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REVIEWER'S REPORT

Manuscript No.: IJAR- 57956

Title: Quantitative estimation of effective dose using dose length product in CT head at University hospital

Recommendation:
Accept after minor revision

Rating	Excel.	Good	Fair	Poor
Originality		✔		
Techn. Quality			✔	
Clarity			✔	
Significance	✔			

Reviewer's ID: JPR- Bilqees Hamza

Detailed Reviewer's Report

The manuscript under review addresses an exceptionally vital, highly relevant, and structurally critical area of modern clinical medicine: the optimization of patient radiation dosimetry in Computed Tomography (CT) neuroimaging. The authors properly frame the inquiry around a retrospective quantitative audit conducted at a major tertiary care center—Dhulikhel Hospital, a University Hospital in Kavre, Nepal—providing a robust institutional context for evaluating real-world radiation exposure parameters. The radiological and public health significance of this research lies in its direct engagement with the "linear non-threshold" model of radiation-induced carcinogenesis, exploring how routine diagnostic procedures can be systematically monitored to minimize stochastic health risks while preserving vital diagnostic image quality.

By focusing specifically on CT head examinations, the study targets one of the most frequently requested and high-volume ionizing radiation procedures in emergency and neurological medicine worldwide. The scope of the paper successfully transitions from raw mechanical scanner outputs to biological risk assessments, translating technical machine-specific parameters into a standardized metric of whole-body equivalent risk. This clinical translation makes the text highly relevant to medical physicists, hospital radiologists, and international radiation protection regulatory bodies tasked with establishing regional Diagnostic Reference Levels (DRLs) and enforcing the fundamental ALARA (As Low As Reasonably Achievable) principle in developing healthcare systems.

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Methodologically, the study utilizes a retrospective, quantitative, cross-sectional design, evaluating a sample of 150 adult patients aged between 18 and 80 years who underwent head CT examinations. The data collection framework is well-engineered, utilizing a sophisticated 128 multi-slice Siemens Somatom Perspective CT scanner, which reflects a modern clinical standard capable of modulating exposure factors. The core strength of the dosimetric synthesis rests on its systematic extraction of console-displayed parameters—including tube voltage, tube current-time product, volume CT Dose Index, and Dose Length Product—and the subsequent conversion of these values into effective dose measurements using the recognized International Commission on Radiological Protection publication 103 conversion factor for head tissues.

The documentation provides essential regional baseline data, showing how mechanical scanner parameters correlate with actual patient exposure profiles. The paper successfully links these technical parameters with basic patient data gathered through questionnaires, including clinical histories and demographic variables. However, to meet the publication standards of a premier peer-reviewed medical physics journal, the manuscript's overall reporting framework, statistical analysis, and comparative discussion require a substantial academic upgrade. The analysis remains largely descriptive, and the lack of advanced statistical tests exploring the independent impact of patient anatomy and scan length on total dose limits the deeper clinical value of the paper.

The central thesis of the manuscript argues that the routine quantitative estimation of effective dose from readily available machine parameters is an essential institutional practice for tracking patient safety and identifying unnecessary exposure variations. The authors construct this argument by demonstrating that the Dose Length Product serves as a reliable, direct proxy for calculating whole-body equivalent biological risks when adjusted using region-specific normalized conversion coefficients.

Operating through the conceptual lens of clinical radiation safety, the paper links scanner protocol selection to broader operational challenges, such as the need for standardized scanning protocols and better operator awareness. From an institutional standpoint, the manuscript offers a practical look at quality control, correctly identifying the gap between generic manufacturer settings and customized, patient-centric protocol optimization. The paper effectively concludes that reducing unnecessary patient dose requires moving past passive compliance with machine defaults and implementing active, data-driven internal audits, strict adherence to established clinical guidelines, and regular hardware calibrations to protect patients from excessive radiation without sacrificing diagnostic clarity.

Recommendations for Manuscript Improvement

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Upgrading Statistical Execution and Incorporating Multivariate Analysis

The primary and most critical recommendation to elevate the manuscript's scientific depth centers on the sophistication of its quantitative data processing. The current draft compiles highly precise data on scan parameters across 150 patients but presents these factors primarily as basic descriptive values without proving any deeper statistical correlations. To achieve publishable standards, the authors must upgrade their statistical analysis by moving from simple summaries to inferential and multivariate modeling. The updated text should feature Pearson or Spearman correlation coefficients to measure the exact mathematical relationships between tube current-time product, volume CT Dose Index, and total Dose Length Product. Furthermore, the authors should execute a multiple linear regression analysis to isolate how independent variables—such as patient age, gender, specific clinical indication, and total scan length—statistically influence the final effective dose, converting a basic administrative audit into a rigorous piece of medical physics research.

Explicitly Documenting the Anatomical Scan Boundaries and Rationale

While the manuscript correctly notes that the Dose Length Product is directly tied to the total scan range, the narrative lacks explicit descriptions regarding how the anatomical boundaries of the head CT scans were defined and managed across the patient cohort. The authors must thoroughly revise the methodology section to detail the exact starting and ending anatomical landmarks used for their standard head protocol, such as scanning from the base of the skull to the vertex. Crucially, the discussion needs to evaluate whether variations in the final effective dose were caused by operators unnecessarily extending the scan range into the upper cervical spine or orbit areas. Addressing this factor will provide an essential clinical explanation for dose variations, showing how operator behavior directly impacts patient exposure.

Clarifying the Handling and Segmentation of Contrast-Enhanced Studies

A significant dosimetric variable that remains ambiguous in the current draft is the mixed inclusion of both non-contrast head CTs and contrast-enhanced or multiphase CT angiographic scans within the 150-patient sample. Contrast-enhanced and multiphase examinations require multiple passes of the X-ray beam, which dramatically multiplies the cumulative volume CT Dose Index and total Dose Length Product delivered to a patient compared to a single-phase unenhanced scan. The authors must expand their methodology and results sections to explicitly state the exact proportion of single-phase versus multiphase scans in their study. The data must be stratified so that effective dose values for non-contrast brain scans are analyzed and presented separately from complex angiographic procedures, preventing skewed averages and ensuring valid comparisons with international standards.

Deepening the Comparative Analysis Against Global and National DRLs

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The discussion section in the current text notes the institutional findings at Dhulikhel Hospital but fails to contextualize these measurements against a broad spectrum of established international and regional Diagnostic Reference Levels. To improve the manuscript's comparative value, the authors need to integrate a comprehensive narrative review that directly benchmarks their mean volume CT Dose Index and Dose Length Product values against published data from neighboring South Asian nations, as well as reference levels from Western bodies like the American College of Radiology and the European Commission. Critically analyzing whether the university hospital's protocols run higher, lower, or equal to these global benchmarks will help isolate specific areas for improvement, such as updating aging default protocols or optimizing tube current modulation settings.

Standardizing and Completing the Incomplete Bibliographic Metadata

A detailed audit of the concluding reference bibliography reveals multiple missing metadata fields, incomplete citations, and minor formatting errors that detract from the manuscript's professional presentation. Several reference entries, including citations to international radiological protection reports, are missing essential publication details such as specific volume designations, issue numbers, precise page ranges, or valid digital object identifiers (DOIs). The authors must systematically review and correct the entire reference list to ensure that every entry conforms perfectly to a singular, standardized academic citation manual, such as the Vancouver style or APA seventh edition. This standardization is an absolute requirement for the manuscript to be properly indexed in international medical physics, radiology, and global health databases.

Cleaning Minor Typographical Slippages and Improving Visual Layout

Finally, the review copy contains minor mechanical formatting shifts, uneven line spacing around major section boundaries, and occasional paragraph alignment shifts that affect its professional presentation. There are a few instances where punctuation marks are placed incorrectly next to citations, along with minor typing slips within the introductory abstract paragraphs, such as the spelling of manufacturer names. The authors must carefully proofread the entire document to eliminate these visual artifacts. Ensuring that the manuscript possesses a flawless visual layout will provide a polished, highly professional appearance that matches the structural importance of the clinical public health data.

Editorial Recommendation

This manuscript is recommended for **publication with minor revisions**. The authors have selected a highly valuable, original, and timely research focus by documenting patient radiation exposure and calculating effective doses from head CT examinations within a university hospital environment. The use of standard conversion factors to determine biological risk is well-conceived, and the emphasis on

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tracking real-world scanner parameters addresses a clear need in modern clinical radiology and radiation protection literature.