Changes in Patient Drawings of the Heart Identify Slow Recovery After Myocardial Infarction

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Objective: The objective of this study was to investigate how changes in heart attack patients' drawings of their heart over the recovery period relate to psychological and functional recovery. **Methods:** Sixty-nine inpatients admitted for acute myocardial infarction at the coronary care unit at a metropolitan hospital completed questionnaires at discharge, including a drawing of what they thought had happened to their heart after their heart attack. Fifty-six patients returned follow-up questionnaires at 3 and 6 months, including heart drawings, cardiac anxiety, time to return to work, changes in exercise frequency, and healthcare use. **Results:** Increases in the size of the heart drawn at the 3-month follow-up relative to discharge were related to slower return to work ($r = 0.48$, $p < .01$), higher cardiac anxiety ($r = 0.35$, $p < .05$), and more phone calls to health services ($r = 0.37$, $p < .05$) as well as increases in worry about another myocardial infarction ($r = 0.39$, $p < .01$), increased activity restriction ($r = 0.34$, $p < .05$), higher use of alternative medicines ($r = 0.40$, $p < .05$), and less frequent exercise ($r = -0.39$, $p < .05$) relative to before the myocardial infarction. **Conclusions:** Drawings of the heart may be useful in identifying patients who have experienced heart attacks who are likely to develop greater heart-focused anxiety, complaints of ill health, and higher use of health care. Increases in the size of the patient's drawing of the heart may reflect increases in the extent to which their heart condition plays on their mind and directs their daily activities. **Key words:** myocardial infarction, drawings, cardiac anxiety, recovery, perceptions.

MI = myocardial infarction; **CAQ** = Cardiac Anxiety Questionnaire.

INTRODUCTION

Patients' perceptions of their heart attack have an important influence on their recovery and return to normal activities. Negative patient beliefs about the ability to resume work, the length of recovery time, and the personal consequences of the heart attack have been found to predict a slower return to work (1–3). More pessimistic perceptions and erroneous beliefs about the patient's heart condition have also been shown to predict greater disability in social interactions, work around the home, and recreation (3,4).

We recently reported the results of a prospective study investigating the use of patients' drawings of their heart as a method to assess patients' perceptions of their heart attack (5). The study found that the amount of damage patients drew on their heart at hospital discharge was a better predictor of recovery than were clinical indicators of damage (troponin T level). We found the greater the area of damage drawn by the patient, the slower to return to work and the poorer perceptions of recovery at 3 months after the myocardial infarction (MI).

A further aspect we have investigated is how changes in the size of the heart drawn by the patient over time are associated with recovery from MI. In previous research, changes in the size of a drawn object have been interpreted as changes in the importance or salience of the object to the individual. For example, children's drawings of Santa Claus have been shown to increase in size as Christmas approaches as Santa becomes a more prominent figure in the child's life (6). In another medical study, cardiac patients drew larger human figures after being told that they needed cardiac surgery than before (7). In the current study, we hypothesized that increases in the size of patients' heart drawings over a 6-month follow-up would indicate increases in patients' focus on the heart and would predict higher cardiac anxiety and poorer recovery.

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METHODS

This study was conducted between June 2002 and August 2003. The sample consisted of 74 consecutive patients admitted to the Coronary Care Unit of Auckland Hospital, New Zealand, for acute myocardial infarction who spoke English, were aged less then 70 years, had no other serious comorbid conditions, and gave informed consent. The Ministry of Health Ethics Committee approved the study. Sixty-eight of the participants were men and the mean age was 55 years (standard deviation [SD] = 8.1). Most participants ($n = 47$) were European in origin; 15 were Asian, 10 Maori or Pacific Islanders, and two were from other races. At the time of their MI, 39 worked full-time, 10 worked part-time, 11 were retired, and 14 were unemployed, working in the home, or on sickness payments. Fifteen participants had been diagnosed with a previous MI. The average stay in the hospital was 9.5 days (SD = 5.4). Five participants did not return the initial questionnaire: one died in the hospital, one withdrew from the study, and three did not return the questionnaire.

The sample size for this study was made assuming 50% of patients would be unavailable for final assessment. Thirty-five patients would provide sufficient power (80%) to detect (at the 5% significance level) a difference in drawing height of half a SD (approximately 5 mm). Differences of this magnitude would be sufficient to enable correlations of 0.45 and above to reach conventional statistical significance. In cross-sectional analysis of the baseline data, 70 patients enable correlations of at least 0.33 to be detected.

Procedures and Measures

Participants were given a questionnaire to complete at hospital discharge that included the following instructions: "Please draw a picture of what you think your heart looked like before your heart attack and another picture of what you think has happened to your heart after your heart attack. We are not interested in your drawing ability; a simple sketch is fine. We are interested in what you think has happened to your heart." The participants were provided with two blank boxes in which to draw their heart before and after their MI; each box measured 95 mm wide × 120 mm long.

Three months and 6 months after enrollment in the study, participants were sent follow-up questionnaires that stated: "Please draw a picture of what you think your heart now looks like, noting any damage or blocked arteries. We are not interested in your drawing ability; a simple sketch is fine. We are interested in your ideas about what has happened to your heart." Patients were again provided with a blank box of the same dimensions in which to draw their heart, titled "Picture of my heart 3 months after my heart attack" or

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"Picture of my heart 6 months after my heart attack." A photocopy of the patients' previous drawings was included to remind them of what they had drawn on earlier occasions.

To assess perceptions of heart damage, the amount of damage drawn on the heart at discharge was measured using ImageJ software (8). Results of the effect of these perceptions on recovery have been reported elsewhere (5). At discharge, patients were also asked to rate their understanding of their heart condition on a scale from 0 = "do not understand at all" to 10 = "understand very clearly."

Health behaviors were assessed at discharge and at both follow-up points. At discharge, patients were asked how often in the average week *before their admission to the hospital,* they engaged in strenuous or moderately strenuous exercise (e.g., brisk walking) and took alternative or complementary remedies. The response options were never, once a month, once a week, two to three times per week, four to five times per week, and every day, and were coded from 0 to 5. At both follow-up points, these questions were repeated but in reference to the average week *after the heart attack*. In addition, at discharge, they were asked how much they thought they would have to restrict their activities as a result of their heart condition on a scale from 0 = "not at all" to 10 = "enormously." At both follow-up points, they were asked how much they restricted their activities as a result of their heart condition on the same scale.

To assess anxiety at the follow-up points, patients were administered the Cardiac Anxiety Questionnaire (CAQ), an 18-item scale that assesses heart focused attention, fear, and avoidance (9). The scale has good internal reliability (Cronbach's alpha for the overall scale = 0.83) and higher scores represent greater anxiety. At all three time points, patients were also asked to rate their worry about another heart attack on an 11-point scale from 0 = "not at all worried" to 10 = "extremely worried."

At the 3-month follow up, medical visits were also assessed. Patients were asked to report how many times they had rung the hospital or general practitioner with questions related to their heart condition, number of visits to the general practitioner or emergency room, and number of visits to a cardiologist since the heart attack as a result of their heart condition. Patients were asked to rate their experience of symptoms from their heart condition on a scale from 0 = "none at all" to 10 = "many severe symptoms" at discharge, 3 months, and 6 months.

Patients were also asked their employment status and the date that they returned to work after their heart attack (if they had been working before their heart attack).

Data Analysis

Using a similar method to previous studies (6,7), the height of patients' drawings was measured from the lowest to the highest point in millimeters. Changes in size were assessed by subtracting the height of the individual's drawing of their heart after their heart attack at discharge from the height of his or her drawing of their heart at follow-up. The normality of variables was established using the Shapiro-Wilk statistic. Spearman's rho correlation coefficients and Mann-Whitney U tests were used for data that were not normally distributed. Pearson correlation coefficient and Student independent groups t test were used for normally distributed variables. Mixed models analysis was used to compare drawing size over time using a first-order autoregressive covariance structure. The mixed models analysis was performed using the mixed procedure and imputation of missing values was performed using the mimpute procedure of SAS. All tests were two-tailed and a p value $<.05$ was considered statistically significant.

RESULTS

In general, patients found the drawing task acceptable. Fifty-nine of the 69 patients who returned the discharge questionnaire drew their heart (86%). Fifty-one of the 62 who returned their 3-month questionnaire drew their heart (82%), and 45 of the 56 who returned their 6-month questionnaire drew their heart (80%). Those patients who did not draw their heart at 6 months largely overlapped with those who did not draw their heart at 3 months (eight patients did not draw their heart at either point).

First, the data were explored to investigate whether there were any systematic differences in the missing data from the collected data. Independent samples t-tests showed no difference in age between those who did and did not return the follow-up questionnaire at 3 months, but patients who returned their questionnaire at 6 months were significantly older (mean = 55.86, 95% confidence interval [CI] = 53.77 to 57.95) than those who did not return the questionnaire (mean = 51.19, 95% CI = 47.11 to 55.26) (p = .04). T-tests showed that there were no differences in age between those who did and did not draw their hearts at either follow-up point. Mann-Whitney U tests revealed no differences between patients who returned their 3-month or 6-month follow-up questionnaires and those who did not or between those who drew hearts and those who did not in troponin T, understanding of their heart condition at discharge, or size of damage drawn at discharge. We also explored whether there were any differences in outcome measures between patients who drew their heart and patients who did not in those who returned their follow-up questionnaires. Mann-Whitney U tests revealed no differences between groups in return to work, cardiac anxiety, changes in worry, exercise frequency, activity restriction, symptoms, alternative medicine use, phone calls, or medical visits.

To investigate whether there were any changes in mean drawing size among discharge, 3 months, and 6 months, a mixed models analysis was conducted. The main effect of time was significant (p = .0048). Post hoc examination (Tukey) of this effect yielded significant differences between baseline and 6 months and 3 months and 6 months, but the difference in height between baseline and 3 months failed to reach statistical significance. A test for linear trend was significant (p = .02). The means (95% CIs) for baseline, 3 months, and 6 months were 64.2 mm (62.1 to 66.4), 66.7 mm (64.5 to 68.85), and 69.2 mm (67.1 to 71.4), respectively. This model used a fully saturated data set with missing values replaced using a maximum likelihood imputation method.

Change in drawing size was normally distributed with a mean change in size between 3 months and discharge of 2.69 mm (95% CI = −2.87 to 8.26, range = −27 to 39) and a mean change in size between 6 months and discharge of 7.91 mm (95% CI = 3.07 to 12.74, range = −14 to 40). Two examples of how patients' drawings changed in size over time are shown in Figure 1.

To investigate whether any variables predicted change in drawing size between 3 months and discharge, Spearman's rho correlations were conducted. There were no significant correlations between change in size at 3 months and in-hospital troponin T (r = −0.23, p = .12), perceived damage at discharge (r = 0.01, p = .95), or understanding of the heart attack at discharge (r = 0.04, p = .77). A Pearson correlation coefficient was then calculated to explore whether age predicted change in drawing size. Age was not significantly

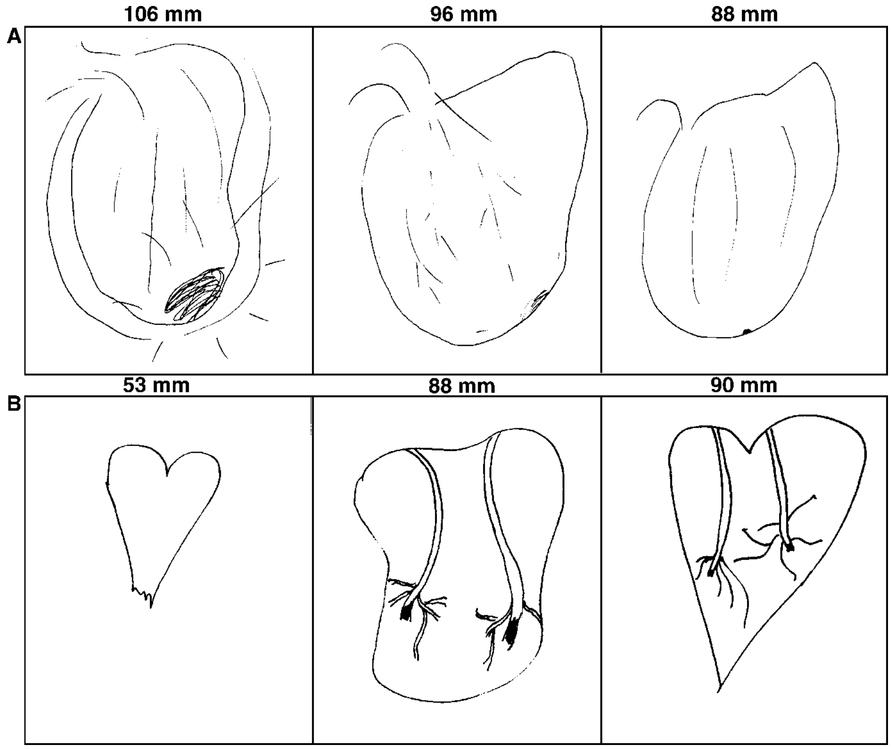

Figure 1. (**A**) An example of a patient's drawings decreasing in height from discharge to 3 months and 6 months. (**B**) An example of another patient's drawings increasing in height among discharge, 3 months, and 6 months.

associated with change in drawing size over the first 3 months ($r = 0.27$, $p = .07$).

Similarly, Spearman's rho correlations showed that change in drawing size over the recovery period from discharge to 6 months was not predicted by troponin T ($r = -0.28$, $p = .09$), damage drawn at discharge ($r = 0.01$, $p = .99$), or understanding of the heart condition at discharge ($r = 0.08$, $p = .63$), although there was a nonsignificant trend for lower troponin T values to be associated with larger drawings. Pearson correlations showed that change in size of drawings from discharge to 6 months was associated with age such that younger age predicted greater increases in drawing size over the recovery period ($r = -0.45$, $p = .005$).

To assess whether increased drawing size was associated with health outcomes, Spearman's rho correlations were conducted (Table 1). These results show that the bigger the increase in drawing size, the higher cardiac anxiety, slower return to work, greater increase in worry about another MI, greater decrease in frequency of exercise, greater increase in activity restriction, greater increase in use of alternative medicines, and the more phone calls to the general practitioner or medical center over the first 3-month recovery period. Changes in size were not significantly associated with reported cardiac symptoms or medical visits. A graph of the relationship between change in height of drawing at 3 months and speed of return to work is shown in Figure 2.

Independent samples *t*-tests were conducted to further investigate whether there were any differences in change in size of heart drawn between groups based on medical care use. Patients who called their general practitioner or hospital at least once as a result of their heart condition ($N = 30$) had a mean change in drawing height of 11.07 mm (95% CI = 3.12 to 19.02) over the 3-month period. In contrast, those who did

TABLE 1. Spearman Correlations Between Change in Height of Heart Drawing Over the Recovery Period With Health Outcomes

	Change in Height at 3 Months ($N = 44$)	Change in Height at 6 Months ($N = 37$)
Health Outcomes		
Cardiac Anxiety Questionnaire (total)	0.35[a]	0.05
Return to work (days)	0.48[b]	0.42[a]
Change in worry about another myocardial infarction	0.39[b]	0.38[a]
Change in exercise frequency	−0.39[a]	−0.14
Change in restriction of activity	0.34[a]	0.18
Change in alternative medicine use	0.40[a]	0.16
Phone calls to general practitioner/hospital	0.37[a]	
Visits to general practitioner/ medical center	0.03	
Visits to a cardiologist	0.12	
Changes in cardiac symptoms	0.18	0.05

[a] Correlation is significant at the 0.05 level (two-tailed).
[b] Correlation is significant at the 0.01 level (two-tailed).

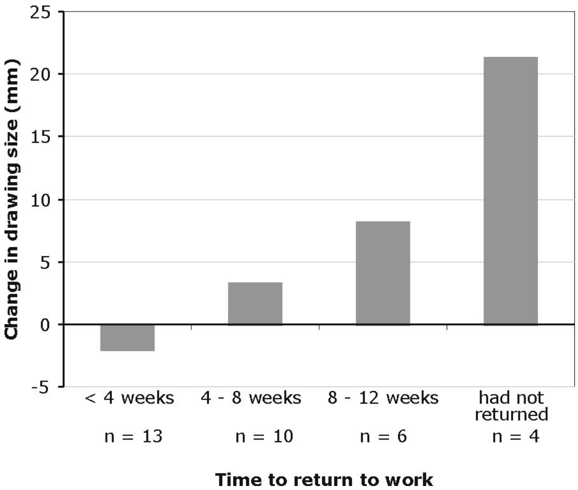

Figure 2. The relationship between change in height of drawing between discharge and 3 months and time to return to work.

not call ($N = 14$) had a mean change in height of -0.73 mm (95% CI = -6.64 to 5.18). This difference was statistically significant ($p = .02$). There were no statistically significant differences in change in height of drawings between groups based on number of medical care visits.

DISCUSSION

On average, patients' drawings of their hearts increased in size over the follow-up period in a linear fashion. Increases in size at both 3 months and 6 months were associated with slower return to work and increased worry about another MI, and at 3 months were associated with higher cardiac anxiety, less frequent exercise, greater activity restriction, greater use of alternative medicines, and more phone calls to the general practitioner or hospital.

These results suggest that patient drawings of their heart may be used as a marker for increased cardiac anxiety and an intensified focus on the heart that may be unhelpful in promoting recovery after MI. The findings are consistent with previous work that has shown that drawing size increases as the saliency of the object to the individual increases (6,10). Drawing size in heart patients seems to pick up the importance of the heart in directing the patients' day-to-day activity. Size increases were not significantly related to changes in symptom reports or medical visits, which suggests that drawing changes were not simply reflecting ongoing medical problems.

The study indicates the potential application of patient drawings in the cardiology area. The content of the drawings may be a useful way to check the patient's understanding of their heart condition and as a method of correcting misunderstandings about damage, heart functioning, and the necessity for future interventions. By looking at a series of a patient's drawings performed over a period of time, the dynamics of their perceptions can be appraised. For example, a patient who drew damage on their heart while in the hospital may draw a reduced area of damage in a follow-up drawing, indicating a perceived improvement and reducing perception about the timeline of their condition (see Fig. 1A). Similarly, a patient who drew blockages in the hospital may draw clear arteries at follow up, indicating perceptions of cure. Figure 1B shows change from a Valentine-style heart drawing to more complicated drawings of blocked arteries, which suggests increased awareness of heart disease. However, this change was not common; patients tended to stick either to a Valentine-style or a more medicalized style of drawing. Looking at differences in outcomes between those who draw simple style hearts versus those who draw a more medical view could be an area for future work.

Drawings are an alternative way of assessing patients' illness perceptions to questionnaires or interviews. Drawings of how the heart has been affected by a heart attack measure perceptions that are not picked up by illness perception questionnaires such as the Illness Perception Questionnaire (11). Furthermore, drawings can illustrate ideas in a more concrete and specific way than words. For example, when a patient says "my arteries are blocked," they may be thinking about very different arteries to their cardiologist. Drawings can clearly show which arteries the patient is referring to. Drawings also offer a window into the patient's psychological world and are an indicator of whether the patient's concerns and anxiety are likely to interfere with their long-term functional recovery. More research needs to be performed to develop drawings into a predictive tool resulting from the large variability in what patients draw.

It may be that heart drawings have a role to play when patients are denying symptoms or cardiac illness, but this needs to be established in future research. Drawing may also be useful in other illnesses of the heart such as heart failure. They may also be applicable to illnesses in other parts of the body such as tumors of the lung, and this is an area for future work to explore.

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