Changing Trends in Fracture Fixation

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Internal fixation requires a sound understanding of the principles and techniques of the use of implants. Proper understanding of mechanical and biological aspects of fracture repair is key to selection of implant for the treatment of a particular fracture. Fracture fixation is guided by results of various laboratory researches and is related to cellular biology, vascular physiology, biomechanics and our observation and experience from clinical practice. Due respect should be given to microcirculation of bone and soft tissues which is equally important while considering the internal fixation of fractures. One major factor for non-healing of fractures has been the association of the motion at the fracture site during the process of healing after internal fixation causing instability. In cases of internal fixation, this will affect the choice of implant and its principle of application.

Kuntscher first developed the technique of intramedullary nailing as early as 1939. Kuntscher's work was marked by his extensive knowledge, his wealth of ideas and his understanding of the biological process of bone healing, which are impressively, documented in his monograph 'The problem of consolidation and intramedullary nailing'. His contributions in this field include flexible intramedullary reamers, distraction device, intramedullary saw, and the detensor, which was the first type of interlocking nail. Kuntscher's original nail was hollow, slotted; cloverleaf shaped and became progressively popular all over the world.

During the last 20-25 years interlocking nailing has been the golden standard in the treatment of diaphyseal long bone fractures. In 1972 Klemm and Schellmann from Frankfurt and Maine developed the first version of Interlocking nail. Subsequently at CTO Strasbourg around 1974-76 Grosse and Kempf modified, developed and improved the original nailing interlocking system. Lot of changes has occurred in this methodology of nailing-interlocking fixation. Second-generation Reconstruction nail, Gamma nail, PFN and very recent third generation telescoping locking nails are some recent newer modifications.

The treatment of open injuries during the course of fracture treatment dictate the use of methods believed to reduce the risk of complications, including urgent or emergent treatment and thorough debridement of wound and stabilisation by various methods of fracture stabilization, which includes markedly improved external fixators and intramedullary (IM) devices. External fixation devices were used as early as 1840 by Malgaigne to hold a fracture tibia in position and in 1843 a clamp to approximate fractures of the patella. Lambotte in 1907 is also credited with the use of monolateral system with threaded pins, which looks like the AO fixator. However the method failed to gain widespread acceptance till Hoffmann from Switzerland published his series in 1938 with good results. Today it is one of the best methods of fixation for open fractures especially grade III B and C. With the development of VAC system the prognosis of open injuries have improved. Another significant development in this area was the Ilizarov's technique of ring fixators, which has revolutionized the treatment of infected nonunion and reconstruction of comminuted intra-articular fractures.

Stable reconstruction of the fractured bone minimizes the load to be carried by the implant. Stability of the fixation is therefore a critical parameter with respect to implant fatigue and corrosion. Fracture fixation once achieved should produce absolute quietness of fracture by way of stable or biological fixation. This was the basis of AO principles, the group formed in 1958 that promoted the treatment by internal fixation. However their principles are changing and

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they have moved from rigid fixation to biological fixation & stable fixation allowing micromotion. Stability in internal fixation is used to describe the degree of immobility of the fracture fragments. Stable fracture fixation (Osteosynthesis, term coined by Lambotte) means a fixation with little displacement. A special condition is described by the term absolute stability. This defines complete absence of relative displacement between fracture surfaces. Within the same fracture surfaces, areas of absolute and of relative stability may be present simultaneously. Over the years there has been a major change in the philosophy of the AO/ASIF group. It is now preferred to have a stable biologic fixation than a rigid fixation The principles of Biological Fixation may be summarized as: Repositioning and realigning by manipulation at a distance to the fracture site, preserving soft tissue attachments, leaving comminuted fragments out of the mechanical construct while preserving their blood supply, using low elastic modulus, biocompatible material, decreasing contact between the bone and the implant and limiting operative exposure when possible. The degree of stability achieved has a determining effect upon the amount of the load borne by the implant used for fixation. The load carried by the implant is critical with respect to possible fatigue failures and /or to fretting corrosion.

Today with the development of key-hole & minimally invasive surgery, arthroscopically assisted fracture reduction, reconstruction of articular surface & fixation is very much in vogue, especially for distal radius, tibial plateau and plafond fractures. The principle of indirect reduction has been developed lately for fracture fixation. The technique of plating as well as plate design has been modified. The AO principles, techniques and implants have changed considerably over the time. There is a shift of emphasis from mechanical to biological aspect of internal fixation with great emphasis being placed on the preservation of blood supply to the bones & soft tissues. Less Invasive Stabilisation System (LISS) and Minimally Invasive Percutaneous Plate Osteosynthesis (MIPPO) represents a new generation of plates and principles, which act as internal fixators, minimising any surgical insult to the bone and approach related soft tissue damage.

Similarly, there have been lot of developments for the easy and safe technique of closed nailing and interlocking of femur, tibia and other bones. Use of ultrasound for control of passage of guide wire by closed technique is one of the latest developments. Ultrasound and Doppler studies are used for assessing the fracture healing. The technique studies the morphology of callus and neo-vascularisation to predict the progress of fracture healing. The test is non-invasive, cheap and easily accessible. Minimally invasive surgery and computer-aided techniques will influence future developments in the fracture management.

With the increase in the medicolegal issues related to the field of medicine, especially in orthopedics, there is no specific single method of treatment available, for a particular fracture/injury. Major changes are taking place around the world concerning fracture treatment. Change cannot be avoided and will, sooner or later, arrive. The specialty of orthopedics in particular has grown by leaps and bounds in the last 50 years, thanks to the modern day pandemics – road traffic accidents. From a neglected specialty that dealt with deformity, osteomyelitis and low energy trauma, it has become a specialty of demand and glamour, ever growing with quantum leaps. Improved metallurgy, asepsis, intensive care facilities, anesthesia, imaging and diagnostic methodology has allowed us to progress faster.

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