ORIGINAL ARTICLE

Aortic dissection in an accident and emergency department in Hong Kong

CME

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Objectives To compare the clinical characteristics of aortic dissection in Hong Kong with the International Registry of Aortic Dissection, and to evaluate the sensitivity of the Accident and Emergency Department in diagnosing aortic dissection and its role in aortic dissection management.

Design Retrospective observational study.

Setting Regional public hospital, Hong Kong.

Patients Newly diagnosed aortic dissection patients attending the Accident and Emergency Department from 2002 to 2005 inclusive.

Main outcome measures Correct diagnosis in Accident and Emergency Department, tertiary unit transfer, and in-patient mortality.

Results Twenty-eight patients were found to have aortic dissection, with an estimated annual incidence of 2.1 per 100 000 inhabitants. The sensitivity of Accident and Emergency Department in diagnosing aortic dissection was 54%; 11% of the patients were diagnosed at postmortem examination. Compared to the International Registry of Aortic Dissection, the patients in this Tseung Kwan O Hospital study had less abrupt and less severe pain, less chest pain, and a lower proportion were operated on. Higher mortality was associated with age 70 years or older (odds ratio=6.4), female gender (21.0), known hypertension (3.8), systolic blood pressure below 100 mm Hg (6.0), aortic dissection not diagnosed in the Accident and Emergency Department (3.2), and the patient not reaching tertiary unit (33.8). The hourly cumulative mortality rate was 1.32%. The group of aortic dissections diagnosed in the Accident and Emergency Department had 55.1% more transfer to tertiary unit (95% confidence interval, 14.4-79.1%; P=0.006), 84.5 hours less transfer time (95.3-263.6 hours; P=0.232), and 27.2% lower mortality (12.6-58.6%; P=0.246). The yield rate of contrast computed tomography of thorax was 43%.

Conclusions Diagnosing aortic dissection in the Accident and Emergency Department enabled optimal disposition and lower in-patient mortality.

Key words
Aneurysm, dissecting; Asian continental ancestry group; Emergency service, hospital; Tomography, spiral computed; Hospital mortality

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Introduction

Aortic dissection (AD) occurs when blood enters the media or the potential space between intima and media, creating a false lumen, which then spreads in an antegrade or retrograde manner within the vessel wall. It does not necessarily imply aneurysmal dilatation in the affected vessel. Therefore dissecting aneurysm is a misnomer.[1] However, "aneurysm, dissecting" is the Medical Subject Heading term of PubMed for AD.

Acute aortic syndrome is a new concept. It embraces a heterogenous group of patients with a similar clinical profile that includes AD, intramural haematoma, and penetrating atherosclerotic aortic ulcer.[2-4]

The annual incidence of AD in western populations was estimated to be 2 to 4 per 100 000,[5,6] and was correctly suspected during initial presentation in 15 to 43% of such patients.[6,7] At initial presentation the diagnosis was missed in up to 38% of patients,[8] about 21% died before admission,[6] and up to 38% were diagnosed at autopsy.[5]

香港急症室內對主動脈剝離的診治研究

目的 就主動脈剝離的臨床特徵，比較香港與國際急性主動脈剝離註冊研究（International Registry of Aortic Dissection, IRAD）的異同，並評估急症室診斷主動脈剝離的敏感度和治療主動脈剝離的角色。

設計 回顧觀察性研究。

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患者 2002至2005年內急症室接獲的主動脈剝離新症。

主要結果測量 急症室的正確診斷率、轉往第三級醫療中心的比率、以及住院死亡率。

結果 28名病人被發現患有主動脈剝離，估計每年主動脈剝離的病發率為每十萬人有2.1人。急症室診斷主動脈剝離的敏感度為54%。在所有主動脈剝離的病人中，11%是經驗屍檢查而診斷的。將本研究的資料與IRAD作比較後，我們發現，本研究的病人較少出現突發疼痛、嚴重疼痛、胸膛疼痛，手術比率亦較低。本研究又發現，以下類別人士死於主動脈剝離的比率較高：70歲或以上人士（風險比率為6.4）、女性（21.0）、已知的高血壓病人（3.8）、收縮壓少於100 mm Hg的病人（6.0）、未經急症室診斷為主動脈剝離的病人（3.2），以及未能轉往第三級醫療中心的主動脈剝離病人（33.8）。每小時主動脈剝離的累積死亡率為1.32%。經急症室診斷為主動脈剝離的病人，轉往第三級醫療中心的比率多出55.1%（95%置信區間為14.4至79.1%；P=0.006），轉往第三級醫療中心所需的時間平均節省84.5小時（95.3至263.6小時；P=0.232），死亡率亦減低27.2%（12.6至58.6%；P=0.246）。以造影胸廓電腦掃描診斷主動脈剝離的發現率為43%。

結論 經急症室診斷為主動脈剝離的病人，所獲的診治安排較佳，住院死亡率也較低。

The International Registry of Aortic Dissection (IRAD) is an ongoing multi-national multi-centre registry started in 1996. It involves 18 large referral centres and has a coordinating centre at the University of Michigan. The Registry's founding objective was to assess the aetiology, mode of presentation, clinical features, management, and outcomes of patients with acute AD.

Hagan et al[9] analysed the data of ADs registered in IRAD from 1996 to 1998, and Mehta et al[10] analysed the data for corresponding Stanford type A dissections. Suzuki et al[11] analysed the data of Stanford type B dissections registered in IRAD from 1996 to 2000. Although China accounts for one fifth of the world population, there were few published studies about the clinical characteristics of AD in Chinese patients.[12,13]

Early diagnosis is important. In 1975, the cumulative mortality was 1% per hour.[14] In the Meszaros et al's study[6] in 1972 to 1998, it was 1.42% per hour (68.2% in 48 hours). In the report by Hagan et al[9] of IRAD registered cases from 1996 to 1998, it was 0.42% (10% in 24 hours).[2]

There were only a few studies on the role of emergency physicians in AD management.[7,13] Moreover, there was a need to know the clinical characteristics of AD in Chinese (as compared to western) populations, and to assess the role of local accident and emergency departments (AEDs) in the diagnosis and management of this condition.

Methods

Setting

Tseung Kwan O Hospital (TKOH) was a secondary care hospital in the Hong Kong Special Administrative Region (HKSAR). It started a 24-hour emergency service on 5 February 2001. The AED had an average annual attendance of 100 000. It served the population of the Sai Kung district, which has a population of 330 000.[15,16] Patients requiring emergency cardiothoracic surgical care would be transferred to the Cardiothoracic Surgery Unit (CTU) of the Queen Elizabeth Hospital (QEH), for which the average travelling time was about 30 minutes. In the early period of the study, some AD patients were transferred to the CTU of the Grantham Hospital (GH).

Selection and exclusion criteria

Newly diagnosed AD patients attending TKOH from January 2002 to December 2005 inclusive were recruited. Patients with known AD and AD diagnosed in the out-patient clinic were excluded.

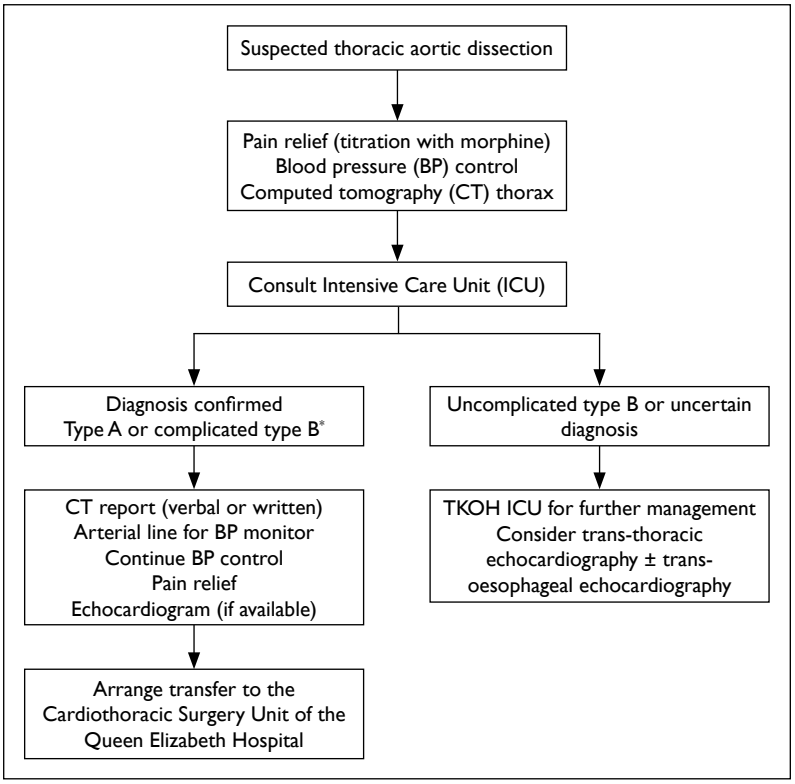
Study design

The medical records of all eligible AD patients in the TKOH were retrieved for review, and included contrast computed tomography (CT) of the thorax and abdomen (the investigation of choice); emergency magnetic resonance imaging (MRI) was unavailable in our hospital. Trans-oesophageal echocardiography (TOE) data, operation records, and postmortem information were also accessed. Our hospital adopted a standardised AD management flowchart (Fig 1) since January 2005.

Data collection

Diagnostic codes for AD in the International Classification of Disease Version 9 with Clinical Modifications with procedure codes (ICD-9CM) were selected. The diagnostic codes for aortic aneurysm were also added for screening purpose as well as the codes for plain and contrast CT thorax in the Radiology Information System Exam Code (RIS Exam Code). The codes are shown in the Box.

There were two main selection criteria: (1) all accident and emergency (A & E) attendees from January 2002 to December 2005 with a diagnostic code of AD,



* Complicated type B aortic dissection included suspected leaking, persistent pain, end-organ ischaemia (neurological, limb, visceral) and aortic aneurysm equal to or larger than 5 cm

FIG 1. The management flowchart for suspected aortic dissection in the Accident and Emergency Department of the Tseung Kwan O Hospital (TKOH)

Coding for diagnosis and investigation for aortic dissection (AD)

a. The diagnostic codes for AD in the International Classification of Disease Version 9 with Clinical Modifications with procedure codes (ICD-9CM)
   - 441.00 dissecting aortic aneurysm
   - 441.01 dissecting thoracic aortic aneurysm
   - dissecting thoracic aortic aneurysm, ruptured
   - dissecting thoracic aortic pseudoaneurysm
   - 441.03 dissecting thoracoabdominal aortic aneurysm
   - 441.1 rupture thoracic aortic aneurysm
   - 441.2 thoracic aortic aneurysm
   - 441.6 rupture thoracoabdominal aortic aneurysm
   - 441.7 thoracoabdominal aortic aneurysm
   - 441.9 aortic aneurysm

b. The investigation codes for computed tomography (CT) thorax in the Radiology Information System Exam Code (RIS Exam Code)
   - 4201 plain CT thorax
   - 4202 intravenous contrast enhanced CT thorax

related diagnosis, or having a contrast CT thorax; (2) all TKOH admissions from January 2002 to December 2005 with a diagnostic code of AD, related diagnosis, or having a contrast CT thorax.

Correct diagnostic codes might not be inputted. Some AD patients might be diagnosed by TOE. Additional patients encountered from January 2002 to December 2005 were screened from: (1) those having a CT thorax requested directly by AED in the Radiology Department directly; (2) those transferred out from TKOH AED or TKOH wards to the three hospitals with cardiothoracic surgery service in HKSAR; and (3) those having postmortem examination with AD diagnosed by the TKOH Pathology Department.

The Clinical Data Analysis & Reporting System (CDARS) was used to generate the patient lists according to the above criteria. Individual patient data were retrieved from the A & E Clinical Information System (AEIS) and Clinical Management System (CMS).

For analytical purposes, all AD patients were divided into (1) survivors versus those who died, (2) ADs diagnosed in the AED versus those diagnosed elsewhere. Outcomes measures were (1) correct diagnosis in AED, (2) successful transfer (in time) to a tertiary unit, and (3) in-patient mortality. Tertiary units were defined as CTUs for Stanford type A and complicated Stanford type B ADs; the TKOH Intensive Care Unit was used for uncomplicated Stanford type B ADs.

Individual patient identifiable data would not be disclosed. The principles of the Declaration of Helsinki 2004 were adopted. Approval of the local research ethics committee was obtained.

Statistics

Summary statistics were presented in terms of frequencies, percentages, means, and standard deviations. Missing data were not defaulted to negative. Statistically significance was defined as P value of less than 0.05.

Comparisons of means of continuous data of two groups were made by independent samples *t* test (2-tailed, equal variance not assumed). Comparisons of means of continuous data of the study with the IRAD data were made by the one sample *t* test (two-tailed). Two-sided Fisher's exact test, rather than Chi squared test was used to compare the categorical data in two groups, because of small sample size.[17] Curve estimation was done for cumulative mortality for AD versus time. Risk estimate analysis yielded odds ratio (OR), 95% confidence interval and P value of Fisher's exact test. Statistical Package for the Social Sciences (Windows version 14.0; SPSS Inc, Chicago [IL], US) was used. Confidence interval of a proportion was calculated by adjusted Wald method.[18] Confidence interval for the difference between two independent proportions was calculated by the Wilson procedure with a correction for continuity.[19]

Results

Case list of aortic dissections in Tseung Kwan O Hospital from 2002 to 2005

Twenty-eight new AD cases were identified, yielding an estimated annual incidence of 2.1 per 100 000 inhabitants; 15 ADs were diagnosed in the AED, 10

TABLE 1. Clinical characteristics of patients with aortic dissection (AD) in Tseung Kwan O Hospital (TKOH) versus International Registry of Aortic Dissection (IRAD)

Clinical feature	TKOH 2002-2005, n=28*	IRAD 1996-1998, n=464*[9]	Mean difference	95% CI of the difference	P value (two-tailed)
Type A AD	15/25 (60%); 40.7-76.6%†	289/464 (62%); 57.8-66.6%†	2.3%	-16.5% to 23.9%‡	0.835§
Age in years (mean; SD)	66.6; 17.6	63.1; 14.0	3.5	-3.3 to 10.3‖	0.300‖
Age ≥70 years	13/28 (46%)	-	-	-	-
Male sex	16/28 (57%)	303/464 (65%)	8.2%	-10.2% to 28.3%‡	0.417§
Hypertension	15/28 (54%)	326/452 (72%)	18.6%	-0.4% to 38.3%‡	0.051§
Diabetes mellitus	1/28 (4%)	23/451 (5%)	1.5%	-15.2% to 5.8%‡	1.000§
Hyperlipidaemia	4/28 (14%)	-	-	-	-
Smoking		-	-	-	-
Smoker	4/28 (14%)				
Ex-smoker	2/28 (7%)				
Non-smoker	7/28 (25%)				
Unknown	15/28 (54%)				
Any pain	25/28 (89%)	443/464 (95%)	6.2%	-2.1% to 24.9%‡	0.150§
Abrupt onset	6/28 (21%)	379/447 (85%)	63.4%	43.0% to 76.2%‡	0.000§
Severe pain	5/28 (18%)	346/382 (91%)	72.7%	52.7% to 84.1%‡	0.000§
Chest pain	12/28 (43%)	331/455 (73%)	29.9%	9.7% to 48.2%‡	0.002§
Back pain	12/28 (43%)	240/451 (53%)	10.4%	-9.9% to 28.8%‡	0.332§
Abdominal pain	5/28 (18%)	133/449 (30%)	11.8%	-8.4% to 23.7%‡	0.205§
Radiating pain	7/28 (25%)	127/449 (28%)	3.3%	-17.3% to 17.6%‡	0.830§
Migrating pain	1/28 (4%)	74/446 (17%)	13.0%	-4.0% to 18.2%‡	0.103§
Syncope	2/28 (7%)	42/447 (9%)	2.3%	-15.7% to 9.0%‡	1.000§
Systolic blood pressure			-	-	-
≥150 mm Hg	14/28 (50%)	221/451 (49%)			
100-149 mm Hg	10/28 (36%)	156/451 (35%)			
81-99 mm Hg	3/28 (11%)	36/450 (8%)			
≤80 mm Hg	1/28 (4%)	38/452 (8%)			
Surgery	6/28 (21%); 9.9-39.9%†	243/464 (52%); 47.8-56.9%†	30.9%	10.4% to 44.2%‡	0.002§
Mortality	11/28 (39%); 23.5-57.6%†	127/464 (27%); 23.4-31.7%†	11.9%	5.8% to 32.3%‡	0.195§

* **Data are shown in No./n (%), except otherwise indicated**
† **Confidence interval of a proportion by adjusted Wald method**
‡ **Confidence interval for the difference between two independent proportions by the Wilson procedure**
§ **Fisher's exact test**
‖ **One sample *t* test**

(36%) were diagnosed or suspected in the ward, and three (11%) only at postmortem.

Sensitivity of the Accident and Emergency Department of the Tseung Kwan O Hospital to diagnose aortic dissections

Thus, for the diagnosed AD, the TKOH AED had a sensitivity of 15/28 (54%).

Presentations of aortic dissection in Tseung Kwan O Hospital

Among the 28 patients with AD, the chief complaints were chest pain in 36% (10/28), back pain in 29% (8/28), abdominal pain in 14% (4/28), syncopal symptoms in 4% (1/28), shoulder pain in 4% (1/28), dizziness in 4% (1/28), coffee ground vomitus in 4% (1/28), shortness of breath in 4% (1/28), and flank pain in 4% (1/28). Regarding the 13 patients with AD not diagnosed in the AED, the chief complaints were: chest pain in 31% (4/13), epigastric pain in 15% (2/13), chest discomfort in 15% (2/13), shortness of breath in 8% (1/13), dizziness in 8% (1/13), collapse in 8% (1/13), flank pain in 8% (1/13), and coffee ground vomitus in 8% (1/13).

Clinical features and outcomes of aortic dissection in Tseung Kwan O Hospital and International Registry of Aortic Dissection

Among the 28 patients with AD admitted to TKOH, 15 had type A and 10 had type B dissections, and in three others (all of whom had an autopsy) the type was nevertheless unknown. Clinical features encountered in our TKOH patients and in IRAD patients are summarised in Table 1. Both groups were comparable with regard to proportion

TABLE 2. Clinical characteristics of Tseung Kwan O Hospital (TKOH) aortic dissection (AD) survivors versus those who died (2002-2005)

	TKOH, AD, survived group, n=17*	TKOH, AD, death group, n=11*	Mean difference	95% CI of the difference	P value (two-tailed)
Age in years (mean; SD)	61.2; 12.2	74.9; 21.7	13.7	-1.7 to 29.1†	0.077†
Age ≥70 years	5/17 (29%)	8/11 (73%)	43.3%	0.7% to 70.2%‡	0.051§
Male	14/17 (82%)	2/11 (18%)	64.2%	21.0% to 84.0%‡	0.001§
Risk factors	9/17 (53%)	9/11 (82%)	28.9%	-12.3% to 57.5%‡	0.226§
Hypertension	7/17 (41%)	8/11 (73%)	31.6%	-10.4% to 61.1%‡	0.137§
Smoking			-	-	-
Smoker	4/17 (24%)	0			
Ex-smoker	2/17 (12%)	0			
Non-smoker	4/17 (24%)	3/11 (27%)			
Unknown	7/17 (41%)	8/11 (73%)			
Hyperlipidaemia	2/17 (12%)	2/11 (18%)	6.4%	-23.6% to 41.8%‡	1.000§
Diabetes mellitus	1/17 (6%)	0	5.9%	-26.7% to 30.8%‡	1.000§
Marfan	0	1	-	-	-
Initial systolic blood pressure in mm Hg (mean; SD)	178.1; 44.9	127.5; 35.2	50.6	19.3 to 81.9†	0.03†
Initial diastolic blood pressure in mm Hg (mean; SD)	95.4; 26.3	74.0; 25.2	21.4	0.8 to 41.9†	0.043†
Pulse per minute (mean; SD)	72.5; 15.7	83.3; 25.3	10.7	-7.4 to 28.9†	0.226†
Type of AD			-	-	-
A	9/17 (53%)	6/11 (55%)			
B	8/17 (47%)	2/11 (18%)			
Unknown	0	3/11 (27%)			
Complications of AD			-	-	-
Present	6/17 (35%)	9/11 (82%)			
Suspected	7/17 (41%)	0			
Absent	4/17 (24%)	2/11 (18%)			
Haemopericardium			-	-	-
Present	1/17 (6%)	7/11 (64%)			
Suspected	0	0			
Absent	16/17 (94%)	4/11 (36%)			
Mediastinal haemorrhage			-	-	-
Present	2/17 (12%)	1/11 (9%)			
Suspected	2/17 (12%)	1/11 (9%)			
Absent	13/17 (76%)	9/11 (82%)			
Haemothorax			-	-	-
Present	1/17 (6%)	4/11 (36%)			
Suspected	0	0			
Absent	16/17 (94%)	7/11 (64%)			
Branches involvement			-	-	-
Present	4/17 (24%)	0			
Suspected	3/17 (18%)	1/11 (9%)			
Absent	10/17 (59%)	10/11 (91%)			
Surgery	5/17 (29%); 13.0-53.4%‖ Type A: 5/9 Type B: 0/8	1/11 (9%); 0.0-39.9%‖ Type A: 1/6 Type B: 0/2 Postmortem: 0/3	20.3%	-18.0% to 48.2%‡	0.355§
Diagnosed in AED	11/17 (65%); 41.2-82.8%‖	4/11 (36%); 15.0-64.8%‖	28.3%	-13.0% to 60.0%‡	0.246§
Transfer to tertiary unit	15/17 (88%); 64.4-98.0%‖	2/11 (18%); 4.0-48.9%‖	70.1%	27.2% to 87.9%‡	0.000§
Transfer time to tertiary unit in hours (mean; SD; 95% CI)	26.6; 64.9; -101.8 to 155.0†	2.2; 1.1; -0.06 to 4.4†	24.4	-11.5 to 60.4†	0.167†

* **Data are shown in No./n (%), except otherwise indicated**
† **Independent samples *t* test**
‡ **Confidence interval for the difference between two independent proportions by the Wilson procedure**
§ **Fisher's exact test**
‖ **Confidence interval of a proportion by adjusted Wald method**

of type A dissections, age, and gender. Patients in TKOH had less abrupt and less severe pain, less chest pain, and were less likely to undergo surgery. The mortality of AD patients in TKOH was 39%, compared to 27% for those

TABLE 3. Odds ratio for aortic dissection (AD) death in Hong Kong versus International Registry of Aortic Dissection (IRAD)

	All AD, Tseung Kwan O Hospital 2002-2005, n=28 (OR, 95% CI; P value of Fisher's exact test)	All AD, IRAD 1996-1998, n=464,[9] (OR)	Type A AD, IRAD 1996-1999, n=547,[10] (OR, 95% CI; P value)	Type B AD, IRAD 1996-2000, n=384,[11] (OR, 95% CI; P value)
Age ≥70 years	6.4, 1.2-34.6; P=0.051	-	1.7, 1.1-2.8; P=0.03	1.6, 0.7-3.6; P=0.3
Sex	Female: 21.0, 2.9-151.4; P=0.001	Female: 1.59*	Female: 1.38, 0.85-2.27; P=0.20	Male†: 0.96, 0.39-2.36; P=0.92
Hypertension	3.8, 0.7-19.7; P=0.137	-	-	-
Hyperlipidaemia	1.7, 0.2-14.0; P=1.000	-	-	-
Systolic blood pressure <100 mm Hg	6.0, 0.5-67.2; P=0.269	-	3.0, 1.8-4.8; P<0.0001	23.8, 10.3-54.9; P<0.001
Not diagnosed in Accident and Emergency Department	3.2, 0.7-15.6; P=0.246	-	-	-
Not reaching tertiary unit	33.8, 4.0-283.2; P=0.000	-	-	-
Transfer time in hours (time, SD, number of patients, P value)	Survival group (t=26.6, SD=64.9, n=15) vs death group (t=2.2, SD=1.1, n=2); P=0.167‡	-	-	-

* **Estimated OR of female for death in IRAD 1996-1998 = {female AD died/female AD survived}/{male AD died/male AD survived} = {33.5% / (100%-33.5%)}/{24.1% /(100%-24.1%)} = 1.586**

† **OR of male for death was presented in the original study**

‡ **Transfer time in the survival group was paradoxically 24.4 hours longer than the dead group, probably due to the small sample size**

in IRAD. Among the 14 AD patients transferred to CTU, 11 were transferred to the QEH and three to the GH. In this subgroup, the operative rate was 43% (6/14) and the mortality was 7% (1/14). Comparison of the latter group with patients in the IRAD database yields a 10% lower operation rate and a 20% lower mortality. The mortality in patients with type A dissections in TKOH was 40% (6/15); 17% (1/6) in those operated on and 56% (5/9) in the remainder. For the 10 type B dissections in the TKOH series, the mortality was 20% (2/10); nil in those operated on, and 20% (2/10) in those treated medically.

Predictors for death in aortic dissections

The clinical characteristics of AD patients who survived and died are compared in Table 2. The ORs for death associated with specific characteristics were calculated and compared with corresponding figures for IRAD patients reported in related articles; the results are shown in Table 3. In the TKOH series, higher mortality ORs were associated with age equal to or older than 70 years, female gender, known hypertension, systolic blood pressure less than 100 mm Hg, patients with AD diagnosed in AED not reaching the tertiary unit. The cumulative mortality curve for our AD in patients is shown in Figure 2. By the curve estimation using SPSS, the formula of estimation of mortality was derived (mortality=$e^{3.721-6.371/t}$), t in hours. In the first 24 hours, cumulative mortality increased 1.32% per hour.

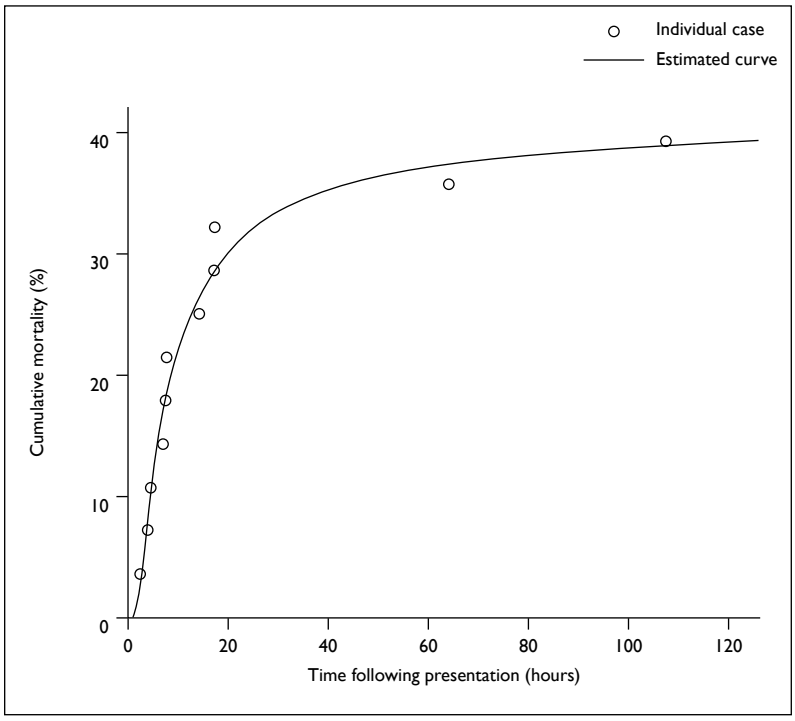


FIG 2. The cumulative mortality rate for aortic dissection (AD) in Tseung Kwan O Hospital, 2002-2005

Diagnosis of aortic dissection in the Accident and Emergency Department of the Tseung Kwan O Hospital

Comparison of the clinical characteristics of patients with AD diagnosed in AED and elsewhere are provided in Table 4. Both groups were similar with respect to age, sex distribution, history of hypertension and diabetes mellitus, initial systolic blood pressure, initial diastolic pressure, and pulse rate. Compared to patients whose AD was diagnosed elsewhere, those who were diagnosed

TABLE 4. Clinical characteristic of aortic dissections (ADs) diagnosed in Tseung Kwan O Hospital (TKOH) Accident and Emergency Department (AED) versus those diagnosed elsewhere (2002-2005)

	AD diagnosed in TKOH AED, n=15*	AD not diagnosed in TKOH AED, n=13*	Mean difference	95% CI of the mean difference	P value (two-tailed)
Age in years (mean; SD)	63.8; 14.7	69.9; 20.5	6.0	-8.2 to 20.3†	0.387†
Age ≥70 years	5/15 (33%)	8/13 (62%)	28.2%	-12.3% to 59.2%‡	0.255§
Male	11/15 (73%)	5/13 (38%)	34.9%	-6.0% to 64.2%‡	0.125§
Risk factors	9/15 (60%)	9/13 (69%)	9.2%	-28.6% to 43.2%‡	0.705§
Hypertension	8/15 (53%)	7/13 (54%)	0.51%	-36.4% to 37.0%‡	1.0§
Smoking			-	-	-
Smoker	3 (20%)	1 (8%)			
Ex-smoker	1 (7%)	1 (8%)			
Non-smoker	5 (33%)	2 (15%)			
Unknown	6 (40%)	9 (69%)			
Hyperlipidaemia	3/15 (20%)	1/13 (8%)	12.3%	-21.2% to 41.6%‡	0.600§
Diabetes mellitus	1/15 (7%)	0	6.7%	-22.4% to 34.0%‡	1.000§
Initial systolic blood pressure in mm Hg (mean; SD)	165.4; 50.5	149.9; 45.1	15.6	-21.6 to 52.7†	0.397†
Initial diastolic blood pressure in mm Hg (mean; SD)	93.3; 28.6	79.6; 25.4	13.7	-7.2 to 34.7†	0.190†
Pulse per minute (mean; SD)	74.2; 24.6	79.7; 14.2	5.5	-10.0 to 20.9†	0.469†
Type of AD			-	-	-
A	8 (53%)	7 (54%)			
B	7 (47%)	3 (23%)			
Unknown	0	3 (23%)			
Complications of AD			-	-	-
Present	8 (53%)	7 (54%)			
Suspected	3 (20%)	1 (8%)			
Absent	4 (27%)	5 (38%)			
Haemopericardium			-	-	-
Present	4 (27%)	4 (31%)			
Suspected	0	0			
Absent	11 (73%)	9 (69%)			
Mediastinal haemorrhage			-	-	-
Present	2 (13%)	1 (8%)			
Suspected	2 (13%)	1 (8%)			
Absent	11 (73%)	11 (85%)			
Haemothorax			-	-	-
Present	2 (13%)	3 (23%)			
Suspected	0	0			
Absent	13 (87%)	10 (77%)			
Branches involvement			-	-	-
Present	3 (20%)	1 (8%)			
Suspected	3 (20%)	1 (8%)			
Absent	9 (60%)	11 (85%)			
Surgery	5/15 (33.3%); 15.0-58.5%‖ Type A: 5/8 Type B: 0/7	1/13 (7.7%); 0-35.4%‖ Type A: 1/7 Type B: 0/3 Postmortem: 0/3	25.6%	-10.8% to 54.6%‡	0.173§
Mortality	4/15 (26.7%); 10.5-52.4%‖	7/13 (53.8%); 29.1-76.8%‖	27.2%	-12.6% to 58.5%‡	0.246§
Transfer to tertiary unit	13/15 (86.7%); 60.9-97.5%‖	4/13 (30.8%); 12.4-58.0%‖	55.1%	14.4% to 79.1%‡	0.006§
Transfer time to tertiary unit in hours (mean; SD; 95% CI)	3.9; 2.8; -1.7 to 9.6†	88.1; 112.8; -135.2 to 311.5†	84.5	-95.3 to 263.6†	0.232†

* **Data are shown in No./n (%), except otherwise indicated**
† **Independent samples *t* test**
‡ **Confidence interval for the difference between two independent proportions by the Wilson procedure**
§ **Fisher's exact test**
‖ **Confidence interval of a proportion by adjusted Wald method**

in the AED were 55.1% more likely to be transferred to a tertiary unit, mean transfer times to such units were 84.5 hours shorter (3.9 vs 88.1 hours) and mortality was 27.2% lower. However, these differences in beneficial

effects were not statistically significant.

Yield rate of aortic dissection by computed tomographic thorax ordered by the Accident and Emergency Department of the Tseung Kwan O Hospital

In all 71 contrast CT thorax examinations were performed over the corresponding period, 35 being for suspected AD. In 15 of these patients, the diagnosis was corroborated, yielding a diagnostic rate for AD of 43% (15/35). Three leaking ADs were diagnosed in patients with known AD history. The final diagnosis in the remaining 17 patients included: thoracic aortic aneurysm with a subarachnoid and subdural haemorrhage, aortic arch aneurysm with syncope (without a leak or dissection), mediastinal mass (lung carcinoma), pancreatic carcinoma with multiple metastasis, carcinomatosis and multiple small bowel obstructive growth, acute myocardial infarction (n=2), acute cerebrovascular accident, brainstem infarct, atypical chest pain (n=3), epigastric pain (n=2), hypertension, syncope, and back pain with no definite pathology.

Discussion

The incidence of AD was estimated to be 2.1 per 100 000 inhabitants to TKOH per year, which was comparable to the figure 2-4/100 000 inhabitants per year in western studies.[5,6] With the population of 6 994 500,[15] Hong Kong encountered 147 AD patients yearly. There are only three cardiothoracic surgery centres in Hong Kong, so the role of emergency physicians is crucial in the initial diagnosis, stabilisation, and transfer of such patients.

The sensitivity of the TKOH AED for diagnosing AD was 54%, which was higher than the 43% (19/44) reported by Sullivan et al[7] in the US and the 27% (7/26) in another HKSAR series described by Chung and Lai.[13] The most obvious difference between the TKOH study and Chung and Lai's study was the former's ready availability of contrast CT. Eleven per cent of AD patients were diagnosed at autopsy, which might be an underestimate because not all deaths in TKOH had postmortem examinations. In TKOH and IRAD AD patients, old age and hypotension on presentation were associated with higher mortality. In the TKOH series, overall mortality was 39%, which was higher than that reported for IRAD (27%) by Hagan et al.[9]

Interestingly, both the operation rate and mortality were lower in the subgroup of AD patients transferred to the cardiothoracic referral centres. Although all IRAD hospitals are all referral centres, they manage both types A and B AD. In Hong Kong, transferred patients had mainly type A and complicated type B dissections, hence uncomplicated type B ADs (with lower anticipated mortality) were not included. Therefore, the lower mortality in our more serious transferred patients was contrary to expectations. Possible reasons include: (1) our AD patients being atypical, (2) those with poor premorbid states were less likely to be diagnosed, (3) patients with very unstable haemodynamics being less likely to be transferred to the cardiothoracic units, and (4) our small sample size being too limited to formulate reliable conclusions.

Over the first 24 hours, the cumulative hourly mortality rate in our cohort was 1.32%, which was higher than the 0.42% per hour reported for IRAD patients by Hagan et al.[9] In the TKOH study, female had OR of 21.0 for death, which was higher than the OR of 1.38 to 1.59 reported for IRAD patients.[9,10] The reason could be related to racial differences, small sample size, differences in methodology or standard of care. Further studies in other hospitals, the central registry in the HKSAR and other reports on Chinese patients are needed.

Patients whose AD was diagnosed in AED were more liable to be transferred to a tertiary unit and as expected they also enjoyed shorter transfer times and lower mortality, especially as mortality increased with time. Delay in diagnosis, could very well result in deterioration/complications that contributed to failure to transfer the patient to a tertiary unit and death.

In the HKSAR, only a few AEDs had the ready access of contrast CT thorax for suspected AD patients. The experiences in our unit support the role of such ready access in the early investigation, diagnosis, and management of AD.

Limitations

Ours was an observational study and not sufficiently robust to draw causal links. Not all AD cases might have been captured, due to missed diagnosis, death without postmortem examination, improper coding of the diagnosis (especially for TOE diagnosed patients). Such problems could affect estimation of annual incidence, the sensitivity of AD diagnosis, and mortality.

There were only 28 patients in the study; so only large differences were likely to be statistically significant. The patients were mainly in the Sai Kung district of the HKSAR. Thus, external validity was a potential problem for extrapolating our results to the whole of the HKSAR and to Chinese patients in general.

This study did not provide a validated clinical guideline to diagnose and manage AD in AED. The comparison of HKSAR AD data and IRAD data were unmatched with respect to the years they referred to.

High-resolution CT thorax and urgent radiology reporting might not be available in all acute hospitals in the HKSAR. Moreover, contrast CT thorax is contra-indicated in unstable patients and those with known contrast allergy and advanced renal impairment. Thus, such CT is not 100% sensitive for diagnosing AD; TOE and MRI are useful in such cases.

Conclusions

Approximately 54% of our AD patients were diagnosed in the TKOH AED; 43% as a result of contrast CT thorax. For AD patients diagnosed in AED, mortality was 27.2% lower, and was 55.1% more likely to transfer to a tertiary unit than for the remainder. Their mean transfer time was 84.5 hours shorter. Beneficial effects of such early diagnoses were demonstrated but were not statistically significant. A central registry of AD in the HKSAR and for Chinese patients could prove useful.

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