

# A secondary care retrospective clinical audit: assessing coronary angiography door-to-catheter times in acute coronary syndrome

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## ABSTRACT

### Background

Coronary angiography is an invasive procedure that utilises X-ray imaging and contrast medium to visualise the coronary vasculature to guide management. Current National Institute for Health and Care Excellence guidance aims to provide angiography within 72-hours for patients with high-risk (GRACE>3%) non-ST elevation myocardial infarction (NSTEMI) and patients with late-presenting (>12 hours) ST-elevation myocardial infarction (STEMI).

### Methodology

This clinical audit retrospectively investigated the duration of time patients admitted to the Royal Lancaster Infirmary (RLI) had to wait to undergo coronary angiography at Blackpool Victoria Hospital (BVH), a tertiary care centre for angiography, from August 2022 to September 2022. Eligibility was limited to asymptomatic patients with NSTEMI or late presenting STEMI. Patients indicated for urgent PCI, type 2 MI or conservative medical management were excluded. Time duration was assessed using three metrics: RLI door-to-referral (DTR) time, referral to treatment (RTT) time at BVH and door-to-catheter (DTC) time.

### Results and discussion

55 patient records were identified with 38 referred for coronary angiography (mean  $\pm$  SD age being  $73.4 \pm 11.8$  years vs  $69.7 \pm 11.1$  years, respectively). Only 31.4% of patients received angiography within 72hrs (n=35). The mean DTR time from admission was  $17h33m \pm 4h45m$  (mean  $\pm$  95% confidence interval, n=38), and only  $15.6\% \pm 4.8\%$  (n=35) of the DTC time was DTR. Thus, extensive RTT times at BVH contribute to delays.

### Conclusions

To optimise clinical outcomes, recommendations regarding early notification, medical advice to referring team, improved transfer coordination and dissemination of audit findings have been recommended. A reaudit four months post-presentation will complete the PDSA cycle.

## INTRODUCTION

### Background

Coronary angiography is an invasive procedure that utilises X-ray and contrast to visualise the coronary vasculature. In acute coronary syndrome (ACS), the rupture of an atheromatous plaque and vessel occlusion from the resulting thrombus leads to a type 1 hypoxic myocardial infarction (MI). Angiography can be used to determine the location, pattern and severity of any coronary artery disease present in the coronary circulation. This allows the identification of patients that may benefit from further intervention, including percutaneous coronary intervention (PCI) and coronary artery bypass graft (CABG).

Angiography is utilised in a variety of patient groups including both non-ST-segment elevation myocardial infarction (NSTEMI) and ST-segment elevation myocardial infarction (STEMI) patients. In NSTEMI, the National Institute for Health and Care Excellence (NICE) guidelines advise using angiography in patients with a 6-month mortality exceeding 3%.<sup>1</sup> This is typically estimated via GRACE score. The rationale is that in this group, the risks posed by angiography are outweighed by the net clinical benefits. STEMI patients who are late presenting, defined as presenting over 12 hours post-symptom onset, with or without ongoing signs of ischaemia, are also commonly investigated with angiography with the intention of preventing further myocardial damage and dysfunction.<sup>2</sup>

The period between initial presentation to secondary care and initiation of angiography is called the door-to-catheter time. Excessive delay in this period contributes to poor patient outcomes. While evidence of patient outcome variance between 12 and 24-hour door-to-catheter time is mixed, delays exceeding 72 hours (delay-to-angiography) show higher rates of recurrent in-hospital ischaemia, reinfarction, and heart failure.<sup>3-5</sup> This highlights the importance of a time efficient angiography referral process, which forms the *raison d'être* of this clinical audit.

### Aim, Objectives and Standards

The primary aim was to identify the duration of time patients with NSTEMI, admitted between August 2022 and September 2022 at the Royal Lancaster Infirmary (RLI), waited to undergo coronary angiography at Blackpool Victoria Hospital (BVH).

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The secondary aim was identifying if there were any delays in arranging angiography referrals.

Given that the RLI is not a tertiary centre for cardiology, it must coordinate care with BVH. Therefore, there may be delays for patients requiring coronary angiography, which could result in unnecessary hospital stays. Despite the controversy between differing temporal strategies for coronary angiography in NSTEMIs,<sup>6</sup> an angiography delay of beyond 72 hours adversely affects patient outcomes.<sup>5</sup>

Accordingly, NICE has issued Quality Standard (QS68) statement 3, which recommends coronary angiography within 72 hours, or sooner if possible, for adults with NSTEMI or unstable angina.<sup>7</sup> Thus, we define the gold standard is for 100% of NSTEMI patients with an estimated 6-month mortality rate above 3% to have had a coronary angiography within 72 hours post-diagnosis. Despite this, we predict that we achieved the gold standard in 80% of patients but accept this as satisfactory given that we are not a tertiary centre. This audit was approved by the local audit team and will undergo a PDSA iterative cycle.

## METHODOLOGY

### Participants

This study identified 55 patients admitted between August 2022 and September 2022 at the RLI, with 38 included in final analysis. Eligibility was limited to patients with asymptomatic NSTEMI and patients with late-presenting STEMI which was outside the necessary time window for primary PCI and thrombolysis. They were deemed ineligible if they had ACS with any ongoing chest pain or shortness of breath, which would have required urgent PCI at BVH rather than delayed coronary angiography. Additionally, any patients with ACS deemed for medical management by a consultant cardiologist were also excluded. Similarly, all type 2 myocardial infarctions were excluded.

### Study design

This retrospective, single-centred audit collected three main data points to examine patient waiting times. The time of admission at the RLI of the patient, the time referral was done to BVH via the online cardiology whiteboard, and the time when the patient had a coronary angiogram performed at BVH. The only parameter concerning patient characteristics collected was age at time of admission. We used three main sources of information: Lorenzo patient record systems (RLI), online cardiology whiteboard (Inter-trust) and the Blackpool cardiology picture archiving and communication system (BVH).

### Outcome measures

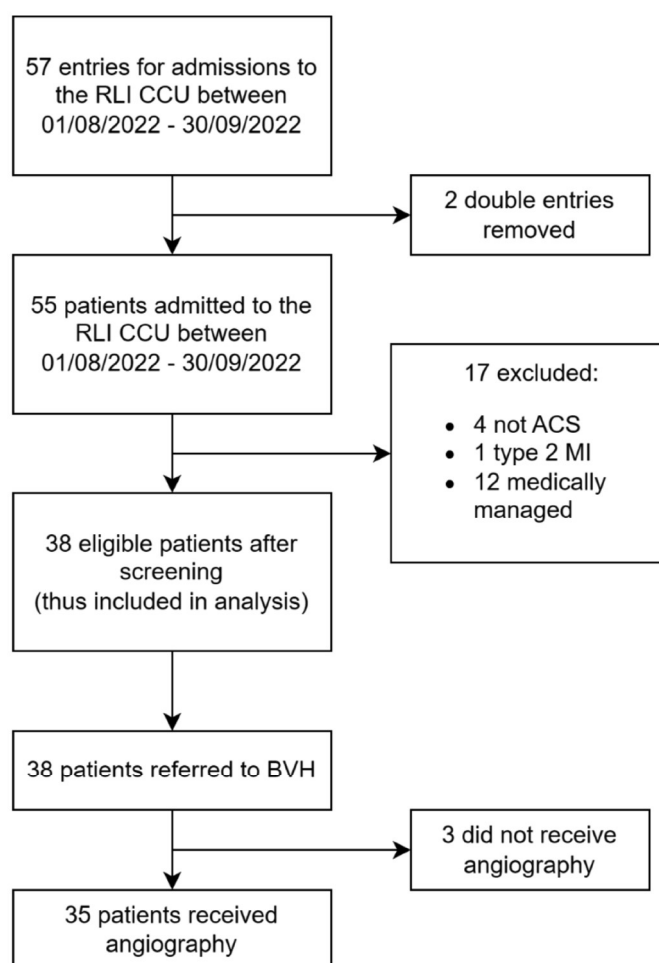
From the aforementioned time points, we can derive three durations: the referral wait, intervention wait and the total wait duration. The door-to-referral (DTR) duration is defined as the time period from admission to whiteboard referral. The referral-to-treatment (RTT) time is defined as the time period from the whiteboard referral being made to the time coronary angiography was performed. Lastly, each patient's door-to-catheter (DTC) wait time is measured from the time of admission to the time coronary angiography was performed:

put simply, the sum of the DTR and RTT.

From these durations, we can derive the primary and secondary measures, the percentage of patients with a DTC time below 72 hours and the mean of the percentage fractions of each patient's DTR time divided by their DTC time, respectively. The former measures whether our coronary angiography pathway achieves the predicted 80% of the 72-hour DTC gold standard and the latter assesses whether delays are due to referral delays at the RLI or interventional delays at BVH.

## RESULTS

### Participants



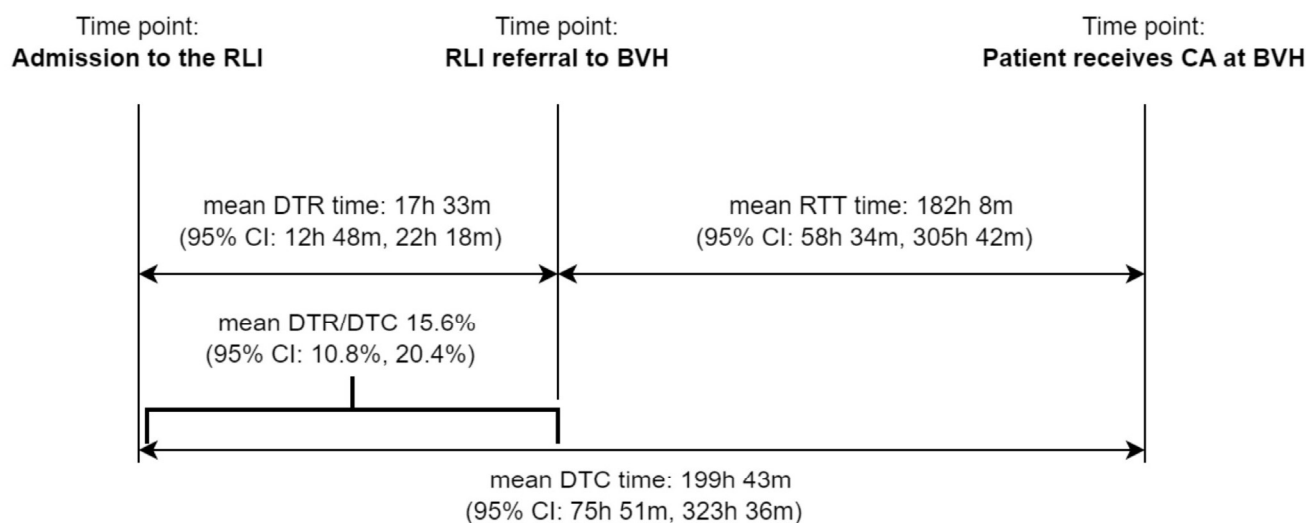
**Figure 1: Flowchart of patient selection.**

This retrospective clinical audit study included patient data from 1st August 2022 to 30th September 2022 from the Royal Lancaster Infirmary's (RLI's) Coronary Care Unit (CCU). Overall 38 were eligible for inclusion, with 35 receiving angiography at Blackpool Victoria Hospital (BVH). Other abbreviations: acute coronary syndrome (ACS); myocardial infarction (MI).

Overall, through screening 55 patients admitted to the RLI Coronary Care Unit (CCU), 38 were referred to BVH and thus eligible for inclusion, of which 35 received coronary angiography (see Figure 1). The only demographic

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**Figure 2: Time-point analysis of patient door-to-catheter times.**

Chart shows the three time points between admission at the Royal Lancaster Infirmary (RLI), referral to a tertiary care centre and receiving coronary angiography (CA) at Blackpool Victoria Hospital (BVH). All data is shown as arithmetic means with 95% confidence interval (CI) limits. Not to scale. Other abbreviations: hours (h); minutes (m); door-to-referral (DTR) time; referral-to-treatment (RTT) time; door-to-catheter (DTC) time; percentage fraction of door-to-referral time divided by door-to-catheter time (DTR/DTC).

parameter collected was age at time of admission, thus whilst a mean age at admission  $\pm$  standard deviation may be provided, no male-to-female ratio can be deduced. The mean age of patients admitted to the ward was older with a larger standard deviation than those receiving referrals to angiography ( $73.4 \pm 11.8$  years vs  $69.7 \pm 11.1$  years;  $n=55$  vs  $n=38$ , respectively). The mean age of the cohort receiving angiography were the youngest ( $68.9 \pm 11.1$  years,  $n=35$ ).

### Time-point analysis

Time-point analysis demonstrates that the mean DTC time was  $199\text{h}43\text{m} \pm 123\text{h}52\text{m}$  (mean  $\pm$  95% confidence interval,  $n=35$ ), with the lowest confidence interval of  $75\text{h}51\text{m}$  being above the recommended 72 hours. Only 31.4% of patients received angiography within 72hrs ( $n=35$ ). The mean DTR time from RLI admission was  $17\text{h}33\text{m} \pm 4\text{h}45\text{m}$  ( $n=38$ ), and only  $15.6\% \pm 4.8\%$  ( $n=35$ ) of the DTC time was DTR. Thus, the majority of the wait time occurs in BVH due to extensive RTT times, with the mean RTT time being  $182\text{h}08\text{m} \pm 123\text{h}34\text{m}$ . Overall, we have not met the 80% DTC within 72-hour NICE gold standard.

## DISCUSSIONS

### Challenges and study limitations

Limitations and hurdles exist to achieve the gold standard of practice. Firstly, NSTEMIs and late-presenting STEMI often present in resource-limited settings such as accident and emergency (A&E). Whilst the short DTR time contributes little to the delays to angiography, the BVH delay in receiving referrals likely increases the RTT time, as referrals are only being actioned at BVH during office hours. Furthermore, logistical difficulties such as transport availability and dependency on BVH and their respective bed availability further increases RTT time.

### Recommendations and action plans

Multiple recommendations and actions will be initiated to reduce DTC times and improve patient clinical outcomes. Firstly, early notification and priority referrals for the cardiology team for ACS patients can further reduce DTR time, as referral decisions for coronary angiography can be expedited. To date, we have shared the audit outcome with the RLI's acute medical unit (AMU) and A&E teams. An emphasis of early discussion between 09:00 and 16:00 may facilitate the process of BVH receiving whiteboard referrals during office hours. We have also discussed that the referring team should investigate and/or treat any medical reason that might delay angiography referrals, such as, gastrointestinal bleeding, sepsis, anaemia, *inter alia*. Additionally, an electronic flyer for the RLI ED and AMU teams will be created to emphasise the timeline for NSTEMI angiography referrals and advice on overcoming the hurdles in achieving more expedient referrals.

To address the RTT time delays, we have shared the audit outcome with the BVH cardiology team. We have asked for any action or modification at their end to achieve the 72-hour goal and we have agreed that the role of an organiser for the transfer between UHMB and BVH is vital. Any case that needs to be discussed, should be discussed directly between the consultant cardiologists of the two hospitals to prevent any delay.

Finally, we will disseminate this information via an MBMJ publication for transparency and ease of access for other cardiology departments with a planned closed-loop reauditing to assess for improvements at 4 months post-presentation.

## CONCLUSIONS

In summary, we are currently not achieving the predicted 80% of door-to-catheter time below 72 hours as recommended by NICE. Timely coronary angiography in patients with NSTEMI and late presenting STEMI is an area that requires significant improvement. Whilst we will take actions within UHMB to



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further reduce DTR times, the majority of delays come from extensive BVH RTT times. More awareness and communication must be present both interdepartmentally within the trust and between the trusts. A reaudit will formally assess any improvements made by our actions.

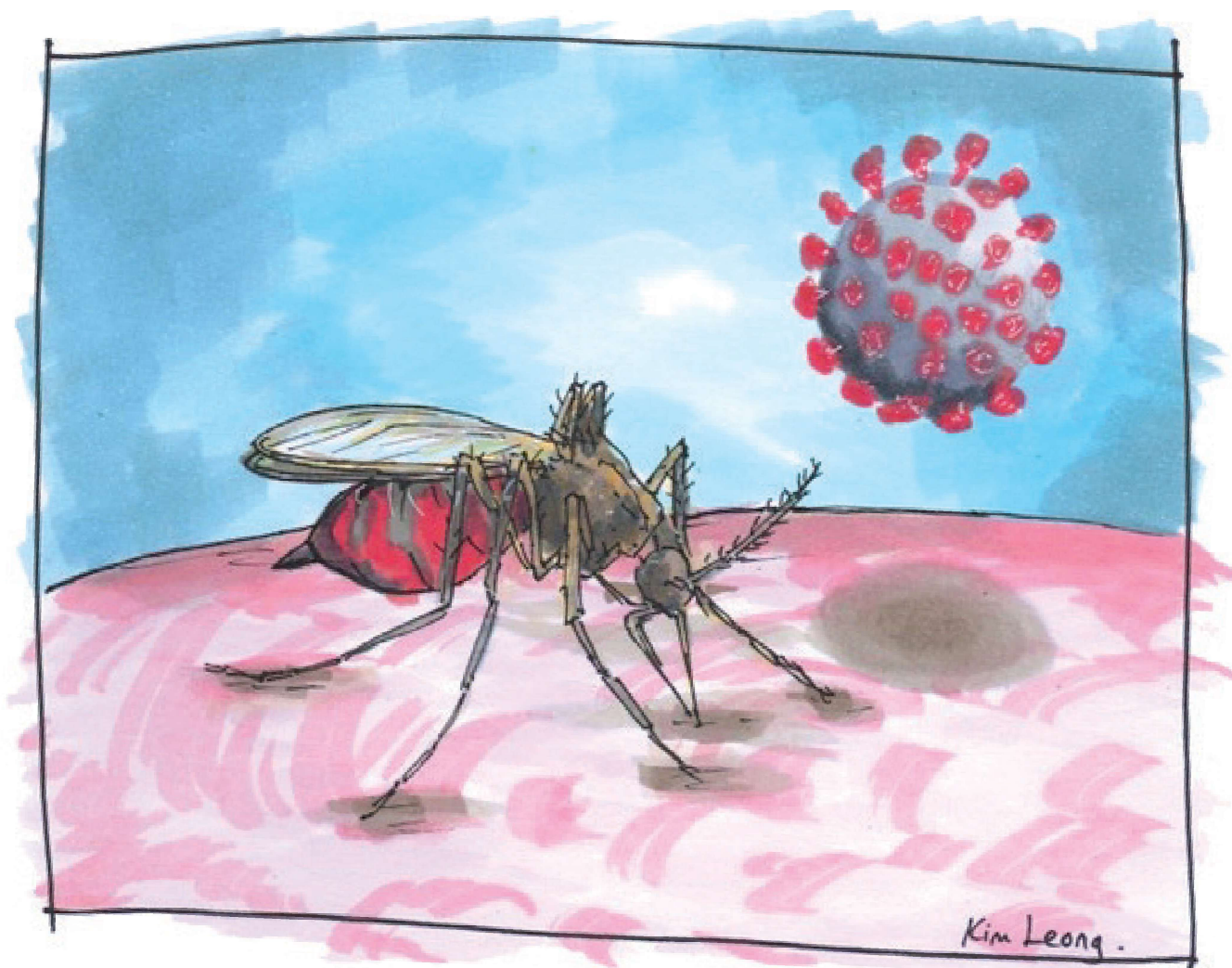
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