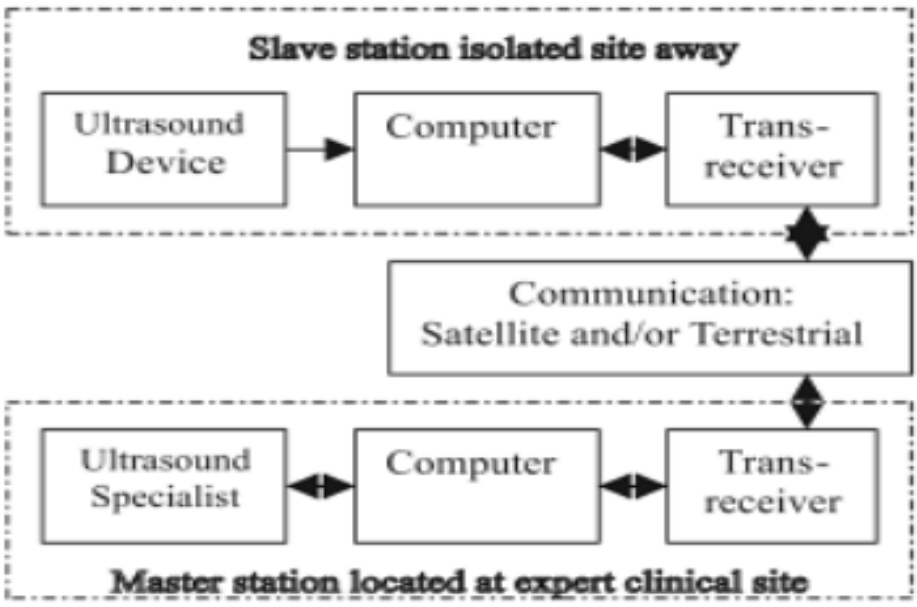
ADVANCED BIO MEDICAL INSTRUMENTATION

LECTURE 11: TELEMEDICINE

TELEMEDICINE- FUNDAMENTALS

Telemedicine is the use of medical information exchanged from one site to another via electronic communications to improve a patient's clinical health status.

Block diagram of Telemedicine



Scope & Benefits and Limitation of Telemedicine

Scope

1. Teleconsultation
2. Tele-education
3. Telemonitoring

Benefits

1. Being at home rather than in institutional care
2. Convenience
3. More equitable access to healthcare
4. Cheaper care
5. Earlier return home from hospital
6. Better resource utilization.

Limitations

1. Dangers of misuse
2. Reduction in the quality of the doctor-patient relationship
3. Impersonal technology
4. Additional training needs

Applications –Teleradiography, Telecardiology, Telesurgery

Teleradiology

Teleradiology is the ability to send radiographic images (x-rays) from one location to another. For this process to be implemented, three essential components are required, an image sending station, a transmission network, and a receiving / image review station.

The most typical implementation are two computers connected via Internet. The computer at the receiving end will need to have a high-quality display screen that has been tested and cleared for clinical purposes. Sometimes the receiving computer will have a printer so that images can be printed for convenience.

he teleradiology process begins at the image sending station. The radiographic image and a modem or other connection are required for this first step. The image is scanned and then sent via the network connection to the receiving computer.

Telecardiology

ECG or electrocardiograph can be transmitted using telephone and wireless. This system enabled wireless transmission of ECG from the moving ICU van or the patients home to the central station in ICU of the department of Medicine. Transmission using wireless was done using

frequency modulation which eliminated noise. Transmission was also done through telephone lines. The ECG output was connected to the telephone input using a modulator which converted ECG into high frequency sound. At the other end a demodulator reconverted the sound into ECG with a good gain accuracy. The ECG was converted to sound waves with a frequency varying from 500 Hz to 2500 Hz with 1500 Hz at baseline.

This system was also used to monitor patients with pacemakers in remote areas. The central control unit at the ICU was able to correctly interpret arrhythmia. This technique helped medical aid reach in remote areas.

Telesurgery

Telesurgery, also called remote surgery, is performed by a surgeon at a site removed from the patient. Surgical tasks are directly performed by a robotic system controlled by the surgeon at the remote site. The word "telesurgery" is derived from the Greek words tele , meaning "far off," and cheirourgia , meaning "working by hand."

On September 7, 2001, Operation Lindbergh culminated in the first complete remote surgery on a human patient (a 68-year-old female), performed over a distance of 4300 mi (7000 km). The patient and surgical system were located in an operating room in Strasbourg, while the surgeon and remote console were situated in a high-rise building in downtown New York. A team of surgeons remained at the patient's side to step in if need arose. The procedure performed was a laparoscopic cholecystectomy (gall bladder removal), considered the standard of care in minimally invasive surgery. The established time delay during the surgery was 135 ms—remarkable considering that the data traveled a distance of more than 8600 mi (14,000 km) from the surgeon's console to the surgical system and back to the console. The patient left the hospital within 48 hours—a typical stay following laparoscopic cholecystectomy—and had an uneventful recovery.

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Electric shock hazards

Reasons for electric shock hazards

- Body contact with overhead power lines
- Faulty insulation
- Improper grounding of equipment
- Loose connections or defective parts
- Ground faults in equipment
- Unguarded live (electric) parts
- Failure to de-energize electrical equipment when it is being repaired or inspected
- Use of defective and/or unsafe tools

Gross shock

It is experienced by a subject by an accidental contact with the electric wiring at any point on the surface of the body. The body acts as a volume conductor at the mains frequency.

Effects on human body

1. Threshold of perception
2. Let go current
3. Physical injury and pain
4. Ventricular fibrillation
5. Sustained myocardial contraction
6. Burns

Micro and macro electric shock

Micro shock

A small electric shock resulting from current that has passed directly into the cardiac tissue from

an electrode in contact with it. It is less than 1 milliampere and may not be felt. It causes produces ventricular fibrillation of the heart.

Macro shock

It s the most common type of shock received and occurs when the human body becomes a conductor of electric current passing by means other than directly through the heart. This effect can readly occur with the use of medical electrical equipment as the natural resistance of the skin to current flow is often reduced or bypassed by electrodes and electorde paste or by invasion into mucous membrane. It provides a shock from an electric current of 1 mA or greater.

Leakage current and types

Leakage current is the current that flows through the protective ground conductor to ground. In the absence of a grounding connection, it is the current that could flow from any conductive part or the surface of non-conductive parts to ground if a conductive path was available (such as a human body).

There are two types of leakage current: ac leakage and dc leakage. Dc leakage current usually applies only to end-product equipment, not to power supplies. Ac leakage current is caused by a parallel combination of capacitance and dc resistance between a voltage source (ac line) and the grounded conductive parts of the equipment.