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Emerging Technology & Futuristic Practices: Issues of Concern for Radiography Practice in Nigeria

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GROUP A: RADIATION PROTECTION AND DOSIMETRY

A1

Establishment of Diagnostic Reference Levels (DRLs) for Radiography Examinations in North-Eastern Nigeria

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Background: Diagnostic reference levels (DRLs) are essential optimization tools in radiography and radiological sciences.

Objective: To establish DRLs for radiography examinations in North-eastern Nigeria

Methodology: A prospective cross - sectional study conducted in two university teaching hospitals in north-eastern Nigeria. Seven hundred and fifty (750) patients were recruited for the study. Thermo-luminescent dosimeter (TLD) chips were exposed for each examination. Pearson's correlation was used to determine the relationship between the dose and anthropo-technical parameters. Statistical significance was set at $p < 0.05$.

Results: The DRL for chest x-ray (PA and lateral) were 0.59 mGy and 1.02 mGy, while for skull x-ray (PA and lateral) were 1.02 mGy and 1.01 mGy. Another DRLs for x-ray examinations were: 0.57 mGy and 1.77 mGy (PA and lateral elbow); 0.71 mGy and 0.83 mGy (AP and lateral shoulder); 0.58 mGy and 0.61 mGy (dorsi-plantar and dorsi-plantar oblique foot); 1.03 mGy and 1.09 mGy (AP and lateral dorsal spine); 0.62 mGy and 0.79 mGy (AP and lateral cervical spine); 1.22 mGy and 1.59 mGy (AP and lateral lumbosacral spine). Others were: AP wrist (0.52 mGy), lateral wrist (0.87 mGy), AP knee (0.50 mGy), lateral knee (0.91 mGy), Abdominal x-ray (1.01 mGy), pelvic x-ray (0.82 mGy), hand dorsi-palmar (0.28 mGy), hand dorsi-palmar oblique (0.83 mGy) and dental x-ray (0.46 mGy).

Conclusion: DRLs in this work recorded lower values compared to internationally established work. Regular dose optimization etiquettes are required to ensure good practice.

Key words: Diagnostic reference levels, X-Ray, Thermoluminescent dosimeter, milliGray

A2

Diagnostic Reference Levels (DRLs) for Contrast Radiography Examinations in North-Eastern Nigeria

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Background: This study was carried out as part of a comprehensive project to establish DRLs for radiological examinations for the first time in North-eastern Nigeria.

Objective of the study: To establish DRLs for contrast radiography examinations in North-eastern Nigeria and to compare it with other established work.

Methodology: A prospective cross - sectional work conducted in two university teaching hospitals. Three hundred and Sixty (360) patients were recruited for the study. Dose were recorded using thermo-luminescent dosimeter (TLD) chips in x-ray and dose area product (DAP) in fluoroscopy. Student T-test was used to determine the relationship between the mean entrance skin dose (ESD) obtained in the two centres while Pearson's correlation was used to determine the relationship between the dose and anthropo-technical parameters. Statistical significance was set at $p < 0.05$.

Results: DRLs for this study were 6.68 mGy and 10.66 mGy.cm^2 (IVU), 2.31 mGy and 3.67 mGy.cm^2 (HSG), 2.66 mGy and 8.98 mGy.cm^2 (barium meal), 12.78 mGy and 20.64 mGy.cm^2 (barium enema), 2.73 mGy and 6.56 mGy.cm^2 (barium swallow), and 2.05 mGy and 7.77 mGy.cm^2 (RUG), respectively. The ESD and DAP showed statistically significant relationship for barium enema while it was mAs and kVp that showed a similar relationship for barium swallow and barium meal, respectively. The remaining study showed no statistical significance ($p > 0.05$).

Conclusion: DRLs in this work recorded lower values compared to internationally established works. However, regular dose optimization technique and etiquettes are required to ensure good practice in this locality.

Key words: Diagnostic reference levels, dose area product, thermoluminescent dosimeter, ,entrance skin dose, x-ray

A3

Recommended $CTDI_{vol}$ and DLP for Computed Tomography in Nigeria

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Background
Inspite of the risk of radiation hazard, there is increasing installation and use of computed tomography (CT), a high dose imaging modality, in Nigeria. Sadly, the radiation output of the scanners have not received commensurate interest. This presents a daunting challenge to the optimization of patient protection.

Objective
To assess a sample of CT scanners for $CTDI_{vol}$ and DLP output and set threshold levels to improve the optimization of protection for patients.

Methods
The volume computed tomography dose index ($CTDI_{vol}$) and cumulative dose-length product (DLP) of head CT scan were extracted manually from the subject's dose information on the computer screen, and the mean, as well as the 75^{th} percentile were then calculated for each zone, and the entire country. Data was analyzed with the aid of computer software, statistical packages for the social sciences (SPSS) version 20.0.

Results
A total of 175 CT scanners are installed in Nigeria with 66 % (n = 116) of them in a state of functionality as at June 2017. The $CTDI_{vol}$ and DLP were assessed using scanners from general electrics (GE), Toshiba, Philips, Siemens and Neusoft. CereTom was the only model left out due to low distribution and inaccessibility. The slice capacity ranged from 4 to 128. Tube potential was uniform (120 kVp) in the centres while tube current was within a narrow range (200 – 250 mA). The radiation output for head investigation amongst the adult population gave a mean/75^{th} of 57/63 mGy ($CTDI_{vol}$) and 1336/1431 mGy.cm (DLP), respectively. This is comparable to a similar work from Kenya but higher than the recommendations of the European Commission.

Conclusion
Threshold $CTDI_{vol}$ and DLP are 63 mGy and 1431 mGy.cm, respectively. Because the DLP is considerably higher than values found in the literature, it is recommended that an update course for CT radiographers be urgently carried out by the regulatory board, to ensure that subsequent surveys will have much lower and acceptable values.

Keywords: CT scanners, dose, CTDI, DLP, optimization

A4

Recommended $CTDI_{vol}$ and DLP for Computed Tomography in Anambra State of Nigeria

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Background
Diagnostic reference levels were initiated as a result of wide variations in patient dose levels for the same examination. Current works on computed tomography (CT) doses in Nigeria produced significant variations. These observed variations, coupled with unavailable national or regional diagnostic reference levels have presented the need for the establishment of standards through a dose survey.

Objective
To determine and recommend threshold radiation output for computed tomography of the head in the adult populations of Anambra State of Nigeria.

Methods
A retrospective survey which was undertaken from February to June, 2016 in the four busiest CT centres. The digital computed tomography population considered was those of subjects examined in 2015, and who were aged ≥ 18 years. Two hundred folders, comprising fifty from each centre were included. The on-screen $CTDI_{vol}$ and DLP for the subjects were recorded. The 75^{th} percentile was then calculated for each centre to establish centre-specific diagnostic reference levels. Finally, a combined 75^{th} percentile of the $CTDI_{vol}$ and DLP for all centres was calculated to establish the diagnostic reference levels for the State. Data was analyzed with the aid of computer software, SPSS version 20.0 (SPSS Incorporated, Chicago, Illinois, USA).

Result
The digital folders of 104 male and 96 female subjects with age range of 18 -93 years were analyzed. The specific 75^{th} percentile of the $CTDI_{vol}$ and the DLP of the centres ranged from 46 – 86 mGy and 794 – 1785 mGy-cm, respectively. The threshold radiation output for the state are 66 mGy ($CTDI_{vol}$) and 1,444 mGy.cm (DLP), respectively.

Conclusion
The diagnostic reference levels for head Computed tomography in Anambra State have been derived. Although the $CTDI_{(vol)}$ is comparable to the recommendations of the European Commission, the DLP is significantly higher. Further training on dose optimization may help to bring the radiation dose in the locality at par with foreign values.

Keywords: Computed tomography, dose, $CTDI_{(vol)}$, DLP, CT protocol

Awareness of Possible Health Effects of Radiation Emitted by Mobile Phones: A Case Study of University of Nigeria, Enugu Campus Students

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Objective: To assess the awareness of University of Nigeria, Enugu Campus (UNEC) students on the radiation emitted by mobile phones and the possible health effects of the emitted radiation.

Methods: A cross-sectional convenience study of UNEC students was conducted from April to July 2017. A well-structured questionnaire comprising three sections was administered to some students from the five faculties of UNEC.

Results: A total of 360 students comprising 172 males (47.8%) and 188 females (52.2%) participated in the study. Three hundred and thirty-eight students (94%) were aware that mobile phones emit some form of radiation. Furthermore, 320 students (88.9%) were aware that the emitted radiation from mobile phones may have some harmful effects. All respondents (100%) in the three faculties of Health Sciences & Technology, Medical Sciences and Environmental Sciences stated that they were aware of the negative effects of using mobile phones. However, in the faculties of Business Administration and Law, only 63 respondents (84%) and 60 respondents (82.2%), respectively, stated that they were aware of the negative effects of using mobile phones.

Conclusion: The awareness level of mobile phone radiation and its possible health effects among UNEC students is high. Students from science-oriented faculties were better informed on the subject matter than those from arts and business-oriented faculties.

Keywords: Radiation, e-commerce, mobile phones, microwave, radiofrequency.

A6

X-Ray Film Reject/Repeat Analysis as a Quality Indicator in a Tertiary Health Centre in Northwestern Nigeria

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Objective: To assess rate of reject and to improve service delivery.

Methods: A retrospective assessment of radiographs generated by the Radiology Department of Usmanu Danfodiyo University Teaching Hospital, Sokoto. The work was undertaken from July to December 2016. All rejected radiographs were analyzed under uniform viewing conditions. All images with good diagnostic quality, those carried out for special examination and mammograms were excluded. Data were collected and entered into database for analysis.

Results: The overall reject rate was found to be 16.4% with chest radiograph contributing 7.1%. Inadequate collimation was the most common reason for reject (18.1%) while the least reason for reject was positioning error (0.3%).

Conclusion: A total of 16.4% reject/repeat was noted in the study conducted, which is above the recommended level given by World Health Organization (WHO) (20). Individual causes of reject have been highlighted. This calls for rectification.

Keywords: X-ray film, reject film, repeat analysis, quality assurance

A7

Radiation Dose Comparison Between Film-Screen and Digital Mammography Systems: A Literature Review

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Objective: To review and compare existing literature on radiation dose assessment in Digital and Film-screen mammography systems.

Methods: Manual literature search was done using Google search engine to retrieve published articles on radiation dose assessment in Digital and Film-Screen mammography systems. Search terms used included: Mammography, radiation dose assessment, mean glandular dose, digital, film-screen, and dose comparison. Eighty-four articles were obtained out of which 17 were finally considered for the review. Information relative to the study design was extracted and summarized in a tabular form. Reported mean glandular doses from both Digital and Film-screen systems were analyzed and compared according to different conversion factors used (Dance et al. and Wu et al.), and methods employed (measurement and calculation). Data was analyzed using SPSS version16 statistical software.

Results: Reported mean glandular doses for cranio-caudal (CC) and medio-lateral oblique (MLO) projections were analyzed. Radiation doses from film screen systems were slightly higher than those from digital mammography systems. However, no significant difference was noted between radiation dose delivered in both systems (95% confidence interval of $p \leq 0.894$, $p \leq 0.454$) for CC and MLO projections respectively.

Conclusion: A slightly higher mean glandular dose from film screen system was noted. However, the values obtained were below the recommended European DRLs for mammography. Thus, mammography centers should be encouraged to migrate to digital system and existing film screen systems be further optimized.

Keywords: mammography; film screen system; digital system; comparison; mean glandular dose.

A8

Emerging Technology and Futuristic Practice: Issues of Concern for Paediatric Radiation Protection in Nigeria

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Background: Rapid technological developments in the field of medical imaging makes it difficult for radiographers and the entire medical community to stay ahead of the technology train. These have present and future implications for radiation protection of paediatric patients. Hence, this paper intends to explore emerging technologies and the challenges of paediatric radiation protection in Nigeria.

Methods: authors reviewed relevant literature for current and updated information on the subject. Key words such as radiation protection, current trends in paediatric radiography, and protection, emerging technology, and digital imaging were used to search the internet. Major search engines and websites related to radiation protection such as Google, Google Scholar, and International Commission on Radiological Protection, International Atomic Energy Agency, World Health Organization, and Image Gently websites were consulted. Only literature related to paediatric radiation protection were used.

Results: findings from this review show that a lot has happened in the field of radiation protection has implications for radiation protection in Nigeria. Issues of concern are lack of awareness of radiation protection among health professionals and patients, lack of specialized training and facilities in paediatric radiation protection.

Conclusion:emerging technologies have increased the use of ionising radiation in medicine globally with present and future implications. However numerous issues of concern such as lack of awareness of radiation protection and specialized training exists in Nigeria. These can be improved by increasing awareness, appropriateness and audit of paediatric imaging.

Keywords; Paediatric radiography, emerging technology, current trends, digital imaging, radiation protection

A9

The Changing Landscape of Diagnostic Radiography Practice and the Role of Technical Exposure Charts: Findings from Northeastern Nigeria

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Objectives: In view of the changing landscape of diagnostic radiography practice, this study assessed the availability, content and use of technical exposure charts in Northeastern Nigeria.

Methods: A prospective study design was adopted for the study. A total of 12 tertiary hospitals across Northeastern Nigeria were purposively selected and studied. The hospitals were labeled hospitals A to L for purpose of confidentiality. An observational checklist and data capture sheet were used for data collection. To assess adequacy of the technical exposure charts, seven items such as Patient categorization (paediatric/adult), patient thickness, kVp, mAs, FFD, grid, and cassette type, were used to validate the adequacy of the contents of each exposure chart. Descriptive statistics such as frequencies and proportions were generated and analyzed using Microsoft excel office 2010.

Results: Out of the 12 hospitals studied, only three, (25%) had technical exposure charts. In terms of adequacy of contents of the technical exposure charts, the results show that one hospital was 85.7 % adequate while the least had an adequacy of 42.9%. The results also showed that technical exposure charts were not available for computed tomography and fluoroscopy.

Conclusion: With only 25% of the centers having technical exposure charts for diagnostic radiography and none for computed tomography and fluoroscopy procedures, this study highlights the need to optimize the development, deployment and use of technical exposure charts for quality radiography practice and radiation protection of patients in Northeastern Nigeria.

Keywords: Technique charts, exposure protocols, radiography, x-rays, Northeastern Nigeria

GROUP B: RADIOGRAPHY

B1

Audit of Image Annotation Practice Among Radiographers in a Tertiary Health Institution in Northern Nigeria

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Background: The dangers of wrong image annotations include clinical and radiologic confusion, medico-legal issues, time wastage and perhaps increased cost with attendant unnecessary radiation to the patient and staff.

Aim and objective: This study was aimed at auditing the practice of image annotation among radiographers in the University of Maiduguri Teaching Hospital (UMTH). The specific objective was to investigate x-ray images performed in UMTH for appropriateness of annotation with a definitive side marker, patient identification and proper collimation, and to identify challenges to proper image annotation.

Methods: A descriptive survey study involving both prospective and retrospective phases was conducted. Ethical approval was obtained from the ethical committee of UMTH. Thirty semi- structured, self administered questionnaires were distributed among radiographers practicing in UMTH for a two month period (December 2016 – January 2017). Retrospective data was collected from the archived data on the computed radiography monitor for a period of four years (March, 2013 – March 2017). Data was analyzed using statistical package for social science (SPSS) version 20.0, where descriptive statistics (mean, standard deviation and frequencies) were used specifically.

Result: This study found good practice of image annotation, but poor image collimation practice and inadequate use of anatomical marker. Inadequate quality control and quality assurance practice on the equipment was the major reason of poor image collimation practice, while excessive work load, inadequate supervision and burnout were the major challenges to proper image annotation.

Conclusion: Image annotation practice at the centre was good. Appropriate collimation and adequate use of anatomical marker should however, be improved upon to avoid repeats.

Keywords: Audit, annotation, anatomical side markers, collimation.

B2

An Assessment of Radiation Protection Practices in Computed Radiography: A Case Study of Two Teaching Hospitals In North-Central Nigeria.

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Background: With increasing demand for quick service, good quality images and dose optimization, computed radiography (CR) is gradually taking the centre stage in the practice of radiography in Nigeria. At the same time, radiation safety issues are also becoming a matter of great concern. In the present study, a comprehensive assessment on the knowledge and practice of CR with respect to radiation protection was carried out in two teaching hospitals in North-central Nigeria.

Objective: To assess the practice of CR with respect to radiation protection, using beam collimation as an assessment criteria.

Methods: Computed radiography images generated between March to August, 2017 were involved. A total of 210 pre- and post-processed of the images from 7 anatomical regions (30 each) were retrieved from two CR systems. The images were then assessed using some criteria. First was cassette size selection. Then essential image characteristics of Clark's Positioning in Radiography (12^{th} edition), was adopted taking into consideration the exposed area before and after processing, and degree of enhancement. Data was analyzed using the statistical package for social sciences (SPSS) version 16.0 (IBM, New York, USA), where descriptive statistics such as frequency, mean, and percentages were derived.

Results: A total of 192,851.49 cm^2 area was exposed out of which 74,823.45 cm^2 was not justified. Poorly collimated images stood at 62.85% with chest (10.71%) and abdomen (12.14%) taking a greater percentage. Inappropriate cassette size was 44.29%, positively and negatively enhanced images were 34.29% and, 33.57%, respectively while 32.14% of the total images obtained were unenhanced.

Conclusion: Computed radiography systems have the potential to reduced dose and give optimal image resolution. However, this is an advantage only when the radiographers ensure good practices. Findings from our work indicate that there is much more room to improve practices.

Keywords: Computed radiography, collimation, dose, radiation, protection.

B3

Evaluation of Image Quality of Plain Chest Radiographs at University of Maiduguri Teaching Hospital, Maiduguri, Nigeria

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Purpose

1. To determine the quality of chest radiographs at UMTH in accordance with Commission for European Communities (CEC) guideline,
2. The most common factor that affects chest radiographs.
3. To provide measures that will reduce these factors.

Methods

A total of 380 plain chest radiographs generated between October 2010 – February 2011, **were retrieved from the film** archive **and** subjectively evaluated using basic radiographic image quality criteria such as collimation, marker, positioning, lung field visualization, scapulae off the lung fields, inspiration and penetration as defined by the Commission of European Communities (CEC). Radiographs were scored as adequate and not adequate for the parameters. They were then ranked in order of overall quality.

Results

Results generally showed good image performance for pooled data, overall quality was 77.7% which is higher than all other cited works in this study. Based on individual parameters, the study found 2.63% of the total number of radiographs 'rejectable'. Of the 380 radiographs studied, 295 (77.6%) satisfied all the criteria for good quality images.

Conclusion

It has been shown that chest radiographs from UMTH Maiduguri, Nigeria, reveal generally good individual criteria image performance but possess overall quality above average or marginal.

Keywords: Chest, image quality, radiographs, evaluation, x-ray.

B4

Radio-Morphometric Evaluation of Mandible for Age and Gender Determination in a Nigerian Population

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Objectives: To undertake radio-morphometric evaluation of mandible for the purpose of age and gender determination in an Igbo population.

Methodology: Two hundred and fifty-three digital lateral skull radiographs stored in the database of Radiology Department, Nnamdi Azikiwe University Teaching Hospital, Nnewi were retrieved and their gonial angle (GA), gonial index (GI) and condylar ramus height (CRH) were assessed using Radiant Dicom Viewer 4.1.6. The radiographs were that of Igbo population with no pathology, fracture or developmental anomaly. The GA and GI were assessed using Mattila's and Bras' methods, respectively, while the CRH was measured from the most superior point on the mandibular condyle and extending to the tubercle. Data was analyzed with the aid of SPSS version 21. The GA, GI and CRH measurements were correlated with age and gender using Pearson's method. Statistical significance was set at $p < 0.05$.

Result: The mean of gonial angle (123.05^{o} vs 120.34^{o}), gonial index (3.97cm vs 3.47cm) and condylar ramus height (6.21 vs 6.14cm) were higher in males than females. Condylar ramus height correlated positively and strongly with age ($r = 0.602$, $p = 0.000$). Gonial index showed moderate positive correlation with age ($r = 0.378$, $p = 0.000$) while gonial angle showed mild negative correlation ($r = -0.287$, $p = 0.000$). All were statistically significant ($p < 0.05$). In terms of gender, there was no significant relationship between ramus height and gender ($r = 0.023$, $p = 0.716$) while gonial angle ($r = 0.192$, $p = 0.002$) and gonial index ($r = 0.218$, $p = 0.000$) showed statistically significant relationship with gender, but with weak correlations.

Conclusion: In the selected Nigerian population, condylar ramus height may be useful in age prediction, while gonial index may prove beneficial in gender determination.

Keywords: Mandible, gonial index, gonial angle, condylar ramus

GROUP C: COMPUTED TOMOGRAPHY

C1

Volumetric Quantification of Sella Turcica in a Nigerian Population With Computed Tomography

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Objectives: To establish a normative reference standard for sella turcica morphometry among adult age group and gender in a Nigerian Igbo population.

Methodology: Three hundred and fifty-six post contrast cranial CT images (181 males and 175 females) of apparently healthy Nigerians of Igbo origin aged 18 – 83 years were assessed on the monitor of the CT suite. Volumetric quantification of the sella turcica was done using 2D digital meter rule by measuring the sella depth and length on sagittal, and width on axial reconstructed bone window images. Data obtained were analyzed using SPSS Version 21. Depth, length and width of the sella turcica were obtained using Di Chiro and Nelson's method. Volume of the sella was obtained using Di Chiro proposed formula (Volume = ½ x Depth x Length x Width). Pearson's correlation was also done to establish relationship between some variables. Statistical significance was set at p value ≤ 0.05.

Results: The population had a mean of 12.04mm (depth), 13.55mm (length), 17.63mm (width) and 1453.93mm^3 (volume). Age was statistically significant and had a positive and mild correlation with depth ($r = 0.295$, $p = 0.000$), length ($r = 0.262$, $p = 0.000$), and width ($r = 0.387$, $p = 0.000$), and a moderate correlation with volume ($r = 0.426$, $p = 0.000$). Gender was equally statistically significant. It also demonstrated a positive and mild correlation with depth ($r = 0.301$, $p = 0.000$), and a moderate correlation with volume ($r = 0.416$, $p = 0.000$) and length ($r = 0.530$, $p = 0.000$). Correlation of gender with sella width ($r = 0.02$, $p = 0.610$) was not significant statistically and clinically. Sexual dimorphism was observed in sella depth, length and volume but not with width.

Conclusion: This study has established normal reference values for sella turcica dimensions in a Nigerian Igbo population. This finding will be useful in evaluating and detecting pituitary abnormalities.

Keywords: Sella turcica, computed tomography, volume, width, depth

C2

Stereological Volumetry of Lateral and Fourth Cerebral Ventricles on Normal Human Computed Tomography Images in Kano, Nigeria

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Background
Volumetric change of any interested organ is an index for studying the health status of that organ. Studies of various diseases revealed brain volume changes e.g. schizophrenia, multiple sclerosis, epilepsy and Alzheimer's disease. Systemic ventricular volume is directly affected by these changes. In recent times, volume and volume fraction have been objectively and statistically estimated using the stereological methods. The absence of local reference values on cerebral ventricular volume has made diagnosis on ventricular system irreproducible.

Objectives
To estimate the mean cerebral ventricular volume (lateral & fourth) using Normal Computed Tomography Scans.

Methods
80 normal computed tomography (CT) images comprising 47 (58.8%) males mean age ±SD (20.68±20.08) and 33 (41.3%) females mean age ±SD (28.12±19.34) were retrospectively reviewed in the CT archives of radiology department of Aminu Kano Teaching Hospital. Cerebral ventricular volume was determined using cavalieri's principle.

Results
Overall cerebral ventricular volume range was 21.66±8.79cm^3 to 37.05±18.65cm^3. Overall mean cerebral ventricle volume was estimated at 26.45 ± 14.51cm3. Women had higher cerebral ventricular volume than men but the difference is not significant across age groups ($p>0.05$). Cerebral ventricular volume increases with age in both sexes. Different pattern of is exhibited between the lateral ventricles and the fourth ventricle across age groups.

Conclusion
Age is a major variable relating ventricle volume and the right and left lateral ventricular volume are strongly related in both sex while the fourth ventricle showed marked differences.

Keywords: Stereology, Volumetry, Computed Tomography and Cerebral Ventricles

C3

Diagnostic Accuracy of Computed Tomography (CT) Scan in the Diagnosis of Patients with Suspected or Established Dementia

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Background: The accuracy of computed tomography (CT) in identifying treatable or surgically treatable causes of dementia enjoys ongoing research interest.

Objective: To use CT as alternative to MRI in patients who cannot undergo a brain MRI due to contraindication or unavailability.

Methodology: A systematic review was conducted. Medical subject heading (MeSH) were identified and the words ''AND'' or ''OR'' were used to combine the concepts**. Data sources:** Electronic database in health care interventions were searched. MEDLINE and EMBASE are the most commonly used sites, but, NICE, AMED (complementary medicine), AgeInfo, AgeLine and CINAHL were also used

Results: The review resulted in a total number of 313 studies being imported into the bibliographic database (Endnote $_x$7, Thompson Reuters, UK). Following removal of duplicates, 290 were removed based on the title and abstract due to (1) being discussions, updates and guidelines on dementia (n=12), (2) use FDG-PET (n=86), (3) use SPECT/CT hybrid (n=84), (4) use fMRI (n=10), (5) use cognition drug effect (n=85), (6) can't access full text (n=15). Full papers of the remaining 23 studies were reviewed with the removal of 14 due to (1) use MRI only (n=6), (2) use MRI and PET (n=3), (3) did not report sensitivity/specificity (n=5), (4) are systematic reviews (n=2). The remaining 5 studies were qualitatively synthesized and quantitatively analysed.

Conclusion: This systematic review has shown that CT measurement of medial temporal lobe (MTL) and the radial width of the temporal horn (rWTH) are sensitive and specific biomarkers in dementia, particularly Alzheimer's disease. Modern CT scanner is a fast and accurate imaging modality in dementia. It can be considered a nearly equivalent alternative to MRI in patients who cannot be diagnosed with MRI.

Key words: Computed tomography, MTL, rWTH, CT scan, Dementia, dementia.

GROUP D: MAGNETIC RESONANCE IMAGING

D1

Design and Development of a Multi-Channel Radiofrequency (4-Channel Receive and a Transmit) Coil for Use on a Fast-Field Cycling Magnetic Resonance Imaging (FFC-MRI)

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Objective:
To design and develop a 4-channel phased array surface receive coil and a single element transmit Radio Frequency (RF) leg (tibia and fibula) coil for use on experimental FFC-MRI scanner.

Methodology
Developmental research design was used using inductors and capacitors (fixed and variable) to design a circular loop surface coil, saddle coil and a transmit/receive coils. Hand tools like those of bending, cutting, crimping, smoothening, drilling and gluing were used. Electronic devices like the Network analyser, Q-meter, soldering iron were also used and other components like the coaxial cables, BNC plug and the PC boards were also used.

Results
A circular loop surface coil was designed and developed using a copper wire of 2.5mm, saddle coil using a litz wire of 2.5 mm, single rectangular transmit coil with a copper wire of 3.15 mm and a 4 rectangular double loop coil array designed with a copper wire of 1.25mm which serves as the receive coil all characterized using the Q-meter, tuned and matched at 8.5 MHz, 50 Ω using the network analyser. The 4 receive RF coils were well decoupled and actively detuned with each other and with the transmit coil and were all glued onto a half cylindrical perspex. Values obtained for B_1field variation with increase in distance, attenuation measurement, decoupling the coils, Q-factor determination and Q-spoiling or active detuning processes of the transmit/receive coil were carried out.

Conclusion
The multi-channel phased array coil was tested and FID signals, axial and sagittal images of a phantom were acquired. Artefacts noted on the images were all hardware related and the solution to ameliorating the effect of these artefacts is to get the cable going into or exiting the scanner properly filtered and the B_0 field adequately stabilized.

Keywords: MRI, FFC-MRI, RF Coil, Circular loop coil, saddle coil, transmit/receive coil, Development.

D2

Sodium Magnetic Resonance Imaging: An Overview

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Background: Magnetic Resonance Imaging (MRI) continues to cross new frontiers and is constantly evolving. Traditional proton MRI exploits the magnetic properties of hydrogen atoms to provide anatomical and functional information. Technological innovations have facilitated the use of Sodium atoms to characterize biomedical processes; the clinical applications of Na MRI need to be explored.

Objectives: The review and present an overview of Na MRI and the potential clinical applications of the technique.

Methods: An extensive literature search was conducted using various search terms such as Sodium MRI; applications of sodium MRI; sodium MRI brain; sodium MRI breast cancer; sodium MRI stroke; sodium MRI cartilage. All relevant articles published to date were reviewed.

Results: Sodium MRI provides metabolic information on cell integrity, which is crucial to the understanding of anatomical and physiological disease processes. It finds applications in brain, breast, muscle, kidney, and cartilage imaging. Sodium MRI has improved the diagnosis of brain tumors, stroke, and neurodegenerative conditions. The technique predicts the onset of stroke and can determine which brain tissues are salvageable. It also shows promise for differentiating malignant and benign breast tumors, and diagnosing cardiomyopathies and muscle dystrophy.

Conclusion: Evidence shows that Na MRI is a robust non-invasive technique for assessing tissue viability and predicting response to treatment. Sodium MRI can complement proton MRI in the diagnosis of various disease processes, however, its clinical use suffers from low detectability of Na signal in biological tissues, as well as systems limitations. Work is ongoing to address these limitations.

Keywords: Biomedical, cell, imaging, metabolism, sodium MRI.

GROUP E: EMERGING PRACTICES

E1

The Role of Imaging in Teaching Anatomy to Radiography Students (Preliminary Study)

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Background: Teaching radiographic anatomy to radiography students is an important component as it relates anatomical studies to clinical medicine and the same time prepares them for the radiology they will encounter in their clinical years.

Aim: The aim of the study is to assess the role of radiological imaging in teaching anatomy.

Methods: This is a descriptive, cross-sectional study involving 200 and 300 levels radiography students of Usmanu Danfodiyo University, Sokoto. Self- administered questionnaires were given to the students, filled and returned. Data obtained was analyzed using EXCEL.

Results: A total of 62 (28 second and 34 third year) radiography students participated in the study. In assessing the perception of students, 38 (61.3%) had lecture on imaging use in teaching anatomy and 23 (37.1%) had not while 3 (4.8%) did not respond. Out of those that had lecture, 13(20.9%) had one, 4 (6.5%) had two, 5 (8.1%) had three and 14 (22.6%) had more than three. On the usefulness of imaging techniques, 58 (93.5%) found it useful while 2 (3.2%) did not find it useful. In addition, 50 (80.6%) rated it as very useful. Majority of the respondents, 59 (95.2%) were aware of the radiology specialty and 44 (70.9%) intended to specialize on it. Radiography and ultrasonography were found to be the most useful imaging techniques by 23 (37.1%) of the respondents. 57 (91.9%) of the respondents thought there is need to increase the use of imaging in teaching anatomy.

Conclusion: There is poor understanding of radiological imaging amongst undergraduate radiography students. There is an urgent need to increase awareness and teaching methods of radiological imaging among the students.

Keywords: Role, Radiological Imaging, Teaching Anatomy, Radiography Students.

E2

Mathematical Modelling in Cardiovascular Imaging: Effect of Wall Shear Stress on the Development of Atherosclerotic Lesions

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Background: Atherosclerosis is one of the principal causes of mortality and morbidity especially in the Western countries. An early detection of atherosclerotic changes in a blood vessel is of fundamental clinical interest since this improves clinical management. Combining Doppler studies with appropriate mathematical models could predict potential atherosclerotic sites, an important objective of predictive medicine. Early atherosclerotic vascular manifestations induce alterations in the blood flow patterns. Studies suggest that the frequent occurrence of atherosclerotic plaques in bifurcations, curvatures, and branching of blood vessels may not be unconnected to fluid dynamics, especially wall shear stress, i.e. the frictional force that blood exerts on the intimal surface of the arterial wall.

Objective: This paper will describe the contribution of a mathematically derivable concept – the wall shear stress – on the pathophysiology of atherosclerotic lesions, hence the role that mathematics can play in cardiovascular ultrasonography. The focus will be on mathematical models that explain and predict carotid artery blood flow, and how variations in wall shear stress are associated with the development of atherosclerotic lesions.

Methods: The pathophysiology of atherosclerosis is explored, and the Navier-Stokes equation for modelling blood flow is presented, its mathematical assumptions and governing equations. The carotid artery is used as a case study.

Results: A mathematical model describing the effect of wall shear stress on carotid blood flow using subject-specific Doppler indices is thus presented.

Conclusion: Cardiovascular mathematics and modelling is an emerging field in medical imaging that can be used in predictive medicine for subject-specific cardiovascular studies.

Keywords: mathematical modelling, Doppler ultrasonography, atherosclerosis, carotid artery, predictive medicine.

E3

Virtual Radiography as a Supplement for Clinical Postings

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Background: For the past 15 years, the number of students offering Radiography has been on a steady incline, with the number of standard facilities for clinical postings remaining almost constant. This leads to overcrowding of the clinical facilities and poor clinical skills among students, and arguably, a loss of interest in basic radiographic techniques in students. There is a need for a virtual learning environment to stem this tide to maintain the clinical competence of graduating radiography students.

Objective: To assessed the clinical postings conditions students are exposed to, give an introduction to virtual Radiography and how it can improve students clinical experience.

Methods: Five Nigerian universities that offer Radiography: University of Nigeria Enugu Campus, Nnamdi Azikiwe University, Awka, University of Lagos, Bayero University, Kano, and University of Calabar were selected for study. A standard structured questionnaire titled Professionals and Students' Virtual Radiography Awareness Questionnaire (PSVRAQ) was administered to their staff and 3rd to 5th-year students. Tables, charts, descriptive and inferential statistics were used for data presentation

Results: Overcrowding stood out as the core problem during clinical postings. Controlling for the year of study, the majority of students are not allowed either aided or unaided hands-on practice. Interestingly, most of the respondents have heard about virtual radiography software and claim to be ICT compliant.

Conclusion: There is a need to introduce a method to supplement the clinical experience of radiography students. Computer-based simulation methods for routine radiographic practice are suggested.

Keywords: Virtual Radiography, clinical postings, simulation, Nigeria.

E4

Training of Future Radiographers: Impact of Patient Attitude

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Background: Proper training of health care providers enhances the standard of health care delivery. The importance of practical training using real life situations cannot be overemphasized. Many schools of thought have, for ethical reasons, advocated obtaining patients' consent prior to their being used for teaching or demonstration for students. It is believed this may adversely affect clinical training of radiography students.

Objectives: This study is designed to determine variables that influence patient's perception and attitude towards Medical Radiography students' involvement in the radiological investigations.

Methodology: A survey was conducted using a manual questionnaire tailored to suit the purpose of this study. A total of 265 questionnaires were completed by randomly selected outpatients for routine and special examinations that visited two private and two government owned radiology departments in Enugu metropolis.

Results: Result showed that acceptance of students by patients was significantly higher for patients who were able to differentiate between the radiographers and the students (87.1%) than those who were unable to differentiate (75.3%). Acceptance also was associated more with those that have been attended to by the students previously (91.9%). A positive perception and attitude towards the students by patients was observed in the four hospitals studied.

Conclusion: Students' presence and participation in carrying out radiographic procedures are very important to their training as professional radiographers. The fear that patients may resist students' involvement seems unfounded.

Keywords: Radiography, Training, Clinical, Patient attitude

Inter and Intra-Professional Collaboration: Key to Effective Teamwork Practice and Care Delivery in the Radiology Departments

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Background: The radiology department, a subsystem of the hospital, has over time been associated with the utilization of team approach to realize its organizational role of patient care and diagnostic imaging. This team effort involves many people with varying skills and roles that are highly interdependent, and should work together towards attainment of high level of patient care.

Objective: To identify team skills and the core competencies of inter and intra professional collaboration existing among radiology workers and to assess the effectiveness of teamwork practice among various professionals in the radiology departments of six major hospitals in Enugu and Lagos states.

Method: A cross-sectional survey was carried out on 200 radiology workers using convenient sampling technique. The instrument for data collection was a self-administered questionnaire. Data were analysed using SPSS version 22.0 statistical software.

Results: Six team skill areas and six core competencies were identified in the radiology departments studied. Drivers to the intra professional collaboration of the radiology staff were identified. However the three major radiology professionals agree there is little or no communication in terms of combined departmental seminar and research. The major barriers to teamwork in the department were egotism, ineffective communication and poor orientation on teamwork.

Conclusion: Collaborative team work is increasingly being advocated by healthcare policy makers as a means of assuring quality and safety in patient care service delivery. Adopting it will enhance practice.

Keywords: Professional collaboration, teamwork, radiology

E6

Patient Safety Culture Among Nigerian Health Workers: A Cross-Sectional Survey of two Tertiary Radiodiagnostic Centres

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Background: Medical errors are an inevitable reality hence the need to establish culture of safety.

Objectives: To measure the level of patient safety culture practiced in select radiodiagnostic centres.

Methods: This study was conducted from May to July 2017 among health workers at the Nnamdi Azikiwe University Teaching Hospital, Nnewi and the University of Nigeria Teaching Hospital, Enugu. A validated questionnaire by AHRQ was used as data collection instrument. Data was analysed using Spss version 17.

Results: Response rate for questionnaire was 70%. A total of 55.4% of respondents were Radiographers. Many respondents (41.1%) rated patient safety culture as very good. The highest range of reported events was 3 - 5 (28.6%). The composite with the highest positive response was teamwork within units (81.3%) while frequency of events reported was the least. T-test shows there is no significant relationship between positive responses in the present study and that of AHRQ benchmark.

Conclusion: Patient safety culture was barely above average hence, a need for urgent improvement with much emphasis on staffing, non-punitive response to error, communication openness and frequency of events reported.

Keywords: Safety, culture, health workers, radiodiagnosis, Nigeria

GROUP F: ULTRASOUND

F1

Optimizing Ophtalmic Health, via Fast Emerging Sonodiagnostic Tool

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Background: The pitfalls in dacrocystography and the ophthalmologist's still lamp and fundoscopy techniques in the characterization, delineation and quantification of ophthalmic lesions underscore the need for ocular sonography.

Objective: To review the value of ocular sonography as a cost effective tool in the diagnoses of eye disorders.

Methods: An extensive review of previous literatures was done to showcase on one hand, the competitiveness between radiography and sonography of the eye, and the complementary nature of opthalmologists' tools and sonodiagnostic tool on the other.

Results: Lesions of the anterior chambers of the eyes namely, giant cataract of the lens, may obscure the retina on fundoscopy in which case sonography becomes indispensable. Doppler ultrasound of the eyes characterizes eye masses better than other imaging modalities, thus differentiating malignant ocular lesions. Similarly B-mode or real time ultrasound has good sensitivity in the localization and delineation of ocular lesions, thus making surgeries easy.
Conclusion: The superficial anatomic location of the eyes and its cystic nature enable high frequency ultrasound transducer to optimize the demonstration of normal anatomy and pathology of the eyes.

Key Words: Occular sonography, dacrocystography, optimization, ophthalmic lesions

F2

Prevalence of Ultrasound-Detectable Adnexal Masses Among Women Undergoing Gynaecological Sonography at University Of Maiduguri Teaching Hospital, Nigeria

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Background: Adnexal mass is a common cause of morbidity and mortality worldwide. Ultrasound scan is the mainstay in detecting pelvic adnexal mass.

Objective: To determine the prevalence of ultrasound detectable adnexal masses among women undergoing gynaecological sonography at UMTH.

Methods: This was a non-experimental retrospective study carried out at radiology department of a teaching hospital. Data was collected using convenient sampling method and was grouped into positive and negative ultrasound findings. The data was analyzed using SPSS version 17.0 statistical software.

Results: Total of 300 subjects were recruited for the study. A prevalence of 15.7% or 1 in every 6 patients (1:6) ultrasound detectable adnexal masses was reported. Young adult (20-40 years) had the highest prevalence of adnexal mass (9.7%)

Conclusion: This study has established the prevalence of ultrasound detectable adnexal masses seen at the radiology department of UMTH.

Keywords: Ultrasound, prevalence and adnexal mass

Conceptualized by the Education Committee of the ARN (2017 – 2020)

Adejoh, T. (Chairman); Joseph, D.Z.; Nkubli, F.B.; Balogun-Adebiyi, R.I.; Okeji, M.C.; Luntsi, G.