

Implementation of Machine Learning and Natural Language Processing in clinical practice facilitates identification of patients with Acute Aortic Syndrome

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Background

The efficiency of referral of AAS to specialist care teams and to research studies is poor. The machine learning (ML) using natural language processing (NLP) can enhance and automate this process. Our earlier work demonstrated that NLP could enhance and automate identification of cases by analysing radiology reports, as opposed to relying solely on Electronic Health Records (EHR) or HES data. This study aimed to perform external validation of developed ML algorithm and to compare the efficiency of identifying cases of Acute Aortic Syndromes (AAS) through NLP-aided screening of radiology reports with that of EHR/HES data using ICD-10 codes.

Method

External validation of the algorithm was performed using radiology reports issued between 2011 and 2021 in the neighbouring Trust. Simultaneously, local EHR/HES was searched for AAS cases using ICD-10 codes.

Results

External validation of the developed ML algorithm performed on 40,030 radiology reports showed good model performance with AUC of 0.85. The EHR/HES screen identified patients with corresponding aortic pathology codes were cross-validated against NLP-identified cases. The cross-check revealed that 1 in 3 cases (28.7%) was not coded in EHR/HES. Patients without an ICD-10 code in EHR/HES were twice as likely to die during follow-up compared to those with a recorded ICD-10 code (HR 2.07, 95% CI 1.06-4.04, p=0.032).

Conclusion

Good performance of ML model on external validation could facilitate early identification of patients with AAS and improve referral pathway when implemented in the clinical practice.

Systematic review and meta-analysis of matrix metalloproteinases in peripheral arterial disease

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Background

Several studies have investigated the role of matrix metalloproteinases (MMPs) and their tissue inhibitors (TIMPs) in peripheral arterial disease (PAD). The aim of this study was to undertake a meta-analysis to determine which MMPs and TIMPs are key in PAD and the effect of endovascular intervention.

Method

Literature review identified 16 studies suitable for inclusion. Meta-analysis was conducted where possible and systematic review undertaken when not. Meta-analysis was carried out using Review Manager 5.4.1 using standardised mean difference and random effects.

Results

Meta-analysis identified a significant increase in both MMP9 and MMP2 in PAD patients (MMP9 SMD 0.80 (0.37, 1.23 $p=0.0003$), MMP2 SMD 2.39 (0.88, 3.91 $p=0.002$)). Meta-analysis was not possible for MMP-1, 3, 7, 10, 12 or 13 or TIMP-1 or 2 however systematic review showed significant increases in all MMPs and TIMP-1 in PAD patients compared to controls. TIMP-2 had no significant difference and neither TIMP was significantly dysregulated by endovascular intervention. Systematic review also showed significant dysregulation of MMP-3 and MMP-7 post-endovascular intervention at both 24 hours and 6 months post-operatively. MMP-9 levels were not significantly dysregulated by endovascular intervention at 24 hours (SMD 0.93 (-0.59, 2.46 $p=0.23$)), however 6 months following intervention there was a significant decrease in MMP9 (SMD -0.45 (-0.65, -0.24 $p<0.0001$)).

Conclusion

A wide variety of MMPs are dysregulated in patients with PAD however their clinical value is not yet established. Further work correlating the levels of MMP to walking distance and the impact on intervention should be carried out.

Clinical predictors of two-year survival in patients with infrarenal and juxtarenal abdominal aortic aneurysms

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Background

Assessing life expectancy is crucial for shared decision-making and patient selection in infrarenal and juxtarenal aneurysm repair. However, survival predictors derived from population-level data may not apply to local cohorts due to inherent differences. We evaluated factors associated with 2-year survival in patients treated at a tertiary referral centre in the West Midlands.

Method

We analysed patients undergoing elective infrarenal and juxtarenal aneurysm repair using standard EVAR and fenestrated EVAR (FEVAR) between 2007 and 2021. Survival was assessed using Kaplan-Meier analysis with right censoring at 730 days, and stepwise Cox proportional hazards regression evaluated the effect of covariates on survival.

Results

A total of 656 patients (91.0% men) with a median age of 75 years [IQR 70.2-80.0] underwent repair (64.6% EVAR, 35.4% FEVAR) for infrarenal and juxtarenal aneurysms (median diameter 61mm [IQR 58-67]). There was a high prevalence of smoking (72.8%), hypertension (85.8%), ischaemic heart disease (44.2%), hypercholesterolaemia (85.1%) and respiratory disease (27.6%). On multivariable analysis, age (HR 1.04, 95% CI 1.01-1.08, $p=0.008$), COPD (HR 2.03, 95% CI 1.32-3.11, $p=0.001$), CVA (HR 1.76, 95% CI 1.05-2.97, $p=0.033$) and treatment modality (HR 0.63, 95% CI 0.41-0.97, $p=0.034$) were independently associated with 2-year mortality.

Conclusion

Optimising patient selection is essential to achieve acceptable long-term outcomes in infrarenal and fenestrated aneurysm repair. Survival predictors are likely to vary with local population characteristics and should be carefully considered.

Acute Upper Limb Ischaemia outcomes meta-analysis

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Background

Acute upper limb ischaemia (AULI) is a vascular emergency, potentially requiring urgent intervention to prevent irreversible limb damage. Depending on symptoms patients may be managed medically, surgically or endovascularly. This study aims to report outcomes for each treatment option of AULI to guide clinical decision-making.

Method

EMBASE and Medline were searched for studies reporting outcomes for AULI including technical success, complications, reintervention, stroke, amputation and mortality. Data were analysed using Stata/MP, and probabilities were pooled using a DerSimonian and Laird random effects model with Freeman-Tukey arcsine transformation.

Results

27 studies were identified for inclusion. Conservative management (10 studies, 214 patients), surgical embolectomy (17 studies, 2712 patients) and endovascular intervention (7 studies, 101 patients) identified overall success rates of 75.69% (95%CI: 50.43–94.71), 90.94% (95%CI: 85.27–95.50), and 69.43% (95%CI: 43.30–90.77) respectively. Reintervention rates were significant in both the surgical (16.24% 95%CI: 6.67–28.24) and endovascular groups (49.88% 95%CI: 31.50–68.28). Overall complication rates were high in those undergoing surgical intervention (19%), with significant rates of stroke 9% (95%CI: 3–14), amputation 6% (95%CI: 3–7), and mortality 10% (95%CI: 5–14).

Conclusion

Although surgical management appears to have the highest overall technical success, there remains a significant risk of complications in these patients, and paucity of data on endovascular and conservative management options. In addition, this cohort of patients has a significant risk of mortality. Further prospective and randomised studies are essential in this area.

A comprehensive systematic review of all reported outcome measures in studies of Chronic Limb Threatening Ischaemia: First step toward a core outcome set

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Background

The prevalence of Chronic limb-threatening ischemia (CLTI) is increasing and associated with high morbidity and mortality. Published research in CLTI is evolving but there are currently no outcome reporting standards for research in CLTI. The aims of this review were to describe and categorise all reported outcome measures in published studies of CLTI, and review discrepancies in their definitions.

Method

Medline, Embase, CINAHL, and Cochrane Central databases searched from inception until March 2024 to identify all studies recruiting CLTI patients and reporting at least one outcome measure. Abstract, full text screening, and data extraction were performed by two investigators independently. Outcome measures extracted verbatim. (PROSPERO: CRD42023412204)

Results

A total of 19,760 abstracts and 4,516 full texts were screened: 1,284 studies were included. Across all the studies 678 unique outcomes were reported, 481 (71%) of these were reported once. All-cause mortality, primary patency, and Major Adverse Limb Events (MALE) were the most frequently reported outcome measures. Patient-reported Outcome Measures (PROMs) were reported in fewer than 37% of all the studies. Validated quality of life tools were used in only 26% of the studies. There were wide variations in definitions of commonly used endpoints across the studies.

Conclusion

There is substantial heterogeneity of outcome measures in studies of CLTI. Consensus regarding which outcomes to use, standardised definitions, and optimal methods to measure some of these outcomes are yet to be established. A core outcome set for CLTI is urgently needed to improve the quality and comparability of CLTI studies.