Modern Medicine
Part 1

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• Modern medicine is the way the medicine is practised today
  • It is also synonymous with Western Medicine
  • Its origin can be traced to Greco-Roman medicine
• Modern medicine took its present form after the industrial revolution in 18th century
• The British brought this medicine in India
• With the setting up of the first medical college in India, it took its root
Introduction

• With the emergence of new knowledge and certain revolutionary technological invention the face of the medicine changed

• Inventions in science and technology contributed immensely for the development of modern medicine

• Early medicine mostly had philosophical orientation

• Modern medicine is now evidenced based
Evidence-Based Medicine

• Definition
  • In simple terms, it means:
  • “using the current best evidence in decision-making in medicine in conjunction (together) with expertise of the decision-makers and expectations and values of the patients/people.”

• EBM is a process of lifelong learning
  • This learning emphasises a systematic and rigorous assessment of evidence for use in decision-making in health care
  • The evidence is analysed with expertise of the decision makers and expectations and values of the patients.

Evidence-Based Medicine

• In summary, the EBM has
  • One goal
  • Two principles
  • Three components, and
  • Four steps

• (The author puts it as 1-2-3-4)\(^1\)
  • EBM has one goal to
    • improve quality of clinical care,
Evidence-Based Medicine

• Contd.

• Two principles are
  • hierarchy of evidence and insufficiency of evidence

• Three components are
  • evidence, expertise and expectations of patients

• Four steps are
  • ask, acquire, assess and apply
Evidence-Based Medicine

• Why EBM
  • EBM integrates expertise in the subject of decision makers, patient values and expectation with evidence
  • Expertise alone is not sufficient to make a decision.
  • The decision may prove to be wrong unless weighed against best evidence

• Manufacturers claim
  • Many clinicians use a new drug or device based on manufacturers claim
The information is always not valid
This may be more harmful to use such inventions unless backed up by appropriate evidence

Example:
- The companies promoted use of hormone replacement therapy (HRT) in post-menopausal syndrome without good evidence
- Large clinical trials later demonstrated the harms that it can cause
Evidence-Based Medicine

• Level of evidence
  • There are various classification on strengths of evidence
  • Classification published by Centre for Evidence-Based Medicine
    • This system of grading was published by Oxford University
      • This is an excellent system of grading for clinical studies
      • This grades evidence levels from 1 through 5
  • Level 1
    • These are very large RCT or systematic reviews
Evidence-Based Medicine

• Level 2
  • These are smaller RCT with less than 50 subjects

• Level 3
  • These are small cohort or case control studies

• Level 4
  • In these, evidence is derived from case reports and low level case control and cohort studies

• Level 5
  • This is derived from expert opinion or consensus based upon experience, physiology or biological principles
Many innovations and technology development have changed the way medicine is practiced today.

Some of these are:

- **Vaccine**
  - Dr Edward Jenner first developed vaccine against small pox in 1876. Small pox has been eradicated from the world.
  - Since then many vaccines have been developed and have helped preventing many diseases.
  - Vaccination is practiced routinely in clinical medicine.
• Surgical Anaesthetic and antisepsis
  • Advancement in surgical techniques have been possible due to discovery of anaesthetic agents in 1846 – ether was discovered this year
  • Cardia surgery, organ transplant, orthopaedic surgery like joint replacement, minimally invasive surgery are now performed in almost all tertiary care hospitals
Technology and Innovation

• Contd.
  • Antisepsis methods and use of phenol in 1867 discovery by Joseph Lister was a landmark development
    • Use of antisepsis and aseptic techniques have reduced the incidences of post operative infection
  • Further development in this field has lead to modern practice in safety in surgery
  • Ignaz Semmelweis was the founder in 1847 of the merits of hand sanitisation
Technology and Innovation

• Contd.
  • Hand washing is routinely performed by all healthcare workers today before delivering patient care
  • This practice has helped in reducing hospital associated infection

• Blood transfusion
  • In 1901, Karl Landsteiner identified different types of blood groups
  • In a tertiary care hospital about 5 to 6 units of blood and blood products per bed are used
Antibiotics and antivirals

- Since the discovery of penicillin in 1928 by Sir Alexander Fleming, many antibiotics were developed
- This was thought of as a panacea for all infectious diseases
- Unrestricted use of antibiotics led to development of resistance towards antibiotics
- Emergence of multidrug resistance bacteria has become a challenging problem in medical care today
Technology and Innovation

• Imaging Technology
  • Since the discovery of X-ray in 1895 by Dr. Wilhelm Roentgen, many imaging modalities have been discovered
  • These are:
    • CT scanner
    • PET CT
    • MRI
    • Ultrasonography
It is estimated that nearly 70 percent patients attending hospital undergo imaging investigation

Today awareness is growing that there is overutilization of radiation based imaging technology

Imaging technology has helped physicians to more accurately diagnose diseases

This also has helped patients to obtain better healthcare

Image guided diagnostic and therapeutic procedures have been able to deliver better patient care
Endoscopy

- This is a direct visualisation technique
- Almost any body part can now be visualised
- This has given modern doctors improved diagnosis and treatment capabilities
- All holes of the body are utilised for this purpose.
- Where there is no hole, a small nick is made to introduce the endoscope
There are various types of endoscopic procedures used today. These are:

- Arthroscope
- Bronchoscope
- Colonoscope
- Cystoscope
- Enteroscope
Technology and Innovation

• Contd.
  • Hysteroscope
  • Colposcope
  • Laparoscope
  • Medistinoscope
  • Sigmoidoscope
  • Thoracoscope
  • Capsule endoscope
  • ERCP
  • Chromeoendoscopy
Organ Transplantation

- Current medical technology has been able to overcome the various barriers to organ transplantation
- A diseased organ can now be changed by a health organ donated by a living donor or a cadaver donor
- As there is a large gap in demand and supply of organs, unethical practices and trade in human organ was not uncommon
- Surgical techniques, infection control and immunological techniques have improved considerably to make this possible
- The phenomenon of organ rejection has been largely overcome by development in immunosuppressive drugs
Technology and Innovation

• Clinical Laboratory
  • Technological revolution has taken place in all areas of care delivery process
    • Clinical laboratory is no exception
  • In modern medicine, diagnostic tests are important part of medical care
    • Laboratory testing has a major effect on clinical decision in modern medicine
  • More than 70 percent of clinical decisions are influenced by the in vitro diagnostic tests\(^3\)

Laboratory testing has a major effect on clinical decisions

- The test results provide physicians, nurses and healthcare providers with important information
- This information helps the care providers in the prevention, diagnosis, treatment and management of disease

Laboratory medicine in modern healthcare supports the practice of evidence-based medicine

Laboratory tests are important indicators for assessing quality of care
More than 4000 laboratory tests are available for clinical use\textsuperscript{4}

The number of genetic tests are showing a rapid increase

- An estimated number of 1430 diseases are now detectable using genetic testing
- The figure includes an estimated 287 tests used for research purposes only

Hospital-based laboratories account for the largest proportion of total testing volume (55%)
Technology and Innovation

• Contd.
  • Consumers of today are more knowledgeable and are taking charge of their health in their own hands
    • This has been made possible by the internet
    • Consumers are searching more and more the health related websites
  • In modern healthcare, consumer directed testing is a key area for market growth
    • In 2004, 10-15% of hospital and commercial clinical laboratories offered some form of direct access testing (USA)

4. The Lewin Group. Laboratory Medicine: A National Status Report
Dr Roentgen

First X-ray Photograph of Dr Roentgen’s wife
Personalised Medicine

• Personalised medicine is a move away from a ‘one size fits all’ approach

• The approach includes the shift
  • To the treatment and care of patients with a particular condition
  • To one which uses new approaches to better manage patients’ health and targets therapies
  • Aim is to achieve the best outcomes in the management of a patient’s disease or predisposition to disease.
Personalised Medicine

• We are all unique.
  • Our health is determined by our inherent differences combined with our lifestyles and environment.

• In personalised medicine
  • Information of our lifestyle and analysis about our genome, with other clinical and diagnostic information, is combined

• The concept of personalised medicine is not new
  • New possibilities are now emerging
• Novel approaches are brought together, such as
  • whole genome sequencing,
  • data and informatics, and
  • wearable technology.
• It is the interconnections between these innovations that makes it possible to move to an era of truly personalised care.
• By this, patterns can be identified
  • This pattern can help to determine our individual risk of developing disease;
  • Detect illness earlier; and,
  • Determine the most effective interventions to help improve our health,
  • This intervention may be medicines, lifestyle choices, or even simple changes in diet.
Personalised Medicine

• Personalised medicine is a broad and rapidly evolving field that is becoming increasingly important in the targeted prevention, diagnosis and treatment of human disease.\(^4\)

• It is now possible to deliver specific targeted drug in cancer
  • Improved patient response and better patient outcome have been achieved

• Clinicians can employ screening programmes that can identify patients who are at higher risk of developing disease
Contd.

• These patients can then make informed decision and lifestyle choices
• Personalised medicine has changed treatment of cancer and neurodegenerative diseases
• Molecular profiling is employed for specific treatment of a particular cancer type
• Novel therapeutic approach can target specific cancer type
• New specific tailor made therapies can be delivered and the existing regimen can be optimised
Personalised Medicine

• One example of these targeted cancer therapies is treatment of breast cancer
  • Some Targeted Therapies include
    • Anti-oestrogens in hormone receptor-positive breast cancer
    • Monoclonal antibodies such as Herceptin in HER2-positive breast cancer
    • Cetuximab for cancers housing a mutant EGFR gene
    • Tyrosine kinase inhibitors in chronic myeloid leukaemia
    • RAF inhibitors such as Vemurafenib for malignant melanoma, and
    • PARP inhibitors in ovarian, breast and prostate cancers
**Neurodegenerative Diseases**

- In this group of diseases progressive death of nerve cells occur
- The cell death is manifested by ataxia and/or dementia
- Most studied neurogenerative diseases are:
  - Alzheimer’s disease
  - Parkinson’s disease
  - Huntington disease, and
  - Amyotrophic Lateral Sclerosis
Personalised Medicine

• These diseases are caused by DNA damage and body’s inability to repair this DNA damage

• DNA repair mechanism can be targeted in cancer treatment
  • Pharmacologic inhibition of DNA repair enzymes can impair the ability of cancer cells to repair damaged DNA
  • This leads to increase response to cancer therapy

• Most readily targetable enzyme is PIKK (phosphoinositide-3-kinase-related protein kinases)
The four ‘P’s of personalised medicine

1. Prediction and prevention of disease
   • Genomic technologies and other diagnostics will be able to identify people most at risk of disease even before the onset of their symptoms

2. More precise diagnoses
   • Knowledge of each individual’s complex molecular and cellular processes, informed by other clinical and diagnostic information, will enable fully understand the abnormal function and determine the true cause of the symptoms.

3. Targeted and personalised interventions
   • Knowledge of the genetic variants responsible for individual drug response can be used to create an individual’s ‘pharmacogenomic’ profile, identifying optimal treatment.

4. A more participatory role for patients
   • They can consider lifestyle changes, and when treatments might not be necessary.

End of Part 1