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EVALUATION OF A RAG-LLM CHATBOT TO ENHANCE WORKFLOW PRODUCTIVITY IN A SINGAPORE TERTIARY TEACHING HOSPITAL

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ABSTRACT

Background:
As a tertiary teaching hospital, we routinely receive new trainees, some of which without prior radiology experience. There is a steep learning curve in a radiology rotation. Significant amount of time is spent manually searching for radiology-related information stored across various formats and locations within our hospital's internal cloud storage for answering protocolling related queries. Currently, at least two radiology trainees are assigned to handle such inquiries daily.
We trialled a retrieval-augmented generation (RAG) chatbot powered by a large language model (LLM), trained with internal radiology documentation to address this inefficiency. This study aimed to evaluate the chatbot's impact on workflow efficiency, specifically in terms of time savings and response accuracy.

Methods:
42 duty and 27 vetting sessions, each lasting 4.5 hours, were randomly selected and retrospectively analysed, between December 2024 and March 2025. Radiology-related clinical queries that were potentially answerable by the chatbot were identified by reviewing phonecall logs. Consistency, accuracy, and reliability of the chatbot were also reviewed by five radiology trainees and two senior radiologists using 50 standard questions which were subsequently paraphrased.

Results:
The average time per radiology-related phonecall was 5.06 minutes (median 5.0; 95% CI: 4.06–6.06) on duty stations and 3.06 minutes (median 2.0; 95% CI: 2.66–3.46) on vetting stations.
The chatbot response time was 5-10s (rounded up to 1 minute) with 76% accuracy and demonstrated consistent answers for 92% of paraphrased questions.

Conclusion:
The chatbot showed strong potential for reliably handling routine radiology queries and shows potential to enhance overall operational efficiency.

CAN A FREE AI TOOL HELP DETECT LUNG INFECTIONS IN ER X-RAYS?

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ABSTRACT

Background:
Chest X-rays (CXRs) are essential in emergency departments for diagnosing lung infections, especially when radiologists are unavailable. This study explores whether a free, open-source AI model can assist by automatically analyzing CXRs for signs of infection in resource limited settings.

Methods:
We retrospectively analyzed 1,006 anonymized chest X-rays from ER patients taken after hours using the CARPL.ai platform. The open-source CheXNeXt algorithm evaluated each image for pneumonia and lung consolidation (radiological measures of infection), using a 70% probability threshold to indicate a positive result. These findings were compared to official radiologist reports.

Results:
Consolidation: Sensitivity 28.2%, specificity 98.8%, PPV 84.1%, NPV 85.7%, AUC 0.900
Pneumonia: Sensitivity 30.8%, specificity 98.7%, PPV 83.6%, NPV 86.6%, AUC 0.855
The high specificity means the model rarely mislabeled healthy patients as sick, but low sensitivity indicates it missed many actual cases. The implication is that such a model can potentially help in the early triage, admission and management of sick patients in the ER.

Conclusion:
The AI demonstrated strong performance in identifying positive cases with high confidence. This will allow faster and more efficient triaging of patients with reduced rates of delayed diagnosis. Given that such a model is open source and freely available, there is scope for a fast and low-cost deployment of such an AI model in smaller and less well-funded healthcare centres.

MAXILLARY SINUS MORPHOMETRY FOR FORENSIC IDENTIFICATION USING CBCT: A STUDY IN MALAYSIAN AND INDONESIAN POPULATIONS

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ABSTRACT

Background
Radiographic analysis is integral to forensic identification, particularly in estimating age, sex, and individual identity. The maxillary sinus is a structurally unique and radiographically accessible feature yet remains underutilised. Cone beam computed tomography (CBCT), with its superior resolution and reduced radiation exposure, offers a valuable modality for evaluating sinus morphology. This preliminary study aims to investigate the potential of CBCT-derived maxillary sinus morphometry in forensic identification, among Malaysian and Indonesian adult populations.

Methodology
210 CBCT scans from Malaysian and Indonesian populations were analysed for maxillary sinus width, height, volume, septa presence, shape variations, and anatomical proximity to the hard palate. Morphometric data were statistically compared across sexes and age groups.

Results
In the Malaysian population, males exhibit significantly greater left sinus height (mean: 39.16 mm, $p < 0.001$). Right sinus height and right volume also varied significantly by sex. Right volume decreased with age, particularly beyond the age of 40, indicating potential as an age-related marker. Regression analysis shows significant relationship between rights sinus width and age. In the Indonesian population, similar trends were observed with sinus height, width, and volume. The maxillary sinus showed high discrimination potential for sex in both populations.

Conclusion
Morphometric analysis of the maxillary sinus through CBCT demonstrates strong forensic value. Distinct sex- and age-related variations, along with individual maxillary sinus uniqueness, support its application in forensic identification, particularly within the Malaysian population. These findings reinforce the role of CBCT imaging as a reliable and precise tool in forensic odontology.

Keywords: Maxillary sinus, CBCT, forensic identification, morphometric, forensic odontology

THE ESSENTIAL ROLE OF RETRO ORBITAL FAT VOLUME AND EXTRAOCULAR MUSCLE IN EVALUATING PROPTOSIS (STUDY OF THYROID EYE DISEASE PATIENTS)

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ABSTRACT

Background
Thyroid eye disease (TED) is a disease that causes proptosis, which is affected by increased retroorbital fat tissue volume and enlarged extraocular muscles. This study aims to determine the differences in the values of proptosis (IZ measurement), retroorbital fat volume (RFV), extraocular muscle volume (EMV), and the relationship between these parameters and the incidence of proptosis in patients with TED.

Methodology
Observational analytic design with a cross-sectional approach, involving 30 patients with TED and 30 patients without TED who underwent CT scans at Saiful Anwar Hospital Malang. Proptosis measurements were performed with RadiAnt DICOM viewer; RFV and EMV measurements were performed with 3D Slicer 5.6.1 software. Correlation and logistic regression analyses were performed to identify the relationship and influence of the parameters on proptosis.

Results
The IZ measurement, RFV, and EMV in TED patients were higher than those in the normal group ($p < 0.05$). In TED patients with proptosis, RFV and EMV (especially in the inferior and medial rectus muscles) were significantly higher than those in the non-proptosis group. Correlation results showed a significant positive relationship between RFV and EMV, as well as IZ measurement, in TED patients ($p < 0.05$). Logistic regression analysis showed that RFV had a significant effect on proptosis, with an odds ratio (OR) of 1.001 ($p = 0.005$).

Conclusion
Measurement of RFV and EMV is a helpful indicator in assessing the incidence of proptosis in patients with TED. RFV had a significant influence on the occurrence of proptosis.

Keywords: CT scan, EMV, proptosis, RFV, TED

ULTRASOUND FEATURES ASSOCIATED WITH NONDIAGNOSTIC RESULTS IN FINE-NEEDLE ASPIRATION CYTOLOGY OF THYROID NODULES

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ABSTRACT

Background
FNAC is a common method used in evaluating thyroid nodules. Unfortunately, up to 33.6% of FNAC may prove to be insufficient or nondiagnostic. Nondiagnostic results may be related to several factors, including intrinsic characteristics of the thyroid nodule. Our study aimed to evaluate whether ultrasound features of thyroid nodules are associated with nondiagnostic FNAC results.

Methodology
All patients with thyroid nodules who underwent FNAC in our centre from January 2021 to December 2022 were included in this study. The ultrasound characteristics of each thyroid nodule (composition, echogenicity, calcifications, margin and shape) and the corresponding FNAC results (diagnostic or nondiagnostic) were retrospectively collected from clinical records. Chi-square test was performed to determine the association between both classifications using SPSS version 30.0.

Results
Out of 172 nodules, 61 (35.5%) were nondiagnostic. Nodule composition was the only ultrasonographic feature significantly associated with nondiagnostic outcomes ($p = 0.020$), with predominantly cystic nodules more likely to yield insufficient samples. No statistically significant associations were found for nodule size ($p = 0.148$), echogenicity ($p = 0.310$), calcifications ($p = 0.147$), margin definition ($p = 0.279$), or shape ($p = 0.521$).

Conclusion
The study suggests that thyroid nodule composition may be associated with nondiagnostic results, with solid nodules more likely to yield diagnostic samples, while cystic nodules had higher nondiagnostic rates. Although the association was statistically significant, the reliability of the Chi-square test is limited due to small expected counts in some categories. Further analysis using larger sample sizes is recommended to confirm this association.

Keywords: ultrasound, thyroid, nodule, TIRADS, nondiagnostic

MEASUREMENTS OF VESTIBULAR AQUEDUCT WIDTH IN AXIAL AND 45° OBLIQUE (PÖSCHL) PLANE TO ASCERTAIN A NORMAL RANGE FOR MALAYSIAN PEDIATRIC POPULATION WITHOUT HEARING LOSS

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ABSTRACT

Background
In their original 1978 description, Valvassori and Clemis reported that a midpoint vestibular aqueduct (VA) width of greater than 1.5mm is abnormal. This is measured by using hypocycloidal polytomography and this value is still generally accepted today. Yet, there has been no precise definition of normal VA width on CT studies. This study will help to determine the normative values of VA width in the axial plane and 45° oblique (Pöschl) plane for Malaysian pediatric population without hearing loss.

Research Objectives
To determine the normative values of VA width in the axial plane and 45° oblique (Pöschl) plane for Malaysian pediatric population without hearing loss.

Hypothesis
The upper limit of normal VA width is 1.0mm in the axial plane and 0.9mm in the 45° oblique plane.

Methodology
Study design: Retrospective study.
Study location: Radiology Department, HCTM
Study period: 1st Jan 2022 – 31st Dec 2024
Study population: 20 years old and below.
Inclusion criteria: CT examination performed for indications other than hearing loss.
Exclusion criteria: Age 21 years old and above. History or clinical evidence of hearing loss.
Sample size: 85
Data collection: Available scans of CT Brain, CT Face or CT Paranasal sinuses with bone reconstruction done are retrieved from PACS via convenient sampling method. Each CT indications are then assessed for inclusion and exclusion criterias via the available clinical data on CHETS. The VA width measurements will be made with the use of current workstation software (Osirix/Horos) by two head and neck radiologists, in bone window setting.

Results

	Mean	**Std. Deviation**	**Minimum**	**Maximum**
Right Ear VA widths in Axial plane (mm)	0.47	0.18	0.10	0.88
Left Ear VA widths in Axial plane (mm)	0.40	0.18	0.10	0.96
Right Ear VA widths in 45° Oblique (Pöschl) Plane (mm)	0.49	0.17	0.10	0.88
Left Ear VA widths in 45° Oblique (Pöschl) Plane (mm)	0.49	0.17	0.10	0.79

Percentile (n=85)	**Size (mm)**			
	50th	**75th**	**90th**	**95th**
Right Ear VA widths in Axial plane	0.47	0.61	0.72	0.75
Left Ear VA widths in Axial plane	0.40	0.51	0.66	0.74
Right Ear VA widths in 45° Oblique (Pöschl) plane	0.51	0.61	0.69	0.78
Left Ear VA widths in 45° Oblique (Pöschl) plane	0.44	0.55	0.65	0.72

Conclusion

The upper limit of normal VA width is 8.0mm in both the axial plane and 45° oblique plane.

Keywords: vestibular aqueduct width, pediatric, head and neck

CENTRAL VENOUS STENOSIS SCREENING USING ULTRASOUND GUIDED SNIFF TEST: A PROSPECTIVE STUDY (C - VENUS)

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ABSTRACT

Background:
Central venous stenosis (CVS) is a significant complication among dialysis patients. Diagnosis using digital subtraction angiography (DSA) is resource-intensive and involves radiation. Ultrasound-based "sniff test" offers a non-invasive, radiation-free alternative for screening, but its diagnostic performance remains underexplored.
Objective:
To evaluate the diagnostic accuracy of the ultrasound-based sniff test in detecting CVS.

Methods:
57 patients scheduled to undergo central venography for suspected CVS were recruited. Prior to the procedure, each patient underwent an ultrasound sniff test. Greater than 40% reduction in subclavian vein diameter during forceful sniffing compared to rest was considered a *positive* sniff test. CVS was confirmed using central venography.

Results:
57 patients were enrolled, with a median age of 67 years (IQR: 57–75). 26 patients had confirmed stenosis. The sniff test was positive in 52.6% of patients and negative in 47.4%. Patients with a *negative* sniff test had significantly higher odds of having stenosis (OR: 17.5; 95% CI: 4.67–65.58). It demonstrated good sensitivity [80.77% (95% CI: 60.65%–93.45%)], specificity [80.65% (95% CI: 62.53%–92.55%)], positive predictive value [77.78% (95% CI: 62.48%–88.03%)], and negative predictive value [83.33% (95% CI: 69.06%–91.80%)]. The overall diagnostic accuracy was 80.70% (95% CI: 68.09%–89.95%), and the area under the ROC curve was 0.81, indicating good discriminatory ability.

Conclusion:
The sniff test demonstrates promising diagnostic performance in screening for CVS, with high sensitivity, specificity, and overall accuracy. Given its non-invasive nature and accessibility, it is a useful tool to identify patients requiring further confirmatory imaging via venography.

Keywords: Central venous stenosis, screening, ultrasound, sniff test

APPARENT DIFFUSION COEFFICIENT (ADC) NORMALISATION AFTER EARLY REVASCULARISATION IN ACUTE STROKE PATIENTS AND ITS' RELATIONSHIP WITH PATIENT OUTCOME

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ABSTRACT

Background
Diffusion weighted imaging (DWI) together with Apparent Diffusion Coefficient (ADC) have been shown to be more sensitive in detecting ischemic stroke in the acute stages. However, debate exists on the clinical usefulness. This study was undertaken to determine the prevalence of ADC normalisation after early revascularisation and its relationship with patient outcome.

Methodology
A retrospective cohort study was conducted on 77 patients with acute ischemic stroke (AIS) who underwent mechanical thrombectomy. Their ADC values at baseline MRI and post recanalization (day 5) and were classified according to clinical outcome. The ADC measurements and reversal (pseudonormalisation) were then analysed and compared between these two groups. Receiver Operating Characteristic (ROC) curves and Area Under Curve (AUC) were used to determine optimal cut-off values, sensitivity and specificity.

Results
Patients who have lower initial NIHSS score, higher baseline and day 5 (post recanalisation) mean ADC value and ratio, as well as patients with better ADC pseudonormalisation (ADC reversal closer to normal tissue) in day 5 imaging have significantly more favourable outcome. Multiple regression analysis revealed that younger age, higher baseline (day 1) means ADC value and ratio, patients with better ADC pseudonormalisation as well as absence of reperfusion haemorrhage in day 5 MRI were associated with good clinical outcomes.

Conclusion
ADC normalisation is not a rare event and is detected in post revascularisation of acute stroke patients and that earlier intervention and revascularisation improves the chances of ADC pseudonormalisation. ADC pseudonormalisation in post revascularisation of acute stroke patients is associated with better clinical outcome and is a potential indicator in predicting clinical outcome of stroke patients.

Keywords: acute ischemic stroke, ADC, pseudonormalisation

TRANSARTERIAL EMBOLIZATION OF PANCREATICODUODENAL ARTERIOVENOUS MALFORMATION (AVM) WITH PANCREATITIS AS A COMPLICATION: A CASE REPORT

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ABSTRACT

Pancreaticoduodenal arteriovenous malformation (AVM) is a rare vascular anomaly and mostly congenital in origin. We report a case of 51-year-old male who presented with recurrent hematemesis, melena and anemia. Esophagogastroduodenoscopy revealed a large D1 Forrest III ulcer. Contrast-enhanced CT angiogram demonstrated a pancreatic head AVM. Subsequent celiac and superior mesenteric angiograms confirmed the presence of multiple, tortuous vascular network supplied by the gastroduodenal artery and inferior pancreaticoduodenal branch of the superior mesenteric artery, with venous drainage into the portal and superior mesenteric veins. He underwent staged transarterial embolization (TAE) of the feeding arteries using 20% lipiodol glue and polyvinyl alcohol (PVA) particles (355–500 μm and 250 μm). These interventions achieved partial embolization with a 40–50% AVM size reduction. Post-procedure, he developed pancreatitis as a complication. This case highlights the definitive treatment for these conditions, emphasizes the role of AVM angioarchitecture classification in guiding the endovascular treatment strategies and outlines the clinical scenarios when endovascular intervention is indicated.

Keywords: Pancreaticoduodenal arteriovenous malformation.