CABG who presented with a significant lesion in the saphenous vein graft, internal mammary artery, native vessel or a combination of significant lesions. The second group of patients (e.g.

those with native vessel lesions) was further divided into 'simple' versus 'complex' CAD. The group of simple CAD included patients with 1-vessel disease (1VD) or 2-vessel disease (2VD) with and without involvement of the proximal left anterior descending (LAD) artery; and the group of complex CAD included patients with 3-vessel disease (3VD) or left main (LM) disease. The SYNTAX score, if calculated by the Heart Team during the meeting, was used only for patients with complex CAD, who were divided into 3 groups: SYNTAX score 0–22, SYNTAX score 23–32 and SYNTAX score ≥ 33 .

Statistical analyses

Discrete variables are reported using percentages and counts of the total sample. Continuous variables are presented as mean with standard deviation or median with interquartile range (Q1–Q3), where appropriate. Five-year survival rates were estimated using Kaplan–Meier methods, and comparisons between groups were made using log-rank testing. Subgroup analyses were performed for subgroups of patients with LM disease or 3VD and within the group of patients with simple coronary disease. A 2-sided *P*-value of <0.05 was considered statistically significant. Analyses were performed using SPSS Statistics version 21.0 (IBM Corporation, Armonk, NY, USA).

RESULTS

Heart Team meetings

Between November 2010 and January 2012, 1000 cases were discussed and 297 meetings took place. A mean of 3.36 cases were discussed at each meeting (median 3, Q1–Q3 2–4). Forty cases were rediscussed, and treatment was initiated only after the second discussion. This process resulted in a total of 960 different case discussions that resulted in a treatment proposed by the Heart Team. Of the 960 cases, 822 (85.6%) were referred by 22 different community hospitals and 138 (14.4%) were referred by a cardiologist from our own institution.

Patient population

The mean age of the population was 65.1 ± 11.0 years, and 73% were men (Table 1). Diabetes was present in 29% of patients, and 23% of patients had left ventricular dysfunction. The mean additive EuroSCORE was $4.0\% \pm 3.0\%$, and the logistic EuroSCORE was $4.6\% \pm 5.6\%$.

The majority of patients presented with stable or unstable CAD, or a recent non-ST-segment elevation myocardial infarction (Table 2). Group 1 included 53 patients (5.5%) in whom the involvement of the coronary artery was not clear at presentation to the Heart Team, who had coronary artery spasm or malformation, or who had no CAD at all (Fig. 1). Group 2 included 830 patients (86.5%) who presented with native vessel CAD. Group 3 included 77 patients (8%) with a history of CABG. Among the patients with native vessel CAD, the majority of patients presented with simple CAD either with or without involvement of the LAD artery (69.4%). The other 30.6% of the patients had complex CAD with a mean SYNTAX score of 23.2 ± 10.4 .

Table 1: Baseline clinical characteristics presented to the Heart Team

Characteristics	Patients (n = 960)
Age (years)	65.1 ± 11.0 (960/960)
Male gender	73.0 (701/960)
Comorbid risk factors	
Obesity	27.4 (220/960)
Diabetes	29.0 (278/960)
Hypertension	98.2 (943/960)
Dyslipidaemia	90.6 (870/960)
Tobacco use	20.4 (196/960)
Positive family history	30.7 (295/960)
COPD	12.9 (124/960)
Renal impairment	2.1 (94.7/960)
Cardiovascular history	
No prior cardiovascular events	63.8 (613/960)
Prior PCI	25.8 (248/960)
1 × PCI	18.9 (181/960)
2 × PCI	4.9 (47/960)
3 × PCI or more	2.1 (20/960)
Prior CABG	8.0 (77/960)
1 × CABG	7.9 (76/960)
2 × CABG	0.1 (1/960)
Prior other cardiac procedure (excluding CABG)	1.1 (11/960)
Prior heart failure	6.1 (59/960)
Peripheral vascular disease	11.1 (107/960)
Recent myocardial infarction ^a	24.8 (238/960)
Left ventricular function	
Normal	77.3 (742/958)
Mild	12.5 (120/958)
Moderate	5.4 (52/958)
Severe	4.6 (44/958)
Risk scores	
Additive EuroSCORE	4.0 ± 3.0 (954/960)
Logistic EuroSCORE	4.6 ± 5.6 (954/960)

Values are shown as mean ± SD (n) or % (n/N).

^aOccurred in the last 3 months.

CABG: coronary artery bypass grafting; COPD: chronic obstructive pulmonary disease; PCI: percutaneous coronary intervention; SD: standard deviation.

Time intervals

Patients referred by the cardiologists from Erasmus MC were discussed at the meeting held the same day as the referral or the day thereafter and received treatment a median of 10 days (Q1–Q3 1–27) after discussion by the Heart Team.

For patients who were referred to the Heart Team from community hospitals, the Heart Team meeting took place a median of 2 days (Q1–Q3 1–4) after the referral (Fig. 2). It took a median of 16 days (Q1–Q3 4–27) from referral to treatment. In the subgroup of cases with simple CAD, it took a median of 16 days (Q1–Q3 4–26) from referral to treatment, whereas for complex CAD it took a median of 14 days (Q1–Q3 5–35). Treatment was performed within 6 weeks of referral in 90.0% of the cases: 93.2% for simple CAD and 80.2% for complex CAD. Treatment within 2 weeks of referral was performed in 48.0% of the cases: 46.5% for simple CAD and 51.4% for complex CAD. In only 27 of the 822 externally referred patients (3.3%), the time from referral to treatment took more than 3 months, which was explained by the need for further evaluation of another cardiac condition in 11 cases (1.3%), a requested delay by the patient in another 11 cases

Table 2: Disease-specific and anatomical characteristics at presentation to the Heart Team

Characteristics	Patients (n = 960)
Presentation	
Asymptomatic or atypical symptoms	15.7 (151/960)
Stable angina	35.3 (339/960)
Unstable angina	23.5 (226/960)
NSTEMI	14.2 (137/960)
STEMI	3.2 (31/960)
Congestive heart failure	7.6 (73/960)
Out-of-hospital cardiac arrest	2.0 (20/960)
Coronary artery disease	
Undefined or non-significant	5.5 (53/960)
De novo	86.5 (830/960)
Simple	69.4 (576/830)
1VD or 2VD—non-proximal LAD	77.4 (446/576)
1VD or 2VD—proximal LAD	22.6 (130/576)
Complex	30.6 (254/830)
3VD only	64.6 (164/254)
Left main, any	35.4 (90/254)
Left main, isolated or with 1VD	35.6 (32/90)
Left main, with 2VD or 3VD	64.4 (58/90)
Previous CABG	8.0 (77/960)
Bypass graft (SVG or IMA)	48.1 (37/77)
Native vessel	33.8 (26/77)
Both bypass graft and native vessel	18.2 (14/77)
SYNTAX score	23.2 ± 10.4 (156/254)
Low (0–22)	51.9 (81/156)
Intermediate (23–32)	29.5 (46/156)
High ≥(33)	18.6 (29/156)

Values are shown as mean ± SD (n) or % (n/N).

1VD: single-vessel disease; 2VD: 2-vessel disease; 3VD: 3-vessel disease; CABG: coronary artery bypass grafting; IMA: internal mammary artery; LAD: left anterior descending; NSTEMI: non-ST-segment elevation myocardial infarction; STEMI: ST-segment elevation myocardial infarction; SD: standard deviation; SVG: saphenous vein graft.

(1.3%) and another non-cardiac condition that required investigation or treatment before revascularization in 5 cases (0.6%).

Heart Team decisions

The Heart Team requested an additional investigation in more than one-third of the case discussions before deciding on a final treatment recommendation (Table 3). Invasive cardiac imaging was required in 29.2% of the cases. In 4.3% of the cases, it was necessary to perform non-invasive cardiac imaging to assess myocardial viability or concomitant valve disease.

The majority of patients in Group 1 received medical therapy. After further investigation, 18.8% underwent PCI and 3.7% had CABG (Fig. 3). Of the patients in Group 2 who presented with native 1VD or 2VD, PCI was the recommended treatment in 84.7% of patients without proximal LAD involvement and in 87.6% of patients with proximal LAD involvement, whereas CABG was recommended in only 2.6% and 6.1%, respectively. Patients with isolated LM disease or LM plus 1VD underwent PCI in 81.2% of cases and CABG in 15.6%. Patients with LM disease and 2VD or 3VD underwent PCI in 18.9% of cases and CABG in 70.6%. There was an equal split of 45.7% PCI and 45.7% CABG in patients with 3VD without LM disease, whereas 8.5% of patients received medical therapy. Patients in Group 3 with a previous CABG

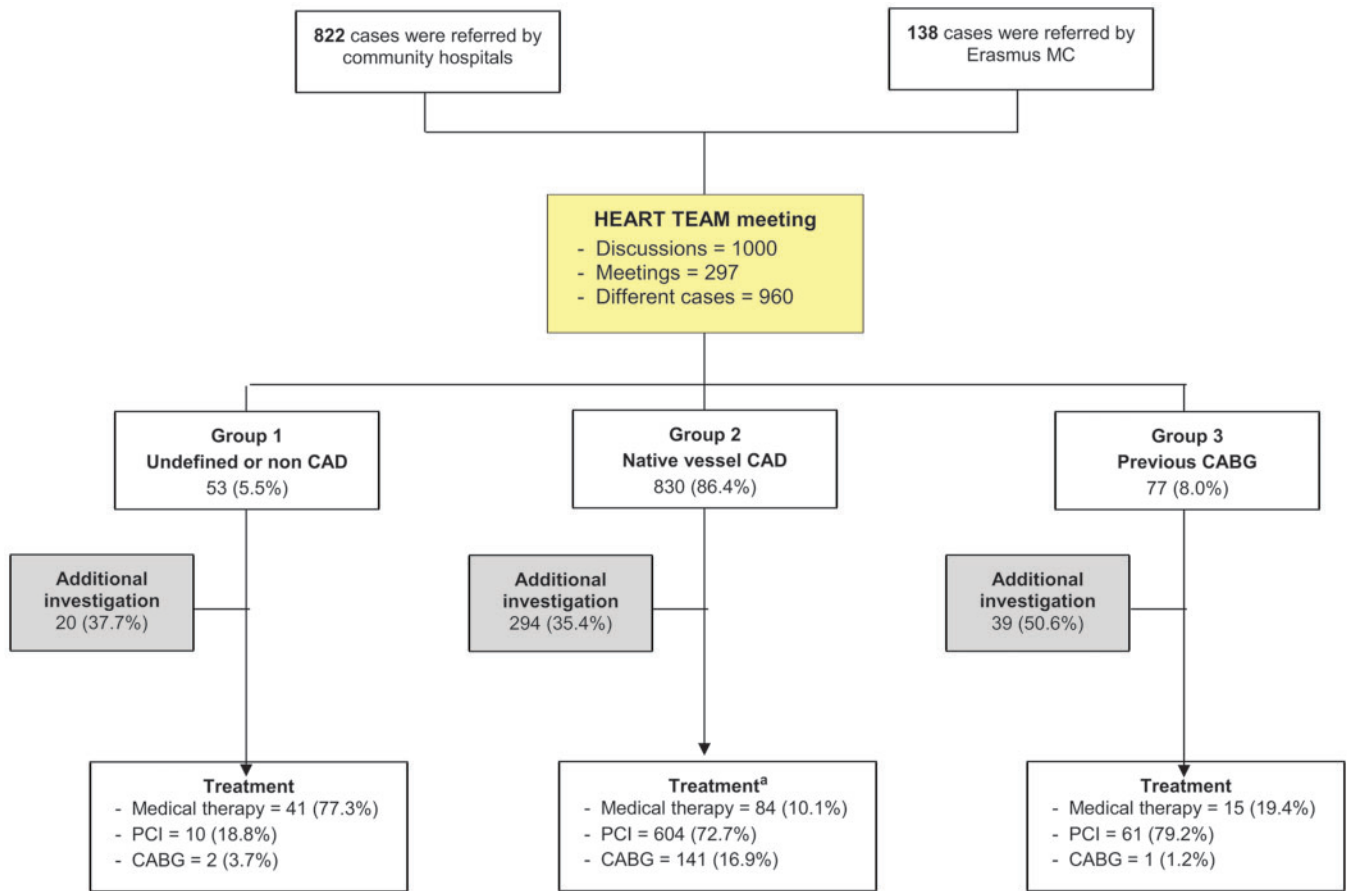


Figure 1: Patient flowchart according to clinical presentation. ^aOne patient was lost to follow-up. Additional investigation: clinical evaluation (comorbidity evaluation or other specialist opinion), non-invasive cardiac imaging (myocardial ischaemia test, dobutamine stress echocardiography, magnetic resonance imaging and multi-slice computed tomography) and invasive cardiac imaging (intravascular ultrasound, coronary angiography and coronary angiography with fractional flow reserve). CABG: coronary artery bypass grafting; CAD: coronary artery disease; PCI: percutaneous coronary intervention.

Time interval between the different care steps involved in the decision-making process of the Heart Team

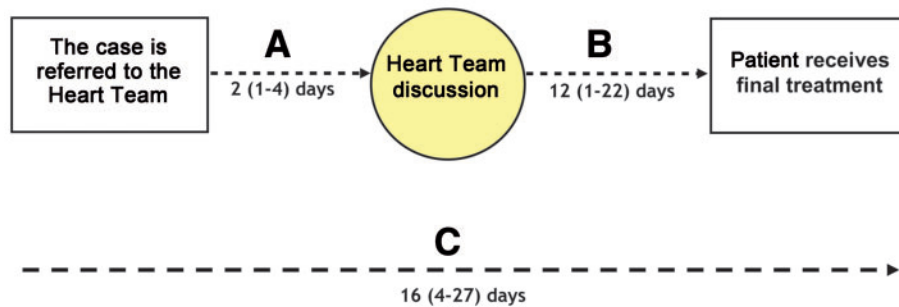


Figure 2: Time from referral from community hospitals to the Heart Team discussion and treatment. Times represent referral by the community hospital to the Heart Team discussion (A); from the Heart Team discussion to final treatment (B); and from referral to final treatment including the discussion in the Heart Team meeting (C). The median of time in days and its corresponding interquartile range (Q1–Q3).

underwent PCI in 79.2% of cases and received medical therapy in 19.4%, whereas only 1 redo CABG was performed.

Long-term survival

Twenty-six patients were lost to follow-up during a median time of 4.6 years (Q1–Q3 4.2–5.0). The 5-year mortality rate of patients

with simple native-vessel CAD was comparable for 1VD or 2VD with proximal LAD involvement (16.4%) and for 1VD or 2VD without proximal LAD involvement (15.7%) ($P=0.70$) (Fig. 4A). Patients with isolated LM or in combination with 1VD showed the lowest mortality rate (3.4%), whereas those patients with LM and additional 2VD or 3VD had the highest mortality rate (26.9%) after 5 years (Fig. 4B). Patients with 3VD without LM disease had a mortality rate of 17.1% after 5 years of follow-up.

DISCUSSION

This study includes all of the steps of care of a large group of patients with CAD discussed by a real-world Heart Team. By analysing 1000 cases discussed by the Heart Team from referral to

Table 3: Heart Team recommendations for additional investigations

Additional investigation request	Patients (n=1000)
Any request	35.3 (353/1000)
Clinical evaluation ^a	2.4 (24/1000)
Non-invasive cardiac imaging	4.3 (43/1000)
Myocardial ischaemia test ^b	16.6 (7/43)
Dobutamine stress echocardiography	23.3 (10/43)
Magnetic resonance imaging	32.6 (14/43)
Multislice computed tomography	27.9 (12/43)
Invasive cardiac imaging	29.2 (292/1000)
Intravascular ultrasound	0.3 (1/292)
Coronary angiography	30.1 (88/292)
Coronary angiography with fractional flow reserve	69.5 (203/292)

Values are shown as % (n/N).

^aFurther clinical evaluation when the clinical status of a patient has changed or other non-cardiac comorbidities have been diagnosed during the interval between referral and the Heart Team meeting.

^bNon-specific request.

long-term survival, we found a structured Heart Team approach to be feasible and safe in formulating treatment strategies for patients with CAD. Heart Team discussions have not been widely implemented despite the well-established multidisciplinary approach in other specialties and the fact that the need for Heart Team decision making for CAD is emphasized to promote transparency in decision making, improve the exchange of knowledge, adhere to established guidelines and minimize physician-related bias [5–10]. This study provides more evidence to support Heart Team decision making.

From a logistical standpoint, our Heart Team meetings are held early in the morning to avoid interference with other clinical obligations. This timing also allows the treatment recommendations to be performed during the day of the meeting, when necessary, limiting further treatment delays. According to the 2014 European Society of Cardiology/European Association for Cardio-Thoracic Surgery (ESC/EACTS) guidelines on myocardial revascularization, PCI or CABG should be performed within 6 weeks after angiography for patients with simple CAD and within 2 weeks for patients with a high-risk anatomical configuration [3], based on adverse events that may occur in patients on the wait list for revascularization [11]. In this study, revascularization was performed within 6 weeks after referral in the majority of patients, and within 2 weeks in 51.4% of cases with complex CAD. It is important to acknowledge that even with a Heart Team discussion, revascularization can be performed within the recommended time intervals and thus can be considered safe.

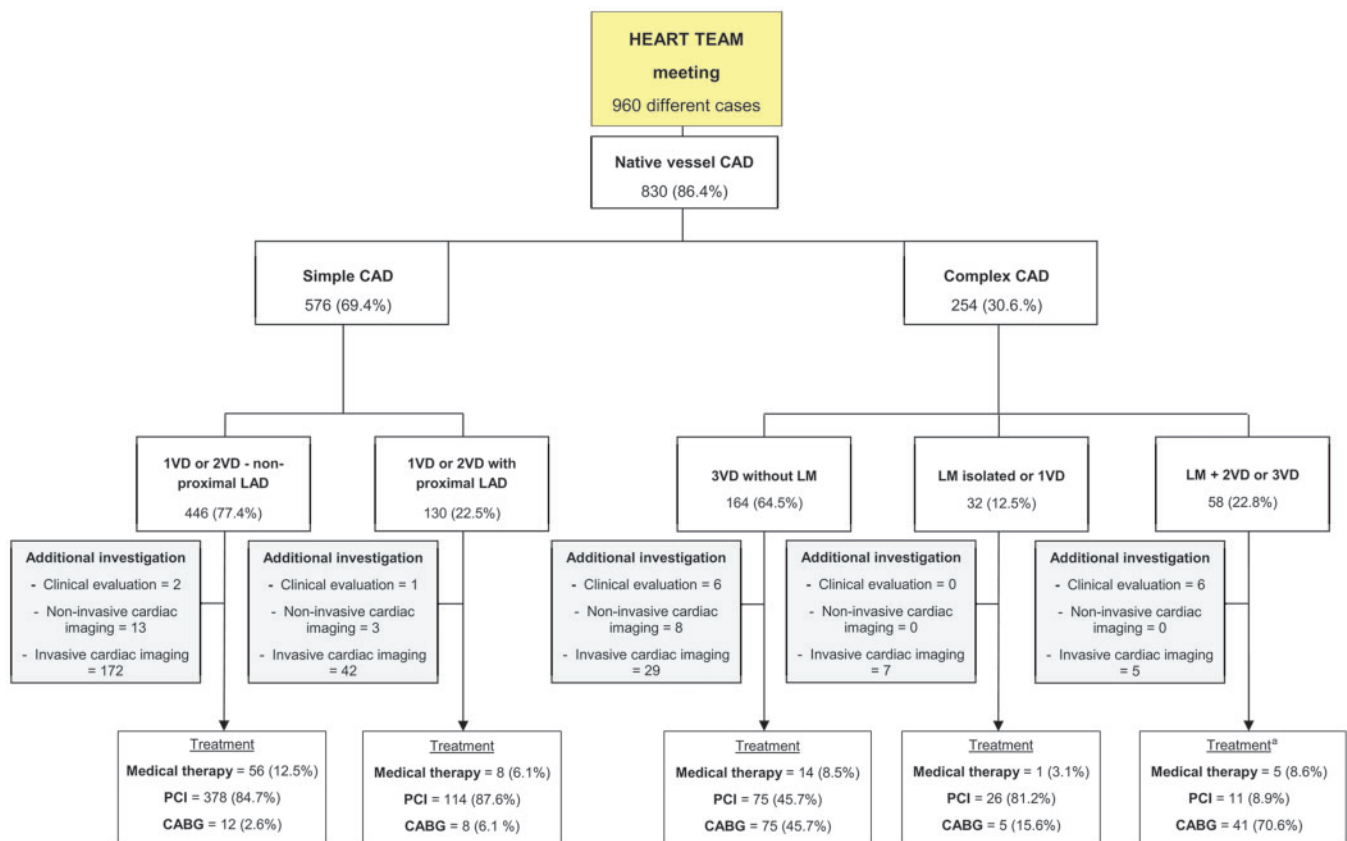


Figure 3: Patient flowchart according to complexity of disease. ^aOne patient was lost to follow-up. 1VD: single-vessel disease; 2VD: 2-vessel disease; 3VD: 3-vessel disease; CABG: coronary artery bypass grafting; CAD: coronary artery disease; LAD: left anterior descending; LM: left main; PCI: percutaneous coronary intervention.

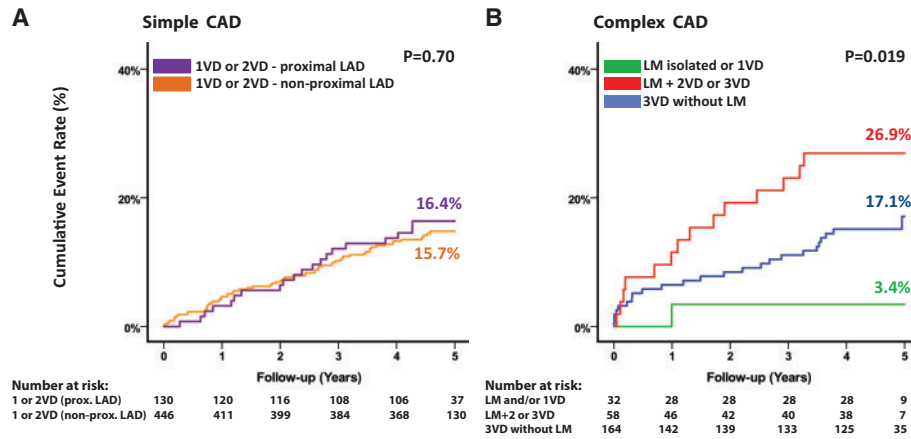


Figure 4: All-cause death after Heart Team proposed treatment for patients with native vessel CAD. **(A)** An analysis of patients with simple CAD; **(B)** an analysis of patients with complex CAD. 1VD: single-vessel disease; 2VD: 2-vessel disease; 3VD: 3-vessel disease; CAD: coronary artery disease; LAD: left anterior descending; LM: left main.

In 353 of the cases (35.3%), the Heart Team requested additional diagnostic tests before deciding on a specific treatment recommendation. Due to their complexity, 40 cases (4%) were rediscussed before a decision could be reached. This means that Heart Team decision making can be further optimized by providing adequate information and imaging at the time of the meeting so that a decision can be reached immediately. Nevertheless, even after assessing the patient's record, reviewing the cardiac images, and carefully considering the risks and benefits of revascularization, in 2.4% of cases, there was a need to clinically evaluate the patient. This critical look exemplifies how the multidisciplinary heart team approach promotes customized, patient-centred care. Furthermore, the Heart Team aims to increase agreement among surgeons and cardiologists, which enables a more consistent tailor-made final treatment recommendation and a bidirectional exchange of information and preferences between physicians, patients and their families. Indeed, numerous studies have shown that multidisciplinary teams in oncology changed the initial management plan because of new insights or newly clarified diagnostic information and improved patient satisfaction by providing a shared decision-making process [12].

Other studies have explored different aspects of the Heart Team decision making. Denvir *et al.* [13] assessed variations in decisions to revascularize patients with CAD between specialists and found that there was a statistically significant poor agreement between cardiac clinical specialists in the choice of treatment offered to patients. An open discussion appeared to improve agreement by providing more evidence to support the Heart Team discussions and thereby improving the decision making. This finding has been demonstrated by Sanchez *et al.* [14], who found that the decision to revascularize, as provided by the Heart Team was appropriate according to the Appropriate Use Criteria in 99.3% of cases. Importantly, our data add to the existing literature on using a Heart Team by showing that the treatment recommendation of CABG, PCI or medical therapy as provided by the Heart Team was consistent with clinical guideline recommendations [3]. Patients with simple native vessel CAD most often underwent PCI, whereas patients with more complex diseases increasingly underwent CABG. Only 1 patient who presented with angina after previous CABG underwent redo CABG; the remaining patients received either medical therapy or PCI, which is the recommended strategy

in patients with atherosclerotic graft disease [3, 4]. Several studies found that the Heart Team treatment suggestion was implemented in >90% of the cases [15, 16]. In cases in which the Heart Team decision was not implemented, this was usually due to factors unknown at the time of the discussion [15, 16]. However, some patients require urgent PCI while awaiting CABG, which may cause deviations from the Heart Team suggestion.

Non-primary PCI without on-site surgical backup is controversial and may lead to physician-related bias. Success and failure in the care of patients, especially those with multivessel CAD, hinge on communication between surgeons and cardiologists. Therefore, clear protocols by national regulatory bodies on which patient should be discussed within a Heart Team are warranted. Patients who received revascularization without a documented Heart Team decision will only be covered legally if the procedure is performed according to national guidelines.

Our analysis provides novel insights into the real-world, long-term survival of patients treated according to the Heart Team decisions. In the SYNTAX trial, the 5-year mortality rate in the randomized cohort of patients with LM or 3VD was 11.4% after CABG and 13.9% after PCI. Specifically, patients with 3VD had a mortality rate of 9.2% vs 14.6% after CABG and PCI, respectively [17], which is lower than the 17.1% mortality rate in our study. However, our real-world cohort also included patients who would otherwise not be randomized in the SYNTAX trial; indeed patients in the SYNTAX registries had a 5-year mortality rate of 12.6% (CABG Registry) and 30% (PCI Registry) [18], respectively. Thus survival of the entire SYNTAX cohort will be higher than that of the randomized cohort and more comparable to that of our analysis. Moreover, only patients with *de novo* CAD were included in the SYNTAX trial; whereas we included a large percentage of patients with a history of PCI, which may increase the risk of death during the follow-up period.

Limitations

This study is retrospective; therefore, several inherent limitations should be considered. For example, some information may not have been recorded in patient records; for example, information on SYNTAX scores was available for only 61.4% ($n=156$) of patients with complex disease, so we could not evaluate the

distribution of patients to different treatment strategies according to SYNTAX score tertiles. During the enrolment period of the current study, the calculation of the SYNTAX score was not 'standard point of care' in our hospital.

Moreover, data are available only on decisions made by the Heart Team, so we were unable to assess whether the treatment decisions suggested by the individual Heart Team members were changed during the Heart Team discussion. In addition, although we included 1000 case discussions, the complexity of disease was variable so the groups of patients with specific coronary complexities were too small to compare 5-year survival rates with different treatment strategies.

CONCLUSIONS

The Heart Team approach is feasible and provides transparency for decision making. Decision making and treatment by the Heart Team followed within a short time after patient referral, suggesting that the Heart Team does not compromise maximum waiting times. However, the flow of patients can be further optimized if adequate information and imaging files are available at the time of the Heart Team meeting. The final treatment recommendation by the Heart Team was largely in accordance with clinical guidelines.

SUPPLEMENTARY MATERIAL

Supplementary material is available at *ICVTS* online.

Conflict of interest: A. Pieter Kappetein is an employee of Medtronic. All other authors have no conflict of interest to disclose.

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