Original Article

Pattern and Outcome of Subsidised Referrals to Cardiology Specialist Outpatient Clinics

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Abstract

Introduction: Increasing demand for public healthcare and access to specialist care has become a major concern. Characterising the referral pattern to a national centre's cardiology specialist outpatient clinics (SOCs) and the diagnostic outcomes may be useful in formulating referral guidelines to contain rising demand. Materials and Methods: A prospective observational follow-up study was conducted of all consecutive new patient referrals to the cardiology SOCs of the National Heart Centre over a 1-month period. The records of these 1224 patients were reviewed following their first visit and again after 3 months of evaluation and investigation. Patients' demographics, referral sources, indications of referral, risk factors, provisional and final diagnoses were collected. Referrals from the top 2 volume sources (government polyclinics and hospital Emergency Department) accounted for 600 referrals. These subsidised referrals formed the study group for analysis. Results: The mean age of referred patients was 56 ± 15.2 years, with equal proportion of males and females. Most patients had known cardiac risk factors of hypertension (53.2%) and hyperlipidaemia (42.3%). Only 23% of referrals had significant cardiac abnormalities. Referrals for typical chest pain derived the highest yield whereas referrals for atypical chest pain, non-cardiac chest pain derived the lowest yield. Referrals for asymptomatic electrocardiogram (ECG) changes (except for atrial flutter/fibrillation) did not yield cardiac abnormalities. Multivariate analysis of chest pain referrals showed typical chest pain and hyperlipidaemia to be statistically significant predictors for coronary artery disease. Conclusion: Referrals to cardiology outpatient specialist clinics should be based on the presence of patient symptoms, particularly that of typical chest pain. In asymptomatic patients, routine ECG screening did not appear to yield significant cardiac abnormalities.

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Key words: Diagnostic outcome, Outcome, Referral, Symptoms

Introduction

Singapore faces an increasing demand for public healthcare from an ageing population in need of chronic care. At our cardiology specialist outpatient clinics, the volume of new cardiology subsidised outpatients has increased at an average of 12.8% per annum for the past 10 years.

The increasing demand for cardiology care may be attributed to the belief that cardiac events can be prevented by screening for coronary artery disease (CAD). Patients or primary care physicians may request screening tests, leading to referrals of patients with doubtful results to cardiologists. Nevertheless, it has been suggested that demand for specialist care is not entirely rational and there can be increased utilisation without evidence of improved outcome.[1,2] Over-referral may contribute to fragmented care, over consumption of services, patient confusion and complacency on the part of generalists, diminishing their desire to continually acquire new skills and knowledge.[3-5]

To date, there has been no local study that examines the referral pattern and diagnostic outcomes of cardiology referrals. While a number of overseas studies have examined the quality or appropriateness of referral to specialist care,[4,6-8] these studies examined appropriateness based on the

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opinions or satisfaction of specialists at the initial visit, but did not examine the actual outcome of the referrals. We are not aware of any similar local study that followed the referrals for clinical outcomes.

Subsidised patients form the majority of the workload at the National Heart Centre. The main referral sources of such patients are the Emergency Department (ED) at the Singapore General Hospital (SGH) and the government polyclinics. This study aimed to investigate the pattern of subsidised referrals to a cardiology specialist outpatient clinic (SOC) and the diagnostic outcomes to understand the nature of the demand.

Materials and Methods

Survey of New Referrals

A prospective observational study was conducted of all new consecutive referrals to the Cardiology specialist outpatient clinics of National Heart Centre (NHC) over a 1-month period (1 November to 2 December 2005). The records of patients were reviewed at their first visit and again after 3 months of evaluation and investigation. Ethics approval was obtained from the relevant Institution Review Board. Patient informed consent was not required as this study involved patient record review only. The design of the survey was based on common symptoms that were written on referral letters and the common questions that were asked at initial consultation. We collected information on demographics, referral sources, indications for referral, referral type (urgent or non-urgent), cardiovascular risk factors (based on details given in the referral letter and patients' self-report at the initial consultation), types of investigations done, provisional and final diagnoses. Prior to knowledge about diagnostic outcomes, doctors at NHC classified chest pain according to the 3 categories of Diamond[9]: typical chest pain, atypical chest pain and non-cardiac chest pain.

Analysis of Referral Patterns, Outcomes and Yield

A total of 1224 patients attended the cardiology SOCs as new referrals during the study period. Main referral sources were government polyclinics (418 patients) and the ED of SGH (182 patients). These 600 subsidised referral patients formed the study group. Their outcomes were tracked beyond the initial visit until the results of any further investigations ordered were obtained. The diagnostic outcomes for these referrals were determined. A positive outcome was defined as a cardiac abnormality with a diagnosis of CAD, valvular disease, arrhythmia, cardiomyopathy, congenital heart disease, or other miscellaneous cardiac abnormalities. Referral yield was defined as the percentage of patients diagnosed with cardiac abnormalities after the first visit or after investigations. Analysis of data was performed with SPSS version 14. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated. A P value <0.05 was considered statistically significant.

Results

Pattern and Yield of Referrals

The demographics and cardiovascular risk factors of the study population (n = 600) are summarised in Table 1. The mean age of these newly referred patients was 56 ± 15.2 years. The proportions of both genders were similar. Compared to the country's ethnic distribution, Chinese and Indian ethnicities were over-represented, while Malay ethnicity was under-represented. The outcomes of these referred patients after the initial consultation are shown in Figure 1. Eighty-seven patients (14.5%) were discharged after the initial consultation, while the remaining 475 patients (79.2%) were scheduled for further cardiac investigations. Table 2 shows the yield for various cardiac abnormalities for these 475 investigated referral cases. Only 139 patients (23.1%) were found to have significant proven or suspected cardiac abnormalities after 3 months of evaluation. CAD was suspected in 10.5%, arrhythmia was present in 5.8%, valvular heart disease in 4.8%, and 2% had miscellaneous abnormalities. No cardiac abnormalities were present in 41%. Fifty-eight patients (9.7%) who were scheduled for cardiac investigations defaulted their appointments and did not return for repeat consultation.

Table 1. Demographics of the Study Population (n = 600)

	No. (%)
Gender	
Male	291 (48.5)
Female	309 (51.5)
Race	
Chinese	499 (83.2)
Indian	55 (9.2)
Malay	37 (6.2)
Others	9 (1.0)
Age	
Mean (SD)	56.0 (15.2) years
Cardiovascular risk factors	
Hypertension	319 (53.2)
Diabetes	102 (17.0)
Hyperlipidaemia	254 (42.3)
Current/ex-smoker	79 (13.2)
Positive family history i.e. first degree relative having CAD, father <55 years old, mother <60 years old	60 (10.0)

CAD: coronary artery disease; SD: standard deviation

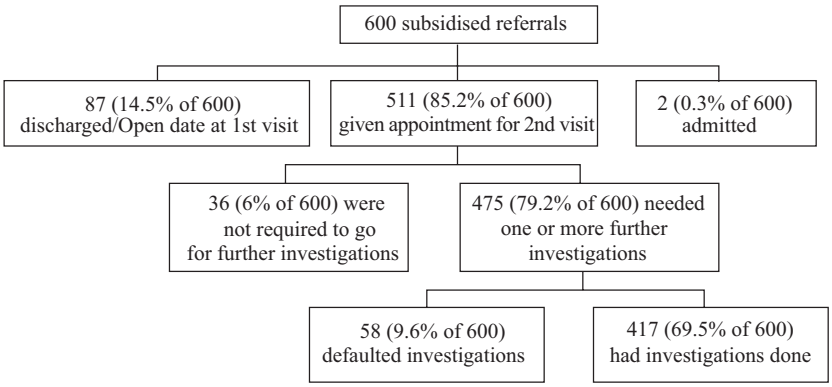

Fig. 1. Outcomes of patients after first consultation.

Table 2. Yield for Different Cardiac Abnormalities after Investigations

Impression after investigation	**No. (% of 600*)**
No cardiac abnormalities	248 (41.3%)
Defaulted	58 (9.7%)
Inconclusive	4 (0.7%)
"Hypertensive heart disease"	27 (4.5%)
Not stated	1 (0.2%)
Suspected coronary artery disease	63 (10.5%)
Coronary artery disease – catheterisation ordered	35 (5.8%)
Coronary artery disease – No catheterisation ordered	28 (4.7%)
Confirmed coronary artery disease by catheterisation†	24 (4.0%)
Arrhythmia	35 (5.8%)
Valvular disease	29 (4.8%)
Miscellaneous abnormalities	12 (2.0%)
Congenital heart disease	5 (0.8%)
Cardiomyopathy	2 (0.3%)
Mildly dilated descending aorta	1 (0.2%)
Nephrotic syndrome	1 (0.2%)
Pericardial effusion	1 (0.2%)
Deep vein thrombosis	1 (0.2%)
Metastatic breast cancer	1 (0.2%)

* Four hundred and seventy-five patients were sent for investigations. Two of them had more than one diagnosis.

† For the 24 patients who were confirmed to have coronary artery disease by catheterisation, 13 were referred for typical chest pain, 5 for atypical chest pain, 3 for breathlessness, 1 for giddiness, 1 for pedal oedema and 1 for chest pain (types not categorised).

Table 3. Breakdown of Different Referral Indications from Government Polyclinics and SGH-ED

Indications of referrals (n = 600)	**No.**	**(%)**
Chest pain	286	(47.7)
Atypical chest pain	172	(28.7)
Non-cardiac chest pain	62	(10.3)
Typical chest pain	49	(8.2)
Not categorised	3	(0.5)
Asymptomatic referrals	119	(19.8)
Reported ECG abnormalities	71	(11.8)
Incidental findings of murmur	15	(2.5)
Known heart disease before	13	(2.2)
Abnormal exercise treadmill	8	(1.3)
Blood pressure issues	6	(1.0)
Patient requested "heart checkup"	3	(0.5)
Not stated	2	(0.3)
Preoperative assessment	1	(0.2)
Others	1	(0.2)
Breathlessness	79	(13.2)
Palpitation	65	(10.8)
Hypertension	12	(2.0)
Syncope	8	(1.3)
Giddiness	7	(1.2)
Lower limb oedema	7	(1.2)
Others	17	(2.8)
Total	600	(100)

Referral Indications and Yield of Cardiac Abnormalities

The referral indications are shown in Table 3. The 2 major referrals indications were chest pain (47.7%) and asymptomatic referrals (19.8%). Other common symptoms for referrals were breathlessness and palpitations. Asymptomatic patients were referred for ECG abnormalities, cardiac murmur, preoperative assessment, abnormal exercise stress tests, or at the patient's request.

The yield for cardiac abnormalities varied according to referral indications (Table 4). The yield for cardiac abnormalities was highest for typical chest pain, which was more than 3 times that of atypical and non-cardiac chest

Table 4. Yield of the Selected Referrals Indications: Symptomatic and Asymptomatic with ECG Abnormalities

Indication of referral from polyclinics and SGH-ED	No.	Yield for cardiac abnormalities with and without investigations	Yield for cardiac abnormalities without investigations	With investigations				
				Yield for cath-confirmed CAD	Yield for suspected CAD	Yield for valvular disease	Yield for arrhythmia	Yield for miscellaneous abnormalities
Symptomatic referrals								
Typical chest pain	49	0.53	0.10	0.27	0.12	0	0.02	0.02
Palpitation	65	0.42	0.03	0	0.03	0.03	0.25	0.08
Breathlessness	79	0.36	0.15	0.04	0.06	0.04	0.01	0.06
Non-cardiac chest pain	62	0.19	0.10	0	0.05	0.02	0.02	0
Atypical chest pain	172	0.17	0.07	0.03	0.05	0.02	0	0
Asymptomatic ECG referrals								
Atrial fibrillation/atrial flutter	12	0.83	0.09	0	0.08	0.08	0.58	0
Right bundle branch block	11	0.09	0	0	0	0.09	0	0
Other ECG abnormalities*	48	0	0	0	0	0	0	0

CAD: coronary artery disease; ECG: electrocardiogram; LVH: left ventricular hypertrophy

*Other ECG abnormalities included ST and T abnormalities, LVH pattern, atrial/junctional extrasystole, sinus bradycardia, premature ventricular contractions, normal ECG but interpreted incorrectly, evidence of previous myocardial infarct, left bundle branch block, Q waves in lead III and sinus tachycardia

Table 5. Logistic Regression of Chest Pain Group (n = 174)

Variable	**B**	**SE**	***P* value**	**OR (95% CI)**
Male gender	0.48	0.48	0.32	1.62 (0.63,4.15)
Hypertension	0.02	0.47	0.97	1.02 (0.41,2.56)
Diabetes	0.42	0.58	0.47	1.53 (0.49,4.74)
Hyperlipidaemia	1.16	0.46	0.01	3.18 (1.30,7.79)
Family history of CAD	-0.48	0.77	0.53	0.62 (0.14,2.79)
Smoking	-0.78	0.79	0.33	0.46 (0.10,2.16)
Chest pain types (vs atypical chest pain)				
Typical chest pain	1.90	0.51	<0.001	6.67 (2.44,18.24)
Non-cardiac chest pain	0.22	0.72	0.76	1.25 (0.31,5.14)
Age	0.04	0.02	0.09	1.04 (0.10,1.08)
Constant	-4.76	1.29	<0.001	0.01

95% CI: 95% confidence interval; CAD: coronary artery disease; OR: odds ratio; SE: standard error

pain. Referrals for asymptomatic ECG abnormalities resulted in a low yield for cardiac abnormalities. The only exception was referrals for atrial fibrillation (which, by itself, is defined as an abnormality).

Chest Pain Referrals and CAD

Referrals for chest pain constituted the biggest proportion, and had higher yield for CAD (Tables 3 and 4). Of these 286 referrals for chest pain, 112 were excluded (8 with prior history of heart disease, 65 patients without further investigations, 14 patients with diagnosis other than CAD, 22 defaulters and 3 with incomplete data). The remaining 174 chest pain referrals were analysed to identify factors associated with CAD. Typical chest pain (OR, 6.67; 95% CI, 2.436-18.242; P <0.001) and hyperlipidaemia (OR, 3.18; 95% CI, 1.297-7.790; P = 0.011) were found to be statistically significant predictors for the diagnosis of CAD after investigations (Table 5). Age as a predictor for CAD only reached borderline significance.

Fast-track Clinics and Yield for Cardiac Abnormalities

Fast-track referrals were available for referring physicians

who request early appointments for urgent cases. Almost all these patients were seen within 14 days of referrals. Only 80 patients (13% of 600) were referred to fast-track clinics. The yield for cardiac abnormalities in this group was 0.34, which is lower compared to those with typical chest pain (yeld = 0.59, Table 3). Only 29% of 49 patients with typical chest pain were referred to fast-track clinics. Among 63 patients diagnosed with CAD after investigations, only 22% were referred to fast-track clinics.

Discussion

This present study is the first in Singapore to examine the utilisation of cardiology SOC services. We did not ask cardiologists to rate the appropriateness of referral. Instead, we followed the outcomes of referrals. Studies where specialists rate appropriateness have reported high proportion of appropriateness of higher than 70%.[4,6-8] Our study examined the outcome of referrals based on an objective measure, the final diagnosis after 3 months of specialist evaluation, and found a low rate of detected abnormalities, suggesting that there may be potential to improve the selection of patients for referral. Of the 600 referrals from government polyclinics or hospital emergency department, only 23% were found to have suspected or proven cardiac abnormalities (e.g., CAD, arrhythmia, valvular disease or other miscellaneous abnormalities) after investigation. While it may be argued that cardiologists are better trained and equipped so as to determine appropriateness compared to referring physicians, our study identified areas where the clinical quality of referrals can be improved.

Diagnostic outcomes were looked at 3 months after the initial consultation. This time frame was chosen in the belief that most cardiac investigations would be completed and the patient would have returned to the SOC for review visit. Indeed, all patients in the study group had cardiac investigations scheduled within 3 months of the initial SOC visit. However, 58 (9.7%) patients defaulted their appointments for cardiac investigations. It is unknown whether these patients sought subsequent treatment elsewhere or experienced adverse events.

Two main findings are evident in our study. First, significant cardiac abnormalities (confirmed or suspected) were detected in only 23% of outpatient cardiology referrals from government polyclinics and hospital emergency department. Approximately 11% of all patients referred were suspected to have CAD, and eventually only 4% had angiography-proven CAD. Second, typical chest pain and hyperlipidaemia were significant predictors for the diagnosis of CAD.

Chest Pain Referrals

The commonest reason for referral was chest pain (47.7%), while the next commonest reason was for ECG abnormalities (11.8%). When chest pain was classified according to the three categories of Diamond[9] (typical, atypical and non-cardiac), atypical chest pain was found to be the most common referral indication. The yield for cardiac abnormalities or CAD was highest for typical chest pain and lowest for atypical and non-cardiac chest pain (Table 3). There is potential for this simple categorisation as a tool to prioritise referrals to cardiology.

We further analysed the probability of detecting CAD in patients with different types of chest pain. Among the 174 patients referred for chest pain, without prior history of heart disease, logistic regression showed that typical chest pain and hyperlipidaemia were independent predictors for the detection of CAD. Diamond and Forrester[10] reported that patients with typical chest pain had a higher prevalence of CAD followed by those with atypical and lastly those with non-cardiac chest pain. Since its publication in 1983,[9] Diamond's chest pain classification has been widely used.[11,12]

Multivariate analyses showed that typical chest pain and hyperlipidaemia were significant predictors for angiographic coronary heart disease.[13,14] While risk factors like smoking, hypertension and positive family history were found to be statistically non-significant predictors, this was likely due to the small sample size and the low prevalence of these risk factors in our population.

ECG Abnormalities

Another common indication of referrals was asymptomatic patients with ECG abnormalities. All of the asymptomatic patients with atrial fibrillation/flutter were classified to have a cardiac abnormality, since atrial fibrillation/flutter is not a normal finding. Other ECG patterns, except the 1 case of right bundle branch block, were found to have no significant cardiac abnormalities. ECG abnormalities other than atrial fibrillation/flutter in asymptomatic patients may be a normal variant and this indication alone may not be sufficient to refer for cardiology care.

Although conventional thinking is to detect CAD early by screening, research has proven otherwise in asymptomatic patients.[15-17] If the prevalence of CAD in the population is low (e.g. 5%), even a highly accurate test such as computed tomography angiography will be calculated to have a 50% false positive rate and a commonly used test i.e., ECG stress test will have an 87% false positive rate. Here, screening may detect CAD in some patients. However, the large number of false-positives generated means more tests will be done unnecessarily. Therefore, routine screening for CAD in patients without symptoms is not recommended due to limited accuracy.

Currently, there is insufficient evidence to recommend routine screening for CAD in asymptomatic adults.[15-18] The Singapore Ministry of Health Clinical Practice Guidelines on Diabetes (2006) recommends ECG screening for diabetic patients at baseline only, with subsequent ECG performed when clinically indicated.[18] Similarly, the American Heart Association and the American College of Cardiology recommend that ECG be repeated on patients with known CAD only when there is a change in symptoms or clinical presentations that is suggestive of dysrhythmia or syncope.[17] Hence, at primary care level, it may be more effective to focus on aggressive risk factor modification and patient education, rather than screening of asymptomatic individuals.

Our findings have significant implications for referrals to cardiology SOCs. Currently our guidelines recommend that patients with suspected acute coronary syndrome (typical symptoms, signs of heart failure, abnormal ECG findings or enzyme elevation) should be transferred immediately by ambulance to the emergency department, while referral for patients without these features should be prioritised based on the assessment of risk. In 2002, NHC piloted a priority "fast-track" referral system for patients to obtain early cardiac appointments at the SOC, based on medical needs. Other public hospital cardiac departments now have similar systems in place. Based on the results of our study, all patients with typical chest pain should be considered for fast-track referral, since the likelihood of catheter-proven CAD is high. Conversely, patients with atypical chest pain, non-anginal chest pain and breathlessness have low likelihood of CAD and can be referred as a routine appointment. Finally, referral of asymptomatic patients with "abnormal" ECG findings other than atrial fibrillation or atrial flutter does not appear to be effective as the yield for cardiac abnormality is low (0.8%).

Conclusion

In a prospective observational study of all consecutive referrals to a tertiary cardiac SOC, only 23% of patients were found to have definite or suspected cardiac abnormalities after 3 months of evaluation and investigation. Typical chest pain and hyperlipidaemia were the best predictors of CAD. Apart from atrial fibrillation or flutter, the likelihood of detecting abnormalities in patients referred for asymptomatic ECG findings was very low. Our findings may be helpful for guiding the selection of patients for referral to cardiac SOCs.

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