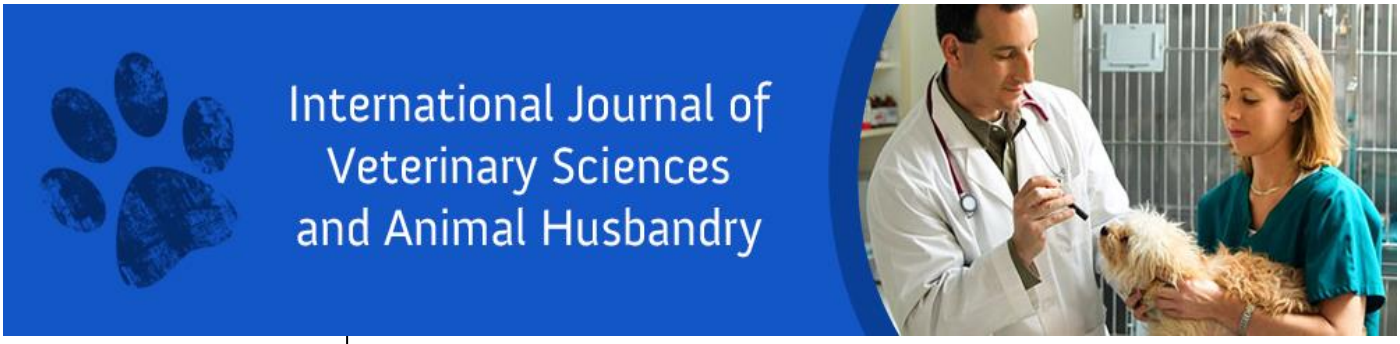
International Journal of Veterinary Sciences and Animal Husbandry 2025; 10(6): 266-270



ISSN: 2456-2912
NAAS Rating: 4.61
VET 2025; 10(6): 266-270

www.veterinarypaper.com
Received: 02-05-2025
Accepted: 03-06-2025

Chavan SR
MVSc Scholars, Post Graduate Institute of Veterinary and Animal Sciences (PGIVAS), Akola, Maharashtra, India

MG Thorat
Professor and Head, Surgery and Radiology, Post Graduate Institute of Veterinary and Animal Sciences (PGIVAS), Akola, Maharashtra, India

RV Raulkar
Associate Professor, Department of Surgery and Radiology, Post Graduate Institute of Veterinary and Animal Sciences (PGIVAS), Akola, Maharashtra, India

FA Fani
Hospital Superintendent, TVCC, Post Graduate Institute of Veterinary and Animal Sciences (PGIVAS), Akola, Maharashtra, India

Kamdi BP
Assistant Professor, Department of Veterinary Pathology, Post Graduate Institute of Veterinary and Animal Sciences (PGIVAS), Akola, Maharashtra, India

Yelmule SS
MVSc Scholars, Post Graduate Institute of Veterinary and Animal Sciences (PGIVAS), Akola, Maharashtra, India

Meenu PM
MVSc Scholars, Post Graduate Institute of Veterinary and Animal Sciences (PGIVAS), Akola, Maharashtra, India

Sontakke AS
MVSc Scholars, Post Graduate Institute of Veterinary and Animal Sciences (PGIVAS), Akola, Maharashtra, India

Corresponding Author:
RV Raulkar
Associate Professor, Department of Surgery and Radiology, Post Graduate Institute of Veterinary and Animal Sciences (PGIVAS), Akola, Maharashtra, India

Fiberglass and plaster of Paris cast for management of metacarpal and metatarsal fracture in cattle

Chavan SR, MG Thorat, RV Raulkar, FA Fani, Kamdi BP, Yelmule SS, Meenu PM and Sontakke AS

Abstract
A total 16 clinical cases of closed metacarpal and metatarsal fracture in cattle were divided into two equal groups of eight cattle each and were subjected to two different external immobilization techniques. In group I (8 cattle) fractures were treated by fiberglass cast application while, in group II (8 cattle) fractures were treated by splint and plaster of Paris cast application. Among these 16 cattle, 56.25% (N=9) had metacarpal fracture and 43.75% (N=7) had metatarsal fracture. The physiological, haematological and biochemical estimations didn't show any significant variations in all cattle during the study period except serum alkaline phosphatase which significantly increased. It might be due to increased osteoblastic activity. Scores for lameness and weight bearing was significantly reduced on 21st and 45th day of immobilization in both the groups. However, the cattle under group I showed greater decrease in severity of lameness than that of group II. The radiographic evaluation of fracture healing revealed that cattle under group I showed a marked reduction in the fracture gap due to bridging callus than that of cattle in group II. In group I complications like non-union was seen in 2 cases. However, in group II mal union and non-union was observed in 3 cases. It can be concluded that fiberglass cast application was superior due to stronger and rapid setting time which keeps the fracture fragments in apposition as compared to splint and plaster of Paris cast application.

Keywords: Fiberglass, plaster of Paris, external immolization technique, metacarpal and metatarsal fracture, cattle.

Introduction
Long bone fractures in cattle resulting from musculoskeletal injuries might result in a significant financial loss of farmer due to lack of draught ability, reduced milk production or reproductive potential. During movement, bones are subjected to various physiological forces generally and supra physiological forces occasionally. When the supra physiological forces acting on the bone due to automobile trauma or accidental fall exceeds the bearing strength of bone, it leads to the breach in anatomical integrity, thus causing fracture.

Plaster of Paris cast application is most widely practiced external fixation technique in both small and large animal. Plaster bandage consists of cotton bandage impregnated with plaster of Paris that harden upon wetting. Plaster of Paris is anhydrous calcium sulphate that has been heated. In the presence of water, the soluble form of calcium sulphate becomes insoluble (hardening) with production of heat. Fiberglass cast is water activated polyurethane resin combined with bandaging materials, so it offers greater strength and durability. Lighter weight of cast provides more comfort to patient. Fiberglass cast is water impermeable, so inside padding does not get wet. Plaster of Paris application and fiberglass cast application is indicated in fracture below the mid diaphysis of radius or tibia and is most suitable for straight limb applications like fracture of metacarpal, metatarsal and radius-ulna. Plaster of Paris and fiberglass cast used in only those fractures which can be closed reduced and maintained with at least 50% of bone ends in contact. Plaster of Paris or fiberglass cast application is contraindicated in fracture of femur, humerus due to anatomical configuration of bone. External coaptation aids bone healing by maintaining the close apposition and reduced motion of fractured pieces at the fracture site. Finally, the fracture heals by producing new bone callus effectively and rapidly in cattle.

The purpose of immobilizing a joint above and below the fracture is to minimize displacement of the proximal and distal fracture segment that would occur during joint movement and to maximize the likelihood of neutralizing weight-bearing force as the limb is loaded during standing and walking. Present study was undertaken with the aim to compare the efficacy of fiberglass and plaster of Paris cast application for management of closed metacarpal and metatarsal fractures in cattle.

Materials and Methods

Total 31 cattle with history of long bone fractures with main complaint of not bearing weight on affected limb were presented at Veterinary Clinical Complex, Post Graduate Institute of Veterinary and Animal Sciences, Akola. Out of these, 16 cattle which were confirmatively diagnosed with closed metacarpal or metatarsal fracture irrespective of age, breed, sex and body weight were included in this study. These clinical cases of cattle were divided into two equal groups of 8 cattle each were subjected to two different external immobilization techniques as mentioned in the Table 1.

Table 1: Grouping of animals

Group	External Immobilization Technique	No of cattle
I	External coaptation using fiberglass cast	8
II	Splint and plaster of Paris cast	8

Data regarding the incidence of the long bone fractures in the cattle presented at Veterinary clinical complex, Post Graduate Institute of Veterinary and Animal Sciences, Akola was collected and the age, bone involved, type and location of fractures were recorded and analyzed. The etiology of fractures was recorded in all the cattle during the study period. The physiological parameters *viz* rectal temperature (°F), heart rate (beats/min.) and respiratory rate (breaths/min.) were recorded on day '0' (zero), 21th and 45th post immobilization day. Clinical parameters like lameness grading and weight bearing on the affected limb were assessed and recorded on day '0' (zero), followed by 21th and 45th post immobilization day. Haematological examination such as Haemoglobin (Hb) in g/dl, packed cell volume (PCV) in%, total erythrocyte count (TEC) in N×106/ mm3 total leukocyte count (TLC) in N×103/mm3 and differential leukocyte count (DLC) in% were evaluated on day '0' (zero), 21th and 45th post immobilization day. Biochemical estimations such as Calcium (mg/dL) Phosphorous (mg/dL) Alkaline Phosphatase (IU/L) Total protein (g/dL) Blood Urea Nitrogen (mg/dl) and Serum Creatinine (mg/dl) were done on 0th day, 21th and 45th postoperative day in all 16 cattle. All the clinical cases of metacarpal or metatarsal fracture from both the groups were evaluated radiographically on the day of presentation to assess the site, type, extent of fracture and immediately after application of external immobilization technique to assess fragment apposition and alignment. Radiographic evaluation of all the cases was carried out on 21st and 45th post immobilization day for the assessment of fracture healing.

Results and Discussion

The overall incidence of fractures was high in metacarpal (N=13, 41.94%), followed by metatarsal (N=7, 22.58%), tibia fibula (N=5, 16.13%), femur (N=2, 6.45%), radius and ulna (N=3, 9.68%) and humerus (N=1, 3.23%) and depicted in table II.

Table 2: Details of the Bone involved in the fracture

Sr. No.	Bone involved	No of animals	Incidence (%)
1	Metacarpal	13	41.94
2	Metatarsal	7	22.58
3	Tibia fibula	5	16.13
4	Femur	2	6.45
5	Radius and ulna	3	9.68
6	Humerus	1	3.23
	Total	31	

Out of 16 clinical cases, 56.25% (N=9) were of metacarpal fracture and 43.75% (N=7) were of metatarsal fracture indicating that the incidence of fracture in forelimb was higher than in hindlimb.

Table 3: Details of the bone wise incidence of the fracture in both the groups

Bone involved	Gp I	Gp II	Total	Percentage (%)
Metacarpal	5	4	9	56.25
Metatarsal	3	4	7	43.75
Total	8	8	16	

Similar findings were also observed by Madhav (2022) [3] who reported that among 28 cases of fracture, nine cases were of metacarpal fracture and eight were of metatarsal fracture. It was observed that incidence of the fracture was higher in the age group of > 1 year (N=8, 50%), followed by age group 6-12 months (N=6, 37.50%) and by the age group < 6 Months (N=2, 12.50%) and depicted in table IV.

Table 4: Details of the age wise incidence of the fracture in both the groups

Age	Gp I	Gp II	Total	Percentage (%)
< 6 Months	1	1	2	12.50
6-12 Months	3	3	6	37.50
> 1 year	4	4	8	50.00
Total	8	8	16	

These findings of present clinical study are in concurrence with Prabhakar (2012) [4] who also recorded highest incidence of fracture in the age group of > 1 year (1-3 years).

It was observed that comminuted fractures were higher (N=9, 56.25%), followed by oblique fractures (N=5, 31.25%) and transverse fractures (N=2, 12.50%) and depicted in table V.

Table 5: Type of fracture

Type of Fracture	Group I	Group II	Total	Percentage (%)
Transverse	1	1	2	12.5
Oblique	2	3	5	31.25
Comminuted	5	4	9	56.25
Total	8	8	16	

These findings are in agreement with Prabhakar (2012) [4] who also reported that rate of incidence of comminuted fracture to be higher as compared to non-comminuted fracture and he further opined that comminuted fracture were generally caused by high energy trauma which might be due to automobile injury. It was observed that the automobile trauma (N=8, 50%) was the leading cause of the fracture followed by falling from height (N=3, 18.75%), slipped on floor (N=3, 18.75%) and fell down in pit (N=2, 12.50%).

Table 6: Haemato-Biochemical parameters of cattle under both the groups at different intervals

Parameter		Day 0	Day 21	Day 45
Hb	Gr 1	10.04±0.23	10.40±0.19	10.64±0.15
	Gr 2	10.00±0.17	10.38±0.24	10.39±0.19
PCV	Gr 1	31.28±0.7	32.05±0.61	32.13±0.58
	Gr 2	30.95±0.52	31.66±0.56	31.99±0.42
TEC	Gr1	6.67±0.15	6.72±0.08	6.7±0.17
	Gr 2	6.63±0.17	6.71±0.09	6.66±0.12
TLC	Gr 1	10.61±0.40	10.58±0.40	10.34±0.56
	Gr 2	10.93±0.45	10.61±0.35	10.56±0.53
Neutrophil	Gr 1	30.25±0.75	29.63±0.46	29.25±0.82
	Gr 2	29.5±0.78	29.38±1.17	28.63±0.68
Lymphocyte	Gr 1	63.75±0.41	63.88±0.55	64.75±1.45
	Gr 2	64.88±1.03	64.25±1.35	65.63±1.13
Calcium	Gr 1	9.98±0.27	10.43±0.29	10.16±0.44
	Gr 2	9.56±0.18	9.94±0.08	9.85±0.16
Phosphorous	Gr 1	5.19±0.1	5.21±0.15	5.28±0.13
	Gr 2	5.03±0.13	5.18±0.08	5.38±0.11
ALP	Gr 1	150.69±5.45	205.51±10.76	168.97±7.19
	Gr 2	123.59±3.26	187.31±7.75	156.52±8.21
Total Protein	Gr 1	8.01±0.31	8.25±0.29	8.10±0.35
	Gr 2	8.06±0.22	8.02±0.15	8.16±0.1
BUN	Gr 1	16.58±1.42	16.14±1.3	16.52±.09
	Gr 2	17.10±1.56	16.56±1.34	16.31±1.52
Creatinine	Gr 1	1.01±0.07	0.96±0.09	0.98±0.09
	Gr 2	1.13±0.08	1.01±0.12	0.92±0.13

The findings of present clinical study are in harmony with the findings of Prabhakar (2012) [4] who also documented that higher incidence of fracture was caused by automobile trauma.

Physiological parameter such as rectal temperature, respiratory rate and heart rate showed a statistically non-significant variation within normal range throughout the clinical study. Both of these techniques did not induce any inflammatory response. These findings are in accordance with the results obtained by Daron Joseph (2013) [1], Tejas Yadav (2021) [9] and Madhav (2022) [3].

All the cattle included in this clinical study were presented with non-weight bearing lameness. It was observed that out of 16, grade 5, 4 and 3 lameness score showed by 4, 7 and 5 cattle respectively on the day of presentation.

By 45th day, it was observed that all cattle attained grade 1 and 2 lameness except case 2 of group I and case 4 of group II. The results are in conjunction with Farooq *et al*., (2019) [2] who stated that the high pain, lameness and swelling score on pre-operative day in their study might be due to the inflammatory reaction initiated by the trauma, which gradually subsided at the end of the leading to significant reduction in pain, lameness and swelling. These findings are consistent with the results obtained by Prabhakar (2012) [4] and Daron Joseph (2013) [1] who also recorded marked decrease in severity of lameness in fiberglass treated group when compared with plaster of Paris treated group. Further, Tamilmahan *et al*., (2017) [8] reported that cattle reinforced with splint and POP cast showed non-weight bearing lameness up to seven days followed by gradual weight bearing on affected limb.

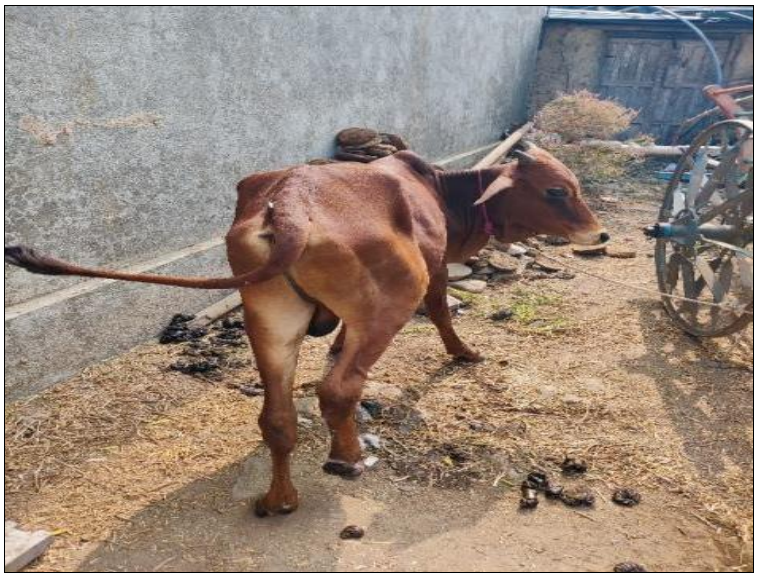


Fig 1: Non-Weight bearing by right hindlimb before external immobilization

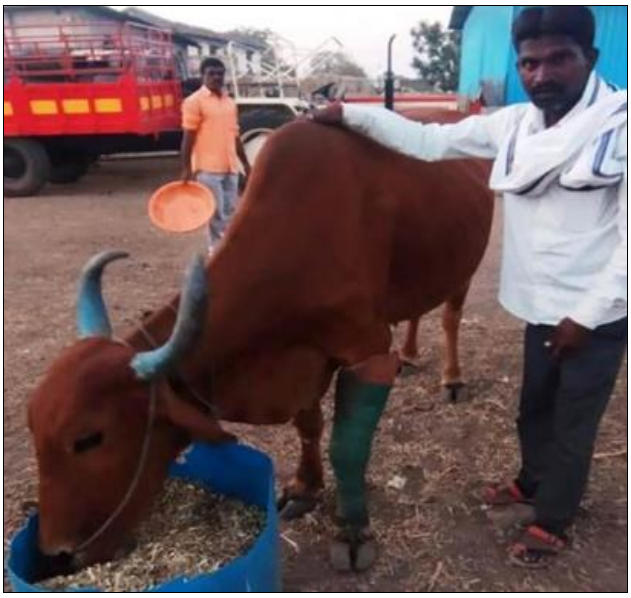


Fig 2: Complete weight bearing on 45th day of external immobilization

It was reported that hematological parameters such as hemoglobin, packed cell volume, total erythrocyte count showed statistically non-significant variation within normal range throughout clinical study. These findings are in accordance with the results obtained by Ramanathan *et al*., (2006) [5], Prabhakar (2012) [4], Syed (2013) [7], Yadav *et al*. (2020) [11], Tejas Yadav (2021) [9] and Madhav (2022) [3].

Further, the total leucocyte counts and neutrophils count showed a statistically significant declining trend throughout the study. However, all the values were fluctuating within normal physiological limits during the study period. This is in accordance with the findings of Sravanti *et al*., (2022) [6]. They opined that this might be due to the gradual decrease in the inflammation reaction.

Serum biochemical estimation revealed that the calcium, phosphorous, total protein, BUN and serum creatinine values had a statistically non-significant variation and were within normal range. However, mean± SE of the serum alkaline phosphatase showed statistically significant rise up to 21st day. Later the values followed a descending trend till the end of the study period. These findings are in accordance with Sravanti *et al*., 2022 [6]. They opined that osteoblasts were responsible for both new tissue (bone matrix) formation and its mineralization and secrete large quantities of ALP which was involved in bone healing process.

Radiographic evaluation revealed that in group I, in all cattle bridging callus with decrease in fracture gap was observed except case 2 and 3 in which bridging callus was not observed at 45th immobilization days which might be due to large gap in the fracture fragments. In group I, 3 cases showed complete radiographic healing on 45th day followed by 3 cases which showed appropriate progress towards healing and 2 cases with inappropriate progression towards healing. In group II, in all cattle bridging callus with decrease in fracture gap was observed except case 4, 6 and 8 in which malunion or delayed union occurred which might be due to reduced stability of fracture fragments by splint and plaster of Paris cast. In group II, a case showed complete radiographic healing on 45th immobilization day followed by 4 cases which showed appropriate progress toward healing and 3 cases showed inappropriate progression towards healing.

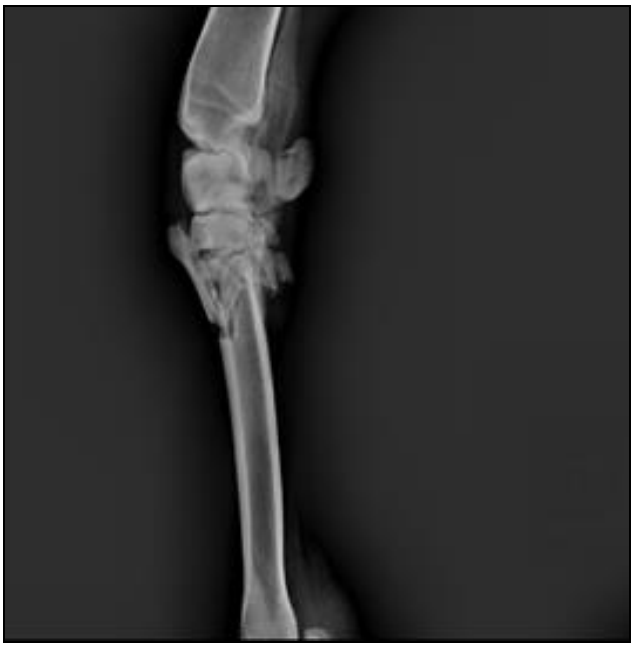


Fig 3: Antero-posterior radiograph of Group I Case 1 showing comminuted fracture of metacarpal at proximal one third on day of presentation

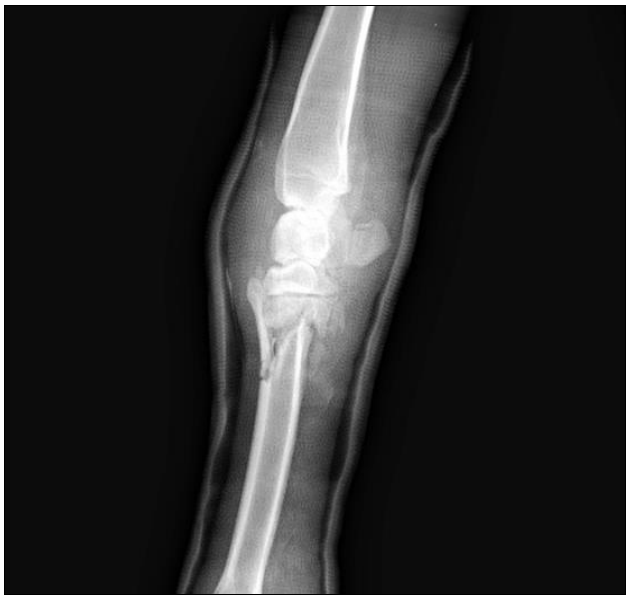


Fig 4: Latero-medial radiograph of Group I Case 1 showing complete union of metacarpal on 45th day of immobilization

The radiographic findings of group I are in accordance with Prabhakar (2012) [4] and Yadav (2018) [10]. The radiographic findings of group II are in accordance with Prabhakar (2012) [4] and Tamilmahan *et al*., (2017) [8] who reported bridging of callus noticed on day 30 and complete callus on day 60. It was observed that, in group I, case 2 and 3 shown non-union which might be due to large gap in fracture segment. In group II, case 4 and 8 shown delayed union and in case 6 mal-union with valgus deformity shown which might be due to heavy wight and reduced stability of fracture fragment by splint and plaster of Paris cast. Similar complication recorded by Prabhakar (2012) [4] and Tamilmahan *et al*., (2017) [8]. Functional outcome was excellent in four cases, good in two cases and poor in two cases in group I whereas it was excellent in two cases, good in three cases and poor in three cases in group II.

Conclusion

Both external immobilization technique significantly decreased the severity of lameness throughout clinical study but fiberglass cast application was found to be more effective than splint and plaster of Paris cast application in cattle. Fiberglass cast is lighter, stronger than plaster of Paris cast. Faster setting time of fiberglass make it preferred choice for management of metacarpal and metatarsal fracture in cattle.

Conflict of interest

Not available

Financial support

Not available

References

1. Joseph D. Comparison of fiberglass with plaster cast for treatment of long bone fractures in goats. MVSc thesis, Karnataka Veterinary Animal and Fisheries Sciences University, Bidar, Karnataka, 2013.
2. Farooq F, Kumar A, Dwivedi DK, Zama MMS, Sharma A, Gupta P, Bhardawaj HR. Clinical evaluation of demineralized bone matrix allograft in femur fracture in dogs. Journal of Animal Research. 2019;9(2):269-273.
3. Ajjodi M, Nagaraja BN, Suresh L, Kamran CA, Girish MH. Supercutaneous plating for the treatment of traumatic compound metatarsal bone fracture in bovines. The Pharma Innovation Journal. 2022;11(SP10):1872-1877.
4. Prabhakar V. Studies on conservative and surgical management of long bone fracture in large animals. MVSc thesis, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, 2012.
5. Ramanathan A, Ganesh TN, Manohar B, Murali, Halder S. External skeletal fixation of metacarpal fracture in calves: A clinical evaluation. Indian Veterinary Journal. 2006;87:135-138.
6. Sravanti M, Sekhar CEL, Latha C, Kumar P, Lakshman M. Haemato-biochemical changes of external skeletal fixation on long bone fractures in sheep and goats. The Pharma Innovation Journal. 2022;11(4):1315-1319.
7. Syed FRAM. Modified type II external skeletal fixation for the repair of metacarpal fracture in bovines. MVSc thesis, Karnataka Veterinary Animal and Fisheries Sciences University, Bidar, Karnataka, 2013.
8. Tamilmahan P, Arunprasad A, Senthilkumar S, Vijayakumar M. Surgical management of metacarpal and metatarsal fractures: A study of five bovines. Intas Polivet. 2017;18(2):462-464.
9. Yadav T. Studies on percutaneous tibial fracture repair by intramedullary pinning in bovines. MVSc thesis, Karnataka Veterinary Animal and Fisheries Sciences University, Bidar, Karnataka, 2021.
10. Yadav. Outcomes of metacarpal and metatarsal fractures repaired using external coaptation in bovine. MVSc thesis, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, 2018.
11. Yadav GP, Sangwan V, Kumar A, Mahajan SK, Gupta A. Prognostic factors associated with successful outcome of metacarpal and metatarsal fractures repaired using external coaptation in bovines. Indian Journal of Animal Research. 2020;54(5):578-592.

How to Cite This Article
Chavan SR, Thorat MG, Raulkar RV, Fani FA, Kamdi BP, Yelmule SS, *et al*. Fiberglass and plaster of Paris cast for management of metacarpal and metatarsal fracture in cattle. International Journal of Veterinary Sciences and Animal Husbandry. 2025;10(6):266-270.