Basic Sciences of Medicine 2023, 12(1): 13-25
DOI: 10.5923/j.medicine.20231201.02

Can Examination Reforms in Human Anatomy Improve Clinical Practice?

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Abstract Anatomy is foundation of medical education, end use of which is clinical practice to keep disease free society. Thus, Anatomical knowledge directly affects the clinical practice in diagnosis and treatment. There is concern a among anatomists and clinicians that medical trainees possess inadequate knowledge of anatomy to comprehend medical subjects and clinical practice. Umpteen number of reasons have been assigned to inadequate knowledge of anatomy. One of main cause of this inadequacy is attributed to existing examination system. The purpose of the study is to explore loop holes in present traditional examination system and to suggest reforms in it, thereby, improving clinical practice by removing inadequacy of anatomical knowledge. Literature search and authors own skill brought out the deficiency of prevailing examination system producing inadequate knowledge of anatomy and reforms to eradicate deficiencies have been proposed. Existing examination system is not only formal, routine and unfocussed on need of clinical practice but also the absence of teaching and examination during clinical phase of medical education. Therefore, the vast syllabus of Anatomy has been distributed in preclinical phase and by horizontal and vertical integration of Anatomy in clinical phase. Apart from this, reforms in scheduling of syllabus, paper setting and pattern of theory and practical examinations of Anatomy during preclinical and guide lines to syllabus and examination in clinical phases have been proposed. The Suggestions in examination reforms in Anatomy will definitely will improve knowledge of anatomy improving the safe and successful clinical practice.

Keywords Human Anatomy, Medical Education, Clinical Practice, Examination system, Integration

1. Introduction

Clinical practice is the end product of medical education and the objective of clinical practice is to make *disease* free society. The medical education is chiefly, evolved from caring of human body against diseases thereby from Human Anatomy (HA). The causative of disease are *invasion of pathogens, injury or trauma, misuse of limbs, sudden exposure to varying environmental conditions, side-effects / reactions and iatrogenic injuries* creating anatomical distortions in form of *break, cut, degeneration, extra growth/stones, narrowing, dilatation, thickening, thinning, blockage, dislocation, compression, variation, hematoma formation and variant attachments of tendon/ligaments and muscle fibers* [1-2] in structures/organs/systems (SOS) of human body. These distortions, transform *shapes, sizes, locations, orientations, branching patterns, pathways and configurations of macro/microstructures* such as Vessels, Nerves, Fascicles, Bones, Muscles, Glands, Organs, Limbs and Systems constituting the organs and systems together with cascading effects on processes like altering *the kinematics of organs, systems and associated activities and functions of the processes like haemo/fluid dynamics of flow through vessels/organs, two-way communication through nervous system, skeletal system of bones supporting chassis of body, muscular system providing strength supporting the activities and functions and Immune system supporting self-protection* of the human body for survival. These distortions and their cascading effects *impair the functions and activities of SOS creating signs and symptoms* which helps in *identifying the diseases* through physical examination in preliminary diagnosis to estimate hidden *location, identify structure in organs and systems, mapping* the distortions through Surface Anatomy associated with surface markings. Further, the distortions are also correlated with impairment of functions and activities of SOS, disturbances in processes, signs and symptoms and diseases through altered morphology/morphometry keeping in mind the gross Anatomy of SOS and their variations/anomalies to confirm the disease. Later, by radiological/laboratory tests and interpretation also needs the knowledge of very precise normal/variant morphology of anatomical structures to identify distortion and to differentiate distortion from variations, anomalies and artifacts for right interpretation in final diagnosis [2]. Having finalized the diagnosis by

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Received: May 20, 2023; Accepted: Jun. 12, 2023; Published: Jun. 14, 2023
Published online at http://journal.sapub.org/medicine

identifying the disease the treatment analysis is carried out. During the training of *medicinal treatment* analysis, the action mechanism of medicines/drugs in relation to altering the functions and activities of anatomical SOS/interacting with metabolic and other processes including secretion / absorption from various glands/systems of body, is needed to teach/examine to avoid side-effects. The configuration of pathways of anatomical structures and organization of structures surrounding the distorted structure to be accessed for *surgical intervention* should be either revised or explained afresh and can also be *demonstrated on cadaver* to build more confidence in students studying Surgery. The relevant anatomical knowledge should be taught/examined. Then, the image examination and laboratory reports are to be analyzed by the clinician to keep check and balance of lapses of radiological/laboratory interpretation and confirmation of diseases. This loudly speak that the trainee students must know the above-mentioned Anatomy to take right decision in clinical analysis or he will be deemed to possess inadequate knowledge of Anatomy. But there is consensus among most of clinicians and anatomists that the clinical trainees possess inadequate knowledge of Human Anatomy to grasp other medical subjects and analysis of clinical practice [3-11]. The reasons for delivery/acquisition of inadequate knowledge of HA are absence of standardized syllabus due to arbitrary pruning, reduction of time schedule, closing of Department of Anatomy and dissection halls, filtering of experienced faculties of Anatomy, growing reduction/removal of cadaveric dissection including deteriorating examination system of preclinical phase and *the absence of teaching / examination of HA schedule during clinical training of medical education*. However, Much more has been said and done about all other factors to improve inadequate knowledge of Anatomy by learned authors [3-11] but little has been said about the impact, of prevailing formal unsystematic and haphazard examination system, on acquisition of Anatomy and *absence of examination / teaching during clinical training of UGs, Specialties and super specialties causing acquisition of inadequate knowledge of Anatomy*.

"***Education in general and medical education in particular, is not only learning of facts, but the training of mind to think***" as aptly said by ***Albert Einstein***. Evaluation is inextricable from an ideal curriculum which can stream line the learning process. However, it is well known fact that the examination is backbone of evaluation of 'surface', 'strategic' and 'deep' learning [12]. The knowledge may be inadequate, adequate and sound due to unsuitable examination system. The examination system is responsible for proper monitoring/ evaluating the ability of accumulated knowledge of HA of medical trainees. Thus, *absence of a rational good examination system is one of the greatest reasons to acquire inadequate knowledge of HA.* Therefore, better is the examination system and its evaluation, better will be acquisition of knowledge.

But good examination system can be developed only by improving it through reforms in prevailing examination system. So, these reforms can make the examination system so better that, not to speak of, acquisition of adequate knowledge rather acquisition of sound knowledge is possible. As the degree of knowledge cultivated among the trainee medical students is monitored by examination system so, linking examination/evaluation to the learning process is a new route that ensures, not to speak of, acquiring quality and quantity of adequate Anatomy rather, standard of medical education can be raised [13] through boosting the performance of students in clinical practice. The educational environment and assessment of examination system are the only factors which influence students to adopt surface, deep or strategic learning [14]. In contrast, the students, driven by fear of failure, use 'surface' learning. They learn by rote with a simple aim of reproducing the material in examination. On the other hand, the students driven by recognition and encouragement through honest assessment use 'deep' learning to understand the meaning of contents of HA and its application in future. Students with 'strategic' learning are motivated on achieving higher grades and might switch between surface to deep learning methods [15-16]. This transformation in learning attitude will definitely give boost to improve the inadequate acquisition of anatomical knowledge.

Thus, it is important to note here that, if the progressive and continuous monitoring of the acquisition of anatomical knowledge, by a refined rational examination system is adopted, the problem of inadequate knowledge of Anatomy can largely be taken care beforehand. Therefore, this study has been planned to suggest reforms in the examination system to compensate deficient accumulation of knowledge of Anatomy to satisfy the need of medical/clinical comprehension. The medical profession/education is aimed at providing safe and successful clinical practice which is expected to be achieved by reforming examination system as the *end-use of medical education is safe and successful clinical practice*.

2. Material and Methods

The prevailing examination system has become traditional, formal, unsystematic and haphazard so, this is not suitable to monitor and evaluate knowledge of HA not only in preclinical phase but also there is absolutely, no schedule of teaching/examining for delivering/accumulating knowledge of HA, during clinical training of UG/ Specialty (PG)/Super-specialty (PPG) courses of medical education. However, '*absence of a good evaluation /examination system dramatically reduces teacher's efficiency, student's intelligence and adequacy of resources'* [17] so, the students acquire inadequate Anatomy as *the students pass the examination but do not know Anatomy. 'Students work to pass, not to know...They do pass and they don't know.' as uttered by Thomas Huxley, a legendary figure* [12]. So, the examination system should be fully overhauled to focus it on the accurate evaluation and monitoring of the HA in context with the need of its uses in learning the other medical

subjects including safe and successful clinical analysis.

The deficiencies in the examination system during preclinical phase have contributed heavily to inadequate knowledge of Anatomy to comprehend clinical practice. However, a good examination system, on the whole, depends on 1. Evaluation of comprehension of standardized syllabus of HA which should be well focused and in context with need of learning other medical subjects along with analyzing the diagnosis and treatment in clinical practice, 2. Competent faculties, who can design and develop the suitable new reformed examination system consisting of i. Scheduling of examination/tests, ii. Setting of good question papers, iii. True evaluation, iv. The honest promotion policy, in accordance with syllabus and 3. The practical/theoretical examinations consisting of examination papers focused on need based clinical applications and experiments on cadaver to be carried out by the examinee.

Besides these properties to evolve a good examination system, let us analyze and compare the deficiencies of prevailing examination system to design reformations. The absence of *standardized, syllabus due to pruning, experienced faculties, reduction/elimination of cadaver dissection, nonteaching/examining of variation/ anomalies* and *interrelationship among HA, Physiology, Pathology, Radiology, Medicine and Surgery* are the main deficiencies in prevailing examination pattern**.** In the same continuation, the nonteaching/examining of anatomical distortions creating cascading effect on metabolic and other processes, functions and activities (Physiology) of SOS during eruption of diseases (Pathology) and mapping, identification and correlation of normal/ distorted SOS firstly, by physical examination involving Surface Anatomy and marking of gross Anatomy on surface of human body in HA then by Radiological interpretation in diagnosis and restoration of anatomical distortions in morphology of SOS through Medicines/Surgery, are another group of deficiencies in prevailing examination system. Besides, these deficiencies, there is no anatomical backup through experienced anatomical faculties during clinical training of UG / Specialty/Super-specialty courses of medical education when the application of HA in diagnosis and treatment is needed. *This is another very serious deficiency in examination system*.

Ideally, the vast syllabus of HA should have been distributed as basic part during preclinical phase and its revision/addition for clinical applications during clinical training phase. In clinical training phase, Anatomy is referred by the words of mouth from consultants/faculties of that particular specialty or studied by the trainee himself, as such *neither teaching of standard syllabus nor examination of HA* is conducted during clinical phase. This is the *greatest reason to acquire inadequate HA to comprehend clinical analyses.* The need of scheduled teaching and examining is evidenced by BSMS model of integrated HA [18]. So, it is recommended that the clinically significant syllabus of HA should be integrated and taught/examined during clinical training. *This is severest deficiency in prevailing system of education.*

However, in the BSMS model [18] based on horizontally and vertically integrated systemic module, a need-based HA has very nicely been planned but with some scars of weaknesses such as reduced teaching and dissection hours, piecemeal syllabus and teaching by fellow colleagues/demonstrators/tutors/ bureaucrats making irreparable damage to knowledge of HA. There is a trend of multiple-choice questions in examinations which is a hurdle to grasp the thoroughness of the subject. All these deficiencies have been analyzed in this section and reformations have been suggested.

Reformed examination system of HA in *preclinical phase*: The objective of examination is to monitor/evaluate the accurate level of comprehension of subject and its application. Thus, analyzing the deficiencies of prevailing examination system and keeping in mind the characteristics of a good examination system as described above, the reformations are designed as under:-

The ***syllabus*** of HA should be designed, developed and standardized for teaching/examination to remove the arbitrariness, variation and haphazardness of ***syllabus*** in preclinical phase crept into its examination through pruning of syllabus in various medical schools. So, the vast syllabus of HA should be redistributed partly into preclinical phase and partly into the clinical phase by integrating Anatomy, horizontally and vertically. Thus, the syllabus of HA for new examination system in preclinical phase should concentrate on basic knowledge of morphology & morphometry covering shapes, sizes, locations, orientations, branching patterns, pathways and configurations of multitude of anatomical macro/microstructures in organs or systems. The syllabus should also envelop surface Anatomy/surface markings and its morphometry with respect to landmarks, development of embryo to well-developed human being, standard histological slides, variations/ anomalies and a flying view of distortions pertaining to diseases. The examination should concentrate not merely on learning of facts rather train the mind of the students to think. So, examination should test not merely description of structures among the students rather their mind should be trained to apply this anatomical knowledge in grasping other medical subjects and clinical analysis by learning interwoven interrelation among anatomical SOS, their functions and activities, the normal/distorted SOS, their impact not only on functions and activities and eruptions of signs and symptoms of diseases, imagery analysis but also on changes in metabolic and other processes to be detected through lab. tests for diagnosis and advising treatment. As regards the *faculties*, no model can sustain in the absence of experienced faculties as these are the stalwarts who can appropriately give final shape and implement these examinations reformations by designing and developing the scheduling of teaching and examination/tests, setting of good question papers, guidance for evaluation and guidelines for promotion effectively.

Therefore, the glimpses of salient features of planning for

theory and practical examination along with the guidelines for promotion will be given here under. Broadly, this model has been adored with following features pertaining to ***1. scheduling of examination/tests, 2. setting of question paper, 3. their evaluation*** and framing ***promotion*** strategy to evolve rational examination system.

Scheduling of examination/tests: The examination schedule completely, depends on teaching schedule of syllabus covering systems/extremities/regions/topics of HA. As described above, there is no standardized syllabus, so, the examinations/tests' schedule is also formal, depending on syllabus taught. However, removing all these constraints, the schedule of the examinations/tests has been evolved as under.

There will be 5 parts completion tests (PCTs) on every taught and completed topics. The topics have been segregated into 5 extremities mixing embryology, histology, surface Anatomy and Radiology in all the extremities because the later topics are taught throughout the year corresponding to extremities. There will be two terminals on all taught topics at the interval of 6 months and Final examination after completion of full syllabus at the end of 12 months allocated after reduced schedule of HA (Table 1). The examinations of HA are conducted in two parts, 1. Theory and 2. Practical for doubly enhancing the expertise and skill.

Paper setting in Human Anatomy: Unfortunately, a little attention is paid to the attributes of a good question paper by most of the paper-setting faculties. Occasionally, the questions have ambiguous language, this should be avoided. The question paper should cover the whole of the prescribed syllabus as far as possible targeting the clinical utility [19]. The standard of the question paper should be maintained keeping in mind the average difficulty and discrimination index to segregate the best students from the average students, setting the questions to test the sufficient knowledge of HA cultivating the skill for its application in clinical practice. A good question paper should ensure objectivity, validity and feasibility for not only optimizing the evaluation system but also ensuring applicability of HA in clinical analysis. The objectivity will normalize the similar scores earned by students if evaluated by two or more independent expert evaluators. Validity refers the extent to which a test fulfils the purpose for which it is designed for. Written tests are valid for measuring knowledge but not for measuring attitudes and psychomotor skills. Feasibility refers the process which can be implemented in the practice [20]. The format of question papers has been shown in Table 2. The theory paper will have 5 types of questions to meet all the requirements of a good examination system to cover the entire syllabus and its comprehension to applicability to clinical analyses. Firstly, to develop the language of Anatomy, the definition of terms/standardization of names is very important to comprehend the subject. These terms / names can be asked in form of objective type / **multiple-choice questions (MCQs)**. These definitions should cover terms, location, shapes, sizes, orientation and development of macro/microstructures, organs, limbs, processes and systems and any other question whose answer can be composed in 4/5 options. Though multiple-choice questions cannot test the power of expression or logical thought process yet it measures higher levels of cognition, covers wider portion of the syllabus and can easily discriminate between good and poor students.

The 2nd type of questions should cover the short explanations, the internal/external relations among anatomical structures, functions and activities, normal/ variant morphology altering morphometry of macro/ microstructures, identification of normal distorted structures, neurovascular structures in various organs and limbs, interrelations of impairment with signs and symptoms, the prediction of probable disease in 1 or 2 sentences should be covered in **short note type of questions (SAs)**. These questions will explain the definitions which will help in comprehending the subjects.

Table 1. Model schedule of examinations/tests for preclinical Anatomy

S.no.	Topics/ Extremity	Time months	Dissection	PCTs	Terminals (papers/ months)	Final Examination
1	Upper limb	1	1	PCT-UL	Terminal I within 6 months, 2 papers and practical	3 papers and practical after 11 months
2	Thorax	1	1	PCT-TH		
3	Head & Neck+NA	2	2	PCT-HN		
4	Abdomen	2	2	PCT-AB		
5	Lower limb	1	1	PCT-LL	Terminal II after 11 months; 2 papers and practical	
6	Embryology, Genetics	R Y 40 h		IE		
7	Histology	R Y, 40 h		IE		
8	Surface Anatomy;	R Y		IE		

R Y= Round the year; IE=included with extremity, PCT=Part completion test, UL=Upper limb, TH=Thorax, HN= Head and Neck, AB=Abdomen, LL= Lower limb; RY Embryology- Genetcs~2 months, RY Histology~2 months, RY Surface Anatomy will be taught with extremity

The 3rd type of questions should cover elaborations of structural configurations and branching patterns of structures forming organs/systems/limbs, functional relations, cascading effects on various processes, genetic / developmental variations/anomalies/distortions in morphology & morphometry, the organization of systems and articulation of bones, the comparison of normal and accidental injury/distortions and simple cases for diagnosis / dissection to judge the cognitive ability and understanding of the subject by the students in the body in ½ to 1 page. These questions may be named as **extended short notes (ESAs)**.

The explanatory questions are descriptive and need more space so these can be asked as **long answer type questions (LAs)**. The knowledge of surface marking of internal anatomical structures, organization of systems, limbs and organs' configuration, pathways of neurovascular structures can be tested through **diagrams (Ds)**. Thus, to fully evaluate the ability of students all these things suggest that the question paper should be designed to have 5 types of questions namely, MCQs, SAs, ESAs, LAs and Ds. However, a considerable weightage to different types of questions (SAs, ESAs, LAs and Ds) in a question paper have a comprehensive approach of assessment [20-21]. There is a recent trend that the question papers should possess only multiple-choice questions. It is dangerous to comprehend the interrelation of Anatomy with other subjects and clinical analysis in medical education.

The practical examination: There is no examination presently, conducted to focus on evaluation of ability of student to dissect the cadaver efficiently/forming a gate way to surgery to test the knowledge of configuration of structures, system and organization of organs in human body. These are very essential not only in surgical procedures but also in diagnosis and treatment. So, the practical examination has been formatted as, 1. Spotting to identify morphology of SOS, 2. Organ identification (Soft parts), 3. Observation of standard Histological slides 'To identify the microanatomical structures' describing the location, pathways and area of innervation and SOS as well as viva, 4. Osteology, Bone identification, describing the morphology and morphometry and setting/articulation & viva, 5. Surface marking (mapping of internal structures from surface landmarks) and viva, 6. X-ray/MRI/Ultrasound images' identification, and viva. The calibration of SOS in images from cadaveric parts and comparison of normal and distorted structures.7. Cadaver dissection for testing knowledge of location, spread, configuration and pathways of SOS and viva. This knowledge will be used in diagnosis and treatment. This format of Practical examination will be set for all PCTs, Terminals and Final examination.

Evaluation system & promotion strategy: In the process of imparting education faithfully, though pedagogy and learning principles are important factors yet monitoring the progress of teaching/learning and the results revealing not only the clear concept of knowledge acquired by the students but also the performance of the teachers/students in transferring/acquiring the knowledge and ability to reproduce and apply it. This requires a perfect evaluation system to monitor the progress of learning. However, 'Absence of good evaluation system dramatically reduces teacher's efficiency, student's intelligence and adequacy of resources' [17]. So, the evaluation system has to be designed in such a way that the comprehension and understanding of the subject may be evaluated objectively. The theory and practical examination are major tools in the gambit of evaluation. For overall assessment of students, the examination papers should be evaluated for all aspects of learning that is cognitive which is based on recall / interpretation/analysis and psychomotor skills–based on application to safe clinical practice /problem solving / diagrams and affective neatness and presentation skills. The Judging of students cannot be completed if the importance is not given to the content knowledge of students. The questions pertaining to clinical sciences would encourage the development of problem-solving attitude including appreciation of application of HA in clinical analyses and prevent students from cramming up. Holistic approach of assessment involves varied form of questions. The evaluation is of magnanimous significance as medical education is aimed at producing skilled and expert clinicians who deal with life and death of patients [12]. The formatting of questions and marking scheme with proper instructions to evaluator should be coherent so that, there should be no variations in marks even if evaluated by different evaluators. The evaluation should be given utmost importance and it should not be evaluated by below standard/proxy evaluators. There should be a strict standard scale on marks to promote the students such as the minimum marks for promotion should be 60%.

Examination system of HA for *clinical phase*: As elaborated above, there is no teaching/examination schedule, syllabus and theory/practical examination of HA during clinical phase, so as such no monitoring of acquisition of knowledge of HA is done during clinical training phase in UG, Specialty and super-specialty courses. So, firstly, the teaching of needed HA may be horizontally and vertically integrated during this phase and secondly, the new examination system in HA, as derived above for preclinical phase with modifications suggested, should also be introduced during these courses to eliminate the menace of inadequate Anatomy for grasping and its application in other medical subjects and safe and successful clinical practice. Therefore, firstly, the ***syllabus*** of HA should be allocated / standardized for all clinical streams of UG/Specialty/ Super-specialty courses. The syllabus of HA in UG / Specialty/super-specialty courses, should be designed such that the revision of basic needful HA (focusing on the regions of body directly or indirectly related to the particular stream of clinical specialty) including deep, analytic and advanced knowledge of interwoven HA to be applied in diagnosis and treatment corresponding to specialties. The clinical Anatomy may be subdivided into topics corresponding to Specialty/Super-specialty with overlap of interwoven essential part of HA directly or indirectly

required in clinical training of the specific specialty. The topics will consist of all aspects of Anatomy like, morphology & morphometry covering shapes, sizes, locations, orientations, branching patterns, pathways and configurations of all anatomical macro/microstructures in organs/systems, surface Anatomy/surface markings and its morphometry, development of embryo to well-developed human child, standard histological slides, variations / anomalies and a flashing view of distortions pertaining to diseases in specific specialties. Though this is a very big job to allocate and standardize the syllabus for all the courses and must be decided by both senior Anatomical & clinical faculties together, yet we try to place some guidelines for one specialty as an example from viewpoints of anatomy for UG, specialty and super-specialty to cultivate a safe and successful clinical skill among upcoming medical professionals. The syllabi of all the clinical courses (UG, specialties and super-specialties) cannot be accommodated here due to lack of space and time and large numbers of specialties super-specialties so, for sample's sake, one specialty will be discussed at length from anatomical point of view. For example- ENT enshrined in head and neck region of Anatomy for **UG/specialty/super-specialty** clinical courses. Its syllabus will contain basic normal morphology such as shapes, sizes, locations, orientations, branching patterns, pathways and configurations of macro / microstructures as Vessels, Nerves, Bones, Muscles, Glands, organs, Limbs and Systems their developmental aspect, Microanatomy through histological analysis, the structural variations, anomalies and likely distortions due to trauma/injury and infections due to pathogens pertaining to ear, nose and throat to supplement physical examination consisting of surface Anatomy/surface markings with morphometry with respect to landmarks for ENT specialty syllabus together with clear concepts of SOS structural / functional relations interlinked with various systems and processes of body. As the anatomical parts of specialty in human body do not work in isolation rather other parts and systems are interrelated by blood /nerve supply, respiratory, digestive, immune rather all the systems and functions / activities of processes and locomotion controlled by immune system through brain for protection from any threat. ENT specialty/super-specialty are, anatomically and functionally very closely, associated with respiratory functions together with processes of secretion of mucus, constriction/ dilatation of trachea, bronchus effecting functions of lungs and working of immune system commanded/controlled by brain and nerve network. The ENT structures are also directly or indirectly related to many other structures, organs and systems together with their innervation by nerve network and information flow from/to brain. Therefore, the **syllabus** of HA must envelop all the related structures, their developmental or otherwise variations/anomalies and distortions which are caused by *invasion of pathogens, injury or trauma, misuse of limbs, iatrogenic injuries, sudden exposure to varying environmental conditions and many times by reactions /side-effects of medicines including cascading impact, on kinematics associated with activities and functions of corresponding SOS including two-way communication through nerves, haemo/fluid dynamics of flow of fluids via vessels/organs, skeletal system of bones, muscular system and processes like* secretion/absorption from glands/organs of the ENT stream related to their application in clinical analyses of this specialty. *The distortions* are detected by imagery and its interpretation based on anatomical variations/anomalies/distortions in morphology and lab. tests. In addition to this, with the advancements of medicinal and surgical techniques, the microanatomy can further reduce the invasive effect of these treatments. Therefore, *it is worthwhile to include all above mentioned anatomical parts and their Microanatomy in the syllabus of theory and practical both*. The syllabus for UG, specialty and super-specialty may be segregated depending on the clinical need of courses. Similarly, the syllabus of HA can be standardized in other specialties, namely, Pediatrics, Obstetrics and Gynecology, Pediatrics, Ophthalmology, Orthopedics, Medicine and Surgery and corresponding super specialties.

It is worthwhile to add that the teaching/examination of the above anatomical syllabus depending on courses can only be delivered by experienced, apt and skilled anatomical *faculties* [4,22-23].

The model examination/tests schedule of HA: The tests/ examinations' schedule of Anatomy should be intermingled with clinical training program/tests/ examinations schedule in corresponding courses.

The papers setting of examinations/tests in HA: The examination will be taken in theory and practical. So, the question papers and experiments in HA should be prepared from entire syllabus on the same theme as described for preclinical phase, that is the question papers of HA during clinical phase of UG, specialty and super-specialty courses should have 5 types of questions. For example, MCQs, SAs, ESAs, LAs and Diagrams. However, the question papers should focus on clinical need rather than basic Anatomy. For guidance, a sample questions of each of 5 types of questions is given here under. *Model MCQ*, 'write the name of distorted structure for bronchial asthma, 1. Trachea, 2. Lungs, 3. bronchi and 4. All of the above.", *SA*, 'write type of distortion in anatomical structures in trachea during asthma.', *ESA*, 'Why anatomical structures in trachea are deformed in asthma?' *LA*, 'Describe various anatomical and functional complication in an asthmatic patient with the help of involved structures and processes coupled with analysis of side-effects.' and *Diagram*, 'Sketch the respiratory track from nose to lungs.' The questions for all the courses will be prepared from the allocated syllabus to various courses, UG/Specialty/Super-specialty.

Practical examination during clinical phase: The Practical examination in HA during UG, Specialty and super-specialty clinical training stages can be designed on the basis of need and application of knowledge of Anatomy directly to diagnosis and treatment. The guidelines have already been laid down in the description of format of

practical examination in preclinical phase.

For UG during 2nd professional, 3rd professional and mini professional of six months the experiments will be set for practical examinations/tests on revision of syllabus of corresponding specialties to be revised or new additions for use in clinical practice. The experiments should be designed on practical knowledge and cadaveric dissection along with Viva-voce.

In Specialty clinical training, the practical examinations/tests in HA will be taken on revision of syllabus of Anatomy taught / examined during 3rd professional of UG isolating the Anatomy pertaining to single specialty. Whatever practical aspect of interlinked anatomical syllabus with clinical skill, is allocated and taught for better comprehension of clinical analyses during this training phase of specialty students, will also be examined with the help of Viva-voce and experiments scheduled in the practical examination during this phase. The nature and pattern of modules of practical examination will be decided on the basis of practical training requirement. Apart from this, the surgical treatment needs more anatomical backup as it is invasive treatment so to minimize the invasion, the discussion on involved Anatomy in operating room before surgery and surgical exercise is very essential as it already in practice in USA Philadelphia CA [18]. However, it will be highly beneficial if the entire surgical exercise is carried out, first, on cadaver by trainee students to boost the level of confidence, if it is possible.

The practical examination for Anatomy during super-specialization can be formatted as under. The practical examination in HA, during super-specialty, will envelop the monitoring of necessary and sufficient knowledge of Anatomy among the super-specialty trainees to diagnose the disease and administer the treatment as referred above. As the super-specialty professionals normally attend more critical and complex patients pertaining to the specific super-specialty, so, these professionals need clear concept of related anatomy, thereby, the experiments, under the format given for preclinical practical examination, should be designed to have relook of related Anatomy already taught and examined during their specialty program and advanced Anatomy to be added as per need of the diseases depending on the syllabus. The practical examination should concentrate on how Anatomy related to complex problems of diseases and should be tested by Viva-Voce. The experiments on practical examination should be designed on the basis of failure cases due to lack of anatomical knowledge. The use of endoscopy, laparoscopy, robotic surgery, imagery guided surgery including many other advanced instruments in diseases of super-specialty must need more accurate and precise morphology/morphometry of SOS should also be examined. This is essential not only to surgeons but also this is needed to physicians in analysis of diagnosis/treatment to avoid, misdiagnosis which always leads to mistreatment, and to avoid side-effects as these may not only be heavy on the pocket of patients but also many times these may result in mortality.

Evaluation & promotion during clinical phase:

Having planned a good examination system, its evaluation also has immense importance as right, objective and useful evaluation plays crucial role not only in grading the comprehension, ability, power of expression and knowledge of HA to be applied in safe and successful clinical practice but also it encourages the students for betterment of their future to become a skilled and proficient Doctor. The evaluation has already explained in developing an examination system in preclinical phase of medical education. That remains a guiding factor for this examination system also. As regards promotion to emerge as a successful healthcare stalwart, the above-mentioned strict norms should be observed to maintain the quality of product.

3. Results

The outcomes of standardization and scheduling of anatomical syllabus: The standardization of **syllabus** of preclinical anatomy has not been done so far. The syllabus of HA has been arbitrarily pruned due to reduction of schedule of preclinical Anatomy and cadaver dissection. So, different syllabi are taught in different medical institutions which indicate that the syllabi have been adopted by pick and choose methods at the free will of the institutes. This has further aggravated the situation of standardization of syllabus. That is why the arbitrary syllabus has been adopted in different medical institutions. However, the guidelines for standardization and scheduling of syllabi of HA for new reformed examinations in preclinical and clinical phases have been given in Material and methods section. The preclinical examinations have been designed as 5 PCTs (part completion tests), 2 Terminals and Final examination. The entire basic Anatomy has been divided into 7 topics, segregating into 5 extremities. This will be planned to be conducted progressively, by 5 PCTs. The PCTs will be conducted after completion of extremity. There will be 2 terminals every six months and a final examination within 12 months as currently schedule of HA has been reduced to 12 months. The schedule has presented in Table 1. The planning of examination with weightage has been done as shown in Table 2, 3. The PCTs will be having a theory paper of 50 marks followed by a practical for 50 marks. The terminals will be taken. through 2 theory papers each carrying 100 marks and a practical for 100 marks totaling to 300 marks. Final examination will consist of 3 papers in theory and a practical carrying 100 marks each totaling to 400 marks. There will be a weightage of 10% for PCT aggregates, 20% for terminal marks obtained by the students and a weightage of 70% may be given to marks obtained in Final Examination (Table 2, 3).

Paper Format: 5 types of questions have been proposed in the model for all the theory examinations. These are MCQs, SAs, ESAs, LAs and Diagrams. MCQ has been assigned 1 mark, SA 2 marks, ESA 3 marks, LA, 10 marks and Diagrams, 5 marks each in theory. The proper weightage

to questions and PCTs, Terminal and Final examination has also been considered. There will be 7 types of tests associated by Viva-Voce in practical for marks described above. The details of these questions have shown in the Tables (2, 3).

Evaluation: The evaluation will be straight and objective for MCQs SAs. The ESAs, LAs and Diagrams will be designed having clearcut divisions according to marks and that will be communicated to evaluators explicitly.

Promotion: So, after evaluation result will be prepared for promotion. Thus, 5 PCTs will contribute weighted marks equal to 10% of marks obtained by students out of a total of marks of 50 = (500*10)/100 (As there will be 5PCTs of 100 each), the terminals will contribute with a weightage of 20% marks, so, this will be of 120= (600*20)/100 (As there will be 2 terminals of 300 each). The final examination will contribute a total qualified marks of 280=(400*70)/100 (As there will be one Final examination of 400 marks) forming a grand total of marks 50+120+280=450. The passing marks for promotion may be kept to 60%. For example, if a student secure 300/500 in PCTs, 360/600 in terminals and 240/400 in final examination, his aggregate will be= 30+72+168 = 270/450 forming 60% marks. So, he will be declared passed. The tentative results may be divided into 1. First division may be kept at 80%, second division at 70% and minimum passing marks for examinees will be 270 while maximum will be 450.

The examinations in HA during Clinical phase: The clinical training, in medical education, provides the opportunity to realize and assess the need, utility and application of HA during clinical analyses. This will ensure as to how much HA is required during different clinical courses, such as UG, Specialties and Super-specialties coupled with, how, then, can it be cultivated? This will help in standardization of syllabus clinical phase of medical education. Presently, there is no syllabus or schedule of HA to be taught/examined in the clinical phase of medical education so, the inclusion of integrated needful Anatomy horizontally and vertically, is recommended such that vast syllabus of HA, may be distributed among the preclinical and clinical phases to eliminate the menace of inadequate Anatomy.

Standardization of syllabus for teaching/examination of HA: The syllabus of HA during clinical phase is dependent on revision of involved basic and applied HA based on the need of Anatomy during specialty and super-specialty courses. Broad guidelines have been given in material and methods section but final standardization of syllabus will be finalized by senior anatomical and specialty / super-specialty faculties based on need and application of Anatomy in diagnosis and treatment. This will almost completely solve the problem of inadequate Anatomy limiting to teaching/examination to specific specialty / super-specialty streams of medical education which may immensely improve the safe and successful clinical practice. However, so far, no syllabus has been prescribed during clinical phases.

Scheduling of syllabus for teaching/examination of HA: The examinations schedule depends on teaching schedule and syllabus taught. As soon as the syllabus of HA is standardized and started to be taught, the examination, as suggested in material and methods section, will be scheduled in conformity with clinical examinations schedule keeping the formats of examinations in HA as proposed in preclinical phase.

Table 2. 'Theory papers of Human Anatomy': PCT, Terminals, Final model examination and weightage

			Type of Questions						Ws
	Tests/examination	Papers	MCQ's marks	SN Marks	ESN Marks	LA marks	Dia. marks	Total marks	
Theory question Papers	PCT-5 =250	5	10*1=10	5*2=10	5*3=15	1*10=10	1*5=5	50	0.1
	Terminals-2= 400	4	20*1=20	10*2=20	10*3=30	2*10=20	2*5=10	100	0.2
	Final Exams-1=300	3	20*1=20	10*2=20	10*3=30	2*10=20	2*5=10	100	0.7

PCT=Part completion test, MCQ=multiple choice question, SN= short notes, ESN= extended short notes, LA= long answers, Dia= Diagrams, Ws= weightages

Table 3. 'Practical related to Human Anatomy': PCT, Terminals, Final model examination and weightage

Format of Practical examination										Ws
Type of test /exam.	Experiments	Spotting marks	Organ Id marks	Histo. S. Id marks	Bone Id marks	S M Rad. /marks	Emb. Viva	Dissection	Total marks	
	Expt.no.	1	2	3	4	5	6	7		
PCT/5	7	10	10	5	7	8	5	5	50	0.1
Terminals/2	7	15	25	10	15	15	10	10	100	0.2
Final Exam.	7	15	25	10	15	15	10	10	100	0.7

PCT=Part completion test, Expt.no= experiments number, Id= identification, Histo, S Id= histology slide identification, S M = surface marking, Emb= embryology, Ws= weightages

Paper setting in HA, its evaluation then promotion to next stage: The paper setting will be done on the same format and pattern as in preclinical phase with a difference that these papers should be in a position to test the ability of student to apply needful Anatomy in diagnosis and treatment while analyzing the patient's problems as ***it is not only learning of facts, but the training of mind to think***" as aptly said by ***Albert Einstein***. Questions in theory paper should base on Surface Anatomy & surface markings for physical examination in initial diagnosis of the patient, so that the trainee may use this knowledge to locate the distortion in concealed SOS from the skin of the body of patients corresponding to disease and signs and symptoms. The questions should also be framed on cascading changes after distortions in functions of systems and processes so that by eliciting the signs these may be confirmed by imagery and lab. tests. The questions should also focus on radiological interpretations of structures and distortions in the light of variations/anomalies in morphology and morphometry. When it comes to planning of treatments, questions should also be on side-effects of medicines/drugs in the light of their effect on other parts of body and detailed configuration of normal/distorted structures in forming organs/systems to avoid iatrogenic injury. The sample of questions has been given in ***Material and Methods*** section. The *evaluation and promotion* should be done as in preclinical phase.

4. Discussion

As already described, the upcoming medical professionals possess inadequate knowledge of needful Anatomy, so, it deteriorates safe and successful clinical practice lowering the standard of medical education. As the Anatomy is taught and examined in two episodes 1. teaching/examining Anatomy during preclinical stage and 2. teaching/examining Anatomy during clinical stage. As traditional trend of teaching/examining Anatomy during preclinical phase is delivering arbitrary syllabus of basic Anatomy with pinch of clinical applications due to reduced time schedule of Anatomy from 18 months to 12 months so, it affected the delivery of Anatomy. Apart from this, the examination system too has become formal. This has also tremendously reduced the delivery of Anatomy as it has induced the students to pass the examination rather than to grasp the subject. This has almost the paralyzed the delivery/ acquisition of knowledge of Anatomy. The plight of delivery of Anatomy in clinical phase is still miserable which might have tremendously contributed to inadequate Anatomy among the clinical students ready to learn clinical analyses as there is no teaching/examination syllabus / schedule of Anatomy in this phase. This is another a big reason of inadequate Anatomy among the clinical students.

However, the chief reason, for inadequate knowledge of Anatomy, is the present examination system which is a mere formality with deficiencies such as arbitrary syllabus, formal tests/ examinations' schedule, conservative question papers, subjective evaluation and hollow promotion policy during preclinical phase of medical education and nonexistence of ***any standard syllabus and schedule for teaching / examination in HA during clinical phase consisting of UG, (PG) specialty together with (P PG) super-specialty courses*** in all the clinical streams. Although, some Applied Anatomy on the name of Clinical Anatomy is referred by word of mouth traditionally, by clinical faculties who possess remnant knowledge of Anatomy learnt during preclinical phase, of course, adored with rich experience of clinical practice which provide piecemeal anatomical knowledge. But sound anatomical knowledge along with systematic syllabus is lacking as elaborated by Cornwall, 2013 and Leveritt at al., 2016 [4,6]. '*One of the greatest factors, for inadequate HA among the medical trainee students'*, is absence of standardized syllabus and formal anatomical examination system in preclinical phase and *no schedule of teaching or examination in HA during clinical training phase pertaining to UG, PG, P PG courses*. Let us illustrate how this inadequacy influence the clinical practice.

The clinical constraints of inadequate Anatomy:

The arbitrarily, pruned syllabus of Anatomy and improper monitoring due to unsuitable examination of acquired knowledge of UG/PG/P PG students create incapability of analyzing diseases as Pathology deals with analysis of morbid structures of human body [24]. The morbidity is distortions/injury in macro/microstructures of SOS causing disturbance in metabolic and other processes, thereby, impairing of functions/activities of SOS. These impairment and imbalance of processes produce signs and symptoms of discomforts to patients as obtained via patient's input. But the distortion in concealed organs and systems underneath skin is estimated by physical examination with the help of knowledge of surface Anatomy and surface markings, on patient input, thereon, during preliminary diagnosis. Then, the distortions are tested through imagery interpretation by comparing with normal and distorted structures and laboratory tests for disturbed processes. *These analyses can be carried out only when the trainee student have clear concept of morphology/morphometry, configuration of structures with respect to functions of organs and systems of gross Anatomy including variations/anomalies, the developmental processes of SOS, the standard signature of axons and fascicles (microstructures) through histological slides, the interrelations among anatomical distortions and processes, impairment of functions/activities of SOS, signs and symptoms coupled with diseases for the specific specialties*. So, if these anatomical factors are not known, the *morbid structures and its impact on impairment and signs and symptoms cannot be correlated*. Now, till the normal functioning of SOS are not known, the effect of morbid structure on the functions and activities of SOS including *the degree of impairment of functions and activities of those SOS, cannot be estimated*. This is a severe constraint in learning clinical analyses as the signs and symptoms of disease are produced by impairment of SOS and changes/disturbances in

processes by distortions through action of *Immune system* against the threat. As, no sooner than, the structure is distorted by causative of diseases, this message is communicated by the sensory nerve network to brain, then the brain sends command to various anatomical elements (SOS and Processes) to take counter action against the threat. These create impairment, changes in processes producing signs and symptoms of discomforts in the body. This suggests that the trainee students must know the *complete Anatomy along with Neuroanatomy in relation to functioning of Immune system involved with diseases of specialty*. Apart from this, cascading effect on SOS and processes after medication, the functioning of the Immune system should also be taken care to avoid adverse side-effects and detailed configuration and morphology of SOS along with variations/anomalies may constraint the radiological interpretation and surgical procedure. Thus, this involved anatomical knowledge is a constraint for safe and successful clinical analyses.

In the same continuation, these specialists (**PGs**) examine more advanced diseases so, they need disease and specialty specific advanced Anatomy, to investigate more critical cases. Such as, these trainees require the knowledge of more variations/anomalies/distortions, the specific development of SOS of the specialty, more precise comparison of normal / distorted structures (by more accurate knowledge of morphology/morphometry of SOS) in images, normal / variant/distorted microstructures in histological slides their correlation to map the pathways of fascicles [25] for repairing less invasive fascicular surgery, specific and detailed interrelations of normal/distorted structures with functions/activities of systems, processes, organs and limbs, mechanism of generation of signs and symptoms and identification of diseases, of course, **for a single specialty**. Though the touching knowledge of Anatomy and physiology of **Immune system** might have been delivered broadly, in preclinical and clinical phase of UG course, yet more detailed working of Immune system corresponding to that specific specialty is essential to analyze meticulously, the diagnosis and treatment in that specialty. If the trainee students of the specific specialty do not *command above mentioned anatomical know-how, they cannot make a safe and successful clinical practice*. These are again constraints of clinical practice.

Further, the **super-specialty** medical trainees are trained for clinical analyses of more complicated and critically serious cases along with new diseases in that specialty so these trainees need more precise and deterministic diagnosis and treatment for safe and successful clinical practice. This advanced skill demands better command of involved and interwoven Anatomy together with very clear concept of functioning of Immune system for analyses of diseases during diagnosis. More Neuro/Micro-neuroanatomy is required to these trainees undergoing super-specialization in particular clinical stream. As after injury, there are two events, 1. the impact of distortion on processes, run in/by the organs, glands and systems, which are associated with working and functions of Immune system controlled by brain of the body to counter the threat, 2. The signs and symptoms of disease might be generated by neural disorders. In first case, normal but advanced diagnosis will be carried out whereas in second case, neural diagnosis should be carried out. These are the constraints faced by the super-specialist trainees. The treatment analysis also needs detailed Anatomy of organs/systems/limbs associated processes and interrelated Immune and nervous systems to estimate the *adverse effect of medicine/drug and chalk out the pathway to target distorted structure for its manipulation*. So, if the trainees do not possess this anatomical knowledge, their clinical analyses will be subjective, unsafe and unsuccessful clinical practice. *It is pertinent to mention here that the constraints described above are in addition to basic constraints in para1 above.* **Elimination of inadequate Anatomy thereby clinical constraints through new examination system:** As already pointed out that one of the crucial reasons for inadequate learning is obsolete examination system so, the reformed examination system has been designed to meet the challenges of inadequate knowledge of Anatomy hampering the comprehension of clinical analysis. All the constraints of inadequate Anatomy mentioned above can be compensated by well organized examination system as described in material and methods and results sections.

In the new examination system, the syllabus of Anatomy has been distributed between the preclinical phase and in clinical phases consisting of UG, (PG) specialty and (P PG) super-specialty courses focusing on application of Anatomy taught, therein, under the condition of reduced time schedule of preclinical phase. However, the standardization of syllabus is to be done according to the guidelines given in this model. However, i*t is pertinent to mention here that the a very strong recommendation has been made to introduce necessary and sufficient teaching monitored by reformed examination system of HA by experienced faculties of Anatomy and clinical sciences* in this phase of medical education.

The reformations in paper setting of Anatomy and its encouraging evaluation pattern and strict promotion strategy as illustrated in material and methods section will definitely, bring sky change in comprehension of clinical practice. Let us examine, how?

Such as during clinical phase in **UG course**, though the students might have learned the surface Anatomy, surface markings and Radiology in preclinical phase to some extent, yet the instant and timely revision and additional required Anatomy will be taught and examined through a continuous integration of Anatomy. So, while examining the patients, they will use this currently delivered knowledge of Anatomy. For example, a patient comes with a problem of sneezing and continuous flow of nasal secretion associated with headache and fever in OPD, the UGs in clinical phase diagnose as under. In such cases, patient might have been exposed

to change of weather associated with sharp change in temperature by inhaling air through the nose-throat and bronchus to reach lungs for oxygenation. In this process, the surface, which came in contact with air, might have experienced cold and there would have been differential contraction (anatomical distortion) of tissues along with activation of nasal glands in this track. This might have been communicated by innervating nerves to brain as threat so it might have sent a command to take precautionary measures which might have activated various nasal glands for secretion (anatomical structures) causing flow of nasal discharge obstructing even breathing process, fever by activation of temperature center in the brain and clearing of track for any obstruction causing sneezing. The secretion and lower temperature may create obstruction in breathing and headache through other processes and system's functioning. These appear to be caused by allergens/viral disease in throat effecting ear, nose too. Thus, such patients are prescribed specific antibiotic for throat and specific anti-inflammatory /pain killer/ antipyretic drugs which may have less or no side-effect for these anatomical structures/organs/systems in this anatomical region. The medicines are prescribed based on the severity of signs and symptoms in this viral disease.

Similarly, during **specialty course** also, the upcoming specialists will be supplemented with disease/case specific Anatomy through vertically integrated delivery and the new examination system. Such as, during Analysis of disease, though the students already have preliminary idea of estimating distortions in corresponding SOS and their cascading effects on functions and activities of metabolic and other processes through Surface Anatomy, Surface Markings already studied in UG course yet through revising, refreshing and adding more knowledge through integrated delivery/examination of focused Anatomy, the knowledge is updated. Thereafter, the injured structure will be identified by radiological imaging/interpretation and the disturbances in processes by laboratory test results. It is worthwhile to add here that the trainee students should also learn radiological interpretation to keep check and balance over the radiological interpretation. But radiological interpretation completely depends on acquired knowledge of normal / distorted/variant morphology of SOS which will also be supplemented/examined by integrated Anatomy. As PGs specialties are deputed for patient's investigation in OPD/wards/emergency services. If they encounter a patient with pain in right iliac fossa radiating to umbilicus, it is expected that there is inflammation in appendix. This may be due to some small seeds or any hard food particles accumulated or bacteria in appendix. This might have created anatomical distortion in the shape and size of appendix. appendix hardly affect the activities and functions of any SOS except inflammation while touching other structures. So, while diagnosing the pain by physical examination through palpating, percussing and auscultating, the diagnosis is carried out. The trainee student should be aware of surface location of this structure and its probable variations from surface landmarks to carryout physical examination further. It is pertinent to mention here that it is very difficult to image this distortion by imagery. The elicitation of signs is done by 'Rovsing Test'. This test is completely dependent on the *anatomical location, morphology and morphometry, configuration of structures in organs and systems surrounding the appendix.* The left iliac fossa is pressed/palpated so, the coils of intestine come in contact with inflamed appendix which gives a feeling of pain to the patient. In normal case, Rovsing test is negative and the signs and symptoms are not elicited in case of retrocecal and pelvic appendicitis. Moreover, other causes of pain in right iliac fossa should also be kept in mind to differentiate the pain of appendicitis. The appendicitis is treated, in general, by surgery and very rarely by medicines. For surgical treatment, the surgeon needs the access path to appendix and meticulous configuration of surrounding structures to avoid any iatrogenic injury. *Here in the new examination system, the questions in Anatomy to be asked from trainee students keeping in mind the testing of knowledge of HA required in their streams of clinical practice as illustrated above.* Not only the knowledge of macro/microanatomy will be delivered to **Super-specialists** during this stage but also *it will be asked in the new examination model to enhance the cognitive ability for future use*. The clinical students must have the knowledge of working and functioning of body's *Immune system* to master the diagnosis besides revising the involved Anatomy in diagnosis discussed in UG/Specialty courses. Furthermore, the medical students also analyze the treatment for restoration of distortions and corresponding disturbances in processes in the light of mechanism of actions of medicines/ drugs and their side-effects along with side-effects created by the functions of Immune system involving Anatomical SOS. The distortions ***create signs and symptoms of diseases*** through impairment of functions / activities of SOS and disturbances in processes. This is how the disease is identified/confirmed in diagnosis. The analysis of treatment needs the Anatomy likely to be adversely affected by medicines/drugs and iatrogenic injury. This involved Anatomy may be asked in the theory /practical examinations to eliminate inadequacy of Anatomy.

More advanced and critical patients approach to a super-specialist so; more meticulous HA is required for the disease to be analyzed and the treatment be prescribed. For example, typical cardiac pain is felt in the left side of chest radiating to left arm. There may be many reasons but if it is focused on cardiac disease, it may be blockage of coronary artery, valve malfunction, myocardial disorder or something else. This needs specific imagery interpretation and cascading effect on disturbed processes to be analyzed. This requires normal and variant morphology and morphometry (shapes, sizes, orientation) of heart and configured structures, branching pattern and pathways of neurovascular structures, their normal/obstructed diameters and other knowledge associated with such clinical cases in the stream of their

clinical practice. If surgery is required to be carried out, the detailed access path and distorted structure and configuration of surrounding structures is to be meticulously located, mapped, identified precisely to plan surgery. If the accumulation of necessary and sufficient syllabus of HA is monitored by new examination system and found satisfactory through the questions prepared on the basis of theme of 5 types of questions as elaborated above in reformed examination system, the trainees are ready to take a challenge of grasping related medical subjects and apply HA in clinical practice.

There are a few institutes in the world where a day before surgery, the surgeons and trainees are given complete demonstration of mapped access path to target distorted structure and detailed and meticulous configuration of surrounding structures involved in this surgical intervention to plan surgery This process of integration of anatomy to surgery has already been started in the University of South Florida. Regional anatomy has been taught before and during surgical procedures in the operating room [26,27]. Moreso, the procedure has been suggested to be carried out on cadavers to contain the iatrogenic injuries [2]. The questions in the examinations should be so designed that these cases should be covered in question paper with special attention to failure cases due to anatomical lapses.

However, there is a very beautiful reformative decision by 'The Brighton and Sussex Medical school (BSMS) in Great Britain' to implement horizontal and vertical integration of Anatomy in their medical graduation course [18]. But not only the hours of dissection and teaching have been drastically reduced, but also, the teaching by demonstrators / tutors/bureaucrats/fellow colleagues and arbitrary syllabus of HA are deficiencies in this system.

Whatever advanced, secured and focused on mass destruction, the weaponry be, till the soldiers do not have intuition, encouragement and zeal to fight against their enemy with the objective to defeat, it will be rather impossible to win the fight. [Dr Rajani Singh]. Similarly, the first and foremost necessity to cultivate and test the necessary and sufficient HA among medical trainees at various stages of medical education and clinical practice, is that both ***trainee students and both faculties*** should be motivated to contribute to their level best to achieve the goal of sufficient HA. If both or any of them will ignore the reformations, it will not bear fruits as sweet as needed.

5. Conclusions

The chief advantage of reformed examination system is to remove the menace of inadequate knowledge of Anatomy to clearly understand the safe and successful clinical practice. The suggested reformed examination system coupled with strong recommendation to integrate Human Anatomy horizontally and vertically in UG/ specialty/super-specialty courses together with monitoring of adequate Anatomy through the above examination system have been proposed in this article. Thus, *reformed new model of examination system will eradicate inadequate knowledge of Anatomy.*

6. Recommendations

As there is no conventional teaching and examination system of HA during clinical phase of UG, specialty and super-specialty courses prevailing in medical education so it is strongly recommended to integrate standardized syllabus of HA and an examination system as brought above.

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