Editorial

Art and science of Orthopedics

The practice of medicine is a balance of art and science. Science is knowledge of anatomical and pathological basis of disease and its cure, alongwith rationale of various treatment options and expected outcome. The clinician from sequence of symptomatology, and elicitation of clinical signs makes a tentative list of differential diagnosis. The use of investigations narrows down to the final diagnosis. Among the various options of management, a clinician chooses the best option that can provide an outcome which suits the needs of a particular patient. The execution of procedures (treatment) should give a predictable result, which depends on training of treating surgeon, infrastructure, implant quality, if required, and nutritional status of patient (soil). These variables in different proportions result in variable outcome for a given clinical situation in the hands of the same person, thus making orthopedics (medicine) an artistic application of science.

The outcome of mathematics summation is same in all circumstances and that is science because outcome is predictable. While in medicine it does not always make the similar outcome; the variables which influence the outcome depends on several factors, namely: (a) How well a tentative diagnosis is drawn? (b) How well is the option of management chosen? (c) How well the particular option is exercised? (d) Quality of the infrastructural support (technology and its availability). (e) Response of biology (patient's body tissue) to the treatment affected. All these variables will determine whether outcome is going to be predictable or not.[1] Summarily, orthopedics (medicine) is science of knowledge and artistic application of knowledge to achieve healing.

The explosion and universal availability of information technology has made the information about the science of medicine and science of orthopedics available worldwide. Most of the newer technologies emerge from affluent countries. Traditionally we have been conditioned to accept and adopt solutions suggested by developed countries.

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However, the lifestyle of people, socio-economic status, resources available, and infrastructure facilities are different in the developing half of the world.[2] In the United States, for a population of 308.5 million, there are 780,000 doctors, whereas in India for a population of 1.2 billion, the number of doctors available is 750,000. Four billion people in the world live on less than Rs. 100 (US $ 2/-) per day. Most of these people are living in South-East Asia and sub-sahara African countries. Even in the US, the richest country of the world, 47 million (16%) Americans do not possess (cannot afford) a credible medical insurance coverage.[3] In the Indian sub-continent, 70% of people live in rural and mofussil areas and many have no easy access to a standard medical facility, and 30% of total population is living below the poverty line. Any civilized society has to evolve methods to take care of the marginalized sections of the populations; and any current technology which cannot benefit the poorest needs modifications.

Orthopedic surgeons of the 21st century are expected to be well-informed, enlightened, and educated about the currently available scientific options, however, when it comes to treatment he/she is the counsel of his patients keeping in mind the ground realities. Orthopedic surgeon working in smaller towns away from the metropolitan cities have been looking after the community under constrained environments. They have the ability to evolve "out of the box" solutions. Most of such procedures employ simpler technology with higher biological options, even if these are labour intensive. Simpler procedures are not associated with serious complications and after all, healing in orthopedics is by biological processes.

Options in Science of Orthopedics

In clinical practice, for most of the diseases or disorders there are several options for treatment. Fracture distal end of radius can be treated by closed reduction and suitable casting, open reduction and buttress plating, or closed reduction with multiple Kirschner wire fixation. Each one of these can give a satisfactory functional and cometic outcome, and none of these can eliminate late degenerative changes in the articular cartilage if the cartilage was damaged at the time of trauma or by operative intervention. The choice of treatment modality should depend upon factors such as location of the patient, accessibility to the treating facility, infrastructure available to the treating doctor, and the expertise or training of the orthopedic surgeon.

Similar options are available for most of the fractures of upper end humerus and its diaphyseal fractures, fractures of tibia upper end, lower end and diaphysis, fractures of metatarsals, metacarpals, clavicle, scapula, ribs, etc. We must ensure that the patient has been offered various options for his ailment; in the US they express it as "informed patient choice".

Let us look at another condition of painful arthrosis of a hip joint in a 60 year old active person. The options available are fusion of hip joint in the best functional position (25-30° of flexion, neutral of abduction – adduction, and 5° of external rotation), or excisional arthoplasty (acceptance of additional shortening of 3 cm, some degree of instability and use of a walking aid in the contralateral hand), or accept the fused joint as it is and manage with a walking aid in the contralateral hand. Fused hip joint after 10 to 15 years leads to significant disturbance of kinematics of spine, ipsilateral knee, contralateral hip and knee. No orthopedist or an engineer can produce a normal hip to enable the patient play football.[4,5] However, the treating orthopedician must counsel the patient regarding various options depending upon his life style, facilities accessible to the patient, and training of the treating doctor.

A fused hip joint offers the patient a painless stable hip, the patient however cannot perform floor level activities (squatting, kneeling, cross-leg sitting) and he would need a chair and commode facilities and may have difficulties in travelling by public transport. A total hip replacement offers the patient a painless, mobile and stable hip joint, however floor activities are prohibited. The patient and family have to be ready for a second operation after 12 to 15 years. Excisional arthroplasty provides the patient with a mobile, painless hip with possibilities of all floor activities; however, the patient has to accept an additional shortening, limping, and need for a walking aid. The patient can manage it as one time operation.

Limitations of the Science of Orthopedics

We as orthopedic surgeons should also know our limitations or the limitations of the science of orthopedics. With that understanding we should express our limitations and counsel the patient and their families, rehabilitate such patients and make their life less uncomfortable. A 7-year-old child with complete transaction of cord at mid-dorsal level is not going to gain anything by decompression and implant fixation, the patient will remain paralysed and non-walker whatever treatment is available at present. As soon as the local pain subsides (in 3-4 weeks) wheel-chair rehabilitation should be initiated with involvement of the family. An osteosarcoma of femur with generalized metastatic deposits presents with a pathological fracture of humerus. Must we do an operative implant fixation of the humeral fracture and subject the patient and the family to emotional stress and financial burden. The art is to make the patient comfortable with a suitable orthosis or cast for the short duration of his life.

Neglected dislocation of shoulder is not an uncommon condition in developing countries. Theoretically, one is tempted to repose the bone and restore anatomy, or excise the dislocated humeral head and do a shoulder arthroplasty. Even in the hands of experienced surgeons operative procedures involve extensive dissection through scar tissues, and disturbed tissue plains, with risk to the nerves and major vessels fraught with extensive blood loss and complications. None of such procedures achieve a normal shoulder function; most of such operations achieve about 50% of the shoulder function. One can however obtain almost similar function by nonoperative physiotherapeutic measures. One has to however counsel the patient and family with all information.

Information Technology and the Art of Sifting

Present day clinician is obligated to be knowledgeable and he should be able to sift the information as "advertisional" or individual "promotional" or "imaginational" or credible to be of practical use. Manufacturers of devices, drugs, and (now) clinical biologics spend millions to bring a new product to the market. The investors (mostly private hands) expect a return on their capital, therefore marketing is pervasive, slick, subtle, and mostly in synchronization with medical profession.[6] Take the example of rigid fixation advocated by AO-school which converted a generation of orthopedic surgeons to become "callus haters" and "plaster haters". The same school had to take a U-turn to advocate semi-rigid fixation to encourage fracture healing by a visible (natural) callus.

Stem cell technology at present is passing through a similar phenomenon. Scientists have made available stem cells from various human tissues; the stem cells potentially may be totipotent, omnipotent, or pleuripotent.[7] The cells must however be induced to multiply, migrate (to the target areas), and modify (metaplacise) to replace or repair the damaged tissues.[8] There is at present no clear, reproducible evidence for its usefulness in the repair of damaged tissues (e.g. spinal cord) in human beings. The information media has however been projecting worldwide possible repair of sensitive tissues and organs by stem cells. The biological industry (biologics) and commercial organizations are selling stem cells in syncronisation with medical specialists for repair

of damaged spinal cord, nervous tissues and devitalised bones. All new technologies pass through experimental phases. So, as long as stem-cell technology (science) is being used in institutions without financial burden on the recipient patient (and his family), the observations and analysis can be considered credible. However, tall claims projected in the lay press should need more critical analysis. The results of stem cell treatment in rats and rodents cannot be directly extrapolated to human beings. Animals with short life span (from birth to death) in general have a highly exaggerated natural repair response. Stem cell technology may be a treatment for tomorrow but not today.

The Art of Safety

It is essential to have broad-based knowledge of science of orthopaedics so that the society can get a rational and balanced advice from the surgeon. However, with advancing fields of orthopedic surgery no orthopedic surgeon can do all operative procedures with acceptable efficiency. Total hip arthrorplasty, total knee arthroplasty, endoscopic operations, spinal surgery, and vascularised free bone transplantation are a few examples which need elaborate infrastructure and specialized expertise to perform these procedures efficiently. Quality of patient selection, choice of operative procedures, and postoperative outcome is best in the hands of surgical teams who perform such operations frequently as a routine. The rate of complications increases and postoperative outcome becomes poor if you are an occasional surgeon for highly specialized procedures. Let us limit our surgical practice to those procedures which we have learnt by arduous apprenticeship and we have learnt to do the best. For high expertise operative procedures let us refer the patients to the specialists, so that they get more patients to operate, resulting in excellent postoperative outcome with least complications. If a patient gets a satisfactory outcome by your advice or your treatment it improves your reputation and that of our discipline.

Mechanical Devices *In vivo*

Mechanical devices (implants) are most likely to fail if the underlying bone defect does not get repaired biologically, and if we observe the patients for a long number of years. Unfortunately for most of the implants, long-term failures and associated complications have not been adequately described. Removal of an implant from failed hip is much easier than the implants placed anteriorly in the thoracic or lumbar spine, the later can be catastrophic. Surgeons inserting the implants should also be equipped to remove the implant if required. A minimum of 2% implants would need removal either because of mechanical failures or uncontrollable infection or complications related to neighbouring vital structures. It is therefore mandatory to choose safer implants and safer surgical approaches. Difficulties in choosing the most suitable implants are inherent if we realize that there are more than few dozens of hip implants and spinal implants available in the market.

A standard discectomy has been carried out by few generations of surgeons (precedessors) in general without insertion of any spacers since last sixty years whereas for last few years (15 years) disc arthroplasty is being projected or portrayed as the "gold standard" of disc surgery. However, until this time, there is no clear evidence to suggest that the results are better or the patients are happier, though one thing is clear that the expenditure to the patient is much higher when mechanical devices are used. Results of surgery are accompanied by more complications in the hands of a general orthopedic surgeon than in the hands of the originator or the proponents. The benefit of maintaining the vertical height of the disc space can be debated or countered by common sense observations. All homosapiens are getting diminution of the height of disc by one to two millimeters after the age of 30. Large majority do not get symptoms due to diminution of the disc space or reduction in the size of the intervertebral foramina. When a standard discectomy is performed, the surgeon is supposed to excise essentially the offending material, some part of the annulus fibrosus is left behind and the healing takes place by fibrous replacement of the disc space. The biological tissue would take part in the wear and repair and would maintain the viscoelastic mechanics of the vertebral column and last for the life time of the patient. Any mechanical device will eventually fail by fatigue if the patient lives and uses the device for long enough.

American Orthopaedic Association in their annual meeting in June 2003 elicited the response of the attending members for the choice of their own treatment for unrelenting symptomatic L5-S1 disc. The response was for disc replacement by 7%, anterior spinal arthrodesis by 12%, posterior spinal fusion by 35% and standard discectomy by 56%. What is best for us is good for our patients. The people whom we serve deserve transparency in our advice.

Health for All and All for Health

In the 20th century, WHO propagated the slogan "Health for all (human beings the world over) and all (technological advance) for Health." Health care organizations, universities, governments think tanks will keep on debating and planning for standard uniform healthcare facilities for the people. Execution of such endeavors are time consuming and almost always short of the recommendations.[2] Delivery of medical care cannot wait. Even the richest countries are not

able to ensure the availability of standard medical care for those who are not covered by medical insurance.

Does medical insurance ensure the best? In hospitals that care for insured patients, there is a tendency to choose the procedures involving elaborate surgery because more elaborate an operative treatment more is the income to the surgeon and the hospital. Many a times, there are options for other operations, which are less extensive with equally satisfactory outcome; such operations are less expensive though these may be a little more labour intensive. Many insurees do not mind undergoing repeated investigations and multiple treatments because somebody else is paying the money. The patient may insist on getting a computed tomography (CT) scan for his twisted ankle when a conventional comparative X-ray of both ankles may give adequate information. This phenomenon has been addressed as "moral hazard".[9]

In India, the brightest amongst the medical graduates opt to pursue the discipline of Orthopedics. They have the energy and the wisdom to understand various options available in clinical orthopedics. On the other hand, they have the challenge to look after one-sixth of the world's clinical material with its natural history. Based upon such a rich clinical exposure, we should be able to frame credible guidelines not only for the Indian sub-continent but for people worldwide. The current generation has the challenge and opportunity to evolve the art to develop less expensive standard orthopedic care. Let us join our heads, hearts, and hands to evolve methods of health care for human beings at large.

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