

Making a Diagnosis Through Coronary Angiogram

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Introduction

The work that we present in this paper is work-in-progress that is part of an on-going larger project based in a UK hospital. Our project is exploring the communication of medical test results from angiography (where x rays are taken of the blood vessels around the heart), and the subsequent understanding and perceptions that individuals have about their chest symptoms

The fieldwork we are presenting today was situated in the specialist cardiology centre of a hospital during their weekly angiogram clinics. We followed patients and clinicians through the process of having, and undertaking, an angiography, including preparing for the angiogram and communication of the results. The fieldwork was an integral part of understanding how angiography takes place, and using the experience to inform in-depth interviews with patients, clinicians and nursing staff.

This paper focuses upon the angiogram test and the myriad of work, actors and materials involved. We discuss three points. Firstly we give some background to coronary angiography. We argue that within medical practice, an angiogram can be considered to be a defining moment in the trajectory of chest pain patients, who will have generally started their journey in primary care. The angiogram test result is used, in conjunction with other knowledge's, to make a differential diagnosis, which will then determine the medical management of a patient. For example, blocked arteries or damaged valves can lead to major surgery involving a coronary bypass operation or the replacement of valves. Next, we examine the work that is undertaken to make, and to interpret angiogram results, including the range of knowledge's, technologies and materials, which are brought together for a moment. Third, we highlight the ordering and prioritising of different knowledge's to make a diagnosis, and how it is mediated to the patient. Finally we raise some questions about the

writing and describing of diagnostic practices; in what ways does this contribute to knowledge of bodies and disease? How can this feedback into practices of diagnosis? In this case what can it tell us about the management of cardiac chest pain?

Background to the Angiogram

The detection and treatment of heart disease in the UK is a current research and government priority, as evidenced by the *National Service Framework for Coronary Heart Disease* (DoH 2000). The confirmation of a diagnosis of coronary heart disease can involve the high use of, and cost to, the health services. For example, the financial burden of coronary heart disease in the UK during 1999 in direct health care was £1730 million (Liu, Maniadakis, Gray, Rayner 2002), and in 2000 angina alone cost £669 million (Stewart, Murphy, Walker et al 2003).

There are different presentations into angiography, including patients with acute symptoms, who may well have ended up at A&E with a heart attack and need an angiography to assess the damage to the heart muscles, or valves. Chest pain is often one of the first indicators of coronary heart disease and often the symptoms that prompt patients to present to their General Practitioner (GP). We are particularly interested in patients who present initially with chest pain because they form the majority of patients for angiogram and in relation to our larger project, which has a special interest in patients that get a normal result, patients who present with chest pain rather than an acute episode are more likely to have a normal result..

One can consider that a typical trajectory for chest pain patients is from primary care into secondary care for a variety of diagnostic tests, such as an echocardiogram (ECHO, where ultrasound technology presents a 'picture' of the heart, valves and chambers), a chest X-Ray, an electrocardiogram (ECG which provides an electrical record of the heart), and an exercise tolerance test (where stress upon the heart is tested whilst walking on a treadmill). All of the aforementioned tests are considered to be non-invasive, that is they do not enter into the body itself, they are performed upon the exterior body, whereas the angiogram is considered to be an invasive test. Patients who have these type of non-invasive tests generally end up at cardiology clinics in secondary care for specialist advice, where the results from the non-invasive tests are aggregated to form an opinion about any diseases of the heart.

Nevertheless, such tests are clouded with uncertainty, as one clinician remarked "*It depends upon who's done the test, I'd trust the report from a consultant at the [hospital B], or [hospital H], but otherwise...*" Some patients (Stats here), based upon their medical history, symptoms, and results from the non-invasive test are then referred on for angiography. Some patients may well have normal results from earlier tests but still report chest pain and because those tests are not considered definitive or wholly accurate they are referred for angiogram.

The presentation and management of chest pain in primary and secondary care is complex. For clinicians, there are a variety of management and diagnostic strategies that can be used to, initially, exclude acute life threatening episodes of chest pain, and in the long term to diagnose and treat chest pain. Chest pain patients often represent a clinical dilemma for primary care physicians, general physicians, geriatricians, gastroenterologists and cardiologists. Almost inevitably, secondary care clinicians are faced with patients who have uncertain histories and represent a diagnostic puzzle (Sox 1996). The concomitant workload implications for clinicians results in substantial financial costs to the health service, as well as personal costs to patients.

Depending on the results of earlier tests patients with chest pain may then be referred for a coronary angiogram (mean waiting time was 261 days in 1994 (Black, Langham, Coshall et al 1996). A coronary angiogram is a test whereby a catheter is put into an artery of vein usually in the groin. X-ray films are then taken by putting a dye down the catheter and taking a series of pictures of the heart as the dye is pumped through arteries (or veins) and the pumping chambers of the heart. It visualises the heart and its surrounding blood vessels (Duden – Ultrasound?) through taking x-rays at twelve and a half frames per second, which give the representation of a moving, albeit, slightly stilted film in various shades of black, white and grey. As the British Heart Foundation information leaflet says earlier tests can, *“give a lot of information about the heart. However, sometimes it is not possible to make important decisions about treatment unless a test called a ‘coronary angiogram’ is done”*.

The angiogram can be seen to be a definitive moment in the diagnostic and treatment trajectory of patients with chest pain because it is a test through which the state and functioning ability of the heart, pumping chambers, valves and coronary arteries are visualised in detail. An important difference in this test is that contrast (a proxy for blood flow) can be seen pumping through the heart chambers, valves and arteries and so any disease or damage, e.g. thinning in the arteries or low functioning in the pumping chambers can be seen, thus explaining symptoms or abnormal results of earlier tests. It is the visualisation of abnormalities or in the clinicians terms the ability to ‘see’ them through the angiogram that makes this test so important in the diagnosis of chest pain or an acute coronary episode.

The angiogram can also be seen as a definitive test because it can determine where patients go next in terms of treatment trajectory and patient identity, for example if the angiogram results appear ‘normal’ a patient may be told that they do not have angina, can stop their medication and need no further treatment. Thus these patients move from being a patient with a heart condition, that they may have been treated for for several years, to being ‘normal’. Other patients’ angiogram results may show pathology that will need further treatment or only needs to be treated if the patient feels sufficiently debilitated by the

symptoms. Patients with abnormal results may then move from having query chest pain to severe and life threatening heart disease or non-life threatening disease that may or may not need treatment. Clinicians often have ideas about what they are going to 'see' at the angiogram based upon the patients' notes, symptoms and results of earlier tests. So this suggests the angiogram is not definitive in a way but actually it is because it's the test that decides not the clinicians' intuition, thus they are sometimes surprised but have to follow the results of the test.

Work and Materials involved in Making a Coronary Angiogram

An angiogram is a highly technical procedure, which involves, amongst many technologies, materials, and actors: a dedicated annexe in a hospital; anaesthesia; x-ray machines; computers; and specialised clinicians. It is also a highly risky procedure – entering the heart can cause abnormal rhythms and even heart attacks – especially as some of the patients are quite ill. So during the morning there is a lot of work that the nurses do to calm the patients and ensure the smooth running of the test and prevent adverse reactions to the test.

On the morning of their angiogram, patients arrive at 8.00am where they present themselves at the Cardiac Centre, a purpose built extension to the hospital which consists of a reception area (with filing systems of medical records), an open ward with six beds, an angiography suite, entered through a door off the ward, which is referred to as the 'lab' and a variety of smaller rooms, including a changing room for staff, a kitchen, and a 'diagnosis' room (to which we will return). Patients change into the ubiquitous hospital gown. Blood pressure is checked, medical conditions are asked about, those with diabetes and kidney conditions are highlighted as potentially difficult patients to undertake the procedure, as their vessels may be impaired restricting access to the heart. The consultant cardiologist who is in charge of the team who undertakes the angiography obtains consent from each patient whilst they are on the day ward and consult the patients' notes as they chat to each patient.

The lab is sub-divided into the 'treatment' area taking up approximately three quarters of the room and a 'protected' technician's area. As angiography uses x ray technology, there are a variety of barriers to reduce the risk of exposure to harmful x-rays. Staff who perform the x-rays wear lead-lined aprons, skirts and throat guards. The consultant also wears a 'dosimeter' around his head, ankle and sometimes on the wrist, where the amount of x-ray exposure is recorded. The nurse who observes the patient's vital signs remains behind a barrier to ensure that they are not exposed to the potential harmful x-rays.

At approximately 9.00am the specialised clinicians in the 'lab' are ready to start angiography, and include the consultant cardiologist mentioned above, sometimes a registrar who is

learning how to perform the procedure, two radiographers trained in angiographic techniques, a technician who takes out an angiographic pack for each patient and lays it out on a trolley, and a nurse who observes the patients' vital signs (blood pressure and heart rate) via pads stuck on to the patients body and linked to a computer. Patient's who can, walk unaided into the lab (without slippers!) in their hospital gowns accompanied by nursing staff from the day ward. Others who are having trouble breathing are wheeled in a wheelchair. Patients are seated on the lab bed, their hospital gown is drawn down off their shoulders, tucked underneath their arms, and then they are asked to lay down on the treatment bed, which can be adjusted vertically and horizontally allowing the patient's body to be moved to allow the blood vessels to be seen from different angles. Nursing staff ensures that the correct patient is on the table. At the same time, the consultant is 'scrubbing up' washing hands and forearms, putting on a sterile gown and gloves. The lab technician is laying out the angiographic tray, with a sterile sheet, scissors, cutting blade, swabs, cannula, catheters, antiseptic and swab. The radiographers are preparing their equipment for the test: taking out a bottle of 'contrast', an iodine based fluid which will be pumped into the catheter and then released out of the tiny holes at the end, it is the contrast which is visualised on the x-rays, and it forms the structures of the heart and its blood vessels. As the contrast is quite sticky, it has to be flushed out of the arteries and the chambers of the heart with another solution, heparin with sodium chloride.

The patient's gown is lifted up around the groin, which is then doused in antiseptic via a pyramid-shaped swab on a handle, which is then thrown into a bin at the foot of the bed. A sterile blue cover is then laid over the lower part of the patient's body. The sheet has a circle cut out to enable access to the groin, or any other part of the body. The consultant injects anaesthetic into the groin area with the spoken caveat that the needle may hurt! As the anaesthesia is taking effect, the other lab staff are preparing for the angiography. Once the anaesthetic has taken effect the angiography 'set' with three different catheters is taken from a sterile package. The consultant or registrar cuts into the groin and then inserts a cannula into the femoral artery, this remains in place whilst a catheter is inserted through the cannula and then slides up the femoral artery until it reaches the heart. The catheters are different shapes to accommodate entry into the intricate shape of the heart, such as the chambers.

Whilst the consultant is inserting the catheter into the patient, the radiographers are preparing their equipment for the angiogram: the contrast for a patient is taken from a designated cupboard and a batch label is taken off the bottle and stuck into the patients medical records. The nurse prepares the patients skin for monitoring during the angiogram by rubbing patches with an abrasive and then sticking them on to each shoulder and two on the left leg. Electrical leads are then connected to each patch and a circuit has to be made which then measure the heart rate and the blood pressure and displayed on the monitor in front of the consultant and also to the nurse in the technicians area, who will observe the vital signs throughout the

procedure and verbally warn the clinician if there are any patterns which suggest that there is a problem. This data, that is how the patient responds physically to the test, is recorded as useful data in the diagnosis of the patient.

Once the catheter has been inserted, the radiographer and consultant work closely together to take images of the heart and its blood vessels, which can be considered to be a 'road map'. However, unlike roads, blood vessels are three dimensional and require pictures to be taken from a variety of angles to ensure that overlaps are exposed and any ambiguities in vessels are uncovered. The examination bed can be moved as the contrast is injected so that the full complement of vessels are captured in one shot. Once a film of the vessels is taken, it can be repeated on one of the screens in front of the clinician to make sure that the images are good enough for analysis. Generally, there is a brief discussion between the consultant and the radiographer about the films and their meaning.

The angiogram test can be quite fast moving with the radiographer for example having to move the bed and camera in order to follow the catheters as they move up the body and into the heart. Jessica's notion of collaboration or coupling is useful here as similarly the radiographer has to move as one with the consultant who will get quite grumpy if s/he does not anticipate his every move. So a radiographer has to get to know the clinician, their working practices in order to be able to, as one radiographer said to us, 'read their minds'. The nurses also do a lot of calming of the patient in order to ensure the smooth running of the test – also because this is a highly risky procedure, often done on very ill patients, and can cause heart attacks, so keeping the patient calm is important.

The time taken to undergo an angiogram varies from approximately twenty to fifty minutes dependent upon the patient. Patient's who have complicated histories such as previous bypass surgery, take considerably longer, as grafts have to be found to assess their current state. In the instance of complex patients, clinicians consult the patients' notes before the angiography to formulate a 'picture' of the vessels beforehand – grafts and stents.

Practice varies between consultants in the information given to the patient at the end of the angiogram: one gives a brief synopsis to the patient; whilst the other does not disclose any information. After the angiogram, the clinicians' come back to the protected area and look through the pictures to consolidate their diagnosis, sometimes using the patient notes. If it is a complicated test – for example the patient has bi-passes already – then the clinician will sometimes consult notes during the test.

Analysing the results: 'a real eyeball exercise'

From observing the angiogram test it seems that whilst there might be a designated time and physical space (the reporting room) for 'analysing result further' (as the patient is told), there is not one moment of diagnosis. Rather it is a process that began when the patients first presented with either chest pain or an acute episode – but its not that the process has been linear, for example the angiogram is still in many ways a definitive moment and the pictures have priority but the earlier tests and patient history are brought into the angiogram and analysis of the results. As we have already illustrated, whilst the coronary angiogram test is being done the clinician builds a picture of what the results are going to be, sometimes referring back to images and notes in-between patients. Once all of the coronary angiogram tests are done for the mornings clinic, the clinician will then (after a short break or any other jobs to be done) move to the 'reporting room' to analyse the results in more detail, write up notes and make decisions about treatment options. More often the clinician reports knowing pretty much what s/he is going to report just by looking at the angiogram as it is being done and often they have expectations based on the notes and other results at to what they are going to see in the angiogram test.

In the reporting room the clinician sits in front of a computer screen and views the angiogram images again – sometimes repeating particular images several times over in order to have a good look at something, for example a narrowing in an artery or to make sure that nothing is missed. The clinician then records this data in the patients' records and on a software generated representation of the heart and its surrounding blood vessels. There are a variety of options available within the software, such as the percentage of occlusion, which can be reported for each vessel, ranging from 10-90%. There is no 'firm' way of measuring these percentages of occlusion, it is made by the clinician, based on their experience and the images in front of them. So there is this movement from a highly technological test with the emphasis on precision etc. to this moment of reporting where measurements are made based upon what the clinician, based upon experience, can 'see'. Interestingly, the medical literature is littered with papers discussing a threshold of occlusion, 70%, after which treatment has to take place. Thus, through following the work of angiography we are able to see that practice and guidelines are far more uncertain than imagined.

Finally s/he will make recommendations in the notes for treatment. In a way we were surprised that this process was not more complicated and I think that this made us realise the importance of the angiogram images. At this point, in the cases we have observed so far, the patient's notes are physically absent. The clinicians sometimes refer to results of stress tolerance tests or ECG's but this seems to be more in response to our questions, for example we were told things like, this was someone who performed okay in the stress tolerance test so we didn't expect to see anything and as you can see it is all normal. Expectations from the

patients' history in terms of symptoms and test results are either confirmed or shifted in relation to what is seen on the screen. At this point it is the visual that is most important, as one consultant put it when we asked him about the process of analysing the results, 'it is a real eyeball exercise', because through the angiogram image the technologically mediated truth of the state of the heart, its pumping chambers, valves and arteries can be seen.

Ordering and Prioritising Knowledge

Prior to the coronary angiogram the patients' trajectory is determined by their reported symptoms, response to any drug treatment and results of test. Once the angiogram has been performed images of the heart, its state of disease and functioning take priority and either confirm or displace reported symptoms and other test results. In terms of what to do next in some cases the images of the heart provide a clear pathway for the patient. For example if the results are 'normal' the patient can be discharged. In other cases the extent of disease or damage may be so bad to mean that either a treatment is deemed a necessity or that there is no treatment apart from drugs that can be done. The patient's physical state, history and response to drug treatment are then needed to design the appropriate treatment. There is also a further set of patient's who have disease or damage to the heart but it is not life threatening and so the treatment option is very much determined by how the patients are experiencing their symptoms and thus whether they want to opt for treatment or not. Thus once the 'truth' of the heart is known through the angiogram the patients notes, and symptoms emerge again to decide and negotiate treatment. So whilst the angiogram is definitive there is this movement between the angiogram and the other knowledge's available – the patients reported symptoms, results of tests, history and at different points the other knowledge's take priority. This is also a moment where the uncertainty and unpredictability of heart disease emerges as something that needs to be taken into account in how the diagnosis is communicated to the patient and decisions are made about what to do next.

After analysing the results the clinician does a ward round in order to discuss the results with the patients. At this point the clinician pushes a trolley around with all of the patient's records in. S/he stops at each bedside, extracts the correct records which are then matched with the printed results sheet. The records are looked at briefly and then the clinician moves to the bedside to talk to the patient, at which point the curtains are pulled around the bed for privacy. What we want to now do is just describe a couple of cases to illustrate this point of this movement between prioritising of different knowledge's. For some patient's, this is going to be a difficult time, for others the news can be a relief, and then again, a surprise.

Mr B is in his late fifties, the lab staff had remarked that he worked at the hospital and was known to some of them. After the angiography the consultant had come behind the protective

screen and commented that Mr B's heart and blood vessels were 'bog standard' they would be examples of a healthy heart, absolutely nothing wrong with them, and would hope that all hearts were similar. He commented, 'I hope my arteries look like that'. He replays the pictures to illustrate his point. At the bedside a couple of hours later, the consultant tells Mr B the good news that there is nothing wrong with his heart, and goes on to ask which medication he is taking, which turn out to be for angina. The story unfolds before our eyes and ears, Mr B had been diagnosed seven or eight years ago by his GP as suffering with angina, and had been managed and treated as such until recently when he had started to experience intermittent chest pain, one day walking up a fell with no pain, and then walking into his garden and hardly able to carry on because of the pain. Eventually he was referred for an angiogram to help identify the causes. The consultant then tells Mr B that his chest pain is not related to his heart, but is now translated into a muscular problem. It is the muscles of the chest which are probably causing Mr B his problems with pain and functioning. Perhaps the muscle pain is from strain during exercise. The consultant goes on to instruct Mr B to stop taking all of his angina medication immediately. In the space of a few minutes Mr B's illness of nearly a decade has been ejected, the angiogram reveals another illness through omission rather than inclusion. Mr B's pain is still present, his stories about the unpredictability of his chest pain are constant. But the x-ray visualisation of his heart redefines his illness, it moves away from the heart to the muscles in his chest. Abruptly, years of taking medication are sidelined, Mr B has to re-define himself as 'heart-healthy'.

In this instance, the pain experienced by Mr B has been prioritised in the journey to the angiogram, without his explanations about walking up fells or in gardens, the angiographic test would not have happened. Nonetheless, Mr B's experiences of pain are re-ordered and re-prioritised, the angiogram test results are showing that there are no irregularities of the lumen, no atherosclerosis furring up vessels and restricting the blood flow.

We are looking at the films of a patient where the consultant is showing us a blockage in one of the arteries into the heart of a patient in her/his 50's. We view the image several times over to check its position, size and see it from different angles. He shows us how the rest of the heart seems to be functioning well, there is no left ventricle damage, no other blockages. We ask him what will happen for this patient. He tells us that it really depends on her/him and his/her symptoms, how is s/he experiencing the symptoms and are they impairing his/her life at all. He tells us that the patient is whilst at greater risk of further heart disease is not in immediate risk once the artery has already blocked. The blockage has calcified and so is not likely to do much and if it does we cannot predict that. Treatment in terms of angioplasty may not work on a calcified blockage and a heart bypass is not imminently needed to prevent a life threatening episode. However these surgery options could relieve symptoms and so the next step depends on the patient and her/his symptoms.

The move from the lab to the diagnosis room re-orders and re-prioritises knowledge's. The angiogram test result turns out to be a device to serve the symptoms of the patient. According to the clinicians the ability of the heart and its vessels to remain in working order are uncertain, there emerges a sense of uncertainty. Patients who appear to have relatively mild chest pain symptoms can end up with major surgery, conversely, patients with 'classic' symptoms can leave the day ward with less certain knowledge than when they first arrived. The symptoms of the patient are now paramount in the treatment and management of pain, discomfort and functioning. The work of the angiogram has been to reveal the medical condition of the heart, but it is the patients' perception of their pain, their ability to walk 100 metres to the car park, or the ability to walk up a fell, which will determine the next medical steps.

Conclusion

In this paper we have discussed the making of a diagnosis through a coronary angiogram test. We have described the test itself seen as a definitive moment in the diagnosis of patients presenting with chest pain or an acute coronary episode. We have highlighted how, whilst the angiogram images are prioritised, there is not one moment of diagnosis, rather this is a process. In doing this we have included the 'what happens next' in terms of the patients trajectory of treatment as an important part of that diagnosis, (like Ingunn did yesterday when she talked of the entanglement of diagnosis and intervention). We have stressed how during this process of diagnosis there is oscillation between different factors and we have highlighted the ordering and prioritising of knowledge's that takes place. For example the angiogram is definitive because if it shows a blocked artery the fact that is visualised does not change – the patient will go away being a person with a blocked artery, but in terms of what is done next – unless there is a clear need for intervention to prevent death – what is done next depends on the patient symptoms and previous notes. Also there is not a standard route into the angiogram clinic – who gets there, timescales depends on symptoms, results of tests, the patients' ability to cope with chest pain and deal with professionals, and the referral system. So there is constantly this movement between the variety of knowledge's (factors) at play.

Thinking through ethnographies of diagnostic work and our research of observing angiography, we feel that doing this work raises questions for us – in terms of what do we do with these descriptions of diagnostic work. In what ways does this contribute to knowledge of bodies and disease? How can this feedback into practices of diagnosis? In this case what can it tell us about the management of cardiac chest pain?

We are concerned with questions about making our work accessible and useful to clinicians. We want to ask how do we really engage with consultant cardiologists who perform this procedure regularly, and what does it mean to undertake ethnographic work to unravel the

complexities of practice? Does the ethnographic work of uncovering hidden work necessarily lead to new standards and protocols as someone asked yesterday and is this desirable? There is much work within science and technology studies that has critically engaged with more recent attempts within medicine to standardise practices and create 'best practice'. For example, '*Childhood experts almost unanimously advise that children need structure and rules. Yet the twinkle in our daughters' eyes when violating a "standardized" rule we had only set ten minutes earlier made us, once again, understand both the importance and limitations of standardization*' (Timmermans and Berg 2003: ix). Donna Haraway 'standards are not unimportant but they don't work'.

We remain entranced by what we see on the screen – it is hard to interpret a blocked artery as anything but when you have 'seen' it on the screen. We feel that we want to speak out against the technologically mediated truth, the raising of the technological above the individual but there is something pretty definitive in a blocked artery to the heart when viewed on the screen, we are seduced by the pictures. But the reason why this work we are doing is important and interesting is because these diagnosis are contested within the field. For example we are particularly interested in patients that are given a normal diagnosis, how they are constructed and what happens next to them, we are told by clinicians that these patient's often end up back at angiogram eventually because the symptoms don't go away. Within the medical literature there is also controversy over diagnosis and treatment options. Heart disease is also highly unpredictable thus clinician's tell us that there is no point talking of life expectancy with patients because you just don't know – people with left ventricle damage which is a very serious condition possibly reducing life expectancy to a year can and often do live much longer, you just don't know. If death occurs it tends to be very sudden and unpredictable, not necessarily related to symptoms. So we could de-construct it all – heart disease is highly unpredictable (as the clinicians have told us), could this unpredictability be due to limitations of the diagnosis? We could argue that patient symptoms etc should be taken more seriously, talk perhaps of clinician's power etc but we don't think that is really what is going on, apart from perhaps they could do with a better manner with patients. Diagnosis is messy, complicated, things can be missed but what does it mean to highlight that?

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