ISSN 2348 - 0319

Journal home page: http://www.journalijiar.com

INTERNATIONAL JOURNAL OF INNOVATIVE AND APPLIED RESEARCH

RESEARCH ARTICLE

Efficacy of Bone Cement and Success Rates of Bone Plates in the Management of Open Tibial Fractures in Kano Brown Goats

***G. E. Ochube[1], A. Z. Hassan[2], U. S. Abdullahi[3], M. Y. Fatihu[4].**

1. Veterinary Hospital, Gombe. Nigeria
2. Department of Veterinary Surgery and Radiology, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria.
3. Department of Veterinary Medicine, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria.
4. Department of Veterinary Pathology, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria.

Abstract

The use of bone cement and success rates of bone plates in the management of open tibia fractures in small ruminants was evaluated using eighteen clinical cases of fractures in goats. Under sedation and local anesthesia internal immobilization was achieved using Sherman's bone plates and the fractured tibial ends was filled with bone cement for the goats under the study group(A), while the control group (B) had no cement. Post operative radiographs were taken at 0, 2, 4,8,12 and 16 weeks to evaluate the extent of healing. At 2 weeks, all the animals (100%) had some level of callus formation, between 8 to 12 weeks, sixteen animals (80%) had their fracture line disappearing and bone remodeling had commenced. Following fracture healing, a second surgery was carried out to harvest the implants. Radiographs taken at 16weeks after the second surgery indicated advance bone remodeling. Although, post surgical complications like wound infection occurred in 30% of cases without bone cement after second surgery, a success rate of 97% was achieved during the entire exercise. The relationship between bone cement and fracture healing time was however, not statistically significant ($p>0.05$).Group B had their limbs restored to normal lengths, while group A healed with a bad limp.

Key Words: Bone cement, Bone plates, tibial fracture, and healing time**.**

Introduction

Small ruminant production plays a very important role in the economy of Nigeria and the world at large because of its easy management, low cost of production, quick maturity and acceptability. Nigeria has about 78 million sheep and 23 million goats (FAO, 1990). Small ruminants are increasingly being slaughtered for meat in different parts of the country, the rising cost of beef, increase in human population, urbanization and other reasons are factors that increase the consumption of sheep and goats (FAO, 1990). This class of livestock has been notably used for religious sacrifices, naming ceremonies and also a quick source of money for rural farmers (FAO, 1990).

Nigeria is blessed with abundant land resources, it is therefore, not surprising that majority of small ruminants are managed through free range feeding (semi-intensive) and few instances the confined system-intensive system (FAO, 1990).

As a result of this grazing system (semi-intensive), they are prone to many kinds of accidents of which road traffic accident (RTA) is one. The increased vehicular and motorcycle flow on our roads has led to increase number of fractures cases in the roaming sheep and goat population (FRSC, 2000).

These injuries range from coxo-femoral luxation, lumbo-sacral dislocations, fractures of the humerus, tibia, tarsal bones, femur, radio ulna, carpal bones etc (FAO, 1990). Fractures encountered may also be simple or compound.

Fracture is a break in the continuity of a bone caused by trauma (Hulth, 1980). Fracture become open or compound where the skin is broken, muscles are torn and the fractured ends of the bone communicates with the outside (Lane et al., 1984). When fracture is compound, the conventional way of managing it is via open reduction with internal immobilization using a chosen implant (Milgram et al., 1985).

When fracture is open, there could be fragmentation of bone leading to loss of bone parts (Encarta,2004).The result and effect of this may be mal-alignment, leading to shortening or deforming of affected limb after healing (Onga, 2002).

Preventable structural deformities described above could make people lose interest in their priced pets and other domestic animals, especially those used for festive purposes, such as the Christmas and sallah sacrifices, which prohibits the use of deformed animals. Also, prolific breeds of sheep and goat with structural deformity need to be corrected as it is difficult for lame animals to produce optimally (Charnley, 1979).

Bone cement is a compound consisting of polymethymetacrylate (PMM); the other components are mainly crystals of barium sulphate or zirconium oxide that make the resulting product radiopaque. It acts however not as "glue" but as 'filler' (Harris' 1996).

The objective of this study, therefore, was to evaluate the effects of the use of bone cement alongside internal fixation device, like bone plates.

Material and Methods

Eighteen clinical cases of fracture of the tibial bone were used for this study; the animals were reported to have come from Makarifi, Zaria and Soba Local Government areas of Kaduna State, with geographical locations of, latitude 10 and 11 degree north and longitude 7 and 8 degree east and situated in the northern boundary of the sub–humid zones of north-western Nigeria, West Africa. Their ages were estimated and ranged from six months to twenty months. Animals were given first aid treatment and temporary immobilization with splints was done to allow for proper evaluation and pre-surgical radiographs to be taken. Animals were housed in an insect-free pen at the Department of Parasitology and Entomology, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria. The animals weighed between 10.5 and 20kg. They were screened for endo and ectoparasites. They were fed *ad libitum* with dry groundnut leaves, fresh grass and maize bran. Water was also provided *ad libitum*. The animals were dewormed with albendazole (Albenda, Animal Care Nig) at a dose rate of 10mg/kg, twice (two weeks apart) orally. They were also given ivermectin (ivermec^{R}, MSD, USA) subcutaneously at a dose rate of 200mg/kg to control ectoparasites four weeks later.

Surgical procedure

Animal was properly prepared for surgery by shaving the entire length of the hind limb, proper disinfection of the site was done. Under local anesthesia (xylocaine vipra india), piroxicam (vipra, india) at a dose rate of 20mg/kg, and mild sedative (acepromazine, vipra india, at a dose rate of 0.02-0.04mg/kg), the skin incision was made craniolaterally on the tibia shaft. The subantaneous fascia was opened in the same line as the skin incision. The saphenous vessels and nerve are freed and retreated in the appropriate direction either laterally or medially depending on the area of the bone it is necessary to expose (Piemattei, 1986). The fractured ends of the tibia bone were exposed by incising the deep crural fascia on the medial shaft of the bone. The cranial tibia, popliteous and long digital flexor muscle was reflected from the bone by subperiosal elevation (Greely, 1986).

For this study, non compressional plates (Sherman plates) were utilized. The six holes (4") and four holes (2") plates were used. The plates were placed on the tibia and position of the holes marked. Using a manual Jacob's chuck, holes were drilled on the pre-determined locations proximal and distal to the fractures. With the aid of the bone forceps, the plates were clamped on the lateral side of the bone and held by the assistant surgeon. The surgeon selected a sizeable cancellous screw and using a screwdriver placed d screw into the already pre-drilled hole to secure it (Figure 2).

Bone cement was prepared directly at the operation table by mixing the white polymer powder (polymethymetacrylate) with 5mls of monomer fluids. The resulting product was doughy white mass which polymerize to a hard substance within ten minutes. Using a subperiosal elevator, the surgeon scooped the mixed liquid product and filled the defect, care taken not to allow it stick on the surrounding tissue (Figure 3).

Results and Discussion

Mean healing time for Group A animals was 12.5 weeks with age range of 7-20 months(Table 1),while the mean healing time for group B goats 12.4 weeks with age range 12 -13 weeks (Table 2).

Statistical Analysis;

Results obtained were subjected to statistical analysis using the Student's two –tailed T- test by applying the two variables; Age vs. Healing time. The results were statistically not significant (Figure 1).

Table 1.0: Healing time for clinical cases of tibia fractures in Kano brown goats treated without the use of bone cement.

Group A	Age (month)	Weights (kg)	Pulse (B/m)	Respiration (c/m)	Healing time (weeks)
Mean	13.5	18.5	75.2	30.5	12.5
SD	±0.4	±1.7	±1.8	±2.4	±0.3
Range	7-20	15-23	70-90	25-35	12-13

NB: healing time is the period between onset of injury/fracture and the time the animal start to effect proper ambulation with absence of pain.

Table 2.0: Healing time for clinical cases of tibia fractures in Kano brown goats treated with bone cement.

Group A	Age (month)	Weights (kg)	Pulse (B/m)	Respiration (c/m)	Healing time (weeks)
Mean	12.5	13.5	80.1	28.2	12.4
SD	±0.3	±0.4	±5.2	±1.9	±0.3
Range	7-20	15-23	70-90	25-35	12-13

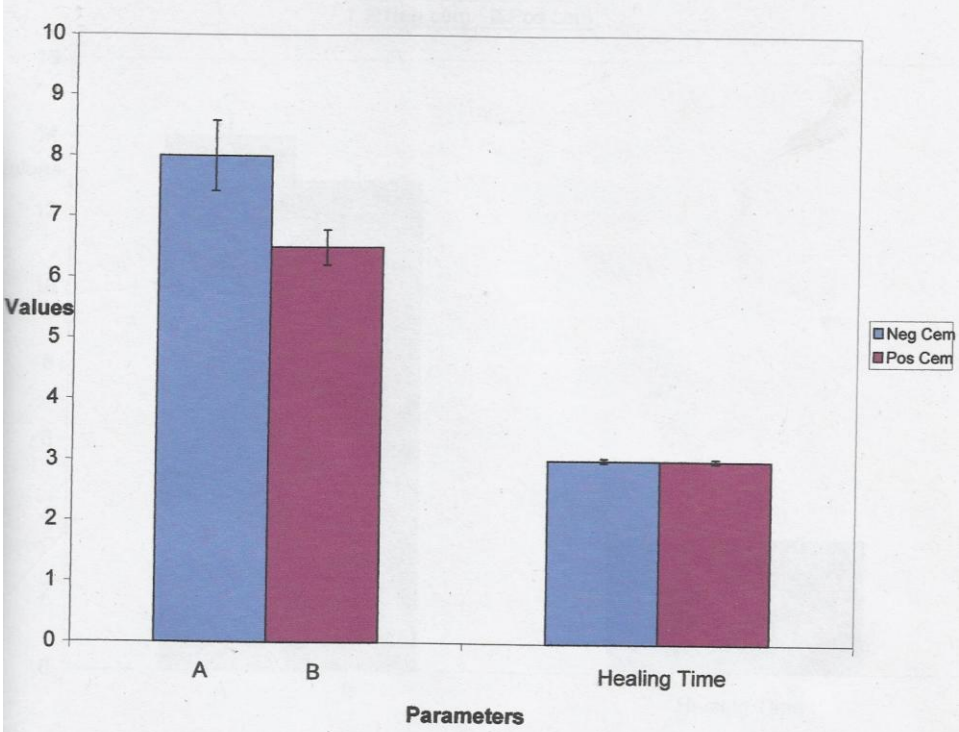

Fig. 1 Graphical representation healing time without cement (Group A)

Key: Values represents age in months,while healing time is in months.
Bar chart 1 displaying age and healing time in months.

Radiographic Evaluation

Group A: The results of the radiographic examinations conducted at weeks 0,2,4,8,12 and 16 post surgery in the Kano brown goats under group A (control) revealed perfect healing of fractures but with the affected limb shorter than normal limb , such goats were observed to exhibit no pain, were limping, and had poor gait. They had reduced appetite and weight loss, although these were found to have improved on the healing time progressed (Figure 5).

Group B: The results of the radiographic examinations conducted at weeks 0, 2, 4,8,12 and 16 post surgery in the Kano brown goats under group B (study) revealed perfect healing of fractures (Figure 4 at 4 weeks), with restoration of the fractured tibial bone to its original length after using bone cement and harvesting the implants (Figure 5 at 20 weeks). These goats were observed to exhibit good stance and good gait in the absence of any undue pain. The reduce appetite and weight loss observed during the earlier stages of the experiment improved towards the end of the study. These goats walked very well using the effected limb with the absence of limping (Figure 7).

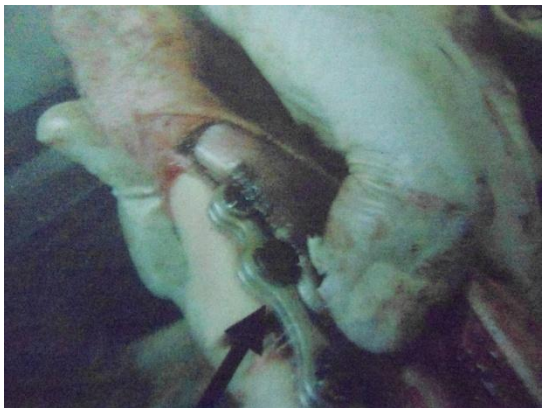

Figure 2

Figure 3

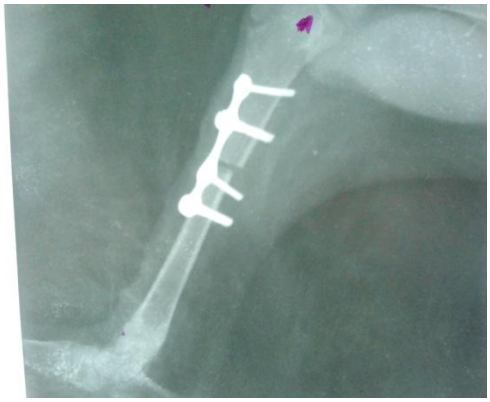

Figure 4

Figure 5

Figure 6

Figure 7

Key: Fig. 2- plating with sherman compression plate.
Fig. 3- bone cementing on the surgical table.
Fig. 4- radiograph of tibial bone showing plating one day post surgery.

Fig.5- radiogragh of tibial after four weeks of harvesting the implant. (the limb was restored to its original length by bone cement).
Fig.6- shows control with akward stance.poor stance.
Fig.7- shows study group treated with Bone Cement. Note the normal gait and stance.

Discussion

Bone cement, which has been indicated and used in the reduction of fractures in which there was loss of bone parts (Harris,1996; Markel, 2001),was found to have restored functional bone length following healing in Kano brown goats. Healing of the fractures resulted in some observable clinical signs which included; pain, abducted limb, limping at the onset of the study to reduced pain, reduced swelling, slight limping towards the end of the study and finally, normal gait, normal stance and posture for the study group (B) at the end of the study. These are conformity with the report of Haboush (1953) and Onga (2002).

Radiographic evaluations of the healing process in the two groups revealed that the formation of callus in goats that are younger occurred much earlier irrespective of the use of bone cement. The goats that weighed less showed faster healing rates as such goats started bearing weight on the affected limbs earlier than the heavier goats. An observation which is in agreement with reports by Iwegbu (1987) and Brown (1993). This experiment showed that bone cement has no effect in hastening or delaying osteogenesis, but was able to restore the limb to its original length because it is a synthetic bone graft material. While all study (Group B) animals that had bone cement did not exhibit any post surgical complications. For group A (control), not all surgical site healed perfectly as post surgical complications such as surgical site infection manifested in some control animals especially after harvesting the implants. This could be attributed to the absence of bone cement which contains antimicrobials. The second opening of the surgical sites predisposed the limb to post surgical complications, which is in the case of group B was possibly ameliorated by the bone cement as observed by Lane, (1984).

Conclusion

The results of the study group showed that bone cement when used in open fracture that is properly immobilized with bone plates can be compatible with both bone and soft tissue and that its histocompatibility enhanced the proper healing recorded

Recommendation

On the basis of the findings of this study, it is strongly recommended that bone cement should be used to fill osteogenic defect where open fracture management is concerned.

Acknowledgement

We acknowledge the following; Dr's Bala Usman, Augustine Andrew; Staff of department of Veterinary Surgery and Radiology, Ahmadu Bello University, Zaria, the Government and people of Gombe State for providing the enabling environment that made this work possible, Finally we are grateful to Professor Oladele Sunday blessing of Department of Veterinary Pathology, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria for reading and editing this manuscript.

.

References

Brown, P.W. (1993); the open fracture. Clinical orthopedic journal. 96: 254.

Charnley, J. (1970). Low friction arthroplasty of the hip. American orthopedic association. Journal 1: 245-253.

Encarta reference library (2004): Microsoft Corporation.

FAO world agricultural report (1990): sheep and goat rearing: pp 17-73.

Federal Road Safety Corps (2000): Northwest/Northeast report: pp 7-15.

Harris, W.H. (1996): Bone healing principles; clinical orthopedic related research journal. 33: 155-157.

Hulth, A. (1980): Fracture healing. A concept of completing healing factors. Acta orthopedic Scandinavia 5: 1-5.

Iwegbu, C.G. (1987): Preliminary results of treatment of fractures by cast tracing the Zaria metal hing joint. Injury 15: 250.

Lane, J.M; Belts, F and Posner, A.S. (1984): Comparison of the effects of compression plates and external fracture on early bone healing. Journal Bone joint surgery 678: 732.

Onga, A. (2002): Fracture management with bone cement. American journal of Bone joint surgery 84: A7, 86-92.

Reigstad, A. and Hellium, C. (1980): Volkmann's Ischemic contracture of the fore arm. Journal bone surgery 72B:213.