Medical Education Relevent to our Social Needs

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Our system of medical education was inherited as legacy of British. Eventhough beneficial to our progress, it has not fulfilled the aspirations and expectations of our people particularly rural poor. Over the years I have been deeply concerned about imbalance in Medicare and rural urban divide. I had the good fortune of working for a three year term in a primary health center almost 45 years ago. Medical education has always been debated and discussed in many countries across the world.

In spite of more than 55 years of our independence we are unable to sort out our priorities. The medical education cannot be uniform in all countries – many of our neighboring countries like Pakistan, Sri Lanka and even Myanmar have realized the need for effecting changes in medical education to address the public health issues and primary health care. In India we are still reluctant to look into the realities and we fail to accept the most needed changes in medical education. No doubt we need specialisation and super specialisation – we do have high tech investigatory facilities like CT/MRI and we are at the cross roads – we need to look into the concern of the 80% of rural population who lack education – water supply, sanitation and nutrition. These are all public health issues. Our medical education should be directed to primary health care.

Health infrastructure is beyond the reach of 72.2% of rural population – our past experience have shown that mere establishment of PHCs and CHCs have not adequately met the needs of the community.

Need for health education

85-90% of diseases are due to malnutrition and poverty and poor living conditions. To increase awareness among the public in health education we need to train middle level health professionals who are local persons drawn empowerment of women to take care of family health – David Warner's book 'Village where there is no doctor' is a useful handbook. I understand Cuba is the only country which has a system where every street has a health professional identified as first level of contact whenever any one falls sick or meets with an emergency. He or she, a well trained professional health worker can identify the problem, offer necessary treatment or manage the emergency situation and arrange for transportation to referral centers.

Starting from Bhore Committee (1946) there were several attempts at reorientation of medical curriculum to produce a basic doctor or community physician. The integrated rural programmes were conducted in Kottayam, Kerala and CMC Vellore. Reorientation of Medical Education (ROME PROGRAMME) of WHO for Asian countries was aimed at developing Medical education system responsive and relevant to the needs of the country by making necessary curriculum changes. The alternative/innovative model of medical education was proposed by Dr. G.R. Dutta, approved by Medical Council of India awaiting clearance from the central Govt. Such innovative models are successfully practiced in some of the countries. This model exposes the student first 1½ years in primary care, next 1½ years in secondary care and only during final 1½ years in tertiary care. This innovative curriculum provides the student first hand knowledge in the context of socio economic and diverse cultural situations, with better understanding of relevant health problems. It is cost effective without need for expensive college campus. The system can absorb non-core faculties and make use of available infrastructure in PHCs and CHCs.

Our medical education is mostly in tertiary care hospitals without any knowledge of real life situation existing in the villages. The students are taught in state of art technology with the result instead of primary care the learning is oriented to tertiary care. This triangle needs to be reversed with greater emphasis on primary care.

Tertiary institutional training

1) Mostly on obscure mechanisms of rare diseases.

2) Dependent on state of art technology & sophisticated high tech medical interventions.

Only 30% of patients who are urban benefit from tertiary care institutions whereas 70% of them do not receive any medical help.

- Teaching is didactic and theory based.
- More of information imparting than problem solving.

- The students are more oriented to examinations.
- Teachers lack training to impart knowledge.

In the pre-clinical years, which was 2 years earlier, has been reduced to one year to learn Anatomy, Physiology, Biochemistry with too much of information squeezed into the curriculum. In the clinical years there is hardly any integrated learning.

Our medical colleges are sequestrated from the community and the present system of medical education is not need based.

With more than 200 medical colleges and 20,000 medical graduates along with other systems of doctors our doctor-patient ratio in India is not inadequate. But where are they? How are they distributed? Whom do they serve? Here lies the problem.

During Recent years we have seen mushrooming of private medical colleges in many states of Karnataka, Maharashtra, Tamil Nadu, Pondicherry, Andhra Pradesh, Kerala and Delhi. The trend is towards increasing commercialization. The health industry would like to get quick return for their huge investments at the cost of patients, who are required to undergo unnecessary investigations and expensive treatment. Even though to charging capitation fees is punishable under the law, the practice continue to go unabated with tacit understanding between different agencies. Through the private medical colleges we are creating a large number of affluent medical professionals from the privileged sections of the society. Having spent a fortune to get medical education how do we expect them to serve the rural population? Many of us feel that the medical degree should be awarded only after two years of service in rural areas irrespective of where the candidate comes from – Government or Private medical colleges.

What are the radical changes required in medical education?

There are many students, qualified as doctors, find at the end of the course, medicine is not their cup of tea – some doctors choose professions other than practice of medicine. There is need to select students with right attitude and aptitude – and prepare doctors for the needs and expectations of the society. The curriculum of medical education needs to be revamped and made primarily self directed and student centered. It should be to encourage problem solving rather than information gathering. To ensure competency rather than acquiring knowledge. Greater emphasis is to be given to solving common clinical problems rather than searching for cases, which one may see once in a blue moon or may not see in his lifetime.

Medical Education & Training should aim at improving the quality of individual care, integrated care, ethics, promotion of healthy life style and protection of environment. These are rarely emphasized in medical curriculum. Having been trained in tertiary care hospitals in urban surroundings influenced with pharmaceutical pressures the doctor does not realize need for cost containment, which is most important in health care delivery today. Instances are plenty where rural indebtedness is caused by spending on medicare which has become a necessary evil even to the less affluent.

The curriculum should be need based – community based with greater emphasis on common illnesses – what the student gets to work in the community. He should be encouraged to make innovations to suit to the needs taking into consideration financial and socio cultural constraint.

Reaching out in to the villages provide the student better understanding of the community he is expected to serve. With interaction with the people he would develop humility, empathy and better appreciation of public health issues and human values, and foster team spirit with participatory approach.

To keep the medical curriculum with focus on social needs the student needs to learn social and behavioral sciences, epidemiology, biostatics and public health; curriculum need to be modified deleting major portion of our present syllabus, which is hardly applied to them in day to day practice.

What do we expect out of those who are the end products? At the end of their training they should be able to assess and improve the quality of health care making optimal use of new technologies, promote health life style and work efficiently in teams. Our present day training is inadequate to manage all by himself in the villages. This is one of the unspoken reasons for the doctors feeling reluctant to serve in the villages. We need more generalists to cater to 80% of population villages. With the type of training offered in tertiary care hospitals most of our graduates are best suited to work as junior doctors in large corporate hospitals to execute the orders of their consultants. Future medical training must be such that the young doctor should feel confident to make accurate diagnosis and plan management based on bedside skills along. It is well known that simply listening to the patient long enough is adequate to diagnose most of the diseases. The value of clinical examination is often ignored. Use of Doppler instead of feeling the pulse, Biothesiometry in place of routine neurological examination are some of the examples of evil effects of our clinical training in high tech medi care. The doctor has to develop good

communication skills – there is hardly any place in our curriculum on bereavement and death.

The doctor should achieve competence in procedural skills to practice independently. These are the basic minimum procedural skills required for every medical doctor.

Procedural skills

Endotracheal intubation

I.V. access

Cardio pulmonary resuscitation

Lumbar puncture

Trauma care

Pleural aspiration

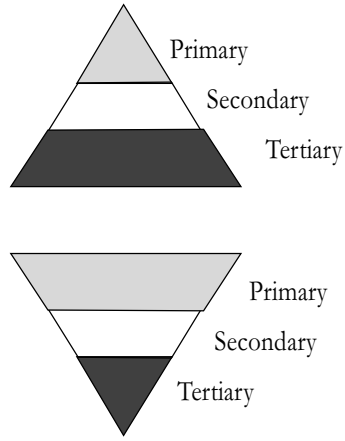
Tension pneumothorox

Naso gastric lavage

Taking ECG

Ob Gyn	:	Normal delivery Episiotomy suturing Forceps extraction
Path	:	Exam or smear
Ortho	:	Splinting fractures
Paed	:	Resuscitation of newborn
Surgery	:	Assessment and closure of wounds burns cathetrisation/SPC
ENT	:	Foreign bodies/ nasal packing trachestomy

There is need for continuous assessment on attitude, knowledge and skills, with mid term evaluation to identify weakness if any and to correct them. The practical examination or orals have to be Objective Structured Clinical Evaluation (OSCE) type eliminating bias and ensuring uniformity.



What type of doctors we need in India?

I am convinced that we need the following three categories of doctors

• Family physicians + Emergency care (70%)- Oriented to preventive medicine and public health with special training in emergency care.

• Rural Surgeons (General Surgeons) (25%)- With ability to manage surgical emergencies/emergency Obstetrics, Ano rectal problems and trauma care

• Specialists in tertiary care medical college hospital (5-10%)- To serve tertiary care/medical college hospitals, to perform- highly technical procedures like kidney transplantation, CABG, valve replacement arthroplasty, spine surgery neuro surgery, radiation oncology, vitreo retinal surgery, etc.

Internship & P.G. training

Majority of medical graduates today tend to opt for post graduation which has focus on tertiary care and super specialization. The period of internship – most valuable period where the trainee could learn technical skills and take part in managing emergencies is often spent preparing for entrance examinations at national or international level. It is time that the trainee is assessed continuously during the internship and also at end of the course before recommending him/ her for the award of medical degrees.

I would like to conclude quoting a message from equally dynamic personality, late Mrs. Indira Gandhi addressing the medical graduates, she said- "*Why have you chosen medicine as a career? Surely not merely out of expectation of gain or fame. These come to the successful in any profession. What must have influenced your own decision is a special sympathy with other people and urge to alleviate their suffering. Guard and cherish that gift of sympathy. For, it is given to doctors more than to all others, to appear in the people's prayers*".

...Indira Gandhi

Revised competency based curriculum

The revised competency based curriculum has been developed by the experts in the specialties of Medicine, OBG, Dermatology, Radiology, Anesthesiology, Ophthalmology, ENT, Orthopedics, Psychiatry, Pediatrics, and Health & Hospital Administration. The curriculum has details of objectives of training, syllabus, tentative posting schedule in various units, list of the desired clinical skills, list of standard text books and reference books and journals. The curriculum also has sample cases and short structured questions for six monthly assessments. These are available on the NBE website.

Commentary

Problem Based Learning

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In the past decade, faculty in educational institutions and universities world wide have begun to move away from traditional didactic instruction to a more student-centered approach to learning. An increasing number of academic institutions throughout the world have recognized that Problem-Based Learning (PBL) as an instructional method that challenges students to develop the ability to think critically, analyze problems, find and use appropriate learning resources.

For the faculty, who are looking for ways to get their students to think, regardless of their disciplines, Problem-based learning (PBL) is the instructional method. It is a pathway to better learning, which challenges students to "learn to learn," working cooperatively in groups to seek solutions to real world problems. These problems are used to engage students' curiosity and initiate learning the subject matter.

Traditional system of learning

The traditional system of learning with its emphasis on teacher–directed learning, passive student participation, and rote memorization of massive amounts of information, was seen as an increasingly inefficient and outmoded system of education and particularly not suitable for training medical and other health workers.

Traditional lecture-based education is driven by the instructor, who controls content delivery. Much of allied health or medical education is memorization of facts and data, often composed of abstract information, which is to be applied clinically at a later time. Cole asserts, "students experience overload, lose their motivation, find it difficult to see the relevance of what they are being taught, and later on experience difficulty in retrieving and applying in a clinical setting the information they learned early on". suggest that although the Many a time health care provider possesses the knowledge, but he or she may be unable to access it during application, especially in actual field or clinical settings. (Boshuizen & Schmidt)

Health sciences and medical education

Problem based approach advocates that learning occurs best when associated with concrete clinical problems. Students explore the basic science and clinical content by discussing and hypothesizing about clinical problems, not through lectures.

The objective of medical education is to prepare physicians to evaluate and treat patients. PBL offers a logical approach to emulate and develop the types of skills, attitudes and applied knowledge that students need to become outstanding physicians.

The group problem-analysis and independent self-directed study, rather than teacher or examination-driven education, may encourage students to become more thoughtful problem-solvers and life-long learners.

PBL is now the instructional method of choice in an increasing number of medical schools around the globe. Introduced in 1969 at McMaster Faculty of Health Sciences, Canada, PBL is now used in about 150 (of 1400) medical schools worldwide.[1] In Australia, PBL was introduced quite early, in 1978, through the pioneering efforts of the late David Maddison and staff at the University of Newcastle. Other medical schools in Australia, such as the University of Sydney, Flinders University of South Australia, the University of Queensland and Monash University, have since followed.

Why has PBL recently become popular in medical education? Clearly, the approach matches current efforts to involve students more actively in their own education, which does improve learning. In addition, students prefer PBL to other methods and spend more time on self-directed learning activities, using more information resources

Definition of PBL

Definitions of PBL vary, but a comprehensive example would be "an educational method characterized by the use of patient problems as a context for students to learn problem-solving skills and acquire knowledge about the basic and clinical sciences".Students usually meet in small groups two or three times a week for PBL tutorials. They are presented with a clinical problem (eg, a patient with chest pain), and, in a series of steps, they discuss possible mechanisms and causes, develop hypotheses and strategies to test the hypotheses, are presented with further information, and use this new information to refine their hypotheses, finally reaching a conclusion. A tutor usually acts as a facilitator, guiding students in this group-learning process.

In the course of this exercise, students identify both their existing levels and gaps

in their knowledge. These gaps form the basis for independent learning outside the PBL tutorials. The identification and pursuit of these so-called "learning goals" is a key element of the PBL process.

Rationale for using PBL

The PBL approach is based on principles of adult education and cognitive psychology. It differs fundamentally from traditional curricula, in which students acquire 'background' knowledge of the basic sciences in the early years of the course and in the later years apply this knowledge to the diagnosis and management of clinical problems. This traditional approach has been criticized for a number of reasons.

- It creates an artificial divide between the basic and clinical sciences;
- Time is wasted in acquiring knowledge that is subsequently forgotten or found to be irrelevant;
- Application of the acquired knowledge can be difficult;
- The acquisition and retention of information that has no apparent relevance can be boring and even demoralizing for students.

PBL can overcome many of these problems. Various disciplines, particularly the basic and clinical sciences, are integrated throughout the curriculum. As students attempt to understand and solve clinical problems, they learn about normal bodily structure and function, and apply this knowledge to their search for a solution. Learning is contextual, and builds on students existing knowledge. This process can help in retention add interest and increase motivation to learn. Students (with initial help from tutors) determine both their own learning needs and the strategies they need for learning (eg, the efficient accessing of library resources or the formation of study groups).

Lipkin notes two encompassing reasons why one medical school in particular elected to examine PBL. One reason is an increase in the motivation level of the students because they would be working with information directly related to their choice of profession. The second reason is that the problem-solving abilities of the graduates, and in turn, their creative abilities, would improve in such a program. Each of these abilities is believed to be vital to medical professionals. Lipkin asserts that the pioneers of this medical school "anticipated outcomes of improved learner satisfaction, more relevant and better organized learning, and thereby improved and better sustained clinical performance". Schmidt notes prior research by Barrows and Tamblyn when he reasons that medical students are adept at acquiring the knowledge of medical school, but lack the ability to apply that knowledge clinically. This has further led medical schools, as well as other disciplines, to seek alternatives to traditional curricula. One such alternative is problem-based learning.

Educational objectives of PBL

- To develop students clinical reasoning and problem solving skills
- To promote students inter personnel skills and ability to work as team members
- To develop students independent, self-directed critical thinking and learning skills
- To encourage students sensitivity to all of patients needs

Advantages of PBL

- an increased retention of information;
- the development of an integrated (rather than discipline-bound) knowledge base;
- an encouragement towards lifelong learning;
- a greater exposure to clinical experience and at an earlier stage in the curriculum;
- an increased student-staff liaison; and
- an increase in overall motivation.

Disadvantages of PBL

- Initial start up needs considerable investment and enthusiasm
- Faculty need special training
- More stressful to the students
- Knowledge of basic sciences will be limited to clinical problem solving needs.

Meaningful learning vs rote learning

'Meaningful' learning, then, involves the acquisition of knowledge in a way that allows you to do something with it . It results in knowledge that is stored in a way that allows it to be accessed from many different starting points. That is, it is knowledge that is well integrated with everything else that you know. Meaningful learning is accompanied by the building of multiple representations (mental models), models that are connected to models for many other phenomena.

What do we want our students to be able to do with the physiology knowledge that they acquire. We certainly expect them to be able to ***predict*** the responses of a physiological system if it is disturbed. We expect students to be able to ***explain*** the responses that occur in systems that have been disturbed. Sometimes we want them to solve quantitative problems (***calculate*** something). And, we expect them to be able to do this with systems and disturbances that they have not encountered in lecture or the textbook. That is, we expect them to be able to apply what they know about physiology to novel situations. When they can do this, we say they "understand" physiology. Or, in the terminology I have been using, we can say that meaningful learning has occurred.

PBL must in postgraduate training

While many universities and medical schools are still debating on merits and demerits of traditional versus problem based learning for undergraduate studies, there can be little doubt about the importance of PBL in postgraduate medical education and training. The trainees have the basic foundation in medical sciences, including basic sciences. The learning environment is ideal, since the trainee has patient care responsibility and has to solve the patients problem.

The administration of PBL

Problem-based learning is a departure from the traditional educational paradigm where a group of students convene for a class that is directed by an instructor. The instructor may lecture on a subject or engage the class in interactive activities such as discussion, small-group assignments, or demonstration. The emphasis is instructor driven. With PBL, the students meet as a small group of typically six to eleven and are guided by an individual referred to as a tutor. The group of students is presented with a complex problem developed by a panel of tutors who are experts in a selected field. The problem may be in clinical case or could be a simulation of some sort. The group discusses the problem typically for a period of 1 to 3 hours. It is during this time that learning objectives are established by the group. The group also determines what relevant information is necessary in resolving the problem. The role of the tutor is to facilitate the conversation while allowing adequate time for individual thought and reasoning. At the conclusion of this initial meeting, the students explore the information necessary to solve the problem scenario.

This self-directed learning phase generally takes 2 to 3 days while the students research data, observe models or specimens, or attend lectures in an effort to obtain knowledge to solve the problem. The small group then reconvenes to continue the discussion and present the new data. Schmidt 12 calls this The second meeting is a time for 'synthesis' where the students exchange ideas in resolving the problem (Schmidt 12). The tutor again takes the role of the facilitator and suggests probing questions to enlighten the conversation of the group. Once the problem is resolved, a new problem is presented with perhaps a different tutor advising and facilitating the group. This process continues until learning objectives are met at which time the students are evaluated on the knowledge acquired in the particular unit.

The type of learning that takes place with PBL is considered more enduring because the learning process is more relevant to the student and the learning is self-directed; that is, the student is responsible for the learning of the content material. Many would argue that this leaves the unmotivated student vulnerable to failure; however, it is reasoned that the support received from the group as well as the desire to not disappoint the other group members would be sufficient to keep students on task.

Faculty development

With respect to faculty recruitment, the common practice among PBL programs is to focus more so on faculty development. Schmidt indicates that faculty development in problem-based learning requires instructors to forego a number of beliefs rooted in the practice of traditional methods and foster new skills intended to contribute to the improvement of a curriculum. This process of faculty development may be vital for faculty in medical schools where many of the faculty are trained as physicians or scientists and not as teachers

Medical education reforms needed

The paper's argument is that medical curricula and medical education, in so far these are described in the literature, typically take limited note of the need to provide educational space for, produce syllabus content around, and devise practices that seek to realize students' engagement with the complexities of Social, economic, organizational and communicational dimensions of care Moreover, the modes of evaluation that have been proposed to gauge the success of curriculum reform initiatives, while strong on measuring changes in knowledge and skills and eliciting feedback from students going through the new programs, have not always put assessment of the objective and logic of curriculum change itself center-stage. Thus, proposals to include course elements such as 'hospital management' may be important and innovative, but unless we are clear about the criteria that motivate their inclusion, we are likely to fall victim to what Bloom has called "the paradox of reform without change." [38]

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Continuing Medical Education for Physician's Competence & Professionalism

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Introduction

A competent physician results from good training and/or from keeping pace with the current developments in the medical field. The assessment of pace with the physician's competent performance is difficult as there are no assessment tools that can be discriminative and relevant to the discipline under consideration.

Major advances in diagnosis and therapeutic modalities are bringing a sea of changes in the concept and knowledge of Medicine. This has necessitated enhancing and expanding their professional competence to find a solution to real-time situations. Skills are attained over a period of time and by experience. There is need for the life-long learning and involvement in a periodic self assessment.

Professional competence

Competence is a professional habit and it is an interaction of the task and clinical abilities. The duty and responsibility of the physician to the patient to his family and to the society has evolved the code of conduct. It focuses the attention on patient care, protection of privileged information and maintenance of a special relationship between doctor-patient.

Epstein and Hundert have defined professional competence as 'the habitual and judicious use of communication, knowledge, technical skills, clinical reasoning, emotions, values, and reflection in daily practice for the benefit of the individual and the community being served [1].

The competence develops on the scientific knowledge and basic clinical skills attained. The physician has to acquire knowledge and apply it to find a solution to real-life situations. The training must make him competent to take a good history from the patient, to make a proper physical examination and to undertake side-room investigations and procedures, and to determine the special investigations that are going to be useful in establishing the diagnosis, and in formulating the treatment.

Skill is not acquired overnight. It develops over a period of time and by experience. It is a habit that engages all faculties and it has to be nurtured by everyone with patience. The person learns from his mistakes and improves his knowledge through experience. As days roll and years pass, he will be in a position to integrate and use clinical reasoning strategies properly. It makes the physician competent to manage vague problems, cope with uncertainty and undertake decisions with limited information & investigation help.

Life-long learning

When one has taken up the medical profession, he is committed to life-long learning. It keeps him ever vigilant to acquire new knowledge and new ways of treatment seful in patient care. In this era to keep abreast and updated in knowledge, one must not be satisfied with one's current level of proficiency and one must make earnest attempts to enhance and expand one's competence. This can be made possible by reading recent medical literature in journals, books and internet, and by attending and listening to the experts in the field at the continuing medical education programs. One has to be ever receptive to learn new things, correct old and achieve perfection. This, in essence, is a continuing medical education throughout the career, as a life-long learning process.

One is entering the profession with a vast store of knowledge about various diseases, and their manifestations, diagnosis, management and prevention. There should be a continuing commitment to stay at the frontier of scientific knowledge throughout one's professional life. There is an explosion in scientific knowledge in the recent decades, and the medical science has made tremendous advances and enormous accomplishments. The things which seem routine today would have taxed the imagination of even the most futuristic person just a few years ago. With scientific achievement, human structure and function have reached a level of comprehension which was unknown. It has revolutionized our concepts and today not only we are talking in terms of medicine of molecular level but also at genetic level. The complexities of many physiological processes & pathological states have been unraveled giving a new insight to our understanding. The parallel advances in other branches of science particularly computer, telecommunications, information technology and diagnostic techniques have changed the concept of medicine.

Professionalism

The history of medicine is as old as the history of mankind. The practice of medicine has evolved from the days of

witchcraft to empirical symptomatic treatment to recent times where we are talking of basics such as life-style to evidence-based medicine. The health care system is in a constant state of flux and Medicine is an ever changing field. We have taken up the profession 'to cure sometimes, to relieve often, and to comfort all the times'. We have attached great value to helping and serving others.

The qualities of a professional man, in the words of Thomas Russell, Executive Director of American College of Surgeons, are multi-dimensional. It consists of competency, and dedication to improve the skills, becoming a roll-model for future generation of medical men and placement of welfare of the patient above everything else. The ultimate aim of the physician is patient care and to that end all their efforts must be directed [2].

There is a continuous quality improvement with new information, new techniques and new technology. Physician has to carry out treatment of the patient in a professional way. Physicians are referred to as care-givers. The patient is entrusting his life in the hands of the physician while seeking medical attention. When taking care of the patient, physician must exhibit understanding, sensitiveness and compassion beyond his technical abilities. Physician has to take interest in the patient, relieve his complaints, and suffering and infuse confidence.

Primary components

Physician has to be competent to take the health care system in which he is working. The education programs must prepare him for such a responsibility. The Accreditation Council for Graduate Medical Education (ACGME) in collaboration with the American Board of Medical Specialties (ABMS) identified the following 6 primary components as a measure of general competence in which the physician has to be proficient [3].

Areas of competence

Adequate medical knowledge, Competent patient care, A life-long commitment to evidence-based and practice-based learning, Interpersonal communication skills, Professionalism, System-based practice.

But there is no uniformity agreeable definition of competence that encompasses all the above mentioned areas of professional medical practice. There is no examination after a person has graduated. There is no system of recertification. Though the physicians are encouraged to attend the continuing medical education (CME) programs held periodically at different places throughout the country to update their knowledge, there is no yardstick to assess their knowledge. There is no procedure of self-assessment.

Epstein refers competence as a habit that engages all human faculties [4]. Competence depends on habit of mind that enables the physician to be attentive, curious, self-aware of one's own thinking, emotions and techniques, and willing to acknowledge and correct errors.

Continuing competence

The ABMS Assembly on March 16, 2002 adopted the following basic components as an evidence for assessment of continuing competence [5].

Basic components

Continuous high-professional standing, Continuous commitment to life-long learning and involvement in a periodic self-assessment process, Cognitive evidence and Evaluation of performance in practice.

There is no agency or mechanism in our country that can conduct an examination to assess cognitive knowledge of the physician during life-time after obtaining the degree and license to practice. It is a welcome thing that there is a greater awareness in the recent years about the process of life-long learning by attending the CME programs relevant to their specialities.

Physician must possess knowledge, skills, and attitudes to act in different clinical contexts. Competence is an interaction of the task and clinical abilities. Physician must possess basic communication skills with an ability to listen and talk with patients. He should show respect to patients and be responsive to patients and society. He must have the capacity to integrate the scientific, clinical and humanistic judgement and must link basic and clinical knowledge to play his role effectively in the complex health care system. The competence should be a professional habit.

Jenkins has summarized the quality of a truly competent physician as the one who sits down, senses the 'mystery' of another human being and offers with an open hand the simple gifts of personal interest and understanding [6].

Charter of professionalism

Physicians belong to a professional group of healers and they have a special respectable place in the Society. From the times of Charaka and Sushruta, the attention of the physicians has been drawn to maintain and practice high professional standards in the patient care. Recognizing the need to bring back the respect and reverence to the physician, the American Board of Internal Medicine (ABIM) took a lead a decade ago campaigning for a rise in the standards of the medical profession. The ideals of this project have been brought out as a charter of the ideals, to which all medical professional can & should aspire'. The document released by ABIM Foundation has become a model across all fields of medicine.

Professional commitments

Professional competence, Honesty with patients, Patient confidentiality, Maintenance of appropriate relation with patients, Improvement of quality of care, Appropriate allocation of resources, Scientific knowledge, Maintenance of trust, Professional responsibilities

This charter has shown a way to the physicians to rise to the expectation of the medical profession. Its principal focus is on the renewal of the physician's dedication to patients' interests. Herold Sox, Editor of Annals of Internal Medicine has rightly advised the physicians to put the interest of their patient before themselves and spend time with the patient under their care to return to their health. They have to be devoted to their duty and strive hard to achieve satisfaction by carrying out their work with competence. Their love to the work will give dividends in the form of appreciation by the patients.

Updating the knowledge

Physician has to maintain his professional competence by updating his knowledge of medicine. The technological advances have given the facilities to do his best which was not possible earlier. The physician must be in a position to deal with all problems under his care. Even *Charaka Samhita* has stressed that 'physician must be learned in many branches of study, & his knowledge of the medical text books must be profound and clear. He must possess knowledge to determine the causes of disease, symptoms, cure & prevention of recurrence of diseases'.

The physician must follow the commitments to become successful in the profession. These principles have to be inculcated during the training as a medical student so as to lay a firm foundation to the profession, which he is going to practice later throughout his life. It will facilitate improvement in the quality of care. Every physician must follow the charter.

Physician must be committed to life-long learning & practice medicine with honesty. He must inform the patients about their ailments and treatment adopted. He has to maintain confidentiality & should not exploit patients for personal financial gains.

Attributes and behaviour of the physician

The physician must conduct himself with dignity & decorum. The physician, who regards compassion for living beings as his highest religion, fulfils his mission & obtains the highest happiness. The charter of 21st century highlights the ideals enunciated by Charaka long ago. 'Physician who is the chief in the medical practice must be knowledgeable & resourceful, honest & pure in his purpose & conduct, and competent. It will go a long way in improving the quality of care provided to the patients. He must uphold scientific standards & promote research which is of benefit to the patients'.

American Board of Internal Medicine while describing attributes and behaviour of Physicians has stated that he must have a commitment

i) to the highest standards of excellence in his practice of medicine and in generation and dissemination of knowledge,

ii) to an attitude and behaviour that sustain the interest and welfare of the patients, and

iii) to be responsible to the health needs of the Society. As care-giver, physician must rededicate himself to the commitment to professionalism.

It is appropriate to quote the statement of Harvard Physician, Francis Peabody[8]: *"The good physician knows his patient through and through, & his knowledge is brought dearly. Time, sympathy, & understanding must be lavishly dispensed, but the reward is to be found in the personal bond which forms the greatest satisfaction of the practice of medicine. One of the essential qualities of the clinician is interest in humanity, for the secret of the care of the patient is in caring for the patient".*

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Commentary

Perspectives of Post Graduate Dental Education in India

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After Independence, the facilities for post-graduation in the country hardly existed. The regular PG course leading to award of MDS degree was in existence only at the De Montmorecy Dental College and Hospital, Lahore in the forties. It was the post-graduates of this college that formed the nucleus for the advancement of dental education during the post-independence era. At the time of partition of the country, there was no Institution imparting the MDS courses in India.

The enactment of the Dentists Act in 1948 can be truly called the turning point in the history of the dental education in the country. The Regulations relating to the Dental Education in India have been governed by the Dental Council of India which started by the enactment of the Dentists Act, 1948. The act made provisions for the regulation of profession of Dentistry and for that purpose to constitute the Dental Council'. The Bill relating to this was passed on 26th Feb, 1948 by the Parliament which received the assent of the President of India on 29th March, 1948. Accordingly, the Dental Council of India was formed on 12th April, 1949 by a Special Notification issued by the Government of India.

The Act provided for a Central Dental Council at the Centre and State Dental Councils in States & Union Territories. While the Dental Council of India (DCI) at the Centre has been the overall body to look after the welfare of the dental profession and for that purpose to maintain uniform standards of Dental Education in the country, the State Dental Councils are primarily responsible for the maintenance of registration of Dentists, Dental Hygienists, Dental Technicians and the matters arising thereof. The Act authorises the DCI to lay down Regulations and Curriculum for various courses in dentistry, including Para-dental courses & ensure uniformity & maintenance of highest standards of dental education. The DCI is also empowered to enter into negotiations with the authorities concerned abroad for setting up of a 'scheme of reciprocity' for the recognition of foreign dental qualifications. The Council is also empowered to lay down 'Code of Ethics' for dental surgeons in their professional behavior. Over and above, the DCI is entrusted with the task of maintaining an All India Dentists Register.

Since its inception 56 years ago, the Dental Council of India has come a long way towards implementation of its objectives and policies laid down by the Government of India. The partition of the country in 1947 left only 3 Dental College in India: viz., the Nair Hospital Dental College, Mumbai, Sir CEM Dental College, Mumbai and Calcutta Dental College, Calcutta. After the Independence and the enactment of the Dentists Act in 1948, the first new Dental College that came into existence was in Lucknow (1949) which was later followed by Dental College all over the country in the following order:- Madras (1953), Patiala (1956), Bangalore, Trivandrum, Ahmedabad and Hyderabad in 1963, Manipal (1966) and Nagpur in 1968. If we see the development of dental profession as per the Five-Year Plans, the number of Dental College in existence, before 1st Five-Year Plan Period was only four. By 1973 i.e. the end of the 5th Five-Year Plan period, the country had 15 Dental Colleges affiliated to various Universities for a regulate 4-year BDS Degree Course. To meet the growing demand of dentists, the country witnessed opening of a number of dental colleges during 1980's and 1990's. The country today boasts of 193 dental institutes which impart graduate and post-graduate qualifications of standards comparable to the rest of the world. Thus, where the Dental Colleges started during the period 1949 to 1973 numbered only 12 (3 already existed); the number of colleges which came up during 1974 to 2004 numbered 177. Further, the PG qualification till 1973 was being imparted only at 9 colleges with an intake of nearly 150 students every year. Compared to this by the year 2004, PG Courses have been instituted in 61 colleges with an annual intake of approximately 1300 students. The amply rbings to light the role played by the DCI in the country over past 30 years which has transformed the scope of dental education in India and given it the much needed direction.

Though the measures adopted by the DCI effectively increased the number of graduate Dental Surgeons over past 56 years, proportionate increase has not taken place towards the Post Graduate qualification. The recommendations of the Bhore Committee in 1950's and the other subsequent committees over past many years have recommended increasing the number of PG qualified doctors in the country. Towards this, till now the Dental Profession had only one avenue for higher studies i.e. the MDS Degree Course. To meet this growing demand

as well as to ensure higher competence in the specialty and with the Primary aim to prepare for a career in teaching, research and specialty practice, the National Board of Examinations (NBE) has accented its permission to conduct DNB Courses in India for graduate Dental surgeons. This can truly be hailed as heralding a new era towards the Post Graduate Qualifications. Opening of these new vistas towards imparting Post Graduate Qualifications is indeed laudable and will serve a dual purpose of increasing the PG seats across the country as well as provide an alternate recognized PG course. The Dental Council of India on its part will be giving a thrust towards this direction by introducing structured programmes for each specialty. The eligibility and criteria for selection, syllabus, training, programme and the accreditation criteria laid down by the NBE shall be adhered to. It is proposed to initially start the DNB courses in select few teaching institutions in the country in chosen specialties with a view to test and structure this module of PG qualification to suit the environ specific to country. In the coming years, the DCI shall be laying its main thrust towards this direction to make this module a success.

Furture perspectives

The DCI over a period of next few years shall be adopting measures and strategies to improve the quality of dental education in the Dental Institutions not only to improve the quality of dentists in the country but also to attract foreign students which can prove to be a major source of foreign exchange for the country. Towards this, a beginning has already been made by making the 'teaching faculty' in each Institution fully accountable towards their primary role. Further, the need to have ongoing 'Continuing Dental Education' programmes has been stressed for improving the standards of teaching in all the Institutions in the country. Learning is a life long endeavor, especially in a world that is changing as quickly as ours. Those of us, who have been in the profession of dentistry for may years, can attest to this need for 'staying current' with professional advancements in the rest of the world as well as to the present day's legal requirement. This is especially true in view of India emerging as the most favored destination across the world for providing the most affordable and best possible dental treatment. The number of foreigners seeking specialist treatment in India in near future is likely to increase manifold which will need certain checks and balances to be introduced to safeguard the interest of dental profession in the country as well as to ensure quality treatment to the foreign visitors.

The policy of awarding 'credit hours' by the reputed universities in India and abroad is being explored to make the Continuing Dental Education Programmes informative and competitive. Further the policy towards 'Dental Education Accreditation' need to be reviewed by a group comprising of the members of the discipline of dentistry, education community, employers, practitioners, the State Dental Councils and the eminent public members. This will have to be modified to suit prevailing scenario with a view to govern the dental education for the next 20 years. These standards of education shall not only be made applicable for Graduate and Post Graduate Dental Courses, advance Education Programmes, Continuing Dental Education Programmes, clinical Fellowship Training Programmes as well as all other Dental Education Programmes being conducted or proposed to be conducted relating to the field of Dentistry in India.

Dentistry is a dynamic and rewarding profession which needs to be structured and groomed to be packed of opportunities and options so as to make it into one of the best careers in the country. Towards this, the Dental Council of India shall strive to continuously achieve higher goals with the participation of the Dental Fraternity and the Members of the Council for the years to come.

Workshops on research methods for DNB candidates and consultants

NBE has been holding workshops for the National Board of Examinations faculty members/consultants of various Accredited hospitals/ institutions running DNB training programmes. During interactions with them it was felt that many consultants/ faculty members need to be given exposure to research methods, so that they are able to provide better guidance to DNB candidates in their thesis work. In that context National Board of Examinations had conducted a pilot workshop at Maulana Azad Medical College, New Delhi from 20th July to 22nd July 2006. Based on this feed back more workshops will be conducted for Consultants and for DNB candidates in near future.

Review Article

Physiological Aspects of Thyroid and Related Recent Advances

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Introduction

The Thyroid gland was the first endocrine gland to be recognized as such on the basis of symptoms associated with excess or deficient function. The thyroid gland, by secreting two important hormones namely 3, 5, 3', 5' tetraiodothyronine(T_4) and 3, 5, 3' triiodothyronine (T_3) maintains the level of metabolism in the tissues that is optimal for their normal functions, the most fundamental component being oxygen utilization. Though not essential for life, the thyroid gland is required in utero and in children for normal growth and development. Deficiency at this stage causes mental retardation and dwarfism. In adults thyroid gland hypofunction leads to mental and physical slowing, poor resistance to cold, bradycardia and spectrum of other symptoms. Excess thyroid secretion on the other hand causes body wasting, nervousness, tremors, etc. The thyroid gland is regulated via hypothalamic (TRH)-pituitary (TSH)-thyroid axis, which is subjected to negative feedback control via circulating level of thyroid hormones. In humans it also secretes another hormone "calcitonin", which plays an important role in calcium metabolism.

Physiological aspects of Thyroid & related recent advances

The thyroid gland develops from the floor of the primitive pharynx during the third week of intrauterine life. The gland descends down from the foramen ceacum to reach its final destination in the neck. Here it attains a bilobed structure connected by an isthmus. The gland starts synthesizing thyroid hormone (TH) by the eleventh week of intra uterine life under the stimulus of fetal thyroid stimulating hormone (TSH). Another hormone, calcitonin is secreted by the parafollicular or 'C' cells, these are scattered in the thyroid gland and develop from the ultimobranchial bodies [1,2].

Development of the thyroid gland is regulated by nuclear transcription factors-thyroid transcription factor-1 (TTF-1), thyroid transcription factor-2 (TTF-2) and homeobox-8. These work together for the development of thyroid gland and induction of thyroid specific genes. Both fetal TH and maternal TSH are required for the normal development [3].

A matured thyroid gland consists of a number of follicles lined by epithelial cells (follicular cells). Within the lumen of the follicles a clear amber, proteinacious fluid called colloid containing the precursor of TH–thyroglobulin is present. The glandular epithelium varies with the state of activity of the cell, being flat when inactive and become columnar in the active state. The edge of the colloid in the active state is scalloped forming resorption lacunae and this occurs due to endocytic resorption of the hormone, containing colloid [4,5].

Synthesis and release of Thyroid hormones

The thyroid hormones are synthesized and stored in the thyroid follicle, as a part of thyroglobulin molecule. The TH are iodothyronins, namely 3, 5, 3' 5' tetraiodothyronine (thyroxine or T_4), 3, 5,3'triiodothyronine (T_3) and 3, 3' 5' triiodothyronine (ReverseT_3 or RT_3). Only T_3 and T_4 are biologically active. The molar activity ratio of T_3 to T_4 being 3-5:1 [5,6].

Iodine in the diet is converted to iodide and the iodide is taken up by the thyroid gland and this uptake is the limiting step in the synthesis of TH. The iodide is taken up by the thyroid cells by the Na^+ I^- Symporter (NIS), resulting in 20-40 times higher concentration intracellularly in comparison with the plasma concentration, a process called as trapping [7]. The thyroid gland contains body's largest iodine stores, which is around 5-7mg in an adult. The energy for this secondary active transport is produced by Na^+ K^+ ATPase. Once inside the cell the iodide is converted to iodine by the process of oxidation, and later gets bound to the tyrosine residue of the glycoprotein-Thyroglobulin with the help of the enzyme thyroid peroxidase present in the colloid, a process called iodination. 95 % of the iodide trapped is present in the colloid and the remaining 5% is found in the intercellular space of follicular epithelium. Iodination occurs in a sequential manner in the apical border of the follicular cells first forming monoiodotyrosine (MIT), later on to form diiodotyrosine (DIT). Pairs of iodinated tyrosyl residue then couple together to form T_3 (75%), T_4 (35%), and RT3 (in traces). This reaction is also catalyzed by thyroid peroxidase [4, 5, & 6].

Secretion of TH begins with endocytosis of colloid at the apical border of the cells, mediated by megalin causing resorption at the edge of colloid. This process brings the colloid in contact with the protease containing lysosomes, resulting in dissociation of thyroglobulin

liberating the free T_3 and T_4 into the circulation. Around 80 micrograms of T_4 and 4 microgram of T_3 is secreted per day into the blood stream. The undissosiated tyrosine; MIT, DIT are deiodinated by Iodotyrosine deiodinase, and recycled forming the second iodine pool, while T_4 and T_3 are released into the circulation later [8-11].

The thyroid inhibitors used for hyper functioning of the thyroid gland, either inhibit iodide trapping (eg:thiocynates) or inhibit hormone synthesis by binding to the thyroid peroxidase (e.g. propylthiouracil) or inhibit hormone release (iodine) or destroy the thyroid tissue (radioactive iodine) [12].

Increased circulating levels of free T_3 and T_4 due to hyper functioning of the thyroid gland, is called Hyperthyroidism. The common causes being Grave's disease, toxic multinodular goitre, toxic adenoma etc, whereas hypothyroidism is a condition resulting from reduced circulating levels of thyroid hormones, caused due to iodine deficiency, autoimmune disease, drug induced, etc. Children or infants who are hypothyroid from birth are termed cretins [13]. Cretinism occurs either due to maternal or fetal factors. The latter includes either mutation in the nuclear transcription factor, their target genes (e.g. gene for the enzyme peroxidase, iodinase etc), partial/complete absence of the enzymes related to the development, maturation and synthesis of TH or due to fetal hypopituitarism. The maternal factors include iodine deficiency or maternal anti thyroid antibodies those cross the placenta [8]. Mental retardation, enlarged protruded tongue, potbelly, dwarfism and failure of sexual development characterize cretins.

American Association of Clinical Endocrinologists (AACE) has recommended screening of all women considering conception and or, all gravid females in their 1st trimester, for subclinical hypothyroidism and also for the presence of thyroid peroxidase antibodies [14]. Lazarus JH have also emphasized the importance of maternal T_4 for the fetal brain development and have suggested screening of all pregnant women in their 1st trimester for subclinical hypothyroidism and for the presence of thyroid peroxidase antibodies. Rose SR, and his coworkers have stressed the need for determine the serum free thyroxine and TSH levels regardless of the screening results, if clinical sign and symptoms suggests hypothyroidism. And that the treatment should be started within two weeks of age to normalize cognitive development [15,16].

It has been postulated that in neonatal hypothyroidism, there is an impairment of Na^+K^+ ATPase activity during critical stages of brain development that lead to their dysfunction [17].

Metabolism of Thyroid hormone

T_3 and T_4 secreted from the gland is bound to the plasma proteins namely Thyroxine binding globulin (5.47mg% of TH), transthyretin (1.6mg% of TH) and albumin (1.08mg% of TH). Thyroid gland secretes 20 times more T_4 than T3.The plasma level of T_4 ranging between 3-8 mg% and that of T_3 is around 0.15 mg%. Amount of T_4 and T_3 binds to thyroxine binding globulin. The binding of hormone to the proteins helps in delay in the hormone clearance, leading to increased circulating pool. 99.98% of T_4 and 99.7% T_3 are bound to the plasma proteins. The less affinity of T_3 to plasma proteins explains the lower percentage of binding and it is the unbound form that is biologically available to the tissues.

Once both forms are secreted from the thyroid gland, nearly half of T_4 is converted to RT_3 and one third of T_4 is converted to T_3. The conversion to T_3 is by the enzyme 5' deiodinase. The extrathyroidal deiodination of T_4 accounts for approximately 80% of T_3. Finally the TH are deiodinated, deaminated and then conjugated in the liver to form glucorinides and sulfate to be excreted in the bile.

During fluctuations in the level of binding protein, normal plasma concentration of free T_3 and T_4 is maintained by decreasing or increasing the entry of free T_3 and T_4 in the tissues [18,19].

Mechanism of action

The multiple effects of TH are the result of T_3 entering the nucleus of the target cell and getting bound to the thyroid receptors TR. TR and Retinoid X receptors RXR form heterodimers and bind to the thyroid hormone response element (TRE), in the promotor region of the target gene. In the absence of the hormone the TR binds to the co-repressor (CO-R) proteins that silence the gene expression mediating the opposite (inhibitory) effects [20,21].

The role of mediators, which co-activate the TR, regulated gene expression by facilitating the recruitment and activation of RNA polymerase II associated basal transcription apparatus have also been studied [22]. T_3 also has non-genomic effects via extranuclear T_3 receptors that are present in mitochondria – where it increases the activity of mitochondrial adenine nucleotide translocase. These extranuclear effects have also been shown to exist in ribosomes and the plasmalemma [23].

Regulation of Thyroid gland

The most important regulator of the thyroid gland function is the hypothalamic pituitary Thyroid Releasing Hormone (TRH) - Thyroid Stimulating Hormone (TSH) axis, it being a classic example of feedback control. TRH is

the major positive regulator of TSH synthesis secretion but TSH establishes the set point in this axis. TSH is the most important physiological marker of actions of TH, which exerts its response, by binding to plasma transmembrane receptors on the gland. Binding of TSH, increases the concentration of cAMP, calcium, phosphoinositide and various growth factors, leading to increased gene expression of NIS, Thyroglobulin, TPO, Megalin. TSH stimulates the synthesis of thyroglobulin, iodide trapping process, and the subsequent steps in T_4 and T_3 synthesis along with the secretion of TH and stimulation of endocytosis of colloid in the follicles. Sustained TSH stimulation leads to hyperplasia of the follicular cells, while atrophy of the gland results in case of absence of TSH. The regulation of TH secretion is under feedback control. Circulating T_4 and T_3 act on the pituitary gland to decrease the level of TSH, on the other hand, if levels of TH decreases, TSH secretion increases. It is the T3 that act as a final common pathway for stimulating the pituitary for secreting TSH. The T4 is converted to T3 with the help of deiodinase present in the pituitary and the later acts as the final effector molecule in turning off TSH.

Intrathyroid iodide itself is another important regulator of thyroid gland function as it exerts a biphasic action. When iodide intake is low, there is a direct relation between TH synthesis and iodide availability. But when the iodide intake exceeds 2mg/day, the intraglandular concentration of iodine increases and it leads to the suppression of NADPH oxidase, NIS and TPO gene activity and thus decreasing the TH synthesis. This autoregulatory mechanism is called as the Wolff chaikoff effect. Both these effects reduce the fluctuation in the TH secretion when an acute change occurs in the availability of the substrate[5, 8].

Actions

Caloregenic and metabolic effects

The hormone has its calorigenic effect on almost all parts of the body except testis, uterus, lymph nodes, spleen and anterior pituitary. It exerts its calorigenic effect by increasing the activity of membrane bound Na+ K+ ATPase and by increasing the availibility of substrates for oxidation. It does so by raising the plasma glucose level by increasing the absorption from the gastro intestinal tract, increasing lypolysis, promoting the free fatty acid release from the adipose tissue and also increases the protein turn over. TH also potentiates the effects of other hormone that produces similar effects, like Glucagon, Cortisol, Growth hormone, Epinephrine and Norepinephrine[4, 5, 24, 25].

Availability of active TH correlates with changes in the body's caloric and thermal status. Ingestion of excess calories increases the production and plasma concentraion of T3, whereas prolonged fasting leads to decreased production of TH [25-27].

Regulation of T4 levels by energy intake and adipose tissue store occurs through leptin effects in the CNS [26] as shown in Fig:1 It has been postulated that one of the thermogenic effects of TH is by regulating the proton leak which reduces the fuel efficiency and produce more heat [28]. Fig: 2 Shows the interaction between the TH and the sympathetic nervous system in regulating the facultative thermogenesis in brown adipose tissue (BAT) [29].

In hypothyroid individuals the Basal metabolic rate (BMR) can decrease by as low as 40%, secondarily causing the accumulation of protein complexed with chondroitin sulphate, hyalorunate and polysauharides. These promotes water retention and causes puffiness of skin (Myxedema). The condition also leads to decreased metabolism in uterus causing menstrual abnormalities and infertility's. There also occurs weight gain, hoarseness of voice, cold intolerance, and constipation due to lack of caloreginic effects. On the other extreme, in hyperthyroidism, the BMR may increase to as high as +100, leading to increased excretion of catabolic products like uric acid, hexosamine, potassium etc. The increased calorigenic effects causes weight loss, heat intolerance, polyuria and diarrhea [4, 8].

Cardio respiratory effects

The TH increases the cardiac output ensuring sufficient oxygen to the tissues. The resting heart rate and stroke volume are also increased. The TH acts via various mechanisms to increase the cardiac output and the rate [30, 31]. Direct action of TH on the heart is by increasing the cardiac muscle myosin heavy chain beta/alpha ratio, sodium potassium ATP ase, sarcolemma calcium –ATPase, beta adregenic receptors and increasing the ventricular contractility. Indirectly the Thyroid hormone also increases the cardiac output indirectly via baroreceptors [32].

Hyperthyroidism leads to sudden heart failure or atrial arrythmias in adults and decreased function of the gland leads to bradycardia, dilated heart and pericardial effusion [5].

Increased level of plasma endothelin-1 concentration has been observed in patients with hyperthyroidism (33). The level of VWF has been found to be significantly higher in hyperthyroid patients compared to that of euthyroid individuals suggesting endothelial dysfunction. This could explain the various cardiovascular manifestation seen in hyperthyroid [34].

The TH increases the respiratory rate, minute ventilation and ventilation response to hypercapnia and hypoxia.

Exertion capacity was also found to be low in hypothyroidism[35].

Growth and devolopment

TH is important for normal growth and skeletal maturation as it is an anabolic hormone and also causes increased release and action of growth hormone. It also helps in tissue differentiation and maturation. TH has a major role to play, both in-utero and after birth. During the fetal life it help in maturation of growth centers of bone. After birth it stimulate the endochondral ossification, linear bone growth, maturation of epiphyseal bone centre and also in bone remodeling. It does these by binding to TR alpha and beta resulting in increase induction of Insulin like Growth Factor-1. In cretin the bone growth is slowed with delay in closure of epiphysis in limbs, resulting in short limbs in comparison to trunk (Thyroid dwarf) Growth and maturation of epidermis, development of tooth, nail and hair follicle depends upon the optimum level of TH[4,18].

Muscle weakness and pain are common features of both hyperthyroidism and hypothyroidism, while osteoporosis being specific to hyperthyroidism[36].

Reproductive functions

TH has a permissive role in regulation of reproductive function by stimulating the hepatic synthesis and release of sex steroid binding globulin. It also has a role to play in the process of ovulation, spermatogenesis, differentiation prepubertal sertoli cell and maintenance of pregnancy[5].

Nervous system

TH is necessary for normal development and activity of central and peripheral nervous system. TH helps in mylenation of axons, branching and development of dendrites, synapse formation, vascularisation of brain and proper functioning of muscle spindles. TH deficiency in foetus and in children upto 2 yrs of age can result in infantile brain i.e. anatomically small and physiologically underdeveloped brain leading to mental retardation, In adults the neurological features of hypothyroidism

Include abnormal mentality and behavior[37,38] and dysfunctions of the peripheral nervous system manifesting as acroparaesthesia, weakness and imbalance of posture, increased reaction time[39]. memory loss,mental lethargy eventually leading to psychosis (myxedema madness) Hypothyroidism is one of the frequent causes of endocrine peripheral neuropathies[37]. The metabolic abnormality, decreased cerebral blood flow and abnormal deposition of mucopolysaccharides that usually accompany hypothyroidism are believed to cause these symptoms. Hyperthyroid patients often have emotional instabilities, anxiety, irritability, restlessness, insomnia and tremor[39,40].

We have been knowing the importance of the thyroid gland for a long time, since increased level of thyroid hormone results in major cardiovascular morbidity, osteoporosis, tremors and many other unpleasant effects. On the other hand hypothyroidism in the fetus results in impaired brain development and a spectrum of perinatal problems. Decreased function later in life causes slowing of metabolism and intellect, and a variety of other manifestations. Only recently have we begun to understand how thyroid hormones work at a molecular level and a lot more still remain to be unfolded so that the therapeutics and prevention can be targeted in a more effective way.

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Legends

Fig 1: Shows relationship between regulation of production and action of

thyroid hormone and energy turnover. Increased T3 and T4 results in decreased release of leptin via unknown mechanism from adipose tissue which inturn inhibits μ MSH (anorexigenic peptide)and facilitate release of Ag RP (orexigenic peptide). This could possibly explain the increased appetite in hyperthyroidism

Fig 2: Shows interaction between thyroid hormone and sympathetic nervous system in brown adipose tissue. On exposure to cold, increased sympathetic nervous system activity occurs resulting in increased release of norepinephrine release. Norepinephrine action via beta-receptors causes increase in intracellular CAMP, which exerts various effects a) increase influx of T_4 into the cell, b) increased conversion of T_4 to T_3, c) increased expression of UCP-1 gene along with T_3. Increased UCP-1 results in heat generation. T_4 also increases the number of adrenergic receptors.

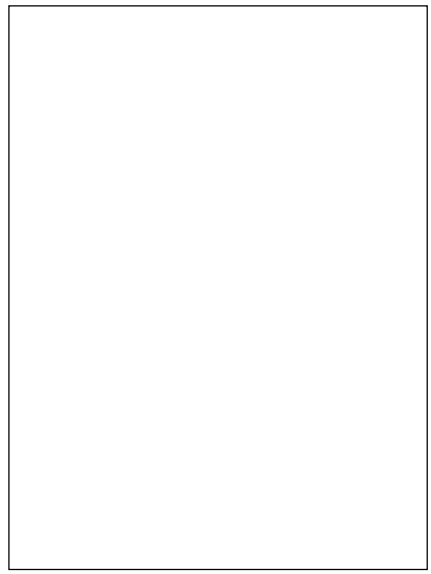

Fig. 1

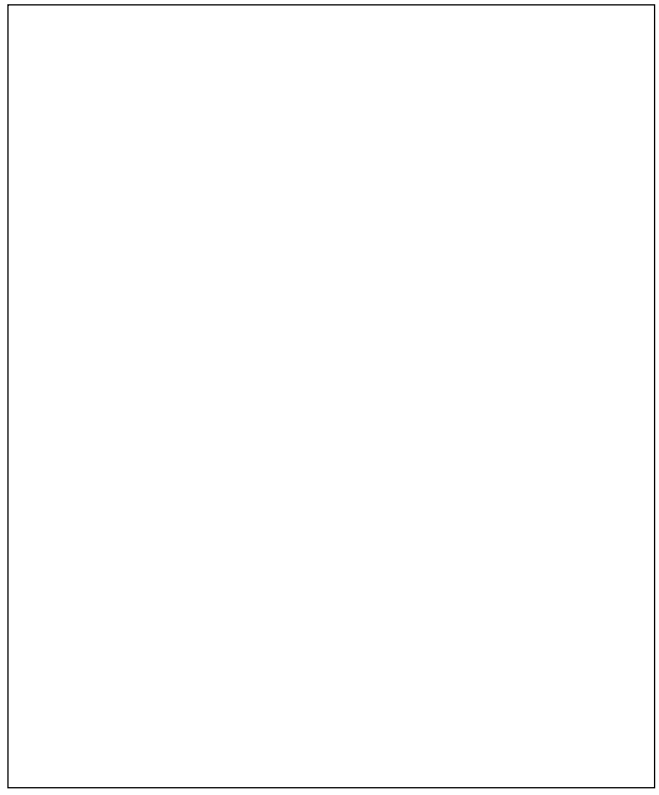

Fig.2

Review Article

Anatomy of Thyroid Gland and its Clinical Applications

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Thyroid gland is a brownish – red highly vascular organ, situated anteriorly in the lower part of the neck. The thyroid gland occupies an important position in the center of visceral compartment of the neck, lying astride the trachea just above the thoracic inlet. Normally weighing about 25g, the anatomy of this vital endocrine gland is relevant both to the non-operating clinician and in operative surgery[1].

The gland has two lobes, shaped roughly like slender pears, hugging the anterolateral aspect of the cervical trachea from the level of the thyroid cartilage to the 5th or 6th tracheal ring. The right lobe is often larger than the, left and the lobes are joined together across the midline by a thin isthmus plastered quite firmly to the anterior surface of the trachea, at the level of the 2nd and 3rd tracheal rings. A variable-sized, but usually small, pyramidal lobe arises from the isthmus somewhere along its upper border near the midline. The thyroid gland is covered by fascia and the strap muscles and, more laterally, it is tucked under the diverging anterior borders of the sternomastoid muscles[2].

Clinical beginners often search for the gland too high in the neck. It should be palpated from behind the subject with the middle and index fingers lying just above the sternoclavicular joint across the trachea, as though spreading the converging sternomastoid muscles. Because of its fascial attachments, the gland moves upwards with swallowing and, therefore, it slides under the examining fingers. The normal gland can be felt in thin necks. It is soft and supple and the tracheal rings can be palpated through it.

The important anatomical features with surgical relevance are:

1. The musculofascial coverings

The strap muscles are ensheathed by the general investing layer of cervical fascia and this unites them in the midline. These muscles are applied to the anterior surface of the gland, but separated from it by a loose condensation of fascia derived from the pretracheal fascia. This false capsule covers the gland which is enclosed by its diaphamous true capsule with its very rich blood supply, clearly visible just beneath its surface [2].

In the surgical approach t o the thyroid gland, the musculofascial envelope is incised down the midline, which is relatively avascular, and the 'space' between the two capsules of the gland is entered. This loose plane is easily developed and the gland exposed by retracting the strap muscles. The nerve supply of these muscles, the sternohyoid and its deeper neighbour, the sternothyroid, comes from cervical roots 1, 2 and 3 via branches from the ansa cervicalis. These branches enter the muscle at its lateral border and on the deep surface and, though it is not often necessary, the muscles may be divided transversely to facilitate access to the gland. Provided they are resutured, there does not appear to be any impairment of function [4].

The other important implication of the musculofascial covering of the gland is that at the end of thyroid operations the divided fascial envelope is resutured in the midline and this again closes the visceral space. If there is postoperative haemorrhage into this closed space, respiratory embarrassment from tracheal compression results and requires immediate release of the sutures to restore the airway.

2 The vascular supply and imporatnt close surgical relations of the Thyroid gland

The thyroid gland is supplied by the superior and inferior thyroid arteries and sometimes by an arteria thyroidea ima from the brachiocephalic trunk or aortic arch. The arteries are large and their branches anastomose frequently on and in the gland, both ipsilaterally and contralaterally [1]. The superior thyroid artery pierces the thyroid fascia and then divides into anterior and posterior branches. The anterior branch supplies the anterior surface of the gland, the posterior branch supplies the lateral and medial surfaces. The superior thyroid artery is closely related to the external laryngeal nerve. The external laryngeal nerve, a branch of the superior lryngeal nerve, descends on the fascia of the inferior pharyngeal constrictor, relates closely to the superior vascular pedicle of the thyroid and then leaves this at a variable height above the gland to travel medially to its destination in the cricothyroid muscle. It is functionally important to the pitch of the voice because the cricothyroid muscle is a tensor of the vocal cord. Damage to this nerve alters the voice quite significantly, and is especially noticeable in singers. Its surgical avoidance has been mentioned [2].

The inferior thyroid artery approaches the base of the thyroid gland and divides into superior (ascending) and inferior thyroid branches which supply the inferior and posterior surfaces of the gland. The superior branch also supplies the parathyroid glands. The relationship between the inferior thyroid artery and the recurrent laryngeal nerve has clinical importance [1]. The recurrent laryngeal nerve is a branch of the vagus arising embryologically in relation to the 4th aortic arch vessles. Because of the descent of these vessels forming the subclavian artery on the right and the aortic arch on the left, the recurrent nerves are taken caudally and thus run an upward course to reach their vocal cord destination. The nerves usually lie in the tracheo-oesophageal groove and then bear a variable relationship to the branches of the inferior thyroid artery before entering the larynx. In the majority of cases, the nerve is found easily in the tracheooesophageal groove just below the thyroid gland, but its course may be anomalous and it may be much more lateral. In very rare instances, because of failure of development of the 4th each vessel and a resultant anomalous right subclavian artery, the nerve on that side will be non-recurrent and then passes directly medially at a much higher level from the vagus to the larynx. In this position it could be in danger at the time of ligation of the middle thyroid vein, though the difference between these two structures should be easily apparent [2].

The venous drainage of the thyroid gland is usually via superior, middle, and inferior thyroid veins. The superior thyroid vein emerges from the upper part of the gland and runs with the superior thyroid artery towards the carotid sheath. It drains into the internal jugular vein. The middle thyroid vein collects blood from the lower part of the gland. It emerges from the lateral surface of the gland and drains into the internal jugular vein. The inferior thyroid vein forms a plexus with the vein on the opposite side. This plexus is located below the thyroid gland and in front of the trachea. From the plexus, the left vein descends into the thorax to terminate at the left brachiocephalic vein. Alternatively, there may be a common trunk draining into the left brachiocephalilc vein.

Thyroid lymphatic vessels communicate with the tracheal plexus, and pass to the prelaryngeal nodes just above the thyroid isthmus and to the pretracheal and paratracheal nodes; some may also drain into the brachiocephalic nodes related to the thymus in the superior mediastinum. Laterally the gland is drained by vessels lying along the superior thyroid veins to the deep cervical nodes. Thyroid lymphatics may drain directly, with no intervening node, to the thoracic duct1.

Innervaction

The thyroid gland receives its innervation from the superior, middle and inferior cervical sympathetic ganglia1.

Imaging

The follicular nature of the thyroid gland is not resolved by current imaging techniques and thus presents a homogeneous texture on crosssectional imaging (US, CT, MRI). Its superficial location makes the thyroid an ideal organ for sonographic examinaton. The thyroid gland is highly vascular and demonstrates intense contrast enhancement and increased signal on T2-weighted MRI. Radionuclide imaging of the thyroid may be performed with technetium (TC 99m) pertechnet ate. This readily available radionuclide is trapped by the thyroid in the same way as iodine, but is not organified. It yields morphological information and will reveal the presence of ectopic thyroid tissue. Functional data can be obtained with the use of 131 iodine which is trapped and organified [1].

Development of Thyroid gland

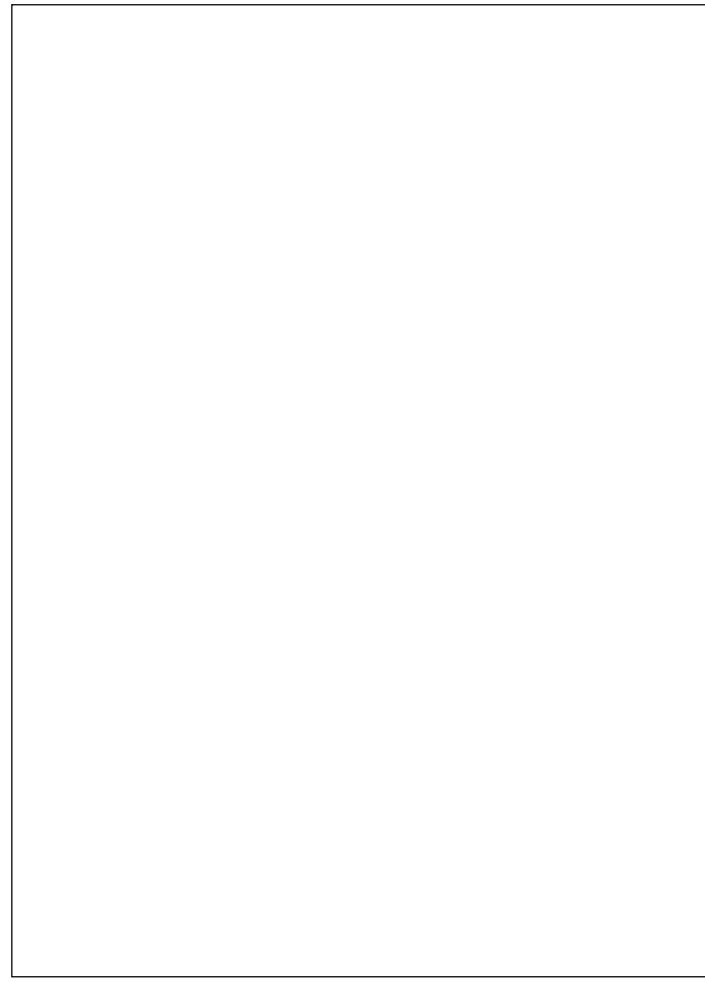
The thyroid gland is first endocrine gland to develop in embryo. It begins to form about 24 days after fertilization from a median endodermal thickening in the floor of the primordial pharynx. This thickening soon forms a small outpouching- the thyroid primordium. As the embryo and tongue grow, the developing thyroid gland descends in the neck, passing ventral to the developing hyoid bone and laryngeal cartilages. For a short time the thyroid gland is connected to the tongue by a narrow tube, the thyroglossal duct.

At first the thyroid primordium is hollow but it soon becomes solid and divides into right and left lobes, which are connected by the isthmus of the thyroid gland, which lies anterior to the developing second and third tracheal rings. By seven weeks the thyroid gland has assumed its definitive shape and has usually reached its final site in the neck. But this time the thyroglossal duct has normally degenerated and disappeared. The proximal opening of the thyroglossal duct persists as a small pit in the tongue- the foramen cecum. A pyramidal lobe extends superiorly from the isthmus in about 50% of people. The pyramidal lobe may be attached to the hyoid bone by fibrous tissue and/or smooth muscle – the levator of thyroid gland. A pyramidal lobe and the associated smooth muscle represent a persistent part of the distal end of the thyroglossal duct.

Histogenesis of Thyroid gland

The thyroid primordium consists of a solid mass of the endodermal cells. This cellular aggregation later breaks up into a network of epithelial cords as it is invaded by the surrounding vascular mesenchyme. By the tenth week the cords have divided into small cellular groups. A lumen soon forms in each cell cluster

and the cells become arranged in a single layer around a lumen. During the eleventh week colloid begins to appear in these structures- thyroid follicles- thereafter, iodine concentration and the synthesis of thyroid hormones can be demonstrated.



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Snippets in Medicine

- National board of Examinations diplomat is a wanted qualification in Kuwait as an alternative to MRCP.
- Incidence of Hepatetis B is more than HIV.
- India is the diabetic capital of the World followed by China, Indonesia & America in that order.
- The Serum Institute of India at Pune is one of the largest vaccine producing Centers in the World. The Centre makes 6,75,000 doses of vaccine daily and send them to 137 Countries.
- Do you know that the incidence of HIV infection is highest in Maharashtra followed by Chennai and Manipur? India shares 10% of global AIDS problem, 4.5 million people live with ALZHEIMER in U.S.A. chances of contracting the diseases increase exponentially with age.
- WHO estimates that nearly 5 million human deaths occur in India every year from polluted water.
- India eradicated small pox in 5-7-1975 and WHO announced India free of Guinea worm on 25-2-2000. President of India Dr. Abdul Kalam is against human cloning.

Thyroid- An Update of Diagnostic Pathology

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Introduction

Conventionally, the abnormalities of thyroid gland are divided as anatomical (structural) and physiological (functional). The congenital abnormalities may be absent thyroid, hypothyroidism due to dyshormonogenesis, ectopy thyroid hemiagenesis and thyroglossal duct cyst. Non-neoplastic excessive proliferation in the absence of thyroid dysfunction is referred to as simple goiter that may show nodular hyperplasia and cystic changes.Grave's disease and Hashimoto thyroiditis are included in the group of autoimmune thyroid diseases (AITD). Thyroid may be host to infective diseases causing suppuration as well as granuloma formation. Whereas the commonest neoplasms are sporadic benign follicular adenomas followed by papillary and follicular carcinomas (tumours of follicular cell origin), inherited forms of thyroid cancer may occur especially in relation to Medullary Thyroid Carcinoma (MTC) mostly as a part of MEN syndrome. It will be beyond the scope of this article to comment on pathogenesis of various thyroid disorders, their functional consequences and biochemical evaluation. The emphasis will be on including various contributions made in the literature to enhance diagnostic accuracy.

Inflammations and autoimmune diseases

The patients with inflammatory thyroid disorders may have Euthyroidism, Hyperthyroidism or Hypothyroidism and may evolve from one condition to other over time.

Infective thyroiditis is rare. Suppurative inflammation caused by pyogenic bacteria like staphylococcus follows trauma or septic focus elsewhere, is characterized by intense infiltration by neutrophils, macrophages and tissue breakdown resulting in abscess formation. Immuno-compromised states due to malnourishment, debilitating illnesses, radiation exposure and immuno-deficiency diseases may predispose for infection by mycobacteria, fungi, pneumocystis, pasteurella multocida and actinomyces etc.[1,2,3] Cytology, demonstration of microorganism on direct smear examination and culture of material obtained on fine needle aspiration biopsy (FNAB) are helpful in differentiating this excruciatingly painful enlargement of thyroid gland from subacute thyroiditis.

Presence of variable number of lymphomononuclear cells and plasma cells on FNAB smears and biopsy sections may be observed in Hashimoto thyroiditis/chronic lymphocytic thyroiditis, De Quervain thyroiditis, silent or painless thyroiditis including postpartum thyroiditis, focal non specific thyroiditis, palpation thyroiditis and Grave's disease. Differentiation of these diseases from each other is important because of therapeutic and prognostic considerations. All these conditions have immunological basis with variable demonstration of Anti Thyroid Stimulating Hormone receptor antibodies, anti thyroglobulins, and anti thyroid peroxidase antibodies. Grave's disease, Hashimoto thyroiditis, post partum thyroiditis and painless thyroiditis have also been collectively grouped as AutoImmune Thyroid Diseases (AITD).[4,5]

De Quervain thyroiditis, believed to be caused by inflammation initiated by viral infections or post viral inflammatory reactions following influenza, coxsackie, echo and adeno virus infection, manifests with painful, firm and tender enlargement of thyroid gland.[6] Unusual organisms like Q fever have also been implicated in its pathogenesis.[7] The differentiation of this disease from others entities associated with lymphocytic inflammation may not be possible on FNAB. Painful enlargement of gland, patchy distribution of inflammation with progression to granuloma formation on histology and complete recovery with restoration of normal histological appearance establish the diagnosis. However, in late stages, persistence of chronic inflammatory infiltrate with onset of fibrosis, immunohistochemical (IHC) demonstration of CA 19-9 and eventual progression to autoimmune thyroiditis have been reported.[8]

The reported incidence of postpartum thyroiditis, a transient illness with complete recovery within a year varies from 2-16%. The disease manifests with features of primary hypothyroidism and painless goiter 3-6 months after giving birth generally in those with identifiable risk factors including family history of AITD, positive thyroid microsomal antibodies during pregnancy, previous postpartum thyroiditis, cigarette smoking and excessive iodine intake. Benign and self limited, silent/painless, and occasionally painful thyroiditis with brief episodes of hyperthyroidism followed by hypothyroidism and then euthyroidism

have also been reported in other age groups in both the sexes mostly in middle age. Occasionally autoimmune dysregulation may result in extensive lymphocytic infiltration, presence of plasma cells and circulating antibodies in these disorders[4,5,9].

The terminology of subacute thyroiditis has been used both for De Quervain thyroiditis and painless thyroiditis with different connotations.

In Hashimoto thyroiditis, autoimmune inflammation due to inherited defects in immune surveillance results in progressively increasing diffuse and extensive lymphomononuclear inflammatory infiltrate with formation of germinal centers, destroying the follicles which are lined by epithelial cells of changed appearance called as hurthle cells. Increased interstitial connective tissue at times may be very prominent resulting in keloid like fibrosis and has been referred as fibrous variant of Hashimoto thyroiditis. Initial features of hyperthyroidism are followed by hypothyroidism. There is increased risk of concomitant autoimmune diseases of other endocrine glands like type I diabetes, autoimmune adrenalitis, and of non-endocrine organs like Systemic Lupus Erythematosus, Myasthenia Gravis and Sjogren Syndrome. Neoplasia including Non Hodgkin's lymphoma of B cell type and plasmacytoma of the gland have also been described following Hashimoto thyroiditis[6]. A peculiar malignancy sclerosing mucoepidermoid carcinoma with eosinophilia has been reported [10,11].

Incidental finding of focal lymphocytic infiltration in the thyroid gland removed on autopsy and surgical biopsies, done for other illnesses from as many as 15-20% of women and rarely in man, has been referred to as focal nonspecific thyroiditis. Iodine complexed with the protein may be the antigen triggering immune response. It has also been suggested that the disease may represent an immunological disorder associated with aging[12].

Riedels thyroiditis (chronic sclerosing thyroiditis), a very rare disease, is characterized by very hard painless goiter due to extensive fibrosis involving the thyroid and contiguous neck structures. It may be associated with reteroperitoneal and mediastinal fibrosis[6].

Granulomatous inflammation of thyroid gland is not exclusive for De Quervain thyroiditis. Palpation thyroiditis (multifocal granulomatous thyroiditis) is an incidental finding that probably represents the thyroid response to trauma. The epithelium of multiple isolated and small groups of follicles is replaced by macrophages with giant cell reaction[13].

Thyroid gland may also be involved isolated or as part and parcel of systemic granulomatous inflammatory diseases. Caseating granulomas suggest possibility of tuberculosis, suppurative granulomas of fungal infections and non caseating isolated or confluent naked granulomas of sarcoidosis. Demonstration of microorganism on direct smear and culture of aspirated material and histology sections, serum calcium levels and angiotensin convertase enzyme levels may provide helpful diagnostic clues[14].

Cytology and histology from diffuse vascular enlargement of Grave's disease may at time be difficult to differentiate from Hashimoto thyroiditis on one hand and papillary carcinoma on the other hand. Morphological features are also altered by therapy in this disease. Lymphocytic infiltration may be variable and at times pronounced. Differentiation from papillary carcinoma and Hashimoto thyroiditis may be possible on the basis of absence of nuclear features of papillary carcinoma, hurthle cells characteristics of Hashimoto, hormonal assay and antithyroid antibodies.

Thyroid neoplasm

The commonest endocrine neoplasm, tumours of thyroid gland are predominantly of follicular origin with C-cell differentiation recorded in up to 5% of tumors[15].

i) Follicular neoplasm: The most common thyroid neoplasm; benign follicular adenomas are surrounded by thin fibrous capsule in contrast to thick capsule observed sometimes in follicular carcinomas[16]. Follicular adenoma is differentiated from encapsulated, minimally invasive follicular carcinoma by capsular/vascular invasion[17]. Histological variants of follicular adenoma include unusual tumors like hyalinizing trabecular adenoma, hurthle cell adenoma, adenolipoma, adenochondroma and clear cell adenoma amongst others. In the absence of vascular/capsular invasion, pronounced cell proliferation and less regular cytoarchitectural patterns have been considered indicative of atypical adenoma; whereas, huge, hyperchromatic nuclei are seen in adenoma with bizarre nuclei[18]. When significant mitotic activity is present, the adenoma should be thoroughly sampled at tumor-capsule-normal gland interface to rule out capsular/vascular invasion[17].

In hyalinizing trabecular adenoma, trabeculae formed of tall follicular cells with peculiar intracytoplasmic yellow refractile bodies are arranged about vascular channels embedded in hyalinized matrix[19]. There is morphological resemblance to medullary carcinoma and paraganglioma, hence, the alternative designation of paraganglioma like adenoma of thyroid (PLAT). Recently, malignant counterpart has also been described[20].

As in other endocrine tumors, histological and cellular patterns do not allow distinction between benign and well differentiated malignant follicular

neoplasm. The diagnostic criteria of vascular invasion must be established on venous caliber vessel, located in or immediately outside capsule with tumour cells attached to vessel wall. Capsular invasion must be full thickness and should be distinguished from FNAB induced rupture[21]. Well-differentiated follicular neoplasms with only microscopic capsular/vascular invasion have been categorized as minimally invasive follicular carcinoma. Recently, follicular tumors with questionable capsular invasion have been termed follicular tumors of uncertain malignant potential (FT-UMP) and if questionable nuclear features of papillary carcinoma are seen, the tumor is called as well-differentiated tumor of uncertain malignant potential (WDT-UMP) [22].

The high-risk counterpart, widely invasive follicular carcinoma shows widespread infiltration of adjacent thyroid tissue, vessels, extensive areas with solid/trabecular growth patterns and increased mitotic activity[23].

Vascular metastasis mostly to bones, liver and lungs is common in follicular carcinomas as compared to lymphatic spread.

Thyroid neoplasm are designated as hurthle cell tumors, when more than 75% cells show oxyphilic change. Irrespective of microscopic growth patterns, these tumours are divided into adenomas and carcinomas depending on capsular/vascular invasion[24]. Tumors showing nuclear features similar to papillary carcinoma are regarded as variant of papillary carcinoma[25]. Hurthle cell carcinomas spread by hematogenous route and show highest incidence of metastasis amongst well-differentiated cancers.

ii) Papillary Thyroid carcinoma (PTC) Papillary arrangements and characteristic nuclear features namely nuclear enlargement, overlapping, ground glass chromatin pattern, longitudinal grooves and cytoplasmic invaginations are diagnostic of the commonest thyroid malignancy; the papillary carcinoma. Carcinoma of small size (< 10-15 mm), usually diagnosed on imaging or incidentally on biopsy specimen, is designated as papillary microcarcinoma. Numerous variants of papillary carcinoma have been described. Tall cell and columnar cell variants do not show characteristic nuclear features and along with diffuse sclerosing type are bracketed as poor prognostic group[26,27]. Follicular arrangement with characteristic nuclear features are indicative of follicular variants including subtypes like macrofollicular, solid, diffuse, multinodular, encapsulated follicular and oncocytic. Papillary carcinomas with cribriform – morular histology and nodular fascitis like stroma have been described[27].

Cervical lymphnode metastasis is common in papillary carcinoma, which may be the only presentation, and when isolated, does not adversely affect prognosis.

iii) Medullary Thyroid carcinoma (MTC) Originating from parafollicular C-cells, these tumors may occur in those with genetic predisposition for multiple endocrine neoplasia (MEN) type 2A and 2B syndromes, non MEN inheritance, and more commonly as sporadic isolated. MTCs as a part and parcel of MEN are bilateral, multicentric, commonly associated with C-cells hyperplasia, occur at younger age and carry a better prognosis[28]. On microscopy, nests of round, polyhedral, ovoid or small cells may be arranged in a variety of patterns including carcinoid like, trabecular, glandular or pseudopapillary with a variable fibro vascular stroma. The diagnostic features include demonstration of amyloid deposition; calcitonin on immunohistochemistry and membrane bound electron dense granules in tumour cells on electron microscopy[29]. Sporadic MTC commonly presents as solitary nodule with early spread to lymph nodes. Distant metastasis may occur in liver, lung, bone and brain. Bad prognostic factors include older age, demonstration of calcitonin and amyloid on histopathology, and abnormal postoperative calcitonin levels in blood[30].

iv) Miscellaneous carcinomas anaplastic Thyroid carcinoma (ATC) the most aggressive thyroid carcinoma generally fatal within six month, may arise Denovo or by dedifferentiation of a preexisting follicular or papillary carcinoma. Mostly seen in elderly females, this non-unencapsulated widely invasive tumour may show a variety of microscopic patterns including squamoid, small cell (mimicking small cell carcinoma of lung) and giant cell types. Majority of sarcoma like tumours of thyroid are histogenetically undifferentiated carcinomas[31,32].

Poorly differentiated carcinomas carry an intermediate prognosis and show insular pattern of growth with small uniform tumour cells arranged in neuroendocrine pattern; necrosis, vascular invasion and mitosis being common[33].

Extremely rare and unusual histological types of carcinoma reported in thyroid include squamous cell carcinoma, mucoepidermoid carcinoma, sclerosing mucoedpidermoid carcinoma with eosinophilia and clear cell tumors[1].

Possibility of infiltration by the carcinomas arising from adjoining structures particularly larynx, pharynx, trachea and esophagus must be meticulously ruled out before confirming primary malignancy of thyroid with unusual histological patterns. Metastasis when detected in thyroid is commonly coming from carcinomas of kidney, colon and melanoma.

v) Lymphomas Thyroid gland may be involved in as many as 20% patients dying of generalized disseminated lymphomas. Isolated thyroid lymphomas are generally seen in elderly females. Mostly of B cell lineage, these tumours are of small, intermediate and large cell types. Next in frequency to diffuse large B cell lymphoma are marginal zone B cell lymphoma of low grade malignancy evolving from mucosa associated lymphoid tissue (MALT)[34,35]. Rapid enlargement, extension and infiltration of the lesion in adjoining tissue in a patient with pre existing immunologically abnormal thyroid particularly Hashimoto thyroiditis, diffuse replacement of the parenchyma by hypercellular areas of proliferating lymphoid cells on histology, monoclonality of the infiltrate and lymphoepithelial lesions as in MALTomas of other organs, help in establishing the diagnosis.

vi)Hereditary and familial carcinomas MTC may be hereditary in many as 25% of the cases transmitted in an autosomal dominant mode. The family members of the patient and children born to parents affected by MTC as well as patients having pheochromocytoma, hyperparathyroidism, marfanoid appearance, multiple ganglioneuromas, multiple endocrine neoplasia (MEN) 2A and MEN 2B syndromes should be screened for MTC. Defects and mutations in the menin gene in MEN-I syndrome predisposes for higher incidence of follicular adenomas, adenomatous polyposis coli (APC) gene for thyroid carcinomas and PTEN gene responsible for Cowden's disease to follicular thyroid carcinoma.

Multiple nodules have been reported in different organs including thyroid in Carney complex associated with inactivated mutation of the PPKARIA gene[36].

Immunohistochemistry and molecular studies

All the tumors of follicular cell origin excepting anaplastic carcinoma are positive for pan thyroid markers like TTF1 and thyroglobulin[37]. In addition, papillary carcinomas are decorated with pankeratin stain; hyalinizing trabecular adenomas with neuroendocrine markers in a focal distribution and type IV collagen around tumor cells; follicular carcinomas with low molecular weight keratin, EMA, laminin and type IV collagen; hurthle cell tumours with mitochondrial antigens and CK14 (probably a selective marker for these cells) and poorly differentiated carcinoma with bcl 2 [38-43]. In anaplastic carcinoma, variable positivity has been reported for keratin and thyroglobulin and negative staining for TTF1[44,45]. Thyroglobulin has been reported positive in metastasis in some cases of anaplastic carcinoma[46].

Medullary carcinomas are negative for thyroglobulin but positive for keratin, TTF1, and pan endocrine markers such as NSE, chromogranin A, B, C, synaptophysin and CEA[47,48].

Molecular analysis can be carried out on FNA aspirate but are quite expensive, not easily available, do not provide a precise identification of cancer subtypes and serve only small number of patients. Expression of galectin- 3, initially considered a promising marker for thyroid nodule was later found falsely positive in multinodular goiter as well as Hashimoto thyroiditis[49,50]. In tandem expression of galectin-3 and HBME-1 has been shown to have high sensitivity for cancers amongst broad groups of follicular neoplasm. ret protein has been demonstrated in sporadic as well as familial MTC particularly with MEN 2. Specific mutations correlate with predisposition to develop other endocrine tumor as well as aggressiveness of MTC. In papillary thyroid carcinoma, genetic mutations are mutually exclusive (Mutations restricted to one of the genes). ret/PTC rearrangements are the most frequent molecular abnormality in PTC. Hurthle cell carcinomas and hyalinizing trabecular tumors may also show ret/PTC rearrangements and there may be p53 mutation in the former in some cases[51].

BRAF gene mutation present in high percentage of melanoma and colon carcinoma cells has been observed in PTC and anaplastic carcinoma of PTC origin. Columnar and classic variants of PTC show higher expression of this mutation as well as metastasis to lymph node compared to follicular variant. This mutation has not been so far reported in other thyroid carcinoma subtypes and is being evaluated for its diagnostic and prognostic significance[52,53].

Fusion oncogene AKAP9/BRAF may be a useful marker in BRAF negative patients with history of irradiation; 20-50% of follicular carcinoma exhibits PAX 8/PPARY fusion that acts as an oncoprotein. FTC lacking this mutation may show RAS mutation[54].

Serum DNA methylation marker for the thyroid carcinoma are under evaluation. However, false positive results have been reported in benign cystic thyroid nodules[55].

P53 mutation are common in anaplastic thyroid carcinoma [ATC].

Thyroid nodular disease (TND)

Increase in the incidence of nodular thyroid disease following transition from iodine deficiency to adequacy and that of AITD in a transient period following iodine sufficiency has been reported[56]. The differential diagnosis of TND comprises a wide spectrum of disorders including solitary nodule, dominant nodule in the setting of multinodular goiter, various benign and malignant neoplasm as well as congenital diseases

like hemiagenesis, cystic lesions including thyroglossal duct cyst and AITD[36]. As many as 50% subject with solitary palpable nodule or diffusely enlarged gland and 50% of general population, even when the gland is normal to palpation, may show thyroid nodules on sonography. In the absence of thyroid dysfunction, autoimmune thyroid disease, thyroiditis and thyroid malignancy, nodular goiter are referred to as simple nodular goiter. The risk of cancer in simple nodular goiter is approximately 3-5 % irrespective of presence of single or multiple nodules[56]. Multidisciplinary approach is required for evaluation of thyroid nodule and the work up includes patients history, clinical examination, laboratory tests like hormonal assays and antibodies, ultrasonography, FNAB, excisional biopsy and molecular studies. FNAB has been recommended on all 8-15 mm hypoechoeic lesions with irregular margins, intranodular vascular spots and microcalcifications and careful follow up advised even if cytology is benign. Distinction of hyperplastic and non-neoplastic nodule from follicular adenoma may be difficult and some pathologists use the term adenomatous nodule for the former, these being polyclonal where as the adenomas are monoclonal. Routine practice of FNAC in nodules > 10 mm, under imaging guidance if required, has reduced the number of surgeries by 50% and increased the yield of cancer from 10 to 50%. In one study thyroid malignancy was found in 6% of non palpable lesions of 8-15mm in size in multinodular goiter(9% in solitary nodules). The risk was similar in nodules smaller or greater than 10mm[57,58,59].

Relatively higher iodine intake in prophylaxis program in iodine deficient areas and use of antithyroid drugs in Grave's disease have been implicated in the genesis of AITD and thyroid carcinoma. Risk of malignancy is high when the nodule is hard or fixed, cold on scintiscan, extremes of age, male gender, history of irradiation, rapid enlargement and associated palpable lymphadenopathy[36].

Thyroid cystic lesions

Thyroglossal duct cyst are usually localized in midline between the base of tongue and the hyoid bone and even reported in the mediastinum. Cysts are frequently encountered as solitary palpable nodules that may be benign pure cyst and solid cystic observed both in hyperplasia as well as in neoplasia. USG guided cytological evaluation should be carried out both of the cystic fluid and the solid structures connected to the cyst wall to rule out minimal risk of carcinomas like Intra cystic papillary carcinoma, collection of mucin in adenocarcinoma and large area of necrosis in other tumors[60].

FNAB versus frozen section

Aspirate from thyroid may be classified as non-diagnostic, non-neoplastic and benign (hyperplasia and inflammation), follicular lesion (usually neoplasm), suspicious of malignancy and finally diagnostic of malignancy. The aspirates may be non representative particularly from small nodules; and distinction between dominant nodule of nodular hyperplasia, follicular adenoma, minimally invasive follicular carcinoma, encapsulated follicular variant of papillary carcinoma and encapsulated hurthle cell tumour may not be possible on FNAB. Some would advocate a report of benign lesion if a nodule is <20 mm, is not increasing with age and aspirate is adequate. Other would like to repeat FNAB within six months. Additional material from aspirates processed as cytospin slides, cell blocks, Millipore filter preparations for immunohistochemistry and molecular genetic analysis may enhance the accuracy. FNAB may precipitate hemorrhage ,necrosis and infarction[59]. Tumor implantation has also been reported in needle tract[61-63].

FNAB has largely substituted frozen section; the later being restricted for evaluation of margins, nodal metastasis and lobectomy carried out for a nodule with unsatisfactory FNAB results. There are inherent disadvantages in the frozen section processing like absence of characteristics nuclear changes of papillary carcinoma and limited sampling for demonstration of capsular and vascular invasion in follicular neoplasm.

Functional abnormalities

Low T_3, T_4 and high T_4 levels with normal TSH have been described in caloric deprivation, liver disease, poorly controlled diabetes mellitus, nephrotic syndrome, chronic renal failure, systemic infections and psychiatric disorders as well as drug intake, without any intrinsic problem with the gland and are referred to as Sick Euthyroid Syndrome.

A decrease in sensitivity of peripheral tissue receptors to thyroid hormone clinically manifests as hypothyroidism despite excess thyroid hormone in the circulation and has been referred as thyroid resistance syndrome.

Inability of pituitary gland to respond to circulating thyroid hormones results in excess secretion of TSH from pituitary and consequent increase in T_3 and T_4 from thyroid is called selective pituitary resistance[64].

Future perspectives

Even though FNAB is increasingly being used to supplement and even substitute ultrasonography and radionuclei scanning for evaluation of morbid anatomy of thyroid gland, the correct nature of the lesion particularly hyperplasia versus neoplasia can be missed. Focal Lymphocytic and/or granulomatous inflammation, in the absence of specific features like follicular destruction,

extensive hurthle cell change and caseation necrosis etc, must be followed up to differentiate self limiting inflammatory disease processes from Hashimoto. Use of the panel of immunocytochemical and molecular markers may enhance precision but are too expensive to be used in routine assessment. Availability of limited number of genetic markers and demonstration of alteration in BRAF gene, thyroglobulin and calcitonin may supplement routine aspiration biopsy and histopathology in future for providing greater accuracy.

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Thyroid Disorders- Issues Related to Efficacy and Safety of Drugs

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Dysfunction and anatomic abnormalities of the thyroid are amongst the most common diseases of endocrine glands. Histopathologically the disorders of thyroid gland are put into many categories but pharmacologically they are divided into two main categories: hyperthyroidism and hypothyroidism, both of which require a definite diagnosis and management. The single most important objective of the treatment is attainment of euthyroid state with optimum therapeutic benefit and maximal safety. This article deals with the issues which can help the prescriber to achieve this objective.

Optimal therapeutic benefit along with maximum safety is always the most desired outcome for any drug treatment. This is more so in case of thyroid disorders where drug treatment needs special skills especially in view of a compromised safety of the antithyroid drugs. Long term treatment is generally the rule and needs significant inputs from both the doctors and the patients alike.

Physician related issues

The treating physician should have complete knowledge about the disease and drugs required to treat it. He should have the experience of different treatment modalities. It is important for the clinician to evaluate patients in context of their presenting symptoms, their personality and beliefs, habits, family and social history, exposure to medications, economic status and job requirements. Astute clinical judgment based on knowledge of disease prevalence and pathophysiology is required for proper diagnosis and treatment. Since several approaches to treatments are available, each with its advantages and disadvantages, it is incumbent on the physician to explain these factors to the patient thoroughly, to indicate a preference and the reason for it and to allow the finial choice to lie with the patient, when appropriate.

Therapeutic issues

Hyperthyroidism

The term 'hyperthyroidism' encompasses a heterogeneous group of disorders, all characterized by elevated levels of thyroid hormone in the blood. The clinical presentation depends upon severity of thyrotoxicosis, duration of disease, individual susceptibility and patient's age. A detailed medical history and thorough physical examination provides the clinician with sufficient clues to suggest the diagnosis of hyperthyroidism and TSH assay is the single best screening test available. True hyperthyroidism must be distinguished from "euthyroid hyperthyroxinemia," which may be caused by certain drugs, nonthyroidal illnesses and a variety of other less common factors. Specific treatment should generally be withheld until the biochemical diagnosis and cause of hyperthyroidism are confirmed. Symptomatic relief can be obtained with beta-adrenergic blocking drugs while the patient is undergoing additional diagnostic testing.

Treatment strategy

The main strategy in treatment of hyperthyroidism revolves around lowering the serum concentration of thyroid hormones to re-establish a eumetabolic state. Currently three modalities of treatment are available, all of which are effective.

Antithyroid drugs (ATDs)- The main antithyroid drugs in use are propylthiouracil, and methimazole. They are used either as a primary form of therapy or to lower thyroid hormone levels before (and in some cases after) radioactive iodine therapy or surgery.

Issues related to use of ATDs regimens- Two regimens are advocated. The starting dose of antithyroid drugs is gradually reduced (titration regimen) as thyrotoxicosis improves or high doses may be given combined with levothyroxine supplementation (block-replace regimen) to avoid drug-induced hypothyroidism. The titration regimen is often preferred as it minimizes the dose of antithyroid drug and provides an index of treatment response.

Latent period- This period can be shortened by using loading doses or large doses of antithyroid drugs at frequent intervals and beta-blockers can be used to control symptoms in the interim.

Duration of therapy- No clear-cut standard for duration of therapy but usually given for 6 months to 2 years as primary therapy.

Follow up- Patients are seen initially at 4 to 12 week intervals, depending on the severity of the illness and then every 3 to 4 months once euthyroidism is achieved. The dose is titrated based on free T_4 levels as TSH levels often remain suppressed for several months and do not provide a sensitive index of

treatment response. Once ATDs are discontinued, patients should be seen at 4 to 6 week intervals for the first 3 to 4 months and then at increasing intervals thereafter, if clinical and biochemical euthyroid status persists.

Radioactive Iodine therapy (RI)- It is currently considered the treatment of choice for thyrotoxicosis by most and is also used for treatment of relapse of hyperthyroidism after antithyroid therapy or surgery.

Issues related to RI regimen- Either an ablative dose of radioactive iodine or a smaller dose is used in an attempt to render the patient euthyroid. Ablative therapy yields quicker resolution and minimizes potential hyperthyroid-related morbidity. It is safe, but most treated patients become hypothyroid and require lifelong thyroid replacement therapy.

Optimum dose- It depends on the size of the gland, uptake of ^{131}I, its subsequent rate of release and individual sensitivity. Many endocrinologists prefer to achieve euthyroid state by using less dose for small goiter, large dose for large goiter and maximum dose for complications. The others prefer to achieve complete thyroid ablation as hyperthyroidisim is considered to be more dangerous than hypothyroidism and since most patients eventually progress to hypothyroidism and levothyroxine replacement is relatively simple.

Pretreatment- ATDs should be given for at least one month before RI and must be stopped at least three days before RI to achieve optimum iodine uptake. This also minimizes the risk of thyroid crisis after RI.

Follow-up- Patients should be seen at 4 to 6 week intervals for the first 3 months following radioactive iodine therapy, and then at intervals as the clinical situation dictates. Hypothyroidism generally ensues within the first 6 to 12 months following therapy, but may occur at any time. Therefore, at least annual follow-up is necessary for those individuals who continue to be euthyroid. Once hypothyroid patients are on a stable dose of levothyroxine, they may be followed at yearly intervals. At subsequent visits, a serum TSH measurement is sufficient to assure the adequacy of therapy.

Relapse- More common in younger males. A second dose of RI can be given but only 4 to 6 months after the first treatment.

Surgery- Thyroidectomy is infrequently recommended for patients with thyrotoxicosis. Specific indications include patients with very large goiters who may be relatively resistant to ^{131}I, those who have coincidental thyroid nodules, pregnant patients allergic to ATDs, and patients who are allergic to ATDs and/or do not wish ^{131}I therapy.

Issues related to surgery procedure- The procedure should be performed only by an experienced surgeon and only after careful medical preparation. Hyperthyroidism may persist or recur if insufficient thyroid tissue is removed.

Preparation for surgery- Patient is made euthyroid with an antithyriod drug. A beta-blocker may be used for comfort and safety and iodine for 7 to 10 days before operation (not sooner) to reduce the surgically inconvenient vascularity of the gland.

Follow-up- The patient should be followed as warranted for postoperative care, and at approximately 2 months after surgery to assess thyroid status. Recurrent hyperthyroidism can occur after surgery but hypothyroidism is far more common, and depends primarily on the size of the thyroid remnant. If levothyroxine therapy is necessary, patients can be followed at yearly intervals after establishing clinical and biochemical euthyroidism. Patients who are euthyroid following surgery should also be followed yearly, using the serum TSH level to document euthyroidism.

Adjunctive therapy- The most useful adjuncts are beta-adrenergic blockers which provide symptomatic improvement until the euthyroid state is achieved. Patients who cannot tolerate beta-blockers may be treated with calcium channel blockers such as diltiazem.

In patients with hyperthyroidism and a low radioactive iodine uptake, none of these therapies are indicated, since low-uptake hyperthyroidism usually implies thyroiditis, which generally resolves spontaneously. Therapy with beta-blocking agents is usually sufficient to control the symptoms of hyperthyroidism in these individuals.

Hypothyroidism

It is a disorder of diverse causes in which the thyroid gland fails to secrete adequate amounts of thyroid hormone. The overwhelming majority of cases are due to primary thyroid gland failure because of chronic autoimmune (Hashimoto's) thyroiditis, radioactive iodine therapy, or surgery. The symptoms are generally related to the duration and severity of hypothyroidism, the rapidity with which hypothyroidism occurs, and the psychological characteristics of the patient. A comprehensive medical history and physical examination can uncover signs and symptoms that will help establish the diagnosis in a patient. The most valuable test is sensitive measurement of TSH level.

Management- Each patient's care must be individualized. It is usually treated with levothyroxine replacement therapy and the mean replacement dosage is based on the age, weight, and cardiac status of the patient and the severity and duration of the hypothyroidism.

Follow up- Patients should undergo reassessment and therapy should be

titrated after an interval of at least 6 weeks following any change in levothyroxine brand or dose. Once the TSH level is in the normal range, the frequency of visits can be decreased.

Factors which affect therapy

1. A high-quality preparation and preferably the same brand of levothyroxine should be used throughout treatment. In general, desiccated thyroid hormone, combinations of thyroid hormones, or triiodothyronine should not be used as replacement therapy.

2. Thyroid hormone absorption can be affected by malabsorptive states and patient age. Since levothyroxine has a narrow therapeutic range, small differences in absorption can result in subclinical or clinical hypothyroidism or hyperthyroidism.

3. Drug interactions- cholestyramine, ferrous sulfate, sucralfate, calcium, and some antacids containing aluminum hydroxide interfere with levothyroxine absorption, anticonvulsants affect thyroid hormone binding and rifampin and sertraline may accelerate levothyroxine metabolism and necessitate a higher replacement dose.

4. Special care needs to be taken in the patients with coronary artery disease who are more prone to have anginal attacks. The dose should be started at a lower level and the increments should be made slowly with lesser doses. Total dose should also be appropriately reduced.

5. The poor compliers may miss a dose or two. Since thyroxine has a long half life, the skipped doses can be taken together which is safe and patient may be suitably informed about it.

6. Some patients fail to loose weight even after the TSH is normalized with thyroxine replacement. It can take upto three months for the symptoms to disappear after full replacement and also needs an appropriate dietary adjustment.

Special issues related to Thyroid disorders

Pregnancy

Hyperthyroidism during pregnancy presents special concerns. Radioactive iodine is contraindicated because it crosses the placenta. Propylthiouracil is the treatment of choice in pregnancy. This also crosses the placenta, and overtreatment may adversely affect the fetus. Therefore, the lowest possible dose of antithyroid drug should be used to maintain the mother's thyroid function at the upper limit of normal. Because pregnancy itself has an ameliorative effect on thyrotoxicosis, the dose of antithyroid drug required usually decreases as the pregnancy progresses. Often the antithyroid drug can be discontinued before delivery. If surgical treatment does become necessary, it is best done during the second trimester of pregnancy.

Untreated overt hypothyroidism during pregnancy may increase the incidence of maternal hypertension, preeclampsia, anemia, postpartum hemorrhage, cardiac ventricular dysfunction, spontaneous abortion, fetal death or stillbirth, low birth weight, and, possibly, abnormal brain development. Even mild, asymptomatic, untreated maternal hypothyroidism can adversly affect cognitive functions of the offspring. Thyroid hormone replacement treatment should be advised for all pregnant women with hypothyroidism, even if it is mild. TSH measurement should be routine before pregnancy or during first trimester screening for thyroid dysfunction.

Subclinical hypothyroidism and hyperthyroidism

Subclinical hypothyroidism refers to mildly increased serum TSH levels in the setting of normal free T4 and T3 estimates. Although it is often asymptomatic, potential risks associated with the condition include progression to overt hypothyroidism, cardiovascular effects, hyperlipidemia, and neuropsychiatric affects. Treatment should be initiated in patients with TSH levels >10 IU/mL or in patients with TSH levels between 5 and 10 IU/mL in conjunction with goiter or positive anti-thyroid peroxidase antibodies (or both). These patients have the highest rates of progression to overt hypothyroidism.

Subclinical hyperthyroidism is characterized by a serum TSH level <0.1 IU/mL and normal free T4 and T3 estimates. The clinical significance of subclinical hyperthyroidism relates to three risk factors: progression to overt hyperthyroidism, cardiac effects, and skeletal effects especially osteoporosis. In most patients, treatment is unnecessary, but periodic clinical and laboratory assessment should be done to determine individual therapeutic options.

Thyroid storm

Thyroid storm is al life-threatening, clinical syndrome characterized by exaggerated

Signs and symptoms of hyperthyroidism, fever, and altered mental status usually precipitated by a concurrent illness or injury, spontaneously following withdrawal of ATDs or following radioactive iodine therapy. When the diagnosis is suspected clinically, therapy must be initiated immediately in the intensive care unit, and consists of providing supportive measures, treating the precipitating cause, and consists of providing supportive measures, treating the precipitating cause, and administering specific pharmacologic agents such as propylthiouracil or methimazole, potassium iodine, lithium carbonate,

ipodate and corticosteroids. The selection of drugs is guided by specific clinical situation. Because of the complexity of thyroid storm, it is recommended that an endocrinologist participate in the evaluation and management of such patients.

Hypothyroidism and depression

The diagnosis of sub clinical or clinical hypothyroidism must be considered in every patient with depression. In fact, a small proportion of all patients with depression have primary hypothyroidism either overt or sub clinical. Moreover, all patients receiving lithium therapy require periodic thyroid evaluation because lithium may induce goiter and hypothyroidism.

Safety issues

Patient related issues

By observing some cautions the patients themselves can contribute towards an improved safety with the use of the drug therapy for thyroid disorders.

- Compliance-Therapy of thyroid disorders is usually of long duration/life long, so, if properly taken, restores normal health and life span.
- Support form the family
- Regulation of physical work
- Appropriate nutritional intakes etc.

Issues related to therapy

The treatment of hypothyroidism and hyperthyroidism is accomplished by a number of adverse effects ranging from trivial to serious.

ATDS-In general the tolerability of these drugs is poor and requires a special effort both by the physical and the patient to make the treatment as safe as possible. The common side effects may resolve spontaneously or after substituting an alternative antithyroid drug. Rare but major side effects require stoppage of drugs. Propranolol or longer acting beta blockers can be used to control symptoms, especially in the early stages before antithyroid drugs take effect.

Radioactive iodine- Radioactive iodine therapy is safe, but most treated patients become hypothyroid and require lifelong thyroid replacement therapy. Certain radiation safety precautions are necessary in first few days of radio-iodine therapy.

1) Patient should avoid close, prolonged contact with children and pregnant females for several days; so as to avoid radiation exposure form residual isotope.

2) A pregnancy test should be carried out in women of child bearing age before ^{131} I therapy is initiated if there is any possibility of pregnancy. Though the patient can conceive safely 4 to 6months after treatment.

3) ^{131} I therapy is absolutely contraindicated during breast feeding.

4) Mild pain might persist due to radiation thyroiditis 1 to 2 weeks after treatment, which can be treated with appropriate analgesics.

5) Elderly or cardiac patients with thyrotoxicosis may require antithyroid drug therapy before treatment with radioactive iodine to deplete the thyroid gland of stored hormone and reduce the risk of excessive post treatment hyperthyroidism as a result of ^{131}I – induced thyroiditis.

6) After administration of a dose of radioactive iodine, thyroid replacement therapy should be carefully initiated during the time the patient's thyroid function passes through the normal range into the hypothyroid range. The final thyroid replacement dose must be individualized.

Surgery- Hyperthyroidism may persist or recur if insufficient thyroid tissue is removed. Patients must be cautioned about potential complications of surgery, including hypoparathyroidism, injury to the recurrent laryngeal nerve and high incidence of post operative hypothyroidism.

Choice of therapy

The choice of therapy for thyroid disorders is influenced by emotional attitudes, economic considerations, and family and personal issues. The natural history of the disease, the advantages and disadvantages of the available therapies, and the features of the population group in which the patient falls should be taken into account. The patient should have a clear understanding of the indications and implications of all forms of therapy, including risks, benefits and side effects, and should be an active participant in the decision-making process regarding type of therapy.

Recent advances

Existing conventional therapies for thyroid disorders are only palliative and it is not yet possible to treat the basic pathogenetic factors. There is also lack of general agreement as to which therapy is best since none is ideal. So, there is constant need to develop newer treatment modalities. These days Recombinant human TSH (rh TSH) is available for diagnostic purposes in thyroid cancer patients. It is also effective in increasing iodine uptake by thyroid remnants after total thyroidectomy and, therefore, may by used in preparation for thyroid remnant ablation and also doubles iodine uptake in multinodular goiter patient, enabling the administration of lower therapeutic doses of ^{131} I and avoiding the need for hospitalization. However, the possibility of thyroid hormone elevations, painful thyroiditis, and an increase in thyroid volume are issues of concern after rh TSH administration in these patients.

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National Board of Examinations sings Memorandum of Cooperation with Indira Gandhi National Open University (IGNOU) on 3rd February 2006

The National Board of Examinations is offering Diplomat National Board (DNB) qualifications in various medical specialties through out the country through the accredited hospitals and institutions. The School of Health Sciences (IGNOU) has also been involved in post graduate medical educational programmes through the courses such as Post graduate diploma in Maternal & Child Health (PGDMCH), Post graduate diploma in Hospital & Health Management (PGDHHM), Post graduate diploma in Rural Surgery, Post graduate diploma in Geriatrics medicine, Post graduate diploma in Community Cardiology etc. IGNOU has a vast network of Regional centers, Study centers and identified hospitals for practical hands on training for the enrolled candidates.

Both the National Board of Examinations and the School of Health Sciences IGNOU have the common concern for the development of need based post graduate medical educational programmes especially in view of the concerns of the Government of India reflected in the National Rural Health Mission 2005, National Health Policy 2002 etc.

The memorandum of collaboration between the two organizations was signed on 3rd February 2006, by the Executive Director, National Board of Examinations Prof. A.K. Sood and the Registrar IGNOU Mr. D.K. Tetri, in the presence, Vice Chancellor IGNOU, Prof. H.P. Dikshit, President National Board of Examinations , Prof. A. Rajasekaran, Prof. S. Bhardwaj, Vice President National Board of Examinations, and governing Body members Prof. P.K. Dave, Prof. A.K. Agarwal, Surg. Vice Admiral V.K. Singh and Directors of various Schools at IGNOU. The memorandum lays the foundation for cooperation and joint actions in all such areas which may be identified and mutually agreed from time to time toward the common goal of developing need based post graduate medical educational programmes, development of learning materials, joint conduction of CME programmes for the students and teachers/ trainers, sharing of facilities and expertise etc. The DNB students, especially those enrolled in the DNB course in Family medicine (New Rules) can get the benefit of the courses offered by IGNOU such as Post graduate diploma in Maternal and Child Health, Post graduate diploma in Geriatrics Medicine, Post graduate diploma in rural surgery, Community cardiology etc. by having access to the course materials, getting enrolled in some of these courses etc. Both the institutions can start new short term courses for meeting the needs of the health manpower in the rural areas (such as short term courses in anesthesia, RCH, Public Health, Medical technologies for paramedical, etc.)