

## Defining the demographics of the 'non-dissecting' acute aortic syndromes

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### Background

Guidelines for the management of type-B IMH and PAU are currently based upon those for aortic dissection. Whilst under the spectrum of acute aortic syndrome, they are individual processes, and patient demographics for each condition may be vastly different which may influence management outcomes. This study defines the demographics for patients with type-B IMH and PAU.

### Method

From a multi-centre UK-based study of 210 patients with type-B IMH or PAU, both patient demographics and details of multi-morbidity were established at the point of admission. CT imaging at admission confirmed the pathology and subgroups, by pathology, were assessed for differences in demographics and multi-morbidity.

### Results

From 210 patients there were 112 PAU (53.3%) and 94 IMH (44.7%). Within PAU, 26.7% had associated IMH (n=30). Hypertension and smoking were major risk factors for 74% and 52.4% respectively. Patients with PAU tended to be male (n=60, 28.6%, p=0.004) with hypertension (n=69, 81.2%, p=0.006) and coronary artery disease (n=52, 61.2%, p<0.001). Patients with IMH were more likely female (53.2%) with more advanced age than males, median 77.3 years (IQR 68.5, 84.1) versus 68.5 years (IQR 59.1, 76.5) p<0.001. There were fewer atherosclerotic cardiac risk factors in the female IMH cohort with lower incidence of known hypertension (n=59, 63.4%, p=0.006).

### Conclusion

The different patient demographics for IMH and PAU identified improve the understanding and may aid development of specific treatment strategies. IMH are likely older females with lower atherosclerotic risk factors whilst PAU occur in older males with more typical cardiac risk profiles.

## **Utilisation of artificial intelligence (AI) technologies to identify acute aortic syndromes from radiology reports**

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### **Background**

The incidence of Acute Aortic Syndrome (AAS) is reported to be between 4.4 to 7.2 cases per 100,000/year. The efficiency of referral of AAS to specialist care teams and to research studies is poor. The machine learning using natural language processing can enhance and automate this process utilising radiology reports as input. We aimed to develop ML algorithm utilising Natural Language Processing to identify cases with AAS, and to analyse epidemiology, short-term and long-term outcomes of patients with AAS managed in the single quaternary vascular centre over the last decade.

### **Methods**

We screened radiology reports from the University Hospitals Birmingham NHS Foundation Trust from 2011 to 2021. Cases were labelled manually as AAS, chronic aortic dissection and suspected acute aortic syndrome to train and test machine learning algorithm. We collected data on epidemiology, demographics, clinical outcomes.

### **Results**

We screened 114,378 radiological reports of CT scans, and identified 256 patients with AAS, 416 cases of chronic aortic dissections, and 2021 cases of suspected acute aortic syndromes. Most patients were male; the average age was 61.8 [IQR]. Majority of patients presented with DeBakey I aortic dissection. Developed ML algorithm was trained on 70% of selected radiology reports and tested on the remaining 30%. The fidelity of the developed ML algorithm was acceptable with accuracy exceeding 80%.

### **Conclusion**

Machine Learning utilising NLP can be used to identify these conditions from radiology reports.

## Identifying health inequities in intermittent claudication: Natural language processing insights into ethnicity, social deprivation, and vascular care

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### Background

Intermittent claudication (IC) is a common pathology, affecting 4.5% of the UK population. Predictors of IC progression and complications including amputation, such as smoking history and diabetes, have been described. However, little is known about the impact of ethnicity and social deprivation. This study leverages Natural Language Processing (NLP) based interrogation of electronic health records to identify the impact of health inequities in IC.

### Methods

Retrospective cohort study of patients with IC at a large, tertiary vascular referral centre identified using the SNOMED term of IC in the Medcat-NLP-AI toolkit. Demographics, Index of Multiple Deprivation (IMD), and indicators of disease progression and amputation were analysed using Kaplan-Meier survival and Cox regression.

### Results

5,027 patients (Mean age 73.7(61.8-85.6), Males 66.1% (n=2,781) were identified. Self-reported population ethnicity was 4.72% Asian, 15.5% Black, 79.7% White. All-cause mortality was 19.5% (n=979), with 5.85% of patients progressing to CLTI (n=294). Progression rates were comparable for Black (5.78%) and White (5.04%) patients. Rates of amputation were higher in Black (8.99%) patients, than White (7.36%) and Asian (5.09%) patients. Black ethnicity approached significance ( $P=.055$ ) as a predictor for amputation in univariate analysis (HR 1.88 (.99, 3.60 95%CI)). Amputation rates in the most deprived (IMD1 9.22%) were higher than in the least deprived (IMD5 6.30%).

### Conclusion

Disparities in amputation rates may exist between ethnicities within a universal healthcare system, although our sample size was insufficient to demonstrate statistical significance. A larger, multicentre analysis is warranted. NLP holds potential to identify health inequities and refine management algorithms.

## **A Pilot Study of Sustainability in Endovascular Surgery – Where does all the packaging go?**

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### **Background**

Sustainable surgery is an ever-growing topic of interest due to the threat of climate change to our global community. Surgery is resource exhaustive with operating theatres contributing 25% of a hospital's carbon footprint. A recent increase in endovascular aortic aneurysm repair (EVAR) has resulted in an expanding market of stent-grafts, which inevitably means more packaging. We aim to address the impact of EVAR packaging and examine disposal methods.

### **Methods**

To assess packaging sustainability, we reviewed EVAR packaging from 4 different companies' devices at our institution that might reflect common usage. All packaging for the main body and two limbs including additional leaflets were documented.

### **Results**

Of the 4 companies examined the packaging for each EVAR component contained 5-7 elements to hold one device. The majority of materials were classed as recyclable; however no packaging displayed the universal symbol for recyclable and not all were disposed of appropriately.

### **Conclusion**

This pilot observational study has highlighted that the majority of EVAR packaging can be recycled but is often not disposed of in a sustainable manner. We are addressing a real-life concern which needs analysis to propose a framework to mitigate the environmental effects of endovascular surgery. Lack of recycling and inappropriate incineration has substantial harmful environmental consequences. We should follow the Intercollegiate Green Theatre Checklist for guidance and could consider making packaging from recycled materials. Individual departments alongside regional/national bodies should discuss with manufacturers about modifying our practice of endovascular device packaging and thus help protect our environment and healthcare system.

# Comparative readability analysis of traditional and large language model derived patient information leaflets in vascular surgery

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## Background

Generative artificial intelligence, in the form of large language models (LLMs), is increasingly used by the public to access healthcare information. The aim of this study is to comparatively assess the readability of LLM responses against traditional patient information leaflets (PILs).

## Methods

Traditional PILs were collected from the Circulation Foundation (CF) and Society for Vascular Surgery (SVS) for: abdominal aortic aneurysm, carotid artery disease and peripheral arterial disease. Subheadings were collected and rephrased into questions. Questions were posed to ChatGPT-4 and BARD chatbots to generate LLM PILs. An automated readability score (ARS) was calculated for traditional and LLM PILs. The ARS represents the mean of the following automated readability indices: Flesch-Kincaid, SMOG, FOG, Coleman-Liau, Linsear-Write, and the automated readability index. ARS were compared between PILs by two-way ANOVA.

## Results

Two-way ANOVA showed no significant two-way interaction between document author and disease condition in PIL ARS ( $F(6,60)=1.96$ ,  $p=0.086$ ,  $\eta^2g=0.16$ ). Disease condition had no effect on PIL ARS ( $F(2,60)=0.45$ ,  $p=0.64$ ,  $\eta^2g=0.01$ ). PIL author had a significant main effect on ARS ( $F(3,60)=3.7$ ,  $p=0.016$ ,  $\eta^2g=0.16$ ). Pairwise comparisons showed ChatGPT-4 had lower ARS than both CF ( $p=0.022$ ) and SVS ( $p=0.007$ ) PILs. BARD also had lower ARS than SVS PILs ( $p=0.044$ ). With Bonferroni adjustment ChatGPT-4 had lower ARS than SVS PILs ( $p=0.043$ ).

## Conclusion

LLM derived patient information has lower average ARS than existing PILs and may be more easily readable. This has potential impact for the recommendation of these resources to patients experiencing vascular pathology.