Evolution in Fracture Management

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Humans have never been immune to injury. As technology advances, so do the severity and frequency of traumatic insult and the demand for ever increasing skill on the part of the fracture surgeon.

Forces that produce fractures cause injury to both the bone and the surrounding soft tissue, which results in an inflammatory reaction in the zone of injury. The physiological environment and the biology of repair has always played a crucial role in the healing of fractures. The periosteal sleeve studded with blood vessels and the fracture haematoma form the important ingredients. A protracted mechanical stability is of equal importance.

Evolution

The practice of bone setting was not unfamiliar to our most primitive forebears. Some form of wooden splintage bandaged to the injured limb has been used from antiquity to the present day. Egyptians were skilled bone setters and both Hippocrates and Celsus (300 B.C) have described this method in detail.

From 800 A.D onwards, Arab surgeons used various types of plasters made of mill dust mixed with egg, a mixture of various gums like mastic, acacia, clay mixed with egg white or egg white mixed with lime. Technique of pouring plaster of Paris mixture around an injured limb appears to have been used in Arabia for many centuries and was brought to the attention of European practitioners only in the 18th century. Plaster of Paris bandages were introduced by Antonius Methijssen, a military surgeon in Holland in 1876 [1].

Open Fractures

Until about 150 years ago, an open fracture was virtually synonymous with death and generally necessitated immediate amputation. Amputation itself carried with it a very high mortality from haemorrhage or sepsis. Progressive understanding of bacterial contamination and cross infection, after the pioneering work of Pasteur, Koch, Lister and Semmelweis, the

use of early splintages and the application of open wound treatment following wound extension and excision led to reduction of the scourage of open fracture.

Internal Fixation

The first account of any internal fixation was probably that with a brass wire by A.M. Icart in 1770, screw fixation by French surgeons Cucel and Rigaud in 1850 and plate fixation by Hansmann of Hemburg in 1886. Almost during the same time. A. Lambotte (1866 to 1955), WA Lane (1956 to 1943), Sherman (1950) and Danis (1940) published their results using different plates with varying success rates. Robert Danis (1880 to 1969) must be regarded as the father of modern osteosynthesis since he was the first one to use a compression plate with Co-Apting screws and described the phenomena of 'Primary fracture healing' with peripheral callus. The concept was however widely publicised and practiced world wide by a group of such orthopaedic surgeons, general surgeons and scientists forming an association in 1958, known by the name AO (Arbeitsgemeinschaft for osteosynthesiager) or ASIF (Association for the study of internal fixation) [1,2]. The fear of 'Fracture Disease' a syndrome produced by prolonged immobilisation of fractured fragments was thus obviated.

In 1969, the Dynamic Compression Plate (DCP) was designed and it became the implant of choice for the next two decades. Clinical and laboratory observations however, revealed that stress protection under the plate led to osteoporosis and chances of re-fracture following its removal.

Limited Contact Dynamic Compression Plate (LDCDP) by AO/ASIF was introduced in early 90s and the emphasis shifted from mechanical fixation to biological fixation [3].

The recent introduction of locking compression plate (LCP) and point contact devices further reduces contact between the plate and the bone and has been found

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Fig. 1 : Future of fracture healing.

useful for osteoporosis and comminuted fractures. The Less Invasive Stabilisation System (LISS) is being used to achieve minimum invasive percutaneous osteosynthesis (MIPO) [5]. Closed 'Intramedullary Fixation' with or without locking screws is being extensively used with an aim to protect fracture haematoma and preserve periosteal blood supply.

Coupled with the change in design of the implants, there is also a major change in the material used for internal fixation. The pendulum has started swinging in favour of titanium than the high grade stainless steel 316L used for many years. The Titanium Alloy used for implants has a high yield strength, fatigue resistance,

and is bio compatible [4].

More recently Biochemists are coming with a method to reach into the body with little more than a syringe and needle containing a liquid gel (NOVOSORB). Applied at the fracture site, the gel cures into a polymer that glues the fractured bone together and mechanically supports it while the bio degradable polymer implant aids and abets the healing process (Fig. 1). Rather than needing follow up surgery to remove pins, the polymer is designed to naturally degrade at a rate that coincides with healing [6].

It may be appreciated that while there is tremendous improvement in metallurgy and technique of surgery, the biology of fracture repair can not be ignored and plays a pivotal role in healing. Thus the concept of 'Fracture management' has come a complete circle with more emphasis on preservation of normal physiological environment.

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