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Research and Report Writing
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Writing Academic Proposals

1. How to be a good researcher
2. How to extract a knowledge gap
3. How to select research methodology
4. Your logistical capabilities
5. Writing proposal



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How to become a good researcher

- Patient
- Trust on yourself
- look for the facts
- Critical thinking
- There is no stupid idea
- Think differently



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How to become a good researcher

- Accept the criticism
- Reading skills
- Problem solving skills
- Writing skills
- Work with groups



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How to become a good researcher

- Building a social network
- Having clear goals / being organized / having a good research plan
- Working hard, working smart
- Stepping out of the comfort zone
- Learn new skills



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How to extract a knowledge gap

- Work experience (Professionals)
- Scientific experience (Professor)
- Literature review (Papers)
- Read the recent literature review (Introduction)
- Look for critical reading
- Read the limitations.



International Conference on Stents: Materials, Mechanics and Manufacturing ICS3M 2019

Distinguish the Stable and Unstable Plaques Based on Arterial Waveform Analysis

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Department of Engineering, Faculty of Science and Engineering, Manchester Metropolitan University, Manchester, M1 5GD, UK

Abstract

The rupturing of unstable plaques, formed by atherosclerosis, is the main factor contributing to the stroke event. According to stroke association in 2017, the stroke is the fourth leading cause of death in the UK. The percentage of plaque composition plays an important role for plaque stability and can be considered as important information to determine whether the patients need surgery or not. The main aim of this work is to determine the relationship that exists between plaque composition and arterial waveform for distinguishing stable and vulnerable plaques. An *in-vitro* experiment, representing the arterial system, is used to investigate the effect of the composition of the atherosclerosis on the propagation of the arterial waveforms. Different types of the artificial plaque, fabricated manually, were implemented into the artificial carotid artery. The pressure, velocity and arterial vessel wall movement were measured simultaneously proximal to the site of the arterial plaques. Wave intensity analysis (WIA) was used to separate the waves into forward and backward waves to identify how the plaque compositions will affect the reflected arterial waveforms. Our results indicated that stable plaques caused the stronger reflected waves, leading to the higher amplitude of the arterial diameter waveform. In general, this study demonstrated that the arterial waveforms are strongly associated with the compositions of the arterial plaques, implying the arterial waveform could provide the information to characterize the types of the plaques, then leading to a novel approach to stratify the atherosclerosis patients and determine if the interventional vascular surgery is needed.

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Keywords: Stable plaque; Vulnerable plaque; Wave Intensity Analysis;

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1. Introduction

Cardiovascular diseases (CVD) cause a death for almost 30% in the worldwide and could even lead to disability (Kohn et al., 2018). Stroke is the fourth largest causes of death in England and Wales, and the third in Scotland where approximately 100,000 stroke events occur in the United Kingdom (Stroke Association, 2018). The atherosclerosis plaque in the carotid arteries is considered the main cause of a stroke and it is

1. Introduction

Cardiovascular diseases (CVD) cause a death for almost 30% in the worldwide and could even lead to disability (Kohno et al., 2018). Stroke is the fourth largest causes of death in England and Wales, and the third in Scotland where approximately 100,000 stroke events occur in the United Kingdom (Stroke Association, 2018). The atherosclerosis plaque in the carotid arteries is considered the main cause of a stroke and it is

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M. Abdulsalam et al. / Procedia Structural Integrity 15 (2019) 2–7

3

initiated by inflammatory processes in the endothelial cells of the artery, which is associated with retained low-density lipoprotein (LDL) particles. The LDL, therefore, will pass through the endothelium, which build up the so called 'Plaque' (Johri et al., 2017).

There are several types of plaques, and some of them are more likely to rupture than the others. The stable plaques are less likely to rupture because they have a thick fibrous cap with a small lipid core (LC) area (van der Wal, 1999). While unstable and vulnerable plaques have been characterized by several studies which indicate that they have a thin fibrous cap (< 65 µm) and its LC is substantial (Libby, 2001; Andrews et al., 2018). If plaque ruptures in the carotid artery, it will either block the oxygenated blood from reaching the brain or bleed, which will lead the brain cells to die (Li et al., 2019).

In recent years, Magnetic Resonance Imaging (MRI) has played an important role in assessing the health of blood vessels. One of the MRI studies investigated the macrophages by using Polymeric Nanoparticle PET/MR Imaging to detect atherosclerotic plaques. That study proved that this technique can be used as a non-invasive method to assess the inflammation plaques and can play an important role in the therapy purposes (Majmudar et al., 2013). However, one of the limitations of this technique is that the acquisition data is not simultaneous, which may lead to creating incorrect results (Cuadrado et al., 2016). In addition, the negative sides of MRI are relatively high cost and require breath holds, which may not be suitable with some patients. The composition of plaque and its vulnerability were examined by Naim et al. (2013) to evaluate the ability of non-invasive vascular electrophysiology (NIVE) by applying high MRI resolution. Although this study success to detect the present of lipid core in the significant stenosis, it fails to detect precisely the vulnerability of plaque.

Jashari et al. (2015) used Cone Beam Computed Tomography (CBCT) in conjunction with ultrasound to detect the atherosclerotic calcification in the carotid artery. It is true that this study identifies the volume and the presence of calcification, but does not show the detection of LC and the progress of plaque in the early stages. Sigovan et al. (2017) applied 3D black blood Magnetic Resonance Angiographic (MRA) of the carotid blood vessel to investigate intra - plaque hemorrhage (IPH) and the stenosis, which showed reliable measurements in the stenosis of the carotid vessel, although overestimation has been detected through comparison with 3D contrast-enhanced angiography. The pulse wave imaging has been used in recent study with stenosis degree between 50% and 80% in order to identify the plaque properties (Li et al., 2019). This study gives an optimistic view that it is possible to differentiate between plaques. However, the results of this study, to large extent, are not accurate because the data was not adequate due to complex waveform. To date, a novel technique, being able to distinguish the compositions of the plaques and providing the accurate information to the vascular surgeons to clarify the types of the plaques, is still lacking. Therefore, the main aim of this paper is to use the wave intensity analysis (WIA) techniques to separate the arterial waveform into the forward and backward components to characterize the difference between stable and unstable plaques.

2. Theoretical background

were firstly collected with no plaque as a healthy case and the measurements were taken proximal to the plaques. The flow rate and wall movement data were collected simultaneously and sent it to the computer. These data were analyzed by Matlab version 16.

4. Results

4.1. The measured diameter and velocity

The measured velocity and diameter for the healthy one (no plaque), unstable plaque and stable plaque are shown in Fig.2 a and b, respectively. It is clear that the higher amplitudes of diameter waveforms were generated in the arteries with the plaques attached, while healthy artery with no plaque has the lowest amplitude of the diameter waveforms. As is expected, the stable plaque generated the highest amplitude of the arterial waveform, while the amplitude of the diameter waveform in the artery with the unstable plaque is less than that with the stable plaque. Similar pattern was also found for the velocity arterial waveform although the difference between three types of arterial system is not very significant.

4.2. The forward diameter and velocity

WIA is used to separate the measured pressure, velocity and diameter into the forward and backward components for three types of arterial-plaque system (Fig.3). The forward velocity amplitude of the stable plaque that generated from the heart (ventricle) is slightly higher than that of unstable plaque (0.553 m/s via 0.533 m/s). Similarly, the forward diameter amplitude of stable plaque is also slightly higher than that of unstable plaque (1.04 mm via 0.96 mm).

4.3. The backward diameter and velocity

The backward waves which produced from the reflections are shown in Fig. 4 a and b. It was observed from the figures that the backward velocity and diameter of soft plaque are higher than those for hard plaque are. This phenomenon is opposite to our prediction as the hard plaque should have higher backward reflection than the soft plaque because of their stiffness.

5. Discussion

This study investigated two types of plaques: the FC and TCFA plaques, which represent the hard plaque and soft plaque, respectively. Configuration of these two artificial plaques were referred from the previous studies regarding the plaque characteristics and properties by Guo et al. (2013), Teng et al., (2014) and Butcovan et al. (2016). The data was collected after five minutes of starting the experiment. Each plaque was tested three times in order to ensure the reproducibility. It is as expected that the stable plaques with the higher proportions of Ca is linked with the higher amplitude of the measured diameter, whereas the unstable plaques with the more percentage of lipid core is related to the lower amplitude of the measured diameter. The visible differences of the measured velocity waveforms were observed for two types of the arterial-plaques system with the lowest velocity amplitude occurring at the arterial system with the stable plaque. This means that stable plaques generated the stronger reflected waves, leading to the higher amplitude of the arterial diameter waveform and lower amplitude of the velocity waveforms.

The observations from Fig. 3a shows that the forward velocity in hard plaque is slightly higher than soft plaque. This observation could be explained as the further reflection of the reflected wave was occurring at the inlet of the system, which led to the increase of the velocity. Likewise, the forward diameter amplitude (Fig. 3b) in hard plaque is slightly higher than in soft plaque with the same reason.

The amplitude of backward waveform in the arterial system with hard plaque is expected to be higher than soft plaque because the stiffness of the arterial hard plaque is higher than soft plaque which supposed to produce higher reflection. It has been observed that the backward reflection amplitude of the soft plaque in velocity and diameter is higher than hard plaque (Fig. 4 a and b). These results do not meet our expectation. The reason of this phenomenon could be from further re-reflections from the inlet tube or because the material properties of the artificial artery of the hard plaque is different from the one that used in the soft plaque which do need further investigations.

Read the last two sentence
of each result

Read the last two sentence
of each discussion
paragraph

Fig. 3. (a) The forward velocity of healthy (blue), hard plaque (black) (FC) and soft plaque (TCFA) (red). The amplitude of velocity for hard plaque is higher than that for soft plaque; (b) The forward diameter of the healthy, hard and soft plaques. The amplitude for hard plaque is higher than that for soft plaque. The double- arrow lines demonstrate how the amplitude is measured.

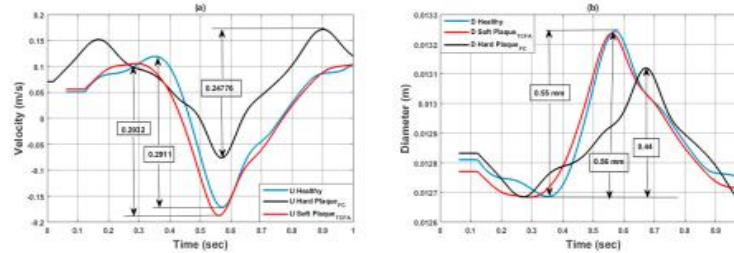


Fig. 4. (a) The backward velocity of healthy (blue), hard plaque (black) (FC) and soft plaque (TCFA) (red). The amplitude for soft plaque is higher than that for hard plaque; (b) The backward diameter of the healthy, hard and soft plaques. The amplitude for soft plaque is also higher than that for hard plaque. These results are not expected and further investigations are needed.

Finally, the limitation of this study is the fact that other types of plaque should be investigated. This may increase the capability of using this technique. Furthermore, the artificial plaque characteristics were fabricated as the same as the real plaque in terms of compositions and dimensions. However, its shape was uniform, which is different from the human carotid arterial plaques observed from clinical studies.

Read the paragraph before conclusion

6. Conclusion

This study demonstrates that the arterial waveform could provide useful information about different types of plaques. The compositions of the plaque are directly related to the waveform properties, which could lead to characterize between stable and vulnerable plaques. Using WIA to separate the waves into forward and backward waves has the potential to distinguish between stable and unstable plaques. Our findings notify that the forward velocity and diameter amplitude in hard plaques is higher than soft plaques. The fact that the backward velocity and diameter amplitude in soft plaque is higher than hard plaque is not expected and needs more investigations. The outcome might assist to distinguish between hard and vulnerable plaques and help the vascular surgeons to make decision precisely.

Read conclusion

Acknowledgement

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How to select research methodology

Qualitative

Quantitative

Mixed



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Qualitative

Qualitative research methods include gathering and interpreting non-numerical data. The following are some sources of qualitative data:

- Interviews
- Focus groups
- Documents
- Personal accounts or papers
- Cultural records
- Observation



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Quantitative

Quantitative studies, in contrast, require different data collection methods. These methods include compiling numerical data to test causal relationships among variables. Some forms of data collection for this type of study include:

- Experiments
- Questionnaires
- Surveys
- Database reports



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Your logistical capabilities

- Do you or your institution have the materials of your research?
- Can you Collect the data easily?
- Do you have the skills to analysis the data?
- Do you have supervisory team?



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Writing proposal

- Title
- Introduction
- Main aim
- Objectives
- Methodology
- Expecting results
- Conclusion
- References
- Gantt chart



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Title

➤ Your title should reflect

- Topic
- Aim
- Method
- Expecting result

➤ Example:

1. **Stent**
 2. **The effects of plaque compositions on the stent**
 3. **In vitro – Wave intensity Analysis**
 4. **Lipid plaque is the riskiest one**
- **The effect of plaque composition on stent to distinguish the risky plaque type using Wave intensity Analysis**



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Introduction

- A statement or 'hook' to gain the reader's interest.
- Important of the research topic
- Contextualizing material which means to provide relevant background information.
- Topic and focus of the proposal.
- The reason for writing the proposal.
- Question research





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Literature Review

- descriptive scientific elements of research title, highlighting important values of research topic.
- similar research undertaken in Libya, or closest provinces.
- similar work done on research topic elements with different approaches or methodology.
- Each paragraph should contain a cited reference in a numbered form, based on alphabetical sorting in References List.



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Literature Review

The structure of writing literature for one studies.

1. Present the study by using passive or active voice
2. Write the positive aspect of this study (Probably the last two sentences in conclusion)
3. Write the limitation of this study (it can be found in the paragraph before conclusion)

PRESENTING THE STUDY (ACTIVE)

Subject + Verb + Object

- Subject = Author name and year
- Verb: The verb of study aim (Paraphrase)
- Object = Either the object of the study aim or the study conclusion

Example: **Abdulsalam (2019)** has studied the correlation between lesion components and arterial waveform



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Literature Review

Presenting the study in passive voice way (One study)

Object + Verb to be + Past participle + by subject + Complement

- Object = aim/ Q research/ Method
- Past participle = part of aim or Q research
- by subject = Author
- Complement = Results/ conclusion

Example: Distinguishing between stable and vulnerable plaques have been investigated by Abdulsalam (2019)¹.



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Literature Review

Write the positive aspect of this study

Write the limitation of this study

<https://www.sciencedirect.com/science/article/pii/S2452321619301088>

This study However,

No	Main author(Year)	Main aim	conclusion	limitation
1	M. Abdulsalam (2019)	The main aim of this work is to determine the relationship that exists between plaque composition and arterial waveform for distinguishing stable and vulnerable plaques.	The fact that the backward velocity and diameter amplitude in soft plaque is higher than hard plaque is not expected and needs more investigations. The outcome might assist to distinguish between hard and vulnerable plaques and help the vascular surgeons to make decision precisely.	Two types of plaques only its shape was uniform

1. Present the study by using passive or active voice
2. Write the positive aspect of this study (Probably the last two sentences in conclusion)
3. Write the limitation of this study (it can be found in the paragraph before conclusion)

Distinguishing between stable and vulnerable plaques have been investigated by Abdulsalam (2019)¹. This study provide information to differentiate between stable and soft plaques and assist the vascular doctors to create decision accurately².

However, this study investigates only two types of plaques and the shape of the plaques are uniform which are not similar to the real one³.



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Literature Review

If you have two studies which one of them is opposite to other, you can use although

Although = Even though + Sub + Verb + Object, Sub + Verb + Object

Despite = In spite of + noun, Sub + Verb + Object

Despite = In spite of the fact that + Sub + Verb + Object , Sub + Verb + Object

Example: Although supporting banks with money by government would reduce the financial crisis (Hamuda et al 2010; Abdulsalam et al., 2008; Hafedah et al 2009), Ali and Mohamed (2010); Sarah et al., (2011) claimed that this support would probably increase the crisis.



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Literature Review

Literature Review Storey way

1. Present the study/ studies by using passive or active voice (explained)
2. Write the positive aspect of this study/ studies (Probably the last two sentences in conclusion)
3. Write the limitation of this study/ studies (it can be found in the paragraph before conclusion)
4. Present the study/ studies by using passive or active voice (explained above) that amend the limitation of the previous study/ studies
5. Write the positive aspect of this study/ studies (Probably the last two sentences in conclusion)
6. Write the limitation of this study/ studies (it can be found in the paragraph before conclusion)

Distinguishing between stable and vulnerable plaques have been investigated by Abdulsalam (2019)¹. This study support to differentiate between stable and soft plaques and assist the vascular doctors to create decision accurately². However, this study investigates only two types of plaques and the shape of the plaques are uniform which are not similar to the real one³. This shape of plaque has been modified to be close to the real one by Badi (2022)⁴. His study provides information about how to reduce the stroke risk which might help to decline the rate of fatal⁵. Yet, the intensity of the waves were not clear because of complex waveform⁶.



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Main aim

- It is the point that you seek to obtain it
- It is a very important factor
- You should discuss with your DoS
- It does not include any justifications
- No contrast linking words



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Main aim

Understand the Purpose:

Clearly understand the purpose of your research. What do you intend to achieve or investigate?

Identify the Problem or Research Question:

Clearly state the problem or research question that your study aims to address. This helps to set the context for your research.

Be Specific:

Ensure that your aim is specific and focused. Avoid vague or broad statements. Clearly articulate what you want to accomplish.



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Main aim

Use Action Verbs:

Begin your aim statement with an action verb that indicates the intended outcome of the research. For example, "To investigate," "To explore," "To analyze," etc.

Include Key Variables:

If applicable, mention the key variables or factors that you will be studying. This helps to narrow down the focus of your research.

Consider the Scope:

Make sure that your aim is realistic and feasible within the scope of your research. Avoid overly ambitious goals that may not be achievable within the constraints of your study.



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Main aim

Align with Research Objectives:

If your research proposal includes specific objectives, ensure that the aim is aligned with these objectives. The aim should encapsulate the overall goal that these objectives contribute to.

Review and Refine:

Take the time to review and refine your aim statement. Make sure it accurately reflects the essence of your research. Seek feedback from peers or mentors to ensure clarity and precision.

Example Structure:

A typical structure for an aim statement could be: "The aim of this research is to [action verb] [investigate/explore/analyze] [the problem or research question] in order to [achieve a specific outcome]."



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Main aim

Keep your aim statement clear and concise. Avoid unnecessary jargon or complexity that might confuse readers.

Relevance to the Field:

Emphasize the relevance of your research to the broader field or discipline. Explain why your study is important and how it contributes to existing knowledge.

Here's a generic example to illustrate the structure:

"The aim of this research is to investigate the impact of [independent variable] on [dependent variable] in order to [achieve a specific outcome]."



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Objectives

What are the means that lead to achieve the main aim?



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How to describe your method

- Methodology type
- How to collect data
- Draw the experiment
- Material
- Procedure
- Participants



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Expecting results

Back again, this depends on:

- Your experience
- Your knowledge
- Your sense



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Reference style using Mendeley

<https://www.mendeley.com/download-desktop-new/>



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Gantt chart

Dissertation Timeline

Task No.	Description	Additional information/ Dates	Resources Needed	Progress	To be completed by/ Submission date?	September				October					
						week 1	week 2	week 3	week 4	week 5	week 6	week 7	week 8	week 9	
1 Topic finding															
1.1	Read through lecture notes and assignments for topic inspiration			In progress											
1.2	Create a mind map of possible topics and what interests me			In progress											
1.3	Select and start learning to use reference management software			In progress											
1.4	Preliminary research: is there enough sources data or literature available?			Not started											
1.5	Refine topic into research questions			Not started											
1.6	Write preliminary objectives for achieving my research question			Not started											
1.7	Meet with supervisor to discuss topic suitability, research question, and objectives			Not started											
1.8	Amend topic focus/ plan based on supervisor feedback			Not started											
2 Proposal															
2.1	Write up agreed research question and objectives			Not started											
2.3	Research methodologies			Not started											
2.4	Prepare ethical statement			Not started											
2.5	Detailed planning (what chapters/ sections?, what will they include?)			Not started											
2.6	Create bibliography and reference list			Not started											
2.7	Meet with supervisor to review proposal before submission			Not started											
2.8	Submit proposal			Not started											Submit!
3 Literature review															
3.1	Refresh searching skills (attend workshop or complete online tutorial)			Not started											
3.2	Carry out searches			Not started											
3.3	Read through materials gathered picking out common themes and debates			Not started											
3.4	Start writing			Not started											
3.5	Speak to supervisor have I missed any of the major sources/ papers?			Not started											
3.6	Proof reading			Not started											
3.7	Check in with Supervisor														



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