JKISTMC
Journal of KIST Medical College

ISSN: 2717-4816 (Print)
ISSN: 2717-4816 (Online)

JKISTMC

Journal Of KIST Medical College

DOI: 10.61122/jkist

VOL 08 | ISSUE 15 | NO. 1 | JAN, 2026

A Peer - Reviewed Journal Of

KIST Medical College

www.jkistmc.orh.np

JKISTMC is Indexed and Associated with:

NepJOL Google Scholar iThenticate Crossref doi Digital Object Identifier

Crossref OPEN ACCESS

Journal of KIST Medical College

An Official Publication of KIST Medical College & Teaching Hospital

Editorial Team

Patron

Er. Ashish Thapa

Chief Editor

Dr. Rupesh Mukhia
Professor, Head of Department Surgery
KIST Medical College & Teaching Hospital
Imadol- Lalitpur
Contact: +977-9851140660
Email:rupeshmukhia@gmail.com

Managing Editor

Dr. Rosha Shrestha
Associate professor, Head of Department of Orthodontics, Dental coordinator
KIST Medical College & Teaching Hospital
Imadol - Lalitpur
Contact: +977-9841281825
Email:ro.sha.shrestha@hotmail.com

Editors

Dr. Bijendra Raj Raghubanshi
Professor, Head of Clinical Microbiology
KIST Medical College & Teaching Hospital
Imadol –Lalitpur
Contact: +977-9841332403
Email: raghu2_47@yahoo.co.in

Dr. Mahipendra Tiwari
Lecturer, Department of Surgery
KIST Medical College & Teaching Hospital
Imadol –Lalitpur
Contact: +977-9842040609
Email: mahipendra86@gmail.com

Dr. Saurav Dahal
Lecturer, Department of Orthopedics
KIST Medical College & Teaching Hospital
Imadol –Lalitpur
Contact: +977-9842023440
Email:dasaurav@gmail.com

Dr. Omi Bajracharya
Lecturer, Department of Pharmacology
B.pharma Coordinator
KIST Medical College & Teaching Hospital
Imadol –Lalitpur
Contact: +977-9841889874
Email:bajracharya.omi@gmail.com

Technical Editor

Mr.Suresh Rijal
Executive Director,
Potent Media Home Pvt.Ltd.
Shankhamul-31, Kathmandu Nepal
Email:info@potentmediahome.com

Statistician

Mr. Prem Prasad Panta
Lecturer, Department of Community Medicine
KIST Medical College & Teaching Hospital
Imadol-Lalitpur
Contact: +977-9841422695
Email:pantaprem7@gmail.com

Advisors

Dr. Abishek Thapa
MBBS, MS (General Surgery)
Managing Director
KIST Medical College & Teaching Hospital
Imadol-Lalitpur
Contact: +977-01-5201834

Prof. Dr. Balman Singh Karki
Principal, Department of Clinical Microbiology
KIST Medical College & Teaching Hospital
Imadol-Lalitpur
Contact: +977-01-5201682
Email: bmskarki@yahoo.com

Dr. Ramesh Kant Adhikari
Professor of Pediatrics
Contact: +977-9851105737
Email: ramesh497@gmail.com

Assistant Editors

Dr. Riya Sharma
Dr. Anurag Marasini
Dr. Rupashi Mukhia

Cover page design by

Raziya Akhtar

Contact

Journal of KIST Medical College
GPO – BOX, 14142
Kathamandu, Nepal
Email: editor@jkistmc.org.np

Publishers

KIST Medical College Teaching Hospital
Imadol, Lalitpur

Copyright

JKISTMC applies the Creative Commons Attribution Non Commercial 4.0 International License (CC BY) to all works we publish. Under the CC BY license, authors retain ownership of the copyright for their article, but authors allow anyone to download, reuse, reprint , distribute, and/ or copy articles in JKISTMC, so long as the original authors and source are cited.

Crossref OPEN ACCESS

Contents

Pages

Medical Education

Blueprinting in Assessment in Medical Education: A crawling concept in Nepal — 1-9
Anjan Khadka, Sammodavardhana Kaundinnyayana

Original Articles

Urological Abnormalities Associated with Anorectal Malformation in Children Presented at Kanti Childrens' Hospital — 10-13
Ellina Dangol, Bijay Thapa, Anupama Thapa Basnet

Accuracy of Ratio of Height to Thyromental Distance in Predicting Difficult Visualization of Larynx — 14-19
Pragya Shrestha, Binita Acharya, Priska Bastola, Arjun Gurung, Aashish Shah

Usefulness of Modified Cave Score to Identify Seizure in Adult Patients with Intracerebral Hemorrhage in Emergency Room — 20-25
Manoj Gaire, Sushant Shrestha, Usha Kiran Pandey, Alin Shrestha

Study on Comparison of Ultrasonographic Fetal Birth Weight with the Actual Birth Weight in Tertiary Care Hospital — 26-30
Sona Pokhrel, Rupesh Sharma

Clinical outcome of Low dose intravesical BCG therapy for Non Muscle Invasive Bladder Cancer — 31-34
Rajan Koju, Vijay Sharma, Arun Shah

Photographic Study of Different Smile Parameters in the Newar Population Pursuing Orthodontic Treatment — 35-39
Rosha Shrestha, Gaurav Acharya, Suvit Maskey, Bishal Karki

GUIDELINES

40-46

Blueprinting in Assessment in Medical Education: A crawling concept in Nepal

Anjan Khadka[1,2], Sammodavardhana Kaundinnyayana[1]

[1] Department of Pharmacology, Nepalese Army Institute of Health Sciences, Bhandarkhal, Kathmandu, Nepal
[2] FAIMER Regional Institute of Indonesia for Educational Development and Leadership (FRIENDSHIP), Yogyakarta, Indonesia

Article History
Recived: 16 August, 2025
Accepted: 15 November, 2025
Published: 31 January, 2026

Funding Sources: None

Conflict of Interest: None

Online Access

DOI: 10.61122/jkistmc356

Correspondence

Dr Anjan Khadka
Department of Pharmacology, Nepalese Army Institute of Health Sciences, Bhandarkhal, Kathmandu, Nepal
Email: anjankhadka14@gmail.com

Citation: Khadka A, Kaundinnyayana S. Blueprinting in Assessment in Medical Education: A crawling concept in Nepal: Blueprinting in medical education. J. KIST Med. Col. 2026; 8(2)15:1-9.

Abstract

Test blueprints are fundamental tools for assessment in medical education that guarantee curriculum alignment with teaching learning methodologies. The goal of this review is to highlight the utilities, types, components and construct of blueprints in medical education. Three main application of blueprints are to facilitate the construction of standardized assessments, provide instructional frameworks for curriculum design, and give learners competency guidelines. By providing thorough subject coverage and coordinating evaluation with learning goals, they guard against validity threats like content and construct under-representation. Commonly used three blueprint categories in medical education are program-level (comprehensive content-by-process matrices), process-oriented (skills and cognitive frameworks using Bloom's taxonomy or Miller's pyramid), and content-oriented (subject-based organization). Weightage are determined through impact-frequency scoring, classifying content as "must know", "should know", and "nice to know". There are five main steps involved in developing a blueprint. Blueprints are necessary for accurate, trustworthy medical education tests that successfully match assessment tools with curriculum goals.

Keywords: Assessment, blueprint, curriculum, medical education, specification grid

Background

There are often complaints from medical students about examination regarding the content and construct of questions in written exams and those asked by the examiners during practical and oral examination. Regarding the theory papers, the complaints include the length of the written papers, under representation of contents, unusual questions out of syllabus and vague questions confusing the students what to write and what not to.[1-3] Similarly, regarding the practical and oral examinations, students complain about rare cases for long and short cases, very subjective question in oral exams, difficult patient during exams, inadequate time and under representation of the contents.[2-5] This occurs because in the conventional assessment, a single teacher/examiner prepares the question paper while practical examinations are conducted by other teachers, including external faculty, often without much coordination among them.[2,5] Frequently, the determination of what to evaluate is entrusted to the examiners' judgment based on what she/he believes is relevant or significant. Students feel bewildered due to their lack of understanding what is truly anticipated

Copyrights & Licensing © 2026 by author(s). This is an Open Access article distributed under Creative Commons Attribution License (CC BY NC)

from them, leading to their struggles in exams. Blueprinting in assessment can largely address these problems, if not entirely, thereby enhancing the validity of the assessment.[7] Overall, both the 'informal curriculum' ('pet' topics, or different examination or procedure methods) and the 'hidden curriculum' (poorly modeled professionalism) are minimized by the application of blueprinting for the assessment.[6,7] This review focuses on the importance and the process of blueprinting in assessment in medical education.

What is blueprint?

The word "blueprint" comes from cyanotype, a photographic printing method created in 1842 by Sir John Herschel, which got their unique name from the procedure that created white lines on a blue background.[7,8] Blueprint as used in medical education, is a map and a specification for an assessment program that ensures that all aspects of the curriculum and educational domains are covered by assessment programs over a specified period of time.[6,7,9] It is also known as test blueprint or test plan or table of specifications or test specification or a grid, which allows examiners to generate content-valid exams by linking the required subject content and competencies to the items appearing on the test.[7] A blueprint outlines a structured multi-step method for an evaluation, specifying the objective (e.g. formative/summative and written/practical) and extent (e.g. for undergraduate or postgraduate learners) of the exam to establish the content and assessment approach.[10] An assessment blueprint is crucial for improving the validity of evaluations and ensuring constructive alignment, especially for high-stake tests.[7] The three components of education include intended learning outcomes, teaching and learning activities, and assessment tasks – this is known as constructive alignment. The alignment among these three pillars of education can be supported by a framework.[11,12] Effective assessment can occur only when the three components (course material, skills to be evaluated & assessment methods) reach the 'optimal alignment'. Hence, blueprint is an assurance of constructive alignment in medical education (Figure 1).[7, 10-12]

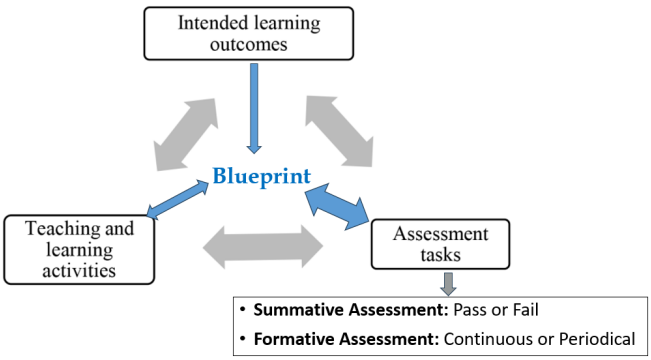


Figure 1: Blueprint in center of constructive alignment

What are the utilities of blueprint?

Blueprint has primarily three functions.[7-9] Firstly, it provides an instructor/teacher with a framework of key disciplines to be incorporated into instruction, serving as the foundation for a syllabus. Secondly, it offers a framework of essential understanding and abilities for learners who are getting ready for the test and striving for certification. And lastly, it permits the assessment to be developed in a uniform manner.[6,13] Test blueprints elucidate the relationships among planning, teaching, and evaluation, which can encourage faculty introspection.

Blueprint connects evaluation to learning goals straightforwardly helping a test creator to identify which question assesses which objective and content unit and the marks allocated to each of them.[14,15] The blueprint translates the design into practical terms, clarifying all aspects of a question (i.e., its goal, its structure, the subject area it addresses, and the points assigned to it) for the test creator. It can be a straightforward content matrix, but it can also incorporate additional details, such as evaluation and testing techniques. By documenting the knowledge and skills addressed by each assessment, test blueprints also serve as tools to facilitate sound curriculum design. The purpose of blueprint is to guarantee that evaluations align with objectives and goals of curriculum, to focus on significant behavioral learning outcomes, and to offer a teaching-learning method that outlines what students need to understand and demonstrate in every assessment.[12,16]

Furthermore, blueprint helps to avoid the common threat of validity like content and construct under-representation.[6,7,17,18] A test that does not sufficiently cover all of the pertinent content areas of a subject is said to be content under representative. Construct under-representation, on the other side, is when a test doesn't capture all the crucial characteristics of the construct it's designed to measure, even if the content is covered. Beyond guaranteeing test validity, test blueprints have other useful applications.[14] They can serve as study aids and convey instructor expectations to students; research backs up the practice of sharing blueprints with students.[15-17] The blueprints' subject categories and competency domains offer a structure for providing students with insightful feedback and aid in the creation of relevant assessment resources, such as scoring rubrics for workplace assessments and simulations.[18-21] They also help clarify the relationships between curriculum planning, instruction, and assessment, potentially prompting valuable faculty self-reflection on their teaching practices.

What are the types of blueprints in medical education?

There are different ways to categorize blueprint in medical education based on the specific context and assessment goals.[6-8]

Content-oriented blueprints: Content-oriented blueprint outline assessments based on the topics or subject matter addressed, typically dividing the test material based on conventional academic fields and the relative weight or proportion of questions dedicated to each (Table 1).[7]

Table 1: Academic subjects for MBBS (based on MBBS Curriculum of Tribhuvan University-Institute of Medicine)[22]

Integrated basic medical science subjects	Community Medicine	Organ System	Clinical subjects
Anatomy	Epidemiology	General concepts	Internal medicine
Physiology	Biostatistics	Musculo-skeletal system	Dermatology, venerology and leprology
Biochemistry	Demography	Neurosensory system (including special senses)	Psychiatry and mental health
Clinical Microbiology	Health promotion and education	Respiratory system	Radiology
Pathology	Medical sociology and anthropology	Cardiovascular system and hematopoietic system	General surgery
Pharmacology	Environment and occupational health	Gastrointestinal system and hepatobiliary system	Anesthesiology
	Family health	Renal and electrolyte system	Dentistry
	Applied epidemiology	Reproductive, endocrine and metabolic system	Pediatrics
	Health service management		Gynecology and obstetrics
			Ophthalmology
			Ear, nose, throat, head and neck surgery
			Orthopedics and traumatology
			Emergency medicine and family practice
			Forensic Medicine

* Curriculum also includes other core subjects like Medical Ethics and Communication skill.

Process-oriented blueprints: Test blueprints focus on processes outlining the procedural skills that students should show. The most commonly used process-oriented test blueprints incorporate skills from the cognitive domain of Bloom's taxonomy (Figure 2).[23,24] A teacher could utilize Bloom's taxonomy to show that 40% of a test focuses on understanding; 40% emphasizes applying knowledge to address clinical issues; and 20% pertains to analyzing an experiment.[24] Miller's pyramid (Figure 3) can similarly be applied to determine that, for instance, 70% of a statistics exam will consist of tasks at the knows and knows how levels, whereas 30% will necessitate students to demonstrate how.[25,26] Process-oriented frameworks are especially beneficial for clinical education, focusing on procedural abilities and the emotional aspect. Two process models particularly important for medical education are the Canadian Medical Education Directives for Specialists (CanMEDS) framework and the Accreditation Council for Graduate Medical Education (ACGME) competencies; various components of these frameworks can be helpful in creating assessments for the classroom.[27,28]

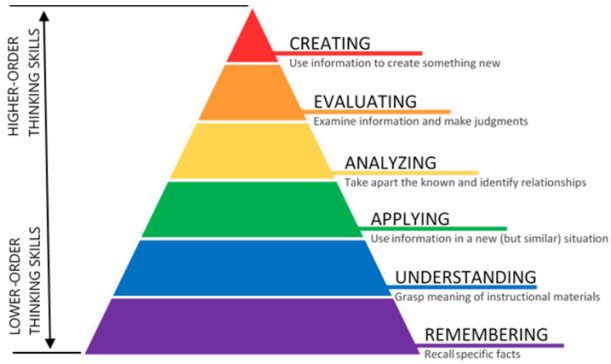


Figure 2: Bloom's Taxonomy- Cognitive domain[24]

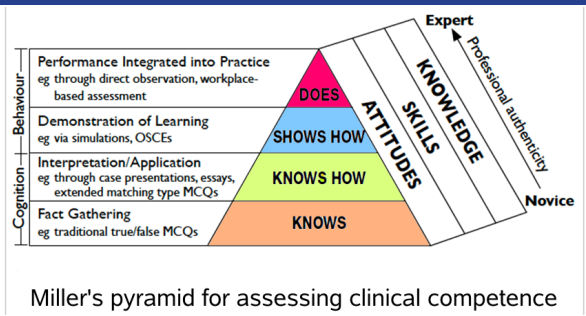


Figure 3: Millers pyarmid[25]

Program-level blueprint: The specialized type of blueprint encompass both content and process oriented blueprint and act as a guide for aligning assessments across multiple courses or years of the medical program.[6, 27-29] Overall, program-level blueprint ensures the quality and effectiveness of medical education programs. This program-level blue print combines two aspects into one structure known as the content-by-process matrix. A content-by-process matrix aligns well with the curriculum design.

What are the components of blueprint in medical education?

The key components of blueprint in medical educations are mainly divided into curriculum-driven goals, learning outcomes, content (topics, domains, weighting) and assessment methods (Box 1).[6,7,10,14,17]

Box 1: Components of blueprint

Curricular directions
- i. Title
- ii. Purpose
- iii. Scope (for which semester or phase of study and academic session)
- iv. Examination guideline (which course, what assessment tools and how many questions)

Learning outcome
- v. SMART behavioral objective (s) for the clinical presentations or topics listed based on curricular setting

Content domain
- vi. Topics and subtopics or chapters
- vii. Weightage: Impact, frequency, weightage % (based on selected criteria)
- viii. Types of questions based on educational domain either from curriculum or blooms taxonomy or Millers pyramid or all
- ix. Marks allocation

Assessment
- x. Assessment tools
- xi. Number of questions
- xii. Identification of question setters
- xiii. Remarks

How to construct a blueprint in medical education?

Constructing a blueprint requires framework from the well-designed curricula and the detail syllabus. While constructing a blueprint for assessment, the principle: all that is expected cannot be taught and all that is taught cannot be assessed should be kept in mind. There are several tips and steps of developing a blueprint.[6, 7, 30-34]

1. **Specify the purpose, scope and curricular guidelines:** The blueprint's parameters should be clearly defined by establishing its purpose, scope and specific guidelines mentioned in the curriculum.It is necessary to select the academic session, the intended semester or study period, and the specific courses that are the focus of the evaluation for which the blueprint is being created. The total number of questions and the assessment instruments need to be identified. This fundamental stage guarantees conformity with educational goals and offers a structure for further planning.[6,7]
2. **Tabulate curriculum content:** Using the specified curriculum setting as a guide, all the topics or chapters or units along with learning objectives are systematically listed. Learning objective must be specific, measurable, achievable, relevant and time-bound (SMART). A thorough inventory should be created that guarantees wide coverage of the curriculum and acts as the basis for developing questions.[6,7,11,17,34]
3. **Determine weightage:** Components of the curriculum need to be assessed to find out how it affects students' learning and how often it appears in exercises or tests. The relative importance and prevalence of topics are determined using predefined criteria. Criteria should be based on evidence as far as practicable. Weightage can be decided on the basis of two parameters[6,33]
   - i. The perceived impact (I)/importance of a topic: For basic science or pre-clinical subjects, impact of topic is judged according to its importance in clinical years or applied phase. For clinical subjects, it is judged on the seriousness or urgency or prevention potential.
   - ii. The frequency (F): For basic science or pre-clincial subjects, it is categorized based on the application of topic in clinical phase and for clinical science, frequency is the occurrence of a particular disease or health problem.

Every topic/subtopics or clinical competency needs to be scored between 1 and 3, 1 being minimum and 3 being maximum (Table 2). The ratio of the product (IxF) to the total IF is called "weightage". As a result, it is possible to determine the weights of each unit/chapter/topic/competency in an assessment.

Table 2: Criteria for scoring[3,5,6,7,9,13,30,34]

Possible score	Importance/Impact (I)	Frequency (F)	Product (I x F)	Weightage % (W)
For basic science or pre-clinical subjects				
1	Less important for clinical implication;	Rarely applied in clinical phase	1	(1/14)*100 = 7
2	Important for clinical implication	Commonly applied in clinical phase	4	(4/14)*100 = 29
3	Very important for clinical implication	Frequently applied in clinical phase	9	(9/14)*100 = 64
Total (I x F)			14	
For clinical science or clinical competency				
1	Non-urgent, little prevention potential; less important for medical officer	Rarely seen; Rarely applied in clinical practices	1	(1/14)*100 = 7
2	Serious, but not immediately life-threatening; important for medical officers	Relatively common in clinical practices	4	(4/14)*100 = 29
3	Life-threatening emergency and/or high potential for prevention impact; very important for medical officers	Frequently applied in clinical practices	9	(9/14)*100 = 64
Total (I x F)			14	

Assigning weightage is a challenging process which has elements of subjectivity, so consensus opinion is required within the specialty, across the specialty and from past learners. For example, consensus opinion of experts in the subject and other disciplines (like surgical faculty can be involved in deciding the weightage to anatomy) before allocating the weightage of anatomy assessment.[34, 35]

Use relative weighting to sort curricular content: The higher the weightage calculated, the more important is the curricular content. The course material an be sorted out into three different knowledge categories: "must know" (vital core knowledge), "should know" (important supplemental knowledge) and "nice to know" (extra useful knowledge). If the number of questions is less than the curricular content items and contents are of knowledge domain, it is better to follow must know, should know and nice to know with 60%, 30% and 10% load respectively.[6, 34-37] The score of product I x F is used to categorize must know, should know (desirable to know) and nice to know (good to know) (Table 3).

Table 3: Criteria for categorization of content[6,7,10,20,34,36,37]

I X F	Category	Percentage of weightage in assessment
6 or 9	Must Know	60%
3 or 4	Should Know	30%
1or 2	Nice to Know	10%

The hierarchical significance of clinical subject areas can be reflected either with the educational domains of Bloom's taxonomy (Cognitive domain: Remembering, Understanding, Applying, Analyzing, Evaluating, Creating) or Miller's pyramid (Knows vs Knows How vs Shows How vs Does), which also directs the distribution of assessment tools.[24, 26] Considering the knowledge and skills to evaluate, suitable assessment method(s) or tools should be determined. Then the weightage can be used to independently determine marks for different assessmet tools after calculating the marks based on the weightage of the topic or chapter. One of the crucial practical factor is time limit on testing. Practically speaking, using content weights or category weights to allocate time and space to different assessment purposes is crucial. The weights in written assessments correspond to the number or proportion of test items in each category which must be achievable in the given the length of testing.[36,37]

Choose the question type and numbers for every category: After determining the weightage of chapter/competency, there must be consensus on types and number of questions to be constructed for each category of curricular content. The predetermined percentages are translated into precise question's marks for identified curriculum content group. The number of questions are then determined from each educational domain level to fulfil the assessment's overall requirements. This step guarantees balanced coverage across all subject areas and gives specific goals for question development. The number of assessment tools (e.g. multiple-choice questions, true-false questions, oral exam, short and long essay questions, objective structured practical examination, objective structured clinical examination, extended matching questions, problem solving questions, mini clinical evaluation exercise, direct observation of procedural skills, etc.) that students can finish within the given time are assessed.[6,7,39,40] Weight (marks) to each primary category or domain are assigned in the test blueprint based on its overall significance and adequate number of assessment tasks are confirmed to back up the assertions intended to present and justify the intended conclusions.[6,7,31]

Number of question items cannot be equally distributed based on the list of curricular content. Increasing the number of test items is one way to improve the test's dependability. It is evident from various studies that minimum of 30-items should be asked for good reliability but to achieve a test reliability of 0.8, 50-60 items are required. The items beyond 100 provided no additional benefit in terms of reliability and feasibility must be considered.[31,33,34-37] Weightage of chapter/competency can determine the maximum number of marks that can be assigned to a specific chapter or competency during formative assessment like class test, system completion tests or internal assessments. During summative assessment tests, such as semester or university exams, chapter/competency weightage can guide the allocation of marks to each chapter/competency. Then, correspondingly, questions can be selected.[37,39] For example, in 50 marks paper, theory or subjective questions carry 40 marks and objective questions (MCQs) carry 10 marks, then the number of questions must be constructed on the provided marks and time-limit (Table 4). Practically, the question setters should be those who teach the topics, who are acquainted with the curriculum, teaching-learning methodologies and assessment tools.

Table 4: Example of blueprint for genera pharmacology for MBBS (Phase I Year 1)

Blueprint: Table of Specifications											
Purpose	**Block completion exam**										
Scope	**MBBS 1st Year, First Block, General Pharmacology**										
Guideline	**Full marks 50: 2 LAQs (10 marks each), 5 SAQs (4 marks each), 20 MCQs (0.5 mark each)**										
Content	**Topic**	**I**	**F**	**I*F**	**Weightage (%)**	**Marks allocation**	**Domain and sub-domains**	**Tools with marks allocation**	**No. of Qs**	**Total marks**	**Remarks**
General Pharmacology	Pharmacokinetics	2	2	4	17	8.5	Knows Knows how	MCQs (0.5) SAQs (4)	1 2	0.5 8	
	Pharmacodynamics	2	3	6	25	12.5	Knows Knows how	MCQs (0.5) LAQ (10)	5 1	2.5 10	
Antimicrobials	Cell wall synthesis inhibitors	2	3	6	25	12.5	Knows Knows how	MCQs (0.5) SAQs (4)	9 2	4.5 8	
	Protein synthesis inhibitors	2	3	6	25	12.5	Knows Knows how	MCQs (0.5) LAQ (10)	5 1	2.5 10	
	Others	1	2	2	8	4	Knows Knows how	SAQs (4)	1	4	
				24						50	
Question setters	1. Associate Professor Dr XYZ of Pharmacology 2. Associate Professor Dr ABC of Pharmacology										
Question Moderator	Professor Dr RST of Pharmacology										

LAQ=Long answer question, SAQ=Short answer question, MCQ=Multiple choice question

Impact (I)

1 Less important for Phase 2

2 Important for Phase 2

3 Very important for Phase 2

Frequency (F)

1 Rarely applied in Phase 2

2 Commonly applied in Phase 2

3 Frequently applied in Phase 2

What to do after preparing blueprint in medical education?

Questions setters for every subject area must be ascertained.. Faculty members should be assigned the task of preparing questions according to their areas of expertise and teaching duties.[6,7,37,39,40] To ensure that the assessment is completely transparent, the marking scheme should be unambiguous. Blueprint should be provided to the learners/students which aids them in building comprehension of the material by offering a structure or mental mode for mind mapping of the content, organizing their study approach, and identifying the topics of greatest importance for assessments. Essentially, a blueprint serves as a template for students, question paper setters, and evaluators.[38-41]

Conclusion

Blueprint is a tool for converting learning goals into assessment approaches, that outlines what will be evaluated based on categories like specific tasks, curriculum elements, and assessment tools. In addition blueprinting is a standard technique for aligning objectives with assessment. Moderation of any assessment should include the blueprint as a crucial component. Making the test blueprint and providing it to the students before the test or exam is beneficial.

References

1. Gautam N, Dhungana R, Gyawali S, Dhakal S, Pradhan PM. Perception of medical students regarding TU-IOM MBBS curriculum and teaching learning methods in Nepal. Kathmandu University Medical Journal. 2022 Jun 30;20(2):219-24. DOI: 10.3126/kumj.v20i2.51404

2. Mathur M, Verma A, Mathur N, Kumar D, Meena JK, Nayak S, Gaiki V, Parmar P. Blueprint designing and validation for competency-based curriculum for theory assessment in community medicine. Med J Armed Forces India. 2023 Dec;79(Suppl 1):S47-S53. DOI: 10.1016/j.mjafi.2021.10.003 PMID: 38144616 PMCID: PMC10746729

3. Patil SY, Gosavi M, Bannur HB, Ratnakar A. Blueprinting in assessment: A tool to increase the validity of undergraduate written examinations in pathology. International Journal of Applied and Basic Medical Research. 2015 Aug 1;5(Suppl 1):S76-9. DOI: 10.4103/2229-516X.162286 PMID: 26380218 PMCID: PMC4552073

4. Patke V, Dahake H, Kuyare S. Evaluation of quality of MBBS biochemistry theory question papers of medical institutions in Maharashtra. Int J Res Med Sci. 2017 Oct;5(10):4336-. DOI Article DOI: 10.18203/2320-6012.ijrms20174114

5. Goyal SK, Kumar N, Badyal D, Kainth A, Singh T. Preparation of blueprint for clinical assessment of undergraduate medical students in psychiatry. Journal of Research in Medical Education & Ethics. 2017;7(3):205-8. DOI: 10.5958/2231-6728.2017.00034.8,

6. Ismail MA, Pa MN, Mohammad JA, Yusoff MS. Seven steps to construct an assessment blueprint: a practical guide. RESOURCE. 2020 Mar 1;12(1). DOI: 10.21315/eimj2020.12.1.8,

7. Raymond MR, Grande JP. A practical guide to test blueprinting. Medical teacher. 2019 Aug 3;41(8):854-61. DOI: 10.1080/0142159X.2019.1595556 PMID: 31017518

8. Carpo M. The Photograph and the Blueprint. Notes on the end of some indices. InDas Auge der Architektur 2011 Jan 1 (pp. 467-480). Brill Fink. DOI: 10.30965/9783846750810_017

9. Fazio SB, Demasi M, Farren E, Frankl S, Gottlieb B, Hoy J, Johnson A, Kasper J, Lee P, McCarthy C, Miller K. Blueprint for an undergraduate primary care curriculum. Academic Medicine. 2016 Dec 1;91(12):1628-37. DOI: 10.1097/ACM.0000000000001302 PMID: 27415445

10. Shappell E, Carter K, Park YS, Gottlieb M. Educator's blueprint: Holistic applicant file review in undergraduate and postgraduate medical education. AEM Educ Train. 2023 Sep 15;7(5):e10904. DOI: 10.1002/aet2.10904 PMID: 37720308 PMCID: PMC10502667

11. Gilic F, Dalgarno N, Simpson MT. Applying constructive alignment and cognitive load in teaching: case study involving a foundational family medicine medical school course. Canadian Family Physician. 2022 Apr;68(4):308. DOI: 10.46747/cfp.6804308 PMID: 35418398 PMCID: PMC9007130

12. Kandlbinder P. Constructive alignment in university teaching. HERDSA News. 2014 Dec;36(3):5-6. Article

13. Kaur M, Kurmi N, Chauhan S, Singhal A, Sharma S, Chaudhary S. Blueprinting for assessment in undergraduate medical physiology curriculum. Indian Journal of Physiology and Pharmacology. 2021 Jun 2;65(1):60-5. DOI: 10.25259/IJPP_183_2020

14. Abdellatif H, Alsemeh AE, Khamis T, Boulassel MR. Exam blueprinting as a tool to overcome principal validity threats: A scoping review. Educacion Medica. 2024 May 1;25(3):100906. DOI: 10.1016/j.edumed.2024.100906

15. Ferris H, O'Flynn D. Assessment in Medical Education; What Are We Trying to Achieve?. International Journal of Higher Education. 2015;4(2):139-44. DOI: 10.5430/ijhe.v4n2p139

16. Banu S, Chacko TV. Blueprinting: a framework for health education programme evaluation. Medical Education. 2011 May;45(5):533-. DOI: 10.1111/j.1365-2923.2011.03966.x PMID: 21486358

17. Boulet JR, Durning SJ. What we measure and what we should measure in medical education. Medical Education. 2019 Jan;53(1):86-94. DOI: 10.1111/medu.13652 PMID: 30216508

18. Gottlieb M, Caretta-Weyer H, Chan TM, Humphrey-Murto S. Educator's blueprint: A primer on consensus methods in medical education research. AEM Educ Train. 2023 Jul 11;7(4):e10891. DOI: 10.1002/aet2.10891 PMID: 37448627 PMCID: PMC10336022

19. Edwards LM, Kim Y, Stevenson M, Johnson T, Sharp N, Reisman A, Srinivasan M. When it's needed most: a blueprint for resident creative writing workshops during inpatient rotations. BMC Medical Education. 2021 Oct 20;21(1):535. DOI: 10.1186/s12909-021-02935-x PMID: 34670565 PMCID: PMC8529814

20. Edwards S, Swamy L, Cosimini M, Watsjold B, Chan TM. Educator's blueprint: A how-to guide for creating analog serious games for learning in medical education. AEM Educ Train. 2023 Nov 29;7(6):e10907. DOI: 10.1002/aet2.10907 PMID: 38046091 PMCID: PMC10685402

21. Lockyer J, Carraccio C, Chan MK, Hart D, Smee S, Touchie C, Holmboe ES, Frank JR, ICBME Collaborators. Core principles of assessment in competency-based medical education. Medical teacher. 2017 Jun 3;39(6):609-16. DOI: 10.1080/0142159X.2017.1315082 PMID: 28598746

22. Tribhuvan University (TU) Institute of Medicine (IOM) Curriculum for MBBS [Internet]. Medium. Digital Medicine; 2011 [cited 2025 Jul 22]. Available from: https://digitalmedicine.com.np/tribhuvan-university-tu-curriculum-for-mbbs-cc70dae71f3?gi=1c5c9cbdc149

23. Furst EJ. Bloom's taxonomy of educational objectives for the cognitive domain: Philosophical and educational issues. Review of educational research. 1981 Dec;51(4):441-53. DOI: 10.3102/00346543051004441

24. Pla RA, Cohen IT. Bloom's taxonomy. Professional, Ethical, Legal, and Educational Lessons in Medicine: A Problem-Based Learning Approach. 2024;274. DOI: 10.1093/med/9780197655979.003.0047

25. Design and teach a course: The Miller model [Internet]. lo.unisa.edu.au. Available from: https://lo.unisa.edu.au/mod/book/view.php?id=611025&chapterid=105881

26. Witheridge A, Ferns G, Scott-Smith W. Revisiting Miller's pyramid in medical education: the gap between traditional assessment and diagnostic reasoning. International Journal of Medical Education. 2019 Oct 25;10:191. DOI: 10.5116/ijme.5d9b.0c37 PMID: 31655795 PMCID: PMC7246123

27. Frank JR, Danoff D. The CanMEDS initiative: implementing an outcomes-based framework of physician competencies. Medical teacher. 2007 Jan 1;29(7):642-7. DOI: 10.1080/01421590701746983 PMID: 18236250

28. Batalden P, Leach D, Swing S, Dreyfus H, Dreyfus S. General competencies and accreditation in graduate medical education. Health affairs. 2002 Sep;21(5):103-11. DOI: 10.1377/hlthaff.21.5.103 PMID: 12224871

29. Harding A, Vallersnes OM, Carelli F, Kiknadze N, Karppinen H, Simmenroth A. European standards for undergraduate medical education in general practice; a blueprint-for-action. Educ Prim Care. 2023 Jan;34(1):2-6. DOI: 10.1080/14739879.2022.2155997 PMID: 36730558

30. Gill JS, Sen S. Blueprinting of summative theory assessment of undergraduate medical students in microbiology. Medical Journal Armed Forces india. 2020 Apr 1;76(2):207-12. DOI PubMed DOI: 10.1016/j.mjafi.2018.12.012 PMID: 32476720 PMCID: PMC7244858

31. Villarroel V, Bloxham S, Bruna D, Bruna C, Herrera-Seda C. Authentic assessment: Creating a blueprint for course design. Assessment & Evaluation in Higher Education. 2018 Jul 4;43(5):840-54. DOI: 10.1080/02602938.2017.1412396

32. Sunita Y P, Nayana K H, Bhagyashri R H. Blueprinting in Assessment : How much is imprinted in our practice? J Educational Res & Med Teach 2014;2(1):4-6.

33. Coderre S, Woloschuk W, McLaughlin K. Twelve tips for blueprinting. Med Teach. 2009;31:322-4. DOI: 10.1080/01421590802225770 PMID: 18937095

34. Tormey W. Education, learning and assessment: current trends and best practice for medical educators. Ir J Med Sci. 2015 Mar;184(1):1-12. DOI: 10.1007/s11845-014-1069-4 PMID: 24549647

35. Bhardwaj N, Krishna H, Ghatak S, Singh K. Blueprinting of assessment for the lower limb in undergraduate anatomy curriculum. Cureus. 2023 Nov 24;15(11). DOI PubMed DOI: 10.7759/cureus.49357

36. Richlin L. Blueprint for learning: Constructing college courses to facilitate, assess, and document learning. Taylor & Francis; 2023 Jul 3.

37. O'Shaughnessy SM, Joyce P. Summative and Formative Assessment in Medicine: The Experience of an Anaesthesia Trainee. International Journal of Higher Education. 2015;4(2):198-206. Article DOI: 10.5430/ijhe.v4n2p198,

38. Schuwirth LW, van der Vleuten CP. A history of assessment in medical education. Advances in Health Sciences Education. 2020 Dec;25(5):1045-56. DOI: 10.1007/s10459-020-10003-0 PMID: 33113056 PMCID: PMC9765899

39. Rao RH, Rao KH. Perspectives in medical education 9. Revisiting the blueprint for reform of medical education in Japan. Keio J Med. 2010;59(2):52-63. DOI: 10.2302/kjm.59.52 PMID: 20601841,

40. Eweda G, Bukhary ZA, Hamed O. Quality assurance of test blueprinting. Journal of Professional Nursing. 2020 May 1;36(3):166-70. DOI: 10.1016/j.profnurs.2019.09.001 PMID: 32527639

41. Chiappinotto S, Galazzi A, Papastavrou E, Igoumenidis M, Cabe CM, Gastmans C, Wiisak J, Stolt M, Suhonen R, Palese A. Blueprint of ethics content in undergraduate education: A workshop-research study. Nursing Ethics. 2025 Jan 16:09697330251313784. DOI: 10.1177/09697330251313784 PMID: 39819274

Orginal Article

Urological Abnormalities Associated with Anorectal Malformation in Children Presented at Kanti Childrens' Hospital

Ellina Dangol, Bijay Thapa, Anupama Thapa Basnet

Kanti Childrens' Hospital, Maharajgunj, Kathmandu, Nepal

Article History
Recived: 7 June, 2025
Accepted: 10 July, 2025
Published: 31 January, 2026

Funding Sources: None

Conflict of Interest: None

Online Access

DOI: 10.61122/jkistmc355

Correspondence

Dr Ellina Dangol
Lecturer, Department of Paediatric Surgery KIST Medical College, Imadol, Lalitpur, Nepal
Email: dr.yagyashrestha@gmail.com

Citation: Dangol E, Thapa B, Thapa Basnet A. Urological Abnormalities Associated with Anorectal Malformation in Children Presented at Kanti Childrens' Hospital. J. KIST Med. Col. 2026; 8(2)15:10-11.

Abstract

Introduction: Anorectal malformations (ARM) are common congenital defects in children that are frequently associated with other congenital anomalies, particularly urological abnormalities. These urological anomalies, which increase in frequency and severity with more complex ARM types, can lead to significant complications such as upper urinary tract deterioration if not identified and managed early.

Methods: This prospective observational study at Kanti Children's Hospital included 50 ARM patients from June 2024 to May 2025. All patients underwent baseline renal ultrasound; MCUG was done selectively for abnormal findings or symptoms. ARM was classified by Wingspread criteria and associated anomalies were documented. The study results were analyzed and compared with previously published data.

Results: Urological anomalies were detected in 44% of patients with anorectal malformations (ARM). The number of male patients with ARM was higher than females. Out of 50 patients, 23 had high-type ARM with 15 showing urological anomalies, 20 had intermediate-type with 7 anomalies, and none of the 7 low-type patients had urological anomalies. The most common urological abnormality identified was hydronephrosis (n = 13), followed by vesicoureteric reflux (VUR) (n = 5). Notably, four out of the five VUR cases were missed during the initial screening and were only diagnosed later during follow-up, often after the patient developed a urinary tract infection.

Conclusion: The high incidence of urogenital anomalies in patients with anorectal malformations highlights the need for thorough evaluation. Routine use of micturating cystourethrography (MCUG) is recommended, even when ultrasound findings are normal, to ensure early detection and timely management.

Keywords: Anorectal malformation, Urological anomalies, Micturating cystourethrography

Introduction

Anorectal malformation (ARM) is a common congenital defect observed in children.[1] ARM is frequently associated with a high rate of other congenital anomalies. It is usually linked to various systemic organ abnormalities, with urological anomalies being the most common.[2] Its presence can cause deterioration of the upper urinary tract. The overall occurrence of these related anomalies exceeds 60%.[3] Moreover, the rate of urological anomalies ranges from 20-50%.[4,5] Early identification of urological

Copyrights & Licensing © 2026 by author(s). This is an Open Access article distributed under Creative Commons Attribution License (CC BY NC)

anomalies is crucial, as it helps prevent severe damage to the upper urinary tract.[6,7]

The association of urological anomalies and ARM is due to their shared embryological development. ARM is characterized by the absence of a normally formed anus in its typical position within the perineum.[8,9] It varies from complex hindgut and urogenital organ anomalies, such as cloaca, to intricate perineal fistulas or vestibular issues fistulas.[8]

The Wingspread classification divides the ARM into high, intermediate, and low categories. Pena in 1995 classified ARMs based on specific anatomy and the child's sex. In 2005, Krickenbeck modified Pena's classification, adding more rare types variants.[10]

Patients with ARM exhibit various urological abnormalities. The occurrence of complications tends to increase with the severity of ARM,[11,12] Both structural and functional urological issues are commonly seen in affected individuals. Vesicoureteric reflux (VUR) and hydronephrosis are among the common abnormalities linked to ARM.8 Renal anomalies are found in 50-60% of patients with high or intermediate forms of ARM and 15-20% of those with low-type ARM.[12] This connection highlights the complexity of ARM and the importance of multidisciplinary care to manage diverse medical concerns.

Despite advancements in medical imaging and diagnostic techniques, debates persist regarding the optimal screening protocols for detecting associated urological anomalies. Additionally, prenatal interventions for ARM remain limited. Prenatal diagnosis of ARM is often overlooked unless associated anomalies are present, such as VACTERL association (vertebral defects, ARM, cardiac anomalies, tracheoesophageal fistula, renal anomalies and limb abnormalities). Existing recommendations advocate for comprehensive screening strategies, including ultrasonography of the urinary tract, voiding cysto-urethrography for vesicoureteral reflux detection, and imaging of the spinal cord to identify lumbosacral anomalies. However, the efficacy of these screening methods in improving treatment outcomes, especially in less complex ARM cases, remain unclear.[2]

The variation in treatment approaches for urological anomalies associated with anorectal malformations (ARM) highlights the need to explore whether these strategies differ based on the severity of ARM. This kind of study could give important information that would help create better, personalized treatment plans for each type of ARM.

Methods

A prospective, observational study done in Kanti Children's Hospital from June 2024- May 2025; where patients who had ARM presented in Kanti Children's Hospital were included. The current study aimed to study urological problems in children with anorectal malformations (ARM) treated at Kanti Children's Hospital, find out which types are most common, and see how these problems differ in the various types of ARM based on the Wingspread classification. All patients meeting the inclusion criteria were taken for the study after consent/assent. Cross table prone lateral Xray and an ultrasound of the abdomen were done during admission. ARM was categorized according to the wingspread classification. For statistical analysis, the type of ARM was dichotomized into high, intermediate and low based on definitions from the 1984 Wingspread classification. In high lesions the terminal pouch lies above the levator ani muscles, intermediate lies within and in low type, it lies below. This was determined by rectal gas shadow with the prone radiological pubococcygeal (PC) line and tip of ischium (I line). If the rectal gas shadow is above the PC line its high type; between PC line and I line is intermediate type and below I line is low type. Surgically by the distance of the terminal rectal pouch being more (high lesions) or less (low lesions) than 1 cm from the perineum. Definitive surgery was done according to the protocol of ARM. On follow up after 7 days of surgery, patients with anomalies in ultrasound are planned for micturating cystourethrogram or CT-IVU who have complex urological abnormalities in ultrasonography and MCUG. Urinary tract anomalies were defined as renal, ureteral or bladder malformations excluding the recto-vesical and recto-urethral fistula. Grading of vesicoureteric reflux was done according to international classification.

Results

During the one-year study period, 50 patients with congenital anorectal malformation (ARM) were admitted (Table 1). Of these, 26 (52%) were male and 24 (48%) were female. Urological anomalies were detected in 22 patients (44%) (Figure 1).

Out of 50 patients with anorectal malformations (ARM), 23 had the high type, of whom 15 presented with urological anomalies. Twenty patients had the intermediate type, with 7 showing urological anomalies. The remaining 7 patients had the low type, and none of these exhibited any urological anomalies. (Figure 1)

Among the 22 patients with urological anomalies, 3 were on regular follow-up after having undergone primary colostomy and were admitted for definitive surgery. Four patients were admitted for colostomy closure. Five patients had previously completed definitive surgery for ARM and presented to the surgical outpatient department with ultrasound reports indicating urological anomalies. The remaining 10 patients were newly diagnosed cases of ARM at the time of admission. The detailed distribution of urological anomalies according to the type of ARM is presented in Table 2.

Table 1: Distribution of associated urological anomalies in patients with different types of anorectal malformations.

Type of ARM	No. of ARM cases according to type (n)	Urological anomalies cases (n)	Urological anomalies cases Percentage(%)
High	23	15	30%
Intermediate	20	7	14%
Low	7	0	0
Total	50	22	44%

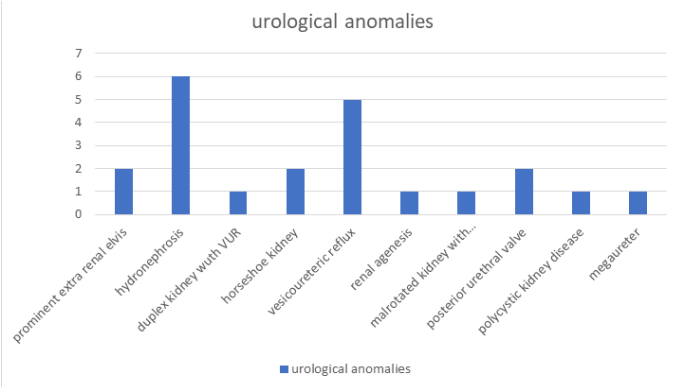


Figure 1: Depiction of various urological anomalies in anorectal malformation

Table 2: Urological abnormalities in different type of Anorectal malformations

	Hydrone-phrosis n (%)	Hydro-ure-terone-phrosis n (%)	Horseshoe kidney n(%)	Renal agenesis n (%)	polycystic kidney disease n (%)	Duplex kidney n (%)	Posterior urethral valve n (%)	Prominent extra re-nal pelvis	megaureter
High	4	2	2	1	1	1	2	1	1
Intermediate	2	3	-	-	-	1	-	1	-
Low	-	-	-	-	-	-	-	-	-

Discussion

Urological anomalies are found to be the most frequent among all the anomalies in ARM. About 40% of ARM have an associated urinary tract anomaly.[1,2] In a study done by Shenoy NS et al, 63% were male and 37% were female. Similarly, in other parts of the world, male cases were high in comparison to females, ranging from 55% to 71%.[3,4,6] In this study, male cases with 52% and female cases were 48%.

Partridge and Gough in 1961 reported 9% incidence of urologic anomalies in low ARM and 30% in high ARM.[13] Parrot reported 14% with low,21% with intermediate, and 40% with high anomalies.[7] Rich et al showed 25%, 42% and 71% associations respectively.8 Todha et al found 38.1% of low, 65.5% of intermediate and 85.7% of high ARM.[9] In this study, 14% low cases, intermediate 40% and 46% high.

Urological anomalies were found to be the most common among all the anomalies in the study conducted by Ratan et al., which showed 31% of patients were affected.[14] Similarly, in other studies, urogenital anomalies range from 26% to 60% in patients with ARM.[10–12] Urological anomalies were present in 44% of cases in this study, with 30% associated with high-type ARM, 14% with intermediate-type ARM, and none with low-type ARM.

In the present study, the most common urological anomaly was hydronephrosis, followed by vesicoureteric reflux (VUR). A total of 13 cases of hydronephrosis were identified. This finding aligns with the understanding that hydronephrosis is often secondary to underlying conditions such as VUR or bladder dysfunction, rather than being a primary abnormality. The observed incidence pattern was consistent with reports from other series.[12,15,16]

The reported incidence of VUR in ARM patients in the literature varies widely, ranging from 19% to 47.2%.[1,15,17] In the current study, the incidence of VUR was comparatively lower, which may be explained by the selective use of micturating cystourethrogram (MCUG). At this center, MCUG was performed only in patients with abnormal ultrasound findings or those presenting with urinary symptoms such as urinary tract infection (UTI). While this approach avoids unnecessary invasive testing, it inevitably results in missed cases of VUR, particularly those that are asymptomatic at presentation.

This limitation was evident in one patient who had undergone definitive ARM repair and later presented during follow-up with a new episode of UTI. Further evaluation revealed VUR, which had not been detected during the initial screening. Overall, there were five cases of VUR in this study, of which four were missed during the initial evaluation and only diagnosed on follow-up. This observation mirrors findings from Fascetti-Leon et al.[12], where a proportion of anomalies were not apparent in the neonatal period but were identified later. In his study, 88% of urological anomalies were detected through the screening protocol, while 12.9% were diagnosed only during follow-up, emphasizing that VUR can remain clinically silent in early life and manifest only under specific circumstances.

These findings show that patients with ARM need ongoing follow-up based on their risk. Although early screening can find most urological problems, some may still be missed without regular check-ups. Using MCUG only when ultrasound or symptoms suggest a problem is practical but may miss some cases. Therefore, future protocols should balance effective detection with minimizing unnecessary tests by scheduling periodic reassessments for high-risk patients, even if they show no symptoms, to ensure early identification and prevention of kidney problems.

Conclusion

Urological anomalies were found in 44% of children with anorectal malformations, most commonly in high and intermediate types. Hydronephrosis and vesicoureteric reflux were the predominant findings. Since some cases were missed on initial ultrasound, routine follow-up and selective use of MCUG are essential for early detection. Timely identification of associated anomalies in patients with anorectal malformations (ARM), particularly urological anomalies, is essential for improving long-term outcomes and quality of life.

References

1. McLorie GA, Sheldon CA, Fleisher M, Churchill BM. The genitourinary system in patients with imperforate anus. J Pediatr Surg. 1987 Dec;22(12):1100-4. DOI: 10.1016/S0022-3468(87)80717-0 PMID: 3440894
2. Metts JC, Kotkin L, Kasper S, Shyr Y, Adams MC, Brock JW. Genital Malformations and Coexistent Urinary Tract or Spinal Anomalies in Patients With Imperforate Anus: J Urol. 1997 Sept;1298-300.
3. Shenoy NS, Kumbhar V, Basu KS, Biswas SK, Shenoy Y, Sharma CT. Associated anomalies with anorectal malformations in the Eastern Indian population. J Pediatr Neonatal Individ Med. 2019 Oct;8(2):e080214.
4. Adejuyigbe O, Abubakar AM, Sowande OA, Olayinka OS, Uba AF. Experience with anorectal malformations in Ile-Ife, Nigeria. Pediatr Surg Int. 2004 Dec;20(11-12):855-8. DOI: 10.1007/s00383-004-1297-1 PMID: 15565306
5. Lawal TA. Overview of Anorectal Malformations in Africa. Front Surg. 2019;6:7. DOI: 10.3389/fsurg.2019.00007 PMID: 30891450 PMCID: PMC6411760
6. Almaramhy HH. Incidence and spectrum of anorectal malformations in Western Saudi Arabia. Saudi Med J. 2012 Dec;33(12):1334-9.
7. Parrott TS. Urologic implications of anorectal malformations. Urol Clin North Am. 1985 Feb;12(1):13-21.
8. Rich MarkA, Brock WilliamA, Pea A. Spectrum of genitourinary malformations in patients with imperforate anus. Pediatr Surg Int [Internet]. 1988 Mar [cited 2025 Aug 9];3-3(2-3). DOI: 10.1007/BF00182762
9. Tohda A, Hosokawa S, Shimada K. URINARY TRACT ABNORMALITIES ASSOCIATED WITH ANORECTAL MALFORMATIONS. Jpn J Urol. 1995;86(8):1388-93. DOI: 10.5980/jpnjurol1989.86.1388 PMID: 7474624
10. Joseph VT, Chan KY, Siew HF. Anorectal malformations and their associated anomalies. Ann Acad Med Singapore. 1985 Oct;14(4):622-5.
11. Endo M, Hayashi A, Ishihara M, Maie M, Nagasaki A, Nishi T, et al. Analysis of 1,992 patients with anorectal malformations over the past two decades in Japan. J Pediatr Surg. 1999 Mar;34(3):435-41.
12. Mittal A, Airon RK, Magu S, Rattan KN, Ratan SK. Associated anomalies with anorectal malformation (ARM). Indian J Pediatr. 2004 June;71(6):509-14.
13. Partridge JP, Gough MH. Congenital abnormalities of the anus and rectum. J Br Surg. 1961 July 1;49(213):37-50. DOI: 10.1002/bjs.18004921310 PMID: 14484114
14. Ratan SK, Rattan KN, Pandey RM, Mittal A, Sodhi PK. Associated congenital anomalies in patients with anorectal malformations-a need for developing a uniform practical approach. J Pediatr Surg. 2004 Nov;39(11):1706-11.
15. Sabzehei M, Bazmamoun H, Mousavi-Bahar S. Urogenital and Other Associated Anomalies in Patients With Anorectal Malformations. Nephro-Urol Mon. 2011 Dec 19;4(1):388-90.
16. Wondemagegnehu BD, Asfaw SW. Urogenital anomalies in children with anorectal malformations: a single institution observational study. Front Surg. 2025 Apr 24;12:1497644.
17. Sangkhathat S, Patrapinyokul S, Tadtayathikom K. Associated genitourinary tract anomalies in anorectal malformations: a thirteen year review. J Med Assoc Thail Chotmaihet Thangphaet. 2002 Mar;85(3):289-96.

Orginal Article

Accuracy of Ratio of Height to Thyromental Distance in Predicting Difficult Visualization of Larynx

Pragya Shrestha,[1] Binita Acharya,[2] Priska Bastola,[3] Arjun Gurung,[3] Aashish Shah[1]

[1]Department of Anesthesiology, Shree Birendra Hospital, Kathmandu, Nepal.
[2]Departement of Anesthesiology, Tribhuvan University Teaching Hospital, Kathmandu, Nepal.
[3]Department of Cardiothoracic and Vascular Anesthesiology, Manmohan Cardiothoracic, Vascular and Transplant Centre, Kathmandu, Nepal.

Article History
Recived: 16 August, 2025
Accepted: 15 November, 2025
Published: 31 January, 2026

Funding Sources: None
Conflict of Interest: None
Online Access

DOI: 10.61122/jkistmc369

Correspondence

Dr Binita Acharya
Department of Anesthesiology,
Tribhuvan University Teaching Hospital
Email: binitaacharya@gmail.com

Citation: Citation Shrestha P, Acharya B, Bastola P, Gurung A, Shah A. Accuracy of Ratio of Height to Thyromental Distance in Predicting Difficult Visualization of Larynx. J. KIST Med. 2026; 8(2)15:14-19.

Abstract

Introduction: Difficult laryngoscopy (DL) and intubation (DI) is a significant contributing cause in anaesthesia-related morbidity and mortality. To identify potentially difficult airways, a number of anthropometric measurements have been recommended. This study is aimed to evaluate the accuracy of Ratio of Height to Thyromental Distance (RHTMD) to predict difficulty in the visualization of the larynx in patients undergoing elective surgery under general anaesthesia.

Methods: We conducted a prospective, observational study including 94 patients of ASA PS I and II patients scheduled for elective surgery requiring general anaesthesia with endotracheal intubation. Preoperatively, airway assessments were performed including TMD and RHTMD. During intubation CL grading of the patient was noted by attending anaesthesiologist. TMD, RHTMD, CL gradings and other parameters measured were analysed using R programming language. The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of RHTMD in predicting the difficult visualization of larynx during intubation was assessed.

Results: The total incidence of difficult laryngoscopy, defined by CL III and IV was 5.3%, and sensitivity, specificity, PPV, NPV and accuracy of RHTMD were 40%, 98%, 50%, 97% & 94% respectively. In ROC the area under the curve (AUC) was 0.937, 95% CI 0.854-1.0 indicating high diagnostic accuracy in predicting difficult visualization of the larynx.

Conclusion: RHTMD can be used as a bedside preoperative test for predicting difficult laryngoscopy with higher specificity, negative predictive value and accuracy.

Keywords: Difficult laryngoscopy; Height; Intubation; Larynx; Thyromental distance

INTRODUCTION

Airway management is integral component of general anaesthesia. Failure to secure and maintain the airway may lead to failed oxygenation and its consequences which may be catastrophic.[1] A difficult airway includes the clinical situation in which anticipated or unanticipated difficulty or failure is experienced by a physician trained in anaesthesia care, including but not limited to one or more of the following: facemask ventilation, laryngoscopy, and intubation, ventilation using a supraglottic airway, tracheal intubation, extubation, or invasive airway.[2]

Copyrights & Licensing © 2026 by author(s). This is an Open Access article distributed under Creative Commons Attribution License (CC BY NC)

The preoperative prediction of a difficult airway is crucial in anaesthetist's practice, as 85% of all mishaps regarding airway management result in permanent cerebral damage, and up to 30% of all anaesthetic deaths.[3] Hence, preoperative airway assessment and planning is essential for airway management. Among the different preoperative bedside airway assessment tests used, the ratio of height to thyromental distance (RHTMD) and the ratio of height to sternomental distance (RHSMD) have been taken as beneficial screening tests for the prediction of difficulty in laryngoscopy.[4] In addition to the measure of mandibular space (TMD), it also addresses the body proportions of the patient, hence, RHTMD is reported to have better predictability in airway assessment.[5] It is a simple bedside screening tool, without any additional cost, or any harm or discomfort to patients. It is believed to have better specificity, and higher accuracy, sensitivity, and negative predictive value (NPV).[5] We conducted this study to estimate the accuracy of RHTMD to predict difficult laryngoscopy in Nepalese population.

METHODS

This is prospective observational study conducted in Tribhuvan University Teaching Hospital (TUTH) and Manmohan Cardiothoracic Vascular and Transplant Centre (MCVTC) after obtaining ethical clearance from Institutional Review Committee (IRC), Institute of Medicine (IOM). The sample size calculated was 94, which was based on the study by Kaniyil et al.[6] The sampling method used was non probability sampling technique. Patients between the age of 16-65 years, ASA I and II, patient undergoing surgery in general anaesthesia requiring intubation were included in the study. Patient refusing to be the part of study, distorted anatomy of head and neck, cervical spine pathology, inability to stand, need for rapid sequence intubation, midline neck swellings, BMI > 30kg/m^2, known difficult airway were excluded from study. After explaining about the study, written informed consent was obtained who were willing to be the part of the study.

One day before the surgery, detail pre anaesthetic checkup was done which included detailed history, airway assessment, systemic examination and review of investigation. During airway assessment thyromental distance (TMD) was measured in centimetres, with a rigid ruler from the bony point of the mentum to the tip of the thyroid notch with the head fully extended and mouth fully closed. The height of the patient was also measured in centimetres. Then, the ratio (height in cm: TMD in cm) of height of the patient to thyromental distance (RHTMD) was calculated. RHTMD <25 as grouped as Easy-RHTMD and >25 was grouped as Difficult-RHTMD.On the day of surgery, standard preparation of the OT was done including difficult airway cart ensuring the availability fibreoptic bronchoscope for suspected case of a difficult airway. After ensuring the patient identity and performing the WHO surgical safety checklist, patients were shifted to the operation theatre, attached to standard monitors, IV access obtained in the non-dominant hand. Induction of general anaesthesia was done using standard drugs in doses as per the body weight of the patient (Inj. Fentanyl 2mcg/kg, Inj. Propofol in titrated dose of 1.5-2.5mg/kg). Muscle relaxant vecuronium 0.15 mg/kg was given after ensuring the adequacy of manual bag and mask ventilation. After 3 minutes of bag and mask ventilation, with the head in sniffing position, direct laryngoscopy was done with a Macintosh blade of appropriate size by the attending anaesthesiologists. Cormack-Lehane grade was assessed as follows by the intubating anaesthesiologist as grade I: full view of glottis, grade II: partial view of glottis or arytenoids, grade III: only epiglottis seen, grade IV: epiglottis not seen. Cormack-Lehane grades I and II were grouped as Easy visualization of the larynx (EVL) and Cormack-Lehane grades III and IV were grouped as Difficult visualization of the larynx (DVL).

Whenever intubation was not possible with conventional laryngoscopy, ASA guidelines for difficult airway were followed as per the decision of the attending anaesthesiologist. After endotracheal intubation further anaesthetic management was continued as per the requirements and standards decided by the attending anaesthesiologist. Data were collected in a proforma. Statistical analysis was done using R programming language. Descriptive summary of the study patients was presented by mean (SD) or median (IQR) and proportions. Sensitivity, Specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV), and accuracy were calculated using the standard formulae and p value of < 0.05 was considered statistically significant.

RESULTS

A total of 94 patients were included in our study. The demographic characters of study population are mentioned in the table 1.

Table 1. Demographic data of patients

Characteristics	Value
Gender n (%)	
Male	34(36.17%)
Female	60(63.82%)
Age (years), Mean ± SD	42.4 ± 11.4
Weight (kg), Mean ± SD	62.4 ± 9.8
Height (cm), Mean ± SD	159.4 ± 7.9
BMI (kg/m^2), Mean ± SD	24.6 ±3.3
ASA Status, n (%)	
ASA I	74 (78.7%)
ASA II	20 (21.3%)

The thyromental distance, ≤ 6.5 cm, was observed in 8

patients (8.51%) and > 6.5 cm was observed in 86 patients (91.4%). TMD among the study population was not normally distributed. The median TMD was 7.5cm and interquartile range of 1.0 cm and mean TMD was 7.6 ± 0.8. Similarly, out of a total 94 study population, RHTMD, <25 was observed in 90 patients (95.7%) and ≥25 was observed in 4 patients (4.3%). The mean RHTMD observed was 21.1 ± 2.08.

On direct laryngoscopy, CL grade I was recorded in 58 patients (61.7%), CL grade II was recorded in 31 patients (33%), and CL grade III was recorded in 5 patients (5.3%). No patients had CL grade IV.

Table 2. Cormack-Lehane Grading (N=94)

Cormack-Lehane Grade	Frequency(n)	Percentage(%)
Grade I	58	61.7
Grade II	31	33
EVL (Grade I and II)	89	94.7
Grade III	5	5.3
DVL (Grade III and IV)	5	5.3
EVL-Easy Visualization of Larynx; DVL: Difficult visualization of Larynx		

Comparison of TMD, RHTMD, and CL grading is shown in table 3.

Table 3. Distribution of difficult and easy TMD, RHTMD, and CL grade in study population

	TMD	RHTMD	CL grade
Difficult	8 (8.5%)	4 (4.3%)	5 (5.3%)
Easy	86 (91.5%)	90 (95.7%)	89 (94.7%)
TOTAL	94(100%)	94 (100%)	94 (100%)

Among the total, 4 patients were grouped as difficult based on RHTMD (> 25) among those falling in difficult group of RHTMD, 2 had true DVL (CL grade III and IV) whereas 2 had EVL (CL grade I and II). Likewise, among 90 patients grouped as Easy RHTMD (RHTMD < 25), 87 had true EVL whereas 3 had DVL. The relationship between RHTMD and CL grade was not statistically significant (p = 0.15). The comparison of RHTMD and CL grade is shown in table 4.

Table 4. Comparison of RHTMD Prediction (Cut-off ≥ 25) and Cormack-Lehane Grade (N=94)

		Laryngoscopy by CL grade			
		Difficult	Easy	Total	p-value
RHTMD	Difficult ≥ 25	2 (TP)	2 (FP)	4	0.15
	Easy < 25	3 (FN)	87 (TN)	90	
	Total	5	89	94	

TP: True Positive, FP: False Positive, TN: True Negative, FN: False Negative

Table 5. Diagnostic Accuracy of RHTMD (Cut-off ≥ 25) for Predicting Difficult Laryngoscopy (N=94)

	Sensitivity	Specificity	PPV	NPV	Accuracy
RHTMD	40%	98%	50%	97%	94%

PPV: Positive Predictive Value, NPV: Negative Predictive Value

Receiver Operating Characteristics (ROC) curve analysed for evaluating the ability of RHTDM for predicting difficult visualization of the larynx. The Area under the curve (AUC) was 0.937, 95% CI 0.854-1.0 indicating high diagnostic accuracy in predicting difficult visualization of the larynx.

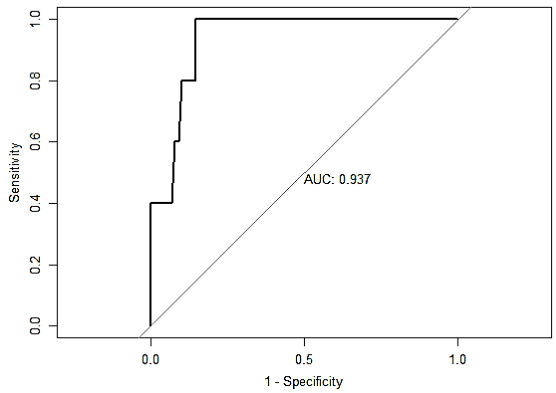


Figure 1. AUC of RHTMD

DISCUSSION

This study was conducted to estimate the accuracy of RHTMD in predicting difficult visualization of the larynx based on the Cormack-Lehane grades. Schmitt et al.[5] introduced RHTMD, as a better predictor of difficult laryngoscopy than TMD. RHTMD takes into consideration the body proportions of the patient rather than a single measurement as TMD,

hence RHTMD is considered to be a better predictor than TMD. In our study, RHTMD of $\geq$ 25, assumed as a difficult group, was observed in 4 patients (4.3%), and RHTMD of < 25, which was assumed as an easy group was observed in 90 patients (95.7%). In our study we found RHTMD was 40% sensitive, 98% specific with 50% of positive predictive value, 97 % of negative predictive value and 94 % of accuracy. Similarly, this study also found that the diagnostic accuracy of RHTMD in predicting the difficult visualization of the larynx was high as denoted by the value of area under the curve (AUC) 0.937, 95% CI 0.854-1.0.

The incidence of difficult laryngoscopy was 5.3% in our study, which is comparable with the reported incidence of 1.5%–13%.[7–9]predictive reliability is unclear. Because the ratio of height to thyromental distance (RHTMD A study done in Nepal by Khatiwada et al. found 3.8% of the patients had difficult intubation.[10]though it is not the exact measure of intubation difficulty. Our objectives were to find out the better predictor of difficult laryngoscopy amongst the routinely used tests and also to find the ability of difficult laryngoscopy to predict difficult intubation.\nMETHODS: This prospective, observational study involved 314, ASA I/II adult patients requiring endotracheal intubation. Measurement of sternomental, thyromental and inter-incisor distances and gradings of mandibular protrusion and modified Mallampati were done. Statistical values including sensitivity and specificity of these tests were calculated to find the better predictor of difficult laryngoscopy. Cormack and Lehane laryngoscopy grade III/IV was defined as difficult laryngoscopy. Requirement of >3 attempts for endotracheal intubation was defined as difficult intubation.\nRESULTS: The sensitivity of the Modified Mallampatti Test for predicting difficult laryngoscopy was highest, 83% compared to other tests. Total 12 (3.8% The wide range of incidence reported in studies could be due to several reasons such as lack of uniformity in the practice of laryngoscopy and intubation as in head and neck positioning, application of Sellick's manoeuvre, external laryngeal manipulation, multiple attempts, type of blade used, and varying skill of anesthesiologist.[9] Similar study by Kaniyil et al.[6] concluded that among the 4 indices (RHTMD, thyromental distance, modified Mallampati test, and upper lip bite test), RHTMD was the single best test with a sensitivity of 62.5%, specificity of 96.1%, PPV of 47.6%, and NPV of 97.9%. CM et al[4] showed that RHTMD had a sensitivity of 62.5%, specificity of 100%, PPV of 100%, and NPV of 91.43%. Our study also showed that RHTMD has high specificity and high NPV which was comparable with other studies. A false positive result is important because a predicted difficult airway necessitates alternate approaches for airway management, which often require more time and resources at the cost of patient discomfort.

A prospective observational study by Safavi et al.[11] in 2011 compared RHTMD with MMT and ULBT in predicting difficult laryngoscopy showed there was no significant difference between the AUC of the ROC for the ULBT (0.709) and the RHTMD (0.711) score. The MMT was the most sensitive of the single tests with a sensitivity of 87.37%. The ULBT was the least sensitive of the single tests with a sensitivity of 66.01 but had the highest specificity and PPV compared with the other two tests. The RHTMD had the highest NPV and the AUC of ROC curve among single predictors which was in line with our study. In a study conducted by Shah et al.[12] 480 adult patients were assessed and graded for ULBT, RHTMD, TMD, MMT, IIG (Inter incisor gap), and HNM (Head and neck movement) and correlated with the Cormack and Lehane grade. ULBT and RHTMD had the highest sensitivity, specificity, positive predictive value, negative predictive value, and likelihood ratio, i.e., 74.63%, 91.53%, 58.82%, 95.7%, 31.765 and 71.64%, 92.01%, 59.26%, 95.24%, 8.96 respectively. The result of RHTMD is almost similar to our result i.e. high specificity and negative predictive value. They concluded that ULBT is the best predictive test for difficult laryngoscopy in apparently normal patients, but RHTMD can also be used as an acceptable alternative.

Similarly, a study by Schmitt et al.[13] showed AUC of RHTMD was significantly greater (P < 0.007) when compared to TMD, indicating a more accurate prediction by the RHTMD. A ratio of 25 for the RHTMD was found to be the optimal cut-off value to predict difficult laryngoscopy. When the sensitivity of both tests was 0.81, the RHTMD had a significantly greater specificity (0.91) than the TMD (0.73) and they concluded that RHTMD should be used instead of the TMD for prediction of difficult laryngoscopy. Our study also showed that RHTMD alone has the highest specificity and accuracy and can be reliably used for the prediction of difficult laryngoscopy. A study by Puneeth Kumar et al,[14] the AUC for RHTMD was 0.875 (0.730–1.000) which is comparable to our study indicating RHTMD to be a better predictor of difficult visualization of larynx. Similarly, another study by Shiva Kumar et al revealed AUC for RHTMD to be 0.87 which is also comparable to our study.[15]

We assume that there may be variability in the observer and performance while performing the laryngoscopy and CL grading, measuring the height and thyromental distance could have produced bias in our result. We did not include obstetrics patients, elderly and children in the study which could be our limitation. We did not analyse other airway assessment tests in our study which we assume to be the limitation of our study.

RHTMD can be used as a useful bedside screening test for preoperative prediction of difficult laryngoscopy in the general population. More studies with larger sample sizes in different populations are suggested for the documentation of our results. The safe outcome of anaesthesia continues to be an important goal for every anaesthesiologist. Unfortu-

nately, there is still no test or group of tests that can predict 100% of difficult laryngoscopies. Even though the internal validity in the present study seems adequate, it may not be applicable to all subgroups of the general population.

CONCLUSION

RHTMD can be used as a bedside preoperative test for predicting difficult visualization of larynx with higher specificity, negative predictive value, and accuracy.

ACKNOWLEDGEMENTS

We would like to thank the head of the department of anesthesiology and all staffs of department of anesthesiology of Tribhuvan University Teaching Hospital, Kathmandu, Nepal

REFERANCES

1. Cook TM, MacDougall-Davis SR. Complications and failure of airway management. Br J Anaesth. 2012 Dec;109(Suppl 1):i68–85. DOI: 10.1093/bja/aes393 PMID: 23242753.
2. Apfelbaum JL, Hagberg CA, Connis RT, Abdelmalak BB, Agarkar M, Dutton RP, et al. 2022 American Society of Anesthesiologists Practice Guidelines for Management of the Difficult Airway. Anesthesiology. 2022;136(1):31–81. pubmed.ncbi.nlm.nih.gov/34762729 PMID: 34762729.
3. Peterson GN, Domino KB, Caplan RA, Posner KL, Lee LA, Cheney FW. Management of the difficult airway: a closed claims analysis. Anesthesiology. 2005 Jul;103(1):33–9. DOI: 10.1097/00000542-200507000-00009 PMID: 15983454.
4. Amarnath C, Rao SS, Kumar R, Reddy V, Kumar N, Singh TS. The ratio of height to thyromental distance (RHTMD) and height to sternomental distance (RHSMD) as predictive tests for difficult tracheal intubation. Cureus. 2022 Sep;14(9):e28734. DOI: 10.7759/cureus.28734 PMID: 36211089; PMCID: PMC9528921.
5. Schmitt HJ, Kirmse M, Radespiel-Troger M. Ratio of patient's height to thyromental distance improves prediction of difficult laryngoscopy. Anaesth Intensive Care. 2002 Dec;30(6):763–5. DOI: 10.1177/0310057X0203000607 PMID: 12500514.
6. Kaniyil S, Anandan K, Thomas S. Ratio of height to thyromental distance as a predictor of difficult laryngoscopy: a prospective observational study. J Anaesthesiol Clin Pharmacol. 2018;34(4):485–9. DOI: 10.4103/joacp.JOACP_283_17 PMID: 30774228; PMCID: PMC6360890.
7. Krobbuaban B, Diregpoke S, Kumkeaw S, Tanomsat M. The predictive value of the height ratio and thyromental distance: four predictive tests for difficult laryngoscopy. Anesth Analg. 2005 Nov;101(5):1542–5. DOI: 10.1213/01.ANE.0000181000.43971.1E PMID: 16244029.
8. Liaskou C, Vouzounerakis E, Moirasgenti M, Trikoupi A, Staikou C. Anatomic features of the neck as predictive markers of difficult direct laryngoscopy in men and women: a prospective study. Indian J Anaesth. 2014 Mar;58(2):176–82. DOI: 10.4103/0019-5049.130822 PMID: 24963183; PMCID: PMC4050935.
9. Yildiz TS, Korkmaz F, Solak M, Toker K, Erciyes N, Bayrak F, et al. Prediction of difficult tracheal intubation in Turkish patients: a multicenter methodological study. Eur J Anaesthesiol. 2007 Dec;24(12):1034–40. DOI: 10.1017/S026502150700052X PMID: 17555609.
10. Khatiwada S, Bhattarai B, Pokharel K, Acharya R. Prediction of difficult airway among patients requiring endotracheal intubation in a tertiary care hospital in Eastern Nepal. JNMA J Nepal Med Assoc. 2017;56(207):314–8. DOI: 10.31729/jnma.2918 PMID: 29255312.
11. Safavi M, Honarmand A, Zare N. A comparison of the ratio of patient's height to thyromental distance with the modified Mallampati and the upper lip bite test in predicting difficult laryngoscopy. Saudi J Anaesth. 2011 Jul;5(3):258–63. DOI: 10.4103/1658-354X.84098 PMID: 21957403; PMCID: PMC3168341.

12. Shah PJ, Dubey KP, Yadav JP. Predictive value of upper lip bite test and ratio of height to thyromental distance compared to other multivariate airway assessment tests for difficult laryngoscopy in apparently normal patients. J Anaesthesiol Clin Pharmacol. 2013 Apr;29(2):191–5. DOI: 10.4103/0970-9185.111700 PMID: 23878440; PMCID: PMC3713666.

13. Schmitt HJ, Kirmse M, Radespiel-Troger M. Ratio of patient's height to thyromental distance improves prediction of difficult laryngoscopy. Anaesth Intensive Care. 2002 Dec;30(6):763–5. DOI: 10.1177/0310057X0203000607 PMID: 12500514.

14. Patil SK, Kagalkar N, Holyachi R, Suntan A. Ratios of height-to-thyromental distance and height-to-sternomental distance as predictors of difficult airway in patients posted for general anaesthesia. Asian J Anesthesiol. 2021 Jun 1;59(2):69–75.

15. Shivkumar PS, Sarvesh NK, Patil V, Sagar GC, Sirigeri S, Monnaiah KP, et al. Ratio of patient's height to thyromental distance (RHTMD) compared to thyromental distance for prediction of difficult intubation. J Evol Med Dent Sci. 2016 Aug 8;5(63):4462–7. DOI: 10.14260/jemds/2016/1018

Orginal Article

Usefulness of Modified Cave Score to Identify Seizure in Adult Patients with Intracerebral Hemorrhage in Emergency Room

Manoj Gaire, Sushant Shrestha, Usha Kiran Pandey, Alin Shrestha

Department of Emergency , Devdaha Medical College, Rupandehi, Nepal

Article History
Received: 1 Sep, 2025
Accepted: 4 Oct, 2025
Published: 31 January, 2026

Funding Sources: None

Conflict of Interest: None

Online Access

DOI: 10.61122/jkistmc354

Correspondence

Dr Manoj Gaire
Lecturer, Department of Emergency
Devdaha Medical College,
Rupandehi, Nepal
Email: gairemanoj@gmail.com

Citation: Gaire M, Shrestha S, Pandey UK, Shrestha A. Usefulness of Modified Cave (Cave2) Score to Identify Seizure in Adult Patients with Intracerebral Hemorrhage (ICH) In Emergency Room. J. KIST Med. Col. 2026; 8(2)15:20-21.

Abstract

Introduction: Seizure is a common neurological disorder causing physical, psychological, emotional, social, and economic effects. Seizure is a serious complication of spontaneous intracerebral hemorrhage (ICH), which can cause significant disability and mortality. The purpose of the study is to determine the frequency of post-ICH seizure, possible associated factors, and use the modified CAVE score (CAVE2) to identify seizures (mainly late seizures) and assess outcomes in terms of mortality at Devdaha Medical College and Research Institute (DMCRI), Nepal.

Methods: This was a descriptive cross-sectional hospital-based study conducted among adult patients attending the emergency room of DMCRI from January 2025 to June 2025 over a six-month period. The study commenced after obtaining ethical approval from the Institutional Review Committee (Reference No: 21/2024). The inclusion criteria consisted of adult patients aged 18 years or above with ICH bleed diagnosed based on history, examination, and CT head, and admitted for complete neurological intervention. Collected data was collected using structured questionnaires, and analysis was performed by using Microsoft Excel and SPSS V.21. C-statistics (ROC) were calculated, and a 95 % confidence interval was taken.

Results: A total of 73 cases between 18 and 86 years of ICH were included. 43 (59%) were male, and 30 (41%) were female. Mean duration of Hospital stay was 17 days (SD±3.74) with a maximum of 47 days and a minimum of 9 days. Late seizure was developed in 14 patients (19.17%), whereas early seizure was in 8 (10.9%) patients. Late seizure was 100% in a hypertensive patient with ICH bleed, followed by a smoker (92.8%) and an alcohol consumer (85.7%). Calculated CAVE2 scores with seizure percentage: 0 (0%), 1(5.5%), 2(16.6%),3(25%),4(83.3%), and 5(100%). The calculated C-statistic (ROC) for the CAVE2 scores was 0.87. In the hospital, the mortality was (n=19, 26%).

Conclusion: The CAVE2 score can identify patients with a high risk of late seizures. The higher the score, the higher the risk of getting seizures in the future. CAVE 2 score in the emergency room helps to triage patients and guide treatment.

Keywords: Seizure, intra cerebral hemorrhage, Modified CAVE (CAVE2), emergency, outcomes

Copyrights & Licensing © 2026 by author(s). This is an Open Access article distributed under Creative Commons Attribution License (CC BY NC)

Introduction

A seizure is a common neurological emergency that is defined as a paroxysmal motor, sensory, autonomic, or psychic event due to abnormal, excessive synchronous electrical discharges from the brain.[1] Seizures are common in patients with intracranial hemorrhage (ICH). Early seizures are defined as seizures that appear within 1 week, and late seizures appear after more than 1 week of ICH.[2] Common feature is that both early and late seizures are associated with a worse prognosis and poor clinical outcome, greater disability, and greater mortality.[3,4,5]

The symptomatic seizures among patients with ICH range between 5% and 14% within the first twenty-four hours of stroke.[6] Bleeding inside the cranium can be epidural, subdural, arachnoids, intra ventricular, or intra cerebral. Intra cerebral hemorrhage accounts for approximately 10 % to 20 % of all strokes.[7] In 2014, Haapaniemi et al. proposed the CAVE scale, having four parameters each carrying one score (C cortical involvement, A age of patient less than 65 years, V volume of hemorrhage more than 10mm, and E early onset seizure), for the prediction of post-hemorrhagic stroke seizure. The maximum score is 4, and a score of 2 or more is related to 81% sensitivity and 89% specificity for the occurrence of late seizure. The risk of post-stroke epilepsy was estimated at 0.6%, 3.6%, 9.8%, 34.8%, and 46.2%, corresponding to CAVE scores 0 to 4, respectively. The CAVE score seems to be an easy tool to apply. However, it only applies to hemorrhagic strokes, which limits its use.[8] Some studies show that cortex involvement increases the risk of seizures, when the cortex score was changed to 2 points, which increases the predicted value of the CAVE score. Thus, in 2023, the CAVE Score was refined into the Modified CAVE (CAVE 2) score using data from 408 patients in Taiwan. The CAVE2 score was proposed, which includes 2 points for cortex involvement and 1 point each for age <65, hematoma volume >10 ml, and early seizures.[9]

Methods

This single-center study was conducted in the emergency room at DMC-RI, one of the major referral tertiary hospitals in western Nepal. The study population comprised adult patients aged 18 years and above who were diagnosed with ICH bleed during the six months of the study period, from January 2025 to June 2025. A total of 84 patients were admitted and treated for ICH; however, 11 patients were excluded as they did not fulfill the inclusion criteria. A total of N=73 patients were followed till their complete hospital stay and were enrolled in the study. The inclusion criteria were adult patients with new spontaneous intra cerebral bleed, whereas patients diagnosed as pseudo seizure, head injury, TIA, brain tumor, SAH, SDH, Ischemic stroke with hemorrhagic transformation, anticoagulant drugs, patients who did not provide consent, and patients below 18 years were excluded. Informed consent was obtained from willing participants. A non-probability convenience sampling method was used, allowing the inclusion of all eligible cases that presented themselves within the stated timeframe. Data were collected using a structured questionnaire that included demographic characteristics. Modified CAVE (CAVE2) was calculated for each patient. Clinical records, CT head findings, and laboratory investigations were reviewed to supplement the patient interviews. Hematoma volume was calculated according to the A × B × C/2 method.[10] Collected data was performed using structured questionnaires, and analysis was performed by using Microsoft Excel and SPSS V.21. C-Statistics (ROC) was calculated, and a 95 % confidence interval was taken.

Sampling method/ technique: Quantitative, Non-probability convenience sampling

Sample Size: 73

Justification of sample size

$n = Z^2 \times P \times (1- P)/e^2$

Z: for confidence interval of 95%, Z = 1.96

P = Prevalence e = allowable error (6 %)

Prevalence in adults = 7.3 %.[11, 12]

Total sample size will be = 1.96 2 × 0.073 × (1-0.073) /0.0036 = 73

(Modified CAVE / CAVE 2): Score

Variables	Point / score
C. Cortex involvement	2
A. age < 65 year	1
V. Volume > 10ml	1
E. Early seizure	1
Total CAVE 2 Score	5

Limitations like being single-center in nature may not allow wide generalizability, while reliance on convenience sampling may result in selection bias. Moreover, we only analyzed patients with motor seizures, which may underestimate the late seizure rate. The study excluded patients who lost follow-up after discharge from the hospital.

Results

During the study period, 84 patients were admitted and treated for ICH; 11 patients were excluded as they did not fulfill the inclusion criteria. A total of 73 patients could be followed till hospital stay and enrolled in the study (Table 1). Proportions of males were 43 (59%) and females were 30 (41%). Late seizure was more than 21% in males, as females had 16.7%.

Table 1: Characteristics of patients: Late seizure was developed in 14 patients (19.17%), whereas early seizure was in 8 (10.9%) patients. Eight patients with an age of less than 65 had late seizure, while late seizure was developed in six patients with an age greater than 65.

Variables (n=73)	No Seizure (n = 59)	Late Seizure (n= 14)
SEX Male (43) Female (30)	 34 25	 9 5
AGE < 65 (39) >= 65 (34)	 31 28	 8 6
CORTEX INVOLVEMENT Yes (19) No (54)	 11 48	 8 6
VOLUME (ml) <= 10 CC (57) >10 CC (16)	 52 7	 5 9
EARLY SEIZURE Yes (8) No (65)	 5 54	 3 11

Table 2: Risk factors associated with ICH and late seizure: Co-morbidity of the patient was associated with late seizure. All patients 100% (n=14) with hypertension developed late seizure (n=14) followed by 192.8% (n=13) smokers and 85.7% (n=12) developed late seizure.

Variable	No Seizure (n = 59)	Late Seizure (n=14)	P Value
Hypertension (52)	38	14(100%)	< 0.001
Diabetes Mellitus (36)	27	9(64.2%)	< 0.001
Dyslipidemia (55)	46	9 (64.2%)	< 0.001
Smoker (45)	32	13(92.8%)	< 0.001
Alcohol consumer (52)	40	12 (85.7%)	< 0.001

Table 3: Relations Modified CAVE (CAVE 2) score and late seizure: Risk of developing late seizure increases with an increase in CAVE 2 score. Late seizure was developed in all patients having a CAVE2 score range from 1 to 5; however, the patient with 0 CAVE2 had no seizure.

Score	Patient number (n=73)	No Seizure (n=59)	Late Seizure (n=14)
0	22	22	0 (0%)
1	18	17	1 (5.5%)
2	12	10	2 (16.66%)
3	12	9	3 (25%)
4	6	1	5 (83.3%)
5	3	0	3 (100 %)

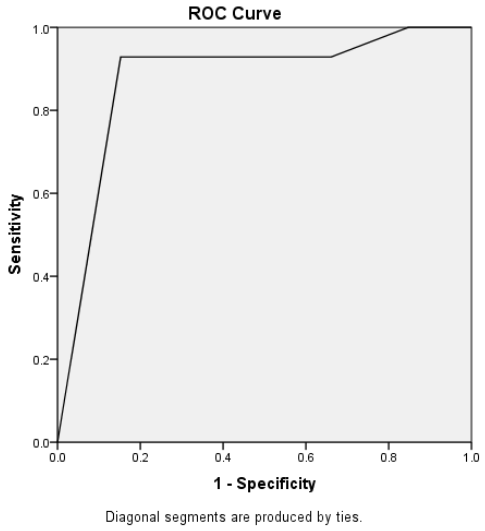


Figure 1: AUROC (Area under receiver operating curve) of CAVE 2 scores at 95% CI to identify predictive accuracy for late seizure: The calculated Concordance statistic / C-statistic (AUROC) was 0.825, which suggests good predictive ability of CAVE 2 scores to find the possibility of late seizure in ICH patients.

Area Under receiver Operating Curve (AU ROC) = 0.875				
Test Result Variable(s): Predicted probability				
Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.875	.055	.000	.767	.984

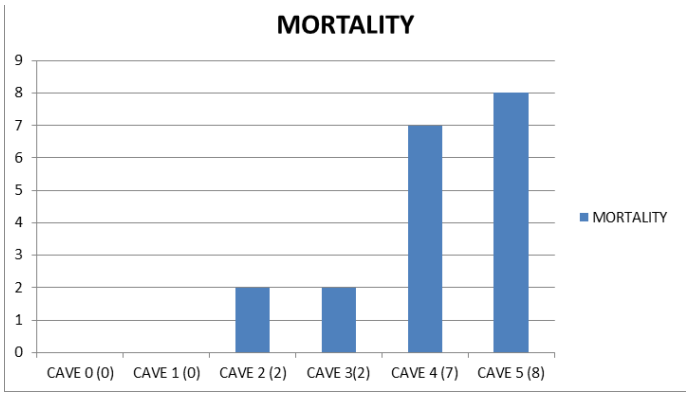


Figure 2: Mortality: Out of 73 patients, 19 died during treatment at the ICU, and the remaining had focal neurological deficits due to intracranial bleed. In hospital mortality according to the modified CAVE score, the highest mortality (n = 8) was in the CAVE 2 score, followed by 7 deaths in the CAVE 4 score. Cave scores of 0 and 1 have no mortality.

Discussion

Spontaneous, non-traumatic intra cerebral hemorrhage (ICH) is the second most common type of stroke and is linked to high rates of death and lasting disability.[13]

In this study, late seizures occurred in 9 men (64.3%) and 5 women (35.7%). This male predominance matches the findings by Huang YC et al.[9], who reported 41 men (15.1%) and 11 women (8.0%) with late seizures following intra cerebral hemorrhage. Whereas a study conducted by Ismail M et al.[14] had a higher proportion in females, 53.6% than males, 46.4 %. This gender variation may be due to biological and hormonal differences (men have larger amygdale/thalamus and women tend to have larger hippocampus and cortical regions, estrogen and progesterone affect recovering neural injury.[15] Similarly, men often experience ICH at younger ages, which may also contribute to higher seizure rates among younger males.[16]

Incidence:

The incidence of late seizure in our study was 19.18 % which was higher than the study by Wang et al., being 11.1%.[17], Huang YC et al.[9] being 12.7% and Haapaniemi et al.[8] being 9.2%, however, it lines with the study by H. Butzkueven et al.[18] being 19%. The variation in incidence across different hospitals may be due to the availability of diagnostic methods for additional autoimmune vascular disease, prior use of early anti seizure medication[19] and patient demography (younger patients are more likely to have late seizure).[9] Incidence of early seizure in our study was 10.95 %, which lines with the study by Haapaniemi et al.[8] being 11.0%. Whereas, a study by Ismail M et al.[14] shows 14.4 % had early seizure.

Risk factor for seizure:

We found hypertension as a major risk factor in 14 (100%) patients for late seizure (n=14), followed by smoking in 13 (92.8%) and alcohol consumption in 12 (85.7%). A similar finding was found in research by Rossi et al.[20], where hypertension was a risk factor in 16(52%) patients for late seizure (n=31), followed by smoking in 8 (26%) patients. However, multivariate analysis conducted by Wang et al.[17] and Ma S et al.[21] in China shows there was no relationship between seizure and risk factors for stroke (such as hypertension, diabetes mellitus, and coronary heart disease). This difference may be due to the low prevalence of risk factors in the sample population and study period context.

Mortality:

A 26% mortality rate in ICH patients in our study is notably high but aligns with findings of a single-center study from Iran (mortality 36%).[22] However, in the Finnish study, post-stroke seizure patients experienced a relatively low mortality rate of 10.4%.[8] Variation in mortality across different studies is likely due to Cortical involvement, Hemorrhagic transformation of an infarct, and Intra cerebral hemorrhage (ICH).[21] Also, Mortality among seizure patients may also vary depending on the availability of immediate emergency and intensive care services, urgency and success of neurosurgical interventions, patient characteristics such as age, sex, and co-morbidities, and timely use of antiepileptic medications.

The relation between the modified cave score (CAVE2) and late seizure:

We used CAVE2 (where cortical hemorrhage scores 2 points) to stratify risk of late seizure after ICH and found possibility of late seizure increases with increase in CAVE2 scores: 0 (0%), 1(5.5%), 2(16.6%),3(25%),4(83.3%)and 5(100%). Our Finding aliens with retrospective study by Huang YC et al.[9] in Taiwan, where the incidence of late seizures correlated with increasing CAVE2 scores: Score 0: 0%, Score 1: 4.6%, Score 2: 18.3%, Score ≥3: 54.4%.

Our study reported a C-statistic (ROC) of 0.875 for CAVE2, indicating good predictive ability for late seizure. Similarly, the study reported by Huang YC et al.[9] had a C-statistic of 0.74, which also shows good predictive capability. A slightly higher C-statistic for identifying late seizure in our study may be due to limited Acute Stroke Care, delays in Intervention, larger and untreated cortical infarcts or hemorrhages, poor treatment in hypertension and diabetes.[23]

Conclusion

The CAVE2 score can identify patients with a high risk of late seizures. The higher the score, the higher the risk of getting seizures in the future. For example, someone with a score of 3 or more has a more than 50% chance of late seizures. The CAVE2 score is a quick, easy tool used in the emergency room to identify ICH patients at high risk for later seizures, helping guide decisions on starting preventive anti-seizure medication and determining whether to admit to ICU or a high care unit.

Reference

1. Fisher RS. Final comments on the process: ILAE definition of epilepsy. Epilepsia (Series 4). 2014 Apr 1;55(4). DOI: 10.1111/epi.12585
PMID: 24731068

2. Yang TM, Lin WC, Chang WN, Ho JT, Wang HC, Tsai NW, Shih YT, Lu CH. Predictors and outcome of seizures after spontaneous intracerebral hemorrhage. Journal of neurosurgery. 2009 Jul 1;111(1):87-93. DOI: 10.3171/2009.2.JNS081622
PMID: 19301969

3. Huang CW, Saposnik G, Fang J, Steven DA, Burneo JG. Influence of seizures on stroke outcomes: a large multicenter study. Neurology. 2014 Mar 4;82(9):768-76. DOI: 10.1212/WNL.0000000000000166 PMID: 24489133

4. Hesdorffer DC, Benn EK, Cascino GD, Hauser WA. Is a first acute symptomatic seizure epilepsy? Mortality and risk for recurrent seizure. Epilepsia. 2009 May;50(5):1102-8. DOI: 10.1111/j.1528-1167.2008.01945.x PMID: 19374657

5. Burneo JG, Fang J, Saposnik G, Investigators of the Registry of the Canadian Stroke Network. Impact of seizures on morbidity and mortality after stroke: a Canadian multicentre cohort study. European journal of neurology. 2010 Jan;17(1):52-8. DOI: 10.1111/j.1468-1331.2009.02739.x PMID: 19686350

6. Krakow K, Sitzer M, Rosenow F, Steinmetz H, Foerch C. Predictors of acute poststroke seizures. Cerebrovascular diseases. 2010 Nov 1;30(6):584-9. DOI: 10.1159/000319777 PMID: 20948201

7. Feigin VL, Lawes CM, Bennett DA, Barker-Collo SL, Parag V. Worldwide stroke incidence and early case fatality reported in 56 population-based studies: a systematic review. The Lancet Neurology. 2009 Apr 1;8(4):355-69. DOI: 10.1016/S1474-4422(09)70025-0 PMID: 19233729

8. Haapaniemi E, Strbian D, Rossi C, Putaala J, Sipi T, Mustanoja S, Sairanen T, Curtze S, Satopää J, Roivainen R, Kaste M. The CAVE score for predicting late seizures after intracerebral hemorrhage. Stroke. 2014 Jul;45(7):1971-6. DOI: 10.1161/STROKEAHA.114.004686 PMID: 24876089

9. Huang YC, Wong YS, Wu CS, Tsai CF, Ong CT. Modified CAVE score for predicting late seizures after intracerebral hemorrhage. BMC neurology. 2023 Dec 19;23(1):448. DOI: 10.1186/s12883-023-03510-1 PMID: 38114955 PMCID: PMC10729474

10. Broderick JP, Brott TG, Duldner JE, Tomsick T, Huster G. Volume of intracerebral hemorrhage. A powerful and easy-to-use predictor of 30-day mortality. Stroke. 1993 Jul;24(7):987-93. DOI: 10.1161/01.STR.24.7.987 PMID: 8322400

11. Rajbhandari KC. Epilepsy in Nepal. Canadian Journal of Neurological Sciences. 2004 May;31(2):257-60. DOI: 10.1017/S0317167100053919 PMID: 15198454

12. Mac TL, Tran DS, Quet F, Odermatt P, Preux PM, Tan CT. Epidemiology, aetiology, and clinical management of epilepsy in Asia: a systematic review. The Lancet Neurology. 2007 Jun 1;6(6):533-43. DOI: 10.1016/S1474-4422(07)70127-8 PMID: 17509488

13. Feigin VL, Lawes CM, and Bennett DA, Barker-Collo S, Parag V. Worldwide stroke incidence and early case fatality reported in 56 population-based studies: a systematic review. Lancet Neurol. 2009;8(4):355-9. DOI: 10.1016/S1474-4422(09)70025-0 PMID: 19233729

14. Ismail M, ELmotayam A, Fahmy A. Prediction of post hemorrhagic stroke seizures. Zagazig University Medical Journal. 2022 Nov 1;28(6.1):202-6.

15. Reddy DS, Thompson W, Calderara G. Molecular mechanisms of sex differences in epilepsy and seizure susceptibility in chemical, genetic and acquired epileptogenesis. Neuroscience letters. 2021 Apr 17;750:135753. DOI: 10.1016/j.neulet.2021.135753 PMID: 33610673 PMCID: PMC7994197

16. Lidetu T, Zewdu D. Incidence and predictors of post stroke seizure among adult stroke patients admitted at Felege Hiwot compressive specialized hospital, Bahir Dar, North West Ethiopia, 2021: a retrospective follow up study. BMC neurology. 2023 Jan 25;23(1):40. DOI: 10.1186/s12883-023-03083-z PMID: 36698085 PMCID: PMC9875475

17. Wang G, Jia H, Chen C, Lang S, Liu X, Xia C, Sun Y, Zhang J. Analysis of risk factors for first seizure after stroke in Chinese patients. BioMed research international. 2013;2013(1):702871. DOI: 10.1155/2013/702871 PMID: 24298553 PMCID: PMC3835814

18. H. Butzkueven, A. H. Evans, A. Pitman et al., "Onset seizures independently predict poor outcome after subarachnoid hemorrhage," Neurology, vol. 55, no. 9, pp. 1315-1320, 2000. DOI: 10.1212/WNL.55.9.1315 PMID: 11087774

19. Kwon SY, Obeidat AZ, Sekar P, Moomaw CJ, Osborne J, Testai FD, Koch S, Lowe MR, Demel S, Coleman ER, Flaherty M. Risk factors for seizures after intracerebral hemorrhage: Ethnic/Racial Variations of Intracerebral Hemorrhage (ERICH) Study. Clinical neurology and neurosurgery. 2020 May 1;192:105731. DOI: 10.1016/j.clineuro.2020.105731 PMID: 32062309 PMCID: PMC7183434

20. Rossi C, De Herdt V, Dequatre-Ponchelle N, Hénon H, Leys D, Cordonnier C. Incidence and predictors of late seizures in intracerebral hemorrhages. Stroke. 2013 Jun;44(6):1723-5.
DOI: 10.1161/STROKEAHA.111.000232
PMID: 23640832

21. Ma S, Fan X, Zhao X, Wang K, Wang H, Yang Y. Risk factors for early-onset seizures after stroke: A systematicreview and meta-analysis of 18 observational studies. Brain and Behavior. 2021 Jun;11(6):e02142.
DOI: 10.1002/brb3.2142
PMID: 33942550 PMCID: PMC8213649

22. Faghih-Jouybari M, Raof MT, Abdollahzade S, Jamshidi S, Padegane T, Ehteshami S, et al. Mortality and morbidity in patients with spontaneous intracerebral hemorrhage: A single-center experience. Curr J Neurol 2021; 20(1): 32-6.
DOI: 10.18502/cjn.v20i1.6377
PMID: 38011469 PMCID: PMC8511605

23. Leone M, Ciccacci F, Orlando S, Petrolati S, Guidotti G, Majid NA, Tolno VT, Sagno J, Thole D, Corsi FM, Bartolo M. Pandemics and burden of stroke and epilepsy in sub-Saharan Africa: Experience from a longstanding health programme. International Journal of Environmental Research and Public Health. 2021 Mar 9;18(5):2766.
DOI: 10.3390/ijerph18052766
PMID: 33803352 PMCID: PMC7967260

Orginal Article

Study on Comparison of Ultrasonographic Fetal Birth Weight With The Actual Birth Weight in Tertiary Care Hospital

Sona Pokhrel[1], Rupesh Sharma[1]

[1] Department of Radiodiagnosis, Lumbini Medical College, Kathmandu University, Palpa, Nepal

Article History
Received: 1November, 2025
Accepted: 5 December, 2025
Published: 31 January, 2026

Funding Sources: None

Conflict of Interest: None

Online Access

DOI: 10.61122/jkistmc364

Correspondence

Dr Sona Pokhrel
Assistant Professor, Department of Radiodiagnosis
Lumbini Medical College & Teaching Hospital, Palpa, Nepal.
E-mail: sonapokhrel@hotmail.com

Citation: Pokhrel S, Sharma R. Study On Comparison Of Ultrasonographic Fetal Birth Weight With The Actual Birth Weight in Tertiary Care Hospital. J. KIST Med. Col. 2026; 8(2)15:26-30.

Abstract

Introduction: Accurate estimation of fetal weight is important in the management of delivery.Ultrasonography is widely used for fetal weight estimation because of cost-effectiveness and well defined measurement procedure.Early methods to predict birth weight with an ultrasound will help the clinicians to make decisions on the route of delivery.

Method: This was a cross sectional study conducted at Lumbini Medical College and Teaching Hospital, Palpa in the Department of Radiodiagnosis for a duration of nine months from February 2024 to October 2024. The study was approved by the Institutional Review Committee of the institute (IRC-LMC-05/M-24). The study population included singleton pregnancy at term (at/after 37 weeks) meeting inclusion criteria. A total of 180 pregnant women participated in study.

Result: The mean actual birth weight (ABW) was 3070.57 gram ± 301.13.The estimated mean fetal birth weight (EFW) by ultrasound was 3346.62±204.29 grams using Hadlock 1 and 3308.89±204.69 grams using Hadlock 2. There was no significant difference between the mean fetal weight estimated by ultrasound scan using Hadlock formula and mean actual birth weight (p-value = <0.05). There was a positive correlation between ultrasound estimated fetal weight and actual birth weight ($r=0.34, p<0.05$ for Hadlock 1 and $r=0.36, p<0.05$ for Hadlock 2).

Conclusion: Ultrasound is reliable method for estimating fetal birth weight through Hadlock formula and it has strong correlations with actual birth weight, making it the preferred method for estimating fetal weight and planning delivery.

Keywords: Actual, Birth weight, Comparison, fetal, Ultrasound

Introduction

Fetal birth weight estimation is important in the management of delivery and predicting fetal survival. Ultrasonography is widely used for fetal weight estimation because of cost-effectiveness and well defined measurement procedure.[1] Antepartum weight estimation is also helpful in monitoring and detection of macrosomia and intrauterine growth restriction thus, fetal weight is an independent risk factor for determining perinatal mortality.[2,3] The accuracy for predicting fetal birth weight by different ultrasonic measurements, different formulas has been studied but no particular formula or biometric measurement has superior accuracy.[4] However,

Copyrights & Licensing © 2026 by author(s). This is an Open Access article distributed under Creative Commons Attribution License (CC BY NC)

the commonly used formulas are proposed by Hadlock and colleagues.[5,6] There are numerous formulas which uses multiple parameters in different combinations, only few of them are in clinical use. In this study, we utilized the most commonly used formula which is referred to as Hadlock(H1) 1 and Hadlock(H2) 2. Hadlock 1 formula incorporates HC, AC and FL parameters whereas Hadlock 2(H2) excludes HC for EFW calculation.[3]

So, the aim of this study is to compare the accuracy of ultrasonographic fetal birth weight with the actual birth weight using Hadlock1 and Hadlock.[2]

Methods

This was a cross sectional study conducted at Lumbini Medical College and Teaching Hospital, Palpa in the Department of Radiodiagnosis for a duration of nine months from February 2024 to October 2024. The study was approved by the Institutional Review Committee of the institute (IRC-LMC-05/M-24). The study population included singleton pregnancy at term (at/after 37 weeks) meeting inclusion criteria. Verbal consent was taken from the patients. A total of 180 pregnant women participated in study.

Procedure for the ultrasound fetal weight estimation: Bladder was emptied. Patient was asked to lie with knee joints slightly flexed. Ultrasound estimated fetal weight (EFW) was obtained for all women by the same radiologist with a 3.5 MHz transducer (MEDISON Ultrasonic machine) using standard Hadlock 1 and 2 formula that used biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC) and femur length (FL) for calculating fetal weight. BPD was obtained at midline with thalami, cavum septum pellucidum and third ventricle on a transverse image of skull. Calipers were placed outer to inner margin of the bone. Head circumference (HC) was taken at the same level of the outer perimeter of the skull. AC was obtained with transverse image of abdomen where fetal stomach, portal vein and umbilical vein were demonstrated. Calipers were placed on the skin. FL measurement was taken with femur as horizontal as possible and distance between outer borders of diaphysis of the femoral bone. Weight of fetus was measured using Hadlock 1 and Hadlock 2. The maternal age, date of delivery, gestational age at ultrasound were recorded. After delivery the weight of the fetus was measured using standard weighing machine. The accuracy of sonographic estimation of fetal weight was determined with the following: (1) mean (EFW − ABW/ABW), (2) mean of absolute error (absolute value of EFW − ABW/ABW) (3) mean percentage error ([EFW − ABW] × 100/ABW).

Inclusion criteria

- Normal and singleton pregnancy after 37 weeks

Exclusion criteria

- Preterm labour
- Multiple pregnancies
- Congenital anomalies
- Intrauterine fetal death
- Polyhydramnios and oligohydramnios
- Mothers with obstetric complications like severe pre-eclampsia, eclampsia, HELLP syndrome
- Existing new medical illnesses

Statistical analysis

Date was analyzed using statistical package for social science (SPSS) version 21.0 software. The results were expressed as frequencies and percentages. Mean with standard deviation were calculated. Accuracy of Hadlock 1 and Hadlock 2 were calculated. Differences between EFW derived from the formulas and the actual birth were illustrated by the mean with 95% confidence interval and the results were tested by t-test. Mean error, mean absolute error, mean percentage error were calculated for each formula. The Pearson correlation between the estimated fetal weight and the actual weight was also determined and plotted as a scatter plot.

Results

The mean maternal age was 25.67 years with ± 4.90. The minimum maternal age was 17 years and maximum were 39 years. The mean actual birth weight (ABW) was 3070.57 gram ± 301.13. Minimum weight was 2415 grams and maximum were 4000 grams. Table 1

The estimated mean fetal birth weight (EFW) by ultrasound was 3346.62±204.29 grams using Hadlock 1 and 3308.89±204.69 grams using Hadlock 2. There was no significant difference between the mean fetal weight estimated by ultrasound scan using Hadlock formula and mean actual birth weight (p-value = <0.05). The mean of EFW for each method and the mean of ABW were compared using the paired t-test. Table 2

There was a positive correlation between ultrasound estimated fetal weight and actual birth weight ($r=0.34, p<0.05$ for Hadlock 1 and $r=0.36, p<0.05$ for Hadlock 2). Table 3

The mean in the estimation of birth weight was 22.38 gram and 22.13 gram for Hadlock 1 and Hadlock 2. The mean absolute error in the estimation of birth weight was 276.04 g and 238.32g. The absolute mean percentage error was 8.99% and 7.76 %. Table 4

Table 1: Maternal and fetal variable

Parameter	Mean (standard deviation)	Range	
		Minimum	Maximum
Maternal age(year)	25.67(4.90)	17	39
Actual birth weight(gram)	3070.57(301.13)	2415	4000
Hadlock 1 weight(gram)	3346.62(204.29)	2956	4210
Hadlock 2 weight(gram)	3308.89(204.69)	2923	4171

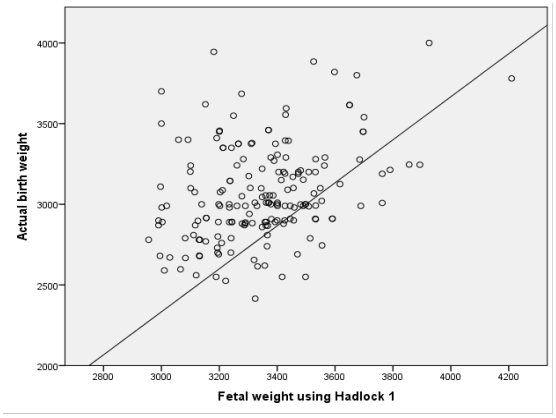
Table 2: Comparison of estimated actual birth weight with Ultrasound Hadlock 1 and Hadlock 2 methods

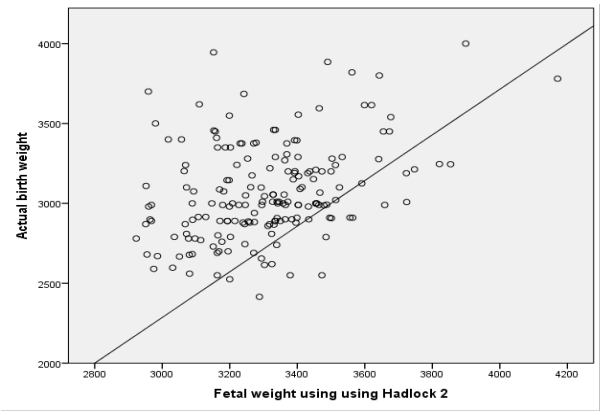
	Mean	Std. deviation	Std Error mean	95% CI of the difference		t	df	sig
				lower	upper			
Hadlock 1 weight with ABW (gr)	276.04	300.27	22.38	231.88	320.20	12.33	179	.00
Hadlock 2 with ABW (gr)	238.32	296.99	22.13	194.64	282.00	10.76	179	.00

*Paired Samples Test

Table 3: Correlation between ultrasound estimated fetal birth weight with actual birth weight.

Figure 1:





Graph showing the relation between ultrasound estimated fetal weight (EFW) using Hadlock 1 and Hadlock 2 with actual birth weight (ABW) (in grams) and a linear association between variables.

Table 4: Accuracy of method

Parameter	Mean	Absolute mean error(gr)	Absolute mean percentage error (%)
Hadlock 1	22.38	276.04	8.99
Hadlock 2	22.13	238.32	7.76

Discussion

Accurate estimation of fetal weight is important in the management of delivery. A lot of work has been done to find out accurate methods of estimation of fetal weight in utero including clinical and ultrasound estimations. Before the availability of ultrasound, conventional methods such as measurement of the maternal abdominal circumference and uterine height were used to estimate fetal weights. though the traditional methods are easy to use, several maternal factors may affect assessment abilities.[7]

Early methods to predict birth weight with an ultrasound will help the clinicians to make decisions on the route of delivery. Estimation of fetal weight is done ultrasonographically using Hadlock and other formulae.[5] Ultrasound estimation of fetal weight, while being accurate to a certain degree, is associated with error ranging from ± 6 to 11% depending on parameters measured and the equation used for estimation. Determination of weight within 10% of actual birth weight is considered acceptable accuracy.[8]

The mean actual birth weight in this study was 3070.57 grams ± 301.13. This was similar to the mean actual birth weight of 3070 grams reported by Bajracharya et al.9 and slightly higher than the study done by Prasad VN et al (2822.5 grams).[10] The reason may be due to socioeconomic factors and proper diet during pregnancy.

The mean of ultrasonic weight estimation was 3346.62 ± 204.29 grams for Hadlock 1 and 3308.89 ± 204.69 for Hadlock 2 and with mean difference between EFW and the actual birth weight was 276.05 grams and 238.32 grams respectively. When the result was compared with actual

birth weight, it was found that actual birth weight was not significantly different. Similar findings have been observed by other studies.[11,12]

In our study, the mean is 22.38, absolute mean error 276.04, absolute mean percent error (APE) is 8.99% for Hadlock 1 and 22.13, 238.32 and 7.76 Hadlock 2 respectively.[13] In a study done by Mattsson N et al,with Hadlock formula, mean absolute percent error was 6.2% and SD of error was 7.6% of mean birth weight.[14] In various study, the mean absolute percent error has ranged between 6 and 15%[15] and about three-quarters of estimations were within 10% of birth weight.[16,17,18] So, ultrasound should be used to estimate the fetal weight for the purposes of planning delivery and monitoring of the fetus.

Conclusion

Ultrasound is reliable method for estimating fetal birth weight through Hadlock formula and it has strong correlations with actual birth weight, making it the preferred method for estimating fetal weight and planning delivery.

References

1. Kiserud T, Piaggio G, Carroli G, et al. The World Health Organization Fetal Growth Charts: A Multinational Longitudinal Study of Ultrasound Biometric Measurements and Estimated Fetal Weight. PLoS Med. 2017;14(1):e1002220. Published 2017 Jan 24. DOI: 10.1371/journal.pmed.1002220 PMID: 28118360 PMCID: PMC5261648

2. Milner J, Arezina J. The accuracy of ultrasound estimation of fetal weight in comparison to birth weight: A systematic review. Ultrasound. 2018;26(1):32-41. DOI: 10.1177/1742271X17732807 PMID: 29456580 PMCID: PMC5810856,

3. Simms-Stewart D, Hunter T, Fletcher H, DaCosta V, Walters C, Reids M. Comparison of ultrasonographic estimated fetal weight and actual birthweight performed by residents in training at the university hospital of the west indies. West Indian Med J. 2013;62(9):829-832. DOI: 10.7727/wimj.2012.265 PMID: 25117389

4. Preyer O, Husslein H, Concin N, et al. Fetal weight estimation at term - ultrasound versus clinical examination with Leopold's manoeuvres: a prospective blinded observational study. BMC Pregnancy Childbirth. 2019;19(1):122. Published 2019 Apr 11. DOI: 10.1186/s12884-019-2251-5 PMID: 30971199 PMCID: PMC6458793

5. Hadlock FP, Harrist RB, Sharman RS, Deter RL, Park SK. Estimation of fetal weight with the use of head, body, and femur measurements--a prospective study. Am J Obstet Gynecol. 1985;151(3):333-337. DOI: 10.1016/0002-9378(85)90298-4 PMID: 3881966

6. Dakwar Shaheen J, Hershkovitz R, Mastrolia SA, et al. Estimation of fetal weight using Hadlock's formulas: Is head circumference an essential parameter?. Eur J Obstet Gynecol Reprod Biol. 2019;243:87-92. DOI: 10.1016/j.ejogrb.2019.09.024 PMID: 31678760

7. Ugwu EO, Udealor PC, Dim CC, et al. Accuracy of clinical and ultrasound estimation of fetal weight in predicting actual birth weight in Enugu, Southeastern Nigeria. Niger J Clin Pract. 2014;17(3):270-275. DOI: 10.4103/1119-3077.130208 PMID: 24714001

8. Njoku C, Emechebe C, Odusolu P, Abeshi S, Chukwu C, Ekabua J. Determination of Accuracy of Fetal Weight Using Ultrasound and Clinical Fetal Weight Estimations in Calabar South, South Nigeria. Int Sch Res Notices. 2014;2014:970973. Published 2014 Nov 10. DOI: 10.1155/2014/970973 PMID: 27382626 PMCID: PMC4897128

9. Bajracharya J, Shrestha NS, Karki C. Accuracy of prediction of birth weight by fetal ultrasound. Kathmandu Univ Med J (KUMJ). 2012;10(38):74-76.PMID: 23132481 DOI: 10.3126/kumj.v10i2.7349,

10. Predanic M, Cho A, Ingrid F, Pellettieri J. Ultrasonographic estimation of fetal weight: acquiring accuracy in residency.J Ultrasound Med. 2002;21(5):495-500. DOI: 10.7863/jum.2002.21.5.495 PMID: 12008811

11. Milner J, Arezina J. The accuracy of ultrasound estimation of fetal weight in comparison to birth weight: A systematic review. Ultrasound. 2018;26(1):32-41. DOI: 10.1177/1742271X17732807 PMID: 29456580 PMCID: PMC5810856

12. Dudley NJ. A systematic review of the ultrasound estimation of fetal weight. Ultrasound Obstet Gynecol. 2005;25(1):80-89. DOI: 10.1002/uog.1751 PMID: 15505877

13. Kurmanavicius J, Burkhardt T, Wisser J, Huch R. Ultrasonographic fetal weight estimation: accuracy of formulas and accuracy of examiners by birth weight from 500 to 5000 g. J Perinat Med. 2004;32(2):155-161. DOI: 10.1515/JPM.2004.028 PMID: 15085892

14. Mattsson N, Rosendahl H, Luukkaala T. Good accuracy of ultrasound estimations of fetal weight performed by midwives. Acta Obstet Gynecol Scand. 2007;86(6):688-692. DOI: 10.1080/00016340701322119 PMID: 17520400

15. Dudley NJ. A systematic review of the ultrasound estimation of fetal weight. Ultrasound Obstet Gynecol. 2005;25(1):80-89.
DOI: 10.1002/uog.1751
PMID: 15505877

16. Noumi G, Collado-Khoury F, Bombard A, Julliard K, Weiner Z. Clinical and sonographic estimation of fetal weight performed during labor by residents. Am J Obstet Gynecol. 2005;192:1407 -9.
DOI: 10.1016/j.ajog.2004.12.043
PMID: 15902122

17. Colman A, Maharaj D, Hutton J, Tuohy J. Reliability of ultrasound estimation of fetal weight in term singleton pregnancies. N Z Med J. 2006;119(1241):U2146. Published 2006 Sep 8.

18. Ben-Haroush A, Yogev Y, Bar J, et al. Accuracy of sonographically estimated fetal weight in 840 women with different pregnancy complications prior to induction of labor. Ultrasound Obstet Gynecol. 2004;23(2):172-176.
DOI: 10.1002/uog.940
PMID: 14770399

Orginal Article

Clinical outcome of Low dose intravesical BCG therapy for Non muscle invasive bladder cancer (NMIBC)

Rajan Koju[1], Vijay Sharma[2], Arun Shah[1]

[1] Department of Urology, Dhulikhel Hospital, Kathmandu University Hospital, Dhulikhel, Nepal
[2] Department of public health, KUSMS, Banepa, Nepal

Article History
Received: 6 December, 2025
Accepted: 10 January, 2026
Published: 31 January, 2026

Funding Sources: None

Conflict of Interest: None

Online Access

DOI: 10.61122/jkistmc368

Correspondence

Dr Rajan Koju
Assitant Professor,
Department of Urology,
Dhulikhel Hospital,
Kathmandu University Hospital
Dhulikhel, Nepal
E-mail: kojurajan@gmail.com

Citation: Koju R, Sharma V, Shah A. Clinical outcome of Low dose intravesical BCG therapy for Non muscle invasive bladder cancer (NMIBC). J. KIST Med. Col. 2026; 8(2)15:31-34.

Abstract

Introduction: Intravesical Bacillus Calmette-Guerin (BCG) is one of the most effective therapy for Non Muscle invasive bladder cancer (NMIBC), however, due to adverse effects many patients failed to continue treatment. Main objective of this study is to find out efficacy of low dose intravesical BCG in reducing adverse effect without compromising recurrence of tumor.

Methods: This is Cross sectional prospective study which include 39 patients who underwent trans-urethral resection of bladder tumor (TURBT) for bladder mass and histopathology (HPE) report is NMIBC receiving induction or maintenance intravesical BCG from 15th July 2025 to 30th November 2025 at Dhulikhel Hospital, Kathmandu university hospital.

Results: Mean age is 62.38 ± 10.74 years, 28 Male (71.79%) and 11(28.21%) Female patient. Majority of patients (82.05%) received 60mg intravesical BCG. Adverse effect was noted in 12.82% all are genitourinary symptoms. Recurrence is noted in 12.82% of patients.

Conclusion: Low dose of intravesical BCG for NMIBC is as effective as standard dose with similar recurrence rate and decreased adverse effects.

Keyword: Bacillus Calmette-Guerin (BCG), Non Muscle invasive bladder cancer (NMIBC), trans-urethral resection of bladder tumor (TURBT)

Introduction

Intravesical Bacillus Calmette-Guerin (BCG) is one of the most effective therapy for Non Muscle invasive bladder cancer (NMIBC).[1] NMIBC has high recurrence and around 10-20% progress to muscle invasive bladder cancer (MIBC).[2,3] BCG has shown both decrease in recurrence and progression in NMIBC.[4] Clear mechanism of BCG is poorly understood however it is definitely immune response mediated.[5] BCG therapy is usually affected by local and systemic adverse effects which are basically infective and irritative symptoms like cystitis, frequency, sepsis and hematuria which usually occur during induction and initial maintenance phase.[6,7] this symptoms accounts more than 60% leading to discontinue of treatment.[8] Several trial has been done to manage these adverse effect by using antibiotics, intravesical local anesthesia like lidocaine and anticholinergic drugs to decrease irritation.[9] Decreasing standard BCG dose can improve outcome by reducing BCG toxicity.[10,11]

Copyrights & Licensing © 2026 by author(s). This is an Open Access article distributed under Creative Commons Attribution License (CC BY NC)

Methods

This is Cross sectional prospective study among patients who underwent trans-urethral resection of bladder tumor (TURBT) and histopathology (HPE) report is NMIBC who were receiving induction or maintenance intravesical BCG from 15th July 2025 to 30th November 2025 at Dhulikhel Hospital, Kathmandu university hospital. Ethical clearance was obtained from Institutional review committee of Kathmandu university school of medicine (KUSMS) with reference number 178/25.

All the patient undergoing TURBT with HPE report of NMIBC above 18 years of age during study period were included in this study. Inclusion criteria were patient diagnosed urinary bladder mass without nodal and distant metastasis by CT abdomen and pelvis, age above 18 years and HPE report after TURBT is NMIBC.

American Urological Association (AUA) risk stratification was followed, low risk patients were not given intravesical BCG therapy.[12] Only intermediate and high risk patients were given BCG induction and maintenance therapy.

Low Risk	Intermediate Risk	High Risk
LG[a] solitary Ta ≤ 3cm	Recurrence within 1 year, LG Ta	HG T1
PUNLMP[b]	Solitary LG Ta > 3cm	Any recurrent, HG Ta
	LG Ta, multifocal	HG Ta, >3cm (or multifocal)
	HG[c] Ta, ≤ 3cm	Any CIS[d]
	LG T1	Any BCG failure in HG patient
		Any variant histology
		Any LVI[e]
		Any HG prostatic urethral involvement

[a]LG = low grade; [b]PUNLMP = papillary urothelial neoplasm of low malignant potential; [c]HG = high grade; [d]CIS=carcinoma *in situ*; [e]LVI = lymphovascular invasion

Southwest oncology group (SWOG) guideline was followed for induction and maintenance of intravesical BCG therapy. Onco BCG each vial containing 40mg was used. Each vial diluted with 40ml normal saline. BCG was installed via 60ml syringe through 14Fr or 16 Fr foley's catheter. After installation foley's catheter was clamped. Holding time less than 60 minutes was drop out from the study.

Patient were followed up after 2 weeks, then as per SWOG guideline for maintenance BCG and check cystoscopy.

The data were entered in Microsoft excel 2013 and then exported to IBM SPSS version 20 for statistical analysis. Categorical variables were expressed as frequency and percentages. Continuous variables were expressed as mean with standard deviation or median with inter quartile range. We measured only descriptive outcome.

Results

There was total 39 cases with 11 females (28.21%) and 28(71.79%) males. The age ranged from 35 years to 84 years with mean age 62.38 ± 10.74 years.

Mean BMI was 23.35±2.04 kg/m2.

Most of the patients received 60mg intravesical BCG 82.05%, 17.95% received 40mg intravesical BCG.

Adverse effect was noted in 12.82% of patients, out of which frequency was noted in 1(2.56%), burning micturition in 2(5.13%) and UTI in 2(5.13%) patient. All those patients were managed in OPD basis.

Check cystoscopy was done as per SWOG guideline, recurrence was noted only in 5(12.82%) patient who underwent Re-TURBT. Inflamed urothelium was noted in 2(5.13%) patients.

Table 1: Demographic and clinical characteristics

Variables	Total (n=39)
Mean age (years)	62.38± 10.74
Gender Male Female	28 (71.79%) 11 (28.21%)
BMI	23.35±2.04
BCG dose 60mg 40mg	 32(82.05%) 7(17.95%)
Side effects Burning Micturition Frequency UTI	5(12.82%) 2(5.13%) 1(2.56%) 2(5.13%)
Check cystoscopy findings Inflamed urothelium Recurrence normal	 2(5.13%) 5(12.82%) 32(82.05%)
HPE CIS Ta T1	 1(2.56%) 15(38.46%) 23(58.98%)
Tumor Grade Low Grade (LG) High Grade (HG)	 12 (30.77%) 27 (69.23%)

Histopathological findings were: CIS 1(2.56%), Ta 15(38.46%) and T1 23(58.98%).

Most of the tumor were of HG (69.23%).

Discussion

Intravesical BCG therapy is the mainstay of treatment to decrease recurrence and progression of NMIBC. However, due to adverse effects of BCG therapy many patients have to abandoned from this treatment. Many trials have been

conducted to decrease this adverse effect like antibiotic prophylaxis, concurrent use of interferon and dose reduction of BCG.[13,14,15] Decreasing BCG dose has shown improve outcome by reducing BCG toxicity.[10,11]

Though intravesical BCG is mainstay of treatment for NMIBC in intermediate and high risk patient, it carries adverse effect which has be life threatening also.[16] The rate of adverse effect is reported to be less than 5% as per EAU 2024 guidelines and intravesical BCG decrease recurrence and progression in high and intermediate risk patients.[17]

In a study conducted by Larsen et al., only 1% BCG related side effect was noted of which 78.4% was genitourinary symptoms which was much lower than in our study which has shown 12.82% adverse effect but in our study also most of them were genitourinary symptoms.[18] In a study conducted by Vijjan et al, 28.6% and 54% adverse effect noted in 40mg and 80mg group respectively with 5 patients having grade 3 toxicities requiring inpatient management which was unlike our study where all adverse effect were grade 1 and 2 as per NCCN CTC guideline which were managed as outpatient basis.[19]

In a study conducted by Grajales et al., 5.2% of patients dropped out from treatment due to BCG toxicity, however in our study no patient dropped out from treatment except 2 patients with UTI were deferred from treatment until UTI was treated and intravesical therapy was resumed after that.[20]

In our study recurrence rate was 12.82% which correlates with study by Luitel et al. 13% recurrence in low dose intermediate risk group and Vijjan et al. Showing 13.5% recurrence in 80mg group.[19,21]

Immediate post TUR intravesical mitomycin was given in our all cases of TURBT unless contraindicated. In a study conducted by Mian et al., immediate post TUR mitomycin C intravesical vs delayed mitomycin C immediate group has shown to decrease recurrence rate 27% vs 36%.[22]

Study Limitations

This was short duration study. Longer duration of treatment course and follow up would reflect exact recurrence and adverse effect. Sample size of this study is very small and this is single centre study.

Conclusion

Low dose intravesical BCG for NMIBC is as effective as standard dose with similar recurrence rate and decreased adverse effects.

References

1. Choi SY, Ha MS, Kim JH, Chi BH, Kim JW, Chang IH, Kim TH, Myung SC. Low-dose versus standard-dose bacille Calmette-Guérin for non-muscle-invasive bladder cancer: Systematic review and meta-analysis of randomized controlled trials. Investigative and clinical urology. 2022 Feb 9;63(2):140. DOI: 10.4111/icu.20210340 PMID: 35244987 PMCID: PMC8902423

2. Sylvester RJ, van der Meijden AP, Oosterlinck W, Witjes JA, Bouffioux C, Denis L, et al. Predicting recurrence and progression in individual patients with stage Ta T1 bladder cancer using EORTC risk tables: a combined analysis of 2596 patients, from seven EORTC trials. Eur Urol 2006;49:466-5; discussion 475-7. DOI: 10.1016/j.eururo.2005.12.031 PMID: 16442208 PMCID: PMC10140368,

3. Fernandez-Gomez J, Madero R, Solsona E, Unda M, Martinez Piñeiro L, Gonzalez M, et al. Predicting nonmuscle invasive bladder cancer recurrence and progression in patients treated with bacillus Calmette-Guerin: the CUETO scoring model. J Urol 2009;182:2195-203. DOI: 10.1016/j.juro.2009.07.016 PMID: 19758621

4. Vijjan V, Mandhani A, Kapoor R, Dubey D, Srivastava A, Ansari MS, Singh P, Kumar A. A randomized trial comparing low dose (40 or 80 mg) with standard dose (120 mg) of bacillus Calmette-Guerin for superficial bladder cancer. Indian Journal of Urology. 2006 Oct 1;22(4):317-21. DOI: 10.4103/0970-1591.29117

5. Pettenati C, Ingersoll MA. Mechanisms of BCG immunotherapy and its outlook for bladder cancer. Nat Rev Urol 2018;15:615-25. DOI: 10.1038/s41585-018-0055-4 PMID: 29991725

6. Saint F, Irani J, Patard JJ, Salomon L, Hoznek A, Zammattio S, et al. Tolerability of bacillus Calmette-Guerin maintenance therapy for superficial bladder cancer. Urology 2001;57:883-8. DOI: 10.1016/S0090-4295(00)01117-1 PMID: 11337287

7. van der Meijden AP, Sylvester RJ, Oosterlinck W, Hoeltl W, Bono, AV, et al. Maintenance bacillus Calmette-Guerin for Ta T1 bladder tumors is not associated with increased toxicity: Results of a European Organization for Research and Treatment of, Cancer Genito-Urinary group Phase III trial. Eur Urol 2003;44:429-34 DOI: 10.1016/S0302-2838(03)00357-9 PMID: 14499676

8. Brausi M, Oddens J, Sylvester R, Bono A, van de Beek C, van Andel G, et al. Side effects of bacillus Calmette-Guérin (BCG) in the treatment of intermediate- and high-risk Ta, T1 papillary carcinoma of the bladder: results of the EORTC genitourinary cancers group randomised phase 3 study comparing one-third dose with full dose and 1 year with 3 years of maintenance BCG. Eur Urol 2014;65:69-76. DOI: 10.1016/j.eururo.2013.07.021 PMID: 23910233 PMCID: PMC10140368,

9. Koch GE, Smelser WW, Chang SS. Side effects of intravesical, BCG and chemotherapy for bladder cancer: what they are and, how to manage them. Urology 2021;149:11-20. DOI: 10.1016/j.urology.2020.10.039 PMID: 33181123

10. Martinez-Pineiro JA, Flores N, Isorna S, Solsona E, Sebastian JL,Pertusa C, et al. Long-term follow-up of a randomized prospective trial comparing a standard 81 mg dose of intravesical bacille Calmette-Guerin with a reduced dose of 27 mg in superficial bladder cancer. BJU Int 2002;89:671-80. DOI: 10.1046/j.1464-410X.2002.02722.x PMID: 11966623

11. Morales A, Nickel JC, Wilson JW. Dose response of bacillus CalmetteGuerin in the treatment of superficial bladder cancer. J Urol 1992;147:1256-8. DOI: 10.1016/S0022-5347(17)37532-8 PMID: 1569662

12. Holzbeierlein J, Bixler BR, Buckley DI, et al. Diagnosis and treatment of non-muscle invasive bladder cancer: AUA/SUO guideline: 2024 amendment. J Urol. 2024;10.1097/JU.0000000000003846. DOI: 10.1097/JU.0000000000003846 PMID: 38265030

13. Oddens J, Brausi M, Sylvester R, et al. Final results of an EORTC-GU cancers group randomized study of maintenance bacillus Calmette-Guerin in intermediate- and high-risk Ta, T1 papillary carcinoma of the urinary bladder: one-third dose versus full dose and 1 year versus 3 years of maintenance. Eur Urol 2013; 63:462-472.14.

14. Hemdan T, Johansson R, Jahnson S, et al. 5-Year outcome of a randomized prospective study comparing bacillus Calmette-Guerin with epirubicin and interferon-alpha2b in patients with T1 bladder cancer. J Urol 2014; 191:1244-1249

15. Vegt PD, van der Meijden AP, Sylvester R, et al. Does isoniazid reduce side effects of intravesical bacillus Calmette-Guerin therapy in superficial bladder cancer? Interim results of European Organization for Research and Treatment of Cancer Protocol 30911. J Urol 1997; 157:1246-1249. DOI: 10.1016/S0022-5347(01)64936-X PMID: 9120912

16. Lamm DL, Blumenstein BA, Crissman JD, Montie JE, Gottesman JE, Lowe BA, Maintenance bacillus calmette-guerin immunotherapy for recurrent TA, T1 and carcinoma in situ transitional cell carcinoma of the bladder: a randomized southwest oncology group study, et al. J Urol. 2000;163(4):1124-9. DOI: 10.1016/S0022-5347(05)67707-5

17. Lobo N, Hensley PJ, Bree KK, Nogueras-Gonzalez GM, Navai N, Dinney CP, et al. Updated European association of urology (EAU) prognostic factor risk groups overestimate the risk of progression in patients with Non-muscle-invasive bladder Cancer treated with Bacillus Calmette-Guérin. Eur Urol Oncol. 2022;5(1):84-91. DOI: 10.1016/j.euo.2021.11.006 PMID: 34920986 PMCID: PMC11902298

18. Larsen ES, Nordholm AC, Lillebaek T, Holden IK, Johansen IS. The epidemiology of Bacille Calmette-Guérin infections after bladder instillation from 2002 through 2017: a nationwide retrospective cohort study. BJU Int. 2019;124(6):910-6. DOI: 10.1111/bju.14793 PMID: 31054198

19. Vijjan V, Mandhani A, Kapoor R, Dubey D, Srivastava A, Ansari MS, Singh P, Kumar A. A randomized trial comparing low dose (40 or 80 mg) with standard dose (120 mg) of bacillus Calmette-Guerin for superficial bladder cancer. Indian Journal of Urology. 2006 Oct 1;22(4):317-21. DOI: 10.4103/0970-1591.29117

20. Grajales V, Contieri R, Tan WS, Flores M, Schultz M, Pinochet R, Bustamante A, Kamat AM, Fernández MI. Comparative Analysis of Very Reduced vs Full Dose BCG Treatment for High-Risk Non-Muscle Invasive Bladder Cancer: A Contemporary Experience from Chile. Bladder Cancer. 2023 Dec 13;9(4):327-34. DOI: 10.3233/BLC-230047 PMID: 38994240 PMCID: PMC11165921

21. Luitel BR, Chalise PR, Nathani S, Gupta DK, Subedi P, Chapagain S, Sharma UK, Gyawali PR, Shrestha GK, Joshi BR. Risk-based management of non-muscle invasive bladder cancer: experience from Tribhuvan University teaching hospital. Kathmandu Univ Med J. 2016 Oct 1;56(4):352-6.

22. Mian BM. Immediate post-TURBT mitomycin instillation reduces recurrence risk: Benefit observed even in patients receiving adjuvant instillations, data indicate. Urology Times. 2017 Nov 1;45(12).,

Orginal Article

Photographic Study of Different Smile Parameters in the Newar Population Pursuing Orthodontic Treatment

Rosha Shrestha[1], Gaurav Acharya[1], Suvit Maskey[2], Bishal Karki[1]

[1] Department of Orthodontics and Dentofacial Orthopedics, KIST Medical College Teaching Hospital, Imadol, Nepal
[2] Department of Orthodontics and Dentofacial Orthopedics, Institute of Medicine, TUTH, Kathmandu, Nepal

Article History
Received: 28 December 2025
Accepted: 15 January, 2026
Published: 31 January, 2026

Funding Sources: None

Conflict of Interest: None

Online Access

DOI: 10.61122/jkistmc366

Correspondence

Dr Rosha Shrestha
Associate professor,
Head of Department of Orthodontics,
Dental coordinator
KIST Medical College & Teaching Hospital Imadol - Lalitpur
Email:ro.sha.shrestha@hotmail.com

Citation: Shrestha R, Acharya G, Maskey S, Karki B. Photographic Study of Different Smile Parameters in the Newar Population Pursuing Orthodontic Treatment. J. KIST Med. Col. 2026; 8(2)15:35-39.

Abstract

Introduction: A smile is a facial expression that typically expresses joy, friendship and appreciation. Various parameters of smile play important role in esthetics of the patient. The study of smile parameters play crucial role and can be helpful in orthodontic diagnosis and treatment planning.

Methods: Frontal view photographs were assessed with a posed smile. This is the descriptive study of various smile parameters. The smile arc, upper lip curvature, smile line and the amount of teeth visible while smiling were studied.

Results: Average smile line (47.1%), consonant smile arc (43.8%), straight lip curvature (48.8%), and teeth displayed up to 2nd premolars (34.7%) while smiling were found.

Conclusion: It is concluded that the majority of the study participants had an average smile line, a consonant smile arc, a straight upper lip curve, and teeth that were visible up to their 2nd premolars while smiling.

Keywords: Esthetic, Newar, Orthodontic treatment, Smile, Study

Introduction

A smile is a facial expression that usually expresses gratitude, joy, and friendliness. Smile analysis is essential during the diagnosis and therapy planning stages. A person's natural smile is made up of several factors. These include the smile line, smile arc, upper lip curvature and teeth that are visible when smiling. Each plays a unique part in a beautiful smile and should be taken into account.[1]

The majority of orthodontic patients want to improve their smiles. So smile analysis becomes an essential part of orthodontic diagnosis and treatment planning for a patient. Due to subjective variability in perception, the patient's expectations must be taken into consideration.[2] Following the "new esthetic paradigm," orthodontists have better studied the smile arc as an esthetic criterion. For professionals looking for more attractive and youthful natural esthetic results, its diagnostic examination and incorporation into the goals of orthodontic planning have become essential.[3]

One of the main problems in today's society is aesthetic smile. The number of orthodontic patients in orthodontic clinics is rising as a result of growing public awareness and the accessibility of orthodontic specialty services.[4] Analysis of different smile characteristics can be of immense help to orthodontists and they can plan their treatment further. Many ethnic groups

Copyrights & Licensing © 2026 by author(s). This is an Open Access article distributed under Creative Commons Attribution License (CC BY NC)

live in the Kathmandu Valley. Among them, Newar are the largest and most indigenous. The characteristic long and thin facial features of Newars make them clearly identifiable from other ethnic groups.[5] This study was designed to study different smile characteristics in Newar patients of Lalitpur in Nepal which can be helpful in planning better orthodontic treatment for this population.

Methods

This study was carried out in Department of Orthodontics and Dentofacial Orthopedics, KIST MCTH, Lalitpur in Nepal. The study was carried out after ethical clearance was obtained from IRC (08182-2704025-38) of KIST Medical College and Teaching Hospital. This was a retrospective study of various smile parameters in Newari patients seeking orthodontic treatment. Photographs were taken of Newari patients from February 2023-February 2025.

Inclusion Criteria:

- Participants had fully erupted permanent teeth.
- Proper smiling photographs
- 18 years and above.

Exclusion Criteria:

- History of previous orthodontic treatment and mandibular surgeries.
- Facial asymmetry, trauma and syndromes.
- Short lip.
- Congenital deformities, hypodontia.

The primary outcome measure of the study is to study different smile characteristics in Newar population in Nepal.

• In a study by Ramaswamy et. al.[6],2021 Standard Deviation of females in the study was 0.898 with probability of significance of 95% and power of 80%, Standard error is;

$$SE = \frac{S.D.}{\sqrt{n}} = \frac{0.898}{\sqrt{120}} = 0.082$$

where SE= standard error, n= number of samples

$Z\alpha = 1.96$

SD= 0.898

$$n = \frac{(Z\alpha \times SD)^2}{(E)^2}$$

$$= \frac{(1.96 \times 0.898)^2}{(0.16)^2}$$

$$= 121.0055$$

Total sample size is 121

A total of 121 smiling photographs were assessed. Photographs were reviewed and only those fulfilling the inclusion criteria were included in the study. Smiling photographs were assessed for smile arc types, different smile lines, types of upper lip curvature and teeth displayed while smiling.

Statistical Analysis:

The data were entered into Microsoft Excel and then imported into the Statistical Package for Social Sciences version 16 (SPSS) for statistical analysis. For analysis, photographs were coded. Data was collected and studied.

Statistical tests: Distribution frequency was calculated for all measurements.

The following were measured.

Smile arc was assessed. It is the relationship between the upper border of the lower lip and the curvature of the maxillary anterior teeth. The patient's consonant, flat, or reverse arc will be examined.

Consonant smile arc

Smile line was assessed. It is the height of the upper lip in respect to the maxillary incisors or the degree of vertical tooth display when smiling. It can be high, average and low.

Low smile line

Upper lip curvature was also assessed. The relationship between the corners of the mouth and the midway of the inferior border of the upper lip was assessed by drawing a straight line through it. It can be upward curvature, downward and straight upper lip curvature.

Downward upper lip curvature

And also teeth displayed while smiling was also assessed. Teeth displayed while smiling can be upto canines, 1st premolars, 2nd premolars and 1st molars while smiling.

Teeth displayed upto 2nd premolars

Results

In assessment of smile arc,

Table 1: showed consonant smile arc was seen in most patients (43.8%) whereas reverse smile arc was seen in lower Newari population which is 16.5%

Smile Arc	Frequency	%
Consonant	53	43.8
Flat	48	39.7
Reverse	20	16.5
Total	121	100.0

Table 2: showed average smile line was found in larger sample which was 47.1% whereas high smile line was found in least which is 16.5%

Smile line	Frequency	%
Average	57	47.1
High	20	16.5
Low	44	36.4
Total	121	100.0

Table 3: Upward lip curvature seemed to be more than other two types which is 48.8% and upward and downward lip curvatures were seen 24% and 27.3% respectively

Upper lip curvature	Frequency	%
Downward	33	27.3
Straight	59	48.8
Upward	29	24.0
Total	121	100.0

Table 4: showed while smiling the teeth displayed were more upto 2nd premolars (34.7%) followed by upto 1st premolars (30.6%) and least teeth displayed were upto canines and 1st molars (17.4%).

Teeth displayed while Smiling	Frequency	%
upto 1st molars	21	17.4
upto 1st premolars	37	30.6
upto 2nd premolars	42	34.7
upto canines	21	17.4
Total	121	100.0

Table 5: illustrates the statistically significant difference in smile arc types when compared to the various sex groups. Other smile parameters did not show any statistically significant difference

Variable	Categories	Female (n=72)	Male (n=49)	Total (n=121)	p-value
Smile Arc	Consonant	40 (55.6%)	13 (26.5%)	53 (43.8%)	0.005
	Flat	21 (29.2%)	27 (55.1%)	48 (39.7%)	
	Reverse	11 (15.3%)	9 (18.4%)	20 (16.5%)	
Smile Line	Average	33 (45.8%)	24 (49.0%)	57 (47.1%)	0.939
	High	12 (16.7%)	8 (16.3%)	20 (16.5%)	
	Low	27 (37.5%)	17 (34.7%)	44 (36.4%)	
Upper Lip Curvature	Downward	16 (22.2%)	17 (34.7%)	33 (27.3%)	0.083
	Straight	34 (47.2%)	25 (51.0%)	59 (48.8%)	
	Upward	22 (30.6%)	7 (14.3%)	29 (24.0%)	
Teeth Displayed while Smiling	Upto 1st molars	14 (19.4%)	7 (14.3%)	21 (17.4%)	0.685
	Upto 1st premolars	23 (31.9%)	14 (28.6%)	37 (30.6%)	
	Upto 2nd premolars	22 (30.6%)	20 (40.8%)	42 (34.7%)	
	Up to canines	13 (18.1%)	8 (16.3%)	21 (17.4%)	

Table 6: When comparing the age groups using all of the smile parameters, there was no statistically significant difference which is shown in table below

Variable	Categories	Less than 20 (n=56)	More than 20 (n=65)	Total (n=121)	p-value
Smile Arc	Consonant	24 (42.8%)	29 (44.6%)	53 (43.8%)	0.739
	Flat	24 (42.8%)	24(36.9%)	48 (39.7%)	
	Reverse	8 (14.4%)	12 (18.5%)	20 (16.5%)	
Smile Line	Average	26 (46.4%)	31 (47.7%)	57 (47.1%)	0.362
	High	12 (21.4%)	8 (12.3%)	20 (16.5%)	
	Low	18 (32.2%)	26 (40 %)	44 (36.4%)	
Upper Lip Curvature	Downward	15 (26.8%)	18 (27.7%)	33 (27.3%)	0.524
	Straight	25 (44.6%)	34 (52.3%)	59 (48.8%)	
	Upward	16 (28.6%)	13 (20%)	29 (24.0%)	
Teeth Displayed while Smiling	Upto 1st molars	8 (14.3%)	13 (20 %)	21 (17.4%)	0.569
	Upto 1st premolars	16 (28.5%)	21(32.3%)	37 (30.6%)	
	Upto 2nd premolars	23 (41.1%)	19 (29.2%)	42 (34.7%)	
	Upto canines	9 (16.1%)	12 (18.5%)	21 (17.4%)	

DISCUSSION

In modern society, an esthetic smile is valued in both social and professional contexts and plays a significant part in facial expression and look. Individuals' perceptions of aesthetics differ and are influenced by society and individual experiences.[2]

The current study evaluated common features of a posed smile in a sample of Newari people from Nepal. The smiling photographs were used in this study due to its ease of reproducibility. The aim of our study was to examine the various aspects of smiles in the Newari population. In this study we assessed 121 smiling photographs of the Newari patients undergoing orthodontic treatment. Out of 121, 49 (40.5%) were male and 72(59.5%) were female. Different smile parameters like smile arc, upper lip curvature, smile line and teeth displayed while smiling were assessed.

According to a 2020 study by Khan et al., average smile lines (43.3%) and consonant smile arcs (45.2%) are more common than other forms which was similar to our study.1 Females had more consonant smile arcs than males, according to a 2006 study by Krishnan et al.[7] In our study, it was found that 55.6% females had consonant smile arc compared to 26.5% males. In agreement to our study, upper lip curvature was straight (39.9%) which was seen more than upward(26.1%) and downward (34%), in the study by Liang et.al. in 2013.[8] These similarities may be due to the similar facial forms and structures as these studies were done in south asia region.

In contrast to our study, Melo et.al. in 2020 the curvature of upper lip was more upwards (47.1%) than straight curvature (41.4%).[9] The most prevalent characteristic among his research participants, which was comparable to ours, was an upward lip curvature, in a study by Hulsey[10]. In contrast to our study, a greater number of participants had straight lip curvatures, followed by downward and upward lip curvatures, according to Liang et. al.[8] These differences may be due to the different facial forms than ours as this study was done in Chinese population.

Straight smile arcs were found in 49% of participants in another study by Maulik and Nanda 4, and they were followed by consonant (40%) and reverse (10%) smile arcs of patients. Their approach includes making videos of subjects in order to capture spontaneous smiles. This could be the cause of the dissimilar findings from our study, which used participants' posed smiles.

According to the current study, in a posed smile, patients typically reveal six maxillary anterior teeth and the 2nd premolars (34.7%). Similar to our study, Ritter et. al.[11] found out that teeth were displayed up to 2nd premolars while smiling in most participants. In contrast to our study, teeth were displayed up to 1st premolar in a study by Tjan et al.[12] Contrary to what we found, the majority of subjects 70% had their maxillary 1st molar visible when they smiled, and 26.7% had their 2nd premolar visible.[2] The contrasting results might have been found as this study was done in California, United states of America.

Extra caution should be taken when replacing anterior teeth in individuals with high smile lines to avoid excessive gingival exposure. In our study high smile line was seen in less participants, which was similar to the study by Tjan et. al.[12] In contrary to our study, Nold et. al.[13] suggests low smile line was found least among the participants.

Lombardi[14] and Desai[15].found a correlation between an individual's age and the smile arc. Younger people have

more prominent central incisors, and consonant smile arc; however, as people grow old, the curve tends to flatten due to wear.[14,15] In contrast to our findings, a study conducted in Nepal revealed that a higher percentage of individuals had low-type smiles (59.1%) and lower average-type forced smiles (40.0%).[16]

The results cannot be generalized to the entire population because this study was limited to Newari patients and only one medical college. To find out if there is a correlation between various parameters of smile, more investigation is required.

Conclusion

It is concluded that the majority of the study participants had an average smile line, a consonant smile arc, a straight upper lip curve, and teeth that were visible up to their 2nd premolars while smiling.

References

1. Khan M, Kazmi SMR, Khan FR, Samejo I. Analysis of different characteristics of smile. BDJ Open [Internet]. 2020;6(1):1-5. DOI: 10.1038/s41405-020-0032-x PMID: 32411387 PMCID: PMC7200793
2. Kaur S, Soni S, Prashar A, Kaur and R. Perception and Characterization of Posed Smile: A Photographic Study. J Indian Orthod Soc. 2021;55(3):270-7. DOI: 10.1177/0301574220963413
3. Seixas MR, Câmara CA. The smile arc: Review and synthesis. Vol. 26, Dental Press Journal of Orthodontics. 2021. 1-37 p. DOI: 10.1590/2177-6709.26.3.e21spe3 PMID: 34231836 PMCID: PMC8279119
4. Maulik C, Nanda R. Dynamic smile analysis in young adults. Am J Orthod Dentofac Orthop. 2007;132(3):307-15. DOI: 10.1016/j.ajodo.2005.11.037 PMID: 17826598
5. Pradhan R, Rajbhandari A, Manandhar P, Maharjan S. McNamara Cephalometric Analysis oF Newars of Kathmandu. Orthod J Nepal. 2018;8(1):14-7. DOI: 10.3126/ojn.v8i1.21339
6. Ramaswamy S, Rohilla N, Sathe TT. Analysis of various smile parameters using digital photography: An observational study. World J Dent. 2021;12(5):392-8. DOI: 10.5005/jp-journals-10015-1856
7. Krishnan V, Daniel ST, Lazar D, Asok A. Characterization of posed smile by using visual analog scale, smile arc, buccal corridor measures, and modified smile index. Am J Orthod Dentofac Orthop. 2008;133(4):515-23. DOI: 10.1016/j.ajodo.2006.04.046 PMID: 18405815
8. Liang LZ, Hu WJ, Zhang YL, Chung KH. Analysis of dynamic smile and upper lip curvature in young Chinese. Int J Oral Sci. 2013;5(1):49-53. DOI: 10.1038/ijos.2013.17 PMID: 23558343 PMCID: PMC3632766
9. Melo M, Ata-Ali J, Ata-Ali F, Bulsei M, Grella P, Cobo T, et al. Evaluation of the maxillary midline, curve of the upper lip, smile line and tooth shape: A prospective study of 140 Caucasian patients. BMC Oral Health. 2020;20(1):1-9. DOI: 10.1186/s12903-020-1031-y PMID: 32028948 PMCID: PMC7006208
10. Hulsey CM. An esthetic evaluation of lip-teeth relationships present in the smile. Am J Orthod. 1970;57(2):132-44. DOI: 10.1016/0002-9416(70)90260-5 PMID: 5263359
11. Ritter DE, Gandini LG, Pinto A dos S, Ravelli DB, Locks A. Analysis of the smile photograph. World J Orthod. 2006;7(3):279-85. PMID: 17009478
12. Tjan, A. H., Miller, G. D. & The JG. Some esthetic factors in a smile. 1984;53(1):24-8. DOI: 10.1016/S0022-3913(84)80097-9 PMID: 6583388
13. Nold SL, Dent M, Horvath SD, Dent M, Stampf S, Nat R, et al. Analysis of Select Facial and Dental Esthetic Parameters. 2014; DOI: 10.11607/prd.1969 PMID: 25171032
14. Lombardi RE. The principles of visual perception and their clinical application to denture esthetics. J Prosthet Dent. 1973;29:358-82. DOI: 10.1016/S0022-3913(73)80013-7 PMID: 4570911
15. Desai S, Upadhyay M NR. Dynamic Smile Analysis : Changes with Age. 2008; DOI: 10.1016/j.ajodo.2009.01.021 PMID: 19732654
16. Sapkota B, Srivastava S, Koju S, Srii R. Evaluation of Smile Line in Natural and Forced Smile Position : An Institution-based Study. 2017;7(1):27-32. DOI: 10.3126/ojn.v7i1.18898

Author Guidelines

Journal of KIST Medical College

Guideline to authors

Introduction

JKISTMC is a multi-disciplinary, open-access, peer-reviewed, biannually published scientific journal. The journal is the official publication of KIST Medical College, Lalitpur Nepal

Aims and Scope

Aims of JKISTMC is to promote and disseminate research activities in the medical field taking place in the country. JKISTMC seeks articles in basic and clinical medical sciences, medical education, public health, hospital and healthcare management, research and publication ethics in the form of original research papers, review articles, case reports, medical education, viewpoints, letter to the editor relating to any aspect of Medical & Health Science that are not published or not being considered for publication elsewhere.

Article processing charges

There is no article processing charges. All submissions and access to published articles are free of charge.

Peer review process

JKISTMC is a peer reviewed journal. Our aim is to provide all authors with a supportive, efficient, productive and quick editorial process.

The author has to submit their manuscript according to JKISTMC section policy. Submitted manuscript will be first accessed for scope of journal, completeness, language, ethical and legal issues. If found appropriate for consideration it will be sent for external peer review. The submitted articles are sent for online peer review through the OJS.

Two independent external expert reviewers will review the manuscript individually for scientific and technical basis of the work.

Accept Submission: The submission will be accepted without revisions.

Revisions Required: The submission will be accepted after minor changes have been made according to the reviewer's comment.

Resubmit for Review: The submission needs to be reworked, but with significant changes, may be accepted. It will require a second round of review, however.

Resubmit elsewhere: When the submission does not 48 meet the focus and scope of JKISTMC.

Decline Submission: The submission will not be published in the journal.

However, independent from the comment received from peer reviewer final decision regarding the acceptance and rejection will be made by editorial board.It usually takes 4 weeks to a maximum of 3 months for the peer review process to complete.

Copyright and Open Access Policy

JKISTMC provides immediate open access to its content on the principle that making research freely available to the public supports a greater global exchange of knowledge. JKIST applies the Creative Commons Attribution (CC BY) license to all works we publish. Under the CC BY license, authors retain ownership of the copyright for their article, but authors allow anyone to download, reuse, reprint, distribute, and/or copy articles in JKISTMC, so long as the original authors and source are cited. No permission is required from the authors or the publishers.

Article by JKISTMC is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

Policies

JKISTMC adheres to the policy published by International Committee of Medical Journal Editors (ICMJE) and to publishing ethics guidelines published by the Committee on Publication Ethics (COPE).

Section Policies

Editorial

It is written by JKISTMC editors or invited (Guest Editorial) on most pertinent issues on Health in Nepal or in the world.

Original Article

JKISTMC accepts researches conducted in the field of basic and clinical medical sciences, medical education, public health, hospital and healthcare management, allied health sciences and research and publication ethics, with the maximum length of 2500-3500 words (excluding abstract of 250 words). Reference should be limited to 35. JKISTMC requests all authors to register prospective clinical trials in a suitable electronic and freely accessible registry (e.g. www.clinicaltrials.gov, www.controlled-trials.com), according to the ICMJE guidelines.

It should be written under the following headings: Title and authorship, Abstract- Introduction, Method, Result, Conclusion, Key words, Introduction Methods Results Discussion Acknowledgement References. The reference number is superscripted after full stop at the end of sentence.

Case Report

JKISTMC accepts case reports with literature review that includes, a rare case, an unexpected association between diseases or symptoms, an unexpected event in the course of treatment such as complications and other adverse events that are significant enough to share among scientific committee. A case report should have maximum of 1200 words excluding abstract which should be of maximum 100 words and references up to 10. A case report should be written in following sections: 1. Title with Author Information 2. Abstract with key words 3. Introduction 4. Case Report 5. Discussion 6. Acknowledgement 7. References.. Please use the CARE Case Report Checklist while preparing your case report taking an account of CARE Flow Diagram.

Review Article

Review article summarizes the current state of understanding on a topic and analyses or discusses research previously published by others on the subject matter, rather than reporting new experimental results and which does not fit into the category of systematic review. They are thorough literature reviews that identify historical and current trends in the topic, gaps in the research (areas for further exploration), and current debates or controversies. It has to be about 3000 words excluding abstract (200 words) and references should be limited to 40. Required

Medical Education

JKISTMC accepts perspective on undergraduate, postgraduate and continuing medical education highlighting teaching methods, curriculum reform, the training of medical teachers, curriculum development, evaluations of performance, assessment of training needs and evidence-based medicine are accepted, with word limit up to 1500 words excluding abstract of 150 words.

Viewpoint

The article in this section is based on issues related to health sciences to raise the voice, awareness, new ideas, thought to provoke concepts, and personal expert opinion to improve the health.

Letter to the Editor

The section includes comments relating a recent article, an elaboration of an important discovery, or simply a thoughtprovoking commentary of fewer than 1000 words without an abstract.

Book Review

This section is invited by the editorial board of JKISTMC.

SUBMISSION DOCUMENTS

Please submit all the following documents while submitting new manuscript to JKISTMC through online after registering

1. Forwarding letter
2. Authorship letter
3. Declaration letter
4. Manuscript
5. Ethical Approval letter for research article. Ethical approval letter should be taken before starting the research.

Authors should send their manuscripts through online system.

Correspondence Address

The Editor-in-chief

Journal of KIST Medical College

GPO; 8975, EPC: 2588

Kathmandu, Nepal.

Email: jkistmc@gmail.com

Manuscript preparation

- Double-spacing, 12 point -Arial font
- 5-cm margins
- Page numbers in the top right corner
- Line numbers
- Clear concise language
- American spelling (all components of a manuscript must be in English)
- Ensure tables and figures are cited
- The preferred electronic format for text is Microsoft Word
- Manuscripts will be accepted in LaTeX as long as the native LaTeX and a PDF is also supplied
- Use International Systems of Units (SiI) symbols and recognized abbreviations for units of measurement
- Do not punctuate abbreviations e g, et al, ie
- Spell out acronyms in the first instance in the abstract and aper
- Generic drug names are used in title, text, tables, and figures
- Suppliers of drugs, equipment, and other brand-name material are credited in parentheses (company, name, city, state, country)
- If molecular sequences are used, provide a statement that the data have been deposited in a publicly accessible database, eg, GenBank, and indicate the database accession number

Get DOI to issue your protocol with a unique DOI (digital object identifier)

Include the DOI link in the Methods section of your manuscript using the format provided by protocols.io: https://dx.doi.org/10.17504/protocols.io.xxxxxxx (where xxxxxxx is the unique DOI)

1. General Principles

The text of articles reporting original research is usually divided into Introduction, Methods, Results, and Discussion sections. This so-called "IMRAD" structure is not an arbitrary publication format but a reflection of the process of scientific discovery. Articles often need subheadings within these sections to further organize their content. Other types of articles, such as meta-analyses, may require different formats, while case reports, narrative reviews, and editorials may have less structured or unstructured formats

2. Reporting Guidelines

Reporting guidelines have been developed for different study designs; examples include CONSORT for randomized trials, STROBE for observational studies, PRISMA for systematic reviews and meta-analyses, and STARD for studies of diagnostic accuracy. Journals are encouraged to ask authors to follow these guidelines because they help authors describe the study in enough detail for it to be evaluated by editors, reviewers, readers, and other researchers evaluating the medical literature. Authors of review manuscripts are encouraged to describe the methods used for locating, select¬ing, extracting, and synthesizing data; this is mandatory for systematic reviews. Good sources for reporting guidelines are the EQUATOR Network and the NLM's Research Reporting Guidelines and Initiatives.

3. Manuscript Sections

The following are general requirements for reporting within sections of all study designs and manuscript formats.

a. Title Page

The title page should contain

1. Type of manuscript(e.g. Original article, Case Report, etc)
2. Article title. The title provides a distilled description of the complete article and should include information that, along with the Abstract, will make electronic retrieval of the article sensitive and specific. No more than 40 characters
3. Author information:Each authors full names. The name of the department(s) and institution(s) or organizations where the work should be attributed. Full contact information, including land mail and e-mail addresses 50 of corresponding author.. ICMJE encourages the listing of authors' Open Researcher and Contributor Identification (ORCID).
4. Disclaimers. An example of a disclaimer is an author's statement that the views expressed in the submitted article are his or her own and not an official position of the institution or funder.
5. Source(s) of support. These include grants, equipment, drugs, and/or other support that facilitated conduct of the work described in the article or the writing of the article itself.
6. Word count. A word count for the paper's text, excluding its abstract, acknowledgments, tables, figure legends, and references, allows editors and reviewers to assess whether the information contained in the paper warrants the paper's length, and whether the submitted manuscript fits within the journal's formats and word limits.
7. Number of figures and tables. Specification of the number of Figures and Tables before uploading the relevant files. These numbers allow editorial staff and reviewers to confirm that all figures and tables were actually included with the manuscript and, because Tables and Figures occupy space, to assess if the information provided by the figures and tables warrants the paper's length and if the manuscript fits within the journal's space limits.
8. Conflict of Interest declaration. Conflict of interest information for each author needs to be part of the manuscript. The ICMJE has developed a uniform conflict of interest disclosure form for use by ICMJE member journals.

b. Abstract

The abstract should start on the second page. It should be structured for original articles as: Introduction, Materials and Methods, Results, Conclusions and Keywords. Do not include references in the abstract.

c. Introduction

Provide a context or background for the study (that is, the nature of the problem and its significance). State the specific purpose or research objective of, or hypothesis tested by, the study or observation. Cite only directly pertinent references, and do not include data or conclusions from the work being reported.

d. Methods

The guiding principle of the Methods section should be clarity about how and why a study was done in a particular way. Methods section should aim to be sufficiently detailed such that others with access to the data would be able to reproduce the results. In general, the section should include

only information that was available at the time the plan or protocol for the study was being written; all information obtained during the study belongs in the Results section. If an organization was paid or otherwise contracted to help conduct the research (examples include data collection and management), then this should be detailed in the methods.

The Methods section should include a statement indicating that the research was approved by an independent local, regional or national review body (e.g., ethics committee, institutional review board). If doubt exists whether the research was conducted in accordance with the Helsinki Declaration, the authors must explain the rationale for their approach and demonstrate that the local, regional or national review body explicitly approved the doubtful aspects of the study.

i. Selection and Description of Participants

Clearly describe the selection of observational or experimental participants (healthy individuals or patients, including controls), including eligibility and exclusion criteria and a description of the source population. Because the relevance of such variables as age, sex, or ethnicity is not always known at the time of study design, researchers should aim for inclusion of representative populations into all study types and at a minimum provide descriptive data for these and other relevant demographic variables. Ensure correct use of the terms sex (when reporting biological factors) and gender (identity, psychosocial or cultural factors), and, unless inappropriate, report the sex and/or gender of study participants, the sex of animals or cells, and describe the methods used to determine sex and gender. If the study was done involving an exclusive population, for example in only one sex, authors should justify why, except in obvious cases, (e.g., prostate cancer)." Authors should define how they determined race or ethnicity and justify their relevance.

ii. Technical Information

Specify the study's main and secondary objectives–usually identified as primary and secondary outcomes. Identify methods, equipment (give the manufacturer's name and address in parentheses), and procedures in sufficient detail to allow others to reproduce the results. Give references to established methods, including statistical methods (see below); provide references and brief descriptions for methods that have been published but are not well-known; describe new or substantially modified methods, give the reasons for using them, and evaluate their limitations. Identify precisely all drugs and chemicals used, including generic name(s), dose(s), and route(s) of administration. Identify appropriate scientific names and gene names.

iii. Statistics

Describe statistical methods with enough detail to enable a knowledgeable reader with access to the original data to judge its appropriateness for the study and to verify the reported results. When possible, quantify findings and present them with appropriate indicators of measurement error or uncertainty (such as confidence intervals). Avoid relying solely on statistical hypothesis testing, such as P values, which fail to convey important information about

effect size and precision of estimates. References for the design of the study and statistical methods should be to standard works when possible (with pages stated). Define statistical terms, abbreviations, and most symbols. Specify the statistical software package(s) and versions used.Distinguish prespecified from exploratory analyses, including subgroup analyses.

e. Results

Present your results in logical sequence in the text, tables, and figures, giving the main or most important findings first. Do not repeat all the data in the tables or figures in the text; emphasize or summarize only the most important observations. Give numeric results not only as derivatives (for example, percentages) but also as the absolute numbers from which the derivatives were calculated, and specify the statistical significance attached to them, if any. Restrict tables and figures to those needed to explain the argument of the paper and to assess supporting data. Use graphs as an alternative to tables with many entries; do not duplicate data in graphs and tables. Avoid nontechnical uses of technical terms in statistics, such as "random" (which implies a randomizing device), "normal," "significant," "correlations," and "sample."

f. Discussion

It is useful to begin the discussion by briefly summarizing the main findings, and explore possible mechanisms or explanations for these findings. Emphasize the new and important aspects of your study and put your finings in the context of the totality of the relevant evidence. State the limitations of your study, and explore the implications of your findings for future research and for clinical practice or policy. Discuss the influence or association of variables, such as sex and/or gender, on your findings, where appropriate, and the limitations of the data. Do not repeat in detail data or other information given in other parts of the manuscript, such as in the Introduction or the Results section.Link the conclusions with the goals of the study but avoid unqualified statements and conclusions not adequately supported by the data. In particular, distinguish between clinical and statistical significance, and avoid making statements on economic benefits and costs unless the manuscript includes the appropriate economic data and analyses.

Acknowledgement

i. References

The Vancouver system of referencing should be used.Do not use conference abstracts as references: they can be cited in the text, in parentheses, but not as page footnotes. References to papers accepted but not yet published should be designated as "in press" or "forthcoming." Information from manuscripts submitted but not accepted should be cited in the text as "unpublished observations" with written permission from the source.Avoid citing a "personal communication" unless it provides essential information not available from a public source, in which case the name of the person and date of communication should be cited in parentheses in the text. For scientific articles, obtain written permission and confirmation of accuracy from the source of a personal communication. check the accuracy of all reference citations; thus, citation errors sometimes appear in the published version of articles. To minimize such errors, references should be verified using either an electronic bibliographic source, such as PubMed, or print copies from original sources. Authors are responsible for checking that none of the references cite retracted articles except in the context of referring to the retraction. For articles published in journals indexed in MEDLINE, the ICMJE considers PubMed the authoritative source for information about retractions. References should be numbered consecutively in the order in which they are first mentioned in the text. Identify references in text, tables, and legends by Arabic numerals in parentheses.

ii. Reference Style and Format

References should follow the standards summarized in the NLM's International Committee of Medical Journal Editors (ICMJE) Recommendations for the Conduct, Reporting, Editing and Publication of Scholarly Work in Medical Journals: Sample References webpage and detailed in the NLM's Citing Medicine, 2nd edition.

Examples of reference format

1. Standard journal article

Halpern SD, Ubel PA, Caplan AL. Solid-organ transplantation in HIV-infected patients. N Engl J Med. 2002 Jul 25;347(4):284-7.

List the first six authors, followed by et al. If there are more than six authors, list the first

2. Personal author(s)

Murray PR, Rosenthal KS, Kobayashi GS, Pfaller MA. Medical microbiology. 4th ed. St.52

j. Tables

Tables capture information concisely and display it efficiently; they also provide information at any desired level of detail and precision. Including data in tables rather than text frequently makes it possible to reduce the length of the text.

Prepare tables according to the specific journal's requirements; to avoid errors it is best if tables can be directly imported into the journal's publication software. Number tables consecutively in the order of their first citation in the text and supply a title for each. Titles in tables should be short but self-explanatory, containing information that allows readers to understand the table's content without having to go back to the text. Be sure that each table is cited in the text.

Give each column a short or an abbreviated heading. Authors should place explanatory matter in footnotes, not in the heading. Explain all nonstandard abbreviations in footnotes, and use symbols to explain information if needed. Symbols may vary from journal to journal (alphabet letter or such symbols as *, †, ‡, §), so check each journal's instructions for authors for required practice. Identify statistical measures of variations, such as standard deviation and standard error of the mean.

If you use data from another published or unpublished source, obtain permission and acknowledge that source fully.

k. Illustrations (Figures)

Digital images of manuscript illustrations should be submitted in a suitable format for print publication. Most submission systems have detailed instructions on the quality of images and check them after manuscript upload. For print submissions, figures should be either professionally drawn and photographed, or submitted as photographicquality digital prints.

For radiological and other clinical and diagnostic images, as well as pictures of pathology specimens or photomicrographs, send high-resolution photographic image files 127x173 mm(5x7inches). Before-and-after images should be taken with the same intensity, direction, and color of light. Although some journals redraw figures, many do not. Letters, numbers, and symbols on figures should therefore be clear and consistent throughout, and large enough to remain legible when the figure is reduced for publication. Figures should be made as self-explanatory as possible, since many will be used directly in slide presentations. Titles and detailed explanations belong in the legends—not on the illustrations themselves.

Photomicrographs should have internal scale markers. Symbols, arrows, or letters used in photomicrographs should contrast with the background. Explain the internal scale and identify the method of staining in photomicrographs.

Figures should be numbered consecutively according to the order in which they have been cited in the text. If a figure

has been published previously, acknowledge the original source and submit written permission from the copyright holder to reproduce it. Permission is required irrespective of authorship or publisher except for documents in the public domain.

In the manuscript, legends for illustrations should be on a separate page, with Arabic numerals corresponding to the illustrations. When symbols, arrows, numbers, or letters

are used to identify parts of the illustrations, identify and explain each one clearly in the legend.

l. Units of Measurement

Measurements of length, height, weight, and volume should be reported in metric units (meter, kilogram, or liter) or their decimal multiples.Temperatures should be in degrees Celsius. Blood pressures should be in millimeters of mercury, Drug concentrations may be reported in either SI or mass units, but the alternative should be provided in parentheses where appropriate.

m. Abbreviations and Symbols

Use only standard abbreviations; use of nonstandard abbreviations can be confusing to readers. Avoid abbreviations in the title of the manuscript. The spelled-out abbreviation followed by the abbreviation in parenthesis should be used on first mention unless the abbreviation is a standard unit of measurement.

Advertisement

JKISTMC accepts advertisements from organizations related to medical services such as publishers, event organizers; academic professional organizations, other academic journals etc. Medical colleges and hospitals, Pharmaceuticals and medical suppliers are also encouraged to advertise.

Disclaimer

All the information and opinions published in the journal reflect the view of the authors and hence the journal or the editorial board or the publisher will not bear any liability for the accuracy of the information. The authors are requested to refrain from plagiarism and to check for the accuracy of the information and to avoid any copyright infringement in their articles.

Chief Editor's request

All the documents have to be submitted at once in single submission (as listed above).

Email is the preferred methods of communication. We will inform you about the status of your article through our system to the email you at your mail ID which you have provided. We may also contact you anytime for immediate information to speed up the review process.

Please do not contact editorial member's personal telephone numbers. Contact JKISTMC Office for information.

Original Article

JKISTMC accepts researches conducted in the field of basic and clinical medical sciences, medical education, public health, hospital and healthcare management, allied health sciences and research and publication ethics, with the maximum length of 2500-3500 words (excluding abstract of 250 words). Reference should be limited to 35. JKISTMC requests all authors to register prospective clinical trials in a suitable electronic and freely accessible registry (e.g. www.

clinicaltrials.gov, www.controlled-trials.com), according to the ICMJE guidelines.

It should be written under the following headings: Title and authorship, Abstract- Introduction, Method, Result, Conclusion, Key words, Introduction Methods Results Discussion Acknowledgement References. The reference number is superscripted after full stop at the end of sentence.

View Point

The article in this section is based on issues related to health sciences to raise the voice, awareness, new ideas, thought to provoke concepts, and personal expert opinion to improve the health.

Medical Education

JKISTMC accepts perspective on undergraduate, postgraduate and continuing medical education highlighting teaching methods, curriculum reform, the training of medical teachers, curriculum development, evaluations of performance, assessment of training needs and evidence-based medicine are accepted, with word limit up to 1500 words excluding abstract of 150 words.

Case Report

JKISTMC accepts case reports with literature review that includes, a rare case, an unexpected association between diseases or symptoms, an unexpected event in the course of treatment such as complications and other adverse events that are significant enough to share among scientific committee. A case report should have maximum of 1200 words excluding abstract which should be of maximum 100 words and references up to 10. A case report should be written in following sections: 1. Title with Author Information 2. Abstract with key words 3. Introduction 4. Case Report 5. Discussion 6. Acknowledgement 7. References.. Please use the CARE Case Report Checklist while preparing your case report taking an account of CARE Flow Diagram.

Review Article

Review article summarizes the current state of understanding on a topic and analyses or discusses research previously published by others on the subject matter, rather than reporting new experimental results and which does not fit into the category of systematic review. They are thorough literature reviews that identify historical and current trends in the topic, gaps in the research (areas for further exploration), and current debates or controversies. It has to be about 3000 words excluding abstract (200 words) and references should be limited to 40.

Book Review

This section is invited by the editorial board of JKISTMC.

Letter to Editor

The section includes comments relating a recent article, an elaboration of an important discovery, or simply a thoughtprovoking commentary of fewer than 1000 words without an abstract.

Copyright Notice

Copyright and Open Access Policy

This journal provides immediate open access to its content on the principle that making research freely available to the public supports a greater global exchange of knowledge.

JKISTMC applies the Creative Commons Attribution (CC BY) license to all works we publish. Under the CC BY license, authors retain ownership of the copyright for their article, but authors allow anyone to download, reuse, reprint, distribute, and/or copy articles in JKISTMC, so long as the original authors and source are cited. No permission is required from the authors or the publishers

JKISTMC

Journal of KIST Medical College

An Official Publication of KIST Medical College & Teching Hospital

GPD Box: 14142, Mahalaxmi Municipality, Ward No 1, Lalitpur, nepal

Ph: 977-1-5201682, Fax: 977-1-5201496

Email: info@kistmcth.edu.np, www.kistmcth.edu.np