CHAPTER FOUR

DISCUSSION

Many external and internal splints are used to immobilize fractures in goats, but only internal splints are usually suitable for femoral fractures .(fixation, such as intramedullary pins and bone plates (Slatter, 1995

The bony intramedullary pins such as bovine bony shuttle pins have been used for immobilization of the distal third fractures of the radius and tibia .(in goats (Shnain, Khalid and Markus, 1989; Kadhim, 1989

The bony intramedullary pins such as bovine bony shuttle pins have been used for immobilization of mid-shaft femoral fractures in goats, but unfortunately they are not successful. Failure of this type of bony splint could be due to the strong muscular traction of the heavy muscle which makes the additional external splint not efficient, However the main possible cause of failure is the decalcification of the bony intramedullary pin at the fracture line as result of local inflammatory reaction which enhances decalcification (decrease in the pH at this area).Some has found that the freeze-dried bone-plate allografts were eventually incorporated in the host bone (Malinin,Latta ,Wanger and Brown, 1984),while others find that the absorbable osteosynthesis implants will lose their strength subcutaneously and intramedullary cavity of the femur(in vivo) faster

than those in distilled water at 37ċ (in vitro) in the rabbit, (Vasenius,Vainiopaa,Vihtonen and Makela; 1990). Bone healing process is influenced by many factors Including mechanical stress and biochemical stress. The mechanical Stress is the most important factor which is depends on, to use the suitable method for immobilization of .(fracture area (Mann and Payne, 1989

In this study, bony shuttle intramedullary pin splint (camel metacarpal .bone) has been used instead of metallic splint

According to the present study this type of internal splint could be recommended for the fixation of diaphyseal femoral fracture in goats without any effect on the bone marrow. Because it is simple, easy to apply and needs minimal postoperative care. There are no side effects as those associated with the use of the metallic devices, because most of the metallic fracture fixation devices need another operation to remove them .(and that will increase the cost of the operation, (Bostman, 1996

Resorption will occur during the remodeling period, because bony shuttle pin splint acts as a bone implant (xenograft) which is used to establishment and/or restoration of normal or maximal mechanical .function with minimal compromise of biological function

The shuttle pin splint like the xenograft can be a source of calcium for

osteogenesis or bone formation and acts as weight-bearing support .(placed in the cortical bone, (Johnson, 1991

Metallic devices also block the callus and new bone does not develop .(from the avascular cortical ends (Anderson, 1965

Cost of the bony shuttle intramedullary pin splint, its availability, its preparation and the simple sterilization methods should be taken into consideration, because the sterilization of the bone graft is mostly complicated and expensive in comparison with the other sterilization methods of bone implants, like the use of ethylene oxide 84% at 22ċ and atmospheric pressure and stored at 0 ċ for 2 months (Johnson, Eurell and .(Schaeffer, 1992

Boiling or autoclaving is easier, inexpensive but might have little loss of .bone strength

Autoclaving have been used in sterilization of the bony shuttle pin splint .with little effect on its strength until the 7^{th} time of sterilization

CONCLUSION AND RECOMMENDATIONS

:Conclusion

The results of this study revealed the bony shuttle intramedullary pin splint (camel metacarpal bone) is good splint for immobilization of the diaphyseal femoral fractures in the goats without any detrimental effects .on the bone marrow

The bony shuttle intramedullary pin splint ((camel metacarpal bone)) is inexpensive and easily applied with minimal postoperative care and .without need for splint removal like the metallic internal splints

:Recommendations

Further studies were needed to evaluate this splinter use in different animal species with special emphasis on debilitated animals and .pathological fractures

REFERENCES

Allgower M, Spiegel PG: Internal fixation of fractures: Evolution of concepts. ClinOrthopRel Res 138:26, 1979

Anderson, L. D (1965). Compression plate fixation and the effect of different types of internal fixation on fracture healing. J. Bone Joint .Surg. 47-A: 191

Awatif, M.E., O.S.Ali and H.M.Shnain (2006).Kirschner Intramedullary Pining for Femoral Fractures in Caprine. Surgery journal 1(2-4):75-77

Azab ME and Abdel-Maksoud HA (1999).Changes in some hematological and biochemical parameters during pre-partum and post- .partum periods in female Baladi goats. Small Ruminant Res.,34: 77-85

Bostman, O.M. (1996). Metallic or absorbable fracture fixation devices, accost minimization analysis ,Clin. Orthop.and .Rel. Res. No. 329: 233-239

Brinker, W.O. Fracture of the femur, Canine surgery.American veterinary .publications.1965

Brinker, W.O. (1998).Manual of internal Fixation in small animals.2nded .1998.P 194

.De Angelis, M.P. (1975). Current techniques in small animal surgery .The appendicular skeleton, the femur.2: 453

De Bari, C., F. Dell'Accio, et al. (2003). "Skeletal muscle repair by adult human mesenchymal stem cells from synovial membrane." J Cell Biol .160(6): 909-918

De Young, D.J, Probst, C.W. (1985). Textbook of small animal surgery. Methods of internal fracture fixation.2: 1949

.Dingwall, J.S. (1974). Canine surgery. Fractures Chapter 24: 949

,Ehmer, E.A. (1974). Bone pining in fractures of small animals .J.A.V.M.A.CX (838): 14

FESTING, M. F. & ALTMAN, D. G. 2002.Guidelines for the design and statistical analysis of experiments using laboratory animals.*ILAR J,* 43**,** 244-58.

Haitham, H.M., Bakheit, A.O.andShnain, H. (2006). Comparative study between Camel and Bovine Bones as bony shuttle pin splint for femoral fractures in small animals. . Surgery journal 1(2-4):69-71.

.Hickman, J. (1964). Veterinary Orthopedics .Injuries to bone.4: 141

Hurov, L. (1978). Handbook of veterinary surgical instruments and ,glossary of surgical terms. W.B. Saunders Company, Philadelphia

.U.S.A

Jain CN (1986). Schalm's Veterinary Haemoatology. 4th Edn., Lee and .Febiger Publishing, Philadelphia

JAGODZINSKI, M. & KRETTEK, C. 2007.Effect of mechanical stability on fracture healing--an update.*Injury*, 38 Suppl 1**,** S3-10.

.Johnson, A.L. (1991). Principles of bone grafting.Semin .Vet.Med.Surg.Small Anim.6 (1): 90-99

Johnson, A.L. Eurell, J.A.C. and Schaeffer, D.J. (1992).Evaluation of .canine cortical bone graft remodeling. Vet. Surg. 21(4): 293-298

Kadhim, H.A. (1989). Comparative study of bony and metal shuttle pins.M.Sc. Thesis, Department of Surgery, College of Veterinary .Medicine, University of Baghdad

Kelly WR (1984). The Blood and Blood Forming Organs. In: Bailliere Tindal, London. Veterinary Clinical Diagnosis. 3rd Edn.,pp: 312-337

KILKENNY, C., BROWNE, W. J., CUTHILL, I. C., EMERSON, M. & ALTMAN, D. G. 2010. Improving bioscience research reporting: the ARRIVE guidelines for reporting animal research. *PLoSBiol*, 8**,** e1000412.

Kimmerle, E. H. – Baraybar, J. P. (2008): *Skeletal trauma:*. Boca Raton: CRC Press, Taylor & Francis Group

Leighton RL: Permanent intramedullary pinning of the femur in dogs and cats. J Am Vet Med Assoc 121:347, 1952

Leonard, E .P. (1988).Fundamentals of Small Animal surgery.Surgical .exercises for the beginner, femur exposure. 6: 158

.Leonard, E. P. (1971).Orthopedic Surgery of Dog and Cats, 2ndEdn .W.B. Saunders Company ,philadelphia, U.S.A

Makela, E.A ,Miettinen, H. and Vainion, J. (1990). Intramedullary nailing of tubular bones with resorbable implants.An animal experiment study .with growing dogs. 20(1):34-36

Malinin, T, Latta , L. L, Wanger, J. L. and Brown, M.D .(1984). Healing of fractures with freeze-dried cortical bone plates.Comparison with .compression plating.Clin.Orthp. Rel. Res. No.190; 281-286

Mann, F.A. and Payne, J.T. (1989).Bone healing.Semin. Vet. Med .surg.Small Anim. 4(4):312-321

MCKIBBIN, B. 1978.The biology of fracture healing in long bones. J Bone JointSurg Br, 60-B**,** 150-62.

Newton, C. D. (1985): Chapter 11: Etiology, classification, and diagnosis of fractures. In: Newton C. D. – Nunamaker, D. M., eds., *Textbook of .Small Animal Orthopaedics*. Philadelphia: J. B. Lippincott Company

.Oehme .Frederick W. Textbook of large animal surgery.1986

Ortner, D. J. – Turner-Walker, G. (2003): The Biology of Skeletal Tissue. In: Ortner, D. J., ed., *Identification of pathological conditions in human .skeletal remains*. San Diego: Academic Press Elsevier

Paul, H.A, Crumley, L. (1984). Evaluation of fixation devices for prevention of rotation in transverse fractures of the caninefemoral .shaft.J.Vet.45 (8): 1504

Pittenger, M. F., A. M. Mackay, et al. (1999). "Multilineage potential of .adult human mesenchymal stem cells." Science 284(5411): 143-147

Pittenger, M., P. Vanguri, et al. (2002). "Adult mesenchymal stem cells: potential for muscle and tendon regeneration and use in gene therapy." J Musculoskelet Neuronal Interact 2(4): 309-320

Ramadan, R.O., Gohar, H.M. Abdin-Bey., Elgasnawy, Y., Abdalla, Elsir and Elgindi, O. (1991). Incidence, Clinical and Radiographic studies of fractures in sheep and goats.J.Egypt.Vet.Med.Assoc .51:725-735

Rogers, K. (2011): *Bone and muscle: structure, force and motion*. New York: Britannica Educational Publishing

Salter RB, Simmonds PF, Malcolm BW: The biological effect of continuous passive motion on the healing of full-thickness defects in .articular cartilage. J Bone Joint Surg 61A: 1232, 1980

Schindeler, A., M. M. McDonald, et al. (2008). "Bone remodeling during .fracture repair: The cellular picture."Semin Cell DevBiol 19(5): 459-466

Shnain, H; Khalid, F.R. and Markus, N .H. (1989). Bony shuttle pin - .splint. The Iraqi J. Vet. Sci. 8(2):307-310

Shnain, H; Markus, N .H. (1995).Kirschner intramedullary pinning . for femoral fractures. Iraqi J .Vet.Sci . 8(2):307

Singleton, W.B. (1966). Limb fractures in the dog and cat. Fractures of .the hind limb. J. Small Animal Pract. 7(2):163

Stoloff, D.R. (1983). Current techniques in small animal surgery. Bones and Joints, pelvic limb, fractures of the femur, pp. 655

Slatter, D. (1995). Pocket companion to textbook of small animal .surgery. Musculoskeletal system.118:530

Turner, C. (2003): Bone Strength: Current Concepts. *Ann N Y AcadSci*, .1068, 429–446 West, G.P

Van Kampen EJ and W G Zijlstra (1961).Standarization of haemoglobinometry. II. The haemoglobinocyanide method. Clin. Chem. .Acta., 6: 538-544

Vunjak-Novakovic (2009).Textbook ofRegenerative Engineering of Musculoskeletal Tissues and Interfaces.

Wakitani, S., T. Goto, et al. (1994)."Mesenchymal cell-based repair of large, full-thickness defects of articular cartilage." J Bone Joint Surg Am .76(4): 579-592

Web1 :http://en.wikipedia.org/wiki/Long_bone http .Wikipedia: Long bone; 2nd February 2013

web2: http://www.homepages.ucl.ac.uk/~ucgaabr/background.html London's global university, Bone biology lab, Bone; 8th February 2013

web 3: http://askabiologist.asu.edu/how-bone-breaks Arizona State University: Body Depot – How do Bones break? 16th April 2013

/Web 4: http://www.medicalnewstoday.com/articles php#what_is_bone_marrow.285666

.West, G.P. Black’s veterinary dictionary,1995

White, T. D. – Folkens, P. A. (2005): Bone Manual. San Diego: Elsevier Academic Press

Wilson T (1991). Small ruminant production and the small ruminant genetic resource in tropical Africa. In: FAO Animal Production and .Health Paper, 88: 181

Young, R. G., D. L. Butler, et al. (1998). "Use of mesenchymal stem cells in a collagen matrix for Achilles tendon repair." J Orthop Res 16(4): 406- .413

Yousif A and Fadl El-Moula A. (2006). Characterization of Kenana cattle .breed and its production environment. Agri., 38: 47-56