Recent Advances in the Management of Fractures with Special References to Nepalese Conditions

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Introduction :

Search for devices, materials and techniques to repair bone tissue has been ever provocative often discouraging and never without any controversy. There are so many methods employed from time to time to deal with the situation. The use of so many methods itself indicates that none is absolute. On one hand we prefer rigid internal fixation while on the other hand we use functional bracing. But the optimal method of fracture treatment is still controversial despite rapid advances made in the field of Orthopaedic Surgery. But despite all controversies, the common aim of all methods has been the *restoration*, as quickly as possible,to as near as can be, an individual's function.

Ever faster today life has changed the way of living and thinking. There are hardly any who can afford confinement to bed for any long duration and hence early mobilisation and early rehabilitation is the demand of time. But we are incapacitated to apply many advantageous methods due to lack of skill, experience and facilities. Although in our set-up the conventional methods are more feasible and advisable *too*, we must endeavour to cultivate our skill and experiences to get advantages of the recent advances according to our circumstances.

Recent Methods of Fracture Management:

In choosing a method the following should be considered as goals:-

(a) Secure union

(b) Restoration of normal function.

(c) Accomplishment of both as rapidly as possible.

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The functional results are usually proportionate to the excellence of reconstitution of the bone after fracture healing but are significantly influenced by the status of the surrounding soft tissues. Joint stiffness or contracture, poor muscle tone and strength, poor soft tissue flexibility, altered or impaired neuro-circulatory status, and osteoporosis have been collectively referred to as "Fracture-Disease" and may occur-after either open or closed conventional methods of treatment. Prolonged immobilisation has their hazards while early mobilisation leads to early rehabilitation if fracture is mechanically stabilised throughout the course of healing. For this securing union is most important but the other factors influence the choice of treatment method and play an important part in determining the final results.

Closed Methods: ref. 11, 12, 13, 15, 17

Attitudes regarding the treatment of fractures by closed methods have changed during the past few decades and important advances have been made in this field particularly ambulatory cast bracing methods applicable to fractures of the lower extremity. Recently emphasis has changed from rest and prolonged immobilisation to active mobilisation with return to normal function as early as possible. It is erroneous to believe that encasing a limb in plaster cast will effectively immobilise a fractured bone. To believe that the joints above and below the fracture must be included in the plaster cast is also misguided. Hampering movement at joints may facilitate movements at adjacent fractures as it is well shown when a fracture occurs in a long bone with an adjoining ankylosed joint. If a plaster cast must include one or more nearby joints in order to gain any sort of purchase this is not to say that it promotes immobility at the fracture. These statements are well supported by various workers.

Functional Bracing:- ref. 11, 21, 13,

One of the newer concepts in the treatment of fractures, particularly of the lower extremity, concerns the use of functional bracing beginning with the observation of Ernst Dehne in the early 1960's later popularised by Vert Mooney, Sarmiente and others. The gradual development of the concept of ambulatory care of lower extremity fractures has progressed to the point where it is now a universally accepted and approved method of treatment.

Functional braces are used basically to promote early motion in the joints and prevent stiffness. Hinged cast braces are commonly applied at the knee, hip, elbow, wrist and ankle. Other kind of leather or plastic braces allow desired movement at the adjoining joints but maintain stability at the fracture site. In cases of femur and tibia, the purpose of functional bracing is not only to maintain motion at the knee but also to allow early ambu-

ation with partial weight bearing on the fracture itself.

The basic concept of the functional bracing is that immobilisation is unphysiologic while mobilisation is always physiologic. Not only is the healing of the fracture promoted by the added stimulus of pressure to the fracture site but also the ability to mobilise improves circulation to the part by the massaging effect of muscles on the incorporated vessels. Motion also results in the mobilisation of oedema fluid that otherwise would be allowed to collect in the capsules and ligamentous structures of the joints, resulting in temporary or perhaps permanent loss of function. The functional brace, then, offers the physiologic solution to many of the problems related to long continuous immobilisation, either in traction or in plaster. Clinical results of functional bracing by various workers (Sarmiente, 1972) have been shown to be good in more than 70 percent cases. At the same time conventional closed methods yielded only 50-60 percent satisfactory results as noted by others. (Williams et at, 1970, Skirving et al, 1977.).

The closed methods have a lot of place in our circumstances because they are cheap, easy to handle and require less skill and experience. These methods are most suited to our rural set-up because other methods require better understanding and cooperation of the patients. Conventional close method is still popular in our hospitals because the nature of the patient and limitations of the orthopaedist leave no place for recent methods. It becomes very difficult for our patients either to stay in hospitals for a long period or to come for frequent follow-up. In such circumstances it becomes difficult to carry on supervision if recent method like functional bracing is applied. But it does not mean that we do not have any place for it. Functional bracing has got very good future in our hospitals, as it is relatively cheaper and simpler but it requires a lot of skill and experiences. So it should be applied only after properly understanding the details of it, otherwise severe deformity and disability can be produced. Therefore. at places where we can develop our skill and facilities, we can improve our conventional methods by functional bracing wherever and whenever indicated.

Electrical Stimulations– ref. 3,4,6.

Although electricity was first applied to a fracture over a century ago, the evidence for its rational use is much more recent. Two methods have been used. One relies entirely on external apparatus that acts by induction of an electromagnetic field, the other requires that electrodes be implanted subcutaneously in the fracture field and attached to an external or implanted source of current. The cathode coil crosses the fracture area whereas the anode

terminal is embedded away from the bone in the soft tissue. Although both methods have been shown to be followed by bony union of unhealed difficult fractures, the process is often protracted and uncertain. It seems likely that these methods will be used extensively when repeated attempts by conventional methods of achieving bony union have failed. Many workers have reported success in many difficult non-unions and stressed its use on risk-benefit grounds over the conventional use of bone grafting.

Therefore, the use of low strength current to induce osteogenesis is cheaper, simpler and mostly non-invasive or semi-invasive in nature. Clinical trials using electricity in various forms in the treatment of nonunions, congenital pseudoarthrosis and delayed union began in the early 1970's. Constant direct current, pulsed current, and electro-magnetically induced current have all been used clinically to heal bone defects with varying degree of success. Preliminary reports of Bassett, et al (1977) indicated healing in more than 70 percent cases. Brighton et al (1977) reported healing in 68.4 percent case. Although, which form of electricity is most efficient in stimulating oteogenesis is still unknown, the "Piezo-Electric" effect of bone had been well established. Thus, while several investigators have conclusively demonstrated that electricity in its various forms does indeed stimulate osteogenesis, only time and further close scientific investigations will determine which technique of applying electricity is most efficient and effective in promoting osteogenesis and thus is most practical for clinical use.

Open Methods:- ref. 14, 16, 17

Great advance in the management of fractures relate to open methods of treatment. Improved results of fractures treated by open reduction and internal fixation have followed the use of –

- improved medullary devices
- improved image intensifier television fluoroscopy to expedite medullary fixation without opening the fracture site. and
- improved implant designs and fixation techniques developed by the ASIF Group in Switzerland.

Coincident with these advances have deen a better understanding of the biomechanical stresses and forces that act on the musculo-skeletal system and on internal and external fixation appliances, a better understanding of the biologic properties and patterns of fracture healing

and a better understanding of blood supply of the bones.

Modern traumatology has many methods for joining and fastening the bones divided due to injury or artificially by a surgeon. Since many years open osteo-synthesis employing metallic implants was widely developed along with conservative methods. There are many limi. tations and disadvantages if we use metals as fixation devices either intra-soseous or extra-osseous Despite rapid advances in the metallurgical fields many unphysiological effects are seen and hence they have to be removed by a similar second operation.

All those factors stimulated the development of new operative methods like the use of compression osteo-synthesis and fixation with bone grafts which is capable of resorbing. Research is now conducted with the use of resorbing metal alloys for fixation. Among the new methods of chemical osteosynthesis is gluing bones together by use of physically, chemically and biologically inert substance e. g. cyacrine. The bonded union is sufficiently strong and hence external immobilisation can be omitted. Later on as the normal bone healing proceeds the gluing material is replaced gradually and in this way strength of bony union remains unaltered through the course of healing.

Compresion osteo-synthesis:- ref. 1, 2, 5, 7, 14

Advantages of Compression Fixation:-

a) Compression increases the rigidity of fracture stabilisation by impacting the bone ends.
b) The space between the fragments that must be bribged by new bone is narrowed.
c) The developing blood supply is protected by rigid fixation.
d) Early, active and painless movements of the injured limb is possible.
e) The chances of fracture disease are minimised.
f) Early rehabilitation of the patient to the gainful life.
g) External splintage can be omitted if fixation is rigid.

Clinical results of compression fixation have been shown to be excellent or good in more than 90 percent cases by various workers (Anderson et al, 1975 Batten 1969, Elerud et al, 1972)

In the past decade, the universal propagation of the knowledge and experience gained by A. O group from Switzerland has caused a minor revolution in the traditional ways of treating fractures.

Rigid internal fixation following accurate reduction has wide spread acceptance. What has, perhaps regretably, less wide appreciation are the aims and objectives of A. O. and their techniques. This group has frequently stressed that knowledge of the indications and the technique are all important. They do not pretend that the day of plaster therapy is over. One of the most important precepts of the A. O. method is the prevention of joint stiffness around the fracture site and early mobilisation with rigid internal fixation is the basis for this.

If open treatment is selected and internal fixation is not sufficiently rigid to permit early return of function, then most of the advantages of the open method has been lost while all the potential disavantages remain. While rigidity of fixation should be the goal, no internal fixation will substitute for solid bone and allow unrestricted activity, a metallic implant can fatigue, break, bend or pull out when subjected to such forces. Union usually occurs prior to fixation loss or implant failure when patient, fracture, implant and technique are properly matched. Sometimes a compromise has to be made between mobilisation and immobilisation when rigid internal fixation is not obtained. While great progress has been made in the open treatment of fractures, many unsolved problems still persist.

Rigid fixation has produced questions concerning the quality of union that develops when normal stresses have been removed by the fixation appliance.

Ultra Sonic Bone Bonding:- 10.

The mechanism of bonding consists in that sonotrode conveys the ultrasonic vibration to the site of bone joining. The operating part of the sonotrode terminates in a bonding spade of the needed dimension. On reaching the site of bone division the ultrasonic vibrations act on the collagen of the protein matrix of the bone tissue. As a result the collagen stroma is bonded providing for esteo-synthesis. Liquid plastic material called "cyacrine" has been used for the bonding. The ultrasonic effect accelerates polymerisation of cyacrine by several tens of times compared to the routine procedure without ultrasound. If gluing of bones with cyacrine produces adhesion, exposure of cyarine to ultrasond makes it penetrate the bone tissue, and diffuse in it for a distance of 40–150 microns, depending on the operating conditions and thus molecular bonding results. As the result of the physico-mechanical action of the ultrasound at the site of fracture the temp is raised to 50–70 degree in 3-4 seconds. The interaction of the factors discussed determines the process of ultrasonic bone bonding like

in cold metal welding that is well known in technology. The security of the bonded bone union is sufficiently high and ranges from 320–580 kg/cm2.

The clinical experience amounts to over 550 operations in which ultrasonic bone boding were used. A short-lived local action of ultrasound in the parameteres mentioned did not induce any pathological changes locally or systematically in the patients. They did not encounter any local complications and the wound healed and bone tissue regenerated in normal time without any disturbances in the classical phases of restoration.

External Fixation Devices:– 14

In recent years modification of earlier devices and the introduction of newer devices have revived enthusiasm for external fixation in some types of fractures. While external fixation devices could be used for any fracture, perhaps their greatest indication is in the management of severe open fractures especially of the tibia with market soft tissue damage and skin loss. In such fractures infection, instability, malalignment and soft tissue complication with skin necrosis and deep infection are common. There are many successful results of this technique. With help of pins and frame fracture is rigidly secured and wound is managed easily. Double frame external fixation device and pins incorporated in plaster with a dressing window are commonly preferred.

Summary and Conclusions:

There is no class of injuries which a practitioner approaches with more doubt and misgiving than the fractures. Because it demands a greater amount of ready knowledge, self reliance, and consummate skill. But despite the most assiduous attention and the best directed efforts, the patient is likely to be lame and deformed for life. Therefore, one must attempt to outline the indications and recommend the methods of treatment according to his skill, experience and prevailing facilities, since, most fractures may be reduced by closed methods, open reduction as a rule should not be considered unless a better result can be expected. Indiscriminate open reduction and internal fixation of fractures may violate many physiologic principles of healing, and its over enthusiastic use reflects discredit upon the method. Before attempting a complicated open reduction and internal fixation self assessment by the surgeon is necessary in regard to his training, his familiarity with the proposed procedure and his surgical ability. Not all surgeons are equally endowed with technical skills and nowhere are these skills more critical than in the open treatment of fractures in

the severely injured patient. The surgeon must know well the institution in which he is operating. The environment in the operating suite should be superior, the personnel should be familiar with the technique and a full set of the proper instrument and inplants should be available. In addition, a patient who is fully informed of the rewards and risks of the open method and who is willing to cooperate in rehabilitation following surgery can be the determining factor in the success of the method. If a patient is not dependable or cooperative closed method of treatment may be the wiser course. Never the less speed of recovery and related economic consideration should not be the dominant consideration when contemplating methods of fracture treatment. To do so increases the risk of complication or catastrophe.

These days emphasis has changed from rest and prolonged immobilisation to active mobilisation with return to normal function as early as possible. If open treatment is selected and internal fixation is not sufficiently rigid to permit early return of function, then most of the advantages of the open method have been lost while all of the potential disadvangates remain. Other surgeons while appreciating this principal of mobilisation looked to other closed methods in particular fracture and cast bracing.

Early ambulation of the patients with a fracture with marked soft tissue loss supported externally by multiple pins and frames became widely accepted method during recent years.

While great progress has been made in the management of fractures, many unsolved problems still persist. Each method has its own merits and demerits. Hence the optimal method remains controversial due to prevailing local circumstances. Internal fixation appliances of varying stiffens, resorbing implants, piezo-electric effects on bone and bone bonding probably assume greater significance and importance in the management of fractures in the future.

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