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Is outpatient percutaneous coronary intervention suitable for the elderly patient?

Johnman C,¹ Oldroyd KG,² Pell JP.³

1. Dr Cathy Johnman; Clinical Lecturer; Centre for Population and Health Sciences, University of Glasgow, G12 8RZ, UK
2. Dr Keith G Oldroyd; Consultant Cardiologist; West of Scotland Regional Heart and Lung Centre, Golden Jubilee National Hospital, Glasgow, G81 4HX, UK
3. Professor Jill P Pell; Henry Mechan Professor of Public Health; Centre for Population and Health Sciences, Public Health, University of Glasgow, G12 8RZ, UK

Corresponding author

Dr Cathy Johnman
MBCChB MPH MFPH MFSRH DipFMS
Hutchison Research Fellow
Centre for Population Based Health Sciences
Public Health and Health Policy
University of Glasgow
1 Lilybank Gardens
Glasgow
G12 8RZ

Tel +44 (0) 141 330 8547

Fax +44 (0) 141 330 1874

Email cathy.johnman@glasgow.ac.uk

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Abstract

Elderly patients account for an increasing number and proportion of patients attending for management of coronary artery disease. Whilst medical therapy remains the cornerstone of management, percutaneous coronary intervention (PCI) has been shown to improve symptoms of angina and quality of life in elderly patients. PCI is now a routine treatment for both acute and chronic coronary artery disease. In the last decade, a series of technological and therapeutic developments have reduced in-hospital complications following PCI. The transradial approach is associated with fewer vascular complications, reduced bed utilization and reduced time to ambulation. This has facilitated the introduction and expansion of outpatient PCI which has been shown to be as safe and effective in elderly patients. This paper reviews the rationale for outpatient PCI in the elderly and the evidence for its effectiveness and safety.

Importance of coronary artery disease in the elderly

In common with other European countries, the United Kingdom has seen substantial rises in life expectancy at birth and at 65 years which, together with reduced fertility rates, has resulted in an increasingly older population [1,2]. However, there have been much smaller increases in healthy life expectancy and disability-free life expectancy resulting in a decrease in the proportion of life spent in “favourable health states”[3]. The proportion of people reporting that they have a limiting longstanding illness is higher in the older population, with 37% of 65-74 year olds and 48% of those over 75 years reporting that they have such an illness [4].

Coronary arterial disease remains the most commonly reported limiting longstanding illness and accounts for more than a quarter of all deaths in both men and women. Mortality and morbidity from coronary artery disease is strongly associated with age. The age-sex standardised mortality rate under 75 years of age is 56 per 100,000 population, compared with 1,437 per 100,000 population among those aged 75 years and over [101]. Amongst people aged 75 years and over, more than one-third of men and around one-quarter of women are currently living with coronary artery disease [102]. As a consequence of the aging population, it is estimated that this will rise by 42% over the next decade [5]. This will result in the elderly accounting for an increasing proportion of patients presenting to health care services for treatment of symptomatic coronary artery disease.

Management of coronary artery disease in the elderly

Coronary artery disease may be managed using medical therapy or with revascularization techniques such as percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG). Medical therapy remains the cornerstone of the management of chronic stable angina, but randomized trials have consistently demonstrated greater symptomatic relief from coronary revascularization compared with medical therapy alone [6,7,8,9]. However, these trials have tended to exclude or under-enroll elderly patients.

One important study specifically undertaken in elderly patients was the Trial of Invasive versus Medical therapy in Elderly patients (TIME) study in which, 305 patients aged over 75 years with stable angina were randomized to either an invasive strategy (n=153) or optimal medical therapy (OMT) (n=148) [10]. The patients all had angina resulting in at least mild limitation of ordinary activity (Canadian Cardiac Society Class II or worse) that was refractory to two or more anti-anginal drugs. At baseline, patients had a mean age of 80 years. In the interventional group, all patients underwent coronary angiography, with the attending physicians then deciding whether or not to proceed to revascularization and by which approach (CABG or PCI). At 6 months follow-up, both groups reported improvements in angina severity and quality of life [10] but this improvement was significantly greater in the revascularization group compared with OMT alone. OMT was associated with an increased risk of major adverse cardiac events (49% vs 19%; $p < 0.0001$) and, in particular, with subsequent hospital admission for acute coronary syndrome with or without the need for revascularization. At 1 year follow-up [11], using intention-to-treat analysis, improvements in angina and quality of life were maintained in both groups but the differences between them were attenuated and no longer statistically significant. However, major adverse cardiac events continued to be more common in the OMT group (64.2% vs 25.5%, $p < 0.001$) and importantly 46% of this group ultimately required revascularization due to refractory symptoms [12]. When re-

analysed on the basis of actual treatment received, the differences in angina symptoms and quality of life between the groups were significant at one year follow-up, suggesting that the negative results using intention to treat reflected the high cross-over from medical therapy to revascularization [13]. Subsequent follow-up over a median of 3.1 years, demonstrated that long-term survival was similar for both groups. Irrespective of which treatment arm patients were assigned to initially, revascularization within the first year was associated with better survival.

A pre-specified sub-group analysis of the COURAGE (Clinical Outcomes Utilizing and Aggressive druG Evaluation) study assessed the proportion of elderly patients (defined in this study as aged 65 and over) who were angina free at 60 months following PCI in combination with OMT group versus OMT alone. This study recruited only 6.4% of the screened population; there was low representation of women (15%) and drug eluding stents were only used in only 2.7% of PCIs. Nevertheless, the proportion of elderly patients who were angina free at 60 months was found to be higher following the addition of PCI to OMT (80% vs 73%) - post hoc analysis demonstrates that this difference reaches statistical significance, $p=0.01$. Despite this, the authors suggest that PCI in addition to optimal medical therapy “does not reduce clinical events or improve angina relief during long-term follow up” of elderly patients [14].

Coronary revascularization in the elderly

A large number of randomized trials have demonstrated comparable survival rates following PCI and CABG for most patient populations [15,16,17,18]. Again, elderly patients have tended to be excluded from these trials. As yet, no randomized controlled trials comparing PCI and CABG have been undertaken in elderly patients. Therefore, the choice of type of revascularisation in the elderly has to be based on evidence from observational studies and a limited number of non-randomised studies.

A meta-analysis of these observational studies reported that peri-procedural and long-term outcomes in elderly patients were equivalent for PCI and CABG [19]. Thirty day case fatality was 7.3% (95% CI 6.3%

- 8.2%) following PCI compared with 5.4% (95% CI 4.4% - 6.4%) following CABG. One year survival was 86% (95% CI 83% - 88%) and 87% (95% CI 84% -91%) respectively, suggesting that comparable survival seen across younger age-groups extends to the elderly. However, the authors acknowledge that differences in survival between PCI and CABG in the elderly could still exist in view of the low level of the evidence available, use of group-level data (rather than meta-regression) and because of the differences in baseline case-mix found in the studies.

Over the past decade there has been a major shift in treatment patterns, whereby the number of CABG operations performed each year has remained relatively static whilst PCI procedures have increased in number and now account for an increasing proportion of revascularization procedures [20, 103]. PCI is now the most common form of revascularization in both young and elderly patients in both acute and elective settings. Elderly patients tend to present greater technical challenges in relation to PCI due to heavier coronary calcification, tortuous anatomy in both coronary and peripheral arteries and reduced tolerance to bleeding problems [21]. They also tend to have a greater risk profile due to more severe coronary disease and multiple co-morbidities [20].

Outcomes of percutaneous coronary intervention in the elderly

Whilst clinical trials have tended to exclude elderly patients, there are a number of retrospective cohort studies which have examined outcomes in elderly patients undergoing PCI [22, 23,24,25,26,27]. One of the largest of these studies examined outcomes in 82,140 consecutive PCI cases undertaken in New York State over 2000 and 2001 [22]. This multicentre study reported in-hospital mortality and major adverse cardiac events following elective and emergency procedures in three age-groups: <60, 60-80 and >80 years. In-hospital mortality was 1%, 4.1% and 11.5% respectively ($p<0.05$) and in-hospital major adverse cardiac events was 1.6%, 5.2% and 13.1% respectively ($p<0.05$). This study found that, after adjusting for patient co-morbidities and severity of coronary disease, age remained the strongest predictor of in-hospital complications in elective procedures and the second strongest in emergency procedures.

As previously discussed, thirty day and long-term survival rates were examined in a 2003 systematic review, which included only those studies that separately reported baseline characteristics and outcomes for patients aged >80 years and included elective and emergency procedures collectively in the pooled analysis[19]. The pooled estimate suggests that octogenarians were found to have acceptable short and long term outcomes following PCI. A number of the studies included in the review reported in-hospital rather than 30-day outcomes following PCI possibly resulting in an under-estimate of the pooled risk of adverse events.

A study comparing the safety and efficacy of second-generation coronary stents utilized pooled data from six major clinical trials [28]. This found that despite more complex coronary lesions, stenting could be performed safely in patients aged over 80 years, and with low rates of early and late restenosis. After one year, the incidence of clinically evident restenosis was similar to that in patients aged under 80 years (11.2 vs 11.9%, $p=0.78$). However, it was observed that elderly patients had higher rates of major

bleeding complications (5.0 vs 1.0%; $p < 0.001$), in-hospital mortality (1.3 vs 0.1%; $p = 0.001$) and 1-year mortality (5.7 vs 1.4%; $p < 0.001$). Their increased risk of mortality remained statistically significant after adjustment for higher baseline risks (more complex lesions, comorbid conditions and higher prevalence of multi-vessel disease).

Analysis of 31,758 Scottish elderly patients presenting between 2000 and 2007 demonstrated that they accounted for an increasing number and proportion of non-emergency PCIs, had a higher risk profile and experienced more adverse events within 30 days of PCI [20]. The study suggested that the dramatic increase in PCI activity over time could be a result of a change in patient selection. Among elderly patients, the worsening baseline case mix suggests that PCI is being used for patients who previously underwent CABG surgery or were considered unfit for any intervention. An important finding was that despite increasing complexity, the risk of adverse events did not increase significantly over time, either in the elderly or overall.

Elderly patients do have an increased risk of procedure-related complications that are associated with increased early mortality. Almost all of the studies have demonstrated increased risk for vascular access complications and associated major bleeding events in elderly patients, with age being the strongest predictor of vascular complications [29,30,23,31,32]. Bleeding events and transfusion requirement after PCI have been associated with increased mortality during follow-up [29]. Several studies have also shown increased risk for in-hospital stroke in elderly patients [32,33]. This excess risk of vascular and bleeding complications in the elderly is probably due to a higher prevalence of non-cardiac vascular disease and a greater susceptibility to the risk associated with adjuvant medical therapy [29,33]. In addition, elderly patients have an increased risk of contrast-induced nephropathy following PCI. This is particularly important as elderly patients are more likely to have the complex lesions and tortuous vasculature which require greater amounts of contrast utilization during the procedure. Age related changes in renal

function, particularly glomerular filtration rate and tubular function, are also important [34]. Contrast nephropathy has been associated with both early and late mortality [35].

A multi-centre European registry of 47,407 consecutive patients from 2005 to 2008 included over 8,000 patients aged 75 years and older [36]. PCIs undertaken for acute coronary syndrome and stable angina were examined separately. Patients aged 75 years and older were at significantly greater risk of in-hospital death, especially those presenting with acute coronary syndrome, and age remained an independent risk factor following statistical adjustment for baseline characteristics, including co-morbidities and severity of coronary artery disease. This study has the lowest ever reported in-hospital mortality rates (acute coronary syndrome ≥ 75 years 5.2% and < 75 years 1.7%; unstable angina ≥ 75 years 0.5% and < 75 years 0.2%). The authors suggest that this low rate is related to advances in PCI, such as adjuvant medical therapies, drug eluting stents and operator experience. However, in a retrospective analysis of observational data it is impossible to rule out residual bias.

Impact of percutaneous coronary intervention on quality of life in the elderly

Although in-hospital and late mortality following PCI are important, the effect on symptom relief and quality of life are critical considerations and inform patient decision-making. This is particularly pertinent in the elderly population as “the longevity benefits are frequently limited by multiple competing risks and the goals of therapy is often to maintain independent living with reasonable comfort” [37]. As previously discussed, the TIME study demonstrated an improvement in quality of life following revascularization in elderly patients which appeared to be maintained long-term [13] and initially superior to that achieved by OMT alone. There are a number of studies which have shown that PCI produces improvements in quality of life measures in the elderly that are equivalent to or even better than those observed in younger patients [38,39,40,41]. Spertus and colleagues concluded that age was an independent predictor of quality of life benefit [38] in 1,518 consecutive patients in the USA.

Kaehler et al measured quality of life using the Short Form Health Survey (SF36) at 6 months following PCI in only 55 patients aged over 80 years compared with younger patients [39]. They found that the benefits of PCI were at least equal, and for some measures were even more pronounced, in the older patients. Seto and colleagues assessed quality of life using the Short Form 36 and angina symptoms with the Seattle Angina Questionnaire during 1-year follow-up in 295 patients aged over 70 years compared with 1150 younger patients [40]. At 6 months both older and younger patients had significant improvements in mental health, physical health and angina status. The benefits persisted and, at 1 year follow-up, 60% of each group reported no angina. They concluded that quality of life improvements after PCI were not age-dependant. The Seattle Angina Questionnaire was also used at 1 and 3 years follow-up to assess quality of life in a large cohort study of patients who had undergone cardiac catheterisation (with or without subsequent revascularization by PCI or CABG) between 1995 and 1998 [41]. All dimensions of the Seattle Angina Questionnaire were found to be better in patients who had undergone revascularisation rather than those who had received only medical therapy. The only age difference observed was lower exertional capacity in the oldest patients, irrespective of type of treatment. Among patients over the age of 80 years, the Seattle Angina Questionnaire scores were significantly better following CABG. At 3 years follow-up, all of the quality of life scores contained in the Seattle Angina Questionnaire remained constant or improved. Although response rates would be considered reasonably high for a questionnaire-based follow up, there were differences between responders and non-responders which may have introduced bias.

Reducing the risk of percutaneous coronary revascularization in the elderly

In the last decade, a series of technological and therapeutic developments have reduced in-hospital complications following PCI including: adjuvant drug therapies; drug eluting stents and trans-radial access [23, 25, 26, 42, 43, 44]. Historically PCI has been carried out via the femoral artery (see figure 1). Over the last decade, radial access for PCI has become increasingly popular in many countries, with 42.8% of all PCI procedures in the United Kingdom now undertaken using this approach [103]. This route is still uncommon in some countries, such as the United States of America, where less than 2% of PCI procedures are undertaken via radial artery access [45]. It has been suggested that the slow adoption of the trans-radial approach in USA may be due to a lack of operator familiarity and limited availability of training [46].

The major advantages of using a radial, rather than a femoral, approach are reduced access site complications [47], earlier ambulation of patients [48], increased patient satisfaction [49] and reduced costs [48]. The benefits of early ambulation are particularly important for elderly patients who have a higher baseline risk of venous thromboembolism, healthcare acquired infection and oestheoarthritic problems. The risk of access site complications is reduced using transradial access because the hand has a dual blood supply via the ulnar artery, the radial artery is accessed distal to major nerves and veins and the superficial location of the radial artery makes it easier to achieve hemostasis using local compression. Again, these benefits are particularly important for elderly patients who have a significantly higher baseline risk of arterial access complications [30]. Elderly patients are more likely to have heavily calcified coronary lesions [21] and therefore are more likely to require complex PCI strategies such as high-speed rotational atherectomy (HSRA). The transradial approach for HSRA in has been shown to be

feasible, safe and effective [50, 51] in a number of small studies which included younger and older patients.

In a meta-analysis [47] of studies comparing radial and femoral routes of access, the former was associated with a 73% reduced risk of major bleeding following elective or emergency PCI (0.05% vs 2.3%, OR 0.27, 95% CI 0.16, 0.45, $p < 0.005$). Using radial access, the length of stay in hospital was shorter, with a weighted mean difference of -0.4 days (95% CI -0.2 to -0.5, $p < 0.001$). Only two of the randomised controlled trials in the meta-analysis focused on elderly patients [42, 52]. In a study by Achenbach et al., 307 patients over the age of 75 years presenting with suspected coronary artery disease or worsening of existing coronary artery disease, were randomized to either transfemoral or transradial approach [42]. Sixty three patients (16%) were excluded because of clinical contraindications to using a transradial approach; including 37 patients who were excluded because of a positive Allen's test using pulse oximetry. Allen's test is used to assess the collateral circulation in the hand but there is a lack of evidence that it can predict hand ischemia after radial artery occlusion (a possible vascular complication of PCI) and therefore its use may have excluded patients unnecessarily [53]. In the Achenbach et al trial, the data were analysed according to intention-to-treat principles. Among the 152 patients randomized to transradial access, this approach was successful in 91%, with the remaining 9% having to undergo transfemoral access. None of the patients with transradial access suffered major adverse events (defined as death, periprocedural infarction, stroke, vascular access complications that required surgical intervention, blood transfusion or a fall in haemoglobin of more than 3g/dl) compared with five (3.2%) patients with transfemoral access. Only two (1.3%) transradial patients suffered minor bleeding complications, compared with 9 (5.8%) transfemoral patients. A similar sized, but multi-centre, study of octogenarians reported comparable cross-over rates from radial to femoral access (8.9%) as from femoral to radial access (8.1%) [52]. Analysis according to intention to treat, again demonstrated a significantly

lower risk of vascular complications following radial (1.6%) compared with femoral (6.5%) access (p=0.03).

Jaffe et al [54] assessed the safety and efficacy of the approach in an observational study of 228 consecutive, octogenarian patients undergoing PCI for either chronic stable coronary artery disease or acute coronary syndrome. The initial choice of approach was at the operator's discretion and the transradial approach was chosen in 97 (42.5%) patients. There was a cross-over rate of 11% in the transradial group compared with only 4% in the transfemoral group (p=0.03). Procedural success rates were comparable. However, the transradial approach was associated with shorter cannulation and procedure time, reduced use of contrast media, fewer vascular complications (5% versus 20%, p<0.001) and shorter time to ambulation (5.2 ±3.1 versus 11.6±6.3 hours, p<0.001). The mean lengths of stay were 1.7 days for transradial access and 3.1 days for transfemoral access. A single-centre, observational study conducted in China recruited 2,058 consecutive patients undergoing PCI with transradial access [55]. Of these, 719 (35%) were aged 65 years and over. Procedural success rates were high (94.7%). Vascular complications occurred in 4.9% of patients with no statistically significant difference between elderly and younger patients.

Outpatient percutaneous coronary intervention in the elderly

Increased use of transradial access, with its reduced ambulation time and vascular complications, has facilitated the introduction and expansion of outpatient PCI. Outpatient PCI is an attractive option as it: reduces procedural costs; decreases bed utilization, and addresses the demand for the increasing numbers of PCI procedures. It has been shown in numerous randomized and observational studies to be both safe [56,57,58,59,60,61,62,63,64,65,66,67,68] and preferred by the majority of patients [69]. In some centres, outpatient PCI has become the preferred method for managing patients with chronic stable angina who have no medical contraindications (such as comorbid conditions), good angiographic results and an uncomplicated immediate observation period. The Criteria for Overnight Hospital Stay developed by Slagboom *et al* has been widely used (and modified) to inform decision making [65] – see table 1 showing an example of its use in a clinical setting. However, some operators remain concerned about the safety of outpatient PCI, in light of possible delayed bleeding complications and acute coronary occlusion following discharge. In the United Kingdom only 17.4% of all (elective and emergency) PCIs are undertaken on an outpatient basis, but this ranges from 0% to 85% across sites [103].

Only two studies have compared the outcomes of outpatient PCI in elderly and younger patients [70, 71]. The first involved only 117 patients aged 75 or over and attending for transradial PCI between 1998 and 2001 [70]. Thirty six (31%) patients reported one or more access site complications during the first 24 hours, including pain, bleeding, numbness, bruising, haematoma, swelling and infection. However, only 3 of these 36 patients consulted their doctor and none had to attend hospital. There were no major access site complications reported in this group. One patient reported chest pain within 24 hours but did not require investigation or intervention, and one further patient had stent thrombosis 37 hours after the procedure. Whilst this retrospective, observational study may suffer from selection bias and minor

complications may be subject to reporting bias, secondary data analysis ensured that major complications were identified even in patients who did not respond to the questionnaire. No difference in rates of entry site complications were found between younger and elderly patients in this study.

A more recent study which included 212 patients aged 75 years and older in New Zealand demonstrated that same-day discharge, following a 6 hour observation period, is possible in the majority of elderly patients (84%) [71]. This study did, however, show that elderly patients were more likely to be excluded from consideration for outpatient PCI compared with younger patients (4.5% vs 1.2%, $p=0.02$). Patients were excluded for a number of reasons including: inadequate social circumstances; further intervention or testing planned the next day and previous contrast reaction. In those who were put forward for outpatient PCI, it was successfully achieved as often as in younger patients. Suboptimal angiographic results, evidence of periprocedural myocardial ischaemia or infarction, access site complications, late sheath removal and glycoprotein 11b/11a inhibitor infusion were cited as the primary reasons for the failure of same-day discharge. In this study, only 19 (9%) procedures were undertaken using the transradial approach. All of the elderly patients who had a transradial approach were successfully discharged on the same-day. Despite the low utilization of transradial access, there were no deaths in the 24 hours following discharge and 24 hour readmission rates were very low (0.5%). Since only hospital data were used in this study, the investigators did not have access to information on minor complications in the elderly managed without recourse to hospital. Whilst there is a general dearth of literature, it appears that outpatient PCI is feasible and safe in elderly patients who are at low risk of complications and following an uneventful period of post-procedural observation.

Conclusions

The elderly account for an increasing proportion of the population in many countries and the prevalence of coronary artery disease is known to increase with age. Therefore elderly patients account for an increasing number and proportion of patients attending for PCI. PCI is now a routine treatment for both acute and chronic coronary artery disease in both elderly and younger patients. In the elderly, it has been associated with a greater risk of in-hospital, 30-day and long term complications. However the improvements in quality of life are at least as significant as those observed in younger patients

The transradial approach during PCI, is associated with fewer vascular complications, reduced bed utilization and reduced time to ambulation. Even in elderly patients, in whom the baseline risk of vascular complications is higher, the transradial approach is safe, effective and associated with less bleeding from the access site. The transradial approach has facilitated the introduction and expansion of outpatient PCI which has been shown in two small studies to be as safe and effective in elderly patients as it is in younger patients. Whilst this area would benefit from further research, outpatient PCI appears to be a realistic option for elderly patients. Over the next decade the proportion of PCI undertaken on an outpatient basis is likely to increase for both younger and elderly patients.

Executive summary

Importance of coronary artery disease in the elderly

- Mortality and morbidity from coronary artery disease is strongly associated with age
- Elderly patients represent an increasing proportion of patients attending for treatment of their coronary artery disease

Management of coronary artery disease in the elderly

- Coronary artery disease may be managed using medical therapy or techniques such as percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG).
- While medical therapy remains the cornerstone of treatment, randomized trials have demonstrated greater symptomatic relief from coronary revascularization compared with medical therapy alone.

Coronary revascularization in the elderly

- Randomised control trials demonstrate comparable survival between PCI and CABG but have tended to exclude or under-enroll elderly patients.
- Meta-analysis of observational studies demonstrate comparable survival between PCI and CABG in octogenarians.
- PCI is now the most common form of revascularization in both young and elderly patients in both acute and elective settings.

Outcomes of percutaneous coronary intervention in the elderly

- Elderly patients (even after adjusting for baseline characteristics) are at greater risk of procedural-related complications and adverse events.

- Age is the strongest predictor of in-hospital adverse events such as vascular access complications

Impact of percutaneous coronary intervention on quality of life in the elderly

- Effect on symptom relief and quality of life is particularly important in the elderly patients when considering treatment options.
- PCI has been shown to improve short and long term symptoms of angina and quality of life in elderly patients

Reducing the risk of percutaneous coronary revascularization in the elderly

- Over the last decade there have been a number of technological and therapeutic developments which have reduced complications following PCI.
- The transradial approach is associated with reduced access site complications, earlier ambulation of patients, increased patient satisfaction and reduced costs in both younger and older patients.
- Transradial PCI is becoming increasingly popular with 42.8% of all PCI procedures in the United Kingdom now undertaken using this approach.

Outpatient percutaneous coronary intervention in the elderly

- Using the transradial route has facilitated the introduction and expansion of outpatient PCI
- Outpatient PCI has been shown to be safe and effective in elderly patients and its use is likely to increase over the next decade

Conclusions

- PCI is now a routine treatment for both acute and chronic coronary artery disease in elderly patients as it has been shown to improve symptoms of angina and quality of life.

- Elderly patients are at increased risk of adverse events following PCI.
- However, technological advances such as the transradial approach have reduced these risks and have facilitated the use of outpatient PCI which has shown to be both safe and effective in elderly patients.

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**Table 1: Selection Criteria for Same Day Discharge after PCI
(Modified Amsterdam Criteria; CCI 2005; 64: 421-27)**

Inclusions

1. Stable or unstable angina
2. Non ST Elevation MI (NSTEMI) if last episode of ischaemia > 24 hours pre PCI
3. Successful procedure (unless failed chronic total occlusion (CTO) with no adverse events)

Successful PCI is residual diameter stenosis of <30% after POBA (plain old angioplasty) or residual stenosis <20% after stenting AND TIMI 3 flow with patient in stable condition and without ischemia related to the target lesion.

Exclusions

1. ST Elevation MI (STEMI)
2. Expected haemodynamic collapse in case of reocclusion
3. Last remaining vessel or unprotected left main stem
4. Intracoronary thrombus and/or need for GP2b3a therapy
5. Need for monitoring of renal function/renoprotective therapy
6. Non-PCI related reason for hospitalisation – social, transport etc

Criteria for cancelling planned same day discharge

1. Failed procedure or suboptimal result (except failed CTO as above)
 2. Unstented dissection
 3. Major side-branch occlusion/jeopardy
 4. In-lab transient closure
 5. Resuscitation
 6. Prolonged chest pain post-PCI
 7. Persistent ECG changes
 8. Haemodynamic collapse during balloon inflation
 9. Multivessel PCI if >1 vessel remains unstented
 10. Entry site complication
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