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Feasibility of transradial coronary angiography and angioplasty in Chinese patients

華籍病人接受經橈動脈冠狀動脈血管造影術和血管成形術的可行性

Objective. To assess the clinical applicability, efficacy, and safety of coronary angiography and angioplasty via a transradial approach in local Chinese patients.
Design. Prospective case series.
Setting. Regional hospital, Hong Kong.
Patients. All patients undergoing coronary angiography and coronary angioplasty between 1 January and 30 June 2004.
Interventions. Transradial coronary angiography and coronary angioplasty.
Main outcome measures. Feasibility, success rate, and complications.
Results. A total of 268 coronary angiographies (62% of all coronary angiographies) and 118 coronary angioplasties (48% of all coronary angioplasties) were performed via a transradial approach. The procedural success rate for coronary angiography was 93.7% with a mean duration of 21.8 (standard deviation, 13.5) minutes compared with 17.9 (10.0) minutes for angiography via a femoral approach. Most (99%) patients were free from any complications. Of those patients who underwent elective transradial coronary angiography in the morning, 64% were discharged on the same day. Comparison of data in the first half of the study period with those in the second half revealed a significant increase in the percentage of coronary angiographies performed via a transradial approach (from 52% to 73%, P<0.0001), and an improved procedural success rate (from 91.5% to 95.3%, P=0.1). For transradial coronary angioplasty, the procedural success rate was 98%. A total of 246 lesions (2.08 lesions per patient) were treated with no procedure-related complications.
Conclusions. Transradial coronary angiography and angioplasty are feasible in a significant proportion of local Chinese patients and achieve a high success rate and low complication rate. It tends to prolong procedural duration, but improves patients' comfort and permits earlier ambulation and discharge. The procedural success rate improves with accumulating experience.

目的：評估本地華籍病人利用經橈動脈的方法，進行冠狀動脈血管造影術和血管成形術的臨床適用性、功效和安全程度。
設計：前瞻性個案系列。
安排：地區醫院，香港。
患者：2004 年 1 月 1 日至 6 月 30 日期間，在該醫院進行冠狀動脈血管造影術和冠狀動脈血管成形術的所有病人。
療法：經橈動脈冠狀動脈血管造影術和冠狀動脈血管成形術。
主要結果測量：可行性、成功率和併發症情況。
結果：調查期間，經橈動脈冠狀動脈血管造影術進行了 268 次（佔全數冠狀動脈血管造影術 62%），經橈動脈冠狀動脈血管成形術進行了 118 次（佔全數冠狀動脈血管成形術 48%）。冠狀動脈血管造影術的成功率為 93.7%，每次手術平均需時 21.8 分鐘（標準差為 13.5 分鐘）；同樣手術以股骨插入法進行，則平均需時 17.9 分鐘（標準差為 10.0 分鐘）。大部分病人（99%）都沒有併發症。而在早上選擇性進行這項手術的病人中，64% 可於同日出院。調查期上半段和下半段的數據顯示，經橈動脈方式進行這項手術的比例明顯增加（由 52% 升至 73%，P<0.0001），而成功率亦上升（91.5% 升至 95.3%，P=0.1）。冠狀動脈血管成形術方面，成功率為 98%，期間共治療了 246 個病變（平均每位病人 2.08 個），皆沒有出現與手術

Key words:
Angioplasty, transluminal, percutaneous coronary;
Coronary angiography;
Radial artery;
Stents

關鍵詞：
血管成形術，穿腔的，經皮冠狀動脈；
冠狀動脈血管造影術；
橈動脈；
支架

Hong Kong Med J 2006;12:108-14

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程序有關的併發症。

結論：經橈動脈冠狀動脈血管造影術和血管成形術適用於大部分本地華籍病人，成功率高且較少出現併發症。雖然手術需時較長，但可減低病人不適和加快恢復活動能力和出院時間。隨著經驗累積，手術成功率亦上升。

Introduction

Coronary angiography and percutaneous transluminal coronary angioplasty have generally been performed using a transfemoral approach because of the ease of vascular access and large calibre of the femoral arteries. Advances in miniaturisation of angioplasty equipment enable an alternative approach via the radial artery.[1] It has been proven valuable since it limits wound bleeding complications, especially in patients receiving intensive anticoagulation such as heparin and glycoprotein IIb/IIIa receptor antagonists.[2-4] In addition, it has undoubted advantages: patient comfort is improved and early ambulation and a shorter hospital stay are facilitated.[1,5] Transradial coronary angiography (TRCAG) is nonetheless technically more demanding than transfemoral coronary angiography (TFCAG), and requires an initial learning curve.[6] The technique also has limitations, including the need to demonstrate a dual palmar vascular supply, a higher procedural failure rate, and a prolonged procedural time. Furthermore, Chinese patients tend to have a smaller-calibre radial artery than Caucasians because of a smaller body build,[7] thus the procedure is more difficult. All of these factors limit the widespread application of TRCAG or transradial coronary angioplasty (TRCAP), especially in a busy catheterization laboratory. In the authors' institution, coronary angiography and angioplasty have been performed via a transradial approach since 1999. Prior to March 2003, 10% of coronary angiographies were performed via a transradial approach, a figure that increased progressively to 75% by June 2004 (Fig). This study aimed to assess the clinical applicability of transradial approach in local Chinese patients undergoing coronary angiography or angioplasty, and to determine the procedural success rate, risk, and complications.

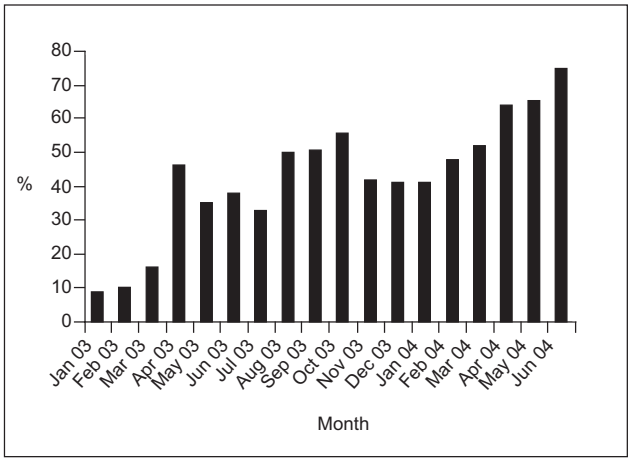

Fig. Percentage of coronary angiographies performed via transradial approach, January 2003 to June 2004

Methods

Patient selection

We prospectively collected data on all coronary angiographies or angioplasties performed in our hospital over a 6-month period from 1 January to 30 June 2004. Transradial access was considered for patients with satisfactory hand perfusion from the ulnar artery, as assessed by modified Allen's test that was performed with a fingertip oxygen saturation detector positioned on the thumb, coupled with plethysmography.[8] In the presence of an adequate collateral circulation, the phasic saturation curve remains either unchanged or regains its original appearance within a few seconds following radial artery compression.[8]

A transradial procedure was avoided in patients with renal impairment, suspected carotid or innominate artery disease and in those who required concomitant procedures, such as electrophysiology study or right heart catheterization that required simultaneous venous access. A transfemoral approach might be used at the discretion of the cardiologist-in-charge in patients undergoing urgent procedures, especially those who were haemodynamically unstable, in patients with small-calibre radial arteries, or when there were time constraints or personal preferences.

Procedure

Both the right wrist and groin were sterilised and draped, with the wrist hyperextended over an arm board. The right groin was prepared to ensure immediate availability of femoral access if radial artery access failed. The skin was infiltrated over the puncture site with 1 to 3 mL of 1% lignocaine and the radial artery punctured with a 20-gauge needle. A 0.018-inch soft-tip straight wire was then introduced through the needle to allow insertion of a 5-French (F) or 6-F valve introducing sheath. Intra-arterial nitrate (200 μg) and verapamil (2 mg) were administered through the sheath to reduce arterial spasm, followed by heparin (3000 IU) to reduce the incidence of radial artery occlusion. Coronary catheters were advanced into the aortic root over a 260 cm-long 0.035-inch J-shaped guidewire that was also used for catheter exchange. If difficulty was encountered in advancing the guidewire in the arm, an angiogram was performed to identify the problem, eg loops or other anatomic variants. A hydrophilic wire such as the Terumo wire (Terumo Corporation, Tokyo, Japan) or floppy tip 0.014-inch coronary guidewire can be used to solve the problem in most cases. For coronary angiography, a single catheter dedicated for cannulation of both left and right coronary arteries via a right radial approach, such as a Tiger catheter (Terumo Corporation, Tokyo, Japan), was used for the whole procedure. If a Tiger catheter was not available,

Table 1. Reasons for not attempting transradial coronary angiography (TRCAG)

Reason	No. of patients not attempting TRCAG, n=165	Percentage of all coronary angiographies, n=433
Urgent procedure for unstable patients	32	7.4
Small radial artery or larger-sized guiding catheter required	28	6.5
Abnormal Allen's test	22	5.1
Cardiologist's preference	19	4.4
Concomitant procedures required, eg electrophysiology study, right heart catheterization	17	3.9
Uraemia with potential need for arteriovenous fistula	14	3.2
Time constraint	11	2.5
Advanced age with co-morbidities	9	2.1
Suspected carotid or innominate subclavian disease	7	1.6
Previously failed radial attempt	4	0.9
Patient refusal	2	0.5

Judkins left (size 3.5 or 4) and Judkins right (size 4 or 5) catheters were used. Coronary angioplasty might be performed as an ad hoc procedure following coronary angiography if prior consent had been obtained, or as a separate procedure. Additional heparin was administrated before coronary intervention to make up to a total of 100 units/kg. The choice of guiding catheter, guidewire, angioplasty balloons, stents, or other adjunctive devices was determined by the cardiologist-in-charge. The procedure was considered successful if thrombolysis in myocardial infarction (T1M1) grade 3 flow was achieved with less than 20% residual stenosis in the vessel being treated.[9]

The introducer was taken out immediately after the procedure and wound haemostasis achieved by local compression using a Stepty-P device (Nichiban, Tokyo, Japan). The haemostasis device was removed 6 hours postoperatively. Patients who underwent coronary angiography without coronary intervention were discharged on the same day if good haemostasis was achieved.

Data analysis

Patient characteristics and procedural details of coronary angiography performed via a transradial approach were analysed and compared with those performed via a transfemoral approach during the study period. Procedural time, defined as the interval between administration of anaesthesia and removal of the last catheter, and fluoroscopy time were recorded for both successful and unsuccessful procedures, with the time required for further angiography from an alternative site included. Subgroup analysis was done to compare procedures performed in the first (period A: 1 January to 31 March 2004) and second (period B: 1 April to 30 June 2004) halves of the study period. Details of procedural outcome and access site complications were reviewed for TRCAP.

Statistical analysis

Continuous variables are presented as mean (standard deviation [SD]) and categorical variables as percentages. Student's *t* test was used for comparison of means between the two groups. Data were considered significant when the P value was less than 0.05.

Results

A total of 433 coronary angiographies and 246 coronary angioplasties were performed during the study period, of which 268 (62%) coronary angiographies and 118 (48%) coronary angioplasties were performed via a transradial approach. All team members, including seven cardiologists and two trainees with varying procedural experience, performed TRCAG during the study period. Their relative contributions to TRCAG during this study period ranged from 3% to 24%.

Reasons for not attempting transradial access in the 165 patients undergoing coronary angiography are listed in Table 1. Among the 268 patients who underwent TRCAG, most of them (72%) were men. The mean age of these 268 patients was 62.7 years (range, 35-89 years). Angiography alone was performed in 185 patients and the remaining 83 underwent concomitant adjunctive angioplasty. The right radial artery was the preferred site for vascular access (99.6%). The left radial artery was used for vascular access in one (0.4%) patient who had peripheral vascular disease over both lower extremities and right-sided symptomatic carotid artery disease. 6-F sheaths were most commonly used (81%) whereas 5-F sheaths were used in the others. Most cases (96%) were elective, while seven patients underwent urgent TRCAG intended as direct percutaneous coronary intervention (PCI). The procedural success rate was 93.7%. Reasons for procedural failure included failed radial puncture (n=13), tortuous subclavian or brachial arteries (n=3), and severe arterial spasm (n=1). Procedural difficulties were encountered in 23 (8.6%) cases—these included subclavian artery tortuosity (n=11), loops or tortuosities of radial/brachial arteries (n=5), brachial or radial artery spasm (n=5), subclavian artery stenosis (n=1), and high radial artery take-off (n=1). Mean procedural duration was 21.8 (SD, 13.5) minutes. The procedural duration was significantly lengthened in 40 cases in which radial access failed or difficulty was encountered compared with the 228 cases with successful radial access and no difficulty encountered (46.5 [SD, 31.0] vs 19.7 [11.5] minutes; P<0.0001). Mean fluoroscopy time was 4.95 (SD, 4.3) minutes. The use of a single Tiger cath-

Table 2. Demographic data and procedural characteristics of patients who underwent transradial coronary angiography (TRCAG) and transfemoral coronary angiography (TFCAG)

	TRCAG, n=268	TFCAG, n=165	P value
Mean age (SD) [years]	62.7 (10.8)	66.0 (13.3)	0.0049
Male:female	72%:28%	52%:48%	0.05
Mean height (SD) [cm]	162 (8.9)	160 (10.2)	0.032
Mean weight (SD) [kg]	65.5 (11.5)	62 (11.0)	0.003
Smoker	25%	19.5%	0.19
Diabetes mellitus	29%	33%	0.337
Hypertension	51%	51%	0.97
Mean procedural duration (SD) [min]	21.8 (13.5)	17.9 (10.0)	0.01
Mean fluoroscopy time (SD) [min]	4.95 (4.3)	4.43 (4.0)	0.24
Mean length of postoperative hospital stay* (SD) [days]	0.59 (0.56)	1.08 (0.33)	<0.0001

* For elective coronary angiography

Table 3. Comparison of demographic data and procedural details of transradial coronary angiography (TRCAG) performed in the first (period A) and second (period B) halves of the study period

	TRCAG, n=119* (period A)	TRCAG, n=149† (period B)	P value
Percentage of total TRCAG	52	73	<0.0001
Mean age (SD) [years]	61 (10.8)	64 (10.8)	0.045
Male:female	73%:27%	72%:28%	0.8
Mean height (SD) [cm]	162 (8.8)	162 (9.0)	0.996
Mean weight (SD) [kg]	66.2 (11.4)	64.9 (11.7)	0.37
Smoker	28.5%	21%	0.18
Diabetes mellitus	26%	31%	0.39
Hypertension	48%	54%	0.35
Procedure performed by trainees	13%	25%	0.011
Tiger catheter used	94%	56%	<0.0001
Procedural success rate	91.5%	95.3%	0.1
Median procedural duration (min)	18	17	0.9
Median fluoroscopy time (min)	4.3	5.4	0.08

* Total No. of coronary angiographies in period A=229
† Total No. of coronary angiographies in period B=204

eter allowed selective catheterization of both coronary arteries in 88% of cases. A total of 64% of patients who underwent elective TRCAG in the morning were discharged on the same day. Most patients (99%) were free from any complications although one had a minor stroke. Another patient had a minor forearm haematoma secondary to arterial perforation during passage of the guidewire across a tortuous radial artery: it resolved following conservative treatment. One patient had an arteriovenous fistula that required surgical ligation.

We compared 268 patients who underwent TRCAG with 165 who underwent TFCAG during the same study period (Table 2). Patients in the TRCAG group tended to be younger with more males and a larger body build. The procedural time was significantly longer in TRCAG, but there was no significant difference in the fluoroscopy time. The mean length of postoperative hospital stay was significantly shorter for elective TRCAG than TFCAG.

We compared the data in the first (period A) and second (period B) halves of the study period to detect any change in practice over time (Table 3). Throughout the study period, coronary angiography was increasingly performed via a transradial approach (from 52% to 73%, P<0.0001). Transradial procedures were attempted in older patients (mean age from 61 to 64 years, P=0.045). Although not significant, there was a trend towards an improvement in procedural success rate (from 91.5% to 95.3%, P=0.1), but the procedural durations were similar (18 vs 17 min, P=0.9).

Transradial coronary angioplasty was attempted in 119 patients. It failed in one patient due to an inability to sit the guiding catheter because of a tortuous subclavian artery. In the 118 successful cases, a total of 246 lesions (2.08 lesions per patient) were treated, with 75.6% type B and 13.8% type C lesions, which implied a significant proportion were of more complex lesions. Success was achieved in 241 (98.0%) lesions. Stents were implanted in 78.9% of lesions. In most cases, a 6-F calibre guiding catheter was used (76.3%); 7-F and 5-F guiding catheters were used in 21.2% and 2.5%, respectively. Procedural details of TRCAP are shown in Table 4. The mean procedural time was 63.0 (SD, 40.8) minutes. There were no access site complications or procedure-related adverse cardiac events. One patient died 4 days after the procedure because of massive intracerebral haemorrhage.

Discussion

The transradial approach provides an attractive alternative

Table 4. Details regarding transradial coronary angioplasty

	No. of patients, n=118
Transradial intervention	
Transradial coronary angiography with ad hoc coronary intervention	83
Transradial coronary angioplasty only	35
Male:female	75%:25%
Mean age (SD) [years]	62.2 (11.1)
Total No. of lesions	246
Mean No. of lesions per patient	2.08
Lesion characteristics	
Type A	26 (10.6%)
Type B	186 (75.6%)
Type C	34 (13.8%)
Angiographic success	98.0%
Radial sheath size	
5-French	3 (2.5%)
6-French	90 (76.3%)
7-French	25 (21.2%)
Stents implanted	194 (78.9%)
Direct stenting	39 (20.1%)
Kissing technique	8 (4.1%)
Use of adjunctive devices	12 (10.2%)
Distal protection device	5 (4.2%)
PercuSurge*	3
Emboshield†	2
Brachytherapy	1 (0.8%)
Intravascular ultrasonography	5 (4.2%)
Thrombectomy device	1 (0.8%)
Adjunctive medications	
Glycoprotein IIb/IIIa inhibitor	2 (1.7%)
Mean procedural time (SD) [min]	63.0 (40.8)
Mean fluoroscopy time (SD) [min]	20.7 (14.9)

* PercuSurge GuardWire device (Medtronic, Minneapolis, US)
† Emboshield (MedNova, Galway, Ireland)

for coronary angiography or angioplasty. Because of the superficial course of the radial artery and its proximity to the bone, haemostasis can be easily achieved by local compression without the need for 'active' compression or a closure device.[5,9,10] This reduces the workload of nursing and medical staff.[5,11] In addition, there are no major nerves or veins located near the artery, thus risk of injury to these structures is minimised. It also permits immediate postoperative ambulation, improves patients' comfort,[12] allows early discharge,[5,13,14] and reduces hospital costs.[14,15]

The transradial approach is not feasible in patients with an inadequate collateral blood supply from the ulnar artery because of the risk of iatrogenic obstruction of the radial artery following the procedure.[5,13] This approach is also technically more demanding, has a steep learning curve,[6,13] and is associated with procedural failure and prolonged procedural duration.[5,14]

A recently published meta-analysis showed that TRCAG is a highly safe and effective procedure that virtually eliminates local vascular complications.[10] The overall procedural failure rate was 7.2%. With improvement and availability of equipment dedicated to the transradial approach, the procedural failure rate dropped to 3.9% after 1999.[10] Reasons for procedural failure can be classified into three categories:

(1) Inability to successfully puncture the radial artery, which may be related to operator skill, especially in the initial learning curve, or to the presence of a tortuous radial artery, or persistent arterial spasm[10,16];
(2) Failure to pass the catheter to the aorta, which can be secondary to severe arterial spasm, loop or severe tortuosity of the radial or brachial artery, or anatomic variations such as remnant radial artery and high radial artery take-off[16,17];
(3) Failed cannulation of the coronary arteries, usually due to a tortuous right subclavian artery. Rarely, this may be due to the retro-oesophageal right subclavian artery, the most common congenital aortic arch anomaly with a reported prevalence of 0.4% to 2%.[16,17]

In this prospective study, the choice of vascular access for coronary angiography was determined by the cardiologist-in-charge, based on the patient's clinical profile, and the cardiologist's preference (Table 1). As noted from the comparison of patients undergoing TRCAG and TFCAG (Table 2), we tended to select patients in whom a transradial approach was more likely to succeed. These included younger patients, male patients, and those with larger body build. A high overall procedural success rate of 93.7% was achieved. With accumulating experience, TRCAG was attempted and was successful in less ideal patients. This is demonstrated by the comparison of TRCAG performed in the first half and second halves of the study period (Table 3). Over this period, a significantly increasing percentage of coronary angiography was performed via radial access (from 52% to 73%, P<0.0001) and was attempted in older patients (mean age from 61 to 64 years, P=0.045). A higher proportion of procedures were performed by trainees (from 13% to 25%, P=0.011); this could have produced a prolonged procedural time and lower success rate. Nonetheless the procedural success rate increased from 91.5% in the initial study period to 95.3% in the later study period, and is comparable with the 96.1% reported in a meta-analysis.[10] This high procedural success rate was achieved with similar procedural durations, and with a low complication rate (1%).

It is interesting that fluoroscopy time during the study period increased despite an apparent shortening in the medium procedural duration (Table 3). A possible explanation may be that with increasing experience, more challenging cases were attempted. As a result, more procedural difficulty would have been encountered in the second half of the study period, for example radial artery loop or subclavian artery tortuosity, and this would have required additional fluoroscopy time.

Tiger catheter is designed for TRCAG and is the catheter of choice in our laboratory. It allowed selective catheterization of both coronary arteries in 88% of patients during the study period, and assisted in shortening the overall procedural time. In the second half of the study period when a Tiger catheter was unavailable, a Judkins left (curve size 3.5 or 4) catheter for left coronary artery was used and could cannulate both coronary arteries in some

cases. Judkins right (curve size 4 or 5) was commonly used for cannulation of the right coronary artery.

Randomised studies[5,15] have demonstrated high procedural success rates with TRCAP, similar to those achieved with transfemoral coronary angioplasty. An added advantage is almost-complete elimination of major bleeding complications. Reported experience in Chinese patients is limited. Wu et al[7] demonstrated safety of TRCAG and TRCAP among Chinese patients. When compared with patients in a Caucasian series,[5] Chinese patients were obviously shorter (mean body height, 162 [SD, 7] vs 172 [8] cm) and lighter (mean body weight, 65 [11] vs 78 [10] kg). This was confirmed by our experience (mean height, 162 [8.9] cm; mean body weight, 65.5 [11.5] kg). The smaller body build of Chinese may theoretically be associated with smaller-sized radial arteries, thus potentially limiting transradial access. However, this study confirmed that TRCAP was both feasible and safe in local Chinese population. In our series, 48% of coronary angioplasties were performed via a right radial approach and a high procedural success rate of 98% was achieved.

Many previous reports of TRCAG and TRCAP were based on early experience, with procedures performed before 1999 when only 6-F guiding catheters were used for angioplasty.[5,7,15] With recent advances in PCI equipment, a 7-F guiding catheter may be required in some cases for certain devices or techniques, eg brachytherapy, some distal protection devices, and 'kissing' technique. The smaller-calibre radial artery in Chinese population may again limit the clinical applicability of TRCAP that requires a 7-F guiding catheter, but data are limited. In the series reported by Lim et al[16] in which 72% of patients were Chinese, 7-F guiding catheters were used in only 1.2% of cases. Yip et al[18] recently reported safety and feasibility of transradial application of PercuSurge GuardWire device (Medtronic, Minneapolis, US) in patients undergoing direct PCI, in which 7-F guiding catheters were used. In our series, 7-F guiding catheters were used in 21% of cases for complex lesions or when special devices were used, including distal protection device, brachytherapy, and thrombectomy devices. Again the safety and feasibility was confirmed, and there were no access site complications.

Transfemoral arterial access for coronary angiography or angioplasty is considered to be the standard approach for most cardiologists because of the ease of access as a result of the superficial location of the large-calibre femoral artery.[10,16] Nonetheless it has the disadvantage of mandatory prolonged bed rest and has associated entry site complications, such as pseudoaneurysms, arteriovenous fistula, nerve injury, or even retroperitoneal bleeding.[16] Such complications have been reported by a recent meta-analysis to occur in 2.8% of cases.[10] New femoral artery closure devices are increasingly popular and are intended to improve patient comfort and reduce puncture site complications. Mann et al[19] published a comparison between a transradial approach and a transfemoral approach with an arterial suture device (Perclose Inc, Menlo Park, US) in 218 patients undergoing coronary stenting. The suture device was not appropriate in 18% of the femoral cases, and failed in 10%. It also prolonged the total procedural duration (57 [SD, 22] min for femoral approach vs 44 [22] min for radial approach; P<0.01). Access site complications occurred only in the femoral group. More patients were ambulatory the same day of the procedure in the radial group (95% in radial group vs 56% in femoral group; P<0.01). The cost of the radial approach was substantially less because of lower supply costs and fewer access site complications. Suture devices are also associated with infectious complications.[20-22] Thus transradial access remains an attractive approach despite advances in femoral wound care devices.

The transradial approach for coronary angiography facilitates day case surgery. In this series, the mean duration of hospital stay was significantly shorter for TRCAG (0.59 [SD, 0.56] vs 1.08 [0.33] days; P<0.0001). A total of 64% of patients who underwent TRCAG in the morning were discharged on the same day. Reasons for not being discharged on the same day included failure in achieving wound haemostasis (19%), other medical problems (13%), and need for in-patient transfer for coronary artery bypass surgery (6%). A significant proportion (62%) of patients was not discharged on the same day because of patient refusal. With better patient education, more patients can undergo TRCAG as day case surgery. Other studies have demonstrated the safety of transfemoral coronary intervention as a day procedure in selected patients, ie non-diabetic patients with stable angina undergoing elective coronary angioplasty, with type A/B1 lesions larger than 3 mm in diameter.[23,24] The virtual abolition of major access site complications together with immediate postoperative ambulation makes the transradial approach ideal for day case PCI, and has been reported feasible by some other studies.[25,26]

Radial artery occlusion has been reported to occur in 3% to 5% of patients after transradial catheterization.[5,11,16] It is a subclinical event in most cases, the clinical sequela being minimal when there are well-developed collaterals from the ulnar artery.[12] A normal Allen's test is therefore a prerequisite before contemplating transradial access, as radial artery occlusion in the absence of an adequate collateral supply would be detrimental.[6] We performed Allen's test in every patient before attempting radial access. One limitation of our study was the lack of systematic follow-up assessment for radial artery occlusion. Yet all of our patients had good radial arterial circulation before discharge, and no patient had symptomatic radial artery occlusion at follow-up.

Conclusions

Transradial coronary angiography and angioplasty are

feasible in a significant proportion of local Chinese patients and can achieve high success rates and low complication rates. The transradial approach tends to prolong procedural duration, but improves patients' comfort and permits earlier ambulation and discharge. The procedural success rate improves with accumulating experience.

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